

VII. Programmatic Evaluation

The VA-DEQ evaluates its Water Quality Monitoring Program on a continual basis and most minor modifications are included in its annual Monitoring Plan, which is finalized in December and implemented on 1 January of each year. Whenever possible, moderate modifications to the Watershed Monitoring Program have been synchronized with the scheduled biennial rotation of watershed monitoring stations. Any major changes (especially those that require significant resource commitment) are characterized and provided to upper agency management and to the US EPA for evaluation and comments by September of even numbered years. This provides sufficient lead-in time for the incorporation of suggested modifications to the original plan prior to the end of the next calendar year, and for additional resource requirements to be evaluated prior to being requested. Budgetary requests for state funding must be presented biennially, in October of odd-numbered years, for consideration by the Virginia General Assembly during the following session. The agency also carries out both internal and external audits of its monitoring program.

A. Internal Audits and Reviews:

The agency completed a Self-Evaluation of its Ambient Water Quality Monitoring Program in February of 2003. A follow-up to the initial evaluation resulted in a Risk Analysis Addendum produced by the DEQ Office of Water Quality Programs – Water Division in December of 2003. A number of specific subjects were discussed on the basis of risk analysis and recommended follow-up actions in these self-evaluations. The majority of these considerations were addressed in a [Water Quality Monitoring Consolidated Guidance Memorandum \(February 2004\)](#) [VII-1a.pdf] and amendments - [Amendment 1 - March 2006](#) [VII-1b.pdf], [Amendment 2 - March 2007](#) [VII-1c.pdf].

(1) Station Siting: Methods for siting monitoring stations are described in the WQM Strategy and the Annual Monitoring Plan guidance, and are implemented at the regional level. Previously, there was no agency-wide review of the siting of monitoring stations to ensure that guidance implementation methods were applied consistently among the Regions. Inconsistent siting of monitoring stations across the Commonwealth could lead to an inconsistent monitoring program. Conclusions drawn from stations assumed to be similarly located spatially could result in the misinterpretation of data. New guidance regarding station siting and follow-up confirmation was included in the new consolidated guidance memo (Water Quality Monitoring Consolidated Guidance Memorandum) in February of 2004.

(2) Parametric Consistency: Minimum parametric selection for ambient monitoring stations is described in the Annual Monitoring Plan guidance and is implemented at the regional level. Regions have the latitude to add additional parameters at selected stations as necessary. Incomplete parametric selections across regional boundaries could make comparisons of data in watersheds which cross regional boundaries infeasible, limited data sets may be indefensible, and when additional parameters are added additional analytical costs might be incurred by the agency for data that cannot be used in the assessment. New guidance regarding parameter coverage and follow-up confirmation was included in the new consolidated guidance memo (Water Quality Monitoring Consolidated Guidance Memorandum) in February of 2004.

(3) Legal Sample Collection and Chain of Custody: Chain of Custody (COC) protocol had changed drastically and was under revision. Although agency monitoring personnel had previously been trained in such procedures, there had no agency-wide, formalized training in the modified procedures or in the related procedures of collecting a legal water sample. Samples collected without proper COC protocol might not

be allowed if litigation were to occur as a result of an enforcement action. A Chain of Custody Workgroup was formed in 2003. As of December 2003, it had developed an outline of a new Water Sample Collection and Chain of Custody Certification Class. Guidance was developed and included in the consolidated water quality monitoring guidance memo, which required all applicable DEQ water program staff to obtain certification by December 31, 2005.

(4) Data Review: Large volumes of monitoring data are uploaded into CEDS daily, allowing near real-time comparison of data to actual environmental conditions. Other than automated checks of the data, there was no required review of the water quality data for accuracy, completeness, or comparability to actual environmental conditions until regional office planners make biennial assessment reviews. These unedited data become available to the public on the DEQ Website as soon as they are put into CEDS. There are a number of ways these data could be in error, examples of which include duplicate data, incomplete data or transcription errors. These errors could lead the public to incorrect data assessments. Also, actual environmental problems might also exist and go undetected by DEQ staff until biennial assessment reviews occurred. New guidance regarding review of monitoring data was developed and included in the consolidated water quality monitoring guidance memo (February 2004). Several improvements to the Water Quality Monitoring (WQM) Module of the CEDS database have subsequently been introduced.

(5) Program Review: DEQ's Ambient Water Quality Monitoring Strategy describes for the general public, as well as for private and governmental data users, how the Agency monitors state waters in accordance with state and federal laws and regulations. There was previously no defined agency-wide review process to ensure that the strategy for monitoring State waters was followed. Inconsistent adherence to the strategy would prevent the assessment group from making uniform assessments of state waters and could expose the agency to outside criticism relative to our assessment process. Specific examples would include the inconsistent monitoring of Waters of Concern, or sampling frequencies that were inconsistent with the monitoring strategy and assessment guidance. New guidance regarding coordination of monitoring activities by central and regional DEQ offices was developed and included in the consolidated water quality monitoring guidance memo (February 2004). This Water Quality Monitoring Strategy also addresses this subject.

(6) Review of Agency-wide QA/QC Data: Large volumes of monitoring data are uploaded into CEDS daily allowing nearly real-time comparison of data to "live" environmental conditions. Timely review of quality control data sets (derived from field and laboratory splits, field blanks, equipment blanks, etc.) is necessary to provide feedback to the regional and central office staff concerning the quality of their monitoring data.

These QA/QC data are also assessable by the public via the DEQ Web site as soon as they are put into CEDS. Failure to review and detect problems in QA/QC could result in erroneous data being stored in CEDS and misinterpreted by the public. Providing timely QC review and reports enables us to meet our Data Quality Objectives. New guidance regarding the review of and reporting on QA data was developed and included in the consolidated water quality monitoring guidance memo (February 2004). Several improvements to automated QA/QC procedures performed by the Water Quality Monitoring (WQM) Module of the CEDS database have also been introduced.

(7) Office of Information Services (OIS) Audit: Large volumes of ambient monitoring analytical results from the state laboratory are also automatically uploaded into CEDS daily, allowing nearly real-time comparison of data to "live" environmental conditions. Timely review of the data input and transfer is necessary to ensure data consistency and completeness. In the past, there was neither a single point of contact nor documented, standardized procedures for data transfer between DEQ OIS (CEDS database) and the state's Division of Consolidated Laboratory Services (DCLS) LIMS database. Several improvements to

the Water Quality Monitoring (WQM) Module of the CEDS database have been introduced, including a process for testing back-up procedures for accuracy and completeness.

(8) Field data review: Field calibration logs for field equipment have traditionally been maintained at the regional offices, where instrument calibration is carried out prior to each monitoring run and confirmed at the end of each field day. The information in these logs is needed to track changes in the operational capability of individual field instruments. When instruments fail to meet calibration standards they are not used in the field. When *a posteriori* calibration checks reveal that a problem has developed during a monitoring run, comments are entered into the CEDS database along with the corresponding data. Failure to review these field equipment logs for malfunctioning equipment on a daily basis might result in erroneous data being collected and entered into the database. Correcting these errors regularly results in more complete and more reliable data. The potential for data loss is proportional to the period between reviews.

Federal 106 grants, however, require that this type of field metadata be included for reporting to USEPA STORET, and DEQ's CEDS database did not capture this data in the past. Agency metadata was therefore not consistent with USEPA requirements. Plans to include the capture of this information in CEDS-WQM, which would also allow periodic Central Office review, have been included in the metadata standards development plan. This plan was interrupted due to resource reductions and the required improvements to the WQM Module of the CEDS database were subsequently postponed. The reprogramming of the CEDS WQM module to include instrument-specific calibration metadata requires significant resource expenditure. The required programming for satisfying the metadata requirements of EPA's new (2000) Water Quality Exchange (WQX), however, is now complete. Several tests of data uploads have been successfully carried out, and DEQ should begin batch uploads of accumulated data to WQX in the near future.

(9) Monitoring Plan (MonPlan) Consistency: DEQ regional offices have always been required to submit monitoring plans, identifying their proposed sampling plans - including station locations, parametric coverages, and frequencies of sampling - annually, in advance of the forthcoming monitoring year. Prior to 2007 this was based on the state fiscal year; It is now based on the calendar year. In the past, such plans were submitted on standardized spreadsheets, but the agency had no official agency-wide review mechanism to effectively ensure consistency of the annual regional monitoring plans with one another or with the monitoring strategy. Regional MonPlans are now developed directly within the CEDS database, and a unified plan is queried from the database to facilitate evaluation for consistency. New guidance regarding monitoring plan development, including responsibilities and time frames for follow-up, has been developed and included in the consolidated water quality monitoring guidance memorandum.

(10) Station descriptions: CEDS-WQM requires certain metadata information when establishing a station. These data are necessary for other people within the agency and outside DEQ to identify monitoring sites. Some of the metadata fields were not required in the past, and there were inaccurate, missing or incomplete data in the database. One significant problem area was an inconsistency between the permit module of CEDS and Water Quality Standards (WQS) designations of watersheds in the James Basin. Several improvements to the Water Quality Monitoring (WQM) Module of the CEDS database were pursued. Sub-basins of the James River system were redefined and approved during the triennial WQS review, and can now be appropriately differentiated in the CEDS database.

(11) DEQ Follow-up to Citizen Water Quality Monitoring: In the past, was no written policy regarding follow-up monitoring where citizen groups had detected evidence of a water quality problem. As a result, regional offices were at times inconsistent in their approach and degree of follow-up. Several citizen monitoring groups had perceived that follow-up monitoring often was not occurring, and that waters

previously identified by volunteers as having water quality problems were not being scheduled for Total Maximum Daily Load development and subsequent clean up actions. New guidance regarding prioritization of citizen monitoring sites for follow up monitoring by DEQ was developed and included in the consolidated water quality monitoring guidance memo (February 2004). Also, the 2004 (and subsequent) Water Quality Assessment Guidance now describe how the Agency will better distinguish those waters where citizen monitoring has indicated that a water quality problem might exist, and where follow-up monitoring by the Agency is needed.

As previously mentioned, the actions undertaken in response to this self-evaluation were summarized and documented in a [Consolidated Guidance Memorandum \(GM04-2005\)](#) [VII-1a.pdf], dated 2 February 2004, and in subsequent Amendments - [Amendment 1 - March 2006](#) [VII-1b.pdf], [Amendment 2 - March 2007](#) [VII-1c.pdf]. Because of continual review of the monitoring program design and improvements in both monitoring methodology and technology, one requirement laid out in the guidance is that it be scheduled for review and updates at least once every three years. Calendar year 2013 is the target date for the next review and revision of this guidance document.

B. WQM Strategy Revisions:

The DEQ WQM Strategy document (1st Edition) originally submitted to, and reviewed by EPA in late 1999 through mid 2000 underwent a complete revision, accompanied by a review of the entire Water Quality Monitoring Program, from mid 2003 through mid 2004. In conjunction with that review, a schedule was established for the periodic revision and resubmission of the WQM Strategy for agency and subsequent EPA reviews, based on the six-year rotational cycle of the agency's Ambient Watershed Monitoring Network. (This network provides the majority of the ambient data from free-running freshwater and estuarine [tidal] streams for assessment purposes.)

A long-term (20-year) schedule was established for synchronizing significant Monitoring Strategy revisions with the Watershed Monitoring station rotation and 305(b)/303(d) Reporting schedules. The Excel spreadsheet "[Planned Cyclic Water Quality Monitoring Activities](#)" [VII-1d.xls] provides a succinct summary of the planned schedule of strategy revisions and station rotation / assessment cycles from 2003 through 2026. A minor strategy revision, with an abbreviated interval, was implemented for July 2005 – December 2006. This facilitated the rapid incorporation of adaptations to problems perceived shortly after the initial strategy implementation, and synchronized future major strategy revisions with the planned six-year watershed station rotation cycles. A revised 2nd Edition (2007) of the WQM Strategy document was submitted to EPA Region 3 in May of 2007. The current (2013) document comprises the 3rd Edition of the Strategy.

Beginning in 2001, DEQ operated its statewide Watershed Monitoring Network on the basis of a rotating schedule, whereby watershed monitoring stations were monitored for two years and then rotated during a six-year full rotation cycle. Two years of bimonthly sampling thus provided 12 sequential observations from each site for assessment purposes. These two-year rotations became fully synchronized with the two-year assessment cycle for 305(b)/303(d) Reports in January of 2007 (refer to [Watershed Station Rotation Schedule](#) [III-A-1a-9a.xls]). DEQ expanded its assessment window to a six-year period beginning with the 2008 305(b)/303(d) Integrated Report. That assured that the time period for which monitoring results were assessed (*i.e.*, the assessment 'window') provided a sufficient number of sequential observations (without significant time gaps) from each watershed station, and that representative statewide water quality data (three two-year rotations) were included in each assessment period. The 2008 assessment included data from 1 January 2001 through 31 December 2006. These data were aggregated by mid 2007, were analyzed

and assessed during the fall and winter of 2007-2008, and a draft 305(b)/303(d) Integrated Report was provided in April of 2008. The most recent (2012) draft Integrated Report, covering the assessment window from 1 January 2005 through 31 December 2010, was submitted in April of 2012.

This (3rd) scheduled revision of DEQ's Water Quality Monitoring Strategy (2013) includes significant changes in the rotation schedule and frequency/duration of monitoring in two primary ambient monitoring programs. The transition from 494 watersheds of a previous (1995) delineation to 1247 sub-watersheds of the National Watershed Boundary Dataset adopted in 2006 stretched the resources of DEQ's Watershed Monitoring Network to the limit, and restricted its ability to adapt to variations in NPS risk potential among watersheds. That change, accompanied by several years of progressively declining resources from 2007 through 2012 has required modifications of the objectives and scheduled activities of several monitoring programs. These changes were described for each program involved in Chapter III - Design and Implementation, and new rotation schedules have been incorporated into the [Watershed Station Rotation Schedule](#) [III-A-1a-9a.xls] presented in this Strategy edition. Several significant changes to the Watershed Station Monitoring Network have been initiated for the next six-year rotation cycle (2013 – 2018). The number of watershed stations monitored annually has been reduced from approximately 400 to 187, the monitoring frequency has been increased from bimonthly to monthly, the duration has been reduced from two years to one year, and their siting protocols have been changed. (See section III.B.1 - Ambient Monitoring Program - Watershed Station Network and section III.B.2b - Probabilistic Monitoring of Free-flowing Freshwaters). For 2013, the resources of 42 stations have been associated with freshwater probabilistic sites to characterize seasonal variations in physical and chemical parameters in lower order streams, and 145 watershed stations have been targeted on 5th order watersheds that were identified as having declining water quality by trend analyses in the 2012 305(b)/303(d) Integrated Report or were otherwise identified as problematic by regional coordinators..

Current intent is to maintain the present design of siting, monthly sampling, and annual rotations for six years, until the next major strategy revision is implemented in 2019. As always, the continuous planning process and constant re-evaluation of resource availability, program efficiency, and data needs may dictate further adaptive changes before 2019. In any case, the next major revision of the WQMA Strategy is scheduled for review in late 2018 and implementation in January of 2019.

C. External Program Evaluations:

In addition, two independent advisory committees have carried out external evaluations of the agency's water quality monitoring program and the associated water quality monitoring strategy document. During the evolution of the original draft Water Quality Monitoring Strategy, from 1997 through 1999, DEQ submitted the document to its Academic Advisory Committee (AAC) for review and comments. Several face-to-face meetings and presentations were carried out during the process, and comments and suggestions of the AAC were discussed and incorporated into the final draft of that document, which was submitted to EPA for further review and comment in December of 1999. For the most part, comments from the AAC were complimentary rather than critical, and few suggestions required significant modifications of the original strategy.

Subsequent to that time, an independent Scientific Advisory Committee (SAC), established expressly for the purpose, carried out an additional review of the WQM Strategy during 2001. Final comments from that review were collated, evaluated, responded to and/or incorporated into the strategy by spring of 2002. Most comments from the SAC were also complimentary rather than critical, and again the few suggestions received required no significant modification of the original strategy.

Similar external reviews of the WQM program by Academic and/or Scientific Advisory Committees, as well as publication for periods of public comment, were planned for all future WQM Strategy revisions. These same review and comment procedures, utilizing the Academic Advisory Committee(s) and public comment periods, are also followed in relation to biennial [Water Quality Assessment Guidance Manuals](http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityAssessments.aspx) [http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityAssessments.aspx] and [305\(b\)/303\(d\) Integrated Water Quality Reports](http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityAssessments.aspx) [http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityAssessments.aspx], as well as for other significant modifications to the agency's Water Quality Monitoring Program.