

## **BASELINE FOR STATE MONITORING PROGRAM**

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**Abstract:** States are often asked to describe and quantify the condition and health of the nation's waters. State environmental agencies, by federal statute, are expected to utilize sufficient water quality monitoring data and an appropriate data assessment process for making such determinations. Additionally, water quality monitoring and assessment are the cornerstone for state decision making, determining attainment of water quality standards and subsequent listing of impaired water bodies under Section 303(d) of the Clean Water Act. The development of TMDL for restoring the quality of the listed water bodies is monitoring dependent. Unfortunately, because of limited financial and personnel resources, many states have curtailed their water quality-monitoring program.

A basic state water quality monitoring program should meet clearly established goals for program management decisions. In order to establish a basic monitoring program, a state should first identify the water quality data that will be needed for the decision process. All sources of available monitoring data should be identified and evaluated for possible use. Quality assurance of data is essential. States should establish an understandable and usable procedure for assessing monitoring data for determining the attainment/non-attainment of water quality standards. Through prioritization of the additional needed data, states can establish or modify existing monitoring and assessment protocol which would then become the basis for the preparation of reports and documents required under Sections 106, 304(L), 314, 305(b), 319, and 303(d) of the Clean Water Act.

## **BASELINE FOR STATE MONITORING PROGRAM**

My purpose is to describe what constitutes a baseline program for monitoring water quality. Each state has its differences geographically, hydraulically, and in the management of water programs among the agencies within that state. Because of these differences in state management of water programs, it is unlikely that a single template for state water quality monitoring program could be developed. We can, however, describe what we believe is the minimum set of requirements or baseline for a state program for water quality monitoring, because of factors which are common in all states and, as such, there are some components and needs which would be found in any state.

Factors that play a key role in planning a baseline state water quality monitoring program are:

1. quality of the water
2. uses made of those waters
3. protection programs in place
4. industrial and agricultural impacts
5. availability of water
6. amount of precipitation
7. number of stream/river miles
8. total surface areas of lakes
9. aquifer yield and size
10. past and existing monitoring programs and,
11. other factors that play an important part in the planning a basic state monitoring plan.

### **HISTORICAL PERSPECTIVE**

With the passage of Public Law 92-500, the Clean Water Act of October 18, 1972, a new emphasis was placed on the monitoring and assessment of the quality of the waters of the nation. Many programs were formalized with the aim of restoring and protecting state's waters. A large number of water quality monitoring programs were initiated and a massive quantity of data was collected. Programs were put in place, which were intended to improve and protect waters that had been monitored, studied, modeled, evaluated, and summarized in reports. For a time, monitoring and assessment of the waters continued. However, it was determined that there was a much greater need for improvement and protection activities than the federal and state governments could address.

The Clean Water Act required all point source discharging facilities to obtain an NPDES permit. This placed facilities under the control of the Environmental Protection Agency and subsequently the state environmental agencies with delegation of the NPDES permitting and enforcement programs. Provisions in the Clean Water Act caused these permitted water pollution sources to improve their discharges and restore and protect the water quality standards of the receiving stream.

EPA and delegated states developed and issued permits that required improvement of the quality of wastewater treatment plant effluent so that the water quality of the receiving stream would meet standards. In fact, the ultimate goal of an NPDES permit is to establish effluent limits and other conditions that will result in no effects on the quality of receiving stream, except increase in flow.

Under the Clean Water Act of 1972, Congress funded the construction or upgrading of municipal wastewater treatment facilities with the Construction Grants Program. A specific goal of this program was that treatment facilities would protect the Water Quality Standards established for the receiving stream by the state.

The various state and federal monitoring and assessment programs identified a multitude of streams that did not meet water quality standards; therefore, municipal construction needs were numerous.

While the identified construction needs and associated costs for municipalities continued to mount, and the calls for ever increasing appropriations from Congress were pressed, the water quality monitoring data continued to be collected by state and federal agencies. In many cases, it became obvious that there was more monitoring data being collected than there was time or resources to assess. There were far more needs identified for modification or construction of new municipal wastewater treatment facilities than available resources, both fiscal and physical, could address. State agencies began to feel that the monitoring data being gathered was less important than the need for personnel to implement the dirt-turning projects which were planned, designed, and in many cases, already funded to address the problems identified by previous monitoring and assessment efforts. As a result, states began to re-evaluate the needs for continued monitoring, and staff was often reassigned to other projects designed to implement the findings of the monitoring data and assessments.

This resulted in a major reduction in the quantity of pollution being discharged to receiving streams. A large quantity of federal funds and a substantial commitment and redirection of state and federal personnel resources were necessary to achieve these gains.

At the same time, the NPDES permitting program began to mature. This resulted in permits with discharge limits for municipal and industrial wastewater treatment facilities that were of such a quality as to no longer contribute to the impairment of the water quality standards of the receiving stream. As congressional appropriations through the Construction Grants provisions of the Clean Water Act provided the means for many municipalities to achieve compliance with the water quality standards, a vigorous enforcement program by EPA and the state agencies delegated the federal NPDES program provided additional incentives to keep water clean. Through a coordinated effort utilizing this carrot and stick approach, those municipalities which produced the greatest amount of water pollution and had the most significant adverse impacts on the water quality, either upgraded existing wastewater treatment facilities or constructed new ones. Though industries were not eligible to receive funding from the Construction Grants Program, public outrage about pollution incidents and enforcement actions resulted in the upgrades to or construction of new wastewater treatment facilities specifically designed to restore and protect the water quality.

Numerous other programs established under the Clean Water Act resulted in more assessment and planning for additional actions that had as aims the reduction of pollution and the restoration of water quality of the nation's streams and rivers. These programs included the Clean Lakes Initiative, which was authorized and funded under Section 314 of the federal Clean Water Act; the Non-Point Source Assessment program, authorized and funded under Section 319; other programs receiving federal funding were authorized under sections 104(b) and 604 of the Clean Water Act.

These programs resulted in additional assessment of water quality, statewide plans to address water pollution, quantification of contributions by non-point pollution sources such as polluted runoff and agricultural activities, and small scale projects to demonstrate methods of addressing water pollution from sources other than permitted discharges.

A major component of many of these programs was providing education to citizens related to the impact of daily activities on the quality of the nation's waters. Providing financial assistance to municipalities and enforcement authority to EPA and the delegated states gave reasonable assurance of success to bring municipalities and industries into compliance thus achieving the goals of the Act. The NPDES discharge permits resulted in discharges which had no noticeable impacts on the receiving stream.

Because a sizable federal appropriation spent on the CGP and other CWA programs, questions were asked concerning the beneficial results of these programs. In other words, what had been bought with the massive infusions of federal dollars into the Clean Water Act programs?

Though there had been numerous water quality monitoring programs ongoing and massive quantities of data collected, states had reduced participation in continued monitoring and assessment and redirected staff, resources and funds to permitting, enforcement, and construction. As a result, monitoring and assessment of the nation's

waters moved to the back burner. Both EPA and states were hard pressed to show that there had been a noticeable improvement in the quality of the nations waters, despite the amount of funds expended for construction to improve the facilities that impacted water quality. Spending could not be directly translated to improvements in receiving streams. The positive impacts on water quality of education, demonstration projects, and planning performed under other sections of the Clean Water Act were equally difficult to measure.

The limited monitoring data available indicated that water pollution was still a problem in many of the nation's water bodies. As most point source pollution had been brought into compliance with NPDES permits, it was assumed that the non-point sources of pollution were the causes of the remaining pollution problems. State and national reports were issued that indicated non-point source pollution was the culprit. Since most of the state's water quality monitoring programs had been cut, it was difficult to either quantify the degree of water pollution remaining or to accurately identify the sources of water pollution.

## **WHY MONITOR?**

Monitoring supports:

1. development of and attainment of Water Quality Standards
2. helps determine if standards/designated uses are appropriate
3. 303(d) listings
4. TMDL development
5. NPDES permit limitations
6. Non-point source controls/point source
7. Watershed and ecosystem protection/point source
8. Measurement of environmental indicators
9. Protection of health by:
  - a. guarding PWS
  - b. swimming advisories
  - c. fish flesh advisories
10. Measuring success for restoration projects

EPA has the authority under Section 106(e): "Grants prohibited to States not establishing water quality monitoring procedures or adequate emergency and contingency plans....the Administrator shall not make any grant under this section to any State which has not provided or is not carrying out as a part of its program appropriate procedures necessary to monitor, and to compile and analyze data on.....the quality of navigable waters and to the extent practicable, ground waters including biological monitoring...provision for annually updating such data and including it in the report required...."

EPA is prohibited from awarding 106 grants to states that have not established and implemented procedures to:

Monitor navigable waters and ground waters including:

chemical parameters

biological assessments

Compile data obtained through monitoring

Analyze and interpret the data obtained through monitoring

classify waters according to eutrophic condition

Prepare and update annually a report (required by Section 1315).

The Clean Water Act requires states to identify those water bodies which are impaired by pollution, and to conduct Total Maximum Daily Loads (TMDL) to determine the amount of pollution reduction from each source that needs to occur in order to restore the water body and remove the impairment. The Act requires EPA to develop a list of impaired water bodies if the state fails to do so. A federal court decision has expanded this EPA responsibility to include conducting TMDL.

Recent 303(d) list and other reports, which tie water pollution to non-point sources such as agricultural activities, have recently come under scrutiny. They have also questioned the basis for decisions that EPA and states are making in the absence of adequate monitoring data and a formal means of assessment of the data, which does exist.

The USGS has also stated that monitoring is inadequate to make management decisions related to water quality. The activist group, Public Employees for Environmental Responsibility, issued a report titled "Murky Waters" that posed serious questions concerning EPA's decisions and recommendations about 303(d). A recent report by the General Accounting Office identified numerous shortcomings with state monitoring programs and seriously questioned their compliance with the requirements of the Clean Water Act.

As we rethink the need for an adequate monitoring program, there is not a large influx of federal money for states to re-establish monitoring programs and to develop specific assessment methods. Few states have surplus staff to be assigned to the water quality monitoring program even if adequate funds were available. Additionally, states have recognized that monitoring needs to be for specific purposes rather than an end within itself. States will avoid gathering large quantities of monitoring data that cannot be adequately assessed or utilized.

The federal Clean Water Act contains a number of references, either directly, or indirectly related to the monitoring efforts expected of states. For instance, Section 106 of the Clean Water Act states that:

"...the [EPA] Administrator shall not make any grant under this section [106] to any State which...is not carrying out as a part of its program...the establishment and operation of appropriate devices, methods, systems, and procedures necessary to monitor, and to compile and analyze data on...the quality of navigable waters and to the extent practicable, ground waters including biological monitoring; and provisions for annually updating such data and including it in the [305(b)] report..."

This would imply that a state could not receive a 106 grant unless it had in place a means of collecting and analyzing monitoring data, including groundwater, updating it annually, and including the results in the 305(b) report.

Section 305(b) of the federal Clean Water Act requires that

"Each state shall prepare and submit to the [EPA] Administrator, biennially, a report which shall include:

- a description of the water quality of all navigable waters,
- an analysis of the extent to which all navigable waters,
- provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife,
- and allow recreational activities in and on the water;
- an analysis of the extent to which the elimination of the discharge of pollutants and a level of water quality which provides for the protection and propagation of a balanced population of shellfish, fish, and wildlife and allows recreational activities in and on the water, have been or will be achieved...together with recommendations as to additional action necessary...and for what waters such additional action is necessary;
- an estimate of (i)the environmental impact, (ii)the economic and social costs necessary to achieve the objective[s]...(iii)the economic and social benefits of such achievement

- a description of the nature and extent of no-point sources of pollutants...”

It is obvious that a means of collecting and analyzing water quality monitoring data is necessary to prepare the required 305(b) report.

*Section 303(d) of the Clean Water Act requires the state to identify and prepare a list of those water bodies where one or more of the designated uses are impaired.*

*There are three components of Water Quality Standards:*

*(1) designated uses to be made of the waters*

*(2) criteria, either narrative or numerical, which describe the conditions which must be present in the water body in order for the designated use to be met, and*

*(3) an anti-degradation policy to assure protection of the state’s water bodies.*

*Criteria are the conditions necessary in the water body for the designated use to be met. In order to determine if the water body is impaired, and should be included on the 303(d) list of impaired water bodies, a state would need to know if the criteria are being exceeded. For instance, if a certain designated use cannot be met if a pollutant exceeds a certain concentration in the water body, then that level or concentration of the pollutant cannot be exceeded in the stream or the designated use is not met. The criteria necessary for the designated use to be met are the concentration of that pollutant must be lower than the level that is selected for it to exceed to not meet its designated use. . Such a determination would be difficult to make without the collection and evaluation of monitoring data for that specific pollutant.*

EPA is currently developing guidance documents for state agencies to use in developing or evaluating their existing methods of assessing monitoring data to determine when water quality standards are being impaired. States should also develop measures to evaluate the data to determine the likely source of pollution. Much work has been done in this area, and the ratio of various pollutants, the level of pollutants during high flows or low flows, the potential pollution sources upstream, and other such information are all useful indicators of the source of the pollutants.

The draft TMDL regulations expected to be released this summer will require states to develop implementation plans to achieve the pollution reductions proposed by the TMDL. If we are unable to identify the sources of pollution, development of an implementation plan will be impossible. When a TMDL is conducted, a target load reduction for the pollutant causing the impairment is assigned to each source. Unless actual water quality monitoring data for the water body being evaluated is available, “book” values are used. This may not be representative of actual conditions, resulting in a pollutant source actually having to provide more treatment and pollutant removal than is necessary to protect water quality standards, or conversely, resulting in designated uses not being met even when the pollutant reductions are achieved.

These examples demonstrate some of the reasons it is important for a state to develop and implement a baseline monitoring program.

## **PLANNING**

Before a state begins to develop a baseline for the monitoring program, it is important that the state determine what they are to accomplish with the monitoring program. Gathering monitoring data simply to have a large volume of data is not a good expenditure of funds.

The Clean Water Act identifies several areas where a state needs monitoring data in order to prepare reports such as the 305(b), 319, 303(d), TMDL, etc. This is a good starting point to establish the purposes for which the data will be used. State agencies should prepare a list of reports and data necessary for the agency to meet its statutory authorities. Then the state agency can determine what specific data will be necessary to meet these requirements. Data collected for use in one report may also be used in the preparation of other reports and for making other management decisions. This will decrease the costs and efforts for the baseline water quality monitoring program.

The next step in developing a monitoring program is to determine what other monitoring programs are ongoing that might supply data that can be used for the reports and for decision making by the state agency. Sources of data

include that gathered by other state agencies, the Corps of Engineers, EPA, wastewater treatment plant discharge monitoring reports, public water supplies, source water assessments by public water supplies, wildlife agencies, universities, USGS, cities, industries, volunteer monitoring groups, etc.

## **SHARING**

The most important step here is to determine if the group collecting the monitoring data is willing to share that data. Data collected by others, if of acceptable quality and taken at proper times and under controlled conditions, may be useful.

All monitoring data must be subject to quality assurance in order to be dependable and of use to the state agency. Additionally, some groups conducting monitoring programs might consider the modification of their programs to add additional parameters or to change collection locations, protocols, etc., in order to assist others. In some instances, there may be a need to provide some incentive, such as money or services, in order to persuade the group performing the monitoring to modify their program to meet the other needs. In this case, it is likely that state cost will be much less than if the state performed the monitoring.

Potential users must determine if the data developed by the another monitoring group is likely to be usable before pursuing cooperative agreements.

The state should also be prepared to share its monitoring data with others if it is to expect to receive their data. The cooperative effort of sharing monitoring data can create other opportunities for partnering on other monitoring activities.

Being aware of the monitoring activities of other agencies and groups can also avoid the possibilities of duplicating monitoring efforts.

## **PRIORITIZE**

The state agency should also prioritize the monitoring data that they must collect. It is likely that states will not have the resources necessary to acquire all data they would like.

It is a probability that the state will not be able to collect all the sampling data that they desire, due either to restriction of available funds or personnel. In this case, the state may need to look at some options. For instance, a state agency may establish specific sites where samples are retaken over a long period of time. Other sites may be selected and sampled for a shorter time. Some states have established a system under Whole Basin Planning of sampling within select basins for one year. The next year, other basins are sampled. This five-year program, meaning that all of the basins within the state are covered in a five-year period, at which time the rotational sampling starts again. Such a process allows for complete coverage of the state's waters ever five years. Permitting, enforcement, TMDL, and construction may also be tied to basins and the same five-year rotational process.

At this point, the state agency needs to summarize the data which will be available compared to the data which they need, according to the priorities previously established. These "holes" in the desired monitoring program then need to be addressed.

## **FUNDING**

Perhaps the most common problem that state agencies are likely to face is the lack of money to implement a baseline monitoring program. Federal funds, through the Clean Water Act continue to be available for state monitoring programs. For instance, 106 funds can be used for certain monitoring activities, including groundwater monitoring programs. The FY01 Presidential budget request seeks a substantial increase in 106 funds for carrying out TMDL activities. Since monitoring data is desirable for TMDLs, these increased funds, should Congress appropriate, would assist state's monitoring efforts.

The President's FY01 budget also calls for a considerable increase of 319 funds. It is likely that EPA will propose allowing states to use up to 20% of the 319 funds for TMDL activities, which would include monitoring to gather site specific data for conducting the TMDL.

There is a proposal to allow violators of the Clean Water Act to provide funding for state monitoring programs in lieu of fines. The details are still to be worked out, but this would be of great benefit to under funded state monitoring programs.

## **PERSONNEL**

Another difficulty that state agencies face today that was common a quarter of a century ago, is a shortage of staff to conduct the monitoring program. States may need to become more innovative to tap resources that they may not have earlier considered. The possibility of partnering with other government monitoring groups has already been mentioned. Another possibility is the use of volunteer monitoring groups. Such citizen groups could provide a valuable yet inexpensive resource. It would be very important to provide proper training and equipment. Quality assurance would also be a high priority. One of the major goals would be to direct those volunteers involved in monitoring programs to "stay with script" rather than "hunting for problems". There are certainly many unreported water pollution sources around the state, but an individual involved in organized volunteer monitoring effort needs to stay with the sampling plan. This is not to say that if problems such as non-permitted water pollution sources are discovered, they should be ignored, but instead is to impress on volunteers the primary goal is to collect the samples in accordance with the sampling plan and to accomplish the primary sampling goal.

Another source of available resources is with the staffs of the conservation districts, which are available in many areas of the country. These individuals are familiar with their area of the state, including the water bodies. They often know the land owners and can obtain access for sample collection, have a vested interest in protecting and restoring waters of the nation and, as government employees, generally recognize the importance of accuracy in their work and the necessity of "staying with the script". Many of these district employees are also looking for a mission related to conservation and would welcome the opportunity to participate.

## **REPORTING**

Once a state agency establishes a baseline monitoring program and formalizes a methodology to evaluate the data that is collected, decisions must be made concerning what to do with the data. Much of the data will be used in preparing reports for submittal to EPA, TMDL, management decision making, and the like. However, an interpretation of the data, the general quality of the states waters, any trends which are apparent, likely causes of the pollution, and possible solutions to the pollution problems are all of interest to the citizens of the state. Making the information available will cause support to grow for the state's monitoring program and may result in the implementation of voluntary actions to halt or reduce water pollution. More importantly, the release of a balanced report will educate citizens on the importance of monitoring and of reducing water pollution.

A cooperative effort between all those collecting samples will cause a Quality Assurance Project Plan to be developed and followed.

## **DATA MANAGEMENT**

There are a couple of very useful tools that a state should consider at this point. Global Positioning Systems (GPS) are inexpensive and can provide accurate locations of monitoring sites, discharge points, potential pollution sites, and the multitude of other facilities or activities which are useful in preparing reports, assessing data, and making decisions.

A second important tool is a computer data system for collection, data storage and ready retrieval. Such a computer data system is also useful, should the state agency decide to make the information available to others through the use of a link to a web site.



Other than ongoing monitoring activities of other agencies and groups, the state should also become aware of historical monitoring data that may have been collected in the past. Once located and accessed, the state can determine if the data is of such quality and usefulness to be used for planning future monitoring activities, for charting trends in water quality, and for other purposes. A state can often profit from the experiences gained; both positive and negative, during monitoring conducted in the past.

Without a baseline monitoring program and the means to assess the monitoring data, states cannot accurately determine the quality of the nation's waters. They can not determine if there are improvements to the quality of the water as a result of the activities, which are specifically designed to restore and protect the water quality standards.

## **What is a baseline plan?**

There is general recognition by EPA and the states that a meaningful, baseline water quality monitoring program needs to be established and maintained by each state. The words above describe lots of activities that go into a good baseline monitoring program. 106 Guidance says, "An overall monitoring strategy includes monitoring for the purposes of

- 1) determining status and trends,
- 2) identifying causes and sources of problems and ranking them in priority order,
- 3) designing and implementing water management programs,
- 4) determining compliance and program effectiveness, and
- 5) responding to emergencies."

A baseline state water quality monitoring program can answer any questions about:

1. quality of the water
2. designated uses made of those waters
3. protection programs in place
4. industrial and agricultural impacts
5. availability of water
6. amount of precipitation
7. number of stream/river miles
8. total surface areas of lakes
9. aquifer yield and size
10. past and existing monitoring programs and,
11. other factors important in knowledge of a state's water quality.