Quality Assurance Project Plan

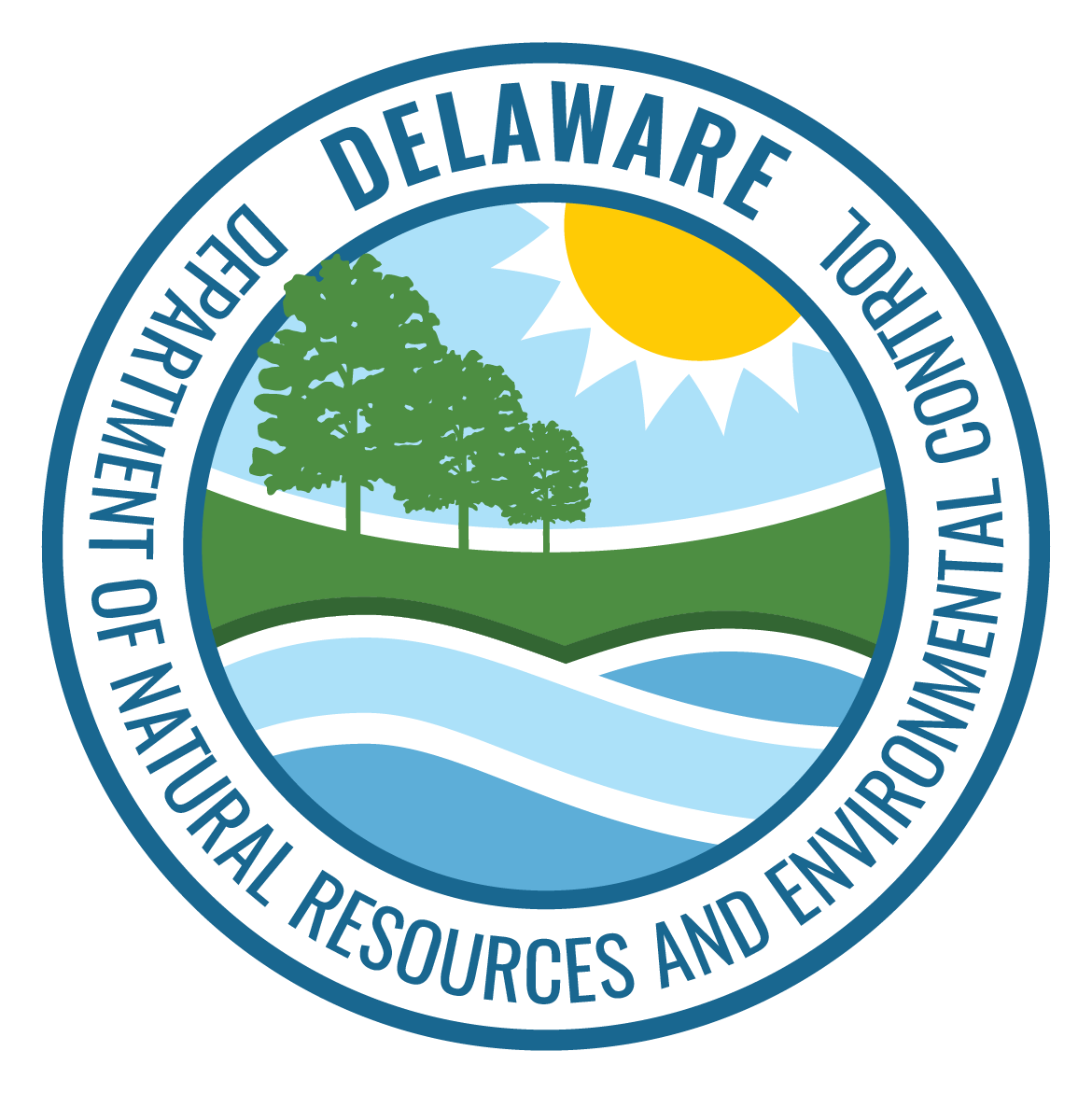
*for*

**Chesapeake Bay Point Source Data Collection**

*Prepared for:*

Delaware Department of Natural Resources and Environmental Control

Division of Watershed Stewardship

Watershed Assessment and Management Section

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May 2017

QAPP 485, Revision 3

REVISED September 2022 by DNREC STAFF

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| --- |
| This quality assurance project plan (QAPP) has been prepared according to guidance provided in the following documents to ensure that environmental and related data collected, compiled, and/or generated for this project are complete, accurate, and of the type, quantity, and quality required for their intended use:   * *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5, EPA/240/B-01/003, U.S. Environmental Protection Agency, Office of Environmental Information, Washington DC, March 2001 [Reissued May 2006]). http://www.epa.gov/quality/qs-docs/r5-final.pdf * *Guidance for Quality Assurance Project Plans. EPA QA/G-5* (EPA 240/R-02/009), U.S. Environmental Protection Agency, Office of Environmental Information, Washington, DC, December 2002. http://www.epa.gov/sites/production/files/2015-06/documents/g5-final.pdf |

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**APPENDICES**

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**ACRONYMS AND ABBREVIATIONS**

CBP Chesapeake Bay Program

DMR Discharge Monitoring Report

DNREC Delaware Department of Natural Resources and Environmental Control

DQO data quality objectives

DWS Division of Watershed Stewardship

eDMR Electronic Discharge Monitoring Report

EPA Environmental Protection Agency

ICIS Integrated Compliance Information System

NEIEN National Environmental Information Exchange Network

NPDES National Pollutant Discharge Elimination System

NWIS National Water Information System

PARCC precision, accuracy, representativeness, completeness and comparability

PCS Permit Compliance System

PM Project Manager

QA quality assurance

QAM Quality Assurance Manager

QAO Quality Assurance Officer

QAPP quality assurance project plan

QC quality control

QCO Quality Control Officer

QNCR Quarterly Non-compliance Reports

SOP standard operating procedure

STORET EPA Storage and retrieval warehouse

TMDL total maximum daily load

TRI Toxics Release Inventory

USEPA U.S. Environmental Protection Agency

USGS U.S. Geological Survey

WIP watershed implementation plan

WWTP wastewater treatment plant

# A PROJECT MANAGEMENT

# A1 Distribution

This quality assurance project plan (QAPP) will be distributed to the Delaware Department of Natural Resources and Environmental Control, Division of Watershed Stewardship (DNREC-DWS), Division of Water (DNREC-DW) and United States Environmental Protection Agency (EPA) staff listed below through the DNREC Project Manager (PM) and EPA Chesapeake Bay Program (CBP) PM.

|  |  |  |
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# A2 Project Organization

The purpose of this QAPP is to describe the quality system that data generators and DNREC users will implement to collect, compile, and harmonize discharge monitoring data and report it electronically to CBPO. Data reported is used by EPA’s CBP staff to assess and evaluate performance of the Chesapeake Bay Watershed Implementation Plan.

This QAPP is intended to cover only point source data collection from Industrial and Municipal facilities along the Chesapeake Bay watershed in Delaware. Data are collected by the permitted facilities or authorized contracted laboratories that use methods approved at 40 CFR Part 136 and participate in EPA’s Discharge Monitoring Report - Quality Assurance (DMR-QA) proficiency testing program. Discharge monitoring data are reported to an information system in accordance with the requirements of 7 Del. C. 1953, § 6014, regulatory and compliance information, facility performance and public information. Currently, data are reported electronically using the electronic Discharge Monitoring Report (eDMR) online results system, which are then reformatted as appropriate for data exchange to EPA’s CBP.

This QAPP includes data quality objectives (DQOs) and quality control (QC) procedures to ensure that the final product satisfies the Bay grant guidance requirements. This QAPP also addresses the collection and assessment of secondary data (data collected for another purpose or collected by an organization or organizations not under the scope of this QAPP). It is anticipated that secondary data will be collected almost exclusively from permittee eDMR submissions.

The organizational aspects of the program provide the framework for conducting the necessary tasks. The organizational structure and function also facilitate project performance and adherence to QC procedures and quality assurance (QA) requirements. Key project roles are filled by the persons who are leading the various technical phases of the project and the persons who are ultimately responsible for approving and accepting final products and deliverables. The responsibilities of these persons are described below.

If, during the period of performance, additional updates, amendments, or revisions to the QAPP are required to describe environmental data operations not included in this plan, DNREC will submit any required updates or amendments to EPA for review and approval prior to performing any environmental data operations identified. The approved attachments or amendments will be distributed by the DNREC PM and the EPA-CBP PM to the personnel identified in the distribution list, and to any other technical staff assigned to support the project.

The project organization chart, presented in Figure 1, includes relationships and lines of communication among all participants and data users. The responsibilities of these persons are described below.

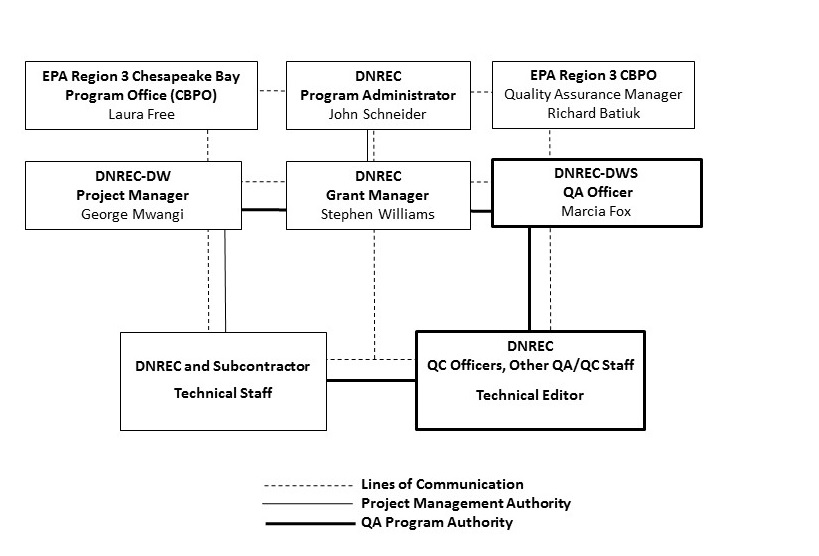


Figure 1. Project Organization

Marcia Fox is the DNREC Program Administrator for the project. She will provide overall administrative and oversight support to the DNREC PM, George Mwangi to ensure availability of resources and technical support to provide EPA’s CBP with valid, reliable data for its continuing assessment and evaluation of the Chesapeake Watershed Implementation Plan.

George Mwangi is the DNREC PM, for the Division of Water and he will provide overall project and program oversight for the project. He is coordinating the development of this plan for implementation in DNREC offices and will oversee plan implementation upon approval. Mr. Mwangi will also collaborate with the EPA CBP PM, Autumn Rose, to ensure that project objectives are sufficiently documented and presented in this plan. The DNREC PM will also have the responsibilities listed below:

* Provide oversight for selection of analytical tools used to support data reporting to the CBPO, including data quality assessment, and adherence to project objectives and system requirements and protocols.
* Maintain the official approved QAPP for DNREC.
* Facilitate participation of the DNREC, EPA, and key local participants on the project workgroup(s)
* Coordinate with contractors, reviewers, and others to ensure technical quality and contract adherence.

Jennifer Walls is the QA Officer for DNREC’s Division of Watershed Stewardship, (DWS), and she or her designee will be the primary point of contact for DNREC in this task, as it is limited to development of QA guidance (this plan) for collection and reporting of data to CBPO. Ms. Walls will coordinate amongst DNREC and EPA CBP staff and management participating in this project, as needed.

Autumn Rose, the EPA CBP PM, will support DNREC Project staff in technical and managerial oversight of the project including establishing technical requirements and specifications, review of interim and final work products. She will also provide final review and approval of this plan and subsequent deliverables developed under it on behalf of the EPA CBP.

The EPA CBP Quality Assurance Manager (QAM) is Durga Ghoush. The QAM, or their designee, will review and approve this plan, conduct external performance and system audits, as appropriate, and participate in any other EPA QA reviews of the study.

# A3 PROBLEM DEFINITION/BACKGROUND

This QAPP addresses the steps DNREC will take to identify and access National Pollutant Discharge Elimination System (NPDES) permitted discharge monitoring data from five permitted point source discharges in the Chesapeake Bay watershed (Table 1); review them for completeness and apparent representativeness; and harmonize or reformat the data as necessary to ensure data integrity in the exchange or transfer of data to CBPO.

DNREC’s point source data collection focuses on collecting data from the five significant permitted industrial and municipal facilities currently located in the Chesapeake Bay watershed. The data are collected through each facility’s submission of eDMRs as required by their permit. eDMRs are reports that provide analytical results of chemicals and nutrients being discharged by NPDES permitted facilities (point sources) into the waterways of Delaware. The data undergo rigorous quality assurance checks before being uploaded into DNREC’s online reporting eDMR system (Delaware Environmental Navigator [DEN]) and uploaded into EPA’s Integrated Compliance Information System (ICIS).

Annually, the point-source data are compiled into a report to be used by the EPA’s CBP in Chesapeake Bay modeling assessment to track the environmental impact upon bay waters. The Chesapeake Bay Program Grant Guidance requires a Quality Assurance Project Plans (QAPP) for the collection and use of environmental data. A QAPP documents the procedure for obtaining thorough, correct data to ensure consistency from year to year. The QAPP needs to be up to date to assist in facilitation of the grant monitoring process.

Table 1. Permitted point source discharges and identifying information

|  |  |  |  |
| --- | --- | --- | --- |
| **Facility Name** | **NPDES Permit Number** | **Federal Registry ID Number** | **DNREC ID Number** |
| Town of Bridgeville Wastewater Treatment Plant | DE0020249 | [110000880761](about:blank) | WPCC 3068D86 |
| City of Seaford Wastewater Treatment Facility | DE0020265 | [110039821271](about:blank) | WPCC 3161F/74 |
| Town of Laurel Wastewater Treatment Plant | DE0020125 | [110012890354](about:blank) | WPCC 3165F/74 |
| INV Performance Materials, LLC (Fomerly Invista S.A.R.L.) | DE0000035 | [110064631849](about:blank) | WPCC 3223E/74 |
| Mobile Gardens Trailer Park | DE 0050725 | [110010052646](about:blank) | WPCC 3014F/77 |

This task does not require environmental measurement or generation of laboratory data but involves the use of primary and secondary data generated by permittees. Data quality used are anticipated to be consistent with EPA’s competency policy, produced by authorized permittees and suitably accredited laboratories using methods approved for use at 40 CFR Part 136. Thus, unless there are observations or other compelling reasons not to believe that the data are scientifically valid, chemical, physical, and biological monitoring data collected under an accepted sampling and analysis plan, including quality control, quality assurance procedures, data will be converted, reformatted, or harmonized (e.g., units of measure) to achieve compatibility with CPBO. All data manipulation or handling necessary to ‘harmonize’ the datasets for supplemental analyses must be documented and retained in electronic metadata records and project files. No original DMR files will be overwritten or directly revised, but staff may make copies of files as appropriate and include the date in the filename to re-enforce version control.

# A4 Quality Objectives and Criteria

This task entails collecting, compiling, assessing and summarizing permitted discharge monitoring data and analytical results, and formatting or repackaging data and information to ensure its compatibility with CBPO technical specifications, completeness for its use in annual report development, and its availability to other exchange partners. No original DMR data collection has been specified. Accordingly, the most relevant QA procedure for this project is professional review of available information, analyses, and written work products.

The basic requirements of this project are that DNREC must ensure that the analyses performed and subsequent interpretations under this task are quality products that are based on sound scientific principles, and that any revisions and updates are reproducible and transparent. The analyses provided will be logical, consistent, and defensible.

Since the task does not include the development or application of a mechanistic model and does not involve sampling/primary data collection, this QAPP follows an abbreviated format and does not describe modeling-related activities but relies more on the guidance described in EPA’s *QAPP Requirements for Secondary Data Projects* (USEPA 2008). If DNREC, in response to EPA CBP technical direction or grant amendment, requests support that entails additional environmental data operations, or if revisions to the QAPP are required to describe environmental data operations not included in this plan, DNREC will prepare any required updates or amendments and provide to EPA for review and approval prior to performing any environmental data operations identified. The approved attachments or amendments will be distributed by the DNREC PM and EPA CBP QA Officer. Distribution of approved updates or plan revisions (approved by the same persons as the original plan) must include all persons identified in the distribution list in addition to signatory staff, and any other technical staff assigned to support the project.

## A4.1 Data Quality Objectives (DQOs) and Criteria

The data quality objectives process describes the technical planning for a specific project or task in the context of the problem being addressed, the study questions to be answered, the decisions to be made, the information and resources required to inform management decisions, and the tolerance for error (importance of the decision in terms of risk). EPA has recommended published guidance on technical project planning using the DQO process as described in EPA’s *Guidance on Systematic Planning Using the Data Quality Objectives Process QA/G-4* (USEPA 2006). The seven step DQO process is loosely applied to the current approach, as the full DQO process includes development of sampling design and technical specifications, which is not necessary for this task. The current task is to access available discharge monitoring data and prepare it for its transfer to CBPO for EPA’s use in annual reporting on the watershed implementation plan.

The data quality objectives and criteria specific to this project are described in Attachment 6 of the Chesapeake Bay Program Grant Guidance “Chesapeake Bay Program Wastewater Facility and BMP Implementation Data Submission Specifications and Requirements.” The document includes established data submission requirements that meet the communications and management needs of the Chesapeake Bay Program. DNREC will use the CBP’s Point Source Data Submission Application to submit wastewater facility Discharge Monitoring Report (DMR) data from the five facilities in the Chesapeake Bay Watershed. Monthly concentration and flow data for all parameters for each discharger facilities will be submitted. Data for the following parameters will be submitted: average monthly flows and average monthly concentrations of NH3, TKN, NO23 (or NO2+NO3), TN, PO4, TP, BOD5, DO and TSS. All nitrogen species will be reported as nitrogen and phosphorus species as phosphorus. DNREC will go through the Application’s QAQC procedures prior to data submission. For any missing concentration data, DNREC will submit the CBP Water Quality Goal Implementation Team’s Wastewater Treatment Workgroup agreed to default concentration data or calculated data based on the species relationship listed in Appendix B. All default or calculated data will be flagged with appropriate descriptions. DNREC will update the facility list annually and identify newly added or removed facilities in the annual data report. The location (county, latitude/longitude) of discharge point, significant or non-significant, facility type (municipal or industrial), ownership (federal or non-federal) and design flow (MGD) will be reported for newly added facilities.

As the project will rely exclusively on secondary data collected and compiled by permittees, the information collection design elements are not applicable.

### A4.1.1 State the Problem

On December 29, 2010, the EPA established the Chesapeake Bay Total Maximum Daily Load (TMDL), a historic and comprehensive “pollution diet.” This TMDL includes accountability features to guide sweeping actions to restore clean water in the Chesapeake Bay and the region’s streams, creeks and rivers.

Despite extensive restoration efforts during the prior 25 years, the TMDL was prompted by insufficient progress and poor water quality in the Chesapeake Bay and its tidal tributaries. The TMDL was required under the federal Clean Water Act and responded to consent decrees in Virginia and the District of Columbia from the late 1990s. It was also a keystone commitment of a federal strategy to meet President Barack Obama’s Executive Order to restore and protect the Chesapeake Bay.

The TMDL is the largest ever developed by EPA, encompassing a 64,000-square-mile watershed. The TMDL identifies the necessary pollution reductions from major sources of nitrogen, phosphorus and sediment across the bay jurisdictions and sets pollution limits necessary to meet water quality standards. Bay jurisdictions include Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia and the District of Columbia.

Watershed implementation plans (WIPs) were developed to assist local agencies toward their compliance with TMDL load and wasteload allocations. The Chesapeake Bay WIPs are described at [https://www.epa.gov/chesapeake-bay-tmdl/chesapeake-bay-watershed-implementation-plans-wips](about:blank).

### A4.1.2 Identify the Decision

WIPs include clear and measurable objectives with regard to their pollution prevention and restoration activities. The WIPs include interim goals toward attainment of TMDL allowable loads (loading capacity), wasteload allocations (WLAs; for point sources) and load allocations (Las; for nonpoint sources). Annually the CBP prepares a report on WIP progress including adherence to schedule, issues impacting schedule or resource limitations, and environmental results and performance of management measures. To facilitate the CBP annual report on watershed implementation, monitoring results for DNREC’s NPDES permitted dischargers will be used to assess progress toward pollutant load reductions. DNREC will access available discharge characterization data, and other information (primarily eDMRs), review them for completeness and apparent quality, and prepare files in a format that is compatible with EPA’s models and analytical tools.

### A4.1.3 Identify Inputs to the Decision

Data and information from permitted dischargers will be accessed from DMRs (eDMR or historical data management systems), and from EPAs ICIS, or legacy permit compliance system (PCS). This plan targets three municipal wastewater treatment plants, a mobile home park wastewater treatment facility and a single industrial discharger to the Nanticoke River within the Chesapeake Bay watershed. As the current plan was developed specifically for discharge characterization data and likely relies almost solely on eDMR and NPDES discharge monitoring data, the balance of the sources identified below may be beneficial in the CBP’s future analyses.

The types and sources of information required to inform EPA’s annual assessment are listed below:

* Government databases (e.g., Delaware’s Water Quality Portal); U.S. Geological Survey [USGS] National Water Information System [NWIS] data for flows and selected water quality measures; EPA Environmental Information Management System: storage and retrieval data warehouse [STORET]; Permit Compliance System and Integrated Compliance Information System [PCS-ICIS; for point sources], or Toxics Release Inventory [TRI])
* Government report(s) including DNREC’s most recent integrated report.
* Government publications (e.g., technical support documents, research reports on management practices and control measures)
* Maps, geographic information system (GIS) layers, plots, land surveys, photographs
* Existing TMDLs
* Published reports.

### A4.1.4 Define the Boundaries of the Study

The boundaries of the data collection focus on the five NPDES permitted discharges to the Nanticoke River. Additional physical, chemical, and biological data within the Nanticoke and its tributaries may be useful in analyses assessing overall WIP performance, but this plan addresses only discharges from permitted facility outfalls.

### A4.1.5 Develop a Decision Rule for Information Synthesis

The purpose of a decision rule is to integrate the outputs from the WIP and additional data into a single statement that describes compliance with the wasteload allocations in the Chesapeake Bay TMDL, as well as interim benchmarks for water quality improvement. The applicable decision rule for this project is: What are the concentrations of nutrients and other pollutants discharged to the Nanticoke River and subsequently to the Chesapeake Bay?

To adequately address the decision rule, the following questions need to be answered:

1. What water quality, pollutant, and flow data/information are available for the permitted point sources?
2. Are they in a format compatible with CBPO and EPA’s modeling and analysis systems?
3. What do the available data/information suggest about the current WIP progress?

### A4.1.6 Specify Tolerance Limits on Decision Errors

DNREC will not be conducting the primary analyses performed with the data collected and prepared for exchange under this plan. Reports from EPA’s modeling and analysis tools will include documentation of the methodology(ies) and assumptions used in the analyses and may also include sensitivity analyses. For the purposes of this data collection and management task, tolerance limits only placed on data handling, formatting, and transfer are appropriate.

The exact tolerance limits that are appropriate to this project depend in part on the quantity and quality of available water quality and flow information from the dischargers, and any potential variability or limitations of EPA’s modeling or analytical tools. To guide the technical information provided by the analysis, general acceptance criteria and procedures for secondary data quality are described in Section B9 of this QAPP.

## A4.2 Project Quality Objectives and Procedures

The basic requirements of this project are that DNREC must ensure capture of all available characterization data for point source discharges within the Chesapeake Bay watershed, and that those data are efficiently compiled and translated as necessary to make them available to EPA’s CBP staff. DNREC will describe QA compliance in the final deliverables, including any gaps or limitations in the available data. DNREC will communicate the level of QA/QC review associated with each data transfer in metadata records describing the transformed dataset.

### A4.2.1 Acceptance Criteria for Quantitative Data

DNREC will implement quality control checks, procedures, and metrics described in Sections A4.2.2 and A4.3 for routine data collections from external electronic databases or hard copy reports. DNREC will determine in consultation with the EPA CBP staff whether additional acceptance criteria should be applied to existing data sources. Additional acceptance criteria for information in these sources could include specific spatial requirements and temporal limits for specific measurement parameters, or specific parameter selection to provide consistency in the evaluation (e.g., flow data). For example, information from monitoring studies in the watershed might be acceptable for assessing or verifying water quality if collected from a particular geographic location where no discharge data have been collected. Non-discharge characterization data are outside the scope of this plan, but they may be useful if discharge monitoring data are not available, or if there are apparent gaps in discharge characterization.

*Relevance to the task*— DNREC is primarily concerned in this project with compiling, evaluating, analyzing, and summarizing flow, nutrient and sediment water quality characterization data in permitted point source discharges to facilitate EPA’s analyses comparing current conditions to prevailing standards and implementation plan goals, to assess the progress of program implementation relative to the schedule and goals of the WIP, to assess the performance of control measures and management practices, and to estimate load reductions as an indicator of plan effectiveness.

*Representative of the areas and times of interest*—for this task, no supplemental data are prescribed other than for discharge characterization. However, if required, DNREC may require inclusion of supplemental data to address a specific need. DNREC will only include data collected under a documented quality program and for which data quality or limitations are documented or can be determined. Depending on the availability of additional data, results from the most recent collections with the least geographical disparity will be considered. EPA will render final decisions as to the appropriateness of any external data available based on spatial (how close to the permittee’s discharge) and temporal coverage (how long ago).

*Individual observations: anomalous or extreme outliers*—Individual data values might be in error because of transcription errors or equipment malfunctions. If the error results in an anomalous or unrealistic value, it can be detected and excluded from analysis. In consultation with EPA CBP staff, DNREC will examine the data for anomalous values and reject values reported well beyond the range of observed variability. Following discussions with EPA, DNREC will report on data gaps including documenting the number of exclusions, if any, the source of the data excluded, and the rationale for exclusion (and cause of the error if it is apparent). This documentation will be retained with project data files used in analysis.

### A4.2.2 Data Management/Handling

The methods and procedures described in this document are intended to reduce the magnitude of measurement error sources and the frequency of error occurrence. The relevant quality objectives for this project include existing data quality and sample (data) handling. The project quality objectives related to data handling are included below:

* Maintaining and documenting a continuing dialog with the EPA CBP staff on technical issues, as appropriate
* Providing answers to specific questions from the CBP Program Manager responsive to the goals of the EPA and DNREC’s Chesapeake Bay WIP
* Providing an assessment of data uncertainty, where applicable
* Documenting and presenting results in the form of interim, draft and final reports in the project files.

Information from data collection operations other than those provided by EPA and DNREC that are found to be of unacceptable quality will not be used. DNREC will document in the project files the quality requirements for data collection and how DNREC ensured that information collected for this project was as inclusive and comprehensive as possible. Apparent deficiencies in EPA- or DNREC-provided data or information will be discussed with the EPA PM and QAO, as appropriate, and a decision made as to the level of effort that should be dedicated to its further assessment.

Uncertainty in the data due to sampling and measurement errors or errors introduced during data manipulation could result in providing incorrect results. Reducing data uncertainty is of highest priority, and it is important to reduce uncertainty by using QC protocols. A discussion of conventional data quality attributes—precision, accuracy, representativeness, completeness, and comparability (PARCC) are presented in section A4.3. However, these attributes are more related to measurement system performance and monitoring design than in the current project’s application of the data. Spot checking of data during compilation will aid in identifying or eliminating erroneous values, most data are assumed to have satisfied the measurement performance requirements published in the methods or adapted within the laboratory’s quality system of standard operating procedures (SOPs). SOPs occasionally do not fully comply with reference method objectives but are based on actual data collected in the laboratory. Examples of differences include estimates of method sensitivity and laboratory method detection limit study data and use of control charts for development of in-house limits. Data assessments against these study- or statistically derived criteria are often of greater value in data interpretation and determining potential limitations.

## A4.3 Discussion of Data Attributes

Datasets will be reviewed relative to the general PARCC quality characteristics of the data provided or available for download, in accordance with EPA’s *Guidance for Quality Assurance Project Plans EPA QA/G-5* (USEPA 2002). These attributes are described below.

*Precision*— Precision of data reported in published databases is generally unknown. Unless there is compelling evidence in an individual data compilation that the precision of the data are unacceptable, it is assumed that the data reported are of precision that meets the quality criteria of the reference method or analytical service’s quality system requirements and is sufficient for use in this project.

*Accuracy (bias)* —Accuracy of data reported in data compilations is generally unknown, as it implies that measurements are being recorded on a known sample. Unless there is compelling evidence that the data were collected incorrectly and are inaccurate, it is assumed that the results for the analysis of positive and negative laboratory controls, calibration verification, and spiked sample analyses meet the quality criteria of the reference method or analytical service’s quality system requirements, and that the data quality is sufficient for use in this project.

Procedural performance accuracy criteria for data handling parameters are presented in Table 2 and are discussed in more detail in Section B5.

*Representativeness*—See the discussion of representativeness in Section A4.2.1 above.

*Completeness*—Whenever possible, data will be downloaded electronically from various electronic sources to reduce scanning of hard copy documents. DNREC staff will develop dedicated hard copy and electronic files. In addition, the following steps for assigning staff and general project procedures will be used to ensure the completeness and correctness of data used in the deliverables:

* All original work performed by any member of the technical staff will be subject to QC checks by a different member of the technical staff who is capable of performing the QC checks.
* All QC reviews will be documented.
* Use of data evaluation factors and limits.
* Members of the DNREC staff are capable of collecting technical data and managing data sources.
* The DNREC PM will ensure data sources are managed in accordance with Section A4, B5, and B10 of this QAPP.
* The DNREC PM will maintain a continuing dialog with the EPA PM on technical issues, including discussions regarding the inclusiveness and comprehensiveness of the data sources collected for the project.
* The DNREC PM will provide answers to specific management questions.

*Comparability*—Comparability is an issue when different sampling or analytical methods are used among different studies that are being combined among parts of a single study. It is expected that if external data and information collections are provided from disparate monitoring studies that variable file formats may need to be synthesized. For interpretation of these external data, if required, DNREC will ensure that different values are expressed in comparable units and that differences among values are clearly tied to how those values were developed.

*Sensitivity*—Sensitivity is the ability of available measurement systems to detect the presence of individual pollutants or indicators, or to detect change. In routine surface water monitoring, it is expected that monitoring designs and QAPPs would prescribe reporting or other quantitative limits appropriate for comparison to prevailing water quality criteria. However, a lack of sensitivity is most problematic where samples are determined to be free of contaminants, as estimated concentrations (due to over-dilution, for instance) are of greater value than reported non-detects at inflated quantitation limits.

Table 2. Procedural (data management) performance criteriaa

| **Measurement parameter** | **Accuracy** | **Description** |
| --- | --- | --- |
| Data entry | < 5% incorrectly entered data | 20 percent of manual data entries will be checked. All errors will be corrected. |
| Data transfers | < 10% incorrectly transferred data | 10 percent of data transfers of pertinent data from existing sources for use in deliverables will be checked. All errors will be corrected. |
| Extraction/interpretation of pertinent data from existing sources for use in deliverables | <10% incorrectly extracted/interpreted data | 10 percent of extraction/interpretations of pertinent data from existing sources for use in deliverables will be checked. All errors will be corrected. |
| Data conversions | < 5% incorrect data transformations | 20 percent of data conversions will be checked. All errors will be corrected. |
| Data calculations | <10% incorrect calculations | 10 percent of data calculations will be checked. All errors will be corrected. |

aAnalytical truth is unknown for precision; accuracy of all measurement parameters in Table 2 will be enforced using the approach described in Sections C and D of this QAPP.

DNREC, in consultation with EPA, will collect information on the flow and chemical composition of effluent discharges and receiving waters to assess the character of wastewater discharges and receiving waters, as well as their comparative condition relative to prevailing permit limits, water quality standards, and any TMDL wasteload allocations.

# A5 Special Training Requirements/Certification

DNREC has assembled a team of highly trained and experienced staff to provide support to the CBP in developing datasets for use in future analysis and reporting. DNREC’s is intimately familiar with the reporting and management of water quality data, the TMDL process and development program, and the requirements of this plan. DNREC staff will work closely with CBP PM, Laura Free, to ensure that system specifications are met, and that necessary data requirements and elements are compatible with the user modeling and analysis applications.

# A6 Documentation and Records

The DNREC PM will distribute the QAPP to their respective staff working on this project. If any changes in the body of the QAPP are required during the project, the DNREC PM will send a memo to each person on the distribution list as soon as possible describing the change(s), following approval by the appropriate persons. The memo(s) will be attached to the QAPP. If a more substantive revision is warranted, the QAPP will be revised and a document revision history will be included before the plan is submitted to the CBP for review and approval. The DNREC PM and CBP PM will distribute the plan as appropriate to their respective project staff.

The DNREC PM will maintain a central project file in their Dover, Delaware offices to contain all related documents, reports, communications, data compilations, checklists or other records, and deliverables (electronic files and hard copies).

Project records will contain descriptions of the work performed, data sets used in analyses, and output data sets, and descriptions of relevant analyses and outputs. Interim and final electronic files used in the development of project deliverables will be stored on the secure local network server in the project office. In addition, a broader description of overall data management is provided in Section B10 of this QAPP.

# B DATA GENERATION AND ACQUISITION

Data are collected from all permitted industrial and municipal facilities in the Chesapeake Bay watershed on no less than a yearly basis. Depending on the permit requirements, the reporting frequency can be monthly, quarterly, semi-annual or annual. Permittees prepare and submit DMRs as instructed by DNREC’s *e-DMR Manual* (DNREC, n.d.). Permit holders submit discharge monitoring data via eDMR (as instructed by eDMR manual). The data undergo quality assurance checks by DNREC personnel (Compliance and Enforcement personnel) before being electronically uploaded into the DEN after which it is electronically uploaded to EPA’s ICIS.

Data received are first verified to correspond with the facility’s respective permit and to ensure there were no apparent errors in the loading of the data to DNREC’s eDMR submittal system. The eDMR system has numerous QA/QC procedures built directly into the interface that prevents facilities from submitting erroneous data, such as detecting missing information or improper units. Facilities cannot submit their eDMR until the errors have been addressed, thus all data received should have a very high standard of completeness and accuracy. DNREC’s Compliance and Enforcement personnel still review all submitted data to look for any errors that may not have been detected by the eDMR system filters and work with the facility representative over the telephone or via email or written correspondence to rectify the reporting problem.

Quarterly Non-compliance reports (QNCR) are available within one month following each quarter. The QNCR are generated from ICIS and will show missing eDMR data and data that violates the permit limits and conditions, as well as show any facilities that failed to submit a scheduled eDMR during the quarter. The Compliance and Enforcement personnel will rectify any missing data and verify the validity of the violations by comparing the eDMR data provided by the facility against the limits and conditions within the permit and contact facility representatives to obtain the necessary reporting data as needed.

# B1 Sampling Process Design

Secondary Data information is provided in Sections B5, B9, and B10.

# B2 Sampling Methods

Secondary Data information is provided in Sections B5, B9, and B10.

# B3 Sample Handling and Custody

Secondary Data information is provided in Sections B5, B9, and B10.

# B4 Analytical Methods

Secondary Data information is provided in Sections B5, B9, and B10.

# B5 Quality Control

The project team will follow the policies and procedures detailed in this QAPP using standard analytical tools and protocols under the direction and oversight of the DNREC PM. Critical QC aspects for the task are handling and preserving the integrity of data and information from secondary sources. This QAPP and other supporting materials will be distributed to all project personnel. The DNREC PM will ensure that tasks described in the work plan are carried out in accordance with the QAPP.

A DNREC QC Officer will evaluate the correctness of transferred data and will review a minimum of 10 percent of all data extractions, transformations and calculations, as described further in this section of the QAPP. Any senior staff member familiar with the project, task, or specific data operation or analysis can serve as QC Officer on work performed by others. In this regard, many persons may fulfill a QC Officer function in advance of the higher-level Project QC Officer reviews. The DNREC PM will review staff performance throughout the project to ensure adherence to project protocols.

Reducing uncertainty by using appropriate QC protocols is of the highest priority. The following procedures for assigning staff and general project procedures will be used to ensure the completeness and correctness of data used in the collected data deliverables:

* All original work performed by any member of the technical staff will be subject to QC checks by a different member of the technical staff who is capable of performing the QC checks.
* All QC reviews will be documented.
* If applicable, 100 percent of scanned or hand entered data from hard copy documents will be reviewed by a technical staff member who did not perform the original work.
* 10 percent of transferred data from each source will be reviewed by a technical staff member who did not perform the original work.
* 10 percent of each type of data transformation will be evaluated by the DNREC QC Officer (or their designee)
* 10 percent of each type of calculation will be evaluated by the DNREC QC Officer (or their designee)
* The DNREC PM will maintain a continuing dialog with the EPA CBP PM on technical issues.
* The DNREC PM will provide answers to specific management questions.

DNREC will review data compilations and data value distributions in the final compiled data through analysis of complete data transfer at the time of transfer and by enumerating records in the original data sources and the final compilation. Data that are transferred among databases will be checked for completeness at the time of transfer by enumerating the number of records in the original and final data sets. Data transfers will be tagged with upload dates and times to accommodate completeness reviews. If data transfer is incomplete, the missing records will be sought and transferred individually if they are valid. A second round of completeness checks will ensue after successive transfers. Once data sets are compiled, the complete set of data value distributions will be analyzed to identify outliers or bimodal distributions that may result from data entry errors or erroneous unit conversions. This will be accomplished by plotting the distributions against expectations of a normal distribution. The DNREC team data analysts are familiar with expected values for all data types that will be collected for this project. Because of this familiarity, they will be able to identify unusual and potentially erroneous values. If necessary, outliers and bimodal distributions will be identified and resolved. Valid outliers can occur and will not be eliminated if the experienced analyst thinks they are plausible. Outliers that are not plausible or show a pattern of potential error will be brought to the attention of the original data supplier and will be excluded from analysis until the original data supplier can confirm their validity.

The accuracy of the transfer of data from electronic databases to the project database(s) will be determined by checking whether data from the original database have been transferred to appropriate rows and columns, whether the same number of decimal places after the decimal point in the original database has been used, and whether the same units from the original database have been used. Such QC checks will be performed on approximately every 10th line of data in each electronic data set transferred into the project database(s). This procedure will enhance the evaluation process by improving consistency in data transfers. If the percentage of incorrectly transferred data exceeds one percent for a staff member, a DNREC QC Officer will review an additional 10 percent of the data transfers performed by that staff member to determine whether that staff member is performing acceptable data entries. If the percentage of incorrect data transfers for the additional sources evaluated exceeds one percent, a DNREC QC Officer might evaluate 100 percent of the data transfers performed by that staff member to ensure accuracy of the information. Any discrepancies in data transfers reviewed by a DNREC QC Officer will be resolved with the technical staff member who originally performed the transfers during the review process to ensure 100 percent agreement in data transfers for the sources.

DNREC does not foresee the need for entering data from hard copy reports or data sheets. Permittees are required to submit data via eDMR unless there is a catastrophic electronic system failure. However, if any raw data are received in hard copy format, they will be entered into a standard database and a DNREC QC Officer will compare 100 percent of data entries to the original hard copy data sheets. A DNREC QC Officer will check 10 percent of the data transformations and will recalculate 10 percent of the calculations to ensure that correct formula commands were entered into the programs. If more than one percent of the data transformations are incorrect, all data transformations will be rechecked after the correction is made to the database. Data quality will be assessed by comparing entered data to original data and checking the accuracy of data transformations and calculations.

After the initial extraction(s) and corresponding QC check(s), if the percentage of incorrectly extracted data exceeds one percent for a staff member, the DNREC QC Officer (or their designee) will review an additional 10 percent of the data extractions performed by that staff member to determine whether that staff member is performing acceptable extractions. If the percentage of incorrect data extractions for the additional sources evaluated exceeds one percent, the DNREC QC Officer (or their designee) might evaluate 100 percent of the data extractions performed by that staff member to ensure accuracy of the information. Any discrepancies in data extractions reviewed by the DNREC QC Officer (or their designee) will be resolved with the technical staff members who originally performed the extractions during the review process to ensure 100 percent agreement in data transfers for the sources.

A DNREC QC Officer will check 10 percent of the data transformations and will recalculate 10 percent of the calculations to ensure that correct formula commands were entered into the program. If more than one percent of the data transformations are incorrect, all data transformations will be rechecked after the correction is made to the database. Data quality will be assessed by comparing entered data to original data and checking the accuracy of data transformations and calculations.

# B6 Instrument/Equipment Testing, Inspection, and Maintenance

Secondary Data information is provided in Sections B5, B9, and B10.

# B7 Instrument/Equipment Calibration and Frequency

Secondary Data information is provided in Sections B5, B9, and B10.

# B8 Inspection/Acceptance of Supplies and Consumables

Secondary Data information is provided in Sections B5, B9, and B10.

# B9 Nondirect Measurements

Non-direct measurements (also referred to as *secondary data*) are data that were previously collected under an effort outside this project. DNREC, in consultation with EPA CBP, will use available discharge characterization data, interim monitoring reports, and pollutant and flow data primarily from permitted dischargers to prepare data files suitable for performing analyses necessary to complete the requested technical tasks. Where data are not available from online sources, DNREC will consult with EPA and permittees on specific data sources and characteristics (water quality monitoring stations, and USGS gage locations) to identify datasets that may fulfill the technical requirements, as well as any EPA tools or procedures for conducting analyses and flow statistics.

DNREC will collect information and prepare data for the CBP to summarize the magnitude of nutrient and sediment concentrations and compare measured observations under a variety of flow conditions to prevailing water quality criteria and load reduction goals. DNREC will compile available discharge characterization data, and any other data necessary to conduct required analyses into new datasets for this project, as described in Section A4.1 of this QAPP.

DNREC will exclude, to the extent possible, any data that have not been collected under documented QA plans or been subject to quality systems and screening in their evaluation for acceptance to established federal or state data management systems (e.g., EPA STORET and USGS NWIS). DNREC expects that project specific QAPPs or similar documentation describing the performance criteria evaluated and met were available for federal and state data recipients to assess the data for acceptance and inclusion of the data in their compilations. It is assumed that data used by or obtained from government agencies have been screened and have met specified measurement performance criteria. If it is apparent that this documentation is not readily available, or if data qualification or other indication of quality limitations are apparent, DNREC will consult with the EPA CBPPM to determine how much effort should be expended to find reports or metadata that might qualify or disqualify the data from use.

DNREC conducts assessments of all point source DMR data in the Chesapeake Bay watershed on a yearly basis. In 2018 CBPO released the CBP’s Point Source Data Submission Application which allows jurisdictions to report point source data to CBP for use in its annual progress runs. The Point Source Data Application uses ICIS-NPDES as the initial source of data. Prior to the release of the Point Source Data Application, DNREC staff prepared and evaluated the annual data between July 1st and June 30th of the year of the June date, and adhered to the following QA procedures during data preparation and submittal:

* Ensured all eDMR data had been properly recorded in DEN by June 30 of each year.
* Extracted Chesapeake Bay watershed data from DEN and converted into an Excel spreadsheet to be uploaded into CBPO.
* Analyzed and evaluated data for accuracy and completeness as outlined by the Chesapeake Bay Phase 5 Community Watershed Model (particularly Section 7: Point Sources, Water Withdraws, and On-Site Waste Disposal Systems) (USEPA 2010), the Chesapeake Bay Program Wastewater Facility and Nonpoint Source Data Submission Specifications and Requirements (USEPA 2016) and the Delaware *Online Electronic Discharge Monitoring Report (e-DMR) Manual* (DNREC, n.d.)
* Completed mathematical calculations for data fields that had no analytical data provided, utilizing the standards and specification provided by EPA in the Chesapeake Bay Program Wastewater Facility and Nonpoint Source Data Submission Specifications and Requirements (USEPA 2016)
* Once the Chesapeake Bay point-source data had been compiled, QC’d and formatted, the data were provided to the CBP no later than December 1st of that year.
* Participated in meetings and conferences.

DNREC submits average monthly flow (mgd) and concentration (mg/L) data for each outfall of the five wastewater treatment facilities in the Chesapeake Bay watershed. Data for the following parameters are submitted:

|  |  |  |  |
| --- | --- | --- | --- |
| * NH3 | * TON | * PO4 | * CBOD/BOD |
| * NO2,3 | * TKN | * TOP | * DO |
| * Flow | * TN | * TP | * TSS |

Also prior to the release of the Point Source Data application DNREC followed the process outlined by the CBP and shown in Appendix A – Wastewater Facility Nutrient Data Processing Flow Diagram, when compiling and reporting nutrient data for wastewater treatment plants in the Chesapeake Bay watershed.

The Town of Bridgeville Wastewater Treatment Plant, City of Seaford Wastewater Treatment Facility, Town of Laurel Wastewater Treatment Plant and INV Performance Materials, LLC are required under their NPDES permit to collect all the twelve (12) parameters above. Prior to the release of the Point Source Data Application, DNREC downloaded monthly eDMR data for each of these facilities from DEN in Microsoft Excel format. The data for each parameter would be entered into EPA’s Chesapeake Bay wastewater data spreadsheet. A data check (TKN>NH3, TKN=NH3+TON, TN=TKN+NO23, TP>PO4 and TP=PO4+TOP) as outlined under the “Compiled Data Check” step of the Wastewater Facility Nutrient Data Processing Flow Diagram shown in Appendix A would then be performed. If the sum of the nutrient species <>TN or TP, the species would be proportioned to add up to TN and TP as follows (TKN’, NO23’, NH3’, TON’, PO4’ and TOP’ are proportioned/adjusted values):

TKN’ = TN \* TKN / (TKN + NO23)

NO23’ = TN \* NO23 / (TKN + NO23)

NH3’ = TKN \* NH3/(NH3+TON)

TON’ = TKN’ - NH3’

PO4’ = TP \* PO4 / (PO4 + TOP)

TOP’ = TP - PO4’

Specific calculations for the Town of Bridgeville wastewater treatment plant include an adjusted flow value. This same methodology is applied to any facility without a continuous discharge. Bridgeville WWTP does not have a continuous daily discharge because they spray irrigate their wastewater, and only discharges via the NPDES outfall if they cannot spray. Therefore, most months, Bridgeville’s eDMR reports “0” discharge. The Chesapeake Bay model does not currently have an input for “days of discharge”. Even if discharge is only for 1 day, the model assumes any reported discharge concentration occurs every day of the month. In addition, the model assumes full month of flow to calculate the nutrient load. Therefore, prior to the release of the Point Source Data Application DNREC would submit a “flow adjusted per full month” value to the CBP for load calculation to account for days without any flow. The flow adjusted per full month is calculated as:

(Reported Flow) x (Days of Discharge)/Calendar Days in a Month

Mobile Gardens Trailer Park normally discharges to rapid infiltration basin systems (RIBs) with occasional discharge at the outfall. Their discharge is therefore reported as zero “0” for most of the months. The facility is required to collect flow, DO, BOD5, TSS, TN and TP. Prior to the release of the Point Source Data Application, the average monthly data for these parameters in the event of a discharge at the outfall, would be downloaded from DEN and the missing parameters be calculated as follows using the nutrient species default relationships for wastewater data provided in the CBP data submission specifications and requirements:

NH3 = 0.07 TN

NO23 = 0.8 TN

TON = 0.13 TN

TKN = NH3 + TON

PO4 = 0.67 TP

TOP = 0.33 TP

In each report, default or calculated values would be marked with appropriate descriptions. Columns were added to the right of the values, which included the descriptions. Once the data had been reviewed and verified to be complete, the data would be submitted to EPA CBP. The EPA CBP would then send a summary of the discharge loads (nutrients and sediment) back to DNREC for review.

Following its release, DNREC used the Point Source Data Application for the 2018 submission and has continued to do so since then. As mentioned above, the Point Source Data Application uses ICIS-NPDES as the initial source of data. When a progress submission is due, DNREC logs into the Application and creates a data set for the reporting period. DNREC performs all the facility/data checks and fixes discussed above within the Application. The species checks and fixes are built into the Application. For the special cases of the Town of Bridgeville Wastewater Treatment Plant and Mobile Gardens Trailer Park which do not have a continuous flow, DNREC calculates an adjusted flow as discussed above and manually enters the calculated values into the Application. After completing the data submission process, DNREC notifies CBPO who then reviews the submission.

# B10 Data Management

DNREC’s computer systems and network servers are specified, inventoried and maintained (either directly or by external service contract) by a dedicated information technology staff, and all interim (working) and final electronic files used in development of project deliverables will be stored on DNREC’s secure network, which is backed up daily. DNREC project scientists will store all computer files associated with the project (including all sources used to prepare deliverables) in a project subdirectory (subject to regular system backups) in the Dover, Delaware office, and will copy the files to disk for archive for 3 years subsequent to project completion (unless otherwise directed by the EPA CBP). DNREC may use a tracking spreadsheet specifically designed for this project to document data collection, assessment and information sources compiled for this project. To maintain version control, DNREC will clearly identify files using the subject of the file and corresponding dates of preparation. The DNREC PM is responsible for ensuring that data sources are managed in accordance with this section, as well as Sections A4 and B5 of this QAPP.

# C ASSESSMENT AND OVERSIGHT

# C1 Assessment and Response Actions

The QA program under which this project will be performed could include performance and system audits, with independent checks of the data obtained from data-gathering activities and subsequent analyses. Final versions of any deliverable that is to be published or widely distributed by EPA must be reviewed by the DNREC PM or authorized designee to ensure that all revisions have been properly made and that the deliverable is consistent with overall contract goals and requirements and does not contain information that could expose EPA to liability. Written deliverables metadata records or other text documentation should be reviewed by a qualified editor or authorized designee.

The DNREC QC Officer will assist the DNREC PM in conducting internal reviews of the deliverables prepared for this project. They will identify and document all issues that could affect quality and make recommendations for improving the reports if appropriate. When internal reviews have been completed, the DNREC PM will submit written deliverables, if any, to a qualified technical editor for editorial review to ensure that the writing is clear and concise; that the written material conforms to predetermined requirements for format, style, and usage; and that the terms, resources, and format are used consistently throughout the document.

The essential corrective action steps in the QA program for addressing any problems that could occur during the project are as follows:

* Identify and define the problem.
* Assign responsibility for investigating the problem.
* Investigate and determine the cause of the problem.
* Identify the corrective action.
* Assign and accept responsibility for implementing appropriate corrective action.
* Establish the effectiveness of and implement the corrective action.
* Verify that the corrective action has eliminated the problem.

Most of the technical problems that might occur in collecting and reformatting data will be solved on the spot by the staff members involved; for example, by modifying the technical approach or correcting errors or deficiencies in documentation. Immediate corrective actions form part of normal operating procedures and are noted in records for the project. Problems not solved this way require more formalized, long-term corrective action.

If quality problems that require attention are identified, the project team will determine whether attaining acceptable quality requires short- or long-term actions. If a failure in an analytical system occurs (e.g., performance requirements are not met), the DNREC QC Officer will be responsible for corrective action and will immediately inform the DNREC PM. Subsequent steps taken will depend on the nature and significance of the problem.

The DNREC PM has primary responsibility for monitoring the activities of this project and identifying or verifying correction of any quality problems. These problems will also be brought to the attention of the QA Officer, who will either initiate or verify the corrective action system components described above, document the nature of the problem, and ensure that the recommended corrective action is carried out. The QA Officer has the authority to stop work on the project if problems that affect data quality and require extensive effort to resolve are identified. The DNREC PM and the EPA CBPPM will be notified of major corrective actions and stop work orders. The DNREC PM has primary responsibility for monitoring the activities of this project and identifying and verifying that any quality problems are sufficiently investigated, that appropriate solutions are evaluated, and that corrective actions are implemented, verified to be adequate to address the problem(s), and documented in project reports.

Failure to meet any QC requirements requires that appropriate corrective actions be taken. All major QC failures and associated corrective actions (and their effectiveness) will be documented and submitted to the EPA CBP PM along with the associated dataset(s). Data associated with QC problems will be clearly identified, along with an assessment as to the potential effects(s) of the QC failure on data quality. The DNREC PM or QA Officer will notify the EPA CBPPM of such problems/corrective actions as soon as possible after the actual occurrence.

# C2 Reports to Management

The DNREC PM will submit a report to the EPA CBP PM describing the status of the project and deliverables, including a discussion of QA/QC activities, the status of data collection and evaluation efforts, and any significant quality problems encountered and how they were addressed.

DNREC will provide to the EPA CBPPM any written reports generated in routine surveillance.

# D DATA VALIDATION AND USABILITY

# D1 Data Review, Verification, and Validation

Data review, verification, and validation processes aid in determining the usability and limitations of data and provide a standardized data quality assessment. No primary data will be collected for this task; therefore, DNREC will not validate data. DNREC will perform data verification as necessary to determine the accuracy of data entries. DNREC will verify the accuracy of data transfers from electronic files into analysis spreadsheets, and correctness of calculations performed in the statistical analyses of these data.

Copies of all original data will be made while compiling data into the project database. The project database will be filed under a separate filename in a project-specific folder which will include screening results and observations and documentation of EPA direction and collaboration on the final resolution of specific data quality or completeness deficiencies.

# D2 Review and Verification Methods

DNREC staff will obtain the data or technical information required to perform the evaluations from EPA and from government databases and web sites, where appropriate. The CBP must provide written technical direction if additional work should be performed to verify values and extract statements of data quality from the original generators. If, in consultation with EPA (who has considered the use of the data and importance of the decision to be made), it is determined that such searches are not necessary and the data must be used in the project, a disclaimer will be added to the metadata records indicating that the quality of the secondary data is assumed to be satisfactory for exchange and subsequent analyses.

As values are transferred to a spreadsheet (data entry) or into a deliverable (word processing), the person performing this action will review the transfer for accuracy and write the complete citation for the source of the data, following the appropriate style guide format, with the short citation entered in the database, text, or footnote, as appropriate (e.g., author, year). All data will have its source identified during deliverable preparation. The QC Officer will manually check the data transfers for accuracy and proper citation of the data source and will report data discrepancies to the technical staff member(s) who originally extracted the data or information. The reviewer initials and dates a copy of the marked data or notes the review in a spreadsheet or on a review form to document the review. The corrections will be made and rechecked by the QC Officer.

# D3 Reconciliation with User Requirements

The DNREC PM will ensure that the type of data, quantity, and quality of sources have been documented, data transfers checked, and any data quality limitations or uncertainties clearly identified in the deliverables. If any problems are encountered in meeting the data acceptance criteria, the DNREC PM will discuss observations with EPA to reconcile the problems, if possible. The EPA CBPPM will also review all deliverables for content accuracy. If EPA determines that DNREC’s data are factually inaccurate or if any other technical errors are found, DNREC will initiate appropriate corrective action investigation, isolate the cause of error, implement appropriate corrective action, and redo the work, if required.

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**APPENDIX A. DATA FLOW, PROCESS DIAGRAMS**

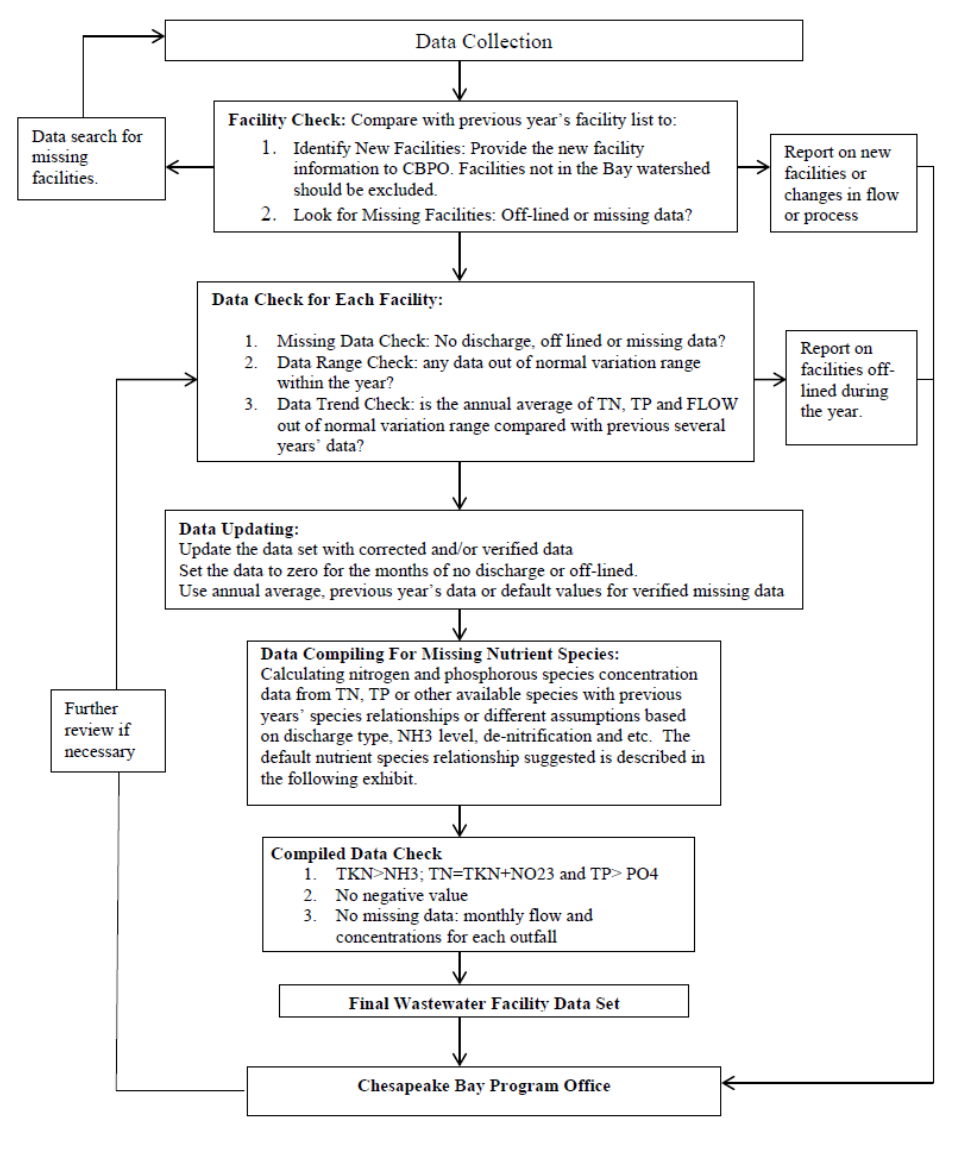
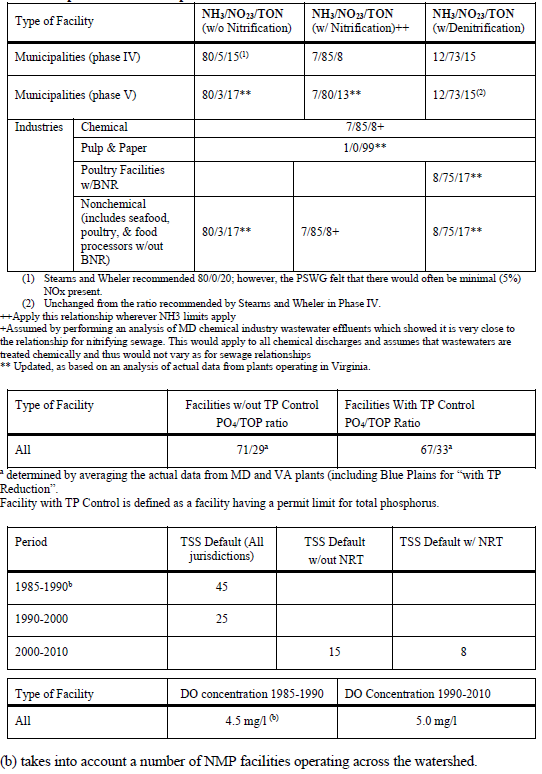
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Figure A-1. Wastewater facility nutrient data processing flow diagram (source: USEPA 2016).

APPENDIX B. SPECIES RELATIONSHIP



**Species Relationship (source: CBP Grant Guidance – Attachment 6**)

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