WHAT IS THE VALUE OF WATER?

"Only what is rare is valuable, and water, which is the best of all things…is also the cheapest." – Plato.[1]

I. What is the issue?

A 25-ounce bottle of Perrier mineral water costs $1.99 at the Lunds supermarket in St. Paul's Highland Park neighborhood. The same amount of tap water in one of the nearby homes costs about five one-hundredths of a cent. [2]

And billions of gallons of Mississippi River water flow through the Prairie Island and Monticello nuclear power plants, performing a critical function, cooling the plants' electric generating apparatus. But the water costs Xcel Energy, the plant's owner, only $250,000 a year for state permits.

The Mississippi flow has great value, but little cost, for the utility and its customers. Similarly, the river is priceless, but cost-free, for the anglers, boaters and sight-seers who flock to the Mississippi for recreation every day of the year.

How should we value water? In public policy decisions, when costs and benefits are weighed, what value should we attach to the services we receive from wetlands that protect us from floods and filter our groundwater? Are we putting enough value on the aesthetics, heritage and recreational uses of the lakes that make Minnesota the land of 10,000 – actually about 12,200 – lakes? And, when we set prices for water usage, should we charge dramatically more for ground water than for surface water?

Determining the value of water, as opposed to setting its price, is a complex issue that is heavily influenced by the values one espouses, as well as the assumptions one makes about the future supply of water and the demands likely to be made on that supply.

In the most comprehensive study made of the value of water in Minnesota, the state Department of Natural Resources and the University of Minnesota's Natural Resources Research Institute concluded 20 years ago:

> "The perception that Minnesota is *water-rich* has resulted in complacency. Our rivers and streams always have water; our wells never go dry. The only price you pay for water is the cost of the pumps and pipes to deliver it; the water itself is *free*."[3]

The same study concluded that ground water, on per-unit basis, was vastly more valuable – 12.8 times – than surface waters in terms of the economic activity and jobs they produced.

II. How can we, and how should we, think about the value of water?

In 1992, delegates to the United Nations-sponsored International Conference on Water and the Environment in Dublin issued a declaration stating that water should be managed as an

economic resource, but that pricing should always take into account human beings' dependence on water:

> "Water has an economic value in all its competing uses and should be recognized as an economic good. Within this principle, it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price. Past failure to recognize the economic value of water has led to wasteful and environmentally damaging uses of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources."[4]

Some people have advocated greater primacy for the rights of human beings to clean and safe water in any effort to put a monetary value on water. For example, two authors, Maude Barlow and Tony Clark, wrote:

> …(T)he Earth's fresh water belongs to the Earth and all species, and therefore must not be treated as a private commodity to be bought, sold, and traded for profit….the global fresh water supply is a shared legacy, a public trust, and a fundamental human right, and therefore a collective responsibility."[5]

A 2005 paper titled "The Value of Water" by W. Michael Hanemann, Chancellor's Professor of agricultural and resource economics at the University of California, Berkeley, offers a very good primer on the economic principles of market price and economic value, public vs. private goods, and estimating value in the absence of a market – all factors that affect the valuation of water.[6]

Hanemann's paper describes the special role that big water projects have played in establishing the framework for cost-benefit analyses of public policy decisions in the United States.

In the paper, Hanemann also offers his own view that water is different from other human necessities, such as food and shelter, and different from other inputs to production, such as land and capital, and therefore worthy of special consideration in valuation decisions.

Adam Smith, in his *The Wealth of Nations,* published in 1776, used water as an example of the paradox that sometimes exists between price and value in a market economy:

> "Nothing is more useful than water, but it will purchase scarce anything; scarce anything can be had in exchange for it. A diamond, on the contrary, has scarce any value in use, but a very great quantity of other goods may frequently be had in exchange for it." (Book I, chapter IV)[7]

According to Hanemann, non-market valuation consists of attributing value to benefits received or provided, even if there is no market that allows any individual to pay for those benefits. And Hanemann says "the history of non-market valuation in the United States is closely intertwined with water projects, since these were an important motivation for the development of cost-benefit analysis."

In a string of laws and other actions, federal authorities reviewing river and harbor projects were directed to weigh local, as well as national, benefits, and to consider "not only private but also social accounting." The federal Flood Control Act of 1936 allowed the Army Corps of Engineers to undertake flood control projects provided that "the benefits to whosoever they may accrue are in excess of the estimated cost."[8]

Hanemann also recounts an effort by the National Park Service in the 1950s to attach an economic value to its parks, which charged no admission fees and, thus, were non-market goods. Economist Harold Hotelling suggested the Park Service chart the distances visitors traveled to the parks and the costs they incurred for travel, lodging and equipment, and then use those costs as a surrogate for the value of the parks.

"The insight behind the travel cost method, and revealed preference generally," Hanemann writes, "is that, while people cannot buy nonmarket goods such as clean water or an unspoiled environment directly, there sometimes exist market goods that serve as a partial surrogate for the nonmarket good because the enjoyment of these goods is enhanced by, or depends on, the nonmarket good."

Hanemann also describes a "contingent valuation" method for non-market goods in which people are interviewed about how much they would pay to enjoy access to a non-market good, such as a wilderness environment, or to preserve that access for others.

Federal requirements for environmental impact statements on major projects receiving federal money solidified a trend toward assigning non-market values to the environment in the 1970s and '80s, according to Hanemann. "…(S)ince the mid-1980s it has not been acceptable in the U.S. to perform an economic assessment of a major water project without including some non-market valuation of the project's environmental impacts," he writes.

As an example of the impact of such consideration, Hanemann cites the California State Water Resources Control Board's 1993 Mono Lake decision requiring Los Angeles to preserve wildlife habitat by dramatically reducing the water it took from Sierra Nevada tributaries to the lake.

Economists use the terms "private good" and "public good" to differentiate between commodities for which one person's use necessarily limits their availability to others, and those that everyone shares.

Hanemann concludes water is both a private and a public good. "When water is being used in the home, in a factory or a farm, it is a private good," he writes. "When water is left in situ, whether for navigation, for people to enjoy for the view or for recreation, or as aquatic habitat, it is functioning as a public good…By contrast, most of the other commodities associated with food, clothing or shelter are private goods and have no public goods aspect…"

III. What is the price of water?

…(T)he prices which most users pay for water reflect, at best, its physical supply costs and *not its scarcity value*," Hanemann writes. "Users pay for the capital and operating costs of the water

supply infrastructure, but in the US and many other countries, there is no charge for the water per se."

That's the same conclusion reached by the Minnesota Department of Natural Resources and the University of Minnesota's Natural Resources Research Institute in a 1985-87 report:

> …(T)he state's water is not presently scarce from an economic point of view. In fact, water supplies are almost double what is required for production…From a pricing point of view, water in Minnesota is essentially treated as a free resource. Thus, water will be used in Minnesota as a substitute for other resources that are not free whenever such substitutions are possible."[9]

State statutes set an annual "water use permit processing fee" for DNR permits authorizing any large withdrawal of ground or surface water, but the fees are minimal. There is no charge for using up to 15 million gallons a year, and the fee for a permit to use a half-billion gallons a year costs only $3,750.[10]

The price of drinking water in Minnesota varies considerably. In 2007, the cost of 7,500 gallons a month – an estimated average use for a residential household – ranged from $8.38 a month in Maple Grove to $42.63 a month in East Grand Forks. The price in Minneapolis was $26.77 and $20.48 in St. Paul. All the prices are for water only, and do not include fees for wastewater or storm water disposal.[11]

Total water-related costs – for drinking water, sewage treatment and storm water disposal – were $59.60 a month in Minneapolis. On an annual basis, that total fee equals about 1.2 percent of the annual median household income for the state.[12] By comparison, water planners in the World Bank have aimed to keep the cost of water and sanitation projects in developing countries to a range of 3 to 5 percent of household income, according to Hanemann.

How has water been valued in Minnesota?

In 1985 through 1987, the Minnesota Department of Natural Resources and the University of Minnesota's Natural Resources Research Institute conducted an exhaustive study of the economic value of water in Minnesota. The study, which was hampered by a scarcity of reliable data on the supply of underground water, looked at water as a contributor to jobs and economic output in scores of industries across the state.

The study also attempted to calculate the non-market value of water for recreation purposes, especially fishing. It did not try to put a value on the purely aesthetic or cultural value of Minnesota's lakes and rivers.

The study relied on water use data from 1985. It examined water "withdrawn" from aquifers and rivers, rather than water "consumed." The difference meant the study included water diverted for pass-through uses such as cooling of electric utilities, rather than only water that was used up or somehow tainted in the process of being employed.

Reviewing data from industry and public water systems, the study determined that Minnesota used about 3.4 million acre-feet of water in 1985. An acre-foot is the amount that would cover an acre to a depth of one foot – 325,851 gallons. Thus, the 1985 water usage, in gallons, was about 1.1 trillion gallons. The industrial sectors using the most water were electric utilities, iron mining and the pulp and paper industry.

By consulting recorded data on river flows, where the data existed, and making rough assumptions about ground water reserves, the study's authors, estimated Minnesota's available water. In a year with normal precipitation, they estimated the state had 22.28 million acre-feet – about 7 trillion gallons – of potentially available surface water. The estimate for surface water did not count landlocked lakes or Lake Superior.

Further, the authors assumed that 85 percent of river flows were necessary for fish and wildlife habitat, recreation, navigation, hydroelectric generation, waste assimilation and sediment transport. The remaining 15 percent of surface water is about 1.1 trillion gallons.

For a groundwater number, the authors applied multiples to the amount of ground water actually used and estimated the available groundwater at about 700 billion gallons.

The authors emphasized that better data on both ground and surface water supplies should be collected.

The study concluded that water would remain "essentially free" until use exceeded supply. It calculated $2,070 per acre-foot as the marginal value of water in a situation in which the demand was slightly less than supply and the available water had to be allocated among potential users.

The study predicted that a "moderately severe drought" in Minnesota could cause the loss of 150 jobs, reduce the state's gross economic output by $5.7 million and reduce state exports by $3.1 million.

Based on the output of industries that used ground water, rather than lake or river water, the study concluded that ground water's economic value was significantly greater. "Ground water has a higher value to Minnesota's economy than surface water," the study said. "In fact, for each dollar of output generated by the use of one acre-foot of surface water, $12.80 is generated from use of an acre-foot of ground water."

The study estimated that "recreators" pursuing fishing or other water-related activities accounted for direct and indirect spending of $1.7 billion and produced 37,533 jobs.

A 1988-2006 summary of water usage in Minnesota, posted on the DNR Web site,[13] reports that total water usage in 1988 was 1.1 trillion gallons, the same total the study had cited for 1985. In 2006, the total reported water usage was 1.4 trillion gallons, a 25 percent increase over 1988 but still well below the available annual water implied in the earlier study's estimates.

The DNR does not have an updated estimate of Minnesota's sustainable water supply. In 2005, the DNR examined the sustainability of groundwater and said the question could not be definitively answered because of a "lack of specific data about groundwater sources and the impacts of pumping them."

---

[1] The quotation comes from "The Value of Water," a 2005 paper by W. Michael Hanemann, Chancellor's Professor of agricultural and resource economics at the University of California, Berkeley. Hanemann attributes the quote to Marian Bowley's *Studies in the History of Economics before 1870*, Macmillan 1973. Hanemann's paper is posted at http://are.berkeley.edu/courses/EEP162/spring05/valuewater.pdf.

[2] Based on estimated average residential water use of 7,500 gallons a month and a charge in St. Paul of $20.48 for that amount. Source: A 2007 water rate survey published by AE2S, an engineering and environmental services consulting company based in Grand Forks, ND.

[3] "The Value of Water to Minnesota," a 1985-87 report funded by the Legislative Commission on Natural Resources. The study, which is Volume I of a report called "Water Allocation and Management," is available at the DNR library.

[4] "Dublin Statement on Water and Sustainable Development." World Water Assessment Programme. http://www.unesco.org/water/wwap/facts_figures/valuing_water.shtml.

[5] Maude Barlow and Tony Clark, *Blue Gold: The Fight to Stop Corporate Theft of the World's Water*. The New Press, 2002. Cited in Hanemann's "The Value of Water."

[6] Hanemann.

[7] Cited by Hanemann.

[8] Hanemann.

[9] "The Value of Water to Minnesota."

[10] Minnesota Statutes 103G.271.

[11] 2007 water rate survey by AE2S.

[12] The three-year, 2004-2006, average for Minnesota's median income was $57,363, according to the Census Bureau. www.census.gov/hhes/www/income/income06/statemhi3.html.

[13] A link to a DNR spreadsheet is available at: http://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/wateruse.html.