



# The Water Report™

*Water Rights, Water Quality & Water Solutions in the West*

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## PHOENIX WATER PLANNING

PHOENIX WATER RESOURCES PLAN: THE 2005 UPDATE

by Tom Buschatzke, City of Phoenix

The City of Phoenix published its first Water Resources Plan (Plan) in 1985 to analyze its water supplies and projected water demand for a 50-year time period. Updates to the Plan were published in 1987, 1990, 1995, 2000 and 2005. The Plan provides guidance for water acquisition, water management and infrastructure development necessary to ensure sustainable water availability for current customers and for anticipated growth over the next 50 years. The City has a diversified water supply portfolio. Despite that fact, new data and recent experience with drought in Phoenix's source watersheds reinforces the need for the City to further assess its vulnerability to long-term surface water shortages. In addition, growth and attendant water demand may be significantly affected by changing economic and demographic trends. Thus, the Plan concentrates on these key uncertainties and identifies relevant strategies to more effectively prepare the City to meet its needs. The primary emphases of Phoenix's water resources planning efforts over the coming years include: protecting, maintaining and effectively managing the City's current supplies; expanding infrastructure to accommodate deployment of future supplies for growth and redundancy needs; and developing cooperative arrangements with other water suppliers and wholesalers in the region to address common objectives through more cost-effective means.

The Plan concludes that Phoenix's well-diversified water resources portfolio and integrated water delivery and treatment system is capable of handling a wide variety of growth and drought scenarios. To accommodate anticipated growth, however, significant capital expenditures will be necessary to "drought-proof" the portfolio and to develop additional treatment and transmission system capabilities to allow for the deployment of all available water supplies. The Plan provides a foundation for the magnitude and timing of water development projects and provides a basis for revenue generating alternatives.

### Background

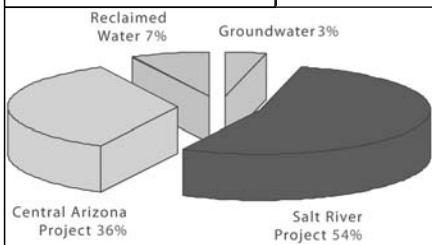
The City has a population of over 1.4 million people, which represents about 40% of the Maricopa County total of 3.5 million and about 25% of Arizona's 5.7 million residents. Phoenix's service area encompasses an incorporated area of 546 square miles. For comparison, this is larger than Los Angeles, at about 466 square miles, and slightly smaller than Houston, at about 579 square miles. The City's primary supplies include in-state surface water supplies from the Salt and Verde River watersheds (north and east of Phoenix) delivered by the Salt River Project (SRP), and supplies from Colorado River water delivered by the Central Arizona Project (CAP). Groundwater and reclaimed water make up a minor component of the normal supply portfolio. A variety of issues may impact the availability of these supplies on an annual or long-term basis (illustrated in Figure 1—next page).

The City's potable water system has a current capacity of 697 million gallons per day (mgd). Wells comprise 67 mgd of that capacity and the remainder comes from five surface water treatment plants. An additional 440 mgd is anticipated to be available in the future from the construction of two new water treatment plants for surface water.



Figure 1

Figure 2



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In normal years, over 90% of the City's water demand is met by surface water from SRP and CAP as illustrated in Figure 2. The water supplies available from SRP and CAP are based upon a variety of water rights, entitlements, contracts, leases, exchanges and other mechanisms. Supplies from different sources are each uniquely sensitive to drought and the issues listed in Figure 1. Furthermore, some supplies (primarily SRP water) are legally restricted for use within specified parts of the City's service area while other supplies can be used anywhere within the service area.

City water demand is largely reflective of the local economy and population. The population in the City's service area has grown over the past 15 years by 43% to just over 1.4 million. Growth is expected to continue into the future. The Maricopa County Association of Governments (MAG) has projected a population of 2.03 million in Phoenix by 2020. MAG population projections have consistently underestimated actual population, a phenomenon seen in

many of the growth areas of the southwestern United States. At the same time rampant growth in population has occurred, the City's gallons per capita per day (GPCD) rate of use has decreased by 16% in the last 15 years to an average GPCD of 214 over the past five years. In fact, over the last 25 years the City's GPCD rate has been reduced by about 20%. Strong water conservation efforts are responsible for the reduction in GPCD rates. Demand management strategies and water conservation are an integral part of the City's efforts to manage its water resources portfolio and its infrastructure needs into the future.

### Planning Methodology

The goal of the City's planning efforts is to achieve a balance between the use of its current water supplies, the need for future water supplies, the incorporation of demand management strategies and growth. Prior plans examined these factors on a City-wide basis. However, potential impacts on the City's water supplies dictated an assessment of a broad range of conditions and outcomes. This approach is particularly important given the many uncertainties, including: over-allocated source watersheds; long-term drought; increasingly stringent environmental regulations; water quality issues; water rights and other litigation; and competition for supplies. As uncertainties in water supply and growth were examined while the Plan was being scoped, a multitude of questions arose.

#### PRESSING QUESTIONS INCLUDE:

- Is the 100-year historical climate record an appropriate indicator of the duration and severity of future droughts or should we plan for longer and more severe droughts based upon tree-ring analyses covering several centuries?
- How soon will shortages occur on the Colorado River, how long will they last and how severe will those shortages be?
- How will Colorado River shortages affect the City's CAP supplies that come from the River?
- How deep will cuts occur in the City's Salt River Project water supplies that come from the Salt and Verde Rivers?
- What is the likelihood that drought on the Colorado, Salt and Verde Rivers will occur simultaneously?
- To what degree can the City depend upon its local groundwater resources to mitigate loss of surface water supplies during drought?
- Considering costs and probabilities of shortages what is the optimal level of water supply infrastructure redundancy needed to avoid adverse consequences to residents, businesses and the local economy?
- What mechanisms are most appropriate to recover those costs?
- How will environmental regulations such as the Endangered Species Act, the Clean Water Act and the Safe Drinking Water Act impact future water supply availability and cost?
- How will climate change affect water supplies?
- How will growth patterns and density increases in Central Phoenix affect water demand?
- How much additional water conservation can be achieved without unduly impacting lifestyle, the economy and the overall quality of life in the community?
- To what degree can customer demand be reduced during an emergency or for a protracted period of time during a drought?
- Under what conditions is it appropriate for the City to impose mandatory water use restrictions upon its customers?

## Phoenix Water

### Growth Scenarios

### SRP Supplies

These are examples of the many questions that the planning effort addresses through the development of water budget projections and models using a wide variety of scenarios depicting the City's water future.

#### The Modeling Approach

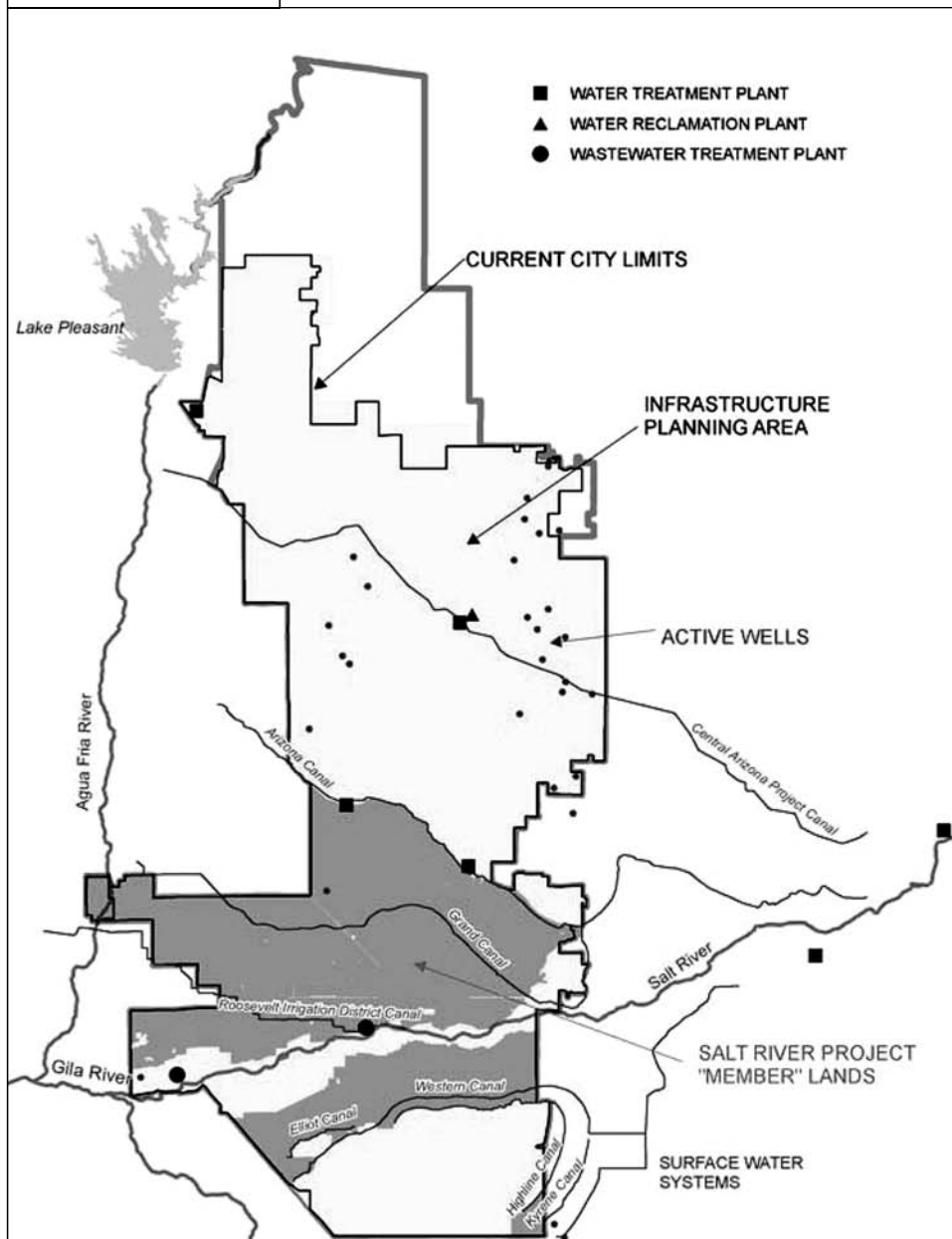
The Plan primarily addresses water supply availability at the service area scale. However, further investigation to identify the spatial impacts of water supply shortages was also part of the process. Key variables were identified to reflect potential changes in each specific water supply available to the City. On the demand side of the equation, alternative growth scenarios were developed along with varied water conservation or mandatory drought reductions.

The service area scale modeling approach reflects the fact that the City service area has two main components: 1) lands that are eligible to receive water supplies from the Salt River Project; and 2) lands that cannot legally use Salt River Project supplies. Figure 3 shows the City's service area and these lands. Lands eligible to use SRP supplies can also legally use non-SRP supplies. Water supply and demand profiles were analyzed to address related variables.

ANALYZED VARIABLES INCLUDED:

- Availability of SRP supplies
- Availability of CAP supplies
- Growth and development patterns
- Water conservation levels

Figure 2



#### SRP Supplies

SRP supplies originate from the Salt and Verde Rivers within Arizona and from groundwater within the SRP boundaries. SRP supplies were modeled at three levels: 1) normal supplies; 2) moderate shortage; and 3) severe shortage. Normal supplies reflect the historic delivery by SRP during non-drought years of reservoir storage and groundwater, and generally equate to three acre-feet per acre. SRP stores unused water in its reservoirs for later use. The City acts as a middleman for the delivery of SRP water for residential purposes, on lands formerly irrigated that have an appurtenant water right.

Shortages in SRP supplies are difficult to accurately predict even with an extensive historical record. Uncertainties discussed previously could cause impacts on water supplies that are not reflected in the historic record. Therefore, the Plan defined shortages in the following manner: *moderate* shortages reflect a reduction in those supplies to two acre-feet per acre, a level of supply that was seen in 2003 and 2004; *severe* shortages reflect a supply of one acre-foot per acre, an unprecedented reduction in the historical record.

The City receives additional water from SRP pursuant to "normal flow" water rights that vary on a daily basis according to measured flow in the Salt and Verde Rivers. "Normal flow" is defined as the amount of water in the river *before* the SRP reservoirs were constructed on the river. Thus, "normal

## Phoenix Water

### "Normal Flow"

### Demand

flow" is the amount of water available that is over and above the three acre-feet per acre of SRP stored water. Historically, normal flow has varied from 0.64 acre-feet per acre to 0.93 acre-feet per acre annually. A water right decree—known as the "Kent Decree"—defines the quantities of normal flow water available to specific parcels of land. The Kent Decree includes water rights with priority dates ranging from 1869-1909.

Currently, demand on SRP eligible lands within the City is 2.4 to 2.6 acre-feet per acre, so even during a moderate drought, water supplies meet or exceed demand for these lands. Though the City's existing General Plan is used as the baseline for growth scenarios, the model also analyzed how increasing densities could impact the balance between supply and demand for SRP eligible lands. It was found that increased densities for these lands could make that portion of the City's service area more vulnerable to drought if additional supplies were not acquired and deployed or if demand management strategies were not implemented. Figure 4 summarizes these scenarios.

#### SRP ON-PROJECT SUPPLY AND DEMAND ESTIMATES

	2010	2015	2020	2025	2040	2055
On-Project Demand (AF):						
General Plan Level	198,000	206,000	214,000	218,000	224,000	224,000
High Density Scenario	212,000	241,000	278,000	301,000	374,000	382,000
On-Project Water Right Acres						
	85,000	90,000	94,000	94,000	94,000	94,000
On-Project Supply Availability (AF):						
Normal Supply Conditions	336,000	356,000	372,000	372,000	372,000	372,000
Moderate Shortage Conditions	226,000	240,000	251,000	251,000	251,000	251,000
Severe Shortage Conditions	141,000	150,000	157,000	157,000	157,000	157,000

**Figure 4**  
**CAP Supplies**

Water from the Central Arizona Project is the main water supply for the portion of the City not eligible to use SRP water. Additional water supplies currently available for this part of the City include: gateway; new conservation space water; three-way exchange water (collectively called "SRP Off-Project supplies"); reclaimed water; and groundwater. The first three types of water (SRP Off-Project supplies) are generated from the Salt and Verde Rivers and are primarily generated during normal and wet years. SRP reservoirs are used to store such water and create some ability to carry over these supplies from wet years into dry years. It is assumed that during drought these supplies will not be available and to a large degree history confirms this assumption.

"Gateway" is SRP water from Horseshoe Reservoir on the Verde River. When originally constructed the reservoir had an ungated spillway. Phoenix paid to have gates put on the reservoir's spillway to increase storage capacity. The City thereby obtained a water right for the yield from the increased capacity, currently around 67,000 acre-feet. That yield amounts to about 21,000 acre-feet per year. "New conservation space water" is water from Roosevelt Lake on the Salt River. Roosevelt Lake Dam was raised, primarily for flood control (completed in 1993). Fifteen feet of additional conservation storage was also added and Phoenix and five other local cities paid those costs which created the "new conservation space water" accorded to those entities. "Three-way exchange water" represents water that is exchanged between the City, SRP and Roosevelt Irrigation District (R.I.D.). The City supplies 30,000 acre-feet of effluent water to R.I.D. and R.I.D. then turns off their groundwater wells to the equivalent of 30,000 acre-feet. Phoenix obtains the right to 20,000 acre-feet of SRP water and the remaining 10,000 acre-feet goes to the Salt River Pima-Maricopa Indian Community. This exchange came about as the result of a water rights settlement with the Salt River Pima-Maricopa Indian Community.

CAP supplies come from the Colorado River and bear shortages before the majority of the water uses in the Lower Colorado Basin States of California, Arizona and Nevada. CAP supplies are subject to regulation when shortages occur based on its junior priority. As part of a compromise made when authorizing legislation for CAP was passed, the state of Arizona had to accept that its rights would have a junior priority relative to California's rights. Arizona was granted an equal footing with Nevada and the Republic of Mexico.

### Supply Sources

### "Gateway"

### "New Conservation Space Water"

### "Three-Way Exchange Water"

### Colorado River

## Phoenix Water

### Uncertainties

### Model Assumptions

### Acquisition Needs

In addition to drought, there are many other uncertainties regarding the future of these supplies. The uncertainties include: the long-term annual average yield of the Colorado River (compared to the water rights allocated from the River); the level of future development in the upper Colorado River watershed; climate change; environmental issues; and how the Republic of Mexico will bear shortages under their Treaty with the United States for the use of Colorado River water. While some generally accepted numbers are available, discrete predictions of how these parameters will affect the long-term availability of Colorado River water and how the CAP would then be affected, are not possible.

For the Plan, the model considers that a normal year supply from the CAP is 1.5 million acre-feet of water. A moderate shortage was then defined as a one-third reduction to 1 million acre-feet and a severe shortage was defined as a reduction to 600,000 acre-feet. For perspective, the current joint proposal to the Secretary of the Interior for management of the Lower Colorado River (from Wyoming, Utah, New Mexico, Colorado, California, Nevada and Arizona) would result in a shortage of about 300,000-500,000 acre-feet to the CAP until Lake Mead hits elevation 1000 feet. Additional shortages will be discussed through a consultation process after that threshold is reached. Therefore, the City's modeling assumptions are very conservative. To further increase the accuracy of the forecasts the model also considered the priorities of water supplies within the CAP because some of the City's CAP supplies suffer shortages sooner than others. The City's General Plan was used to project growth. Even under normal conditions growth will necessitate that Phoenix deploy and perhaps acquire additional water supplies sometime after the year 2020. Moderate and severe shortages increase the need. Figure 5 summarizes the supply and demand scenarios for this case.

**Figure 5**

OFF-PROJECT SUPPLY AND DEMAND ESTIMATES (Currently available supplies only)

	2010	2015	2020	2025	2040	2055
Off-Project Demand (AF):						
General Plan Level <sup>10</sup>	201,108	226,379	254,548	273,503	320,944	328,534
Off-Project Supplies - Normal Conditions (AF):						
CAP Supplies (all) <sup>11</sup>	186,000	186,000	186,000	186,000	183,000	186,000
SRP "Off-Project" supplies <sup>12</sup>	68,000	68,000	68,000	48,000	48,000	48,000
Reclaimed (deliverable in service area) <sup>13</sup>	5,000	5,000	5,000	5,000	5,000	5,000
Groundwater (sustainable volume) <sup>14</sup>	15,000	15,000	15,000	15,000	15,000	15,000
Total <sup>15</sup>	274,000	274,000	274,000	254,000	251,000	254,000
Off-Project Supplies - Moderate Shortage (AF):						
CAP Supplies (all) <sup>16</sup>	186,000	149,000	148,000	147,000	147,000	181,000
SRP "Off-Project" supplies	0	0	0	0	0	0
Reclaimed (deliverable in service area)	5,000	5,000	5,000	5,000	5,000	5,000
Groundwater	15,000	44,000	44,000	44,000	44,000	44,000
Total	206,000	198,000	197,000	196,000	196,000	230,000
Off-Project Supplies—Severe Shortage (AF):						
CAP Supplies (all) <sup>17</sup>	107,000	106,000	106,000	102,000	100,000	118,000
SRP "Off-Project" supplies	0	0	0	0	0	0
Reclaimed (deliverable in service area)	5,000	5,000	5,000	5,000	5,000	5,000
Groundwater	15,000	44,000	44,000	44,000	44,000	44,000
Total	127,000	155,000	155,000	151,000	149,000	167,000

<sup>10</sup> High density scenario primarily impacts on-project lands, and thus was not included here.

<sup>11</sup> The increase in CAP in 2055 (in all scenarios) reflects the "firming" of the Hohokam ID water (which occurs in 2044). At that stage the water converts from a lower priority agricultural supply to a higher-priority M&I supply.

<sup>12</sup> Includes Gatedwater, Roosevelt NCS water and RID/SRP Exchange Water (all supplied through SRP). Assumed that under long-term drought shortage conditions, these supplies are not available as they rely on available reservoir storage.

<sup>13</sup> Assumed deliveries through North Phoenix Reclaimed Water Distribution System.

<sup>14</sup> Though the City has the current capacity to pump approximately 44,000 acre-feet per year (during drought or emergencies), the 15,000 AF estimate represents water "incidentally recharged" due to usage within the City.

<sup>15</sup> Supply figure declines between 2020 and 2025 due to assumption that the SRP/RID Exchange is no longer available (the reclaimed water would be available, though another mechanism for usage will need to be identified).

<sup>16</sup> Includes AWBA replacement for a portion of M&I subcontract CAP water lost due to Colorado River shortages.

<sup>17</sup> Includes AWBA replacement for a portion of M&I subcontract CAP water lost due to Colorado River shortages.



## Phoenix Water






### Future Scenarios

A total of 144 scenarios with varying combinations of supply and demand factors were developed by Phoenix. Six scenarios were chosen to bracket the range of future conditions that the City may encounter.

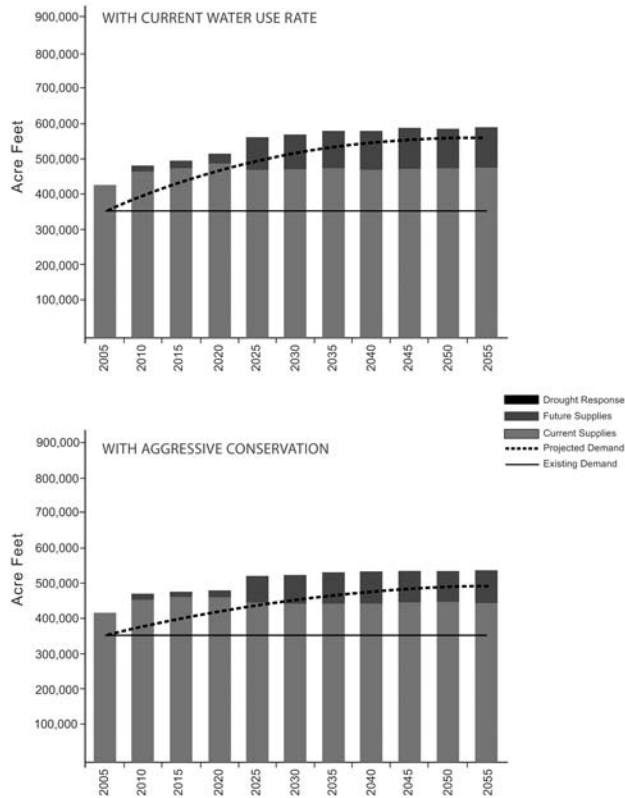
THOSE SCENARIOS ARE:

- A) Normal Supply Conditions with General Plan Growth
- B) Normal Supply with Central Core High Density Growth
- C) Moderate Shortage with General Plan Growth
- D) Moderate Shortage with Central Core High Density Growth
- E) Severe Shortage with General Plan Growth
- F) Severe Shortage with Central Core High Density Growth

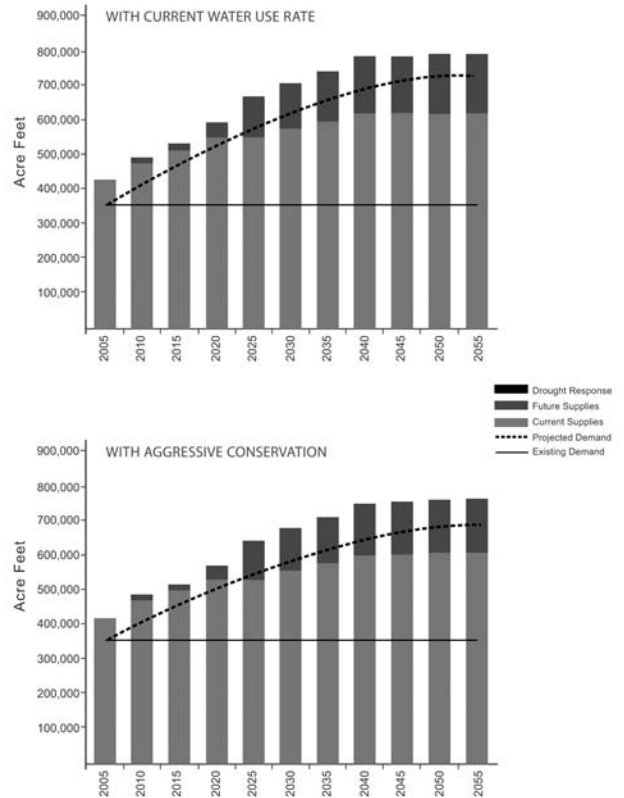
THE FOLLOWING FIGURES graphically represent the scenarios and the following definitions correspond to the key used in each graph:

-  **DROUGHT RESPONSE:** the need to deploy supplemental (new supplies to be acquired) supplies and/or manage demand when current and future supplies are insufficient to meet demand in a given year
-  **FUTURE SUPPLIES:** supplies that the City essentially has access to currently but further actions need to be taken to be able to actually provide the water to customers
-  **CURRENT SUPPLIES:** supplies that the City can deliver to its customers now or in the next few years
-  **PROJECTED DEMAND:** future water demand projections
-  **EXISTING DEMAND:** the current level of water demand projected out into the future.

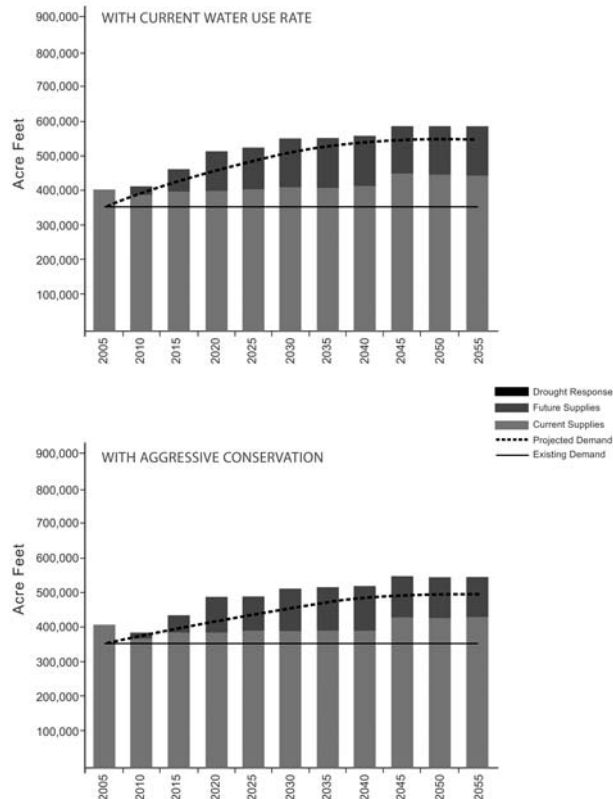
**SCENARIO A:**  
Normal Supply Conditions  
General Plan Growth



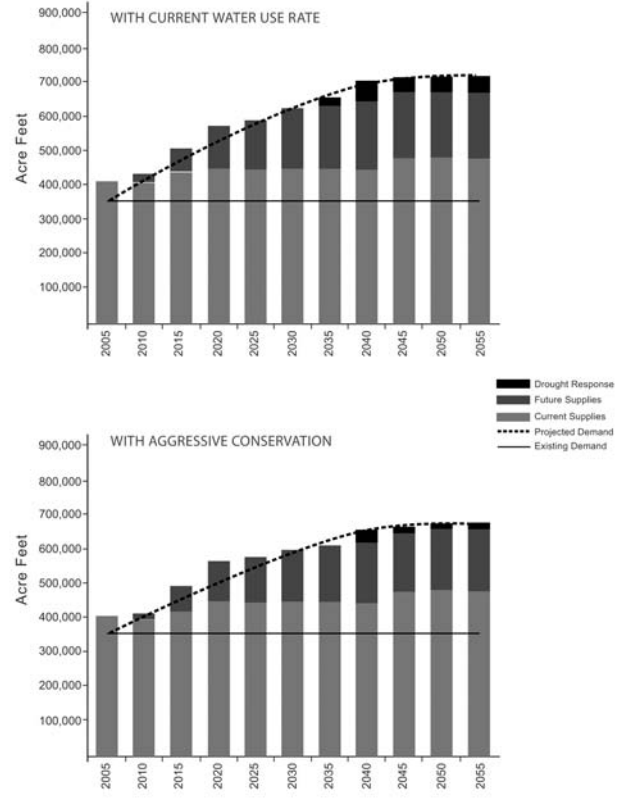
**SCENARIO B:**  
Normal Supply Conditions  
High Density Growth



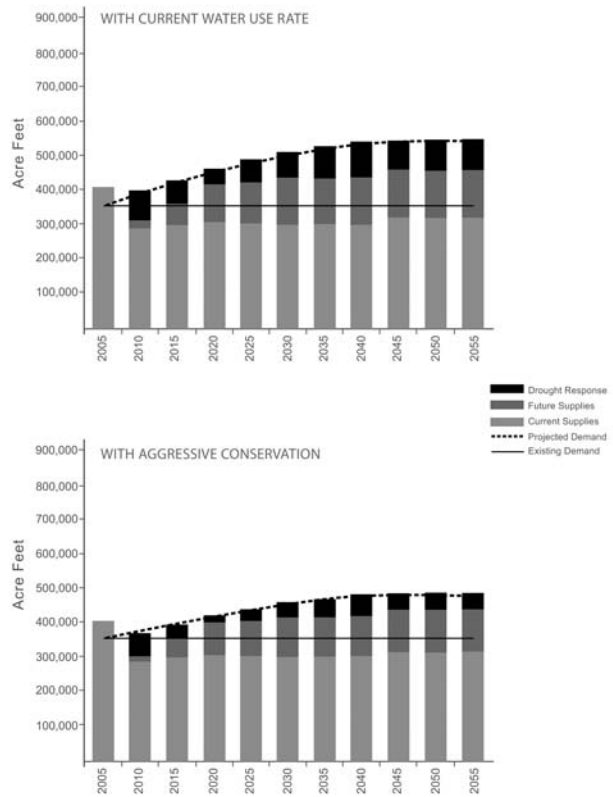
**SCENARIO C:**  
Moderate Shortage Conditions  
General Plan Growth



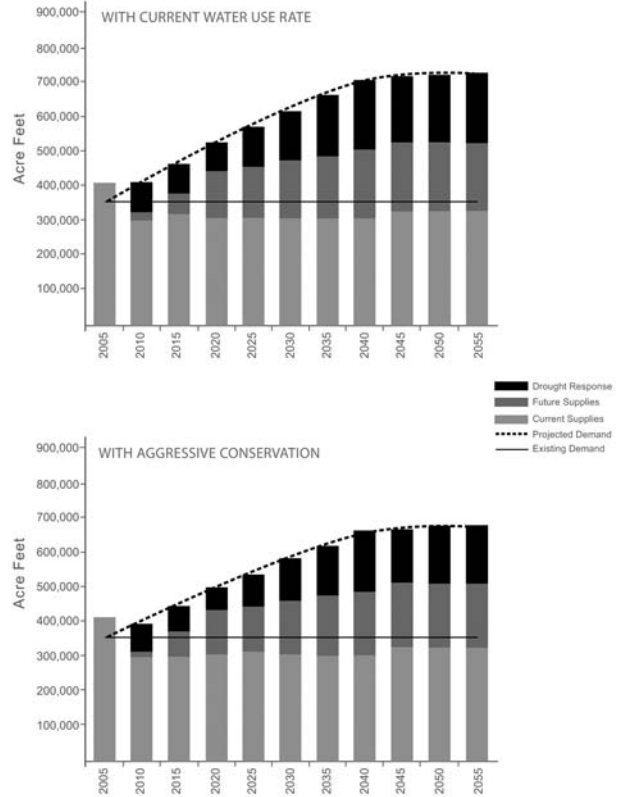
**SCENARIO D:**  
Moderate Shortage Conditions  
High Density Growth



**SCENARIO E:**  
Severe Shortage Conditions  
General Plan Growth



**SCENARIO F:**  
Severe Shortage Conditions  
High Density Growth



<div data-bbox="159 184 300 262"><b>Phoenix Water</b></div> <div data-bbox="146 304 313 336"><b>Conclusions</b></div> <div data-bbox="170 552 289 619"><b>Severe Drought</b></div> <div data-bbox="134 688 324 720"><b>New Supplies</b></div> <div data-bbox="162 829 295 896"><b>"Demand Zones"</b></div> <div data-bbox="139 1077 319 1108"><b>Action Issues</b></div> <div data-bbox="162 1287 295 1354"><b>2015 Shortages</b></div> <div data-bbox="144 1423 315 1455"><b>2015 Actions</b></div> <div data-bbox="134 1707 321 1774"><b>Funding "Impact Fees"</b></div>	<p>Each of these scenarios was evaluated with a stable demand rate to reflect the City's current level of success with its water conservation programs and against a demand rate that reflects a more aggressive conservation program. The results of the analyses of these scenarios led to several important conclusions. THOSE CONCLUSIONS INCLUDE:</p> <ul style="list-style-type: none"> <li>• Existing customer demands can be met under both normal and moderate shortages for the entire 50-year planning horizon. Severe shortages would require mandatory drought reductions of 10% for the duration of the shortage.</li> <li>• Projected demands under the General Plan and high-density development levels can be met with a combination of current and future supplies in both normal and moderate shortage conditions for the entire 50-year planning period. Starting in approximately 2030, a 10% gap between supply and demand may occur in the high density moderate shortage scenario, although increased conservation programs or minor mandatory drought restrictions could eliminate this gap.</li> <li>• Under severe drought conditions, a combination of customer demand reductions and supplemental supplies would become necessary. This would be most significant in the high density scenario where nearly a 30% gap could develop between supply and demand. Over a short-term time frame (perhaps 1-2 years), mandatory drought restrictions could solve this problem. For an extended time frame, supplemental supplies would be needed to close the gap.</li> <li>• Deployment of future and supplemental supplies will entail significant capital expenditures to be phased in over time. Plans to deploy these supplies need to be developed. Costs could include water supply acquisition, well drilling, wellhead treatment, reclaimed water treatment facilities, transmission lines and recharge facilities among others.</li> <li>• The spatial impact of water supply shortages may result in selected parts of the City, characterized as "demand zones" in the model, to experience shortfalls under the moderate or severe shortage scenarios. Preliminary results indicate that these shortfalls can be addressed by changes in water treatment plant and system operations, although in some cases additional deployment of supplies in these localized areas may be necessary.</li> </ul> <p style="text-align: center;"><b>Strategic Concepts</b></p> <p>In order to make the Plan more valuable to the City and to integrate its conclusions into the existing functional arms of the City's Water Services Department for implementation, specific action items or "strategic concepts" were developed. A key component in the development of these strategic concepts was to evaluate a time frame within which actions would need to occur. To establish timelines it is assumed that the region is currently in the early stages of a long-term drought. The historic record certainly demonstrates that the region has experienced drought for about 10 years. Tree rings indicate droughts of 20-40 years duration in the Southwest have occurred. It is possible that the region is in year 10 of a 20-40 year drought. With that assumption in place, the Plan indicates that the City would experience normal supply conditions for another 10 years or so. Thus, the City's current planning horizon includes moderate shortages around 2015. The City, therefore, is focusing on dealing with those moderate shortages by 2015. Supply deployment, project design, capital budgeting and construction activities are being targeted to meet this time frame. Twelve "strategic concepts" flow from that assumption and the results of the Plan.</p> <p>THESE STRATEGIC CONCEPTS INCLUDE:</p> <ul style="list-style-type: none"> <li>• Develop supplies sufficient to target both General Plan (base) growth and high-density growth demands under normal and moderate shortage conditions</li> <li>• Begin deployment of "future" supplies (defined previously in this article) by 2015 to meet growth demands under moderate shortage conditions</li> <li>• Continue phased development of "future" and "supplemental" supplies beyond 2015 to meet growth demands under normal, moderate and severe shortage conditions</li> <li>• Consider cost, reliability, accessibility, and maintenance needs in selecting the appropriate mix of future supplies for deployment</li> <li>• Funding for deployment of future and supplemental supplies should be derived from growth-related revenue (i.e. "impact fees") rather than through water rates</li> <li>• Promote enhanced water conservation to minimize drought impacts to customers</li> <li>• Manage groundwater supplies for aquifer sustainability (cumulative pumping in the region during a prolonged drought may have serious impacts on local aquifers)</li> <li>• Maximize utilization of reclaimed water</li> <li>• Enhance water quality and match it to appropriate uses</li> <li>• Consider environmental benefits and costs in the analysis of water supply and demand management efforts</li> </ul>
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## Phoenix Water

### Functional Plans

- Pursue opportunities for supplemental water supplies and demand reduction measures that could be deployed during severe shortages
- Promote regional cooperation in deployment of drought supplies and strategies

These strategic concepts will help guide the specific steps that the Phoenix Water Services Department will be taking. The concepts will provide links to several functional plans that will provide detailed guidance for achieving the goals of the Plan.

THESE FUNCTIONAL PLANS INCLUDE:

- Groundwater and Reclaimed Water Management Plan
- Water and Wastewater System Master Plan
- Demand Management Plan
- Assured Water Supply Plan
- Salinity Control and Desalination Plan
- Water Resources Acquisition Fee Update
- Capital Improvement Plan-Water Resources Component

### Conclusion

The City of Phoenix Water Resources Plan: 2005 Update continues to build upon the sound water planning and management programs that have resulted in the delivery of a safe and reliable supply of water for Phoenix and its residents. The strategic concepts developed in the Plan, and the link to additional plans and actions, will ensure that the City's water service will continue to achieve the high standards exhibited in the past.

**FOR ADDITIONAL INFORMATION:** TOM BUSCHATZKE, City of Phoenix, 602/ 261-8532 or email: [tom.buschatzke@phoenix.gov](mailto:tom.buschatzke@phoenix.gov)

CITY OF PHOENIX WATER RESOURCES PLAN UPDATE 2005 WEBSITE:

<http://phoenix.gov/WATER/wtrpln05.html> —select >> Water Resources Plan 2005 Update (pdf format)

**Tom Buschatzke** is the City of Phoenix's Water Resources Management Advisor. He is responsible for policy development for management of the City's water resources and works with City executive staff, the City Manager, the Mayor, and members of City Council on a variety of water issues. Mr. Buschatzke also serves as the City's liaison with the Salt River Project, the Central Arizona Project and the Arizona Department of Water Resources. Presently, Mr. Buschatzke is on the Board of Directors of the Western Urban Water Coalition and serves as Chair of their Endangered Species Act Committee. He is a member of the Colorado River Water User's Association; American Water Resources Association; American Water Works Association; and the Governor's Colorado River Advisory Council. Mr. Buschatzke was recently appointed by Governor Napolitano to sit on the Arizona Water Banking Authority (Authority is charged with storing water underground within CAP's service area for future use). Mr. Buschatzke's career in Arizona water resources began in 1982 with the Arizona Department of Water Resources, and he ultimately became a Program Manager in the Adjudications Division. He began working for the City of Phoenix in 1988 as a Hydrologist in the Law Department where he provided assistance to City management and attorneys on issues relating to the City's water rights, water use and water supply. Tom holds a Bachelor of Science Degree in Geology from the State University of New York and has taken Master Degree level courses in Geology at Arizona State University.

### Acknowledgements

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## Tribal Water Quality

### Fish Consumption

### Reserved Treaty Rights

### Tribal Culture

### Health Impacts

### Standards Revision

## TRIBAL FISH CONSUMPTION & WATER QUALITY STANDARDS

by J.D. Williams, Esq. (Portland, OR)

In late 2006 or early 2007, the US Environmental Protection Agency (EPA) is likely to approve the State of Oregon's proposed toxic criteria for its water quality standards (WQS). Those criteria will include the adoption of a rate of fish consumption established by EPA as the national average of 17.5 grams per day (less than one serving of fish per week). This standard will expose Oregon's subsistence fishers, including Indian tribes, to unacceptable levels of human health risk.

This article discusses Oregon's decision to adopt an inadequately protective fish consumption rate, EPA's anticipated approval of Oregon's proposed toxic criteria despite local studies showing higher fish consumption by Indian tribes, the response of one local Indian tribe (Confederated Tribes of the Umatilla Indian Reservation (Umatilla Tribes)), and possible legal challenges.

### Why Eating Local Fish Matters to Oregon Tribes

Most members of the nine Indian tribes in Oregon regularly consume fish taken from Oregon's water bodies. Some of these tribes, as well as tribes in Washington and Idaho, possess treaty reserved rights to fish in Oregon waters. Such rights were reserved by the tribes in their treaties because, as the US Supreme Court has stated, the right to fish is "not much less necessary to the existence of the Indians than the atmosphere they breathed." *United States v. Winans*, 198 U.S. 371, 381 (1905); see also *Seufert Bros. v. United States*, 249 U.S. 194, 197 (1919) ("The Columbia River is '...a great table where all the Indians might come to partake.'") Compared to Oregon's adoption of 17.5 grams per day, a federal court found that one Columbia River tribe traditionally ate 500 lbs/year per person or about 620 grams per day. *United States v. Washington*, 384 F.Supp. 312, 380 (W.D. Wash. 1974), aff'd, 520 F.2d 676 (9th Cir. 1976), cert. denied, 423 U.S. 1086 (1976).

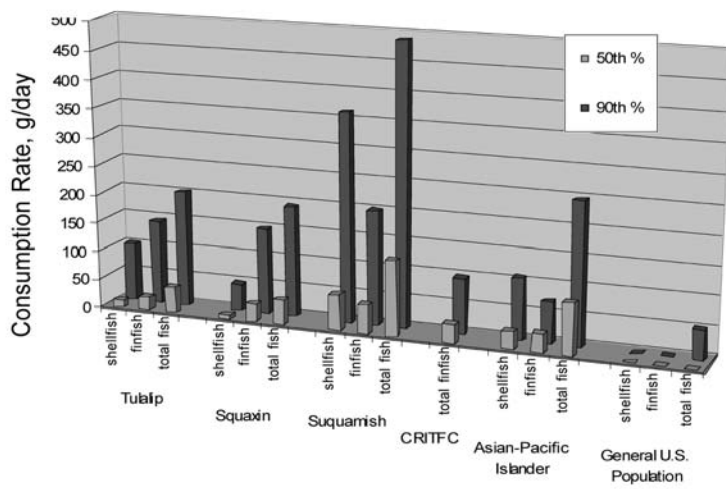
For Oregon tribes, the consumption of fish is intimately related to their culture and the freedom to exercise their religious beliefs. The inability to consume salmon on a culturally appropriate basis directly threatens the existence of these cultures and the tribes' religious freedoms. Congress expects federal agencies, such as EPA, to protect such religious freedoms. [See e.g. *American Indian Religious Freedom Act of 1978*, 42 U.S.C. § 1996]

The inability to consume salmon also directly threatens the health of Oregon tribal members. Nationally, fifteen percent of adult Native Americans have diabetes, more than twice the rate for non-Indian adults. [See [www.diabetes.org/diabetes-statistics.jsp](http://www.diabetes.org/diabetes-statistics.jsp)] Both the American Diabetes Association and the American Heart Association recommend eating two servings of fish a week, or 48.5 grams per day, more than twice the consumption rate adopted by Oregon. Heart disease and diabetes are both reduced by the consumption of cold water, fatty fish high in omega-3 fatty acids such as salmon. [See websites: [www.americanheart.org/presenter.jhtml?identifier=3040358](http://www.americanheart.org/presenter.jhtml?identifier=3040358) and [www.diabetes.org/diabetes-prevention/how-to-prevent-diabetes.jsp](http://www.diabetes.org/diabetes-prevention/how-to-prevent-diabetes.jsp)]

### EPA Methodology & the Local Studies

In 2000, EPA adopted a methodology for use in revising water quality standards, which gave Oregon and other states "flexibility to develop criteria, on a site-specific basis, that provide additional protection appropriate for highly exposed populations." EPA methodology recommends that states give priority "to identifying and adequately protecting the most highly exposed population." EPA also "strongly emphasizes its preference that States...use local or regional data over EPA's defaults...". Office of Science and Technology, Office of Water, EPA, *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health*, 2-2 EPA-822-B-00-004 (Oct. 2000).

In response to concerns about tribal fish consumption, local and regional data was sought by EPA and tribal groups. First, EPA funded a 1994 study reviewing tribal fish consumption by four tribes with treaty rights to fish in the Columbia River basin. Average tribal fish consumption was found to be 63.2 grams per day with 99% of all tribal members being adequately protected if the fish consumption rate was set at 389 grams per day, and 95% protected at 170 grams per day.



## Tribal Water Quality

### Contaminants

### Cancer Risks

### Committee Proposal

### ODEQ Proposal

### OEQC Action

### Tribe's Objection

### Local Data

*Columbia River Inter-Tribal Fish Commission, A Fish Consumption Survey of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribes of the Columbia River Basin, Technical Report #94-3* (Oct. 1994) [See website: [www.critfc.org/tech/94-3report.html](http://www.critfc.org/tech/94-3report.html)] Evidence also suggests that tribal members may eat even more fish than the levels documented in the 1994 fish consumption study. See e.g. S. G. Harris and B. L. Harper, *A Native American Exposure Scenario*, Risk Analysis 17, 789-795 (1997).

Second, in 2002 EPA published a study specifically assessing the level of common contaminants in Columbia Basin fish. EPA found 92 of 131 chemicals analyzed in fish tissue, including high concentrations of pesticides, PCBs, zinc and other chemicals. EPA noted the elevated risks for non-cancer effects and the higher estimated cancer risks due to the elevated consumption rates of tribal members. *Risk Evaluation Unit, Office of Environmental Assessment, EPA Region 10, Columbia River Basin Fish Contaminant Survey*, EPA 910-R-02-006 (July 2002) [See website: <http://yosemite.epa.gov/r10/oea.nsf> FOLLOW: Reports >> Columbia River Basin Fish Contaminant Survey] In some cases, cancer risk for tribal members was greater than 1 in 1,000. Ironically, states typically take regulatory action to protect the public when cancer risks exceed a probability of 1 in 1,000,000 to 10,000. No state appears to consider a risk level of 1 in 1,000 acceptable. See e.g. Environment International, *Difficult Decisions: Tribal Fish Consumption Practices and Risk from Fish Contamination in the Columbia Basin* (2003).

#### Oregon's Response to the Local Data

Based on the local studies, in 2004 the Oregon Department of Environmental Quality's (ODEQ's) Technical Advisory Committee recommended to the Oregon Environmental Quality Commission (OEQC) that it adopt EPA's recommended 142.4 grams/day for areas where fishing was of medium intensity and recommended that OEQC adopt a fish consumption rate of 389 grams per day where tribal members fish on a regular basis. See *Martin S. Fitzpatrick, ODEQ, Toxic Compounds Criteria: 1999-2003 Water Quality Standards Review Issue Paper* at H-36 (undated) [[www.deq.state.or.us/about/eqc/EQCagendasArchive.htm](http://www.deq.state.or.us/about/eqc/EQCagendasArchive.htm) FOLLOW: May 20-21, 2004 >> Item B, Attachment H >> Page 36] The Policy Advisory Committee associated with this effort was unable to reach consensus on this issue, and ultimately the rules proposed by ODEQ to OEQC for adoption utilized an EPA default fish consumption rate for the general population of US, i.e., the 17.5 rate already referenced.

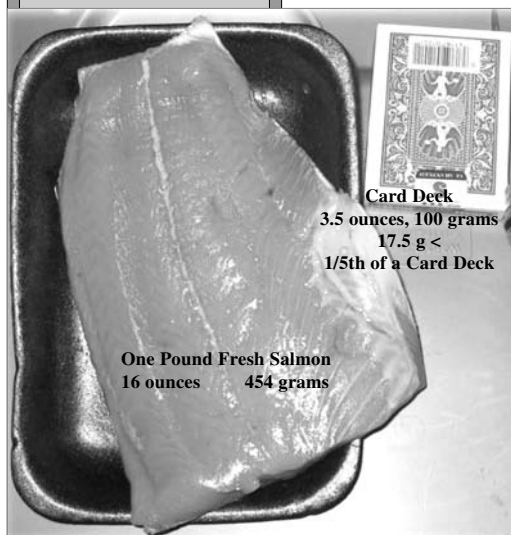
Ignoring the local studies, the advice of ODEQ's Technical Advisory Committee and the testimony of the Umatilla Tribes, in May 2004, OEQC adopted its revised WQS standards, including the fish consumption rate of 17.5 grams per day, with an effective date of February 15, 2005. See e.g. *Memorandum from Stephanie Hallock, ODEQ Director, to OEQC, "Agenda Item B, Rule Adoption: Water Quality Standards, Including Toxic Pollutants Criteria, OAR Chapter 340, Division 41, May 20-21, 2004, OEQC Meeting"* (April 29, 2004). In response, the Umatilla Tribes tried to convince Oregon that it should revisit this decision. Further discussions occurred between ODEQ, EPA, the Umatilla Tribes and OEQC. In early 2005, ODEQ's Director acknowledged that sound local data exists to support more representative tribal fish consumption rates. See *Letter from Stephanie Hallock, Director, ODEQ, to Donald Sampson, Executive Director, Umatilla Tribes* (Feb. 11, 2005).

EPA told OEQC that, "The first preference for deriving consumption rates is the use of local data, which we have for the four Columbia River tribes . . ." and recommended that Oregon adopt 142.4 grams/day for its subsistence fishers, like Indian tribes. See *Statement of Michael Gearheard, Director, Office of Water and Watersheds, US Environmental Protection Agency, Region 10, Before the Oregon Environmental Quality Commission* (April 21, 2005).

A panel of independent scientists from Oregon Health & Science University, Oregon Department of Human Services, EPA, Oregon State University and Washington's Department of Health told OEQC that they "found elevated risk and insufficient protection for tribal populations, particularly women of childbearing age, infants, and children. This finding is especially alarming given the well-established neurological and developmental effects of methyl mercury. . . [we] are concerned not only for the Umatilla, but also other tribes, and subsistence, sport, and ethnic populations who harvest fish in Oregon waters." *Letter to OEQC from Dr. Lambert, et al.* (April 20, 2005).

#### Umatilla Tribes' EPA Civil Rights Complaint

Frustrated with OEQC's decision to ignore EPA's methodology, the local studies showing higher fish consumption by tribal members, and the recommendations from ODEQ's Technical Advisory Committee, the Umatilla Tribes asked EPA to disapprove Oregon's proposed WQS toxics criteria as it relates to the fish consumption rate. Because EPA appeared unwilling to disapprove the fish consumption rate of 17.5 grams per day adopted by Oregon, the Umatilla



## Tribal Water Quality

### Civil Rights Complaint

Tribes filed a civil rights complaint with EPA's Office of Civil Rights in June 2005. The Umatilla Tribes argued that the adoption of the fish consumption rates amounted to a disparate impact on a minority group in violation of Title VI of the Civil Rights Act of 1964. 42 U.S.C. §§ 2000d et seq. (2005); 40 C.F.R. Part 7 (2005). The Tribes also argued that it created an on-going violation since all ODEQ decisions about permitting would be based on toxics criteria driven, in part, by the fish consumption rate. In August, EPA dismissed the complaint because it was not filed within 180 days of OEQC adoption of the WQS in 2004.

According to EPA, as of December 2005, only 20 of 172 complaints filed since 1993 were deemed sufficient to warrant even preliminary investigation. So far, EPA's Office of Civil Rights has not found discrimination in any of these complaints. [See: *Title VI Complaints With EPA*, website: [www.epa.gov/civilrights/docs/t6csdec05.pdf](http://www.epa.gov/civilrights/docs/t6csdec05.pdf)]

To date, the Tribes have chosen not to appeal EPA's decision in this matter. Instead, the Umatilla Tribes are pursuing a political resolution with EPA and Oregon in hopes of having Oregon revisit the fish consumption rate as part of its triennial review of its WQS. The Tribes' goal is adoption of a more protective fish consumption rate in another three years by OEQC.

### Potential Legal Responses

The Umatilla Tribes and other subsistence fishers in Oregon have a number of potential legal avenues. Timely filing of a civil rights complaint with EPA's Office of Civil Rights as soon as ODEQ takes a final action under the adopted and EPA approved WQS toxics criteria is an option. Depending on the factual circumstances, EPA's denial of the claim or its failure to act on the claim may create the opportunity to appeal the matter under the Administrative Procedures Act, 5 U.S.C. §§ 704 et seq. (2000).

The U.S. Supreme Court has shut the door on disparate impact claims by private parties under the Civil Right Act of 1964, but not on intentional discrimination claims if evidence of intent is available. See e.g. *Alexandar v. Sandoval*, 532 U.S. 275 (2001); *S. Camden Citizens in Action v. NJ Dept. Envi'l Prot*, 274 F.3d 771 (3rd Cir. 2001).

A more likely avenue would be a challenge based on the Clean Water Act and the Endangered Species Act (ESA). In April 2006, the Northwest Environmental Advocates (NWEA), based in Portland, Oregon, filed a complaint with the United States District Court of Oregon challenging EPA's failure to approve or disapprove Oregon's proposed toxics criteria within the statutory timeframe. With EPA's expected approval, NWEA and others will have the opportunity to challenge the toxics criteria directly, including the fish consumption rate.

Existing case law on the subject of fish consumption rates shows that the courts usually defer to EPA's technical judgment absent definitive local data or studies. In *Natural Resources Defense Council v. EPA*, the 4<sup>th</sup> Circuit Court of Appeals, responding to a challenge to EPA's dioxin standard based, in part, on fish consumption rates, stated that it "must give due weight to EPA's interpretation and administration of this highly complex statute, particularly when its determination appears to be reasonable and is supported by substantial evidence in the administrative record." 16 F.3d 1395, 1401 (4<sup>th</sup> Cir. 1993).

In *Dioxin/Organochlorine Center v. Clarke*, the 9<sup>th</sup> Circuit Court of Appeals upheld EPA's decision to adopt a dioxin standard for total daily maximum loads in the Columbia River basin based on Washington's fish consumption rate of 6.5 grams per day. EPA concluded that even if all 6.5 grams per day consumed would be contaminated at the maximum possible level for dioxin, the increased cancer risk would still be less than one in a million. One of EPA's key arguments was that no definitive study had been done showing the level of dioxin contamination in the area's fish. 57 F.3d 1517 (9<sup>th</sup> Cir. 1995).

### Conclusion

Whether environmental groups, Indian tribes or others will successfully challenge an EPA approval of Oregon's fish consumption rate remains to be seen. Nonetheless, the simple fact remains that, if EPA approves Oregon's proposed toxic criteria, the low fish consumption rate means tribal members in Oregon must either stop fishing to the point that they must essentially give up their culture and religion, or accept that more tribal members will suffer poor health and die from the effects of toxins in the local fish they eat. As Antone Minthorn, the Chairman of the Umatilla Tribes, stated in his cover letter with its civil rights complaint filed with with EPA:

Oregon has deliberately chosen to sacrifice the health of our tribal members in order to avoid heightened restrictions under its water quality standards. The cost/benefit calculation of sacrificing a minority group like ours to avoid vague, generally assumed economic impacts is insufficient justification for violating our civil rights.

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### Legal Options

### Civil Rights

### Toxics Criteria Challenge

### Agency Deference

### Local Data Critical

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## Washington Stormwater

### Permit Renewal

### Pending Appeals

### Hearings Board

### Narrative Limits

### State Distinctions

### Management Manuals

### Treatment Requirements

### "AKART"

### Demonstration Approach

## WASHINGTON STORMWATER REGULATION



STATE GENERAL INDUSTRIAL STORMWATER PERMITS AT ISSUE  
by James Tupper, Mentor Law Group (Seattle, WA)

In the State of Washington, the Department of Ecology (Ecology) has stated it will release a preliminary draft of the next Industrial Stormwater General Permit in October 2006. Ecology will be concurrently considering the results and recommendations from a comprehensive study on the efficacy of monitoring under a general permit. At the same time, the State's Pollution Control Hearings Board is expected to issue important rulings in pending administrative appeals of general permits for boatyards and construction activities. Several key issues in stormwater regulation will be addressed in these developments, including: the level of agency review required to grant general permit coverage; the use of water quality-based numeric effluent limitations; the obligation to perform a reasonable potential analysis; and the manner in which Ecology determines the benchmark values in its general permits. The following article begins with an introduction to industrial general stormwater permits in Washington State and then addresses the status of the three permits subject to renewal and current litigation.

### Industrial General Stormwater Permits in Washington

In the State of Washington, except on federal and tribal lands, the National Pollution Discharge Elimination System (NPDES) permitting under the federal Clean Water Act is delegated to Ecology. RCW 90.48.260. An important aspect of the state permit program is the role of the Pollution Control Hearings Board (PCHB). The board is established within the independent Environmental Hearings Office and has exclusive jurisdiction over administrative appeals of Ecology permits. Chapter 43.21B RCW. This means that PCHB has the final administrative call on all aspects of an industrial general stormwater permit. As a consequence, PCHB has consistently played an important role in setting and guiding general permit conditions. The structure in Washington is distinct from States such as Oregon where general stormwater permits are issued as administrative rules.

Ecology's general industrial stormwater permits are patterned after national permits that rely on narrative permit limits which address: benchmarks; inspections; corrective action; and self-certification of compliance. For some parameters, Washington differs in several respects from the national permits. These differences include: more conservative benchmarks; more rigorous adaptive management requirements; and more stringent monitoring.

A distinct feature of Ecology's permit program is the use of State stormwater management manuals. Ecology's manuals result from a comprehensive review and evaluation of stormwater **best management practices** (BMPs) undertaken by public and private representatives with expertise in designing and maintaining stormwater BMPs. [See *Stormwater Management Manual for Western Washington* (SWMM)] This review process includes input from representatives of the Washington Department of Fish and Wildlife and the Puget Sound Action Team.

Ecology's manuals are "intended to provide project proponents, regulatory agencies and others with technically sound stormwater management practices which are *presumed* to protect water quality and instream habitat." *Id.* at 1-8 (emphasis in original). The SWMM prescribed approaches are based on best available science and result from existing Federal and State laws that require stormwater treatment systems to be properly designed, constructed, maintained and operated to:

1. Prevent pollution of state water and protect water quality, including compliance with state water quality standards;
  2. Satisfy requirements for **all known available** and **reasonable** methods of prevention, control and **treatment (AKART)** of wastes prior to discharge to waters of the State; and
  3. Satisfy the federal technology based treatment requirements under 40 CFR part 125.3.
- Id.* at 1-8.

Ecology's stormwater manuals have long been considered among the most comprehensive in the United States. In a 2003 review of a prior edition of the SWMM for Western Washington, the State's Independent Science Panel found that the guidance is "impressive in its scope, coverage and quality. It includes discussion on initial planning for selection of devices, sequence of controls, and maintenance components that are typically lacking in most manuals and the discussion on emerging technologies is appropriate and well done."

The current manuals include a demonstrably equivalent approach to BMP selection that is protective of water quality and instream habitat. The Western Washington manual states that the demonstrative approach may be "more cost effective for large, complex or unusual types of projects." SWMM at 1-10. The demonstrative approach is feasible only in those unique circumstances given the requirements for selection and documentation. Under RCW 90.48.555(6)(b)(ii), a Stormwater Pollution Prevention Plan

## Washington Stormwater

### Documentation

### Industrial & Construction Stormwater

### Boatyards

### Appeals

### Industrial Permit Provisions

### Advisory Report

### Concerns

(SWPPP) relying on the demonstrative approach must include the following documentation:

- (A) The method and reasons for choosing the stormwater best management practices selected;
- (B) The pollutant removal performance expected from the practices selected;
- (C) The technical basis supporting the performance claims for the practices selected, including any available existing data concerning field performance of the practices selected;
- (D) An assessment of how the selected practices will comply with state water quality standards; and
- (E) An assessment of how the selected practices will satisfy both applicable federal technology-based treatment requirements and state requirements to use all known, available, and reasonable methods of prevention, control, and treatment.

Ecology has issued both an Industrial Stormwater General Permit (ISGP) and Construction Stormwater General Permit (CSGP). In addition, Ecology has issued industry specific general permits that cover stormwater discharges in the Sand and Gravel General Permit and in the Boatyard General Permit. The current ISGP issued in 2005 resulted from a legislative resolution of pending appeal issues. The permit is subject to expire in September 2007 and Ecology has indicated that it will issue a preliminary draft of the next ISGP for consideration by an external advisory committee in October 2006. Ecology tentatively plans to issue a draft of the ISGP subject to public notice and comment in December 2006 or early 2007.

The 2005 Boatyard General Permit was appealed to PCHB by an industry association and an environmental organization. The consolidated appeals were heard in July 2006 and are pending for final ruling. The 2005 CSGP was appealed to PCHB as well. The parties have submitted several issues for resolution on summary judgment. The final hearing on the CSGP is scheduled to begin in January 2007.

#### 2004 Legislative Compromise – SB 6415

By 2004, the ISGP had been subject to several administrative appeals, efforts at settlement, and was, once again, on appeal before the State Court of Appeals. The appeals were resolved through a legislative compromise that had broad bi-partisan support. The key provisions of the 2004 legislation (SB 6415, codified at RCW 90.48.55) include:

1. A presumption of compliance if a discharger is in compliance with the permit and there is no site-specific information that a discharge is causing or contributing to a water quality violation.
2. Imposition of numeric limits where required under federal effluent guidelines, pursuant to approved TMDLs, or where the department has determined that the discharge has a reasonable potential to cause or contribute to a violation of water quality standards. The reasonable potential analysis must include consideration of existing controls and nonpoint sources of pollution, the variability of the discharge and, where appropriate, dilution of stormwater in the receiving water.
3. An enforceable adaptive management program with monitoring.
4. Increased permit fees to fund, in part, a requirement that the department inspect each facility covered under the ISGP and CSGP.
5. A report to the legislature by December 31, 2006, on the effectiveness of monitoring and stormwater management.
6. A report to the legislature by September 1, 2008, as to how it will develop numeric effluent limits for existing discharges to 303(d) listed water bodies and how it will implement numeric effluent limitations.

#### The SB 6415 Monitoring Data Study

In 2005, Ecology formed an external advisory committee to develop a scope of work for consultants to conduct the legislatively required monitoring study. This committee continued to review draft reports from the consultants during the summer of 2006.

The consultants are scheduled to issue a final report in October 2006 based on comments from Ecology and the advisory committee. In draft reports the consultants have analyzed data collected on a quarterly basis from 2003 through 2005. This data was reported by 818 permitted facilities and included 21,486 values (i.e., monitoring data points). With the exception of ammonia nitrate, the values measured exceeded the benchmarks and action levels in the permit in a number of cases. The consultants characterized these results as being of “high concern” for zinc—where over 50 percent of the samples exceeded the ISGP permit benchmark and 21 percent exceeded the action level. Turbidity and copper were considered to be of “moderate concern”—where 20-to-50 percent of the samples were below the permit benchmark. Finally, lead, pH, oil and grease were characterized as being of “low concern” because less than 20 percent of the sampling values exceeded permit benchmarks.

The draft report analyzed the sampling results against a set of hypothetical water quality standards which were adjusted—in the case of copper, zinc and lead—by factoring in the hardness of receiving water and a very conservative translator value to calculate the total-to-dissolved fraction of metals. The



## Washington Stormwater

### Data Lacking

### Precedent?

### Benchmarks

### Sampling

### Action Levels

#### Level One

#### Level Two

#### Level Three

### Renewal Issues

results of this analysis indicate that a high percentage of industrial stormwater dischargers are exceeding water quality standards—that is, if moderate levels of dilution are not considered.

The hypothetical water standards used in the draft report are described as a “simplified” approach. The report qualifies its findings by stating that “existing data compiled through the general NPDES permit for industrial and construction stormwater cannot be used to assess compliance with state water quality standards.” The draft report points out that the broad generalizations in the hypothetical water quality standard approach result in “broad generalizations for processes that are driven almost entirely by site-specific conditions and interactions.”

This report will certainly provide support for those pushing for numeric effluent limitations and for questioning the adequacy of current benchmarks and monitoring. A preview of this debate was seen in the Boatyard General Permit trial in the summer of 2006 and we may see a significant precedent set in PCHB’s ruling in that appeal pertaining to how Ecology should marshal monitoring data to set general permit conditions.

#### The Industrial Stormwater General Permit (ISGP)

The ISGP was modified and reissued in January 2005 following the enactment of SB 6415. Among the more significant changes to the permit was the incorporation of action levels and adaptive management requirements pursuant to RCW 90.48.555.

THE MODIFIED ISGP RETAINED BENCHMARKS FOR:

- turbidity (25 nephelometric turbidity units (NTU));
- pH (actionable outside a range of 5-to-10 standard units);
- total zinc (117 micrograms per liter (µg/L)—sometimes expressed as parts per billion (ppb))
- oil and grease (15 mg/L).

ISGP at S4.D.2.

A permit requires quarterly water quality sampling. If two consecutive samples are above the zinc benchmark, additional monitoring is required for copper, lead and water hardness. The benchmarks for copper and lead subject to the additional sampling are 63.6 µg/L and 81.6 µg/L.

The permit action levels are set at higher values. For the key parameters, copper is 149 µg/L, lead is 159 µg/L, zinc is 372 µg/L and turbidity is 50 NTU. The action levels in the permit are keyed to these values. A level one response is triggered whenever a sampling result is above a benchmark. The discharger must conduct an inspection and evaluate sources of pollutant loading and identify source or operational methods to reduce pollutant loading. The discharger is also required to evaluate the need for a level two and level three response. Finally, the discharger must document the results of the inspection and analysis, and any remedial actions taken.

A level two response must be initiated when two out of the previous four quarterly samples are above action levels. The level two response includes the same inspection and analysis as the level one response. At level two, however, there is an additional requirement to implement source and operational BMPs identified in the investigation and file a level two source control report with Ecology.

A level three response is triggered when any four samples are above action levels. In addition to the response required for the first two levels, the discharger must implement additional source, operational and stormwater treatment BMPs within 12 months and file a report with Ecology within the same time frame. The level three response allows for a waiver of the implementing stormwater treatment BMPs as long as the waiver request is made within three months of initiating the level three response.

One of the central issues in renewal of this permit will be the formulation of benchmarks and action levels. The SB 6415 consulting team has recommended performance-based benchmarks and action levels. Under this proposal, the benchmarks would be calculated at the 50<sup>th</sup> percentile of the monitoring data and action levels would be set at the 70<sup>th</sup> percentile. A comparison of this proposal with existing permit values is described in the following table from an August 2006 report from the consultants.

**Table 1: Existing ISGP Permit / Proposed Changes Comparison**

Parameter	Existng Permit		Percentile Method	
	Benchmark	Action Level	Benchmark	Action Level
<b>Turbidity (NTU)</b>	25	50	15	42
<b>Zinc (µg/L)</b>	177	372	139	362
<b>Copper (µg/L)</b>	63.6	149	22.2	49
<b>Lead (µg/L)</b>	81.6	159	12	40

<b>Washington Stormwater</b>	<p>Ecology is also considering benchmarks for copper, lead and zinc that will be based on an analysis similar to the hypothetical water quality standards discussed in the monitoring data study. That approach would express the benchmarks as the water quality criteria adjusted for receiving water hardness and a translator to calculate the percentage of the dissolved fraction of total metals. There is no indication that Ecology, at least for the preliminary draft, is considering the use of standard dilution rates as were used in the Oregon ISGP or the Boatyard General Permit discussed below.</p>
<b>Pending Appeal</b>	<p><b>Boatyard General Permit</b></p> <p>The current Boatyard General Permit (Permit) was issued on November 2, 2005, covering discharges from approximately 95 boatyards. A “boatyard”—as opposed to a “shipyard”—is defined as a facility where the predominant work is on vessels under 65 feet. The permit was separately appealed to PCHB by an industry association and environmental organization. PCHB conducted a final hearing in July 2006 but has not issued a final order.</p>
<b>Mandatory BMPs</b>	<p>Consistent with the ISGP, the Permit sets forth mandatory BMPs to control “all particles, oil, grits, dusts, flakes, chips, sediments, decries and other solids.” <i>Permit</i> at S4.C.7. The mandatory BMPs are in addition to BMPs that must be selected and implemented in a Stormwater Pollution Prevention Plan (SWPPP) under Special Condition S5. <i>Id.</i> Mandatory BMPs are intended to comprehensively eliminate the release of paint and paint residue from stormwater discharges. <i>Id.</i></p>
<b>SWPPP Requirements</b>	<p>The SWPPP must include any additional BMPs which are necessary to comply with State water quality standards. <i>Id.</i> at S5. The SWPPP must document: how BMPs are selected; the pollutant removal performance expected from the BMPs; and the technical basis which support the performance claimed for the BMPs selected. <i>Id.</i> The SWPPP must also provide an assessment of how the selected BMPs will meet State AKART standards and federal technology-based treatment requirements. <i>Id.</i> This documentation is not necessary, however, if BMPs are selected from approved stormwater manuals. <i>Id.</i> at S5.B.3.</p>
<b>BMP Implementation</b>	<p>BMP implementation is subject to weekly visual inspection. The SWPPP must contain a checklist for visual monitoring and retention of all inspection records. <i>Id.</i> at S5.B.2.b and S5.B.3.a.vi. The visual inspection report must specifically provide for tracking and followup to ensure that a report is prepared and that appropriate action is taken in response to visual monitoring. <i>Id.</i> The signature requirements in General Condition G17 require an authorized person to sign the weekly inspection report and to certify compliance with the SWPPP under penalty of perjury as to the truth and accuracy of the information in the reports. <i>Id.</i> at G17. One of the critical requirements for visual inspection is a response to any deficiencies in the SWPPP or BMPs. The permit provides, “[w]hen visual monitoring identifies inadequacies in the SWPPP, due to the actual or potential to discharge a significant amount of any pollutant, the SWPPP must be modified and BMPs adjusted to correct the deficiency.” <i>Id.</i> at S5.A.2.</p>
<b>Visual Inspection</b>	<p>BMP effectiveness is also monitored by water quality samples that must be collected five times a year—in January, April, May, September and October. <i>Id.</i> at S3, Table. The samples must be tested for oil and grease, total recoverable copper, and total suspended solids. <i>Id.</i> The results from sampling must be reported to Ecology by the 15th day of the following month. <i>Id.</i> at S6.A.</p>
<b>Sampling Reports</b>	<p>The water quality samples for stormwater must be evaluated against benchmarks for oil and grease, copper and total suspended solids. <i>Id.</i> at S1.C. The copper benchmarks, for existing discharges, vary based on whether the discharge is to a lake (77 µg/L), river (384 µg/L), or marine waters (229 µg/L). <i>Id.</i> Benchmarks were derived by adjusting the acute state water quality criteria for copper, which for marine waters is 4.8 µg/L (WAC 173-201A-040(3) (1997)), to include: (1) a standard dilution factor applicable to rivers and marine waters; (2) a standard dissolved fraction; and (3) a standard water effects ratio for freshwater and marine water. Benchmarks for lake discharges do not include a standard dilution factor.</p>
<b>Benchmark Derivation</b>	<p>The formula used to derive the benchmarks was based on the same analysis that would be used to set a numeric water quality-based effluent limitation. An assumed water hardness of 25 mg/l was applied to the state water quality criteria for copper. The resulting water quality criteria were then adjusted by the dissolved percentage of copper in boatyard stormwater, a water effects ratio and a dilution factor. <i>Fact Sheet</i> at 17-19.</p>
<b>Water Effects Ratio</b>	<p>The percent of dissolved copper used to develop the benchmarks (thirty-percent), was based on a shipyard AKART analysis dated May 7, 1997. <i>Fact Sheet</i> at 18, 22. The water effect ratios for freshwater discharges relied on existing water effect ratio studies including a summary of water effects ratios prepared by the US Environmental Protection Agency (EPA). The freshwater water effect ratios for copper ranged from 1.1 -to- 15.3. Ecology relied on a value of 2.5, which is fifty-percent of the mean of the values reported in the scientific studies referenced in the <i>Fact Sheet</i>. Ecology similarly relied on a study of marine water effects ratios that ranged from 1.43 -to- 2.77 and employed the lowest value (i.e., 1.43), to calculate the marine copper benchmark.</p>

## Washington Stormwater

### Dilution Factor

#### Adaptive Management

### Copper Issue

#### PCHB Precedent

### Numeric Limits Debate

### Benchmarks v. Numeric Limits

### Previous PCHB Decisions

Ecology applied a dilution factor of 10 to calculate the copper benchmark for discharges to rivers and marine waters. *Fact Sheet* at 19. This was considered a conservative approach and the minimum dilution expected for a boatyard discharge. The mean of acute dilution factors from individual permits is 30. *Id.* The initial marine water dilution factors calculated by Ecology for the Permit ranged from 15 -to- 190. In freshwater, the range of acute dilution factors considered by Ecology ranged from 14 -to- 80.

The Permit sets forth adaptive management conditions that lead to submission of an engineering report and treatment BMPs. If any sample exceeds a benchmark, the discharger must identify source and operational controls to reduce contamination. *Id.* If any four samples exceed a benchmark value, the discharger must also prepare a source control report outlining treatment practices and structures. *Id.* If six samples exceed a benchmark value, the discharger must, in addition to the earlier requirements, submit an engineering report to Ecology and implement treatment BMPs within 12 months of plan approval. *Id.* Ecology's emphasis on adaptive management allows each facility to proceed in a reasonable manner and with treatment BMPs that are necessary, appropriate, and tailored to each facility's individual needs.

An important issue for the environmental organization (to be decided on appeal) was the failure of Ecology to conduct a reasonable potential analysis and set water quality-based effluent limitations. Some permit program managers and staff within Ecology supported these contentions. Much of this case rested on monitoring data reported under the previous Boatyard General Permit. That data indicated high levels of copper in stormwater samples collected from the facilities. The appealing environmental organization argued that there was little doubt that boatyards were causing or contributing to water quality violations. A central theme in this case is that BMPs obviously are insufficient given the high levels of copper reported in the data. The manner in which PCHB resolves this issue will set a significant precedent as to how Ecology will — or must — use the monitoring data reported under other general permits.

For its part, the industry association challenged the quality of the data and the basic premise that a general permit should include site-specific water quality-based numeric effluent limitations. Ecology's *Permit Writer's Manual*, for example, recognizes that general permits "do not include any site-specific or facility-specific requirements." *Manual*, Chapter II-10. This aspect of general permits was recognized in Ecology comments during development of the Permit. The Ecology Permit Management Team accepted that numeric water quality-based effluent limitations were not appropriate for the Permit:

A water quality-based limit is very difficult to do in a general permit because of the need for site-specific factors to do it correctly (e.g., background concentrations, discharge characteristics, mixing-characteristics, receiving water hardness, translators). Imposing an effluent limit as the water quality criteria (assuming a hardness for fresh water dischargers) would create a demand for individual permits where they could get site-specific consideration.

Ecology accordingly opted to employ benchmarks rather than numeric water quality-based effluent limitations. The rationale for this approach was further described in the *Permit Fact Sheet*:

The USEPA and Ecology have determined that it is generally not possible to conduct a reasonable potential analysis for each facility covered under a general permit in the same manner as for an individual facility and still retain the benefits of a general permit. However, EPA and Ecology are mandated to protect water quality when authorizing discharges as noted above. To resolve this conflict, EPA derived the concept of "benchmarks" in a general permit. Benchmark values are not water quality standards and are not permit limits. They are indicator values. Ecology considers values at or below [a] benchmark as unlikely to cause a water quality violation. The benchmarks for this permit were derived using factors that are available to individual Permittees.

*Fact Sheet* at 17. The EPA guidance is published at 61 Fed. Reg. 57426 (Nov. 6, 1996).

PCHB has previously held that Ecology is not required to impose numeric water quality-based effluent limitations in a general stormwater permit. *Airport Communities Coalition v. Ecology*, PCHB No. 01-160 (Findings of Fact, Conclusions of Law and Order, August 12, 2002); *PSA v. Ecology*, PCHB No. 00-014 (Order on Motion for Summary Judgment, August 29, 2001); *Save Lake Sammamish v. Ecology*, PCHB No. 95-141 (Order Granting Partial Summary Judgment to Respondents, June 27, 1996).

In *Save Lake Sammamish*, the PCHB stated that a general permit:

[Is] thus part of a regulatory program that is progressing and refining stormwater control measures. As a matter of law this context establishes that the permit as issued is consistent with the [water quality standards]. The department is not required to have perfect knowledge of the ultimate outcome of stormwater regulation before it proceeds. As one court stated, "...this ambitious statute is not hospitable to the concept that the appropriate response to a difficult problem is not to try at all."

*Id.* citing *N.R.D.C v. Costle*, 568 F.2d 1369, 1380 (D.C.Cir. 1977).

## Washington Stormwater

### "Reasonable Potential Analysis"

An important issue to be resolved by PCHB is whether Ecology was legally required to conduct a reasonable potential analysis given the very high levels of copper reported in monitoring data. At the final hearing, Ecology maintained that it is not required to conduct a reasonable potential analysis. This was in part based on EPA's direction for incorporating water quality-based effluent limitations into stormwater permits:

Due to the nature of stormwater discharges, and the typical lack of information on which to base numeric water quality-based effluent limitations (expressed as concentration or mass), EPA has developed an interim permitting approach for National Pollution Discharge Elimination System (NPDES) stormwater permits. While this interim approach applies only to EPA, the Agency also encourages authorized States and Tribes to adopt similar policies for stormwater permits. 61 Fed. Reg. 166, 43761 (Aug. 26, 1996).

Part of the consideration by PCHB is whether the data exists to perform a reasonable potential analysis. Under 40 C.F.R. § 122.44(d)(1)(ii) a reasonable potential analysis is dependent upon data that does not exist under Ecology's general stormwater permits:

When determining whether a discharge causes, has the reasonable potential to cause or contributes to an in-stream excursion above a narrative or numeric criteria within a State water quality standard, the permitting authority shall use procedures which account for existing controls on point sources of pollution, the variability of the pollutant or pollutant parameter in the effluent, the sensitivity of the species to toxicity testing (when evaluating whole effluent toxicity), and where appropriate, the dilution of the effluent in the receiving water.

EPA's approach for determining a reasonable potential to cause or contribute to a violation of water quality standards was adopted as a State statute in 2004 (SB 6415). Under RCW 90.48.555(4), Ecology is directed to make a reasonable potential analysis in the same manner as federal law:

(d)(4) In making a determination under subsection (d)(3) of this section, the department shall use procedures that account for:

- (a) Existing controls on point and nonpoint sources of pollution;
- (b) The variability of the pollutant or the pollutant parameter in the stormwater discharge; and
- (c) As appropriate, the dilution of the stormwater in the receiving waters.

The decision in the Boatyard General Permit appeal will be closely watched to see the extent to which PCHB defers to Ecology on this issue. PCHB typically defers to Ecology's technical expertise on matters such as the derivation of benchmarks. *Northwest Aquatic Ecosystems v. Ecology*, PCHB No. 05-101 (Findings of Fact, Conclusions of Law and Order, Feb. 15, 2006) (PCHB "gives deference to Ecology's expertise as the administering agency for NPDES permits"). In *Port of Seattle v. Pollution Control Hearings Board*, 151 Wn.2d at 595, the Court was clear:

Ecology's interpretation of water quality statutes [is] entitled to great weight, so long as they do not conflict with the statute's plain language. Ecology's interpretations of its own regulations are also entitled to great weight. . . . [D]eference will [also] be given to Ecology on technical issues based on Ecology's specialized expertise.

A third major issue in the Boatyard General Permit appeal is whether Ecology can use standard dilution factors and generalized water effects ratios to set benchmarks. There is no provision under State or federal law prohibiting the reasonable use of available tools in setting general permit benchmarks. Dilution factors and water effect ratios are well-established tools for protecting water quality. See e.g. *Port of Seattle v. Pollution Control Hearings Board*, 151 Wn.2d at 632-35. The use of standard dilution factors in general permits is not unprecedented. Ecology's 2005 Sand & Gravel General Permit set a water quality-based numeric limit of 50 NTU that implicitly assumes a standard dilution factor of 10. In Oregon, the recent ISGP calculates benchmarks for metals assuming a dilution factor of five.

A fourth critical issue in the Boatyard General Permit appeal is whether a discharger must file a SWPPP for Ecology review and approval prior to a decision to grant coverage. On this issue PCHB granted summary judgment and affirmed the permit conditions that do not require SWPPPs to be filed or reviewed prior to the coverage decision. This is consistent with prior rulings by PCHB. *Puget Soundkeeper Alliance v. Ecology*, PCHB No. 00-174 (Order on Motion for Summary Judgment, Aug. 29, 2001) citing *Save Lake Sammamish v. Depts. of Ecology and Transportation*, PCHB No. 95-141 (Order Granting Partial Summary Judgment to Respondents, June 27, 1996). SWPPPs are not engineering reports subject to review and approval under WAC 173-240-020(8).

### Construction Stormwater General Permit (CSGP)

Ecology issued the current Construction Stormwater General Permit (CSGP) on November 16, 2005. The CSGP covers all construction sites larger than one acre of disturbed soil unless stormwater is discharged entirely to groundwater or is otherwise subject to an erosivity waiver. The CSGP was subject

### EPA Approach

### Deference to Ecology

### Dilution Factors

### SWPPP Filing

### Site < 1 Acre

**Washington  
Stormwater****AKART  
Requirement**

to separate appeals by an environmental organization, three industry trade associations and one local government. Numerous issues have been submitted on summary judgment and are currently awaiting a ruling from PCHB. Final hearing on any remaining issues is scheduled for January 2007.

As with the ISGP, this construction permit requires implementation of “all known, available, and reasonable methods of prevention, control, and treatment” (AKART), including: “preparation and implementation of an adequate Stormwater Pollution Prevention Plan (SWPPP), with all appropriate best management practices [BMPs].” CSGP at S3.B. The SWPPP must contain narrative information on 12 specific areas of erosion control and management. *Id.* at S9. BMPs must be consistent with Ecology’s most recent regional stormwater management manual, an approved equivalent manual, or be demonstrably equivalent in their performance and ability to satisfy water quality standards. *Id.* at S9.C.

**Monitoring**

The CSGP assures implementation and maintenance of BMPs through monitoring requirements set forth in Special Condition S4. All covered facilities must conduct visual inspections at least once every calendar week and within 24 hours of any stormwater discharge from the site. *Id.* at S4.B.2. Site inspections must include all areas disturbed by construction activities. *Id.* at S4.B.1. Stormwater must be examined for the presence of suspended sediment, turbidity, discoloration and oil sheen. *Id.* The inspector must evaluate the BMP effectiveness and determine if it is necessary to install, maintain, or repair BMPs to improve stormwater discharge quality. *Id.*

**BMP Evaluation****Reports**

The CSGP requires documentation of the inspections. The results of each inspection must be summarized in an inspection report or checklist. *Id.* at S4.B.4. The report must be entered in the site log book which becomes part of the site plan and records available for agency and public inspection. *Id.* at S4.B.4 and S5.G.2. The CSGP provides that a minimum the inspection report must include:

- a. Inspection date and time;
- b. Weather information; general conditions during inspection and approximate amount of precipitation since the last inspection and within the last 4 hours;
- c. A summary list of all BMPs which have been implemented including observations of all erosion/sediment control structures or practices;
- d. Notation of:
  - i. location of BMPs inspected;
  - ii. location of all BMPs that need maintenance;
  - iii. the reason maintenance is needed;
  - iv. locations of BMPs that failed to operate as designed or intended; and
  - v. locations where additional or different BMPs are needed and the reasons why;
- e. A description of the stormwater discharged from the site. The inspector must note the presence of suspended sediment, turbid water, discoloration, and oil sheen.

*Id.* at S4.B.5.

**Corrective  
Action**

A covered facility must take action to correct any problem identified during an inspection. The CSGP requires that any necessary review of the SWPPP take place within seven days and that a facility fully implement and maintain source and treatment BMPs as soon as possible, but no later than 10 days from the inspection. *Id.* at S4.B.1. This requirement is implemented through a required certification by the inspector that a facility is in compliance with the SWPPP and permit, or a summary of remedial actions required to bring the site back into compliance with a schedule of implementation. *Id.* at S4.B.5.h. The entire inspection report, including the certification of compliance, must be signed under penalty of perjury. *Id.* at S4.B.5.i.

**Sampling**

In addition to visual inspections, construction sites must collect representative water quality samples for turbidity and pH at least once a week when there has been a discharge from a facility. Sampling for pH is only required when there is “significant concrete work”—which is defined as more than 1000 cubic yards of concrete or concrete containing materials such as recycled building materials or soil stabilization materials. Turbidity for sites larger than five acres must use turbidity meters. Sites of one -to- five acres may use a transparency tube to measure turbidity.

**Adaptive  
Management**

The adaptive management requirements of RCW 90.48.555 are implemented by requiring a discharger with a water quality sample above 25 NTU (or its equivalent using a transparency tube) to review and update its SWPPP within seven days and implement all necessary source control and stormwater treatment BMPs within 10 days. If the monitoring results are over 250 NTU, the discharger must: notify Ecology; take immediate steps to reduce the turbidity levels; and continue sampling daily until the monitoring is below 25 NTU or the discharger can document that the discharge will not cause or contribute to a violation of water quality standards.

**Deferred  
Requirement**

The CSGP defers water quality monitoring for one -to- five acre size sites to October 1, 2008. Sites larger than five acres must commence monitoring in October 2006. The delay in water quality sampling

## Washington Stormwater

### Sampling Phase-In

### Economic Considerations

### Legal Issues

### Small Sites

### Regulatory Fairness

### James Tupper

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for small construction sites was based on Ecology's recognition that small construction sites will find it challenging to complete the permit-required inspector training and to implement the permit's mandatory recordkeeping procedures. These concerns were addressed in the CSGP Fact Sheet:

Ecology has determined that it is appropriate to allow permittees a period of time to understand and comply with the new sampling and reporting requirements. The rationale for postponing sampling and reporting includes, but is not limited to:

- Ecology believes that industry, as a whole, is unaware of the upcoming sampling requirements, despite the issuance of a draft permit in 2005. This may be especially true of operators of 1-5 acre sites.
- Ecology plans to conduct education and outreach to ensure that operators understand the new requirements and properly collect, analyze and submit accurate discharge monitoring data.
- Additional employee staffing, training, planning and equipment acquisition may be necessary before permittees are able to comply with the new requirements.
- Ecology data management systems need to be upgraded to deal with the new Discharge Monitoring Report requirements in the permit.

Ecology further explained in response to public comments that the phase-in of water quality sampling for small construction sites was appropriate to address the small business economic impact of the new permit. In the Fact Sheet, Ecology stated that it "decided to phase in sampling requirements for 1-5 acre sites until October 1, 2008. This will allow small builders approximately 3 years to focus on BMP selection and implementation before sampling and reporting requirements begin." Fact Sheet at 23-24 (Comment No. 7).

The prehearing order in the CSGP includes 33 legal issues. Among the more critical issues is the same issue as in the Boatyard General Permit concerning the filing of SWPPPs. The environmental organization has contended that without the SWPPP its members cannot assess whether coverage under the general permit is appropriate or whether the project should be covered under an individual permit.

A second critical issue is whether the CSGP may lawfully phase-in water quality sampling for small construction sites. PCHB will have to consider the relationship between RCW 90.48.555—which requires monitoring—and other permit regulations and statutes that require Ecology to consider the economic impact of permit requirements.

The procedural requirements for issuing general permits are subject to Chapter 173-226 WAC. The terms of this administrative rule were adopted, in part, pursuant to the 1994 Regulatory Fairness Act. Chapter 19.85 RCW. Under this statute and implementing regulation, Ecology conducts an economic impact analysis for every draft general permit. WAC 173-226-120. In addition to these requirements, RCW 90.48.555(8)(b) confers on Ecology the discretion to set the "timing and mechanisms for implementing treatment best management practices." PCHB will have to resolve whether these authorities grant Ecology the discretion to consider and adapt permit conditions to ameliorate adverse economic impacts from its general permits.

A third critical issue to be resolved at hearing is the reasonableness of the 25 NTU turbidity benchmark. While this is the same benchmark value used in the ISGP, it also serves at the action level for the purpose of adaptive management required under RCW 90.48.555. Dischargers under the ISGP respond—for the purpose of level two and three responses—based on sampling results above 50 NTU. In contrast, under the CSGP a single sample above 25 NTU requires modification of a SWPPP within seven days and full implementation of source and treatment BMPs within ten days.

It is not clear how many construction sites will be able to routinely comply with the 25 NTU benchmark. Ecology published a report in August 2005 that included an analysis of 49 water quality samples from construction sites. The majority of these sites were implementing source control and treatment BMPs under the Western Washington Stormwater Management Manual. Nearly half of the reported sampling results were above 25 NTU.

### Conclusion

This update is written at a time when we are anticipating decisions on fundamental aspects of industrial stormwater regulation in the State of Washington. There will be considerable interest in how Ecology modifies, or does not modify, the benchmarks and action levels in the ISGP. At the same time, the development of that permit could be shaped by what are anticipated to be significant decisions by PCHB in the Boatyard General Permit and CSGP.

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## Mercury Analysis

### Methylmercury Concerns

### Mercury Forms

### Conversion Conditions

## ANALYSIS OF MERCURY IN WATER AND SEDIMENT

by James Mc Ateer, Betsy Henry, Kathi Futornick, Gary Bigham  
(Exponent, Inc. — Lake Oswego, OR & Bellevue, WA Offices)

### Introduction

The understanding of mercury cycling, chemical form, and fate is evolving. As stated in an earlier article, *Mercury—A West Coast Perspective* (TWR, #31), recent advances in sampling and analytical techniques have allowed for the detection of mercury in the environment at very low concentrations and for the differentiation of inorganic mercury and methylmercury in surface water. Methylmercury is of particular concern in the environment because of its ability to bioaccumulate and pose toxicity to humans and wildlife. Regulatory agencies have promulgated these “clean” sampling and “low-level” analytical techniques, which, in turn, have been regulatory drivers for mercury legislation and rules. The approved methodologies are now often necessary to meet regulatory requirements, complete risk assessments, and gather data to more completely assess the biogeochemistry of mercury in the environment.

There are four main forms of mercury in the environment: elemental mercury ( $\text{Hg}[0]$ ); ionic or divalent mercury ( $\text{Hg}[\text{II}]$ ); mercury adsorbed onto particles ( $\text{Hg}[\text{p}]$ ); and organic mercury or methylmercury ( $\text{CH}_3\text{Hg}$ ). The majority of mercury in the atmosphere is elemental mercury ( $\text{Hg}[0]$ ), which is converted to the more soluble divalent mercury ( $\text{Hg}[\text{II}]$ ), which is subsequently removed from the atmosphere through precipitation.  $\text{Hg}(\text{II})$  can bind with particulate material to form  $\text{Hg}(\text{p})$ , which can also be removed from the atmosphere and deposited in terrestrial and aquatic systems. Once deposited, the potential for mercury to become an environmental concern depends largely on whether the conditions in the area of deposition support conversion of elemental mercury to methylmercury, a process called methylation. Research has identified sites where methylation is likely to occur, including wetlands (coastal and freshwater); low-pH and low-alkalinity lakes; recently inundated areas (i.e., reservoirs); systems rich in organic acids (i.e., lowland southwestern Oregon coastal streams); and estuaries, salt marshes, and streams subject to water level changes.

Most researchers agree that microbes, in particular anaerobic sulfate-reducing bacteria, are largely responsible for methylation and serve as an important link between sulfur and mercury cycles. Methylmercury biomagnifies upward in the food web, resulting in higher concentrations of mercury in predatory fish and in other predatory species. The specific mechanism of entry into the food web is unknown, but likely includes uptake of mercury-containing sediments in aquatic systems and dissolved methylmercury from the water. Humans and other species bioaccumulate mercury by eating fish and shellfish that contain methylmercury. Mercury is considered a neurotoxin with adverse impacts on the central nervous system. Emerging health issues concerning mercury have raised questions regarding autism and cardiovascular impairments.

Understanding mercury processes in a water environment is important to human health, and dependent on the quality of sampling and analytical techniques. This article presents a brief summary of field sampling and approved analytical techniques relevant to the determination of mercury in water and sediment.

### Field Sampling

Prior to about 1980, water samples analyzed for mercury and other trace metals were unknowingly contaminated. A 1995 review of reported mercury concentrations in natural (i.e., uncontaminated) waters by Nicholas Bloom indicated high concentrations as well as a high degree of variability in the data (Figure 1). With the adoption of a specialized sampling technique to control contamination, reported mercury concentrations in natural waters and standard deviations declined dramatically.

The specialized sampling technique is often referred to as the “clean-hands technique.” The sampling procedure requires two people, one designated as the “clean-hands person” and the other designated as the “dirty-hands person” (Figure 2). Great care must be used to minimize potential contamination sources such as dust from clothing, oil from fingers, and rain. In addition, samples need to be collected in rigorously cleaned

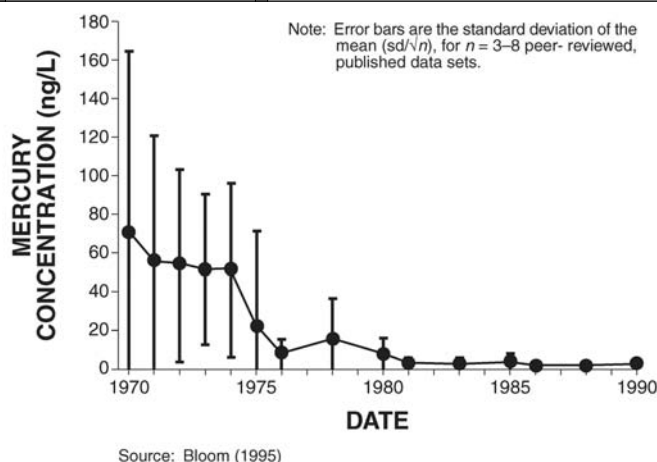


Figure 1. Mercury in uncontaminated surface waters



Figure 2. Clean Hands Technique

## Mercury Analysis

### Sampling Options

fluoropolymer bottles with fluoropolymer (or fluoropolymer-lined) caps. However, if samples are to be analyzed for mercury and not other low-level metals, then rigorously cleaned glass bottles may be used. Polyethylene bottles cannot be used, because they have been shown to sorb mercury and are difficult to clean. Also, because mercury has the potential to diffuse into the atmosphere, caps that tightly seal must be used to avoid potential diffusion of mercury through the threads on the cap.

This sampling procedure was issued by the US Environmental Protection Agency (EPA) in 1995 as Method 1669 and is used for the sampling of ambient water for low-level analysis of trace metals. Where low-level analysis is not required, standard sampling techniques, albeit with rigorously cleaned glass or polyethylene containers, may be used. For sediment sampling, contamination has rarely been an issue because mercury concentrations in sediment are sufficiently high relative to contamination potential. Thus, the “clean-hands” technique is primarily applicable to water sampling.

### CVAFS & CVAAS

#### Laboratory Analytical Techniques

The breakthrough in low-level mercury analysis of water samples occurred in the mid-1980s with the use of cold vapor atomic fluorescence spectroscopy (CVAFS). Prior to that time, and even now for standard analyses, the method of choice was cold vapor atomic absorption spectroscopy (CVAAS). For comparison, the CVAFS detection limit for total mercury in water is 0.1 nanograms per liter (ng/L, or parts per trillion) while the CVAAS detection limit is 0.2 micrograms per liter ( $\mu\text{g/L}$ , or parts per billion, 2,000 times higher than the CVAFS detection limit). EPA issued the CVAFS method in 1999 as Method 1631. The issuance of this method has had considerable impact within the regulated community, in particular for Clean Water Act, National Pollutant Discharge Elimination System (NPDES) permittees.

Using a different sample preparation process (i.e., distillation and aqueous phase ethylation), CVAFS is also used to detect methylmercury concentrations in water samples (Method 1630). As noted above, methylmercury is of particular concern in the environment because of its ability to bioaccumulate and pose toxicity to humans and wildlife. For the analysis of aqueous and solid samples, a leaching and solvent extraction method followed by back-extraction into water, subsequent ethylation, and analysis by CVAFS is often used because false positives or positive biases may be generated when using the distillation/extraction technique (noted by several researchers). Typically, the impact of this bias is considered minor for natural waters because the percentage of mercury (in the form of methylmercury) is high. In sediment and soil samples, however, the bias using the distillation method can be up to 1,000 times as high as the actual concentration of methylmercury in the sample.

### Avoiding Bias

In addition to CVAAS and CVAFS, several other analytical methods can be used, such as inductively coupled plasma-atomic emission spectrometry (ICP-AES), inductively coupled plasma-optical emission spectrometry (ICP-OES), or inductively coupled plasma-mass spectrometry (ICP-MS). However, these analytical techniques are generally not used for the determination of total mercury. There are other “regulator-approved” analytical methods for the analysis of mercury that are not commonly used for the analysis of water and sediment samples. In addition, there are several innovative “research-oriented” analytical methods currently in use for the analysis of mercury (including various species of mercury), but these methods are not “approved” by regulatory agencies at this time.

### Other Methods

Table 1 (next page) summarizes some of the more common laboratory methods for the analysis of mercury and some of the common interferences that may be encountered.

#### CVAAS for Total Mercury

The CVAAS analytical technique is based on the absorption of radiation at 253.7 nm by mercury vapor. The mercury is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an atomic absorption spectrophotometer. Absorbance (peak height) is measured as a function of mercury concentration.

#### CVAFS for Total Mercury

For the determination of total mercury, the CVAFS analytical technique is based on the oxidation of all forms of mercury that may be present (e.g.,  $\text{Hg(II)}$ ,  $\text{Hg(0)}$ , organo-complexed  $\text{Hg(II)}$  compounds, adsorbed particulate  $\text{Hg(p)}$ , and covalently bound organomercurials) to  $\text{Hg(II)}$ . After oxidation, the sample is sequentially reduced to destroy free halogens and then reduced to convert  $\text{Hg(II)}$  to volatile  $\text{Hg(0)}$ . The volatile  $\text{Hg(0)}$  in solution is purged onto a gold-coated sand trap (not used in EPA Method 245.7), which is then heated to thermally desorb the trapped  $\text{Hg(0)}$  to the cell of the CVAFS detector.

#### CVAFS for Methylmercury

For the determination of methylmercury, the CVAFS analytical technique is based on the conversion of all methylmercury forms and species that may be present to volatile methyl ethyl mercury. This is accomplished by aqueous phase ethylation, purging of the aqueous solution to trap any volatile methyl ethyl mercury that was formed. The trap is then heated to thermally desorb onto a chromatographic column to separate out methyl ethyl mercury from potential co-eluting peaks (or interferences) such as  $\text{Hg(0)}$  and diethyl Hg, which forms because of the ethylation of  $\text{Hg(II)}$  that may be present. Detection is accomplished using the CVAFS detector.

Table 1. Summary of Laboratory Methods for the Analysis of Mercury

Analytical Method	Water	Estimated Reporting Limit	Sediment	Estimated Reporting Limit	Common Interferences and Comments
<b>Examples of Common Laboratory Methods for Total Mercury</b>					
EPA 245.1 (manual CVAAS) or EPA 245.2 (automated CVAAS) for water	P	0.2 µg/L	P	0.2 mg/kg	Possible interferences from sulfide, copper, chlorides, and some volatile organic compounds; memory effects (or carryover); high solids content (water only); modification of method needed for analysis of solid samples
EPA 245.5 (manual CVAAS) for solids					
Method 245.7 (CVAAS); used with Method 1669 for "clean hands" sampling	P	2–5 ng/L	P	0.5 µg/kg	Beware of contamination during sampling; possible interferences from chlorides, gold, iodine, silver, and sulfides; water vapor in fluorescence detector; memory effects (or carryover)
Method 7470A (manual CVAAS) for water	P	0.2 µg/L	P	0.02 mg/kg	Possible interferences from sulfide, copper, chlorides, and some volatile organic compounds; high solids content (water only); memory effects (or carryover)
Method 7471A (manual CVAAS) for solids					
Method 1631E (oxidation, purge and trap, and CVAAS); used with Method 1669 for "clean hands" sampling	P	0.2 ng/L	P	0.5 µg/kg	Highly recommended for ultra-trace analyses; modification of method needed for analysis of solid samples; beware of contamination during sampling; memory effects (or carryover); possible interferences from gold and iodine; water vapor in fluorescence detector
<b>Example of Common Laboratory Method for Methylmercury</b>					
Method 1630 (distillation, aqueous ethylation, purge and trap, and CVAAS); used with Method 1669 for "clean hands" sampling	P	0.02 ng/L	P	0.02 µg/kg	Highly recommended for ultra-trace analyses; modification of method needed for analysis of solid samples; beware of contamination during sampling; memory effects (or carryover); possible interferences from gold and iodine; water vapor in fluorescence detector
<b>Examples of Other Laboratory Methods for Total Mercury</b>					
Method 200.7 (ICP-AES)	P	5–10 µg/L	P	2 mg/kg	Not recommended
Method 200.8 (ICP-MS)	P	0.2 µg/L	P	No data	Not recommended
Method 200.15 (ultrasonic nebulization ICP-AES)	P	2–3 µg/L	--	--	Not recommended; possible spectral interferences from molybdenum and vanadium; memory effects (or carryover); high solids content
Method 6010B (ICP-AES)	P		P	No data	Not recommended
Method 6020 (ICP-MS)	P	17 µg/L (instrument detection limit only)	P	No data	Not recommended
Method 7474 (atomic fluorescence spectrometry)	--	--	P	1 µg/kg	Incomplete digestion of matrix; water vapor in fluorescence detector; contamination during sampling
<b>Examples of Other Alternative Methods</b>					
High Pressure Liquid Chromatography-ICP-MS (HPLC-ICP-MS); used for total mercury	P	10 ng/L	P	No data	Not an approved method; not currently used in commercial analytical laboratories
X-ray absorption fine structure (EXAFS) spectroscopy; used for total mercury	--	--	P	~50 mg/kg	Not an approved method; not currently used in commercial analytical laboratories
Micro x-ray fluorescence; used for total mercury	--	--	P	~5 mg/kg	Not an approved method; not currently used in commercial analytical laboratories
Micro x-ray diffraction; used for total mercury	--	--	P	~5 mg/kg	Not an approved method; not currently used in commercial analytical laboratories
Gas chromatography/electron impact mass spectrometry (GC/EIMS); used for total mercury	P	No data	P	No data	Not an approved method; not currently used in commercial analytical laboratories
Capillary GC-ICP-MS (used for methylmercury)	P	12 ng/L	--	--	Not an approved method; not currently used in commercial analytical laboratories

**Notes:** mg/kg or mg/L = parts per million • µg/kg or µg/L = parts per billion • ng/kg or ng/L = parts per trillion

## Mercury Analysis

### Confirming Analysis

### Lower Detection Limits

### Mercury Cycle

### Questions Remain

#### Field Analytical Techniques

Field analyses are most often completed for total mercury only. Table 2 summarizes some of the more common field methods for the analysis of total mercury and some of the common interferences that may be encountered. Typically, field determinations use an **x-ray fluorescence (XRF)** spectrometry method, an **enzyme-linked immunosorbent assay (ELISA)** (or immunoassay) method, or the **CVAAS** method operated in a mobile laboratory. Other types of field screening methods are available, but are not routinely used for a number of reasons. While field screening methods are cost-effective, a minimum of 10 percent of the samples should be submitted for confirmatory analysis by a conventional laboratory using a CVAAS or CVAFS method to provide the data user with information to evaluate the accuracy, precision, and reliability of the field screening data.

**Table 2. Summary of Common Field Methods for the Analysis of Total Mercury**

Analytical Method	Water	Estimated Reporting Limit ( $\mu\text{g/L}$ )	Sediment	Estimated Reporting Limit ( $\text{mg/kg}$ )	Common Interferences & Comments
EPA 4500 (immunoassay)	--	--	Ⓡ	0.5	Temperature
EPA 6200 (portable XRF)	--	--	Ⓡ	30	Possible interferences from physical matrix effects; moisture content; chemical interferences or spectral overlap; operator error
Semiquantitative Immunoassay Methods (i.e., field test kits)	Ⓡ	0.25–25	Ⓡ	0.5–50	

#### Summary

Advances in clean sampling and low-level analytical techniques have greatly increased our understanding of mercury in the environment. The techniques have also had ramifications for the regulated community as lower detection limits have led to lower numerical water quality standards and discharge limits. Mercury behavior in the environment remains a complex issue, and it is therefore important to understand the basis for the analytical and sampling methodologies to ensure high-quality data for decision-making.

We've come a long way in our understanding of the mercury cycle during the past decade, but we still are seeking answers to the question, "How does mercury, which is generally emitted in a gaseous elemental or ionic form, end up as methylmercury in the muscle tissue of fish and other species?" The techniques mentioned in this article are largely responsible for our improved understanding of the mercury cycle, but they are neither exhaustive nor final. Continued research is needed on the development of sampling and analytical techniques for improved measurement of mercury and its chemical forms in freshwater, saltwater, and sediments, as well as in air, soils, and biota. EPA, through the Office of Research and Development, *Mercury Research Strategy* (September 2000), the Mercury Deposition Network, and others including mercury pioneers Nicholas Bloom (Studio Geochimica), Eric Prestbo (Frontier Geosciences), Milena Horvat (IAEA-MEL), Eric Crecelius and Gary Gill (Battelle), Lian Liang (CEBAM), Colin Davies (Brooks Rand), and others are continuing research on new and improved sampling and analytical techniques. So stay tuned to the *mercury story* — more is yet to come.

**FOR ADDITIONAL INFORMATION:** KATHI FUTORNICK, Exponent, Inc. (Lake Oswego, OR), 503/ 624-5523 or email: [kfutornick@exponent.com](mailto:kfutornick@exponent.com)

**Please Note:** Biographical information for Betsy Henry, Kathi Futornick and Gary Bigham accompanied their article in The Water Report's September issue (#31).

**Mr. James Mc Ateer**, a Senior Scientist with Exponent's Environmental Sciences Practice (Lake Oswego, OR), has over 20 years of experience specializing in conducting data quality assessment (DQA) and usability evaluations, interpreting chemical fingerprinting data, evaluating chemical data, and managing projects. His experience is based in environmental consulting and analytical laboratory settings. Mr. Mc Ateer develops and implements **data quality objectives (DQOs)** and **quality assurance and quality control (QA/QC)** strategies, selects or develops appropriate analytical protocols, and implements sampling activities to meet project-specific objectives and regulatory requirements.

**WATER BRIEFS****KLAMATH RELICENSING OR/CA  
FISH PASSAGE FOR DAMS**

As part of PacifiCorp's relicensing proceedings for its hydroelectric facilities on the Klamath River, an administrative law judge in late September rejected most of the power company's challenges to conditions proposed by federal fishery agencies. In March 2006, the US Department of Interior (DOI) and Department of Commerce's NOAA Fisheries announced the submission of their joint preliminary fishway prescriptions for the relicensing of PacifiCorp's dams and hydroelectric facilities on the Klamath River to the Federal Energy Regulatory Commission (FERC). The preliminary prescriptions included fish passage (upstream and downstream) for PacifiCorp's Iron Gate, Copco I and II and J.C. Boyle dams. DOI's press release at that time noted that the fishways would restore access to 58 miles of habitat for chinook, steelhead, and lamprey, and improve connectivity for resident redband trout. The 58 miles includes 46 miles of habitat for threatened coho salmon. Fish passage would also create the opportunity for the development and implementation of a reintroduction plan to return salmon, steelhead and lamprey to more than 300 miles of historic habitat above the project. Exclusion of those fisheries from the upper basin began with the completion of the first dam in 1918.

The hearing was the first of its kind under the recently amended provisions of the Federal Power Act (FPA). [Section 241 of the Energy Policy Act of 2005 (EPAct), 119 Stat. 594, 674-75 (Aug. 8, 2005)]. Federal agencies have the authority to include conditions and/or fishway prescriptions in any hydroelectric license issued or re-issued by FERC. {See 16 U.S.C. §§ 797(e) and 811}. Specifically, under section 4(e), the Secretary of Interior may establish conditions deemed necessary for the protection of Indian reservations and public lands to be included in a hydroelectric license (see 16 U.S.C. § 797(e)). Under section 18 of the FPA, the Secretaries of Commerce and Interior may prescribe fishways to provide for the safe, timely, and effective passage of fish. *Id.* at 811. Pursuant to section 241 of EPAct, any party to the FERC license proceeding is entitled to a determination on "disputed issues of material fact" concerning the conditions and fishway prescriptions following an expedited evidentiary hearing. [See Pub. L. 109-58, § 241, 119 Stat. 594, 674-75 (codified in 16 U.S.C. §§ 797(e) and 811)].

Judge Parlen McKenna ruled against the utility on 11 out of 14 issues of material fact, including all of the issues relating to fish passage and restoration of salmon to the Upper Klamath River. As the party challenging the federal agencies' recommendations, PacifiCorp requested the hearing, and thus had the burden of proof to establish its version of the facts on each disputed issue of material fact by a preponderance of the evidence.

PacifiCorp had proposed trapping salmon and hauling them around the four dams at an estimated cost of \$100 million. The utility also estimated that the changes proposed by the federal agencies for fish passage would cost about \$250 million. An economic analysis by FERC found that when the federal agencies' mandates for fish passage are taken into account, PacifiCorp would lose \$28.7 million a year operating the dams.

The administrative judge's ruling contrasts markedly with the draft Environmental Impact Statement (DEIS) issued by FERC just days before the decision. The DEIS covers relicensing of PacifiCorp's 151-megawatt Klamath Hydroelectric Project, located primarily on the Klamath River in Klamath County, Oregon and Siskiyou County, California. On average, the project generates 716,820 megawatt-hours of electricity annually. The project occupies 219 acres of lands of the US administered by the Bureau of Reclamation and the Bureau of Land Management. In its September 25th DEIS, FERC incorporated most of PacifiCorp's proposed environmental measures, some with certain modifications. The staff alternative also included 31 environmental measures additional to those proposed by PacifiCorp. Comments to FERC's DEIS must be filed by November 24, 2006.

Dam removal was not specifically at issue in the hearing nor decided by the administrative law judge. Nonetheless, the economics surrounding the alternatives have led environmental groups, tribal interests and fishermen to push for dam removal as the cheaper, most practical option for PacifiCorp and its ratepayers, in addition to asserting that it is the best option for the health of the fisheries.

Negotiations are still ongoing between the utility, Indian tribes, conservation groups and fishermen to find a solution agreeable to all sides. The hearing decision, plus another study recently submitted to FERC by the California State Coastal Conservancy regarding sediment issues for dam removal, certainly provides impetus for the parties to reach a settlement rather than waiting for the FERC process to run its course.

**For info:** Alex Pitts, USFWS, 916/ 414-6464; Jim Milbury, NOAA Fisheries, 562/ 980-4006; Craig Tucker, Karuk Tribe, 530/ 627-3446 x3027; Troy Fletcher, Yurok Tribe, 530/ 625-4015; PacifiCorp website: [www.pacificorp.com/Article/Article1152.html](http://www.pacificorp.com/Article/Article1152.html); *In the Matter of: Klamath Hydroelectric Project*, Docket #2006-NKFS-0001, FERC Project #2082 (September 29, 2006) order is available at the website: [www.klamathbucketbrigade.org/JudgeMcKenna\\_DecisiononKlamathRiverDams092906.htm#\\_Toc147145166](http://www.klamathbucketbrigade.org/JudgeMcKenna_DecisiononKlamathRiverDams092906.htm#_Toc147145166); FERC DEIS available on FERC's website: [www.ferc.gov/industries/hydropower/enviro/eis/09-25-06.asp](http://www.ferc.gov/industries/hydropower/enviro/eis/09-25-06.asp)

## MUNICIPAL WATER RIGHTS WA

## RETROACTIVE EXPANSION

A long-anticipated lawsuit asking for declaratory and injunctive relief from certain provisions of Washington's 2003 Municipal Water Law (SESSHB 1338), was filed in King County Superior Court on September 1. The complaint maintains that the 2003 Municipal Water Law (MWL) contains unconstitutional provisions that retroactively expand some water rights to the detriment of existing water users, established instream flows, fisheries, and the environmental, recreational, and aesthetic interests of the residents of the state. Plaintiffs are Joan Burlingame, Lee Bernheisel, Scott Cornelius, Peter Knutson, Puget Sound Harvesters, Washington Environmental Council, Sierra Club, and the Center for Environmental Law and Policy. Defendants are the State of Washington, Washington State Department of Ecology (Ecology), and Washington State Department of Health.

Plaintiffs seek a declaration that the provisions violate the Due Process Clauses of the US and Washington Constitutions and the constitutional separation of powers. As set out in the Complaint (page 2): "For purposes of this case, the Municipal Water Law changes Washington water law in three major respects. First, it defines 'municipal water supplier' to include any private developer with connections for fifteen or more homes. It also retroactively expands the water rights of 'municipal water suppliers' without considering the harm to rivers and streams and other water users. Finally, the Municipal Water Law expands the place of use of the water rights of municipal water suppliers." The complaint maintains that the law violates the separation of powers doctrine under the Washington Constitution by retroactively overruling the Washington Supreme Court's decision in *Department of Ecology v. Theodoratus*, 135 Wn.2d 582, 957 P.2d 1241 (1998). *Theodoratus* held that the water rights of developers were limited to the amount of water actually put to beneficial use, and that Ecology had acted beyond its authority in issuing "pumps and pipes" certificates (i.e. allowing use to the maximum of the capacity of one's system). The *Theodoratus* court also held that private developers were not municipalities for purposes of the Water Code.

The lawsuit follows a letter sent to Washington officials by the plaintiffs in June requesting that action be taken to declare the provisions unconstitutional, as well as a similar letter sent on behalf of the Hoh Tribe, Jamestown S'Klallam Tribe, Lummi Nation, Makah Indian Nation, Squaxin Island Tribe, Suquamish Tribe, Swinomish Tribe, Tulalip Tribes, Quinault Indian Nation, and Yakama Indian Nation in May. In those letters, the parties specified why they believe the law is unconstitutional and what the impacts of its implementation will be (copies of the letters are available on Ecology's website: [www.ecy.wa.gov/programs/wr/rights/muni\\_wtr.html](http://www.ecy.wa.gov/programs/wr/rights/muni_wtr.html)).

The MWL bill greatly expanded which entities may be defined as "municipalities" under Washington's water laws and also allowed the definition to be applied retroactively. Any system with 15 or more connections providing water for residential purposes is now deemed to hold a "municipal water right" regardless of public or private status. This resulted in literally thousands of new municipal water rights by operation of law (see Moon, TWR #4). With the newly-defined status of a "municipal water right" comes protection from Washington's statutory "relinquishment" statute (R.C.W. 90.14.140). In other words, the owner is suddenly protected from loss of all or a portion of the water right due to non-use (also known as "forfeiture" in other western states). The plaintiffs in the lawsuit allege that the MWL, by applying retroactively, effectively allows expansion of water rights that otherwise would have been lost by relinquishment. The alleged expansion negatively impacts any water rights or instream uses that have been developed in the interim, by the ability to divert previously unused water (inchoate quantities) now or in the future.

The plaintiffs also maintain that the MWL will aggravate water shortages by retroactively expanding certain water rights. This will be possible under the new law since it "retroactively validates the 'pumps and pipes' certificates that the Department of Ecology erroneously granted to developers over several decades. These certificates define the magnitude of a water right as the applicant's system capacity rather than as the amount of water put to beneficial use. Holders of these certificates who did not previously use their entire system capacity will now be able to use more water than they were entitled to use before the passage of the Municipal Water Law." Complaint, page 3.

**For info:** Doug Rushton, Ecology, 360/ 407-6513 or email: [drus461@ecy.wa.gov](mailto:drus461@ecy.wa.gov); Ecology's website (Municipal Water Rights section) contains a plethora of information, including the applicable law and copies of relevant pleadings in the case. See [www.ecy.wa.gov/programs/wr/rights/muni\\_wtr.html](http://www.ecy.wa.gov/programs/wr/rights/muni_wtr.html)



### NATIONWIDE 404 PERMITS US CORPS PROPOSAL

The US Corps of Engineers (Corps) is soliciting comments on its proposal to reissue and modify nationwide permits (NWP) for work in wetlands and other waters that are regulated by Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. The Corps is also proposing to issue six new NWPs and one new general condition. The nationwide permits authorize activities that are similar in nature and cause only minimal adverse environmental impacts separately or on a cumulative basis. Activities range from work associated with aids to navigation and utility lines to Coast Guard-approved bridges and cleanup of hazardous and toxic wastes.

The proposal was published in the Federal Register on September 26. The Corps will accept comments for a 60-day period that ends on November 27. The current set of nationwide permits expire on March 18, 2007. The purpose of the Federal Register notice is to solicit comments on the proposed new and modified NWPs, as well as the NWP general conditions and definitions.

Since NWPs were first issued in 1977, the NWP program has become increasingly complex. With each issuance or reissuance of NWPs, the text of the permits and the general conditions has become lengthier, and in some cases, redundant language was added that may make them more difficult to comprehend. The Corps is proposing to revise the text of the NWPs, general conditions, and definitions so that they are clearer, more concise, and can be more easily understood, while retaining terms and conditions that protect the aquatic environment.

Through the NWPs, impacts to the aquatic environment may also receive additional protection through regional conditions, case-specific special conditions, and case-specific discretionary authority to require individual permits. The Corps' division engineers may add, after public review and consultation, regional conditions to protect local aquatic ecosystems or minimize adverse effects on fish or shellfish spawning, wildlife nesting or other ecologically critical events.

According to the Federal Register Notice, special conditions will often include compensatory mitigation requirements to reduce the project impacts to the minimal level. Compensatory mitigation may include the restoration, establishment, enhancement, and/or preservation of aquatic habitats, as well as the establishment and maintenance of riparian areas next to streams and other open waters. Compensatory mitigation can be provided through permittee-responsible mitigation, mitigation banks, or in-lieu fee programs.

Concurrent with the Federal Register notice, Corps district offices issued public notices to solicit comments on proposed regional conditions. In their district public notices, district engineers may also propose to suspend or revoke some or all of these NWPs if they have issued, or are proposing to issue, regional general permits, programmatic general permits, or section 404 letters of permission for use in lieu of NWPs. The comment period for these district public notices will be 45 days.

**For info:** David Olson, Corps, 202/ 761-4922 or email [david.b.olson@usace.army.mil](mailto:david.b.olson@usace.army.mil); Federal Register Notice on Corps website: [www.usace.army.mil/cw/cecwo/reg/nwp/NWP\\_2007\\_proposed.pdf](http://www.usace.army.mil/cw/cecwo/reg/nwp/NWP_2007_proposed.pdf); Corps regulatory program information at [www.usace.army.mil/cw/cecwo/reg/](http://www.usace.army.mil/cw/cecwo/reg/); Links to separate pdfs of each draft nationwide available at: [www.usace.army.mil/cw/cecwo/reg/nwp/nwp.htm](http://www.usace.army.mil/cw/cecwo/reg/nwp/nwp.htm)

### SHIPYARD SUPERFUND WA ELLIOT BAY SEATTLE

EPA is proposing to add the Lockheed West Seattle site to the National Priorities List (aka Superfund list). The site is located at 3443 West Marginal Way SW on Elliott Bay in Seattle, Washington. Historic industrial practices at the former shipyard released contaminants into the bay, including metals, polychlorinated biphenyls (PCBs), and petroleum products. A listing notifies the public that EPA believes a site requires further study and possible cleanup under EPA's Superfund program.

EPA noted that the Lockheed West Seattle site is one among several other contaminated sediment sites in the Harbor Island area that require remediation. Recently, successful cleanups at the Todd Shipyard facility and another Lockheed shipyard have been completed. At these sites, 330,000 cubic yards of contaminated sediments were dredged and removed from the sites, 7800 pilings were removed, and over five acres of fish-friendly inter-tidal habitat were created. Sediment cleanup projects like these are a significant part of EPA's continuing efforts to remove toxins from Puget Sound.

EPA will consider all public comments on the proposed listing received during a 60-day period beginning September 27, 2006. Materials supporting EPA's proposal may be reviewed during regular business hours at EPA Region 10 Records Center, 1200 6th Ave, 7th Floor in Seattle (call 206/ 553-4494 for an appointment). For more information about the site and making comments, go to EPA's website: [www.epa.gov/superfund/sites/npl](http://www.epa.gov/superfund/sites/npl). To have your name added to the site mailing list, contact Cindy Schuster EPA, 206/ 553-1815 or email: [schuster.cindy@epa.gov](mailto:schuster.cindy@epa.gov).

**For info:** Tony Brown, EPA, 206/ 553-1203 or email: [brown.anthony@epa.gov](mailto:brown.anthony@epa.gov)

## WATER BRIEFS

**YAKIMA GW STUDY****WA****USGS REPORT**

The Yakima River flows 215 miles from the outlet of Keechelus Lake in the central Washington Cascades southeasterly to the Columbia River, draining an area of 6,155 square miles. The Yakima River Basin is one of the most intensively irrigated areas in the United States. Population in the Yakima River Basin was about 238,000 in 1990.

Increasing demands for water for municipal, fisheries, agricultural, industrial, and recreational uses will affect the groundwater resources of the basin. In cooperation with the US Bureau of Reclamation, the Washington Department of Ecology, and the Yakama Indian Nation, the US Geological Survey (USGS) studied the groundwater system in the Yakima River Basin and how it interacts with rivers and streams in the basin. The study includes data collection, mapping of hydrogeologic units and groundwater levels, and a computer numerical model to bring together all the information.

Groundwater pumpage information needed to assess water availability in the Yakima River Basin is now available in the report published September 18 by the USGS. The report features data for over 3,000 wells, making it the largest study of its kind ever in the state. The quantities of groundwater pumped in the basin were estimated for 1960 to 2000 for eight categories of water use. Pumpage estimates were based on methods that varied by category and primarily represent pumpage for wells with groundwater rights.

"In 1960, total annual pumpage in the basin was about 115,776 acre-feet," said John Vaccaro, USGS hydrologist and lead author of the report. "By 2000, total annual pumpage was estimated to have nearly tripled, to 312,284 acre-feet."

Irrigation accounts for about 60 percent of the pumpage, followed by public water supply at about 12 percent. Groundwater is the principal source of drinking water in the basin and supplies about 330,000 people in

the three-county area.

Water managers in the Yakima River Basin will incorporate the pumpage estimates into computer models to boost their understanding of the groundwater flow system and to test water management strategies. The report is one of a series of USGS information products for the Yakima River Basin Groundwater Study, needed by managers to help them assess and manage water resources in the basin.

**For info:** *Estimates of Ground-Water Pumpage from the Yakima River Basin Aquifer System, Washington, 1960-2000* (USGS, Scientific Investigations Report 2006 - 5205), can be viewed on USGS website: <http://pubs.usgs.gov/sir/2006/5205/>

**DRINKING WATER****OK****GW & SURFACE CONTAMINATION  
SETTLEMENT REACHED**

The Justice Department and EPA announced on September 15 that they have reached two related settlements with Seaboard Foods LP and PIC USA Inc. The settlements are intended to take significant steps at many of the two companies' facilities to ensure future compliance with environmental laws and to resolve allegations that the companies contaminated groundwater and surface waters near several of their facilities. Seaboard Foods LP, one of the nation's largest vertically integrated pork producers, is the current owner of more than 200 farms in Oklahoma, Kansas, Texas, and Colorado, and PIC USA, Inc. is the former owner and operator of several of the farms located in Oklahoma now operated by Seaboard.

Under the first consent decree, Seaboard Foods and PIC USA, Inc will pay a civil penalty of \$240,000 for violations of the Resource Conservation and Recovery Act (RCRA: federal hazardous waste statute) dating back to 2001. In the second settlement, Seaboard will pay a civil penalty of \$205,000 for failure to comply with the Clean Water Act and the Clean Air Act, and for failure to comply with the continuous release reporting requirements of the Comprehensive

Environmental Response, Compensation, and Liability Act (CERCLA) and Emergency Planning and Community Right to Know Act (EPCRA). Payment of a \$100,000 civil penalty by Seaboard in a separate Air Compliance Agreement with the EPA will be credited toward that amount.

The government's complaints, filed in conjunction with the settlements, alleged that Seaboard Foods LP and PIC USA Inc. contaminated the groundwater near five farms in Oklahoma, and failed to properly investigate or remediate the source of the contamination, in violation of an EPA Order issued under RCRA. As part of the settlement, the companies agreed to clean and close leaking lagoons, implement measures to ensure any future leaking pipes or lagoons are identified and addressed promptly, and take steps to ensure that the area groundwater is cleaned up. In addition, Seaboard Foods LP and PIC USA Inc. agreed that when manure is used for crop fertilization purposes, it will be applied at appropriate rates, to prevent future soil or groundwater contamination.

As part of a separate settlement, Seaboard Foods will be required to implement various erosion control measures at 16 farms to prevent any future runoff of soils and sediments to nearby rivers or streams, and to establish protective buffer zones around sensitive wetland areas at 17 of its farms. Seaboard Foods further certified its compliance with the continuous release reporting requirements of CERCLA and EPCRA at all of its 239 farms.

The Department of Justice lodged both consent decrees in the U.S. District Court for the Western District of Oklahoma on September 15. The consent decrees will be subject to a 30-day public comment period and subsequent judicial approval and are available on the Department's website at [www.usdoj.gov/enrd/Consent\\_Decrees.html](http://www.usdoj.gov/enrd/Consent_Decrees.html).

**For info:** John Millett, EPA, 202/ 564-4355 or email: [millett.john@epa.gov](mailto:millett.john@epa.gov)

## WATER BRIEFS

**ALLOCATION OF WATER US  
CBO REPORT**

The Congressional Budget Office Report, *How Federal Policies Affect the Allocation of Water* (August 2006), discusses the country's water sources and how water is used; what determines allocation policies and do those policies result in maximizing water's potential benefits to society; and what policies might the federal government consider to maximize the potential benefits. One section, entitled "The Increasing Costs of Inflexible Water Allocations," notes that inflexible allocations may exacerbate pressures on federal spending and reduce the net benefits that society derives from water use. The study concluded that inflexible allocations occur because of "four developments augmenting demand pressures: the settlement of Indian tribes' water-rights claims, environmental laws requiring that greater amounts of water be retained in natural courses, shifts in the population toward arid states, and the possibility that changing precipitation patterns as a result of climate change could intensify droughts." In the Appendix, Table A-1 lists selected Indian water right settlements and their water marketing features.

**For info:** CBO Report available on its website: [www.cbo.gov/ftpdocs/74xx/doc7471/08-07-WaterAllocation.pdf](http://www.cbo.gov/ftpdocs/74xx/doc7471/08-07-WaterAllocation.pdf)

**BALLAST WATER US  
NEW REGULATIONS ORDERED**

Finding that EPA's regulation exempting ballast water discharges from the Clean Water Act (CWA) is "plainly contrary to the congressional intent," on September 18 a federal district court ordered the EPA to come up with new regulations in two years [*NWEA et al. v. EPA*, (N.D. CA), Case No. C 03-05760 SI (Sept. 18, 2006)] The order follows the court's finding last year that EPA had illegally exempted ships' ballast water discharges from CWA permit requirements. The ruling directs EPA to take specific action by September

30, 2008 to ensure that shipping companies comply with the CWA and restrict the discharge of invasive species in ballast water.

Plaintiffs noted that the absence of effective federal action, combined with the high cost of invasive species to the environment, industries, and drinking water sources, has led numerous states to pass their own laws. Michigan will require shippers to have permits by early next year. In California, a bill is pending that would adopt the most strict limitations on the discharge of ballast-borne invasive species in the world. Six Great Lakes states — New York, Michigan, Pennsylvania, Illinois, Minnesota, and Wisconsin — joined the environmental groups' lawsuit to persuade the court to require a federal permitting program.

Live species from other countries are carried to US waters in ballast water which ships use for stabilization. The ballast water is discharged into bays, estuaries, and the Great Lakes as ships approach port and when cargo for export is loaded. Over 21 billion gallons of ballast water from international ports is discharged into US waters each year. The cost of invasive species to the US economy is estimated in the billions of dollars annually.

The lawsuit was brought by Northwest Environmental Advocates (NWEA), The Ocean Conservancy, and Baykeeper, three of the signers of a petition filed with EPA in January 1999. EPA denied the petition in 2003, triggering the lawsuit.

**For info:** Nina Bell, NWEA, 503/ 295-0490

**WATER AUCTION AZ  
EFFLUENT WATER SALE**

Beginning November 1, the Town of Prescott Valley plans to auction 2,724 acre-feet of effluent water that can be used to support real estate and economic development. The auction in Prescott Valley is apparently the first of its kind and size in the United States.

Prescott Valley is 85 miles north of Phoenix and is expected to grow from its current 33,575 residents to more than

52,000 residents by 2025. This growth, along with regulatory requirements that restrict groundwater use in the region, has increased the demand for alternative water supplies in Prescott Valley.

The effluent for auction could support as many as 12,000 new homes within Prescott Valley. The effluent could also support industrial, commercial, recreational and wildlife uses or could be resold, according to the Town's water marketing consultant, Clay Landry. Landry is the managing director of WestWater Research LLC, a leading water-marketing firm. In a press release concerning the auction, Landry's firm noted, however, that any purchasers should review the auction materials and complete their own due diligence prior to the auction to fully understand their rights and obligations with respect to effluent purchased at auction. The sale of the effluent will not include any warranties, expressed or implied, the press release noted.

The auction approach to sell effluent is progressive and could generate more than \$50 million in revenue, according to Landry. "In much of the country, water is not seen as a scarce resource. The people in the desert know differently. This approach will help establish true market value for water and perhaps new attitudes towards its use, conservation and value," Landry said.

**For info:** Clay Landry, WestWater Research, 360/ 695-5233, website: [www.waterexchange.com](http://www.waterexchange.com)

**WORLD WATER FORUM US  
FINAL REPORT**

The Final Report of the recent **Fourth World Water Forum** (March 2006) is now available.

**For info:** WWF website: [www.worldwaterforum4.org.mx/home/home.asp](http://www.worldwaterforum4.org.mx/home/home.asp)

**Please Note:** An extended Calendar containing ongoing updates is available on The Water Report's website: [www.thewaterreport.com](http://www.thewaterreport.com). Subscribers are encouraged to submit calendar entries, email: [thewaterreport@hotmail.com](mailto:thewaterreport@hotmail.com)

**October 16-20 WA**  
**Community Action and Innovation for Watershed Sustainability, 2006 Biennial Conference, Walla Walla,** Marcus Whitman Hotel & Conference Center. Collaboration with the Walla Walla Watershed Alliance, Water & Environmental Center & Walla Walla Community College. For info: [www.watershed.org](http://www.watershed.org)

**October 17 WA**  
**Hanford Cleanup Site 2006 "State of the Site" Meeting, Kennewick, WA,** Three Rivers Convention Center, 7016 W. Grandridge Blvd., 6pm-9pm. For info: Lynette Bennett, RCC, 509/ 372-9296 or email: [lebennet@wch-rcc.com](mailto:lebennet@wch-rcc.com)

**October 18 WA**  
**Hanford Cleanup Site 2006 "State of the Site" Meeting, Seattle,** Seattle Center, 305 Harrison Street, Rainier Rm, 7pm-10pm. For info: Lynette Bennett, RCC, 509/ 372-9296 or email: [lebennet@wch-rcc.com](mailto:lebennet@wch-rcc.com)

**October 18-19 WA**  
**Northwest Environmental Summit and Trade Show (NWES), Tacoma.** For info: [www.nebc.org/ECW.aspx](http://www.nebc.org/ECW.aspx)

**October 18-20 NV**  
**Water Quality, Drought, Human Health & Engineering Conference, Las Vegas,** Desert Research Institute. RE: Solutions-Based Forum, Improving Water Quantity & Quality, Impact on Human Health & Engineering, State/ Federal Policies. For info: American Society of Mechanical Engineers' website: [www.asmeconferences.org/water06/](http://www.asmeconferences.org/water06/)

**October 19-20 MT**  
**Water Law Conference, Helena.** RE: Legislative Issues, Water Adjudication, Surface/ Groundwater Interaction, Coalbed Methane, Emerging Issues, GW Augmentation Plans, DNRC, Water Leasing, Tribal Reserved Water Rights, Interstate Issues (Columbia River) & More. For info: The Seminar Group, 800/ 574-4852, email: [registrar@theseminalgroup.net](mailto:registrar@theseminalgroup.net), or website: [www.TheSeminarGroup.net](http://www.TheSeminarGroup.net)

**October 19-20 CA**  
**Artificial Recharge of Ground Water, San Diego.** For info: National Ground Water Association, website: <https://info.ngwa.org/servicecenter/Meetings/Index.cfm#MT2>

**October 20 OR**  
**Willamette River: CERCLA, ESA & CWA, Conference, Portland.** For info: Holly Duncan, Environmental Law Education Center, 503/ 282-5220, email: [hduncan@elecenter.com](mailto:hduncan@elecenter.com), or website: [www.elecenter.com](http://www.elecenter.com)

**October 20-22 OR**  
**Oregon Bioneers 3rd Annual Conference, Eugene,** Lane Community College. RE: Practical Solutions for Restoration. For info: Oregon Bioneers/LCC, 541/ 463-5224, email: [haywardj@lanecc.edu](mailto:haywardj@lanecc.edu), or website: [www.bioneers.org](http://www.bioneers.org)

**October 21-25 TX**  
**WEFTEC 2006 - 79th Annual Conference and Exhibition, Dallas,** Dallas Convention Center. Sponsored by the Water Environment Federation. RE: Water & Wastewater Practices, Solutions & Regulations. For info: WEF, 800/ 666-0206, email: [csc@wef.org](mailto:csc@wef.org), or website: [www.weftec.org/home.htm](http://www.weftec.org/home.htm)

**October 23-24 UT**  
**Utah Water Law, Salt Lake City,** Marriott Downtown. For info: CLE International, 800/ 873-7130, email: [register@cle.com](mailto:register@cle.com), or website: [www.cle.com](http://www.cle.com)

**October 25-27 OR**  
**Communities Working for Healthy Watershed: OWEB 9th Biennial Conference, Seaside,** Seaside Convention Center. For info: Oregon Watershed Enhancement Board website: [www.oregon.gov/OWEB](http://www.oregon.gov/OWEB)

**October 25-28 ID**  
**Groundwater & Surface Water Under Stress: Competition, Interactions, Solutions, Boise.** For info: [www.uscid.org](http://www.uscid.org)

**October 26-27 CA**  
**California Water Law Conference, Irvine,** Hilton Hotel. RE: Water Supply Demonstrations, Groundwater Banking, Integrated Water Resource Planning, Reliability & Storage, & Desalinization. For info: CLE International, 800/ 873-7130, email: [register@cle.com](mailto:register@cle.com), or website: [www.cle.com](http://www.cle.com)

**October 26-27 OR**  
**"Beyond Conflict: Tribal Water Rights, Settlement Strategies, and Environmental Justice," Tribal Water Rights Conference Northwest 2006,** Eugene, University of Oregon School of Law. RE: Global Indigenous Perspectives & Resolving Water Disputes. For info: Jill Forcier, 541/ 346-3845, email: [enr@uoregon.edu](mailto:enr@uoregon.edu), or website: [www.law.uoregon.edu/org/nwtwc](http://www.law.uoregon.edu/org/nwtwc)

**October 26-27 WA**  
**Wetlands in Washington, Seattle.** RE: Supreme Court: Rapanos & Carabell Decision, Implementing New Mitigation Guidelines, Mitigation Banking Developments, ESA Update, Stormwater Runoff, Enforcement Issues, Tribal Archaeological Issues, Nationwide & Individual Permits, Implementation of Critical Areas & Ethics. For info: Law Seminars International, 800/ 854-8009, or website: [www.lawseminars.com/](http://www.lawseminars.com/)

**October 27-28 AZ**  
**"Looking Ahead: Managing Stormwater & Harvesting Rainwater for Conservation," Tucson.** RE: Federal Stormwater Management Requirements, BMPs, Techniques for Beneficial Use of Rain & Stormwater. Sponsors: US Bureau of Reclamation, ARCADIS, U. of Arizona & the Water Resources Research Center. For info: Cado Daily, email: [cdaily@ag.Arizona.edu](mailto:cdaily@ag.Arizona.edu), or website: [www.rcsa-usa.org](http://www.rcsa-usa.org)

**October 28-Nov 2 AZ**  
**6th International Symposium on Managed Aquifer Recharge, Phoenix.** For info: ISMAR website: [www.ismar2007.org](http://www.ismar2007.org)

**October 29-31 CA**  
**Opportunities and Challenges in Agricultural Water Reuse Conference, Santa Rosa,** Hyatt Vineyard Creek. Sponsored by The WaterReuse Association, USDA, and Washington State University. RE: Agricultural Water Reuse, USDA's Role in Water Management, Regulations & Health Aspects of Recycled Water on Edible and Nonedible Crops, Economics, Technology, & Public Perception. For info: Natalie Fleet, WRA, 703/ 548-0880, email: [nfleet@waterreuse.org](mailto:nfleet@waterreuse.org) or website: [www.watereuse.org/USDA\\_conf.html](http://www.watereuse.org/USDA_conf.html)

**October 30 HI**  
**Natural Resources Damages Litigation, Honolulu.** For info: Law Seminars International, 800/ 854-8009, or website: [www.lawseminars.com/](http://www.lawseminars.com/)

**November 1 WA**  
**Hanford Cleanup Site 2006 "State of the Site" Meeting, Hood River,** Best Western Hood River Inn, 1108 East Marina Way, Gorge Rm, 6pm-9pm. For info: Lynette Bennett, RCC, 509/ 372-9296 or email: [lebennet@wch-rcc.com](mailto:lebennet@wch-rcc.com)

**November 1-3 AZ**

**Water Auction, Prescott Valley, Town Council Chambers.** RE: Town of Prescott Valley to Auction 2,724 acre-feet of Effluent Water. For info: Clay Landry, WestWater Research at 360/ 695-5233, or website: [www.waterexchange.com](http://www.waterexchange.com)

**November 1-3 WY**

**Wyoming Water Association 2006 Annual Meeting and Education Seminar, Casper, Ramkota Hotel.** For info: Wyoming Water Association, 307/ 631-0898, or e-mail: [wwa@wyoming.com](mailto:wwa@wyoming.com)

**November 2-3 OR**

**Oregon Water Law 15th Annual Conference, Portland.** RE: Muni Water, Urbanization Ag Issues, Resolving Conflicts, Permitting & Legal Disputes for Storage and Delivery of Water. For info: The Seminar Group, 800/ 574-4852, email: [registrar@theseminargroup.net](mailto:registrar@theseminargroup.net), or website: [www.TheSeminarGroup.net](http://www.TheSeminarGroup.net)

**November 3 OR**

**Sediment Management Conference, Portland.** For info: Holly Duncan, Environmental Law Education Center, 503/ 282-5220, email: [hduncan@elecenter.com](mailto:hduncan@elecenter.com), or website: [www.elecenter.com](http://www.elecenter.com)

**November 3 OR**

**Oregon Fish & Wildlife Commission Meeting, Salem, ODFW Headquarters, 3406 Cherry Avenue NE.** RE: Columbia River Update, Developmental Fisheries, Access & Habitat Report, Bay Clam Dive Fishery Permits. For info: Casaria Tuttle, ODFW Director's Office, 503/ 947-6044, or website: [www.dfw.state.or.us/agency/commission/minutes/](http://www.dfw.state.or.us/agency/commission/minutes/)

**November 5-7 TX**

**27th Annual International Irrigation Show, San Antonio, Henry B Gonzalez Convention Center.** For info: Irrigation Association, website: [www.irrigation.org/show/default.aspx?pg=attend.htm&id=14](http://www.irrigation.org/show/default.aspx?pg=attend.htm&id=14)

**November 6-9 MD**

**Annual Water Resources Conference, Baltimore, Sheraton Inner Harbor Hotel.** Sponsored by the American Water Resources Association. RE: Infrastructure Asset Management, Water (Homeland) Security, Watershed Management, Dam Rehabilitation/Removal, Sustainability of Drinking Water Supplies, Impacts/Solutions of Urbanization, Drought & Flood Management, Ecological Restoration of Wetlands & Stream Corridors. For info: Patricia Reid, AWWRA, 540/ 687-8390, email: [pat@awra.org](mailto:pat@awra.org), or website: <http://awra.org/meetings/Baltimore2006/>

**November 8 OR**

**Oregon's Cleanup Law & Washington's MTCA Workshop, Portland, Red Lion on the River.** RE: Comparison of Two States' Regulatory Programs & "All Appropriate Inquiries Rule," Site Investigations, Hazardous Waste Initiatives in the Columbia Basin. For info: Law Seminars Int'l, 800/ 854-8009, or website: [www.lawseminars.com/](http://www.lawseminars.com/)

**November 8 WA**

**Regulatory Requirements, Seattle.** For info: The Seminar Group, 800/ 574-4852, email: [registrar@theseminargroup.net](mailto:registrar@theseminargroup.net), or website: [www.TheSeminarGroup.net](http://www.TheSeminarGroup.net)

**November 8-9 TX**

**Environmental Forensics: Methods & Applications, Houston.** For info: National Ground Water Association, website: <https://info.ngwa.org/servicecenter/Meetings/Index.cfm#MT2>

**November 8-9 OR**

**"Integrated Pest and Nutrient Management Options: Practices to Protect Water Quality and Enhance Crop Yields," Corvallis, CH2M Hill Alumni Center.** For info: Mary Staben, OSU, 541/ 737-2683 or email: [mary.staben@oregonstate.edu](mailto:mary.staben@oregonstate.edu)

**November 8-10 TX**

**Water Systems Council Fall 2006 Members Meeting, Dallas, Gaylord Texan Resort & Convention Center on Lake Grapevine.** For info: [member\\_services@watersystemscouncil.org](mailto:member_services@watersystemscouncil.org) or website: [www.watersystemscouncil.org/calendar/index.cfm](http://www.watersystemscouncil.org/calendar/index.cfm)

**November 9 OR**

**Southern Willamette Valley Groundwater Management Area Committee Meeting, Harrisburg, City Hall, Smith Street, 8am-10am.** For info: Audrey Eldridge, DEQ, 541-776-6010 x223

**November 12-17 CA**

**Pacific Fishery Management Council Meeting, Del Mar.** RE: Coastal Pelagic Species, Groundfish, Highly Migratory Species, Pacific Halibut, Salmon & Essential Fish Habitat. For info: Dr. Donald McIsaac, 866/ 806-7204, email: [Donald.McIsaac@noaa.gov](mailto:Donald.McIsaac@noaa.gov), or website: [www.pcouncil.org/events/2006/pfmc1106.html](http://www.pcouncil.org/events/2006/pfmc1106.html)

**November 13-15 MA**

**Brownfields 2006 Conference, Boston.** RE: Phoenix Awards for Excellence in Brownfield Redevelopment. For info: Denise Chamberlain, 717/ 761-0554, EPA website: [www.epa.gov/brownfields/bfconf.htm](http://www.epa.gov/brownfields/bfconf.htm)

**November 14 WA**

**Hanford Cleanup Site 2006 "State of the Site" Meeting, Spokane, Red Lion Hotel at the Park, 303 W. North River Drive, 7pm-10pm.** For info: Lynette Bennett, RCC, 509/ 372-9296 or email: [lebenet@wch-rcc.com](mailto:lebenet@wch-rcc.com)

**November 13-15 CO**

**Colorado Water Conservation Board Meeting, Denver, Red Lion Hotel, DIA.** For info: CWCB, 303/ 866-3441, or website: [www.cwcb.state.co.us/Board/meetingschedule.htm](http://www.cwcb.state.co.us/Board/meetingschedule.htm)

**November 15-17 DC**

**Species Protection and the Law: ESA, Biodiversity Protection & Invasive Species Control, Washington D.C.** For info: ALI-ABA, 800/ CLE-NEWS, or website: [www.ali-aba.org](http://www.ali-aba.org)

**November 15-17 MA**

**Developments in Clean Water Law: A Seminar for Public Agency Managers and Attorneys, Boston, Sheraton Boston.** Sponsored by the National Association of Clean Water Agencies. For info: NACWA, 202/ 833.2672, email: [info@nacwa.org](mailto:info@nacwa.org), or website: [www.nacwa.org/meetings/#07winter](http://www.nacwa.org/meetings/#07winter)

**November 16-17 WA**

**The Mighty Columbia Conference, Seattle.** For info: The Seminar Group, 800/ 574-4852, email: [registrar@theseminargroup.net](mailto:registrar@theseminargroup.net), or website: [www.TheSeminarGroup.net](http://www.TheSeminarGroup.net)

**November 16-17 OR**

**Oregon Wetlands, Portland.** For info: The Seminar Group, 800/ 574-4852, email: [registrar@theseminargroup.net](mailto:registrar@theseminargroup.net), or website: [www.TheSeminarGroup.net](http://www.TheSeminarGroup.net)

**November 16-17 ID**

**IWUA Water Law & Resource Issues Seminar, Boise, DoubleTree Riverside.** Sponsored by Idaho Water Users Association. For info: IWUA, 208/ 344-6690, website: [www.iwua.org](http://www.iwua.org)

**November 16-17 OR**

**Oregon Water Resources Commission Meeting, Portland.** For info: Cindy Smith (OWRD), 503/ 986-0876, website: [www.wrd.state.or.us/commission/index/shtml](http://www.wrd.state.or.us/commission/index/shtml)

**November 16-17 CA**

**California Water Policy Conference 16, Los Angeles, Wilshire Grand Hotel.** For info: [www.cawaterpolicy.org](http://www.cawaterpolicy.org)

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**November 16-17**

**OR**  
**Oregon Water Resources Commission Meeting, Portland.** For info: Cindy Smith, WRD, 503/ 986-0876, website: [www.wrd.state.or.us/commission/index/shtml](http://www.wrd.state.or.us/commission/index/shtml)

**November 17 WA**

**AWRA Annual Washington Section Meeting, Seattle,** Museum of History and Industry (MOHAI). RE: Water Resources Disasters in Washington: Risks & Recovery. For info: <http://earth.golder.com/waawra/ASP/Conferences.asp>

**November 28-30 NV**

**Collaborative Management & Research in the Great Basin: 2006 Workshop, Reno.** For info: Dr. Jeanne Chambers email: [jchambers@fs.fed.us](mailto:jchambers@fs.fed.us), or website [www.cabnr.unr.edu/GreatBasinWatershed/](http://www.cabnr.unr.edu/GreatBasinWatershed/)

**November 28-Dec 1 CA**

**National Water Resources Association Annual Conference, San Diego,** Hotel del Coronado. For info: NWRA, 703/ 524-1544, email: [nwra@nwra.org](mailto:nwra@nwra.org), website:

[www.nwra.org/meetings.cfm](http://www.nwra.org/meetings.cfm)

**November 29 - Dec 1 FL**

**Florida Stormwater Association 2006 Winter Conference, Orlando,** Rosen Centre Hotel. For info: FSA website: [www.florida-stormwater.org](http://www.florida-stormwater.org)

**November 30-Dec 1 NJ**

**Natural Resource Damages Litigation Conference, Newark.** RE: Claims for Industrial Impacts to Biological & Physical Resources, CERCLA, CWA, Oil Pollution Act, Minimizing NRD Liabilities, Technical, Legal, Scientific & Economic Modeling, Effective Mediation. For info: Law Seminars Int'l, 800/ 854-8009, or website: [www.lawseminars.com/](http://www.lawseminars.com/)

**November 30-Dec 1 OR**

**Oregon Land Use Law, Portland.** For info: The Seminar Group, 800/ 574-4852, email: [registrar@theseminargroup.net](mailto:registrar@theseminargroup.net), or website: [www.TheSeminarGroup.net](http://www.TheSeminarGroup.net)

**December 5-7 MT**

**Montana Watershed Symposium, Great Falls.** For info: Jennifer Boyer, 406/ 587-7331 or email: [jboyer@sonoran.org](mailto:jboyer@sonoran.org)

**December 5-8 NV**

**2006 NGWA Ground Water Expo, Las Vegas,** Sponsored by the National Ground Water Association. RE: Groundwater Sustainability, DOT Rulings for Drill Rigs, Latest Products & Technologies. For info: NGWA, 800/ 551-7379, email: [customerservice@ngwa.org](mailto:customerservice@ngwa.org), or website: [www.ngwa.org/expo2006/main.cfm](http://www.ngwa.org/expo2006/main.cfm)

**December 7 WA**

**"Evolutionary Changes and Salmon: Consequences of Anthropogenic Changes for the Long-Term Viability of Pacific Salmon & Steelhead," Seattle,** NOAA Fisheries Northwest Fisheries Science Center. For info: Tara Torres, 303/ 497-8694 or email: [tara@ucar.edu](mailto:tara@ucar.edu).

**December 7-8 OR**

**Northwest Environmental Conference and Tradeshow - 18th Annual, Portland,** Red Lion Hotel on the River (Jantzen Beach). For info: Northwest Environmental Conference, 503/ 244-4292 or website: [www.nwec.org](http://www.nwec.org)

**December 7-8 NV**

**2006 Western Governor's Association Winter Meeting, Henderson.** For info: WGA, 303/ 623-9378 or website: [www.westgov.org/](http://www.westgov.org/)

**December 9-13 LA**

**The 3rd National Conference on Coastal and Estuarine Habitat Restoration, New Orleans,** Hilton Riverside Hotel. Sponsored by Restore America's Estuaries. For info: Steve Emmett-Mattox, RAE, 303/ 652-0381, email: [sem@estuaries.org](mailto:sem@estuaries.org), or website: [www.estuaries.org/?id=4](http://www.estuaries.org/?id=4)

**December 11-15 CA**

**American Geophysical Union Fall Meeting 2006, San Francisco,** Moscone Center West. RE: Session on Hydrologic Effects of Forest Management & Disturbance. For info: AGU, 800/ 966-2481 or website: [www.agu.org/meetings/fm06/](http://www.agu.org/meetings/fm06/)

**December 14-15 OR**

**Oregon Environmental Quality Commission Meeting, Location TBA.** For info: Helen Lottridge, ODEQ, 503/ 229-6725, or website: [www.deq.state.or.us/about/eqc/EQCagendas.htm](http://www.deq.state.or.us/about/eqc/EQCagendas.htm)



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