



*Larry Hogan, Governor
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Jeannie Haddaway-Riccio, Secretary
Allan Fisher, Deputy Secretary*

Quality Assurance Management Plan for Environmental Data Collection

Maryland Department of Natural Resources

Version 2.0

March 2022

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Larry Hogan, Governor

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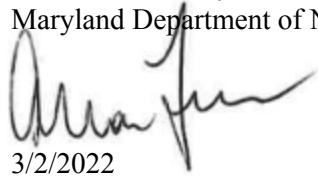
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March 1, 2022

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3/2/2022

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PREFACE

This plan covers all environmental monitoring and measurement activities mandated through the US Environmental Protection Agency (EPA) regulations and memoranda, including environmental data generated through monitoring programs, grants, contracts, memorandums of agreement or understanding and cooperative agreements.

Vision Statement

*In a sustainable Maryland,
we recognize that the health of our society and our economy
are dependent on the health of our environment.
Therefore, we choose to act both collectively and individually
to preserve, protect, restore, and enhance our environment
for this and future generations.*

Mission Statement

*The Department of Natural Resources leads Maryland
in securing a sustainable future
for our environment, society, and economy
by preserving, protecting, restoring, and enhancing
the state's natural resources.*

Acronyms and Abbreviations

ANSI	American National Standards Institute
COMAR	Code of Maryland Regulations
CWA	Clean Water Act (1972 amendments to federal Water Pollution Control Act)
DBM	Maryland Department of Budget and Management
DGS	Maryland Department of General Services
DNR	Maryland Department of Natural Resources
DoIT	Maryland Department of Information Technology
DUET	Data Upload and Evaluation Tool (EPA Chesapeake Bay Program)
EPA	United States Environmental Protection Agency
FWS	United States Department of the Interior, Fish and Wildlife Service
GIS	Global Information System- spatial data
IQ	Information Quality
ITS	Information Technology Service (DNR)
MDE	Maryland Department of the Environment
MDH	Maryland Department of Health
NEERS	National Estuarine Research Reserve (NOAA)
NOAA	US Department of Commerce, National Oceanographic and Atmospheric Admin.
P.L.	Public Law
QA	Quality Assurance
QAMP	Quality Assurance Management Plan
QAPP	Quality Assurance Project Plan
QC	quality control
SWMP	SystemWide Monitoring Program (NEER, NOAA)
TMDL	Total Maximum Daily Load
US	United States
USDA	United States Department of Agriculture
USGS	United States Department of the Interior, Geological Survey

1 INTRODUCTION

It is the policy of the United States Environmental Protection Agency (EPA) that all environmental programs conducted by, or on behalf of, the EPA shall establish and implement effective quality systems to support those programs ([CIO Policy 2105.0, formerly EPA Order 5360.1 A2, EPA, 2000](#)). The EPA defines “quality system” as a structured and documented management system describing the quality control program assurance policies and procedures for ensuring that work processes, products or services satisfy necessary expectations or specifications. Both the EPA and any organizations conducting programs on the EPA’s behalf must document their “quality systems” in an approved Quality Assurance Management Plan.

This is the ***Quality Assurance Management Plan for Environmental Data*** collected by the Maryland Department of Natural Resources (the “department”). The purpose of this plan is to document the department’s data quality systems and to provide a blueprint for how the department will plan, implement, and assess its quality assurance systems for environmental work performed on behalf of, or funded by, the EPA.

The department works to ensure the preservation, development, wise use, and enjoyment of Maryland's natural resources for the greatest benefit to the state and its citizens. The department coordinates all natural resources activities within the state and reviews and evaluates all natural resources policies, plans, programs, and practices of county, state, regional and federal agencies and institutions. With an appropriated FY2021 budget of \$449 million, 1,341 permanent employees and more than 500 full-time contractual employees ([DBM, 2021](#)), the department oversees more than 400,000 acres of public lands and works to protect nearly 10,000 miles of rivers and streams, wetlands and the Chesapeake and Coastal Bays, and more than 20,000 acres of reservoirs. Although the department is involved in a wide arena of environmental protection and management activities, the Quality Assurance Management Plan for Environmental Data details data quality systems currently in place with programmatic activities related, or of concern, to the EPA. This includes programs generating environmental data for EPA-mandated activities conducted through monitoring and restoration programs, grants, contracts and cooperative agreements.

2 QUALITY ASSURANCE POLICY AND GOALS

2.1 Policy

The department’s mission is to lead Maryland in securing a sustainable future for our environment, society, and economy by preserving, protecting, restoring, and enhancing the state’s natural resources. To carry out this mission, the department relies on environmental data from a variety of sources to make decisions to protect the health of the public and the environment. To ensure that the foundation for these decisions is sound, department programs must have appropriate information quality systems in place. These systems are intended to provide reasonable assurance that all environmental data generated and processed will be

scientifically valid, of known precision and accuracy, complete, representative, comparable and, where appropriate, legally defensible.

2.2 Goals

To ensure quality, the department relies on a graded approach consisting of one or more of the following elements, depending on the intended use of the final data and the degree of confidence needed in the quality of the results:

- 2.2.1 Department Project leaders and/or Program Chiefs will assume responsibility for ensuring that data generated by or submitted to the department are of appropriate quality for their intended use. All Project leaders and/or Program Chiefs will conduct appropriate quality assurance planning and will be responsible for coordination of data quality issues among field, laboratory and data assessment staff.
- 2.2.2 The department will design quality assurance processes in the most cost-effective manner without compromising data quality; with emphasis on continuous improvement in the quality management system.
- 2.2.3 Where required by the department or EPA, quality assurance project plans will be developed in accordance with the guidelines contained in EPA's [*Guidance for Quality Assurance Project Plans \(EPA, 2002c\)*](#) and meet specifications listed in the [*EPA Requirements for QA Project Plans \(EPA, 2001b\)*](#). Department Project leaders and/or Program Chiefs will be encouraged to develop quality assurance project plans for other data collection activities for which quality assurance project plans are not explicitly required.

Department Project leaders and/or Program Chiefs will review and approve all quality assurance project plans prior to the initiation of work on the associated projects. The EPA Region 3 Quality Assurance Manager will review and approve quality assurance project plans for monitoring projects funded directly by EPA prior to the initiation of any environmental data collection activities.

- 2.2.4 For any monitoring and measurement activities mandated through EPA regulations, grants, contracts and cooperative agreements, the department and all secondary funding recipients (i.e. those receiving EPA funds from the Department through contracts, Memorandums of Understanding, Memorandums of Agreement, and Joint Funding Agreements) will follow those quality assurance protocols specified as part of the conditions of those regulations or agreements. Specific protocols required as part of these programs and projects are contained in the associated EPA-department agreements.
- 2.2.5 Department Project leaders and/or Program Chiefs will be encouraged to develop data quality objectives for all data generated by or submitted to the department in accordance with the guidelines contained in [*Guidance on Systematic Planning Using*](#)

[*the Data Quality Objectives Process \(EPA, 2006\)*](#). Data quality objectives will be incorporated into quality assurance project plans where appropriate and, in all cases, will be communicated to staff responsible for field, laboratory and data assessment activities.

- 2.2.6 The department will use applicable data quality objectives to assess and validate all data. Technical staff in the department's Tidewater Ecosystem Assessment Division will assist the water quality and resource management programs to develop automated tools to verify and validate environmental data and computer metadata files. Staff will also assist in the "publication" of data to state (the department's database, Maryland Department of the Environment's database) and federal computer database systems (e.g., Chesapeake Bay Program database, EPA's Water Quality Exchange database, US Geological Survey's National Water Information System database).
- 2.2.7 Federal reporting requirements - Organizations or laboratories generating data for the EPA, either funded directly from the EPA or as projects matching funds to an EPA monitoring program (e.g., federal Clean Water Act §319 - Nonpoint source; §117 Chesapeake Bay), will have quality assurance project plans reviewed and approved by the department's Project leaders and/or Program Chiefs and the Bay Program Quality Assurance office. Environmental monitoring programs funded by other federal agencies (e.g. National Oceanic and Atmospheric Administration, USDA Forest Service), should adhere to specific reporting requirements of the funding agency.
- 2.2.8 Organizations contracted by the department to perform environmental measurements or assessments as suppliers will be required to adhere to this plan.
- 2.2.9 The department's Human Resource Service will research available opportunities and/or develop and provide or sponsor quality assurance training for department Quality Assurance Officers, Program Chiefs, Project leaders, grant coordinators and field and laboratory staff, appropriate to their responsibilities.
- 2.2.10 The department will develop and follow standard operating procedures for field collection and measurement activities subject to this plan. All standard operating procedures will follow [*Guidance for the Preparation of Standard Operating Procedures \(EPA, 2007\)*](#). The department will modify (as needed) field collection or measurement standard operating procedures and eliminate measures no longer employed. Special or alternate field protocols that are proposed in an appropriate quality document, such as a quality assurance project plan or sampling plan, will be documented if the department adopts them as a routine measure.
- 2.2.11 The department will conduct internal assessments annually or at a frequency identified in each quality assurance project plan by staff familiar with the quality assurance needs of each program.

- 2.2.12 The department’s Quality Assurance Manager, with input from Program Chiefs, will annually review the plan and update the plan every 5 years or whenever changes affect the process outlined herein.
- 2.2.13 The department does not provide dedicated support for staff to coordinate and train citizen scientists to collect samples, conduct field audits, or analyze and manage data. Department support to these groups has been limited to providing advice and limited training (Stream Waders).
- 2.2.14 The department will ensure that programs that collect environmental data in cooperation with federal agencies other than the EPA, meet data quality requirements for these agencies defined by specific laws, regulations and policies. This plan provides a robust framework to meet other federal agency quality needs, although Program Chiefs should review, with the Quality Assurance Manager, any significant issues or requirements. Examples of federal-state programs with environmental data collection are provided below.

State Program	Federal Program
MD Forest Service	US Department of Agriculture USDA Forest Service National Interagency Fire Center
Chesapeake and Coastal Service	US Department of Commerce National Oceanic and Atmospheric Administration

Federal agencies are required to publish guidelines consistent with the Office of Management and Budget that establish basic standards for ensuring the quality, objectivity, utility, and integrity of information that is distributed, and to provide mechanisms for allowing the public and other parties affected by information that does not meet federal quality standards to seek correction.

This was defined in the [Consolidated Appropriations Act, 2001 \(P.L. 106-554, §515\)](#) as an ‘act’ that is unnamed, though most federal agencies identify this as the “Data Quality Act”. The intent of Congress’ action was to hold agencies accountable for the information they distribute, given the far-reaching impact of that information on such things as commercial interests, the public's perception of risk, and agency priorities for committing their resources.

- 2.2.15 The US Department of Agriculture - Forest Service - the [USDA Forest Services Cooperative Forestry Strategic Plan \(USDA Forest Service, 2015\)](#) guides programs that support the USDA’s Forest Service. States report annual accomplishments to the USDA Forest Service’s Performance Accountability. State Foresters are responsible for incorporating data collected at the local level. These data undergo layered review

(local, state, regional, and national level) which improves the USDA Forest Service's ability to monitor, evaluate, and manage these programs.

In addition, department foresters measure and report on fire incidents (number of starts, acres burned, cause) with an in-house reporting system. The data is given to a cooperative National Interagency Fire Center that has a National Wildfire Coordinating Group defining data standards ([NWCG, 2017](#)).

2.2.16 The United States Department of Commerce- National Oceanic and Atmospheric Administration (NOAA) - the National Oceanic and Atmospheric Administration [Information Quality Guidelines \(Part III\) \(NOAA, 2014\)](#) provides performance standards so that the public can assess the quality of information disseminated by the agency.

2.2.16.1 The National Estuarine Research Reserve (NERR)- the department's Chesapeake and Coastal Service manages the Chesapeake Bay-Maryland National Estuarine Research Reserve under the federal Coastal Zone Management Act §315. Environmental monitoring and data collection under this program are part of the NERR System-Wide Monitoring Program (SWMP) and subject to the [NOAA Office for Coastal Management Data Policy for the NERRS National Monitoring Program](#) that addresses protocols for data ownership, custodial liability, data submission and data access in accordance with Federal guidelines/standards for environmental data collection activities. All NERR SWMP data and data from principal investigators are reviewed for quality assurance/quality control using NOAA-Office of Coastal Management approved quality assurance/quality control protocols and transmitted to NOAA-Office of Coastal Management in accordance with the standard NOAA rules for application to oceanographic data sets ([NAO 212-15, NOAA, 1991](#)).

3 ORGANIZATION, QUALITY ASSURANCE RESPONSIBILITIES AND COMMUNICATION

3.1. Management and Organization

Created in 1969 by consolidating five independent agencies, the department leads Maryland in securing a sustainable future for our environment, society, and economy by preserving, protecting, restoring, and enhancing the state's natural resources. The department coordinates all natural resources activities within the state and reviews and evaluates all natural resources policies, plans, programs, and practices of county, state, regional and federal agencies and institutions. Department policy 05:01 *Executive Operations* (DNR, 2005a) establishes operating procedures for the efficient, effective and responsible management of the department.

The department organization is a hierarchy of programs and sub-programs (**Figure 1**). The department Secretary is appointed by the Governor with Senate advice and consent. The Secretary serves on the Governor's Executive Council and chairs and serves on a number of statewide councils, Boards of Directors, committees, commissions and task forces. The Deputy Secretary operates as the Secretary's chief operating officer; responsible for daily general operations of the agency and ensures that internal departmental issues are managed and resolved in accordance with the direction of the Secretary. The Quality Assurance Manager is separate from the direct line of management and reports directly to the Secretary.

3.1.1. Department framework

- 3.1.1.1 The Deputy Secretary/Chief Operating Officer oversees nine units: Office of Communications, Human Resource Services, Office of Fair Practices, Licensing and Registration Service, Finance and Administrative Services, Audit and Management Review, Information Technology Service and Executive Director Fair Hill.
- 3.1.1.2 The Assistant Secretary for Aquatic Resources leads state efforts to protect, restore and enhance aquatic resources and opportunities for their use. This program is responsible for four units: Chesapeake and Coastal Service, Fishing and Boating Services, Resource Assessment Service, and the Critical Area Commission for the Chesapeake and Atlantic Coastal Bays.
- 3.1.1.3 The Assistant Secretary for Land Resources oversees six units: Park Service, Forest Service, Wildlife and Heritage Service, Land Acquisition and Planning, Engineering and Construction, and Maryland Environmental Trust.
- 3.1.1.4 Programs that report directly to the Secretariat include: Senior Bay Restoration Coordinator/Quality Assurance Manager, Legislative and Constituent Services, Natural Resources Police, and Office of Outdoor Recreation.

3.1.2. Quality Assurance responsive units

Not all department units shown in **Figure 1** collect or assess environmental data. Activities of key units with direct influence on environmental data collection are briefly described below.

- 3.1.2.1. Resource Assessment Service - This unit collects, manages and interprets scientific and economic data that impacts the state's natural resources and affects environmental regulatory and policy decisions, works to help restore, protect, and manage Maryland tidal and nontidal ecosystems and works with federal, state and local agencies, citizens and businesses to motivate their involvement and share information. The unit manages the state's Clean Water Act's (CWA) §117 (Chesapeake Bay Program) monitoring grant and receives

EPA funds as a contractor (e.g., CWA §106 - ambient monitoring). This unit includes four divisions involved with environmental data collection: Tidewater Ecosystem Assessment, Monitoring and Nontidal Assessment, Maryland Geological Survey and Power Plant Research Program. One additional division, Supportive Services, is not involved with environmental data collection.

Maryland Department of Natural Resources Organizational Chart

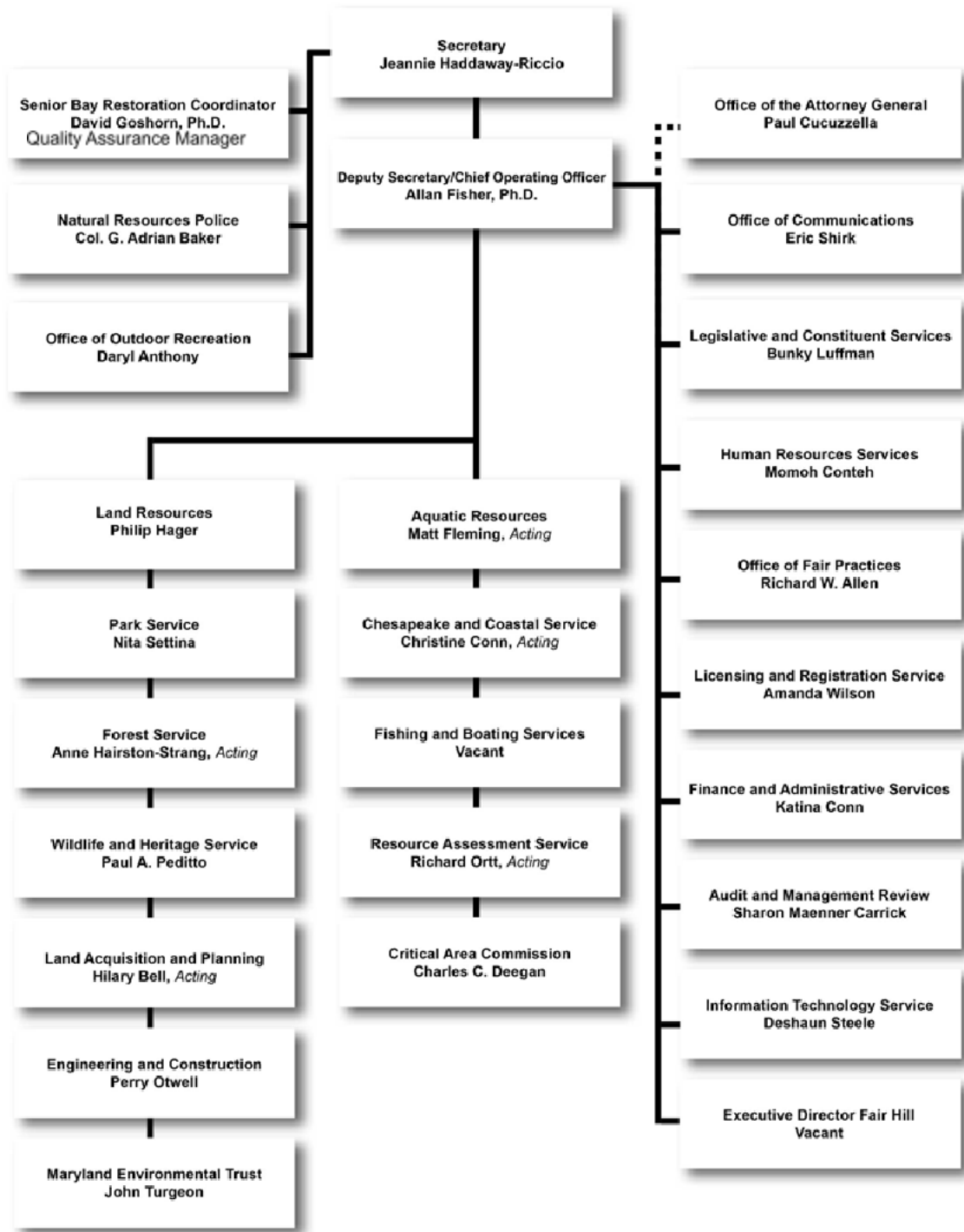


Figure 1. Department organizational chart (February 2022).

- 3.1.2.2. Chesapeake and Coastal Service - Working with public and private partners, this unit develops and supports the implementation of watershed, greenway and waterway management strategies for the restoration, long-term protection and economic vitality of the Chesapeake and Coastal Bays ecosystems. The unit manages the state's Clean Water Act §120 (National Estuary Program), §117(b) (Chesapeake Bay Implementation Grant Program for environmental restoration and some monitoring activities) and Coastal Zone Management Act §6217 (Coastal Nonpoint Source Program) grants.
- 3.1.2.3. Fishing and Boating Services - This program restores fish resources in need of conservation, manages commercial and recreational harvesters to maintain sustainable quality fisheries and promotes fishery ethics and public involvement. EPA funds are used for Fisheries Management Planning and Fish Passage Coordination, not data collection.
- 3.1.2.4. Maryland Forest Service - This unit provides management assistance for forest resources, supporting forest retention, habitat conservation, riparian forest buffer restoration, and afforestation to reduce forest fragmentation. Data on tree survival are collected routinely as part of tree planting projects.

The unit manages the Special Rivers project, funded by the EPA's Chesapeake Bay Implementation Grant, which evaluates planting techniques on tree growth and survival as well as restoration of riparian forest buffers, under an approved restoration plan.

The unit submits data through the USDA Forest Service Performance Measurement Accountability System. The unit also submits geospatial data through the online Stewardship Mapping and Reporting Tool. Data are also reported as Managing for Results measures, for use in the Chesapeake Bay Program models, for USDA and EPA grant reporting, and for Maryland Greenhouse Gas Reduction Act reporting.

- 3.1.2.5. Wildlife and Heritage Service - This unit provides management assistance for land-based resources, ensuring habitat conservation, regulating hunting activities and protecting threatened and endangered species.

3.1.3. Quality Assurance support units

Several key department Enterprise Services divisions shown in **Figure 1** provide significant assistance for quality assurance activities in the department. These activities are briefly described below:

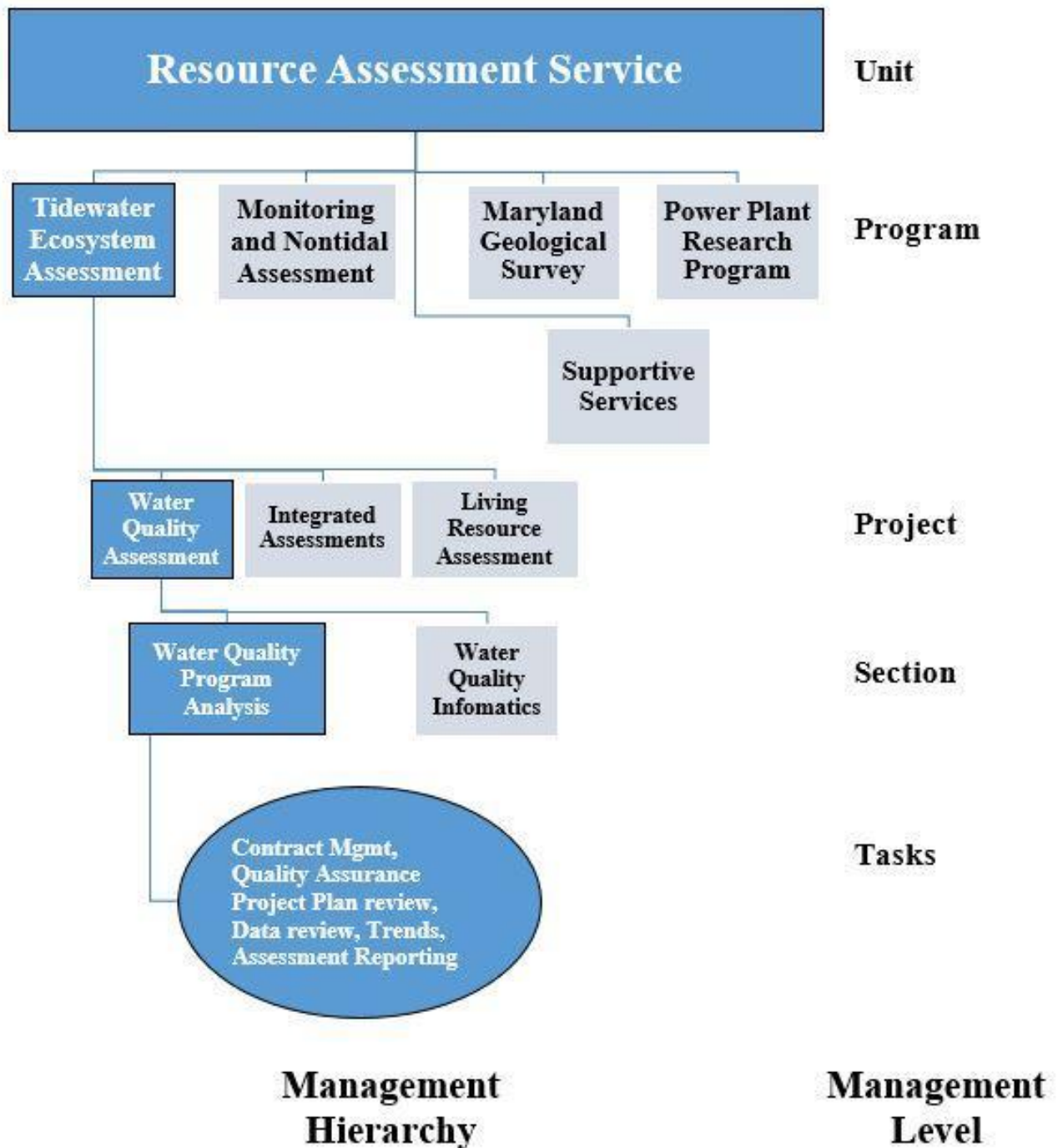
- 3.1.3.1. Information Technology Service- This unit supports the hardware and software needs of the rest of the department and serves as the liaison between the department and the Maryland Department of Information Technology (DoIT).

- 3.1.3.2. Finance and Administrative Services - The Division of Finance and Administrative Services administers the accounting, budgeting, purchasing, supportive services and related functions for the department.
- 3.1.3.3. Human Resource Services - The department's Human Resource Service is dedicated to supporting the department's units, programs and services by maximizing the potential of the department's workforce. To achieve this goal, Human Resource Services works to provide the information, support and counsel necessary to maintain a fair, equitable and positive work environment for all employees.
- 3.1.3.4. Audit and Management Review - This unit ensures department-wide operational effectiveness and compliance with state statutes, regulations, policies and procedures. The department's internal auditors assist executive staff with management issues, planning, organization, troubleshooting and direction of unit objectives; reviews and assesses program performance and departmental procedures.

3.1.4. Quality assurance management framework

Within each department *unit*, there are further hierarchical divisions of additional management levels that generally are divided into *programs*, *projects*, and *sections*, each with defined management responsibilities, tasks and activities.

As an example, the hierarchy of one *section* (Water Quality Program Analysis) within the Resource Assessment Service unit (Water Quality Assessment Program/ Tidewater Ecosystem Assessment Division) is shown in **Figure 2**.



== Resource Assessment Service Unit - to
 == Tidewater Ecosystem Assessment Program - to
 == Water Quality Assessment Section - to
 == Water Quality Program Analysis

Figure 2. Example of a department management hierarchy (from Unit to Section).

3.2. Quality Assurance Responsibilities

The Secretary designates the authority to define and administer data quality programs for the Department and is responsible for the review and update of this Plan. A quality assurance hierarchy parallels the department's management structure with responsibilities often delegated stepwise through the department (**Figure 3**). The Department's Quality Assurance Manager as designated by the Secretary is David Goshorn, Ph.D., Senior Bay Restoration Coordinator.



Figure 3. Generalized quality assurance management hierarchy and chain of delegation and feedback.

In the following discussion, position titles may vary, but the relationship between the Quality Assurance Manager, program managers and those who collect environmental data should be clear. Specific language documenting quality assurance responsibilities/contacts should be incorporated into employees' MS-22 (Position Description) where appropriate and addressed in annual Performance Evaluations.

The Quality Assurance Manager is responsible for ensuring that the quality systems documented in this Plan meet statutory, contractual and assistance agreement requirements for EPA-derived work. The Quality Assurance Manager oversees, reviews and implements the department's Quality Assurance Management Plan and is principal arbitrator for most quality assurance issues and disputes. The Quality Assurance Manager maintains independence within the organization because the Quality Assurance Manager is not in the direct management chain of any of the programs actively collecting environmental data. The Quality Assurance Manager reports directly to the Secretary.

For each program that collects environmental data, a designated Quality Assurance Officer, usually a Division Director, is responsible for ensuring that this policy is uniformly applied to the generation and use of environmental data within their group. Quality Assurance Officers supervise Program Chiefs (or grant administrators or technical advisors) who see that quality assurance-specific requirements in grants, contracts and cooperative agreements are fulfilled.

Program Chiefs have an essential role in this Plan as they actively oversee a hierarchy of technical field, laboratory and analytical staff that may be involved in the development of a

study plan, quality assurance/quality control processes, staffing, training, budgeting, procurement and communications. This delegation approach results in substantially more quality assurance related activities at lower levels in the organization and generally less quality assurance related activities at higher levels in the organization, though it should be noted that the type of quality assurance related activities shift.

Quality assurance activities and responsibilities within the department are generally the same whether projects are simple monitoring activities or are part of a complex, integrated, interagency monitoring effort. Where other agencies are involved in data collection efforts, communications are of paramount importance to ensure that data quality goals are achieved and that these agencies can coordinate priorities, funding and effort. Interagency efforts require written agreements and involve senior managers with the authority to make these decisions and commitments, including Assistant and Deputy Secretaries and, in high profile activities, the Secretary.

All quality assurance levels have the delegated authority to stop work to review/correct monitoring activities, to consult with published standard operating procedures and quality assurance project plans and/or to consult with higher delegated quality assurance authority on issues affecting data quality, either stepwise up the delegated hierarchy or, at any time, directly to the Quality Assurance Manager. **Figure 4** provides an example hierarchy of delegation and feedback paths for the Chesapeake Bay Benthic Monitoring Program managed by the department's Resource Assessment Service.

Questions and disputes regarding quality system requirements, quality assurance/quality control procedures, assessments, or corrective actions are to be elevated to the project's Quality Assurance Officer and, if significant, to the Quality Assurance Manager as representing senior management. Unless the issue requires a simple technical review or management decision, the Quality Assurance Manager may assemble or direct the assembly of a team of experts to quickly identify key issues and make recommendations. In some instances, (e.g., methodological questions), a special study may be required.

If the quality assurance issue involves outside agencies, the Quality Assurance Manager will include representatives of these agencies in the technical panel. If the department is but one contributor to the effort (e.g., Chesapeake Bay monitoring), the Quality Assurance Manager will consult with the contracting agency or their quality assurance representative (e.g., Bay Program Quality Assurance Manager or a technical Bay Workgroup for resolution.)

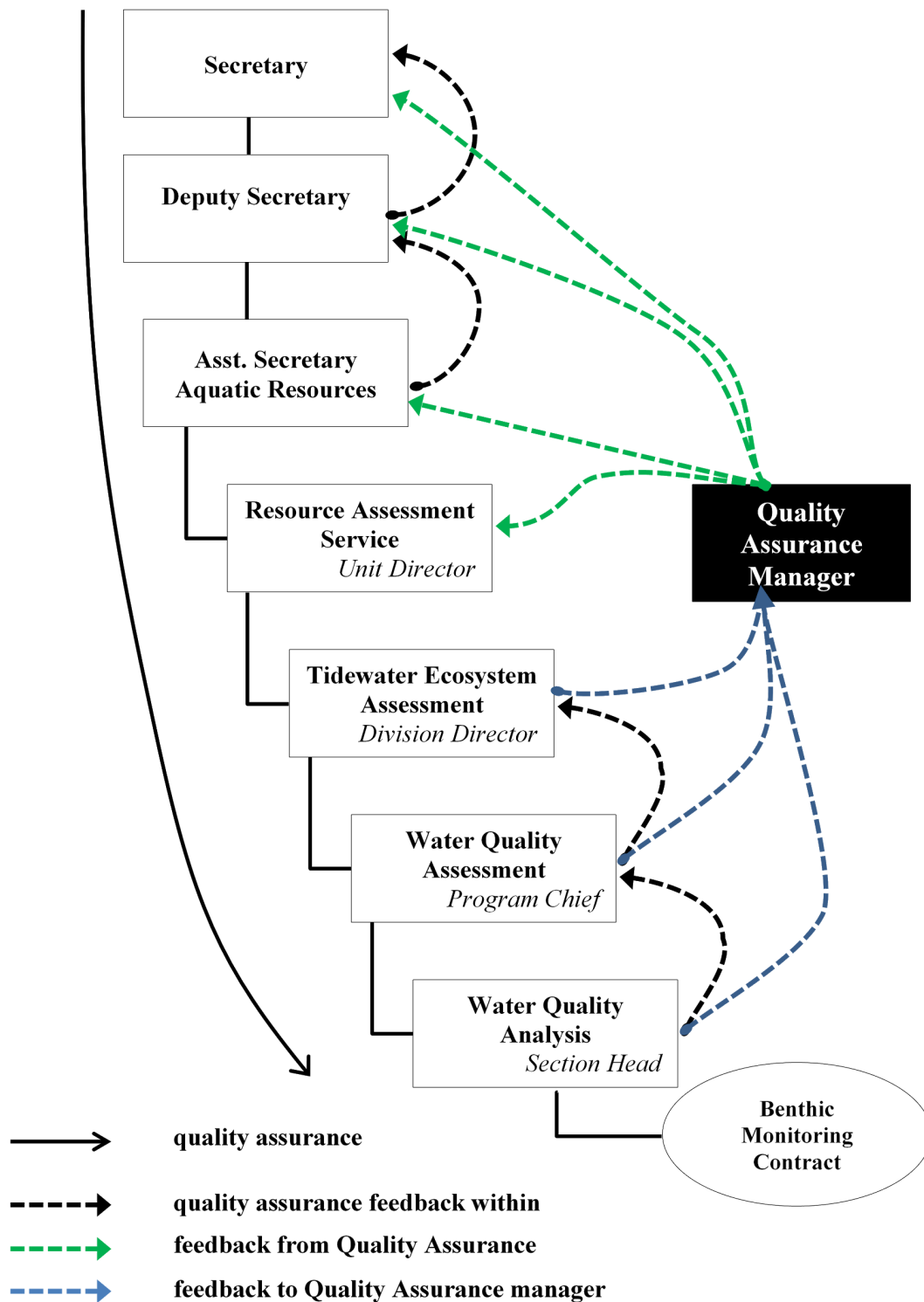


Figure 4. Example quality assurance delegation hierarchy/feedback options for the state's Chesapeake Bay Benthic Monitoring program (contractor).

3.3. Communications

To implement quality assurance department-wide, effective methods to disseminate information about quality assurance processes are needed. Use of the communications tools described below ensures that this information reaches all field and laboratory staff, appropriate data users and managers in the department.

3.3.1. Quality System Documentation

- 3.3.1.1. The Quality Assurance Management Plan provides an overview of the department's quality system – policies and processes that address environmental monitoring and measurement activities mandated through EPA regulations, grant requirements and memoranda.
- 3.3.1.2. Data quality objectives are qualitative and quantitative statements of a study's technical and quality objectives that define the appropriate type of data and specify tolerable levels of potential decision errors. Data quality objectives will be established and documented prior to data collection and/or assessment activities, following the guidance provided in the EPA documents titled, "[Guidance on Systematic Planning Using the Data Quality Objectives Process](#)" (2006), "[Data Quality Assessment: A Reviewer's Guide](#)" (2006b) and "[Data Quality Assessment: Statistical Methods for Practitioners](#)" (2006c).
- 3.3.1.3. Quality assurance project plans - Any activities conducted for or funded by the EPA require development of a quality assurance project plan using the document titled, "[Guidance for Quality Assurance Project Plans](#)" (EPA 2002c). Specific quality assurance requirements for field and laboratory work conducted in support of water and resource management programs are identified in individual quality assurance project plans of which copies are distributed among field and laboratory staff. Approved Quality Assurance Project Plans are valid for up to five (5) years; plans are reviewed annually; material changes to the Quality Assurance Project Plans will be resubmitted to EPA for approval.
- 3.3.1.4. Standard operating procedures - Program standard operating procedures, developed by field operations and laboratory staff, describe routine calibration, operation and use of field and laboratory equipment, sample collection, handling, shipping and custody issues developed for each program. In terms of standardizing sample collection activities, this represents an effective quality assurance communication tool. Standard operating procedures may be incorporated into quality assurance project plans or are cited by reference. Alternate field protocols may be described in an appropriate document (quality assurance project plan or sampling plan). Standard operating procedures and all copies are updated whenever there is a change in procedure; procedural changes also should be documented in metadata files.

3.3.2. Technical meetings

- 3.3.2.1. Program meetings- All department programs have scheduled meetings during which quality assurance issues may be discussed (regular staff meetings at Section, Division, Program or Administration level, meetings with Principal Investigators or contractors, department-sponsored meetings, symposiums or presentations).
- 3.3.2.2. Interagency/other meetings- Meetings provide a forum for the exchange of technical information on environmental data collection between this and other state, local, interstate, and federal agencies. Meetings also may address regulatory information and updates related to environmental data or quality assurance issues. Attendees may include field and laboratory staff, data analysts and managers involved in sampling design and methodology, assessment methods, quality assurance, and data management with groups such as:
- interagency workgroups addressing issues of local and state concern (e.g., TMDL development, Integrated 305(b)/303(d) Report, Maryland Water Monitoring Council)
 - regional governance meetings addressing various watershed scales (e.g., workgroups of the Susquehanna River Basin Commission, Interstate Commission on the Potomac River Basin)
 - meetings with federal and other state agency staff on specific issues (e.g., US Geological Survey, Fish and Wildlife Service, EPA)
 - conferences and symposia where department staff may be invited as speakers or attendees, providing opportunities for communication with other parties that may be affected by quality assurance decisions.

3.3.3. Intranet/Internet

E-mail and internet access and the development of the department's intranet sites, in conjunction with its network of servers, provide opportunities for document storage and dissemination of information and documents. The department maintains an active presence online (dnr.maryland.gov) through which the department disseminates information to the public.

The department also has a subscription email list and several other internet information resources including:

- Maryland Natural Resource magazine
dnr.maryland.gov/Pages/dnrMagazine.aspx,
- Weekly Fishing Report
dnr.maryland.gov/Fisheries/Pages/fishingreport/index.aspx,
- Eyes on the Bay (Maryland tidal water quality data and information)

- eyesonthebay.dnr.maryland.gov/eyesonthebay/index.cfm,
Click Before You Cast (fishing guide information)
- eyesonthebay.dnr.maryland.gov/eyesonthebay/ClickBeforeCast.cfm
- Habitchat (newsletter for Maryland's Stewards of Backyard Wildlife)
dnr.maryland.gov/wildlife/Pages/habitat/habichat.aspx

These sources are routinely updated and include outcomes from the quality assurance system.

The *Maryland Natural Resources* magazine is also available as a quarterly print publication.

3.3.4. Employee performance planning and evaluation

Statewide evaluation of employee performance is a regularly scheduled component of the state's performance management system. This semi-annual process requires an evaluation by the supervisor whereby relevant issues involving environmental data collection, training needs, opportunities for assessment, analysis and communications may be addressed. Specific language documenting quality assurance responsibilities/contacts should be incorporated into employees' MS-22 (Position Description) where appropriate and addressed in annual Performance Evaluations. Staff training activities are discussed in Section 5.

3.3.5. Agency performance evaluation

- 3.3.5.1. [The Governor's Office of Performance Improvement](#) was created by Executive Order on October 9, 2015, to focus on improving the efficiency of Maryland agencies through transparency and accountability, making state government more efficient and responsive to taxpayers.
- 3.3.5.2. [The Open Data Portal](#) is an online database of datasets with datasets, 'dashboard' summaries, and searchable maps and Geographic Information System (GIS) datasets uploaded by state agencies. This system is managed by the Maryland Department of Information Technology (DoIT). Water resource examples of these maps/datasets include: maps showing watershed boundaries, maps showing rivers, tidal waters and impoundments, maps showing high quality and impaired waters, maps showing locations of reported sewer overflows and wastewater treatment discharge quality.
- 3.3.5.3. Maryland's Managing for Results is a strategic planning, performance measurement, and budgeting process that emphasizes use of resources to achieve measurable results, accountability, efficiency, and continuous improvement in state government programs. It is the key component of the state's customer-focused management model that encompasses budgeting, Continuous Quality Improvement, and Employee Performance Planning and Evaluation. Agency Managing for Results details are available online within

annual budget books prepared by the [Department of Budget and Management](#) for the legislature's review and consideration.

- 3.3.5.4. [Maryland Water Monitoring Council](#)- Local, state and federal agency representatives, citizens and representatives from commercial and industrial companies comprise this department-sponsored advisory group. Issues related to planning for monitoring programs (including quality assurance), monitoring, analyses and assessment methods, and reporting are addressed through committees and workgroups. Annual meetings provide for sharing of information about a variety of water monitoring efforts.
- 3.3.5.5. Citizen Advisory Groups - A number of citizen advisory committees, composed of citizen members, provide advice to the department on specific policy and program issues related to land and water resources, wildlife and fisheries. Decisions from these groups rely on quality data developed by the department and other sources.

3.4. Project Planning, Documentation and Assessment

All environmental monitoring programs must have a clear purpose for their existence, use objective, scientific operating procedures and report on findings at the completion of the project. The planning, documentation, implementation and assessment of department projects that collect environmental data are described in detail in Section 4.

3.5. Quality Management Plan Review and Approval

The department's Quality Assurance Management Plan for Environmental Data Collection was originally developed, reviewed and submitted to the EPA in September 1999; the department submitted updates to the Plan to the EPA in 2001, 2006, 2010 and 2016. The most recent and approved plan establishes the procedures under which all environmental data are collected, processed and analyzed.

The department's Quality Management Plan is reviewed annually by department staff at the Program Chief level and any changes needed are communicated to the Quality Assurance Manager. Every five years, or if annual changes are significant to warrant a full revision, the Quality Management Plan is reviewed, updated as needed and submitted by the Quality Assurance Manager to senior management (Assistant Secretaries, Deputy Secretary, Secretary) for final approval and submission to EPA under grant requirements.

In preparing this current update, documents were reviewed including the most recent version of the department's Quality Assurance Management Plan and the most recent "Maryland Department of the Environment Quality Management Plan" (MDE, 2015) to ensure conformity with interagency data quality. EPA data quality documents titled, "[EPA Requirements for Quality Management Plans](#)" (EPA, 2001a), "[Guidance for Developing Quality Systems for Environmental Programs](#)" (EPA, 2002a) and information from the EPA's [Quality of Environmental Data site](#) were reviewed to identify any updates (none were found).

In addition, updates to the EPA’s Region 3 “[Quality Management Plan](#)” (2020), “[Quality Management Plan for the Chesapeake Bay Program Office](#)” (EPA, 2018), and the EPA’s “[2018-2022 Strategic Plan](#)” (2019) were reviewed.

4 QUALITY ASSURANCE MANAGEMENT SYSTEM

EPA leadership, in providing national guidance on quality assurance issues, has assisted the state in developing high quality environmental data that meet users’ data needs. The department’s environmental data collection activities, training programs, contracts, reporting and communications efforts are conducted in a manner that provides the highest quality information. Ensuring the highest quality data and assessments is vital to the department’s mission of “securing a sustainable future for our environment, society, and economy by preserving, protecting, restoring, and enhancing the state’s natural resources.”

An approved and up-to-date Quality Assurance Management Plan is required to meet federal requirements to receive funds directly from the EPA. Plan updates must be submitted for approval at least every five years. The department’s Quality Assurance Management system is shown in **Figure 5**.

4.1 Policy

The department’s Quality Assurance Management Plan is governed by a series of federal and state laws, regulations and procedures expressed in terms of department policies and operating rules. The Plan also addresses the EPA’s requirements for minimum standards that conform to American National Standards Institute ANSI/ASCQ E4-1994 specifications (ANSI, 1995, EPA, 2001a).

Relevant federal regulations include:

(from epa.gov/quality/quality-specifications-non-epa-organizations-do-business-epa)

Quality Assurance for Contracts (48 CFR 46): Allows Federal Agencies to select a national consensus standard as a basis for their quality specifications. The EPA has selected ASQ/ANSI E4 as the basis for its quality specifications and, through tailoring language to 48 CFR 46, requires that applicants/contractors submit a Quality Management Plan (or equivalent) and a Quality Assurance Project Plan (or equivalent) to demonstrate conformance to the standard.

Quality Assurance (2 CFR § 1500.11): Describes the applicability of quality assurance for assistance agreements that involve environmentally related data operations, including environmental data collection, production and use.

40 CFR 35: Establishes administrative requirements for all grants awarded to state, interstate, and local agencies and other entities for the environmental programs listed in §35.101.

State regulations and state and department administrative policies provide a range of management guidelines addressing personnel, training, procurement, records and information management and are identified in subsequent discussions.

4.2 Program

Each department Program Chief, Project Leader and Grant Coordinator is responsible for ensuring that data generated by, or submitted to the department are appropriate for their intended use. A technical advisor or team may be assigned to develop and manage the project's quality assurance-related issues and responsibilities. These responsibilities may include scientific study design, appropriate quality assurance planning, development of data quality objectives, preparation of quality assurance planning documents where appropriate, and the coordination of technical and data quality issues among field, laboratory and data assessment staff involved in the activity.

The state's customer-focused management model encompasses budgeting, Continuous Quality Improvement, Managing for Results and Employee Performance Planning and Evaluation processes. All of these address Data Quality as part of this strategic performance planning initiative.

Maryland Managing for Results (MFR) is a strategic statewide planning, performance measurement and budgeting process that emphasizes use of resources to achieve measurable results, accountability, efficiency, and continuous improvement in state government programs (dbm.maryland.gov/Pages/ManagingResultsMaryland.aspx). Program Chiefs complete this process annually. However, there are no department-wide quality assurance performance measures that are tracked; it is unlikely that any new quality assurance performance measure will be introduced that would address implementation and documentation of the department's Data Quality Management Plan (e.g., identifying Quality Management Plan update; summarizing monitoring programs with approved quality assurance project plans).

The department's annual MFR submissions are reviewed by the Department of Budget and Management's Office of Budget Analysis based on established criteria. The department's MFR submissions are considered in state budgetary decisions, are used to monitor results in key performance areas and are used to assess the progress in addressing key policy issues. The Office of Legislative Audits in the Division of Legislative Services audits agency performance measures (ola.state.md.us/).

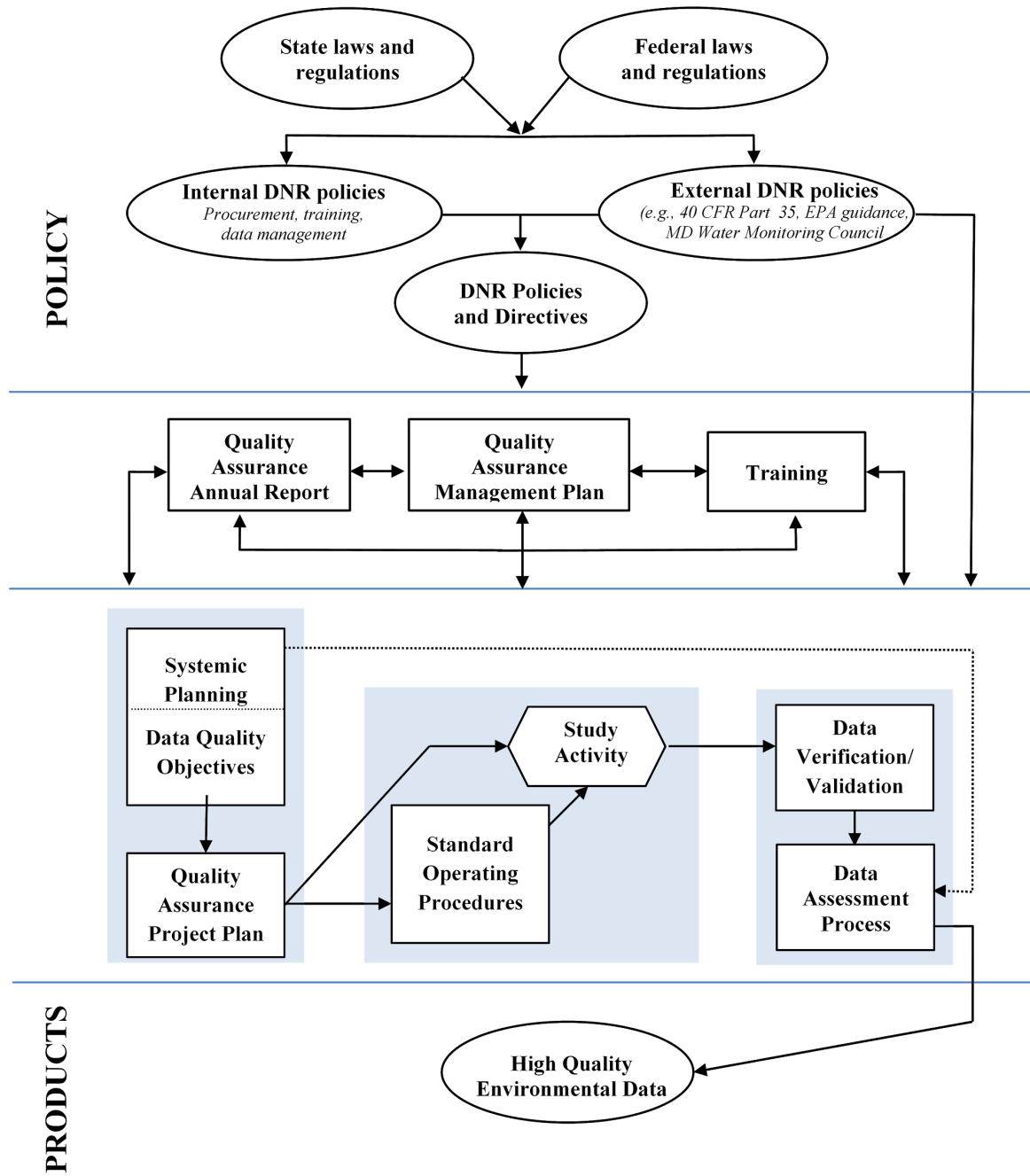


Figure 5. The department's Quality Assurance Management System.

4.3 Project

All environmental monitoring programs must have a clear purpose for their existence, use objective, scientific operating procedures and report on findings at the completion of the project.

4.3.1 Planning

Within the department, each administration evaluates initial requests for a new or modified environmental data collection program based on regulatory requirements or a customer's need and technical or scientific requirements and capabilities. If an environmental data collection program is approved at the planning stage, a project leader and, if necessary, a technical advisor or team, are assigned to manage the technical aspects of the program. This is generally a staff person at the Section Head level or lower who has background experience in the proposed monitoring plan. Management of a program involves evaluating specific requirements of the program; these may include funding (extent, source and term of funding), personnel (classification, training and whether the positions are new or reallocated from other duties), equipment (appropriate technology, availability, cost including replacement, repair, and operation) and support needs (laboratory, information technology, quality control and quality assurance, assessment, reporting).

Each proposed data collection program must be fully examined and documented. This includes any standard operating procedure to be used or developed, training schedules to be developed and implemented, supplies or services that need to be contracted, quality assurance procedures and reporting requirements. Existing standard operating procedures may be used or, in the case of completely new efforts, standard operating procedures may need to be developed.

The Project Leader/Grant Coordinator/Technical Advisor initiates the development of a program's technical and data quality objectives; these objectives define the appropriate type of data and specify tolerable levels of error. The Project Leader identifies a clear, intended use of the data, time and resource constraints and the required data quality. This process requires effective communication among the Project Leader, appropriate field and laboratory technical staff and data users.

4.3.2 Implementation

The Project Leader and/or Program Chief ensures that the environmental data collection program has completed a quality assurance project plan. This comprehensive document describes all the unique and important elements of the project including quality assurance issues, cites the data quality objectives and available standard operating procedures, and includes quality assurance aspects of data analyses and assessment (e.g., identification of equipment, operation or operator error). Acceptable levels of data capture, as well as data values, must be a part of the

proposed project plan. The Project Leader and/or Program Chief will review and approve quality assurance project plans prior to the initiation of work on the associated projects. The Project Leader and/or Program Chief will notify the department's Quality Assurance Manager when an approved quality assurance project plan has been completed.

For EPA funded projects, the Project Leader will submit quality assurance project plans to the appropriate EPA Quality Assurance Officer for review and approval prior to initiation of any additional work on the project. Environmental data submitted to the department for transfer to the Chesapeake Bay Program will be evaluated within the context of a program's documented quality assurance project plans and standard operating procedures. These data will be reviewed to assess data entry/analysis issues and meet data quality levels defined in the quality assurance project plan.

4.3.3 Assessment

Periodic reports provide the Project Leader and Program Chief with an opportunity to evaluate the project's performance in terms of collected data, data quality, data trends, analyses, and comparisons. All staff have the authority to stop work if there is sufficient evidence that project data quality will be compromised due to inappropriate field or laboratory methods, insufficient training or conflicting policies, procedures or directions. In such instances, the functional quality assurance feedback chain to the Quality Assurance Manager is notified and meetings will be held to define a work plan to resolve critical data quality issues, document changes or revise policies/procedures/directions. Once the outstanding issues are resolved, the Quality Assurance Manager will lift the stop work order and notify the functional quality assurance chain that work can proceed.

Program management (including the Quality Assurance Officer) will be responsible for evaluating the project performance and requiring changes as needed to meet the quality assurance project plan goals as presented in the approved project plan. After a management review, interim and final reports are to be distributed to the funding agencies as well as other data users, in the context presented in the project plan. Published versions of the report(s) should reference standard operating procedures used, the criteria used for accepting data values, and any evaluation of the project's performance and results during the period.

Any contractor, assistance agreement holder, or support facility involved in the program will be required to use the standard operating procedures in the project plans or their equivalent. Operations of such contractors or support facilities will be audited and evaluated under accepted procedures contained in the contract or memorandum of understanding. Data from other sources will be evaluated based on a technical review of procedures, techniques, training, etc. used to obtain the data. Only those data obtained by an approved technique or procedure with acceptable

quality assurance/quality control policies and procedures in place and in operation can be used for comparison or inclusion in the program reports. Each data source will be evaluated individually against the approved program plan requirements.

Documentation of each portion of the plan, from planning to approval and operation to completion, must be completed in a timely manner. Such documentation must include the personnel involved in the project stage, the responsible staff at each step and the approval signatures of the responsible party. Timely completion of each portion of the project, as well as its acceptable level of performance, will be a part of the Performance Planning Evaluation for each staff member involved with the project.

A summary of key environmental data collection activities are provided for management review through an annual Managing for Results review process that quantifies past and present activities as well as projected future activities in the context of the department's mission, goals and specific Unit objectives. The Managing for Results review process is linked to the department's Strategic Planning and budget plan exercises.

External environmental data defined by a qualified monitoring program for submission to the EPA Chesapeake Bay Program will first be submitted to the department for review and evaluation within the context of a program's documented quality assurance project plans and standard operating procedures. Reviewed data would be returned to the monitoring program for review, correction, documentation and be submitted directly to the monitoring program for processing, review and merging with other relevant water quality will be evaluated. These data will be reviewed to assess data entry/analysis issues and meet data quality levels defined in the quality assurance project plan.

5 PERSONNEL QUALIFICATIONS AND TRAINING

The department is required by law to assure that its personnel operation complies with the pertinent law, rules and regulations governing the State Personnel Management System. The State Personnel Management System is governed by the Annotated Code of the Public General Laws of Maryland ([COMAR](#)), State Personnel and Pensions Article, Division 1 State Personnel, Title 6 (State Personnel Management System) and Title 10 (Employee Training Program). The State Personnel Management System is governed by the State Personnel and Pensions Article that was enacted by Chapter 10 in 1993 and Chapter 6 in 1994 of the Annotated Code of the Public General Laws of Maryland ([COMAR](#)).

In the State Personnel Management System, the Secretary of the Department of Budget and Management (DBM) establishes classes and rates of pay and ensures that each position within a class has similar duties and qualifications. DBM has delegated responsibility for the selection of

eligible candidates to the department. DBM retains responsibility for the reclassification of all positions except for non-competitive classifications and benchmarked positions.

The department's Human Resource Services is responsible for conducting recruitments, certifying eligible candidates based on levels of education and experience, and overseeing the department's Employee Performance Planning and Evaluation process.

5.1 Personnel Requirements and Responsibilities

Department staff working in environmental programs must be qualified to perform the assigned work, according to project-specific requirements. Some staff have qualifications or classifications unique to the department such as Natural Resources Biologist and Natural Resources Manager. These positions often address quality assurance issues (Program Chief, designated Project leader, field or laboratory staff).

At a minimum, staff with quality assurance related job duties work under the guidance and direction of experienced staff for on-the-job training until they demonstrate a full understanding of the department's quality assurance procedures. Supervisory staff provide oversight to determine that job duties are successfully performed throughout the year. More formalized semi-annual performance evaluations are used to ensure continued adherence to department quality assurance policies and procedures, to document continued successful performance of these duties and/or to identify training needs if required.

5.2 Training Development

Each Unit is responsible for identifying the training needs of its employees. The Quality Assurance Manager may work with department Quality Assurance Officers, Project leaders, Program Chiefs and Human Resource Service staff to identify, develop and promote appropriate quality assurance training programs for field and laboratory staff, data users and department managers.

5.3 Training Activities

Identified training needs often are met with on-the-job training and other formal training opportunities provided by the department or using programs offered by federal or state agencies and commercial training or educational programs. The principal means for determining training needs is the semi-annual Performance Planning Evaluation process (*see Section 3.3.4*). Training programs offered by the Human Resource Service must comply with State Personnel and Pensions Article Title 10 for employee training. Training issues for some positions also may be addressed by the *Risk Management policy 95:02* (DNR, 1995a) and *Safe Vessel Operation policy 95:07*(DNR, 1995b).

Acceptable/supported quality assurance training programs may be offered through various sources including, university/community college system coursework, US Department of Agriculture Graduate School, scientific institutions, (e.g., Smithsonian Institution), federal agencies (EPA Regional biologists, EPA Quality System Training Event, NOAA) and/or their contractors.

5.4 Staff Proficiency – Maintenance and Documentation

The semi-annual Performance Planning and Evaluation process for each employee is an effective mechanism for documenting individual performance plans and maintaining records for levels of performance and experience. This process is based on the essential duties of the job and performance standards identified as acceptable for satisfactory performance, including identified training needs. Each employee's performance, proficiency, and training needs are reviewed and evaluated by staff and supervisors annually. Training needs often are identified in these reviews and can be transmitted to the Human Resource Service. The Human Resource Service is responsible for establishing department training programs in general areas such as sexual harassment prevention, coaching and performance evaluation, employee disciplinary process, structured interview development and administration, and leave management. The Quality Assurance Manager, working with department Quality Assurance Officers, Project Leaders, Program Chiefs and Human Resource Service staff may identify quality assurance training programs needed by field and laboratory staff, data users and department managers and seek to identify or implement these training programs.

Department staff with specific quality assurance duties (including field and laboratory staff, Project Leaders, Program Chiefs, Quality Assurance Officers) have specific language in their MS-22 (position description and performance standards form) that describes the quality management responsibilities for each position.

6 PROCUREMENT OF INFORMATION/ITEMS/SERVICES

The State Board of Public Works has authority over all purchases in accordance with the State Financial Procurement Article of the Annotated Code of the Public General Laws of Maryland and published in [COMAR \(Title 21, State Procurement Regulations\)](#). The Office of State Procurement (OSP) was established on October 1, 2019 and is the primary procurement unit for all delegated procurements from the Board of Public Works except for transportation and transportation-related procurements and otherwise exempt procurements. The State of Maryland's Procurement Mission is to 'ensure Maryland's government procures the highest quality materials, equipment, supplies, and services of every description essential to needs, enabled through the state's centralized eProcurement program.' The Office of State Procurement website provides links to many aspects of the procurement process (procurement.maryland.gov/office-of-state-procurement/).

The state's Procurement Manual is also available online and defines all the requirements under the procurement system (procurement.maryland.gov/maryland-procurement-manual-1-introduction-and-general-overview/). In accordance with these regulations, the department ensures that all agreements involving or affecting environmental programs address appropriate quality assurance requirements. This is an integral item in the evaluation criteria of applicable procurement documents and final agreements. Finance and Administrative Services staff (*see Section 3.1.3.2*) and administrative staff in the individual units provide support to monitor all procurements for compliance with state regulations and any applicable federal grant requirements.

Basic guidance to ensure protection and preservation of the department's capital resources, including sampling, laboratory and data processing equipment are described in the *Equipment Inventory policy* 94:10 (DNR, 1994).

6.1 Procurement Evaluation / Selection Process

The purchase of services or material from an established budget plan are often required to achieve the program objectives. A procurement solicitation includes the item or service required, technical specifications that will meet the needs of the program, selection criteria, and may include quality assurance/quality control and other certification requirements from a vendor.

The Project Lead and/or Program Chief and are responsible for monitoring the procurement to assure that all terms of the agreement are met, and address:

- Is the vendor a minority business enterprise (*Minority Business Enterprise Program Policy* 96:02 (DNR, 1996))?
- Has the vendor met the specifications, such as minimum qualifications, documented acceptable quality assurance/quality control requirements, provided a warranty for equipment or detailed quality assurance/quality control documents, etc.?

6.1.1 Contracts, Memorandums of Understanding, Memorandums of Agreement, and Joint Funding Agreements

Organizations or individuals contracted by the department to perform environmental measurements or assessments are required to follow specified quality assurance protocols. These should be specified within the project scope of work and described in detail in the quality assurance project plan. Some Contracts, Memorandums of Understanding, Memorandums of Agreement, and Joint Funding Agreements with other agencies may include quality assurance specific language. In all instances, an approved quality assurance project plan will provide the specific data quality and reporting requirements that must be met. Additionally, contractors are required to prepare quality assurance project plans involving field sampling and laboratory

analyses and are encouraged to address data quality requirements where appropriate. The Project leader and/or Program Chief are responsible for reviewing the quality assurance project plan and providing it to EPA as appropriate under grant deliverables.

7 DOCUMENTS AND RECORDS

Virtually all of the department's activities are documented through some form of electronic media or paperwork. Documents and files needed for current tasks are maintained by the department's units. Program Chiefs are responsible for ensuring that filing practices conform to the unit's records retention schedules (*see Section 7.1*).

The Project leader and/or Program Chief are responsible for identifying, preparing or reviewing, revising and maintaining current quality related documents and records including quality assurance project plans and standard operating procedures. Standard operating procedures may be referenced within quality assurance project plans as appropriate. The Project leader and/or Program Chief may delegate review and revising of quality related documents to lower level quality assurance staff (such as field staff and laboratory staff) with final review and approval by the Project leader and/or Program Chief. Approved Quality Assurance Project Plans are valid for up to five (5) years; these documents are reviewed at least annually to ensure that methodologies are accurately described and that the documents reflect the active monitoring activities. Material changes to the Quality Assurance Project Plans will be resubmitted to EPA for approval.

Current quality-related documents and records are stored within program offices to ensure that responsible personnel have convenient access to the material and that they are protected from damage and deterioration. Many of the quality assurance project plans are also available through the department's [Eyes on the Bay web page](#) section for [Monitoring News and Reports](#). This section includes a searchable database (search term under 'Publication Type' is 'Quality Assurance Project Plans'). Both department staff and outside users have access to the quality assurance plans through this website.

For some environmental data collection efforts funded through EPA grants, documentation requirements may be defined through federal statute (e.g., Clean Water Act §305(b)-State water quality report, §314-Clean Lakes reports), EPA regulation (e.g., Quality Assurance Project Plan) or EPA guidance. Program Chiefs are responsible for ensuring that quality related documents for these programs meet the requirements described in EPA guidance documents and that records on environmental data and information comply with applicable EPA policies.

7.1 Records Retention

The Program Chief should ensure that out-of-date versions of quality related documents are properly archived for historic reference. The department is required to manage its records, including the establishment or revision of records retention schedules to ensure effective and efficient disposal of records not required by the department. The Maryland Department of

General Services oversees the State Records Management Program (dgs.maryland.gov/pages/recordsmanagement/index.aspx). The State Records Management Program ensures continual, efficient and secure records management consistent with State regulations ([COMAR 14.18.02](#)), and State law ([Annotated Code of Maryland State Government Article 10, sections 608-611](#)).

The Annotated Code of Maryland Article 10, section 610 specifies that the head of each unit of government appoint a records officer from among the executive staff. A records officer serves as the liaison between the government unit and the State Archives and the Records Management Division. The records officer also develops and oversees the unit's records management program. The records officer for the Department of Natural Resources is:

Sharon M Carrick, Director, Audit & Management Review
Maryland Department of Natural Resources
580 Taylor Avenue C-3, Annapolis, MD 21401
Phone: (410) 260-8783, sharon.carrick@maryland.gov

The State of Maryland requires that each unit within a State agency submit a records retention plan for approval by the Maryland State Archives (MSA). The department has multiple retention schedules that are relevant for this Quality Assurance Management Plan. These include retention schedules for the following units:

Maryland State Archives -- Agency Retention Schedules -- Series 1468
Schedule 2813 - Resource Assessment Service (MSA Citation pending final review)
Schedule 2812 - Fishing & Boating Services ([MSA Citation S1468-4137](#) - approved 8/24/2021)
Schedule 2939 - Maryland Forest Service ([MSA Citation S1468-4110](#) - approved 9/11/2019)
Schedule 2902 - Wildlife & Heritage Service ([MSA Citation S1468-4078](#) - approved 8/09/2018. Subject to review in August 2020)

7.2 Records Access

Chain of custody and confidentiality procedures (if applicable) are described in the standard operating procedures and/or the quality assurance project plans. Public access to documents and records of the department is controlled by Maryland's *Public Information Act* (State Government Articles 10-611 to 10- 628). Information on the *Public Information Act* is available from the Maryland Attorney General's office (www.marylandattorneygeneral.gov). This Act allows the public a broad right of access to public records while protecting legitimate governmental interests and the privacy of rights of individual citizens. Documentation and data submitted to the department for transfer to EPA are public records subject to Maryland's *Public Information Act*.

A public record is defined as the original or copy of any documentary material in any form and includes written materials, books, photographs, photocopies, films, microfilms, records,

tapes, computerized records, maps and drawings created by or received by the department in connection with the transaction of public business. Anyone may request public documents. Certain records however, are privileged by law and must be withheld because of their confidentiality. These may include investigation records and inter- and intra- agency memoranda and letters. The department's Office of the Attorney General provides guidance on confidentiality procedures on a case-by-case basis. Details of any required confidentiality process should be detailed in the quality assurance project plan.

Access to most department reports through the Internet is governed by *Universal electronic access policy* 02:02 (DNR, 2002).

8 INFORMATION SERVICES/HARDWARE/SOFTWARE

The Maryland Department of Information Technology (DoIT) was created by 2008 legislation in an effort to consolidate state agency information technology functions and policies into one department; elevating the department to one that reports directly to the Governor (doit.maryland.gov/Pages/AboutDoIT.aspx). The department's Information Technology Service is responsible for managing the hardware, software and communications components that form the foundation of the agency's information technology. The department conforms to data system documentation following Federal Geographic Data Committee (FGDC) standards for metadata documentation. The department's policies are derived from DoIT Policies available online in the [IT Policy Catalog](#).

Department policies include:

Access and Use of Internal DNR Geospatial Data Policy 05:11 (DNR, 2005b)
Universal electronic access 02:02 (DNR, 2011a)
Policy on Equal access to MD DNR Services by Individuals with limited English Proficiency (LEP) Policy 11:03 (DNR, 2011b)
Resource Sharing Policy 16:01 (DNR, 2016a)
Public Information Act Requests 16:02 (DNR, 2016b)
Social Media Policy 16:03 (DNR, 2016c)
Publications Policy 08:02 (DNR, 2017b)

DoIT and department policies provide basic guidance to ensure protection of the department's data systems (including environmental data) and to ensure use of standard formats and metadata to share data with users within and outside of the department.

Data review systems can exist as off-the-shelf software packages or as customized software developed as a commercial product or with a monitoring/research/ reporting partner. There are varying data quality review efforts – usually depending on the volume of data being digitized. Small datasets may be keyed into datasheets, manually reviewed and processed with specific statistics for review. Maryland's more complex CORE and Chesapeake Bay monitoring programs generate a lot of site-specific environmental data, field measurements and laboratory

data requiring a consistent, comprehensive assessment of field data and observations, laboratory measures and summary site information to correctly merge these data into a comprehensive dataset for analysis.

These data, when submitted to EPA's Chesapeake Bay Program, are reviewed through a custom Data Upload and Evaluation Tool (DUET) program that may be flagged for additional review and approval or correction before the Bay Program will accept these data into the Bay watershed data system ([Vistronix, Inc., 2013](#)). All data collected and submitted under funding agreements from the EPA Chesapeake Bay Program Office will comply with the data requirements specified in the *Quality Management Plan for the Chesapeake Bay Program Office* (EPA, 2018).

All department staff are required to complete information technology security training as assigned (monthly).

9 PLANNING

Each department Project leader and/or Program Chief is ultimately responsible for ensuring that data generated by, or submitted to, the department is appropriate for their intended use. This responsibility may include scientific study design, appropriate quality assurance planning and documentation, development of data quality objectives, and coordination of technical and data quality issues among field, laboratory and data assessment staff involved in the activity. The Project leader and/or Program Chief should determine if internal staff will collect all required data or if outside suppliers of data will contribute to the project goals. The project goals, objectives and outputs (i.e. questions and issues to be addressed) should be determined in the planning process and used throughout the implementation and assessment of the project. The Project leader and/or Program Chief should develop a schedule, define needed resources, set data quality objectives and prepare a quality assurance plan to ensure successful implementation of the project. The Project leader and/or Program Chief should review quality assurance project plans annually and notify the Unit Director and the Quality Assurance Manager of findings. Out-of-date quality assurance project plans should be retained in accordance with the provisions in Section 7.1.

9.1 Data Quality Objectives - *see Section 3.3.1.2*

At the beginning of any investigation or data collection activity, the Project leader and/or Program Chief is responsible for initiating development of the project's data quality objectives. During the early planning phase of the project, the intended use of the data, time and resource constraints and the required data quality need to be documented. This process requires effective communication among the Program Chief, Project leader, field and laboratory technical staff, and Quality Assurance Officer as appropriate. The Project leader and/or Program Chief may consult with the Quality Assurance Officer, other technical staff or assigned technical advisor on technical data quality objectives issues. Data quality indicators such as precision, accuracy, and comparability may become elements of the data quality objectives.

9.2 Quality Assurance Project Plans - see Section 3.3.1.2

These plans provide a roadmap of the project, describing in detail, background, goals (data quality objectives), procedures (directly or referenced to standard operating procedures and including, as necessary, chain of custody and confidentiality), and assessment and reporting requirements. These detailed plans include rationale for quality assurance procedures to be used. These plans must be reviewed and approved by the appropriate EPA office prior to the initiation of work on the project

9.3 Environmental Review

To establish a consistent, coordinated procedure for internal review of proposed projects, the department established the Resource Assessment Services Project Review Division -Integrated Policy and Review program to coordinate reviews under the *Environmental Review Policy* 94:06 (DNR, 2017b). The Integrated Policy and Review program conducts reviews and coordinates review by relevant department divisions of any proposed projects and actions that affect the responsibilities of various units of the department in protecting, enhancing and providing for balanced use of the natural resources of the State. These activities include environmental monitoring grants funded by EPA. The department also developed the *Principles and Protocols to Guide the Department of Natural Resources' Actions Regarding Stream Restoration Projects in Maryland Policy* 15:01 (DNR, 2015) for review of stream restoration projects in Maryland.

9.4 External Data Sources

The department may work with partners including other States, Federal Agencies, non-profits and citizen monitoring organizations to expand analysis and interpretation activities beyond the scope possible with department collected environmental data. For some partnerships, such as those through EPA Chesapeake Bay Program, this will be enhanced through existing data quality comparison programs such as the [Split Sample and Blind Audit programs](#) and consistent analysis methods such as developed under the guidance of the [Scientific, Technical Assessment & Reporting \(STAR\) team](#). Project leads, Program Chiefs and Unit Directors should be actively involved in these partnership groups. Project leads and/or Program Chiefs should evaluate the external monitoring programs that generate external data for compatibility with department quality assurance plans and criteria. Project leads and/or Program Chiefs are responsible for evaluating if data acquired from these external sources can be used to supplement department data.

Other external sources may also have EPA mandated quality assurance project plans and well-documented monitoring programs that can be evaluated for consistency with department goals, objectives and standards. The Project leads and/or Program Chiefs are responsible for evaluating if data acquired from these external sources can be used to supplement department data.

The department provides no broad, dedicated support for staff to coordinate and train external sources such as citizen scientists to collect samples, conduct field audits, or analyze and manage data. Department support to these groups has been limited to providing advice and limited training (Stream Waders). Department staff may seek/use/incorporate environmental data from the external sources that do not meet the department data quality requirements as long as staff acknowledge that data quality may differ from expected controls and that staff planning to acquire and use these data seek permission or approval from each data source and provide proper attribution.

10 IMPLEMENTATION

Department program units are encouraged to develop and utilize standard operating procedures wherever appropriate. Existing standard operating procedures for some sampling programs and contractual laboratories may be incorporated into quality assurance project plans by reference. For example, procedures for water quality sample preservation techniques are available in the laboratory standard operating procedures included as an Appendix to in the current ‘MDDNR Mainstem/Tributaries Monitoring Quality Assurance Project Plan.’ Field protocols are also incorporated in the quality assurance project plan. The Project leader and/or Program Chief determine when standard operating procedures are needed and oversee the preparation, review and updates of these documents. The Project leader or lower levels of quality assurance staff (field staff, laboratory staff) should review standard operating procedures annually and notify Program Chief, Unit Director and the Quality Assurance Manager of any changes needed and request approval for the changes from the Unit Director. The Project leader and/or Program Chief are responsible for ensuring that changes are made as described in updated standard operating procedures. Out-of-date standard operating procedures should be retained in accordance with the provisions in Section 7.1.

10.1 Standard Operating Procedures - see Section 3.3.1.3

These documents describe approved procedures for performing certain routine or repetitive tasks. Standard operating procedures are necessary to ensure comparability among activities performed on different occasions or by different individuals. Standard operating procedures should be developed in accordance with EPA’s *Guidance for the Preparation of Standard Operating Procedures* (EPA, 2007). Some standard operating procedures are listed in Appendix B.

11 ASSESSMENT

Different types of assessment activities are used to verify that measurement systems are operating appropriately and that the data generated by these systems are appropriate for their intended use. Quality Control procedures like Data Quality Audits, Performance Audits and Systems Audits should be defined in the quality assurance project plan along with information about the administration and evaluation processes. The Program Chief or a designated QC

Officer is responsible for ensuring implementation of all required Quality Control studies and implementation of any required corrective actions. Results may be used internally to ensure quality field or laboratory data or to correct specific problems, shared with others (as with the Chesapeake Bay Program split sample program) or reported in a summary report as a grant requirement or in a separate document. Corrective actions (Section 12), if required, should be documented in an appropriate reporting format. Each of the following assessment activities may be used alone, or in conjunction with others, to evaluate the targeted process.

11.1 Data Quality Audits (Data Verification/Validation)

Data quality audits involve the evaluation of data generated in support of a program or activity with respect to appropriate quality criteria. These criteria may be established by rule, by contract or by a quality assurance project plan. This evaluation process is a shared responsibility among all levels of data consumers at the department. The Resource Assessment Service developed a data validation tool to help with the review of most water quality, continuous monitoring and spatial (dataflow) data collected by the department. This data validation tool is used by data management staff to review data, address data entry/analysis issues and improve data quality. Additional data review often is performed by receiving agencies (e.g., EPA).

Environmental monitoring programs that are submitting data to the department for transfer to the Chesapeake Bay Program will annually submit their quality assurance project plan to the department. The department will review these to ensure that they meet EPA's structural requirements outlined in *Guidance for Quality Assurance Project Plans* (EPA, 2002c). Copies of these documents along with updated standard operating procedures will be submitted to the Chesapeake Bay Program Quality Assurance Officer for review.

11.2 Performance Audits

Performance audits are quantitative evaluations of the ability of a system to produce appropriate, accurate and reliable data. Performance audits involve submission of like samples, sometimes of known concentration, to laboratories generating data for the department.

Environmental monitoring programs that are submitting data to the department for transfer to the Chesapeake Bay Program should seek opportunities to collect data for comparison of field measures at sites alongside planned on-the-water monitoring activities or adjacent to existing continuously recording sensors. Environmental monitoring groups should seek approval for this activity and procedures about close quarters sampling protocols to minimize disturbance/error in field measures.

- 11.2.1 Laboratory calibration / testing performance - Performance evaluation samples evaluate a laboratory's performance. Some contracts require laboratories to seek or hold certain certifications. The quality assurance project plan should describe

any required performance evaluation sampling and evaluation. Department programs are encouraged to use and consider the results of evaluation programs conducted by federal agencies (e.g., EPA, USGS, Fish and Wildlife Service, and NOAA), local governments (city/county agencies) and citizen monitoring efforts.

- 11.2.2 Inter-laboratory comparison - Department programs may require performance audit data for contractual laboratories that may participate in a specialized inter-laboratory comparison exercise, often with federal laboratories (e.g., EPA, USGS). Required inter-laboratory work should be described in the project quality assurance project plan.
- 11.2.3 Field program comparison - Environmental monitoring programs that are submitting data to the department for transfer to the Chesapeake Bay Program should seek opportunities to collect data for comparison of field measures at sites alongside planned on-the-water monitoring activities or adjacent to existing continuously recording sensors. Environmental monitoring groups should seek approval for this activity and procedures about close quarters sampling protocols to minimize disturbance/error in field measures.

11.3 Systems Audits

Systems audits are on-site, qualitative assessments of an organization's facilities, equipment, personnel, procedures and quality processes. Field audits verify that sample collection procedures are appropriate and are conducted by the project officer or their designee. Laboratory audits may be required by grants. Required systems audits should be described in the quality assurance project plan.

12 QUALITY IMPROVEMENTS

12.1 Corrective Action

Results of all audits identified may be reported as audit findings. These reports may identify deficiencies and corrective actions required of the audited parties. Audited parties may be required to submit a corrective action plan for noted deficiencies. The Project leader and/or Program Chief is responsible for ensuring that corrective actions are implemented as soon as feasible, ensuring that the corrective issue is successful in addressing the identified issue and documenting both the issue and the method used to correct it. The Quality Assurance Officer and Quality Assurance Manager should be notified of successful completion of needed correction actions.

12.2 Evaluation/Response Process

To ensure that all policy and management decisions and technical documents reflect appropriate scientific and legal judgment, a peer review system is available to the Project leader and/or Program Chief. Qualified individuals or organizations independent of the original work product conduct this review. *Internal peer review* may be conducted with department staff or the insight of experts not formally associated with the department may be sought as *external peer review*. Projects eligible for peer review include programs funded by federal or foundation grants, where the review process is a requirement for funding or as part of a Statewide review of proposed grants. Complex programs involving multiple agencies, goals and funds as well as new or unique agency programs, or programs that use innovative technologies may develop a peer review format.

Comments received are reviewed and changes may be implemented. Comments may be retained as part of the grant documentation or in the project file.

12.2.1 Internal peer review

All department programs utilize internal peer review as a quality management tool for the development of resource management policy, technical reports and other documents. Project leaders and/or Program Chiefs are encouraged to utilize peer review extensively, but are allowed wide discretion in its application.

12.2.2 External peer reviews

Many programs also incorporate external peer review into their management process. The external peer review process often involves the establishment and utilization of technical advisory committees, formal peer review panels or the use of existing interagency review processes required for receiving federal grants. External peer review may also be solicited from one or more recognized experts who evaluate department work products independently.

12.3 Dispute Resolution

The department will attempt to resolve quality assurance related disputes involving field, custody, laboratory, or data management practices at the lowest practicable level. In this process, informal quality assurance feedback up to the Quality Assurance Manager level may be sought. Approved or draft standard operating procedures and quality assurance project plan documents, contracts and previous versions of these documents will determine if the issue is a result of miscommunication. If these documents do not have the specific detail needed to resolve the issue, if the disputed practice is not documented or if it is believed that the methods recommended are not appropriate (i.e., incorrect application or outdated methods), then a more formal dispute process will be initiated. Declaration of authority, precedence or “weight of evidence” alone are not sufficient for resolving disputes.

The formal quality assurance dispute process involves several initial steps:

- 1) notification through supervisors/functional quality assurance feedback chain to the Quality Assurance Manager that there is an unresolved quality assurance related dispute to be addressed and who then will monitor the progress of the dispute
- 2) defining and documenting the problem with a summary of available options
- 3) defining and documenting decision support rules
- 4) sharing analysis and review of supportive and relevant peer-reviewed documents, analyses and accessible datasets

All steps will be documented for review. Literature reviews, communications with outside experts and specific research projects may be required to gather relevant data for analysis and review. At each level of review, discussions/proceedings/ findings shall be documented and distributed through feedback pathways to the Quality Assurance Manager. All parties shall make every effort to resolve disputes through discussion and negotiation.

Whenever a formal quality assurance dispute is resolved, this finding is documented and reviewed throughout the quality assurance functional chain. The Quality Assurance Manager will provide a final review and approval. Any required changes to quality assurance project plans or standard operating procedures resulting from a resolved dispute will be summarized for all staff in the functional quality assurance chain and noted in document updates. The Quality Assurance Manager will determine whether these findings should be distributed to other department water monitoring projects for informational purposes.

If the dispute cannot be resolved, the issue and supporting documentation are forwarded up the quality assurance functional feedback chain to the Quality Assurance Manager, who will review the information, request additional input or studies, if needed and make a decision based on the best information available.

Quality assurance issues between agencies or between the department and its contractors or subcontractors (e.g., EPA dispute with the department over the method for preserving nutrient samples) will be addressed at the lowest level. If necessary these issues may be referred up through the Quality Assurance Manager who may define necessary support to help resolve the dispute issue with other agency Quality Assurance Managers and authorities.

If a dispute between agencies cannot be resolved, the Quality Assurance Manager will forward key points of the dispute to the Secretary for review and negotiations with Senior Management representatives of other agencies involved in the dispute (e.g., other State agencies, EPA Regional Quality Council, senior-level EPA Senior Managers - Deputy and Regional Administrator, if necessary). Any negotiated resolution will be documented where necessary (standard operating procedures, quality assurance project plans) and communicated through the functional quality assurance chain to the appropriate level (supervisors, project managers, field staff).

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APPENDIX A – Definition of Terms

activity - an all-inclusive term describing a specific set of operations or related tasks to be performed, either serially or in parallel (e.g., research and development, field sampling, analytical operations, equipment fabrication), that in total result in a product or service.

assessment - the evaluation process used to measure the performance or effectiveness of a system and its elements. In this document, assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation, management systems review, peer review, inspection or surveillance.

audit - a planned and documented investigative evaluation of an item or process to determine adequacy and effectiveness, as well as compliance with established procedures, instructions, drawings, quality assurance project plans, and other applicable documents. Any one type of audit (of which there are several types) does not cover the total measurement system, but rather a specific aspect (e.g., field, laboratory, or management).

auditor - person empowered to perform audit activities.

contractor - any organization or individual that contracts to furnish services, items, perform work.

corrective action - measures taken to rectify conditions adverse to quality and, where necessary, to preclude their recurrence.

customer - any individual or organization for which items or services are furnished or work performed in response to defined requirements and expectations.

data quality assessment - a statistical and scientific evaluation of the data set to determine the validity and performance of the data collection design and statistical test, and to determine the adequacy of the data set for its intended use.

data quality objectives - qualitative and quantitative statements of the overall level of uncertainty that a decision-maker is willing to accept in results or decisions derived from environmental data. Data quality objectives provide the statistical framework for planning and managing environmental data operations consistent with the data user's needs.

design - specifications, drawings, design criteria, and performance requirements. Also the result of deliberate planning, analysis, mathematical manipulations, and design processes.

environmental data - any information or measurements resulting from field data collection activity, laboratory analyses or modeling involving the assessment of chemical, physical or biological factors related to the environment, and that describe environmental processes or conditions, or the performance of engineered environmental systems.

environmental monitoring - the process of measuring or collecting environmental data.

environmental measurements - the data collection or analyses activity or investigation involving the assessment of chemical, physical or biological factors in the environment which affect human health or the quality of life.

environmental programs - work or activities involving the environment, including but not limited to: characterization of environmental processes and conditions; environmental monitoring; environmental research and development; the design, construction, and operation of environmental technologies; and laboratory operations on environmental samples.

financial assistance - the process by which funds are provided by one organization (usually government) to another organization for the purpose of performing work or furnishing services or items. Financial assistance mechanisms include grants, cooperative agreements, and government interagency agreements.

GIS data - Geographic information system (GIS) data is data that captures the geographic location of associated information (known as attribute data).

graded approach - the process of basing the level of application of managerial controls applied to an item or work according to the intended use of results and the degree of confidence needed in the quality of the results.

management - those individuals directly responsible and accountable for planning, implementing, and assessing work.

management system - a structured non-technical system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for conducting work and producing items and services.

method - a body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification) systematically presented in the order in which they are to be executed.

objective evidence - any documented statement of fact, other information or record, either quantitative or qualitative, pertaining to the quality of an item or activity, based on observations, measurements, or tests that can be verified.

organization - a company, corporation, firm, enterprise, or institution, or part thereof, whether incorporated or not, public or private, that has its own functions and administration.

peer review - a documented critical review of work generally beyond the state of the art or characterized by the existence of potential uncertainty. The peer review is conducted by

qualified individuals (or organizations) who are independent of those who performed the work, but are collectively equivalent in technical expertise (i.e., peers) to those who performed the original work. The peer review is conducted to ensure that activities are technically adequate, competently performed, properly documented and satisfy established technical and quality requirements. The peer review is an in-depth assessment of the assumptions, calculations, extrapolations, alternate interpretations, methodology, acceptance criteria, and conclusions pertaining to specific work and of the documentation that supports them. Peer reviews provide an evaluation of a subject where quantitative methods of analysis or measures of success are unavailable or undefined, such as in research and development.

performance audit - A quantitative evaluation of the project measurement systems. This type of audit tests the measurement systems with samples of known composition or behavior to evaluate precision and accuracy. A performance audit is carried out under the authority of the Quality Assurance Staff without the knowledge of the sampler, analysts, or data entry staff.

performance evaluation - a type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst or laboratory.

procedure - a documented set of steps or actions that systematically specifies or describes how an activity is to be performed.

process - an orderly system of actions that are intended to achieve a desired end or result. Examples of processes include analysis, design, data collection, operation, fabrication, and calculation.

quality - the sum of features and properties/characteristics of a process, item, or service that bears on its ability to meet the stated needs and expectations of the user

quality assurance - an integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the customer.

Quality Assurance Manager - the designated lead for oversight of the department's quality assurance program and assists with a variety of quality assurance functions, including performance evaluations for water laboratories and review of quality assurance project plans.

quality assurance project plan - a formal document describing in comprehensive detail the necessary quality assurance, quality control, and other managerial and technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance (data quality) objectives.

quality control- the overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer.

quality improvement - a management program for improving the quality of operations. Such management programs generally entail a formal mechanism for encouraging worker recommendations with timely management evaluation and feedback or implementation.

quality indicators - measurable attributes of the attainment of the necessary quality for a particular environmental decision. Indicators of quality include precision, bias, completeness, representativeness, reproducibility, comparability, and statistical confidence.

quality management - that aspect of the overall management system of the organization that determines and implements the quality policy. Quality management includes strategic planning, allocation of resources, and other systematic activities (e.g., planning, implementation, and assessment) pertaining to the quality system.

quality assurance management plan - a formal document that describes the quality system in terms of the organizational structure, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, and assessing all quality assurance activities conducted.

quality system - a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance/quality control procedures.

record - a completed document that provides objective evidence of an item or process. Records may include photographs, drawings, or data recording media.

service - the category of economic activity that does not produce manufactured items. In environmental data operations or engineering projects, such activities include design, inspection, laboratory and/or field analysis, repair, and installation

specification - a document stating requirements and which refers to or includes drawings or other relevant documents. Specifications should indicate the means and the criteria for determining conformance.

standard operating procedure - a written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps, and that is officially approved as the method for performing certain routine or repetitive tasks.

supplier - any individual or organization furnishing items or services or performing work according to a procurement document or financial assistance agreement. This is an all-inclusive term used in place of any of the following: vendor, seller, contractor, subcontractor, fabricator, or consultant.

surveillance (quality) - continual or frequent monitoring and verification of the status of an entity and the analysis of records to ensure that specified requirements are being fulfilled.

systems audit - A qualitative evaluation of all components of field, laboratory, and data management quality control measurement systems. The purpose of the systems audit is to determine if the measurement systems are being used appropriately. Systems audits may be conducted before, during or after the measurement system becomes operational. A system audit typically involves a comparison of the activities given in this plan and/or the approved sampling and analysis plan with those actually scheduled or performed. A special type of systems audit is the data management audit. This audit addresses only data collection and management activities.

technical review - a documented critical review of work that has been performed within the state-of-the-art. The review is accomplished by one or more qualified reviewers who are independent of those who performed the work, but are collectively equivalent in technical expertise to those who performed the original work. The reviews are an in-depth analysis and evaluation of documents, activities, material, data, or items that require technical verification or validation for applicability, correctness, adequacy, completeness, and assurance that established requirements are satisfied.

validation - an activity that demonstrates or confirms that a process, item, data set, or service satisfies the requirements defined by the user.

verification - the act of authenticating or formally asserting the truth that a process, item, data set, or service is, in fact, that which is claimed.

APPENDIX B – Maryland Environmental Data Quality web pages

Managing and preserving Maryland’s natural resources affects the quality of life, our economy, our health and well-being. The Maryland Department of Natural Resources (the “department”) must collect, analyze and use environmental data to help make informed decisions and effectively manage these resources. To make sure that this information is of the highest quality, the department defines a data quality process to ensure that continuous quality improvement is integrated into every unit in the department.

Below are links for the department’s main quality management plan and some of the individual project Quality Assurance Project Plans and Standard Operating Procedures that define the procedures we follow in our monitoring efforts.

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Quality Assurance Management Plan

MD DNR Quality Assurance Management Plan for Environmental Data Collection version 2.0
February 2022 (available at eyesonthebay.dnr.maryland.gov/eyesonthebay/stories.cfm)

Quality Assurance Project Plans:

All MD DNR QAPPs are available at eyesonthebay.dnr.maryland.gov/eyesonthebay/stories.cfm

External partner QAPPs

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APPENDIX C – Other Environmental Quality Management resources

International Organization for Standardization (ISO)

In addition to guidance for a quality management approach provided by the EPA, documents developed by the International Organization for Standardization (ISO) (iso.org/home.html) may provide an additional source of environmental quality and standards information. ISO is a network of the national standards institutes of 162 countries with a coordinating Central Secretariat in Geneva, Switzerland. ISO is a non-governmental organization that forms a bridge between the public and private sectors, an approach that enables a consensus to be reached on solutions that meet both the requirements of business and the broader needs of society.

Most completed standards are specific to a product, material or process, but ISO 9001 (quality management system, iso.org/iso-9001-quality-management.html) is defined by ISO as “generic management system standards”, that is, they can be applied to any organization, no matter the product or service and to business, public administration or government agency.

Where ISO has not completed standards, they have a number of technical committees (TC) - many of which are working on environmental and resource management standards (methods and materials), including:

- TC 48 Laboratory equipment
 - TC 113 Hydrometry methods
 - TC 147 Water quality methods
 - TC 176 Quality management and quality assurance - especially ISO 18091:2014,
(Application of ISO 9001:2008 in local governments).
 - TC 234 Fisheries and aquaculture
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US EPA / Region 3 and Chesapeake Bay Program

A key influence on quality management within Maryland’s environmental resource protection and management agencies comes from partnerships between federal, state and local agencies that are focused on common goals. Development of working relationships between partners with an emphasis on quality management ensures an outcome that increases knowledge of complex, natural systems and lessons for further success.

EPA Quality System: epa.gov/quality

- Region 3 EPA Quality Assurance:
 - epa.gov/quality/managing-quality-environmental-data-epa-region-3
 - Chesapeake Bay Program Office:
 - chesapeake_bay_quality_assurance_program/quality_assurance_planning
 - Quality Management Plan for the Chesapeake Bay Program Office
chesapeakebay.net/documents/CBPO_QMP.pdf

APPENDIX D – Record of Revisions

Issue	Date	Section Modified	Description
Version 2 Final	February 2022 following EPA Region 3 Review	Throughout	Updates to hyperlinks and references.
		Title Pages	Updated dates and Publication Tracking #.
		Signature Page	Updated dates and Publication Tracking # and appropriate staff names.
		1 Introduction	Updated budget and number of employees to FY2021 numbers.
		2.2 Goals	Add text to 2.2.3, 2.2.4 and 2.2.13 to address EPA Region 3 QMP review comments.
		3 Organization, Quality Assurance Responsibilities and Communication	Updated 3.1.1 information for combined oversight by Deputy Secretary/Chief Operating Officer (update from May 2021 DNR organization); updated Figure 1 to new DNR organization chart as of November 2021.
		3.3 Communications	Updated section 3.3.1.3 to address EPA Region 3 QPM review comments; updated 3.5 to the most recent EPA Region 3 QMP reference.
		7 Documents and Records	Updated second paragraph to address EPA Region 3 QPM review comments; updated 7.1 with most recent citations.
		8 Information Services/ Hardware/Software	Updated Maryland Department of Information Technology citation and removed the specific list of policies because they are integrated into the online references.
		13 References	Updated Reference list and some hyperlinks.
Version 2.0 Draft	May 2021 Update of approved QAMP 2016	Throughout	Corrections, agency/staff updates, website corrections, contact information, references, editorial edits.
		Title Pages	Update format and content.
		Signature Page	Update Executive Officers.
		Preface	Added a List of Figures, moved List of acronyms to Preface.

1 Introduction	Update agency statistics.
2.2 Goals	Edited content to simplify and include hyperlinks to sources.
2.2.13	Edited content to accurately describe department's role; moved some content to new section 9.4.
3 Organization, Quality Assurance Responsibilities and Communication	Edited content to simplify and include hyperlinks to sources.
3.1. Management and Organization	Renamed for consistency with EPA checklist; update department organization and organization chart (Figure 1), Revise Figure 2, specify that the Quality Assurance Manager is independent and reports directly to the Secretary.
3.1.2.1 Resource Assessment Service	Updated and simplified description.
3.1.2.14 Maryland Forest Service	Updated the reporting of Forest Service data.
3.1.3.2 Finance and Administrative Services	Updated text with mission statement text.
3.1.3.3. Human Resources Services	Updated text with mission statement text.
3.2 Quality assurance responsibilities	Revise Figure 3 and 4, Updated Quality Assurance Manager, specify that Quality Assurance Manager is independent and reports directly to the Secretary.
3.3 Communications	Added hyperlinks.
3.3.1 Quality System Documentation	Renamed section for consistency with EPA QMP guidance.
3.3.1.1 Quality Management Plan	Added text to describe staff responsibilities for review and approval procedures for such documentation.
3.3.2.2 Interagency Meetings	Update first bullet of interagency workgroups- removed Tributary Strategy Team.
3.3.4 Newsletters/Reports	Deleted this section and moved information to 3.3.3 Internet/Intranet; publications are almost all online.
3.3.4 Employee performance planning and evaluation	Renumbered 3.3.4, updated content, specified the QA duties are in MS22s.
3.3.6.1 Governor's Office of Performance Improvement	Moved the second paragraph to a separate subsection 3.3.6.2. Open Data Portal and re-numbered the rest.
3.3.6.5 Citizen Advisory Groups	Removed list of specific groups.

3.4 Project Planning, Documentation and Assessment	Added section for consistency with EPA QMP guidance to direct reader to later sections that have the details.
3.5 Quality Management Plan Review and Approval	Added section for consistency with EPA QMP guidance and moved text from section 4 to this section; added text to the review and approval procedures for such documentation.
4 Quality Assurance Management System	Renamed to better reflect EPA QMP structure, Revise Figure 5, edited content to simplify and include hyperlinks to sources; added text to indicate how it relates to department mission.
4.1.1 Program	Elevated up a level, updated and edited content to simplify.
4.1.2 Policy	Elevated up a level, updated and edited content to simplify.
4.1.3 Project	Elevated up a level, edited content to simplify.
5 Personnel Qualifications and Training	Elevated to Section 5 to match EPA QMP structure, updated section title, reviewed and updated by DNR Human Resources; adjusted the lower level sections as appropriate.
5.1 Personnel requirements and responsibilities	Added minimum training for personnel necessary to implement the QMP.
6 Procurement of Information/Items/Services	Elevated to Section 6 to match EPA QMP structure; adjusted the lower level sections as appropriate; added text that Fiscal Services and admin staff help with procurement compliance.
8 Information services/hardware/software	Elevated and moved to Section 8 to match EPA QMP structure, adjusted the lower level sections as appropriate. Updated references.
7 Documents and Records	Elevated to Section 7 to match EPA QMP structure, Renamed section, edited content to simplify, updated to current process for records retention plans and updated hyperlinks, adjusted the lower level sections as appropriate, added text to define review process and staff responsibilities.
7.1 Records Retention	Elevate some text to previous level as initial section of 7, rename section.
9 Planning Process	Elevate to Section 9 to match EPA QMP structure, add text detailing staff responsibilities.
9.3 Environmental Review	Updated the paragraph for consistency with the updated policy.
9.4 External Data Sources	Added section 9.4 to match EPA QMP requirements and structure.

		10 Implementation	Elevate to Section 10 to match EPA QMP structure, rearranged text to match format of other sections; added text detailing staff responsibilities.
		11 Assessment	Elevate to section 11 to match EPA QMP structure, adjust the lower level sections as appropriate.
		12 Quality Improvements	Added Section 12 for Quality Improvements and included former sections 4.8.4, 4.9., 4.10.
		12.1 Corrective Actions	Added text about responsibilities and documentation.
		Moved Appendix B to Preface	Update list of acronyms; renamed other Appendices.
		New Appendix B Maryland Environmental Data Quality web pages	Updated links and contact information for Quality Assurance Manager, update EPA websites and information to new Appendix C- Other Environmental Quality Management resources.
		Moved Appendix E to Section 13 References	Update References.
Version 1.6	March 2016 (interim plan update submitted October 2015)	Throughout	Corrections, agency/staff updates, website corrections, contact information, references.
		Cover	Executive officers, agency home address, vision statement.
		Cover sheet	QA Manager, address and contact information.
		1 - Introduction	Updated agency statistics.
		2.2.13 – Approach to assess non-agency data for the EPA Chesapeake Bay Program	Add discussion about DNR QA procedures to be implemented in support of submitting non-agency data to EPA Chesapeake Bay Program to supplement Bay data.”
		2.2.14.2 – Data from federal agencies other than EPA	Updated US Dept. Commerce/National Estuarine Research Reserve process for submitting national estuarine monitoring data accessible to the Chesapeake Bay Program.
		3.1 Organization	DNR organization – updated organization chart and recent management changes in oversight/program names.
		3.1 1.2 QA Support Units	Update Mission Support unit information.
		3.2 QA responsibilities	Update information/background about QA Manager.
		3.3.6 Agency performance evaluation	Delete references to StateStat and BayStat and incorporate discussion about the Governor’s Office of Performance Improvement (GOPI) as a replacement evaluation tool that is more continuous and utility of the Open Data Portal as an accessible evaluation tool for the public.

		3.3.8 – Citizen advisory groups	Updated with respect to assessing environmental data quality.
		4.1.3 – (Process) Project	Description about how quality of data from non-agency sources will be evaluated and data transferred to EPA.
		4.2.4 – Personnel (Staff proficiency)	Updated information on State Performance Planning and Evaluation process.
		4.5 - Documentation	Describe how State’s Public Information Act are public records.
		4.5.1. Accessibility, protection and Retention- Documentation	Describe use of electronic data review systems to assess quality of larger and more complex datasets of ‘public’ records.
		4.8 – Assessment process (performance audits)	Add section on Field Program Comparison (4.8.2.3).
		4.10 - Dispute resolution	Added detail about responsibilities, QA delegation and feedback, and dispute resolution. Added Figure 4 as an example of one project QA process/pathways.
		Appendix B	Updated list of acronyms.
		Appendix C	Deleted Appendix C from 2010 version (DNR Staff Investment in QA Activities). Replaced with summary of DNR Environmental Data Quality web site.
		Appendix D	Other Environmental Quality Management resources (ISO and EPA).
		Appendix E	Updated references.
Version 1.5	May 2010 (interim plan update submitted June 2008)	Throughout	Corrections, reference updates, duplicate language removed.
		1 - Introduction	Updated annual budget/staffing information.
		2.1 - Policy	Updated agency mission statement.
		2.2 - Goals	Replaced 2.2.7 “Other organizations” with “Federal reporting requirements”. Added 2.2.13 Implementation of other federal agency quality data collection efforts - NOAA, USDA Forest Service with QA requirements.
		3.1 Organization	Updated 3.1.1 to address organizational changes including replacement of Figures 1 (organizational chart) and 2 (QA operational framework).
		3.2 QA responsibilities	Added detail about responsibilities, QA delegation and feedback, and dispute resolution. Added Figure 4 as an example of one project QA process/pathways.

		3.3 Communications	Updated 3.3.6 - added Managing for Results, StateStat and BayStat discussions.
		4. QA Management Program	Updated EPA QA text/citations throughout.
		4.1 Process	Updated 4.1.1 - information about ANSI/ISO/ASQ Q9001. Update 4.1.2 - State management programs / MFRs QA Manager.
		4.2 Personnel and training	Added to 4.2.3 information about QA training activities.
		4.5 Documentation	Added to 4.5.1 information about accessibility, protection and retention. Update on proposed QA website.
		4.10 - Dispute resolution	New section added.
		Appendix A	Modified definitions to address those in plan.
		Appendix B	Added QA-related acronyms/definitions.
		Appendix C	“References” now Appendix E. Contents replaced with “DNR staff investment in QA activities”.
		Appendix D	Replaced “Sample QAPP” with “DRAFT Environmental Data Quality webpage”.
		Appendix E	“Revisions” now Appendix F. Updates references.
		Appendix F	Updated revisions since v.1.4.
Version	November	Signature sheet	Updated (2/2/2006) to address position changes.
1.4	2005 (updates to organization - February/	3.1 Organization	Added applicable specifics regarding the new Executive Operations Policy. Text updated (3/15/2006) for organization changes Figures 1, 2 updated for organization changes.
	March 2006)	3.2 QA Responsibilities	Expanded QA responsibilities provided visual representation of QA chain and discussion to modify applicable staff position descriptions to include QA role in personnel evaluations. Expanded on QA problem solving process.
		3.3 Communications	Updated 3.3.1.4 to address SOP revisions.
		Appendix D	Inserted example QAPP (MD Biological Stream Survey) as Appendix D (Revisions record becomes Appendix E).
Version	August 2005	2.2.12 QA goals	Quality Management Plan review timetable and approval.
1.3		4.1.2 Program Process	Add information about DNR’s Management System Review.
		4.5.1 Records Accessibility	Document updates/outdated document process.

		4.5.2 Records Access	Confidentiality issues.
		4.6.2 QA Project Plans	Should include chain-of-custody/confidentiality as necessary.
		4.7.1 Implementation – SOP	SOP review and format. Example provided.
		4.8 Assessment process	Quality control audit processes as part of QAPP - implement as necessary.
		4.8.1 Data Quality Audits	Update on data validation tool.
		4.8.2 Performance audits	Discussion in QAPPs.
		4.8.3 Systems audits	Discussion in QAPP.
		4.8.4 Corrective actions	Responsibility for ensuring corrective actions defined.
		4.9 Evaluation/Response	Discussion about implementing peer review programs.
Version 1.2	May 2005	Cover page	Banner logo replaced; Updated State executive officers.
		Inside cover page	Updated Department executive.
		Cover sheet	Updated Department executive; Quality Assurance manager.
		Signature sheet	Updated contacts – guidance from EPA QA Officer.
		Concurrence sheet	Deleted.
		Entire report	Updated references.
		1. Introduction	Updated Department statistics.
		3.1 Organization	Updated management structure/function.
		Figure 1	Replaced with updated organizational chart/contacts.
		3.1.2 Watershed services	Renamed unit - removed reference to nonpoint source mgmt.
		3.1.3 Forest Service	Added new management division and description.
		3.1.4 Wildlife and Heritage	Renamed unit - modified description.
		Figure 2	Inserted flowchart of DNR’s QA operational framework.
		3.1.7 Finance and Admin	Modified Department statistics. Deleted.
		3.1.9 Matrix teams	New section extracted from 3.3.2 Technical meetings.
		3.3.3 Intranet/Internet	Updated with Internet e-mail list/newsletter information.
		3.3.4 Newsletter/reports	Updated available magazine and newsletters.

		4.0 Quality Assurance Management Program	Updated Quality Management Program background and references that were reviewed. Modified process to reflect organization changes. Added discussion of DNR Strategic Plan/Mgmt for Results.
		Figure 3	Renumbered Figure 2.
		Appendix A	Added new terms/definitions.
		Appendix C	Updated cited references/resources.
		Appendix D	Added to track revisions.
Version	December	Inside cover page/ sheet	Updated Department executives.
1.1	2001	Signature sheet	Updated contacts.
		Goals (2.2)	Modifications to original QAMP suggested by EPA QA officer. Add internal assessment (2.2.11); Add plan review (2.2.12).
		QA Responsibilities (3.2)	Updated QA Manager duties (3.2).
		Technical meetings (3.3.4)	Expanded interagency meetings.
		References	Corrected references.
Original issue	December 1999	Original	Original