USING MARKET INCENTIVES TO PROTECT WATER QUALITY IN AMERICA

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As America embarks upon its third decade under federal clean water legislation, the question is "has it worked?" The answer is "yes" in several limited ways, and otherwise "no." Congress is attempting to address the many remaining problems in its reauthorization of the Clean Water Act, but its efforts will fall far short of the mark again. The basic problem is that achieving the many economic benefits of improved water quality and related environmental values requires substantial changes in water use throughout the country. But this will not happen until water quality targets are linked to water uses, and major funding is directed toward financing changes in these uses.

The political forces swirling around the reauthorization of the Clean Water Act have yet to recognize that past prescriptions were at best partially successful and at present mostly ineffective. One of the Act's main claims to victory over its life has been the curtailment of pollution discharges from publicly-owned water treatment works (POTWs). This was done with technology-based standards and lavish taxpayer subsidies through the now moribund EPA Construction Grants Program. Even these gains in point source pollution control will depreciate as the POWTW's get old and must be replaced. Other key milestones in the Act's history, such as the wetlands protections offered by Section 404, have recently been seen for what they are — protections which are only as good as the current political alignments in Washington, protections without an economic base which must square off against an array of economic interests on the other side. Further, the history of the Act has been one of delay wherein an array of other unsolved problems remains, including nonpoint source pollution, toxic discharges, contamination of sediments, and groundwater deterioration.

The persistence of these problems signals two major areas inwhich water quality policy in the future should be significantly different from that of the past. First, it is time to adopt goals or targets which are based on actual *performance* in terms of aquatic ecosystem functions and human health. Performance goals for water quality policy is not a new concept. In 1972, Congress had general performance goals in mind with its setting of "fishable and swimmable" as 1985 targets for the nation's waterways. Now that we are seven years beyond that deadline, does the frequent failure to achieve these goals mean that the goals are unrealistic? My answer is "no" — we simply need to be much more specific in defining these goals and making them operational within each of the nation's river basins. A key component of this specificity is the defining of what water-using entities' rights are to use aquatic ecosystems both for supplies of fresh water and for assimilation and dispersion of polluted discharges. And once defined, government needs to enforce the terms of these rights. Current enforcement programs are a "paper tiger" — penalities, commissions, bounties, and other instruments can and should be used as enforcement incentives which will reduce the political and budgetary burdens of government agencies.

Second, we need to develop and encourage business-like means of achieving these targets. This means clarifying the rules, and maximizing the flexibility, for how and what changes in water use occur. Let the water-using industries decide how to operate within the constraints presented by water quality targets. Create markets for water use and pollution discharge rights and for insurance to cover water quality-related damages. And finance environmental trust funds for acquisitions and revolving funds for loans from water use and pollution surcharges. The following are the key elements of a market-based water quality policy,

the implementation of which would require explicit legislative authorization.

Markets for Water Pollution Discharge Rights

Many water pollution dischargers in America have no need for a "license to pollute" since they already enjoy free disposal with little or no regulatory oversight. Clarifying who is allowed to discharge what and where by defining discharge rights would change this. Establishing a system of tradable discharge permits (TDP) would not only set these rights and their limitations, but also would determine a price for these rights. In general, the more the need to limit discharges, the higher the price would become.

The Clean Water Act has already issued discharge permits for point sources of pollution. The NPDES system has adopted technology-based treatment standards for "traditional" pollutants such as BOD, suspended solids, and biologicals. The performance of these standards, featuring "best available technology" (BAT), in improving water quality and beneficial uses has not been linked directly to permit issuance or renewal. However, the existence of these permits provides a starting point from which a more environmentally and economically efficient system could be developed.

Tradable discharge permits offer an incentive-based system with which regulatory agencies can achieve pollutant loading targets. Under a TDP system, regulatory agencies must quantify these targets and issue a corresponding number or amount of permits. Pollutant sources must be permitted according to discharge levels, but permits may be traded among sources. Because permits are valuable, an opportunity cost to hold permits exists and creates an incentive to reduce emissions. Each source is free to reduce emissions in a least cost manner, and will do so to the extent that the cost of reducing emissions is less than the cost of buying discharge permits. Thus, unlike the BAT approach, TDP's allow polluters a degree of flexibility within the limits of the loading targets, and ensure a least cost allocation of discharge reduction across sources.

Set Basin- and River Segment-Specific Pollutant Loading Ceilings

The necessary condition that loading ceilings be established which are specific to individual pollutants and basin segments requires the setting of performance criteria based on beneficial uses. Existing procedures to set "total maximum daily loads" (TMDL's) for watercourses which are in violation of water quality standards are an important step in this direction. However, TMDL's have rarely been set, usually in response to critical water pollution problems or to litigation. In order for trading potentials to be realized, such loading ceilings will need to be established on a broad basis. For highly toxic pollutants, load ceilings would be low, resulting in a limited number of discharge permits and trading possibilities.

The establishment of pollutant loading ceilings would be within existing authorities under the Clean Water Act to avoid impairment of other water uses, as would the use of TDP as an implementation policy. Section 319 (a)(4) of the 1987 amendments to the Clean Water Act states that nonpoint source pollutant management should "to the maximum extent practicable develop programs on a watershed-by-watershed basis." The Act does not specify what type of implementation program is necessary — this is the states' responsibility. A 'watershed basis,' which involves multiple sources of pollutants, holds the possibility of pollutant trading programs. TDP's have been proposed by Congressional leaders, and water quality control programs based on economic incentives and some trading have been utilized in Europe. Extensive pilot studies and projects involving potential trading between point and nonpoint sources of water pollution have been implemented in the Great Lakes Basin, Tennessee, and Colorado.

While over 85 percent of industrial point sources are in compliance with their permit conditions and 90 percent of municipal point sources

have installed secondary or greater treatment, there continues to be heavy pollution loading and frequent violations of ambient water quality standards in many basins. The problem is not that the point source dischargers have not made significant improvements in the quality of their discharged effluent. Instead, the problem is that there continues to be substantial growth in the volume of loadings from municipal and industrial sources in many of the nation's watersheds which will continue to place heavier demands on treatment facilities and consequent loadings. In some basins, tertiary treatment is becoming necessary if additional urban and industrial discharges are to be accomodated by receiving waters.

Establish Accountability Among NPS's

At the same time, most basins also receive substantialpollutant loadings from vast tracts of land containing diverse and dispersed nonpoint sources in agriculture, livestock, forestry, mining, septic tanks, atmospheric deposition, and urban storm runoff. But these discharges have yet to be regulated by permitting or other systems which codify the terms under which they discharge. Nutrients, trace elements, salinity, pesticides, hydrocarbons, acidity, and heavy metals are significant pollutants for particular types of NPS's and regions. During the past fifteen years, the federal government has expended considerable financial resources to identify and subsidize the implementation of various types of best management practices in some NPS industries. While uncertainty continues as to how much water quality improvement results from the implementation of BMP's in any site-specific situation, it is the lack of a credible system of financing and enforcing that implementation that is preventing major new gains in reductions in pollutant loading.

It has long been recognized that issuance of individual discharge permits to the NPS's is not feasible given their large numbers and diffusivity. Nevertheless, in order to control the NPS's in a way that is compatible with the existing NPDES system for point sources, some system is required. Larger geographical units, such as irrigation or drainage districts, watersheds within timber or range lands, or urban storm districts, would have to be the recipients of individual permits. Internal allocation of discharge rights within these units could then proceed in a variety of ways. Governance of these units, based on their charter and the preferences of landowners and other discharging entities, would determine how to implement the terms of the permits. But step one is permitting an NPS region or area. While NPS permitting is not required under the existing provisions of the Clean Water Act, several states have begun to experiment with programs which are aimed at permitting discharges from NPS sectors. Florida, Pennsylvania, Nebraska, and Maryland have programs that have used the "back door" to NPS permitting. For example, the South Florida Water Management District was authorized by the state's legislature to control agricultural runoff through permit systems for consumptive use and for surface storage of water. Since both have water quality implications, the District has incorporated water quality concerns into the terms and conditions of those permits. In Pennsylvania, state laws on erosion control and clean streams have been applied to require conservation plans for agricultural and forestry operations which demonstrate how sedimentation will be controlled. In Nebraska, where fertilizer contamination of groundwater is a major problem, seasonal prohibitions of fertilizer applications in some areas of high percolation and subsurface nitrite concentrations have been applied.

These programs should be viewed as experiments in NPS permitting. Other states and regions are struggling with the same problem — the need to develop accountability among NPS's that have benefited from free pollution disposal in spite of the growing evidence of consequent damages to downbasin water uses and values. Without such accountability, any serious policy of control of NPS pollution is difficult to envision. Certainly obtaining the contractual assurances needed to implement voluntary trading of pollutant loading rights among dischargers will continue to be practically impossible. Indeed, loading discharge com-

pliances, reduction credits, or offsets — whether for regulatory or market-based uses — must be defined, monitored, and enforced if any system of NPS control is to produce real results.

Clarify Discharge Rights and Maximize Trading Opportunities

Government water quality policy embodied in the Clean Water Act must address this problem. The setting of loadings caps and distribution of discharge permits is a tough political decision due in part to the economic benefits of permits and the costs of caps. Auctions and competitive bidding procedures can be used to allocate permits, as can some measure of historic rates of discharge. Since public agencies must grant the rights associated with these permits as well as determine the type and amount of permits to be issued consistent with water quality goals, auctions would attract the most economic users and remove the burden of agency issuance.

Opportunities for trade among NPS's reiterates the need for accountability. For example, in California's San Joaquin River Basin, selenium loading from irrigation drainage poses bioaccumulation risks to fish and wildlife. In 1985, waterfowl populations at Kesterson Wildlife Refuge, which received irrigation drainage, experienced reduced reproduction rates and birth deformities. In order to implement a loading ceiling on selenium in the San Joaquin River, associated wetlands, and downstream estuarine systems, NPS selenium loading units must be identified and accountability assigned. While there are some potentials for PS's, particularly in downstream refinery operations, to participate in selenium discharge trades, most of the opportunities may be among the NPS's themselves. That is, variations in farming and irrigation practices within the San Joaquin River Basin contain opportunities for some irrigated areas to invest in others to develop lower cost selenium reduction credits. But such transactions would not be possible unless water quality regulators have some sort of loading rights established and allocated among the NPS's.

Another important opportunity for the trading of loading rights exists among discharges into POTWs. Nondomestic wastes from industrial sources often contain toxins which can interrupt POTW operations (typically not designed to treat many toxins, which can kill biological agents used in municipal sludge treatment). In addition, contamination of sludge as well as receiving waters can result from these toxic discharges. In order to address these problems, nearly 1500 POTW's have pretreatment programs that regulate about 30,000 significant industrial users (SIU's). Each program issues loading rights to SIU's, usually in the form of a permit, as well as monitor, inspect, and enforce. TDP's are possible where a number of SIU's are linked to a POTW. Of particular interest here is the potential to increase funding for toxic source reduction programs and facilities among the SIU's.

Reduce Pollution Through Markets for Water Rights

Tradability of pollution loading rights creates new opportunities associated with reduced quantitative use of water. For example, a key Best Management Practice (BMP) for reduction of irrigation-induced loads is the reduction in amounts of water applied. Similarly, water conserving measures in municipal and industrial water uses have pollution load reducing impacts. Whether from more efficient use of water through installation of water conservation hardware for irrigation, industrial, and home uses; improvement of irrigation management practices, changes in cropping patterns, or outright removal of some lands from irrigated production; or adoption of arid designs for urban landscaping, reduced water applications tend to yield reduced loads for many pollutants. Thus, various types of projects and programs designed to reduce water use would be obvious candidates for financing from trades in loading rights.

Abolish Water Use Subsidies and Government-Administered Pricing

Water depleting and degrading activities are

currently subsidized directly by government spending programs and indirectly by deductions, allowances, and credits. Further, most water supply and pollution discharge prices are set by government agencies or by state-chartered monopolies such as water districts. Such agencies, which often control water storage and delivery facilities, set prices according to average costs — a "cost-plus" ratemaking essentially allows the agency to recover its fixed and variable costs and avoid "excess revenues," which are frequently disallowed by state laws. The discrepancy of prices derived from these procedures compared to market prices is compounded in the case of federally-developed irrigation water supplies. These reclamation contract prices omit the interest costs of the debt incurred to construct the water supply facilities. In addition, it is still commom for some water supply entities, particularly irrigation districts, to bill for service based on some criterion other than quantity of water consumed. Flat rate and acreage-served assessments are examples. Many sewage treatment and other pollution discharging entities have also received public subsidies in the past which then allow their rates to be lowered accordingly. Most pollution discharge entities bill their customers on a non-quantity basis, usually a flat service fee set by customer class. No effects on quantitities of water use or pollution discharge result from such non-quantity based administered prices.

Attempts to make administered water prices reduce water quality degradation would require an array of reforms. Overcoming the difficult technical and political obstacles to marginal cost-based pricing would be imperative. The traditional debate in ratemaking which focuses on keeping rates low — at significant environmental expense — would have to shift to how to distribute "excess revenues" generated by monopolistic water agencies. Extensive oversight of the ratemaking of such monopolies, as is the practice in electric utility regulation, would be necessary. Public subsidies would not be permitted in the determination of prices, since the resulting reduction in prices encourages water use and pollution. All pricing would be based on quantity of use, requiring metering and/or monitoring of both water supplies and effluent discharges.

In addition, the prices of a number of commodities which depend heavily on water are also administered by government agencies. Agricultural commodity price supports, leases of timber rights on public lands, permits to graze livestock on public lands, and shipping, flood control, and hydroelectric production from facilities constructed and/or operated in part by public funds are examples. These kinds of programs tend to inflate net profits above those that would occur under market conditions for products and inputs. Therefore, they encourage overproduction and consequent overuse and depletion of water supplies and quality. Removal of subsidies together with auctions and competitive bidding procedures to price the right to use these resources would help to reduce water pollution. In the long-run, though, government-administered pricing of water resources should be replaced by a system of tradable use rights.

Encourage Water Rights Trading

The economic gains from water conservation-based pollution reduction can be substantially increased if the freed-up water supplies have significant resell or market value. Most of the 17 western states have local water markets to an extent, and their introduction in other areas may be approaching as water supply constraints develop. The prior appropriations doctrine underlying water rights in state laws is based on usufructuary principles. The emergence of limited water markets in the western U.S. during the past decade has been due to the simultaneous occurrence of (i) substantial supplies of water rights being applied to low-valued uses in agriculture, and (ii) growing urban and environmnental demands resulting from the region's demographic and economic growth. Arbitrage potentials — the difference between prices for irrigation water and those for municipal and industrial uses — are substantial in many regions, often exceeding an order of magnitude. Such arbitrage potentials exist for environmental purchasers as well, though typically with lower

margins.

Water market prices often provide considerable latitude for irrigators to invest in improved irrigation systems and practices, which in turn would have NPS load-reducing results. At the same time, the costs of many irrigation water conservation practices and systems exceed water prices paid by irrigators. While there are frequently yield-related reasons for irrigators to improve their systems and practices, in many cases the value of conserved water in reduced water costs does not cover the costs of investments in water conservation. Income from water sales and leases by irrigators and others could be coupled with financing from NPS load reduction credits to underwrite many additional improvements in water use systems.

But the evolution of water markets faces formidible legal uncertainties and political barriers in many states. Ambiguous definitions of "beneficial and reasonable use" of water in state laws have generally not been clarified by regulation to facilitate orderly trading. Basinwide adjudications are underway in many regions, and trading in the midst of these legal uncertainties can be risky. Further ambiguities about who holds the rights to trade water — end-users such as irrigators, or intermediaries such as water districts — can make it unclear to potential buyers who the seller would be. These uncertainties are being heightened by an array of possibly conflicting claims based on the public trust doctrine, Indian water rights, and third party claims, including possible "area-of-origin" environmental, economic, and community effects. Groundwater pumping from common property (unadjudicated) aquifers is also a problem in some water market transactions.

These problems have slowed the development of water markets. Since state water laws were not originally intended to support transfers, most states are engaged in extensive and time-consuming reforms to define the rules within which water markets will operate. Federal reclamation water supply projects are also slowly being reformed to allow transfers of water contracts. A process to certify the NPS pollution reduction benefits of such transfers should become part of the Clean Water Act's provisions.

Finance Environmental Trust Funds with Revenues from Water Use and Pollution Discharge Fees

Reform of water use and pollution discharge pricing, along with implementation of markets for water rights and TDP's, would provide powerful incentives for conservation and pollution discharge reduction in both the public and private sectors. Arbitrage opportunities among holders of water rights and discharge permits would ensure that substantial financial resources would be unlocked to implement water quality improvements. However, there would continue to be cases in which further environmental improvement and restoration would be productive. Acquisitions of both water quantity rights as well as further reductions in pollution loads will be necessary to achieve these additional gains. With public funding for all programs on the decline, substantive legislative appropriations for such acquisitions may not be forthcoming. The 1987 Clean Water Act Amendments substantially increased water quality-related responsibilities for state and federal agencies, but corresponding funding has not materialized. President Bush's proposed FY93 environmental budget contains an increase of $100 million for clean water programs. But this is an insignificant amount when compared to the financial needs for water quality protection nationwide. Alternative funding sources are needed to supplement the financing generated by water rights and TDP markets.

The most efficient and equitable means of generating this additional funding is through user-based financing. The simple principle is that those who use water resources should pay. There are two general groups of users — those who use water at the expense of the environment, and those who use water as an environmental resource. The first group is relatively easy to identify — it includes all water-using and polluting industries, including

municipal utilities serving residences. Since these users divert, consume, and pollute water resources, an environmental surcharge or fee for their use could generate revenues. There are already a variety of fees in 26 states, including fees for water use permits, waste disposal, underground storage, and other uses. In addition, Section 204(b)(1) of the Clean Water Act requires the development of user charge systems with the option of recovering operation and maintanence costs as wastewater treatment facilities. Further amendments to the Act could expand user charge systems to recover costs of water quality degradation and of environmental protection and restoration.

The design of a fee schedule for these users would not be as simple as the overarching principle. For water quantity, most regulatory authority rests in state water law, although federal water agencies could implement fees for their water supply contractors — included would be reclamation contractors as "direct" users, and inland shipping, hydroelectric, grazing, timber, mining, and agricultural commodities producers as "indirect" users. Most water diversion and consumption is governed by state laws and imposition of fees on such uses would require state actions. On the other hand, fees for pollution discharges could be implemented under the Clean Water Act in all states, under individual state laws, or combinations of both. In the never-ending federal-state sparing on funding of federal water quality and other environmental programs, federal demands for state cost-sharing could be answered at least in part by revenues generated from such water diversion, consumption, and pollution discharge fees.

The actual specification of fee characteristics would dependupon several factors. To be rational, fees would vary according to the water quality degradation and other environmental damages associated with the use. For water quantity, amount, timing, and location of diversion and consumption, along with the water quality and other environmental consequences of that use, would be the key factors. For water quality, these same considerations would need to be applied to significant discharges of individual pollutants. Mass loading and effects on beneficial uses within receiving waters would need to be considered in discharge fee specifications as well. There are substantial measurement requirements to incorporate these kinds of factors into fee design. As noted above, many consumptive uses as well as pollution discharges are not now measured either for volumes or quality. It is likely, therefore, that "flat" fees may be the most practical means ofimplementation since they would not require as much user-specific information. Instead, such fees would be sized to a basinwide or regional revenue target for environmental acquisitions.

The other group of water users are those associated with environmental and recreational values. These uses require water quantity and quality to maintain aquatic ecosystems and associated beneficial uses. Establishment of fees for these groups is a very different matter from that for the consumptive use and polluting users. Instead of damages to the resource, benefits from its protection is the key. This is a more difficult undertaking in large part because environmental and recreational users tend to be harder to identify and measure. A portion, particularly recreational users such as boaters, fishers, and campers, are already charged for their use through day-use fees, licenses, and other instruments. A water quality or environmental protection fee could be included. But many users do not access water resources through organized charge systems, allowing the so-called "free rider" problem (some beneficiaries do not pay) to continue. "Non- market" valuation studies and surveys are increasingly being undertaken to estimate benefits to such users, including those who do not directly use the resource but value its existence anyway. This type of research might be useful in helping to design a user fee system for these "non-captured" environmental and recreational users.

The imposition of such fees on these user groups is predictably an unpopular proposal among both. But this is a core issue in environmental politics — the arguments as to why others should

pay for environmental quality are as diverse as the environment itself. Further, the disposition of funds generated by such fees would also be controversial, with different interests within the water quality and environmental communities competing along with local, state, and federal agencies. Regardless of how the pie gets sliced, environmental trust funds can be created to manage and disperse these revenues for water quality and environmental improvement projects. Priority systems will be needed, and trade-offs among potential projects will need to be addressed in some fashion. Both technical and political factors will be important, but competitive bidding procedures should be fundamental to disposition of these funds. In addition, a portion of fee revenues may be applied to the endowment of revolving loan funds which can leverage additional water quality and environmental investments.

Require Assurance Bonding and Damage Liability.

Another substantial arena of economic incentives to protect water quality involves so-called assurance bonding. The principle here is that degradation of water resources, whether from direct pollution discharge or indirectly through diversions from natural watercourses, causes damages and requires compensation. But the process and extent of damages is uncertain before and often after the fact, creating conditions which are analagous to those faced by the insurance industry. As in the insurance industry, contractual procedures which assign liability, define damages, and specify compensation can help not only to prevent water quality- related damages but also to clean-up and restore affected environments.

Assurance bonding is a means of providing insurance against damages resulting from water quality degradation. In well-developed risk markets, the insurance industry essentially carries the equivalent of a bonded compensation capacity whose coverage is extended to subscribers in exchange for periodic payments. References to assurance bonding for risks of water pollution damages typically assume that the discharging entity would be required to post a substantial bond in exchange for certain rights to discharge. The fate of the bond — reimbursement to the discharger; dispersal to damaged parties; or a combination — would be determined at some future date, presumably according to prior agreements on damage assessment procedures. Private insurance could very well enter into these arrangements to replace the need for dischargers to place bonds with periodic insurance premium payments by dischargers. As with other environmental and toxic risk areas, insurers may continue to be cautious about entering this field until the magnitude and frequency of the risks is better defined.

The existing system of liability and compensation is administered primarily by the judiciary. During the past three decades, a complex sequence of legal opinions has created a de facto policy in which tort litigation is increasingly used by plaintiffs to secure monetary compensation. The growth of such tort litigation has been dramatic — cases in which products, automobiles, and chemicals are alleged to have caused injuries increased fourfold between 1982 and 1986. Plaintiffs' probability of success rose from around 25 percent in the 1960's to over 50 percent in the 1980's, a period during which the average size of award rose by a factor of five. Legal analysts expect this trend to continue, particularly in light of the acceptance by the courts of toxic and environmental torts as legitimate means of pursuing damage claims.

Assurance bonding, and eventually insurance, are means of implementing clearer rules on water pollution-related damages. But government water quality policy must first clarify these rules. The current frenzy of tort litigation is a direct result of the absence of clear rules, assigning the courts by default the responsibility of settling damage claims. Nevertheless, considerable experience exists in applying monitoring and assessment procedures and methods to environmental damage cases, partly in response to tort litigation. Of particular significance is the growing array of economic assessment methods developed to quantify monetary compen-

sation claims resulting from oil or chemical spills into aquatic ecosystems as required in Section 301 of the Superfund legislation enacted in 1980.

Direct assurance bonding and insurance requirements to cover damages from pollution and possibly from diversion and consumption of water resources face substantial regulatory challenges. Damage assessment procedures, and determination of bond (i.e. compensation) values, would necessarily involve judgements where scientific and economic data and analysis would be inadequate. Ranges of damages can be estimated, but precision in point estimates will not be possible. In addition, an evolving issue in the Section 301 litigation (currently governing substantial portions of the Exxon Valdez oil spill damage case) is the degree of expansion of compensation beyond clean-up costs to various types of damages, including both user- and non-user-related claims. In determining bonding and insurance requirements, a procedure to include these types of compensation would be necessary.

Concluding Remark

The restructuring of American water quality policy by implementing these market-based instruments will not occur in the current reauthorization of the Clean Water Act. While most are not prohibited under the Act, they are not likely to be implemented as pollution-reduction policy instruments unless explicitly required by the Act. The concomitant refocusing and clarification of government and industry responsibilites would be a significant departure from past trends in water quality policy in the U.S. The on-going political problem is that, on the one hand, while the water-using and polluting industries may like the economic flexibility, the setting of real and enforceable limits on pollutant loadings would mark the end of the era of free disposal. On the other hand, environmental and water quality interests may welcome the advent of hard constraints on loadings, but market-based implementation policies are frequently viewed with suspicion. Until a "limits and trading" accomodation is reached, accomplishing significant new water quality gains will be difficult.