FINAL REPORT TO THE ENVIRONMENTAL QUALITY COUNCIL ON PROGRESS TOWARD NUMERIC NUTRIENT STANDARDS FOR MONTANA'S SURFACE WATERS

Prepared by the Montana Department of Environmental Quality[1]
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EXECUTIVE SUMMARY

Excess nutrients (nitrogen and phosphorus) released to surface waters can result in adverse effects on water quality such as nuisance algae growth, undesirable changes in aquatic life, and reductions in dissolved oxygen which impacts fish. The Department of Environmental Quality (Department) has been working to manage nutrient enrichment of Montana waters and one of its larger efforts is the development of numeric water-quality standards for nutrients. Scientific work has been largely completed for Montana's wadeable streams, while work continues for other waterbodys. Through the development of these scientifically-grounded numeric standards, it became clear that in some regions (notably western Montana) the standards would be quite difficult to meet. If all communities were made to meet the nutrient standards in one step, the costs would be too high and/or the technology might not be currently available. Therefore, the Department investigated options for implementing the standards in a staged manner. The idea was that if communities and other entities could begin working towards nutrient standards in steps, the standards could ultimately be achieved, given that technologies generally improve and become less expensive over time. It would also allow the Department time to address nonpoint sources of nutrient pollution. Research led the Department to conclude that a temporary variance process that has discharger specific permit limits that differ from the standards for a defined period of time, could work effectively for implementing the standards.

The Department did not have clear legal authority to grant the variances as envisioned, and therefore worked to introduce a bill into the 2009 legislature to provide that authority. The bill (SB 95) passed and is now codified at MCA 75-5-313. The law included the creation of a Nutrient Work Group, convened by the Department, and whose role is to provide the Department advice on the standards and their implementation. The Nutrient Work Group comprises a broad array of Montana interests, from agriculture to municipalities to industry to environmental groups. Meetings are open to the public and have been well attended. Topics covered include detailed discussions of the scientific and legal basis of the standards, alternatives analysis to preclude the need for a variance, and nutrient trading. Much progress has been made; however substantive issues remain to be resolved prior to rule making. For example, compliance/non-compliance issues, basin-wide nutrient reduction strategies, specific cost caps, and details of what would be in a permit are all still being actively discussed. Assuming that these details can

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be adequately addressed over the coming months, the Department and the Nutrient Work Group could be in a position to approach the BER with a rule package in 2011.

1.0 INTRODUCTION

1.1 Background and History of Numeric Nutrient Standards Development in Montana

Controlling the undesirable affects on water quality caused by the release of excess nutrients (nitrogen and phosphorus) into state waters has long been an important concern of the Department. In the mid 1970s and into the 1980s, citizen complaints about excessive algae growth in the Clark Fork River led, in 1998, to a pioneering voluntary agreement among dischargers to reduce nutrient loading to the river. The goal of the agreement was to achieve ambient nutrient concentration targets and bottom-attached algae limits during summer months. These concentrations and algae limits for the Clark Fork River were subsequently adopted into state law in 2002 (ARM 17.30.631).

Narrative water quality standards that address nutrient effects (e.g., nuisance aquatic life) were adopted for all state waters decades ago, but the fact that narrative standards are general statements, rather than specific numbers, has led to their limited application. Since 2000, the Department has been actively working to develop numeric nutrient standards for all state waters. This work is motivated by the Department's long-standing desire to address this significant form of water pollution, as well as by an Environmental Protection Agency (EPA) plan, initiated in 1998, to encourage states to adopt numeric nutrient standards for all of their surface waters.

Many difficult technical problems had to be addressed in order to develop numeric nutrient standards. Unlike other water quality standards, which are commonly developed in laboratories and then promulgated by EPA for the entire nation, it was expected that nutrient standards would be developed at the regional/local scale and would be different for different water body types. This is because nutrient concentrations vary naturally in the environment, due to factors such as local geology, soil types, and vegetation, and this fact needed to be accounted for in developing the standards. The specific manner in which excess nutrient problems manifest themselves in different water body types also had to be sorted out.

Throughout the 2000's the Department carried out a number of scientific studies and analyses, all intended to determine how nutrients detrimentally affected the quality of state waters (e.g., how much bottom-attached algae is excessive), and to determine the appropriate concentrations needed to prevent these problems. As of this writing, work has been largely completed for wadeable streams of western Montana, but is ongoing in eastern Montana prairie streams. Large rivers (e.g., Yellowstone River, Missouri River) were found to be too unique to place into water body groups (i.e., for common treatment), and therefore the Department is addressing them case by case. Work on lakes and reservoirs is also proceeding. A number of the key technical reports prepared by the Department to support this effort can be found at:
http://deq.mt.gov/wqinfo/standards/NumericNutrientCriteria.mcpx

Around 2005 it became very apparent that the scientifically derived nutrient concentrations being developed by the Department were going to be very low (i.e. stringent) in some regions of the state. It also became apparent that some of the nutrient concentrations the Department was considering were at or below levels that can be readily achieved by practical wastewater technologies of today. It is known that as one attempts to achieve lower and lower nutrient concentrations, the cost to do so goes up exponentially. In other words, if all towns were made to meet nutrient standards in one step, the costs might be too high and/or the technology might not be currently available. The Department began investigating options for implementing the standards in a more staged manner. The idea was that if communities and other entities could begin to work towards the nutrient standards in steps, the standards could ultimately be achieved, given that technologies generally improve and become less expensive over time. It would also allow the Department more time to address nonpoint sources of nutrient pollution. The Department commissioned two studies to evaluate the cost of various treatment technologies, as well as the mechanisms by which the standards could be implemented in stages. The studies, and consultation with EPA, revealed that a temporary variance process with discharger specific permit limits for a defined period of time could work effectively for implementing these standards. An outline of the general concept is shown below (Fig. 1.0).

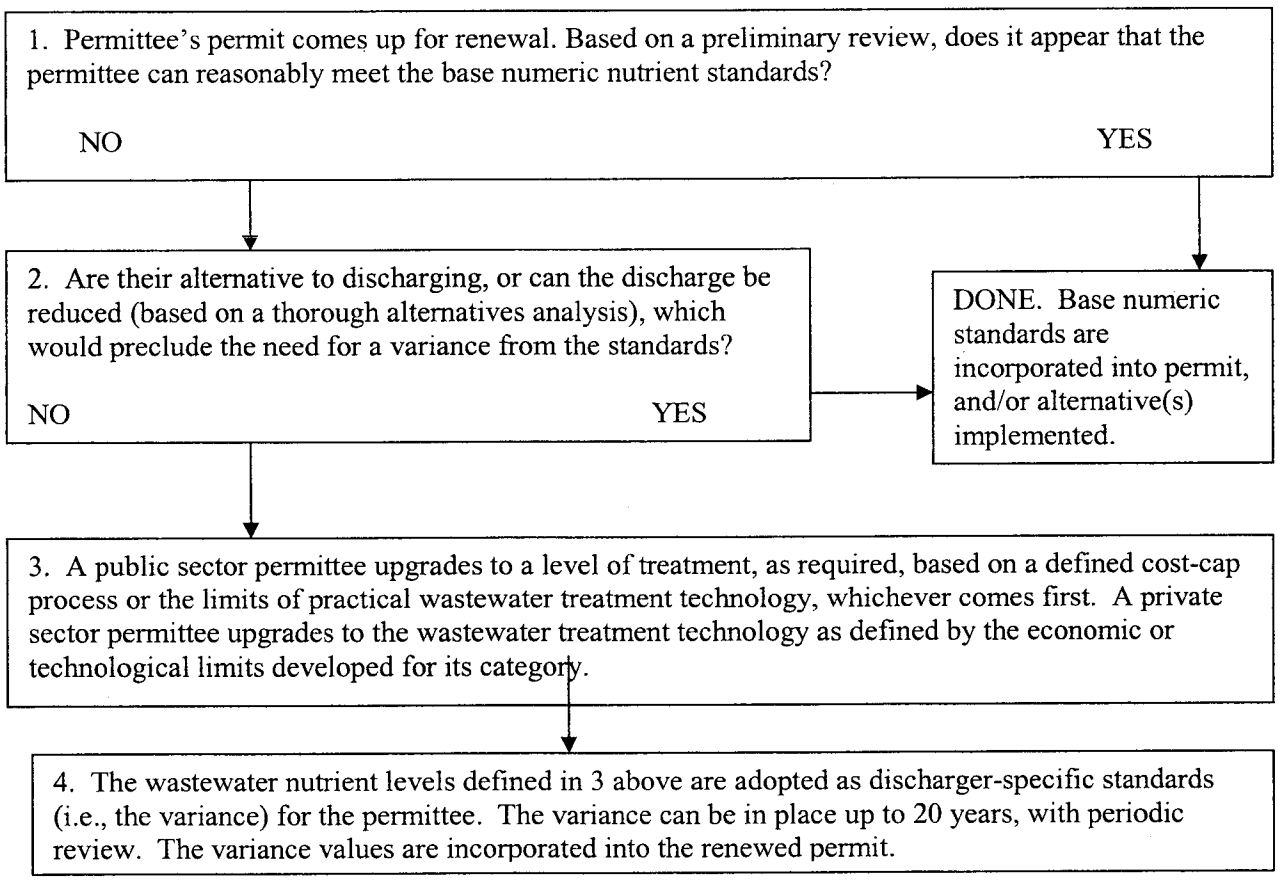

Figure 1.0. Conceptual diagram outlining how variances from numeric nutrient standards would be determined and then incorporated into a discharge permit.

1.2 Senate Bill 95 (MCA 75-5-313)

Consultation with Department legal staff revealed that the Department did not have clear legal authority to allow the case-by-case, discharger-by-discharger variances (Fig. 1.0) envisioned. Temporary water quality standards were already part of state law (MCA 75-5-312; ARM 17.30.630). But these laws allow for temporary changes of standards along an entire reach of stream; the idea is that somewhat less stringent standards can realistically be met during instream remediation procedures (e.g., to remove mine waste), after which the original standards are to be re-instated. In contrast, the Department envisioned a process for nutrient standards whereby the standards, once adopted, would remain the same along the stream so that point and non-point sources of pollution would clearly know what the standards are. However, individual dischargers could (as needed) apply for *discharger specific* variances from the standards. By this mechanism dischargers could remain in compliance with their permits as they moved, over time, towards meeting the standards, while simultaneously the Department worked with nonpoint source nutrient contributors in the watershed. The Department's intent is that the process allows for incremental progress towards the standards on all fronts (point and nonpoint source).

The Department penned a draft bill which was sponsored by MT Senator John Brueggeman ([R]; Senate District 6). The bill was passed, is codified at MCA 75-5-313, and can be found at http://data.opi.mt.gov/bills/mca/75/5/75-5-313.htm. Among its provisos, the law requires that the Department consult with a Nutrient Work Group. The Department, in consultation with the Nutrient Work Group:

> *"...shall develop guidelines to ensure that the economic impacts from base numeric nutrient standards[2] on public and private systems are equally and adequately addressed. In developing those guidelines, the department and the nutrient work group shall consider economic impacts appropriate for application within Montana and may also consider relevant guidance of the United States environmental protection agency pertaining to analysis of economic impacts from water quality standards."*

The bill also allows for nutrient trading, and although not finalized, the Department has a peer-reviewed draft trading policy nearly completed.

Even prior to the bill's passage (since September 2008), the Department had been working with an informal stakeholder group (Nutrient Criteria Affordability Advisory Group) to address many of these cost-related issues. This predecessor group developed a detailed affordability assessment process for publically owned treatment works (POTWs) based on EPA guidance. When the Nutrient Work Group was created by statute and met for the first time in May 2009, many of its members had also served on the earlier informal group. The next section further discusses the Nutrient Work Group.

[2] "Base numeric nutrient standards" is the term used in the bill (and statute) for instream numeric nutrient standards.

2.0 NUTRIENT WORK GROUP

The Nutrient Work Group comprises members representing the following groups or entities:

- Agriculture and livestock
- Conservation districts
- Environmental organizations
- Financing and grant agencies (state-level)
- Forestry
- Manufacturing
- Municipalities (water and wastewater)
- Oil and gas
- Railroad
- Real estate
- Wastewater engineering
- Mining

The Department also provides to the Nutrient Work Group three non-voting members whose primary roles are as technical and policy experts. The meetings are run and arbitrated by a non-governmental arbitrator. In assembling Nutrient Work Group members, the Department actively solicited a broad range of Montana interests so that conclusions arrived at by the group would be, hopefully, acceptable to a large number of Montanans. Meetings are open to the public and are well attended with public members typically doubling the original meeting size. Constructive public input is allowed throughout the meeting, and often leads to enhanced understanding of topics.

Meetings have focused on two major areas that have been covered in great detail.

1) The scientific basis of the draft numeric standards the key topics covered were:
   - Nutrient dose-response studies; how does algae growth change with increasing nutrients?
   - Most-sensitive beneficial use in streams, and the algae levels at which harm occurs to that use
   - Comparison of nutrient concentration data from reference streams to the draft standards
   - Estimation of the % of MT streams not likely to be in compliance with the standards
   - Stream algae levels and their affects on other beneficial uses (aquatic life, fish)
   - Proportion of test water samples that can exceed the standard (allowable exceedence rate)
   - Use of QUAL2K water quality model to derive nutrient standards for large rivers (e.g., Yellowstone River)

2) Regarding the legal facets of the standards the key topics covered were:
   - Basis in state and federal law for numeric nutrient standards
   - Permit shield for permit holders
   - Role of economic considerations in the derivation of water quality standards

- Details of the alternatives analyses so that a variance can be precluded
- Compliance determination in a permit
- Nutrient trading policy (this is a subcomponent of alternatives analysis)

Some legal issues discussed have been sufficiently resolved (e.g., permit shield), while others remain unfinished (e.g., compliance determination in a permit). There is still some question as to whether or not the language in statute (MCA 75-5-313 [1]), which requires case-by-case evaluations for each discharger, is sufficiently broad to allow for categorical treatment levels by industry (e.g., one treatment level required for all dischargers in the conventional oil and gas industry).

Going forward, members will be focusing on the following:

1) The approach to addressing private sector affordability when achieving the numeric nutrient standards is not presently feasible. Private sector members believe that EPA guidance is not satisfactory for determining affordability for the private sector (the Department concurs). An approach mirroring the Best Available Technology Economically Available (BAT), determined by source category, is a preferred option.
2) The group will work through the details of one or more case studies from beginning to end, including determining whether the community can meet the standards or not, and the adoption of temporary nutrient standards and implementation details of the permit.
3) The group will be working with the Department on the details of non-degradation, then the specific implementation language (i.e., the rule package) that will accompany the numeric nutrient standards when they are presented to the Board of Environmental Review for consideration.

3.0 Cost-Benefit Analysis of Numeric Nutrient Standards

Per requirement in MCA 75-5-313, the Department estimated the benefits, and costs of compliance with nutrient standards for major entities that would be affected in Montana. The Department assumed in this analysis that nutrient standards are not always achieved, because most towns would first reach either affordability limits or the limits of technology. <u>If nutrient standards were reached, in all cases, both costs and benefits would be greater than the results presented here</u>. Summary results are shown in Table 3.0. The specific cost of nonpoint source compliance was not calculated, but going forward estimates could be made in some instances.

Table 3.0. Summary results of the economic cost-benefit analysis.

Benefits (annual)	Costs (annual)
Quantified	
Estimated at $15.8 million including improvements in recreation, drinking water, property values, and endangered species	Estimated at $40 million for public sector waste water treatment plant (POTW) upgrades using DEQ assumptions
Net public cost for the state of Montana is an estimated $24.2 million annually. This translates to an average of $47 per year per affected Montanan in additional wastewater costs, or about $4 per month. Just over half of Montanans would be affected.	
Not Quantified	
Other economic benefits such as cleaner water for agriculture, and municipal water supplies	Private sector costs to an estimated 30-40 businesses; non-point source costs
Ecosystem benefits and Non-Use values	Other costs such as additional administrative costs of the standards
Benefits would be long-term	Costs would last at least 20 years for financing POTW upgrades

In order to quantify the benefits of meeting nutrient standards, the Department used an existing, peer reviewed study that directly applied to the economics of nutrient criteria: *Dodds et al. (2008), "Eutrophication of U.S. Freshwaters: Analysis of Potential Economic Damages".*[3] Studies in this topic area are few; however, this particular study is very specific to the question at hand. This study estimates, for the entire United States, the economic benefits of higher water quality resulting from the reduction of adverse water quality impacts caused by nutrient over-enrichment, and compares current nutrient concentrations for U.S. EPA nutrient ecoregions with estimated reference conditions. From published data it calculates potential annual benefit losses in recreational water usage, waterfront real estate values, money spent on recovery of aquatic threatened and endangered species, and drinking water quality that have resulted from nutrient over-enrichment of freshwaters. For example, the study estimates algal bloom effects on recreational losses of trip-related expenses from lake closure due to nutrient over-enrichment.

The authors estimate a cost to the nation of $2.2 billion annually resulting from nutrient over-enrichment of U.S. freshwaters. Another way to look at this is that moving towards nutrient standards would create annually $2.2 billion in benefits for the nation. The Department proportioned this number in order to estimate benefits for Montana, and used Montana's population as a percentage of the U.S. total to proportion down some components of quantifiable nutrient benefits in the Dodds study (e.g. improved drinking water), while using land area percentage for other components (e.g., lower costs to protect endangered species). This led to an estimate of $15.8 M annually in benefits for Montana as a result of moving to nutrient standards from current water quality. This breaks out annually into recreational usage ($10.4 M), waterfront property values ($1 M), endangered species ($1.8 M), and drinking water ($2.6 M). Other economic studies back up the methods of the Dodds study.

[3] *Environmental Science Technology*, Kansas State University, 43(1), pp. 12-19.

Benefits not quantified in the estimated $15.8 M figure include improved water quality for businesses, industry, and water supply, improved agricultural water supply (less clogging of irrigation canals by nuisance algae), fewer livestock and pet deaths and sicknesses, improved business for fishing and fishing guides, and fewer dollars spent on watershed restoration. Non-quantified benefits to the environment include improved health of plants, wildlife, riparian areas, water and nutrient cycles, maintenance of dissolved oxygen levels suitable for aquatic life and fish, minimization of daily pH changes which can harm aquatic life and fish, and the maintenance of healthy aquatic life communities.

Costs of nutrient standards compliance in Montana include those to the public sector (publically owned treatment works, or POTWs), the private sector (an estimated 30-40 larger businesses), and other entities such as the government. The public sector was the only sector that the Department could specifically quantify in terms of costs. For the public sector, the Department assumed that POTWs in Montana would have to upgrade to meet nutrient standards. About 135 out of 200 total POTWs in the state have discharges that outflow into state waters, and those 135 would probably have to upgrade due to nutrient standards. Most towns would hit limits of affordability before reaching the standards. In a few cases, larger cities would hit the limits of technology (LOT).

Using 2010 dollars, the difference between current sewer rates and assumed limits of affordability (1% or 1.5% of median household income of a town, annually, per household) was estimated to be the public cost of nutrient compliance. This rate increase is paid for by sewer rate payers over an average of 20 years in the 135 towns, for a total estimate of $39.8 million more, in annual costs, than rate payers face now. Costs to POTWs (and the public) could be less if alternatives to meeting nutrient standards were found (such as land application), or if water quality trading opportunities exist in the watershed. These public costs translate into $47 per affected person per year in net costs for nutrient compliance (just over half of Montanans would be directly affected), or $4 per month per affected person. In comparison, the value of a Montana resident 'fishing day' is estimated at $52 (2010 dollars).[4]

Non-quantified costs include 30-40 companies expected to be affected by upgrades. Industry members of the Nutrient Work Group presented in December 2009, the estimated costs for reducing nutrients in their respective effluents, and the costs were substantial. The Department is currently working on a private-sector cost-cap process with the Nutrient Work Group.

Benefits of compliance with nutrient criteria would accrue to all Montanans, especially those who recreate on or live near water, and businesses and municipalities that rely on clean water. Benefits would also be enjoyed by out-of-state tourists visiting Montana, and those who live downriver from Montana. Costs would fall mostly on 135 towns (just over 50% of Montanans) and 30-40 businesses. Quantifiable monetary costs of meeting nutrient standards are greater than monetary benefits, and there is no clear agreement among Nutrient Work Group members as to

[4] Duffield, J.W., September 2003. "Economic Valuation Studies of Fish and Wildlife Resources in Montana", Table 8.

whether or not this amount is reasonable. Benefits and costs are approximations; various ecosystem and non-monetary benefits are hard to quantify, as are costs to private businesses.

4.0 Key Issues and Concerns Raised by the Nutrient Work Group

As of the June 2010 meeting, the Nutrient Work Group has met ten times. The Department believes that a lot of progress has been made, and we believe (speaking for the Nutrient Work Group) that most members feel the same way. Nevertheless, it is clear that a number of unresolved concerns pertaining to numeric nutrient standards remain. The following is a synopsis of common and/or substantial comments the Department received from Nutrient Work Group members.

A. Compliance/non-compliance: Several Nutrient Work Group members representing the private sector expressed that it is not acceptable for companies to be at risk for non-compliance with an adopted standard, subject only to the uncertain possibility of obtaining a variance (i.e., temporary nutrient criteria) from the standard. Overall, the members need to see a case study or two worked through from beginning to end. Starting from the point where an expired permit is reviewed for compliance with the nutrient standards, through the alternatives analysis and variance process, and finally to the details of the renewed permit. It is critical that the Department and permitees be able to identify what will be required for compliance under the rule upfront in permitting, and that such compliance be reasonably achievable, before base numeric nutrient standards are adopted.

B. Entire Package - Alternatives Analysis and Implementation: Members have repeatedly pointed out that solving nutrient over-enrichment problems need to be addressed more holistically. Addressing the problem needs to be much more equitable between point sources, which are directly regulated, and non-point sources, which are not, and currently implement BMPs voluntarily. Included in the holistic view is the need to seriously consider alternatives to discharging, which can include statewide phosphate detergent bans, landscape standards (i.e., reduced lawn fertilization), building codes, etc. These implementation components need to accompany the base numeric nutrient standards as part of the rule package.

C. Basin-wide Nutrient Reductions: Members feel that the Department should develop a comprehensive framework for compliance steps and options, including options for trading or offsets that protect water quality in the most efficient way possible. Different strategies should be allowable for different basins/situations. TMDLs and permits need to incorporate these variable approaches. The scale of the basin over which these actions apply needs to be defined in each case.

D. Economic Analysis: The economic analysis presented in Section 3.0 above calculates cost as the cost to hit an affordability cap (1.0-1.5% MHI for affected communities), or the limits of practical wastewater treatment technology. The standards are not achieved in this scenario; there is simply movement towards them. The real cost in 2010 to actually *meet* the standards would be much higher than shown. In working to reduce nutrient effluent, the Department

needs to consider both high-tech approaches (i.e., advanced wastewater treatment) and low-tech approaches (e.g., phosphorus bans, riparian fencing, composting toilets).

E. Affordability: Although many aspects of the affordability variance process have been discussed, members want to see actual case studies worked through (paralleling the point made in **A** above). Guidance from EPA[5] is satisfactory for determining affordability for POTWs, assuming that the status of the preferred cost cap for meeting nutrient standards (1.0% of a community's MHI) can be finalized. Private sector members believe that the 1995 EPA guidance is not satisfactory for determining affordability for the private sector. An approach mirroring the Best Available Technology Economically Available (BAT), determined for categories of sources, has the potential to be a better option.

F. Limits of Practical Wastewater Treatment Technology (LOT): Currently some of the base numeric nutrient standards are more stringent that can be achieved via limits of practical wastewater treatment technology (i.e., processes short of double-loop reverse osmosis). In defining LOT in any rule package, realistic and achievable concentrations must be proposed.

5.0 SCHEDULE

The Nutrient Work Group is scheduled to meet approximately every other month. The main focus of the group over the next few meetings will be the details of the process for determining temporary nutrient criteria for the private sector. Following that, the group will work through the details of a case study from beginning (determination of whether the community can meet the standards or not) to end (adoption of temporary nutrient standards and implementation details of the permit). Next, the group will work with the Department on the details of non-degradation, and then the complete implementation language (i.e., the rule package) that will accompany the numeric nutrient standards when they are presented to the Board of Environmental Review for consideration.

When the Nutrient Work Group has reached a reasonable consensus on these issues, the Department will initiate the process of rule adoption before the Board of Environmental Review (BER). It is difficult to say exactly how long all of this will take. However, it is reasonable to assume that private-sector affordability, case study review, and non-degradation will consume the remainder of 2010. Following that, it seems likely that a package for BER consideration could be prepared in 2011.

[5] EPA (Environmental Protection Agency), 1995. Interim Economic Guidance for Water Quality Standards Workbook. EPA-823-B-95-002.