State of the Art Panel
Policy for Instream Flow Protection

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Introduction

Rivers mean different things to different people. For a person charged with supplying water to users in an urban area, a river might represent the source of that water. For a person concerned about moving bulky commodities to markets, a river might represent a means of transportation. For a person interested in electricity generation, a river might represent a source of power for that generation. For a person wanting to grow a crop in a place without adequate rainfall, a river might provide the water they need for irrigation. Probably for most of us a river is an amenity, a sight that gives pleasure, perhaps a place to fish or swim or boat. For the aquatic and terrestrial organisms within a river and its corridor, that river means life.

Humans use the resources of nature to sustain and improve their well being. Federal and state policies and laws encourage such development and use by providing clarity about who owns or controls the resources, who may use the resources, and under what conditions. Policies respecting human use of rivers have evolved over time as human needs and interests have changed. We are in a period of significant change concerning our views of the values and uses of rivers, and existing laws and policies are being adapted to respond to these changing interests.

Environmentalism—attention to how human activities alter the earth's natural processes—has fundamentally reshaped the way we view the resources of nature. No longer do we see natural and environmental resources solely as economic inputs or places to dispose of human wastes. Such uses remain important, even essential, to human activities. But, in addition, we have come to understand their other functions in providing the conditions that enable life—human and otherwise. Through environmentalism we have come to see the resources of nature not only in terms of individual betterment but more broadly in terms of climatic, physical, and ecological systems of which they are the essential components. Environmentalism has taught us

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to understand how human uses of these resources affect and diminish their ability to provide what is sometimes referred to as "ecosystem services"—that is, their ability to maintain life.

In the context of rivers, environmentalism reacted with dismay to the burning Cuyahoga, the toxic Love Canal, proposals to dam the Colorado River in Grand Canyon National Park, the plight of the salmon. Out of such galvanizing images formed a political consensus to regulate discharges of pollution into our water and to rethink our enthusiasm for on-stream dams. Congress responded in 1968 with the National Wild and Scenic Rivers Act under which segments of rivers with outstanding natural, scenic, or recreational value could be protected from construction of new dams. In 1972 Congress amended the Federal Water Pollution Control Act to place meaningful limits on discharges of pollutants into the nation's water. In 1973 Congress made a national commitment in the Endangered Species Act to reverse the trend toward increasing extinction of species caused by human actions.

Particularly in the western parts of the United States with limited rainfall, attention turned in the 1950s and 1960s to the enormous changes in the region's rivers caused by more than 100 years of aggressive diversion and use of their water. Beginning in this period and extending into the 1970s and 1980s, many states passed laws that for the first time provided a means of protecting flows of water instream. At the national level, political support for federal funding for dam construction to provide water for irrigated agriculture in the American west disappeared in the 1970s and 1980s. With passage of the Endangered Species Act in 1973, the identification of many species of native fishes in western rivers in danger of extinction forced a search for ways to improve their instream habitat—often including improvements in stream flows. The era of using federal development of western rivers as a mechanism for promoting settlement of the West ended. A new era has begun, one in which rivers are increasingly valued for their recreational and ecological functions. That means people are paying increased attention to flows of water and the quality of the water.

Interest in river health is by no means limited to the American West. It is global, and is certainly important in the eastern U.S. as well as Canada. Postel and Richter, **Rivers for Life**. With this greatly heightened attention to the condition of rivers has come an outpouring of

scientific research to help provide a better understanding of how healthy rivers can be maintained or, if necessary, restored. Annear et al**., Instream flows for Riverine Resource Stewardship**. A central finding of this research is the critical importance of flows to river function, that a river's flow regime is the single most important determinant of the river's ecologic condition. Poff et al, *The Natural Flow Regime*. While it is self-evident that there must be water within a discernible channel for at least part of the year for a river to exist, this research has concluded that health of the river is closely linked to the magnitude, volume, frequency, and duration of flows. Maintenance of an existing healthy condition depends on maintenance of the existing flow regime. Richter et al., Ecologically sustainable water management: managing river flows for ecological integrity. *Ecological Applications* 13:206-224. Restoration of desired conditions depends on the ability to restore the necessary flow regime.

In this paper we take a look at water policies in the U.S. and Canada as they relate to protection and improvement of flow conditions in rivers and streams. We focus primarily on state and provincial laws and policies because they primarily determine uses of water. In both nations, federal policies play an important but not central role, as we will explain. We discuss the policy framework more generally governing human uses of rivers and their water, and then we focus more specifically on policies addressing protection of flows. We use examples of policy approaches among the 50 states, 10 provinces, and two nations that seem particularly promising and that might serve as models for others to consider. The paper concludes with a discussion of elements of existing policies that, collectively, represent one view of the "state of the art" in instream flow policy.

The General U.S./Canadian Legal and Policy Framework Governing Uses of Rivers and Water

The U.S. and Canada generally share a common legal heritage that has led to many similarities in their legal systems. Both have constitutionally-based national governments as part of a federal system in which the states/provinces have significant law-making authority—including the primary authority to make laws respecting ownership and use of land and natural resources. Important to use of rivers, both countries place control of navigation at the national level. The Canadian Constitution places authority respecting inland fisheries with the national government, while wildlife management is primarily a state responsibility in the U.S.

1. Riparian Law

Settlement of both countries began in the generally humid eastern areas and gradually moved to the more arid west. The predominant use of rivers in that time was for transportation. Having authority over navigation at the national level helped to ensure that rivers would remain open as "highways of commerce" and not controlled by states or localities solely according to their own interests. Use of flows to generate power to operate mills emerged as another important use of rivers in the early 1800s. Extractive, consumptive uses of water were minimal. Thus the legal problems concerned access to navigable portions of rivers (considered a public right under common law), regulation of obstructions placed into navigable rivers (controlled at the national level), and conflicts between mill operators (resolved as a matter of state property law). The public right to access navigable waters extended to access to the fishery as well. Allocation of water for consumptive uses was not a primary concern.

The English common law regarded the owners of land riparian to a river as having a variety of rights to use of the river. In part, this understanding followed from the fact that the owner of land including the banks of a river had access to the river for use and also owned the land forming the bed of the river to its "thread" or its mid-point in the channel. Ownership of this land in the channel carried with it ownership of everything below (including ground water) and everything above (including surface water). More to the point, ownership of this submerged land carried the right to construct things on it such as docks and piers as well as the structures needed to divert flows of water through tailraces to power mills.

Thus the riparian doctrine developed as a means of providing legal rules respecting uses of rivers, not as a mechanism for apportioning water. As the number and type of uses increased and as these uses increasingly concerned competing claims to water, the courts adopted a "reasonable use" standard to help sort out conflicts. As now articulated, all riparians share the right to use rivers, including their water. Such uses, however, must be reasonable and allow, to the extent possible, other riparians to exercise their rights of use. Obviously such a standard provides little hard and firm guidance, ultimately leaving to a judge the determination of whether a particular use is reasonable.

2. Prior Appropriation

Conditions in the western U.S. and Canada differ from those in their eastern parts. There is relatively little rain. Rivers are fewer, generally smaller, and with more variable flows. Particularly because the agriculture that made possible settlement of these regions required irrigation, it was the water in rivers and streams that was important—not the rivers themselves. It made no sense to limit uses of this water to owners of riparian lands—too much arable land would go unsettled if this were the law. Extraction of water for irrigation required diversion works, headgates, canals, ditches, and laterals—often extending over many miles to carry water to farmlands. To protect the investment in these facilities, the law provided protection for the first to develop and use water. Subsequent users risked curtailment if there was not enough water in a river to satisfy senior users. Appropriators risked losing their right if they did not continue the use. Administrative and judicial systems in the prairie provinces and the western states developed to formalize these rights and provide for their protection.

While river development in the east typically concerned navigation improvements or structures using water to power mills—both flow-dependent uses, river development in the west meant capturing water to enable its diversion and use, usually out-of-stream. Initially this meant building structures in the river that would facilitate direct diversion of flowing water into ditches—primarily during the summer irrigation season. Later it meant building dams within the river channel capable of capturing and holding the large volumes of water typically passing down rivers and streams during the springtime snowmelts or perhaps during summer cloudbursts. The value was in the controlled water, not the flows. Hydropower facilities often were built as part of storage projects, primarily to help pay the costs of constructing and operating associated water storage and delivery facilities.

After more than 150 years of appropriation, most of the American West's water is now fully claimed and used. That is certainly the case in the drier and more populated states of the southwest—Arizona, Nevada, Utah, and New Mexico.

3. Regulated Riparianism

Increased interest in the extraction and out-of-stream use of water in those states following the riparian doctrine has led to the institution of permitting or licensing systems in most of these states and provinces governing such extractive uses. Those desiring to withdraw water, whether riparian landowner or not, must make application to a state or provincial agency. A permit or license authorizes the withdrawal of a certain amount of water for a particular use. Unlike perpetual appropriative water rights, permits or licenses are for a fixed term of years, with provision for renewal. The state or province may impose various conditions on the withdrawal.

4. The Overlay of National Law

In both Canada and U.S. there are national laws that apply to and control certain uses of rivers and water, either directly or indirectly. In the U.S., national control over the navigational uses of rivers regulates the placement of structures such as bridges and dams in navigable waterways. In Canada, the Navigable Waters Protection Act prohibits structures in navigable rivers without approval. Congress has used its navigation authority to regulate the construction of hydroelectric power facilities, authority that has been extended into non-navigable tributaries. Congress has directed the U.S. Army Corps of Engineers to reconfigure and deepen river channels and build locks and other facilities needed to support navigable uses of rivers. Congress extended this program into flood control, funding the construction of dams on rivers all around the U.S. to capture flood flows, along with levees along the river corridors to keep floods within the channel. Private hydroelectric power development is regulated by a federal commission. Thus the flows in segments of many American rivers are regulated by dams controlled either directly or indirectly by the U.S.

Many rivers in the western U.S. are regulated by large, on-stream dams constructed by the Bureau of Reclamation to store water for use primarily by irrigated agriculture. Often these dams include hydroelectric power generation facilities. Water rights for these dams were obtained under state law; irrigation uses of the water operate under contracts with the U.S.

Other areas in which U.S. law is important include protection of water quality and endangered species. Water quality is protected primarily by regulating the discharge of pollutants into waters of the U.S. In addition, states classify rivers according to the primary uses

they presently or potentially support. Water quality standards protective of these uses then are applied. If regulation of pollutant discharges into a body of water is not sufficient to protect the water's quality, states can take other steps toward this end.

Protection of endangered species is sought by ensuring that federal actions such as funding or permitting an activity do not further jeopardize the status of listed species and by prohibiting anyone subject to the jurisdiction of the U.S. from harming or killing a listed species. Because so many freshwater species are listed for protection, this law has had significant effects on river-based activities. Canada adopted the Species at Risk Act in 2002 with a similar prohibition against the harming or killing of protected species.

In Canada, the national government has constitutional authority to manage inland fisheries. Under the Fisheries Act, Fisheries and Oceans Canada has authority to review projects to prevent or mitigate adverse effects on fisheries. This authority has been used to regulate releases from dams to protect fish habitat.

5. Summarizing River and Water Policies in the U.S. and Canada

The policies underlying this legal framework reflect evolving human interests related to obtaining benefits from rivers. Navigation remains a locally or regionally important use of many rivers, but its national significance is obviously much reduced with the development of other means of conveyance. Ideas about flood management have changed over time with recognition that structural approaches were not producing the expected reductions in property damages. Recently, river scientists have noted the ecological importance of overbank flows for riparian vegetation, groundwater recharge, and backwater eddies for fish. High velocity flows move sediments and flush channel cobbles used for spawning.

The era of using rivers as major economic drivers in the U.S. appears to be over. Federal authority over navigation provided a rationale for the U.S. to get actively engaged in the economic development of rivers, initially by ensuring that hydroelectric power development was consistent with the greatest possible economic use of the river and eventually building multi-use projects that included flood control, hydropower generation, water supply, and flatwater

recreation. The national government encouraged trade and commerce in eastern and midwestern states by facilitating navigation on inland waterways, and promoted settlement of the west by making water available to enable agricultural uses of vast areas of arable lands. It used hydroelectric power to help pay the costs of these large water storage projects, enabling the delivery of irrigation water as cheaply as possible. This era reached its peak in the 1960s and has been in transition since then.

States with adequate rainfall for agriculture concerned themselves with supporting local improvements to rivers that would benefit their businesses. They relied on courts to deal with disputes among river users, primarily under common law. States whose economies depended on the extraction of large quantities of water from rivers and aquifers generally ratified existing practices of the users. The policy was to encourage beneficial uses of the water. Rivers were regarded primarily as sources of water. States generally welcomed the large federal investments in river development because of economic benefits they produced.

Loss of political support for federally-funded, large-scale river development resulted for several reasons: growing recognition that the economic benefits were primarily local while the costs were being paid nationally; a changing economy in which the economic products of river development were less important; and growing concern with the environmental impacts associated with these developments. Congress continues to appropriate billions of dollars annually for Corps of Engineers' projects, but many of these projects are intended to help restore rivers significantly altered by previous development, and other projects are subject to more rigorous scrutiny for the economic benefits and involve state and local cost-sharing. Reclamation has effectively stopped new project construction. More than half of its budget now is related to making its existing projects able to comply with the Endangered Species Act or otherwise more river-friendly. And relicensing of hydroelectric power facilities now involves "equal consideration" of environmental values and economic values.

States are responding to the growing interest in river protection and restoration through changes to their water laws that recognize the ecological and water quality benefits of healthy

rivers. The next section provides an overview of these changes, beginning first with states in the western U.S.

Policies for Protecting Stream Flows

This section is organized geographically, providing summaries of the policy approaches found first in the western U.S., then in the eastern U.S., and finally in Canada. In part, this organization reflects the broad differences in water law found in these areas.

1. Environmental Flow Protection in the Western U.S.

Water law in this region follows the prior appropriation doctrine under which a legal right to use water is based on physical capture of water and its application to a beneficial use. Prior appropriation promotes diversion and storage of water as the means to put water to the kinds of out-of-stream uses that were necessary to settlement of the West. In its original version, prior appropriation had no means for giving legal protection to water that stayed instream.

There were early glimpses of the importance of protecting stream flows: Oregon's legislature protected waterfalls along the Columbia River Gorge in 1915, and Idaho protected the water in certain lakes in the northern portion of the state in the 1920s. Gillilan, David M. and T. C. Brown. 1997. *Instream Flow Protection: Seeking a Balance in Western Water Use*. Island Press. 417 pp. As interest in streamflow protection grew, states responded. Oregon established a flow protection program in 1955, and Washington established its initial program in 1967. Many other western states followed in the 1970s and 1980s, as part of a broader awareness of and interest in environmental protection.

The dilemma faced by states was how to alter prior appropriation to enable protection of water instream. The techniques were several. One was simply to legislatively declare the existence of protected flows of water, thus making that water unavailable for future appropriation. This could be done either by withdrawing a designated segment of a stream or a lake from appropriation or by setting some specified flow level by legislation or rule making that was to be maintained, thus making that water unavailable for appropriation. Colorado took the approach in 1973 of authorizing a state agency to make appropriations of water for instream

purposes without any requirement for a diversion. Other states followed this model because of its compatibility with the prior appropriation system.

Thus, in the western states a legally protected instream flow is essentially just another appropriation of water. The appropriation either is established at a single point on the stream (so the appropriated flow of water at that point is protected from reduction by subsequent upstream appropriators) or between two designated points to provide flow protection for a particular stream reach. The rate(s) of flow appropriated is protected from subsequent appropriations according to its priority date.

Fears that all remaining flows would be claimed to prevent additional appropriations caused many western states to limit instream appropriations to a designated state agency (or even the legislature). The purposes for which flows may be claimed vary from state to state. Several states expressly limit instream flow appropriations to the "minimum" amount necessary, a provision that has sometimes been interpreted to limit the purposes for which flows may be protected. In most states, provision is made for reducing protected flow levels in the future if determined to be necessary.

Several states simply allow parties to file for instream flow appropriations under state water law. In this case the party makes application to the state in the same manner as for any other appropriation. The applicant must demonstrate the beneficial use the water will provide, such as to support a fishery. The nonconsumptive rights are expressed as a flow rate and are tied to a particular point or points on the stream.

In the prior appropriation system, the instream right has a priority. It becomes senior to any rights established subsequently on the same source of water. The holder of the instream flow right can require a junior right to cease if that use is impairing protected flows at the designated point on the stream. Moreover, if someone wants to change the use of an existing right, even one senior to the instream right, the change must not impair the flows protected under the instream flow right.

Most western streams became fully appropriated long ago. Typically these water rights involve substantial diversions of water from a stream and consumptive use of much of the diverted water so that stream flows have been substantially reduced from their pre-development levels. In addition, storage of stream flows—particularly in the high runoff spring months—has dramatically altered streamflow patterns. Interest in restoring a flow regime more akin to the stream's pre-development state means making changes in established practices, protected under water rights. Generally such changes require modification of dam operating practices and acquisition of existing water rights, either temporarily or permanently, so that all or some portion of the water historically diverted can be left instream.

The work of appropriating water for streamflow protection has largely ended in the western states. In general, states with active programs have already identified and protected those high-value rivers and lakes with sufficient unappropriated water. Typically these waters are in places with limited competition for their use, often in remote locations, and with important fishery or other aquatic values. Certainly, additional opportunities remain, and more instream appropriations will be made. But these are more often in areas with existing or potential alternative demands for the water, places in which there is more likely to be resistance to flow protections that may restrict additional water development.

The work of restoring flows, however, is only just beginning. Much progress has been made with reoperations of many federal water facilities, both those controlled by the Bureau of Reclamation and those controlled by the Army Corps of Engineers. In some cases, these changes have been driven by obligations arising from the Endangered Species Act. For example, Flaming Gorge Reservoir on the Green River in Utah is now operated in part to meet flow objectives determined to support recovery of endangered fishes as part of the Upper Colorado River Recovery Program. In other cases they have resulted from utilizing the flexibility often available in project operations to make changes more favorable to environmental purposes that do not impair the ability of the project to provide its traditional services, such as for irrigation. A good example is the reoperation of Palisades Dam on the upper Snake River in Idaho.

Acquisition and retirement of existing consumptive uses to help restore stream flows are a much more difficult and expensive process. Acquisition of existing rights is expensive. It is often difficult to find sellers. State processes for changing use of a right from out-of-stream to instream use are time consuming and expensive. There has been some success using leasing and other types of non-permanent arrangements. Some states have been adapting their laws to facilitate such approaches.

2. Environmental Flow Management in the Eastern U.S.

As demands to extract water from rivers in this region increase, many states have responded with legislative changes that put in place some kind of permit system, at least for withdrawals considered to be of a significant amount. Typically, existing uses are grandfathered. Some states regulate only surface water withdrawals, leaving ground water pumping unregulated. State permitting of water extractions provides some ability to consider the effects of proposed withdrawals on stream flows. Only a handful of permit states explicitly subject permit applications to review of stream flow effects. [provide citations]

A growing number of eastern states statutorily provide recognition of environmental flows. The approaches vary, perhaps even more than in the western states. Several states specifically make provision for determination of a protected level of stream flows to be maintained for particular purposes and then subject new water extractions to maintaining such designated flows. In some cases, the state limits this form of protection to particular streams—often designated as having special value. Another approach adopted in several eastern states is to protect stream flows on the basis of flow levels determined necessary to maintain designated stream water quality standards. We discuss these approaches, using particular examples.

Florida was the first eastern state to establish an administrative system to manage water withdrawals and uses, taking that step in 1972. This new law contained a provision directing either the state or the water management districts to establish "minimum" flows for all surface waters. Fla. Stat. Ann. Section 373.042 (1)(a). It stated the minimum flows should be established to reflect the "limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area." It authorized setting flows that reflect "seasonal

variations." Because, despite the mandatory language of this provision, no minimum levels had been established by the mid 1990s, the legislature required the districts to establish priority lists for studying and setting flows. An additional amendment directed the districts to develop a recovery strategy for water bodies not meeting the scientifically-determined minimum flow. Fla. Stat. Ann. Section 373.0421(2). The Florida statutes also authorize the creation of reservations of water, including seasonal reservations, for the protection of fish and wildlife or for public health and safety. FSA 373.223(4). Such reservations are subject to periodic review and may be changed.

Several New England states have established programs that either directly or indirectly protect stream flows. New Hampshire, for example, has designated two rivers for instream flow protection: the Lamprey and the Souhegan. Such flows are to be "maintained at all times, …." RSA 483:9-c, IV; N.H. Rev. Stat. 483:9-c, IV. Flow maintenance is made a condition of any new project or activity within the river area. No interbasin transfers from these rivers are allowed. N.H. Rev. Stat. 483:9. II.

Connecticut first developed minimum streamflow standards in the late 1970s, limited to the purpose of protecting streams with stocked fish. In 2005, partly in response to the "Shepaug River" case (Waterbury v. Washington, 260 Conn. 506 (2002)) the legislature extended the program to all rivers and streams. C.G.S.A. Section 26-141b. Mayland, K., *New England States Move Towards Major Changes in Water Allocation Law and Regulation*, **Eastern Water Law Reporter.**

Maine initiated development of water use requirements in 2002 for maintaining stream flows and lake levels. 38 M.R.S.A.Section 470-H. The standards are to be protective of aquatic life. They are to reflect natural variation in water flows.

Vermont does not directly regulate withdrawals of water, but it does have procedures for establishing minimum stream flows that it may apply to activities through other permitting programs. These procedures, established in 1993, call for protection of natural flow and state that all reasonable alternatives to reduction of natural flows should be considered. Cite.

Mississippi directs its water resources board not to permit use of water of any stream in excess of established minimum flows. Miss. Code Ann. Section 51-3-7 (2). The default minimum flow is the "7Q10" standard (the lowest 7 day flow rate expected once in a 10-year period), but other scientifically-based methodologies may be used to consider biological and other factors.

In addition, several states consider stream flows in connection with their water quality standards. In Vermont, for example, Class A water quality standards include a limitation that no more than a 5% 7Q10 change from natural flows will be permitted, in aggregate. Rhode Island's water quality standards state: "streamflow conditions must be adequate to protect existing and designated uses." Maine's Department of Environmental Protection has developed flow requirements associated with different classifications of streams. Chapter 587: In-Stream Flows and Lake and Pond Water Levels. Natural flows are to be maintained for Class AA waters, while withdrawals of water from Class A, B, and C streams are conditioned on the requirement that all water quality standards be maintained. North Carolina law recognizes the need for flows to meet and maintain stream classifications and water quality standards. N.C.G.S.A. Section 143-215.25 (2). Mississippi law states that "no use of water shall be authorized that will impair the effect of stream standards set under the pollution control laws of this state based upon a minimum stream flow." Miss. Code Ann. Section 51-3-7 (5).

The Great Lakes Agreement represents a major commitment to maintaining the levels of these important bodies of fresh water. All associated riparian states and provinces are committed to carefully regulating withdrawals of waters of the basin that are under their jurisdiction. After use, water must return to the source from which it came. For practical purposes, no water may be transported outside of the Great Lakes basin.

3. Environmental Flow Protection in the Canadian Provinces

The legal regimes related to rivers and their water are at least as diverse among the provinces as they are among the states. Not all provinces regulate water withdrawals.

Nevertheless, several provinces have established provisions specific to protection of rivers and their flows. Cite to Guelph report.

Provincial laws related to human uses of water reflect, in part, the relative abundance of water compared to human demands. Irrigation uses, the most expansive of demands for out-of-stream water, occur primarily in the prairie provinces of Alberta, Saskatchewan, and Manitoba. Use of rivers for hydroelectric power generation has been most active in British Columbia. Out-of-stream water uses exist in the other provinces, but their scale at this time is not substantial.

The laws and policies of several Canadian provinces explicitly mention the importance of the ecological functions of rivers and lakes. Alberta's Water Act, for example, recognizes the need to "manage and conserve water resources to sustain our environment and to ensure a healthy environment." Section 2 (a). It includes a requirement that the government develop an "aquatic environmental protection strategy" within its water management framework. New Brunswick includes wetlands and coastal marshes within its permitting/licensing program for water withdrawals, along with rivers and lakes. Watercourse and Wetlands Alteration Regulation Act, N.B. Reg. 90-80, Section 3(3)(b.3) The stated purpose of British Columbia's Water Protection Act is to "foster sustainable use of British Columbia's water resources in continuation of the objectives of conserving and protecting the environment." Section 2.

The predominant mechanism for protecting environmental flows is the permitting or licensing process for new water withdrawals. Most of the provinces that require such permission include consideration of effects of the proposed withdrawal on fish or other ecological values. Under the Manitoba Water Rights Act, for example, the government is to consider "scientific information relating to the groundwater and water body levels, and the in-stream flows, that are necessary to ensure that aquatic ecosystems are protected and maintained." Section 9.1(1). In Newfoundland, the government is to consider potential adverse effects on water, a water body, or wetlands when issuing a license. Water Resources Act, S.N.L. 2002. c. W-4.01, section 14(1). Nova Scotia requires that water withdrawals be sustainable, defined as withdrawals that can be maintained indefinitely without causing unacceptable environment, economic, or social consequences. Nova Scotia Environment and Labour, "Guide to Surface Water Withdrawal

Approvals," May 7, 2004, at 1.2.1. Perhaps the most extensive statement of a review requirement is found in Ontario, related to "permits to take water." In the manual and regulation addressing such permits, the reviewer is to consider effects on natural functions of ecosystems, including impacts on natural variability of water flow, minimum stream flows and water levels, and water-dependent habitats. Ontario Regulation 387/04, Water Taking, Section 4 (2).

Several provinces use classification systems related to their rivers and streams that have the effect of providing protection for environmental flows in certain places. Ontario classifies applications for water "takings" in three categories, based on their potential impacts to the environment or to other water users, with category 1 considered the least risky and category 3 the most. Different levels and types of information must be submitted dependent on which category the application falls into. Permit to Take Water Manual, at 6. Category 3 applications must include scientific studies including ones that consider the effects of the proposed taking on water flows—magnitude, frequency, duration, time and rate of change. Manual at 16. British Columbia may designate certain streams as "sensitive" under its Fish Protection Act. No new licenses for water use may be issued in such streams. New Brunswick uses water quality classifications to identify uses and standards. Lakes and rivers classified as "outstanding natural waters" are made unavailable for water withdrawals.

Moving more into approaches that either directly allocate the water of some source to environmental purposes or authorize such allocations, several provinces statutorily authorize the reservation of water from appropriation. Alberta's Water Act, for example, empowers the Minister of the Environment to reserve water from appropriation "for any … purpose." Section 35(1)(b). The Northwest Territories provides similar reservation authority under its Water Act. Northwest Territories Water Act, S.C. 1992, c.39, section 18(1)(c)(iii). Quebec is in the process of establishing "aquatic reserves," primarily for the purpose of protecting the biodiversity in such places. New Brunswick has established as protected areas certain watersheds that provide drinking water. The Watershed Protected Area Designation Order. Activities in these watersheds are extensively regulated to protect water quality.

In the maritime provinces there has developed a policy of ensuring the existence of "maintenance" flows as a potential limitation on new water withdrawals. Thus the 1995 Prince Edward Island "agricultural irrigation policy" contains a commitment to maintaining at least 25% of the mean annual flow to ensure protection of fish habitat. It notes a similar policy is in place in the other three maritime provinces. Maintenance flows now are calculated "based on the 70% of the flow rate that is exceeded 50 % of the time for any month." Guelph Group, Tech App. II at Section 10, pg. 39.

While several provinces authorize the licensing of stream flows and lake levels for environmental purposes, none have established a specific provincial-level program for this purpose. Thus, Alberta's Water Act authorizes the government to hold instream licenses to meet "water conservation objectives" (Section 35; 51(2)). Non-governmental entities apparently may not obtain a license for instream use not involving the diversion of water. Michael M. Wenig et al., "Water Under the Bridge? The Role of Instream Flow Needs (IFNs) Determinations in Alberta's River Management," at 13. Manitoba has taken steps to establish protected environmental flows for the Assiniboine River. Manitoba Conservation. 2003. "The Manitoba Water Strategy at 7.". Quebec has apparently identified the importance of reserving flows for ecological purposes, particularly for fish, but has not yet taken steps to establish such reserved flows. Guelph Group, Tech. App. II at Section 11, pg. 44.

One feature distinctive from American law is the authorization found in at least two provincial statutes for cancelling or reducing water allocations if necessary for protection of the environment. Manitoba's Water Rights Act authorizes the government to suspend or restrict licensed withdrawals if necessary for protection of aquatic ecosystems. Section 9.2. Alberta authorizes the Environment Minister to involuntarily amend an existing water license if necessary to address adverse effects on the aquatic environment. Section 54(2). Compensation is required to be paid. Section 158.

With this basic overview of the policies related to protection of environmental flows in the states and provinces, we turn finally to a discussion of an array of policies that might collectively represent "state of the art" approaches

State of the Art Instream Flow Policies

This final section outlines a policy framework drawn from the examples discussed above that represents one view of a state of the art approach that would meet objectives for protection and restoration of environmental flows while also meeting other important objectives respecting human use of rivers and their water. While drawn from existing policies, the elements presented here are selected to represent a composite approach—not necessarily one that would fit within each existing state or provincial framework but one that might be considered to be a "model" approach.

1. A state policy identifying rivers as an important state resources and their health as a priority objective

Perhaps most fundamental is an explicit policy recognition of the state's interest in its rivers, including their water. Importantly, the policy should include clear statements of the objectives sought to be accomplished, including recognition of the multiple functions served by rivers. A model policy statement would make clear the state's intent to maintain those functions while meeting human needs and interests.

A good example is provided by the following statement of policy in New Hampshire law:

New Hampshire rivers and streams comprise one of its most important natural resources, historically vital to New Hampshire's commerce, industry, tourism, and the quality of life of New Hampshire people. It is the policy of the state to ensure the continued viability of New Hampshire rivers as valued economic and social assets for the benefit of present and future generations. The state shall encourage and assist in the development of river corridor management plans and regulate the quantity and quality of instream flow along certain protected rivers or segments of rivers to conserve and protect outstanding characteristics, including recreational, fisheries, wildlife, environmental, cultural, historical, archaeological, scientific, ecological, aesthetic, community significance, agricultural, and public water supply so that these valued characteristics shall endure as part of the river uses to be enjoyed by New Hampshire people. N.H. Rev. Stat. Section 483:1.

The strength of such a statement is its explicit recognition of the value of the state's rivers for a broad range of purposes. Its limitation of instream flow protection to only "certain protected rivers," however, is far too narrow.

2. A state policy that acknowledges the multiple functions and values of river systems, that specifically identifies the essential role played by the river's flow regime, and that establishes a well-defined process for the protection and integration of these functions and values

In addition to a policy recognition of the importance of rivers that explicitly includes a commitment to maintain their health, state of the art laws establish a well-defined process for achieving this objective. It is most common to designate a particular state agency and task it with this responsibility. Typically this is the same entity responsible for permitting human uses of water and protecting water quality. Often, this entity is simply directed to "consider" river health when issuing permits. A better approach is to provide for proactive steps to determine the conditions necessary to maintain river health and to take actions necessary to protect and maintain those conditions—particularly related to protection of a flow regime that supports such conditions.

3. A state policy that specifically mandates the determination of flows and levels regarded as protective of desired ecological and other instream values and establishes a mechanism for the maintenance or restoration of such flows

Connecticut added a provision to its laws in 2005 that sets out direction for the state Commissioner of Environmental Protection to develop "flow regulations" for all state rivers and streams. C.G.S.A. Section 26-141b. The regulations are to

-preserve and protect the natural aquatic life in state waters;

-preserve and protect the natural and stocked wildlife dependent on flows;

-promote and protect the usage of rivers for public recreation;

-be based, to the maximum extent practicable, on the natural variation of flows and levels "while providing for the needs and requirements of public health, flood control, industry, public utilities, water supply, public safety, agriculture and other lawful uses of such water;" and

-be based on the best available science.

Maine added similar direction to its Environmental Protection Board in 2007. 38 M.R.S.A. Section 470-H. The board is to establish "water use requirements" for maintaining in-stream flows and lake or pond water levels "that are protective of aquatic life…." Special attention is to be given to watersheds most at risk because of cumulative water uses. Requirements are to take into account natural variations of flows and levels. The board is to put in place a "mechanism" to help reconcile interest in protecting aquatic life with interest in allowing community water supply systems to meet service requirements.

The important action is to make explicit the flow regime(s) regarded as necessary to protect identified values so that human water uses can be occur in a consistent manner. Obviously such an approach is easier in places where there remain sufficient flows to accommodate these multiple interests. Thus it is more readily applied in the eastern states and eastern provinces where there has not yet been large scale out-of-stream use of water. Perhaps most active in protecting flows in the western U.S. have been Montana and Washington. Montana used a reservation system to set aside a substantial portion of unappropriated water in rivers and streams within the Yellowstone and Missouri River basins in the 1970s and 1980s. MT. ST. section 85-2-316(2)(a)(v). While these reservations are reviewed at least every ten years and may be reduced, they serve as a potential limit on new appropriations from these sources. Washington law specifically provides for the maintenance of "base" flows in all perennial streams. R.C.W.A. 90.54.020(3)(a). The state Department of Ecology went through extensive review processes in the 1970s and early 1980s putting in place protected flows in many rivers, especially in the more arid eastern portion of the state. Barwin & Slattery, *Protecting Instream Resources in Washington State*, in **Instream Flow Protection in the West**, at 374-75. These designated flows, established by rulemaking, limit additional diversions of water that would reduce their amounts.

4. A state policy that provides adequate guidance for reconciling and integrating competing interests for uses of rivers and lakes

Perhaps the most challenging policy matter is to decide what flow levels should be protected. In the western states, statutory provisions providing protection for instream flows

typically state that the flows protected are to be the minimum necessary to achieve the purpose—generally maintenance of a fishery. Interpretations of "minimum" have varied considerably. A variety of methodologies exist for estimating flow levels, varying in their intended objectives, the data requirements, and their complexity and sophistication. Cite to IFC. Analysis of the flow requirements of fish is the most common basis for their use.

The science of river health has made great strides in recent years. Emerging from this work is an improved understanding of how rivers function and what factors are most important in determining their condition. The importance of flow is now well established. Several eastern states now expressly direct that flow standards provide for the natural variation of flows and levels. [examples]

Nevertheless there is a noticeable absence of guidance in most state laws respecting not only the degree of desired protection for rivers but also how to balance human uses with ecological needs. Clearly these are complicated matters and the particulars will vary from source to source and segment to segment. Still there is a need for policymakers to help those implementing these programs and those charged with balancing competing uses. In the federal systems of the U.S. and Canada, these policy determinations will be made primarily at the state and provincial level.

Several eastern states have linked together stream flows and water quality standards, with a requirement that flows be maintained at levels necessary to support stream water quality standards. Thus, for example, the Maine Department of Environmental Protection requires that withdrawals of water from streams classified as A, B, or C must maintain flows sufficient to support all water quality standards, including all designated uses. Chapter 587: In-Stream Flows and Lake and Pond Water Levels, Section 5. A. Flows in Class AA waters "shall be maintained as they naturally occur." Id. at Section 4.A. Mississippi restricts the issuance of permits for water withdrawals in excess of established minimum flows. Miss. Code Ann. Section 51-3-3 (i). Vermont's adopted water quality standards limit aggregate changes in hydrology related to withdrawals to be no more than a specified change from the natural flow regime for Class A streams. Vermont Water Quality Standards at 26, Vt. Code R. 12 004 052; section 3.01(C)(1)(a).

Florida uses the word "minimum" in describing flow levels to be protected but provides further guidance not found in other state laws: "The minimum flow for a given watercourse shall be the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area." Fl. Stat. Section 373.042(2). Such a standard may be most appropriate in jurisdictions with substantial human demands for water withdrawals. Jurisdictions with more abundant supplies compared to human demands might prefer a more protective standard. Even in jurisdictions with heavy demands, there may be some water sources regarded as sufficiently important ecologically that a higher level of protection is warranted.

The challenge of determining protected flow levels has prompted some states to establish formal processes that include key interests as well as the responsible agency or agencies. As part of making a statutory commitment to protection of stream flows, Texas put in place an environmental flows advisory group in 2007. V.T.C.A. Water Code Section 11.0236. Members are appointed by the governor, the lieutenant governor, and the speaker of the house. The statute states: "In evaluating the options for providing adequate environmental flows, the advisory group shall take notice of the strong public policy imperative that exists in this state recognizing that environmental flows are important to the biological health of our public and private lands, streams and rivers, and bays and estuary systems and are high priorities in the water management process." Section 11.0236(i). The legislation identified several priority basins for taking action. It directed the advisory group to appoint basin-level stakeholders groups. The stakeholders' group then is to establish an expert science team to provide environmental flow regime recommendations. Recommendations are to be based on the best available science and are not to be concerned with other water uses. Section 11.02362(m). The recommendations go to the stakeholders' group, the advisory group, and the state commission. The stakeholders' group is to make its own flow recommendations to the commission [full name], taking into account other uses of water. Section 11.02362. Finally the commission is to adopt "appropriate"" environmental flow standards for each river basin and bay system "adequate to support a sound ecological environment, to the maximum extent reasonable, considering other public interests and other relevant factors" and set aside unappropriated water to satisfy the standards "to the maximum extent reasonable when considering human water needs; …." Section 11.1471.

While the Texas approach may be considered too complex for many jurisdictions, it evolved from a 10-year statewide basin planning process in which political consensus was reached about the need for instream flow protection. Such processes have become increasingly common as a means of developing a more shared view of existing uses of rivers and their water and build support for future actions related to rivers. Presumably, streamflow protections emerging from such collaborative processes are more likely to be supported by key interests and less likely to be challenged in the face of new human demands.

5. A state policy that regulates withdrawals of ground water to ensure such withdrawals do not unacceptably impair stream flows and lake levels

Awareness is growing of the effects on surface water of unregulated or insufficiently regulated groundwater pumping. Glennon, **Water Follies**. Traditionally, groundwater use has been addressed separate from surface water use. Many eastern states and some Canadian provinces do not regulate groundwater withdrawals. State of the art river and water management includes regulation of groundwater use for its potential impacts on surface water. [insert discussion of Model Water Code approach and use example of Washington regulation of groundwater pumping to protect stream flows]

6. A state policy that provides for identification of dewatered rivers with important instream values and puts in place a program for restoration of flows

In general, flow levels designated for protection apply to existing unused water so that existing uses are not affected. In significantly dewatered streams, however, such levels may not be sufficient to support desired conditions for important ecologic values. It is increasingly common for the analysis of the river to address ecological values that could be supported with additional flows. Such an analysis helps to provide interested parties with information respecting flow improvements necessary to achieve those values.

Even without this kind of analysis, there are increasing efforts to restore flows in some rivers, especially in the western U.S. State of the art laws facilitating such efforts enable the conversion of existing out-of-stream uses to instream flow, either permanently or temporarily, to

reduce or eliminate the associated withdrawals and water consumption. Oregon and Montana have been most active in this area. Under Oregon's instream flow law, the Oregon Water Resources Department promotes use of leases, permanent transfers, split season transfers, and conserved water as means of restoring streamflows. *See* http://www.oregon.gov/OWRD/mgmt_instream_tools.shtml, visited 9/7/08. As of July 20, 2007 Oregon had put in place over 1,000 instream leases, transfers, and allocations of conserved water, providing an additional 900 cubic feet per second of stream flows. Montana's law authorizes any party to hold a water right for instream flow purposes, either temporarily or permanently. MT ST sections 85-2-408, 85-2-402(2)(b). The Columbia Basin Water Transactions Program provides essential funding to encourage states, water trusts, and others to help restore flows within the basin. A state of the art policy would provide the funding needed to promote efforts to acquire existing rights for instream flow purposes.

7. A state policy that puts in place a program for monitoring and enforcement to ensure protection of stream flows

Once flows have been set aside in some manner for protection of river health, monitoring and enforcement are necessary to ensure their maintenance. Issues are most likely to arise in drought periods when stream flows drop and out-of-stream uses may need to be regulated. Obviously, stream gages are needed to track flow levels. In addition, there must be means of notifying those making withdrawals subject to protection of stream flows that they may need to curtail some or all of their withdrawals. There must be administrative mechanisms for enforcing such curtailments if necessary.

Western states generally have established such administrative systems, at least in areas with chronic water shortages, to manage uses under the priority system. Perhaps the most comprehensive administrative system is found in Colorado, with its seven water basins each supervised by a division engineer and each water district within a basin administered by a water commissioner. The Colorado Water Conservation Board, the state agency authorized to appropriate water for instream flows, has put in place a monitoring program for many protected stream segments and has used the state administrative system to obtain curtailment of junior users to protect flows.

Summary

People are rediscovering the importance of rivers and streams—their natural beauty, their recreational uses, the astonishing life they support. Increasingly, they expect their rivers to not only be free of harmful pollution but to be supportive of native fisheries and recreational enjoyment. The degree to which most rivers have been altered in the past for multiple purposes has prompted increasing interest in protecting the remaining values and restoring at least some of those that have been lost.

With this interest has come the political support necessary to achieve such changes. Laws and policies are changing to reflect these interests. Most importantly for this paper, most states and provinces now recognize the importance of stream flows for healthy rivers. They are increasingly ensuring that new uses of rivers are consistent with maintenance of flows. Many are defining flows to be protected, based on scientific methods that relate flows to desired ecologic outcomes or other means. Some are working on restoring flows in dewatered streams.

Historically, laws related to uses of rivers and water did not consider instream flows except in relation to navigation. Particularly in arid areas, interest focused almost exclusively on extracting water for direct human uses. Now flows are understood to directly affect the health of a stream. Thus efforts often focus as well on protecting and restoring flows.

The work is slow. Because state law primarily governs uses of water, changes must occur state by state. Some states are embracing this new view of rivers and making changes in their laws to provide for these interests. Others are moving more slowly.

There are important challenges. Inevitably those who would benefit from out-of-stream uses of water resist limitations on their ability to make such uses. Indeed, there are often difficult tradeoffs involved in which there are no easy answers. Yet the pressures for increased river protection are growing. Ways are being found to meet needs for water that are more compatible with river health. The state of the art is markedly improving.