Quality Plan for the Watershed Planning and Coordination Section of the Water Quality Restoration Program

Division of Environmental Assessment and Restoration

Florida Department of Environmental Protection

July 20, 2018

2600 Blair Stone Road
Mail Station 3000
Tallahassee, FL 32399-2400
www.floridadep.gov

Table of Contents

Signature Page

The undersigned have read and understood this Quality Plan, are charged with managing and improving the quality system, and are responsible for ensuring that all staff properly execute the procedures discussed in the plan.

7/23/2018

X

Program Administrator
Signed by: a5850aca-6329-44ea-9b20-70df2edb0b3a
7/23/2018

7/23/2018

X

Quality Assurance Officer
Signed by: a5850aca-6329-44ea-9b20-70df2edb0b3a

X No Env. Admin. for this group

Environmental Administrator
Signed by: a5850aca-6329-44ea-9b20-70df2edb0b3a

Introduction

Within the Florida Department of Environmental Protection's (DEP) Division of Environmental Assessment and Restoration (DEAR), the Watershed Planning and Coordination Section (WPCS) is responsible for developing and managing basin management action plans (BMAPs), which are a mechanism for the collaborative implementation of total maximum daily load (TMDL) restoration goals. This Quality Assurance Management Plan (QAMP) is designed to ensure that data collection, generation, interpretation, reporting, evaluation, and archiving are of sufficient quality to support DEP decision making, because BMAPs are adopted into rule by Secretarial Order. It details the process of planning, training, execution, assessment, and corrective action that DEP undertakes to ensure that environmental data meet WPCS established quality criteria.

The DEP Secretary is committed to the implementation of the quality assurance (QA) requirements in the QAMP and as authorized in Section 403.0623, Florida Statutes (F.S.), and Chapter 62-160, Florida Administrative Code (F.A.C.) (the DEP QA Rule). It is the Secretary's intent to carry out these obligations and requirements as detailed in the DEP QA Directive (Directive 972, Revision November 1, 2016).

All WPCS staff are to read, understand, and follow the procedures and criteria described in this plan, and to carry out their assigned responsibilities for the effective use of the WPCS quality system.

The WPCS Water Quality Restoration Program implements the following activities:

- Develops, adopts, and implements BMAPs (water quality restoration plans for impaired waters).
- Conducts regular reviews of BMAP implementation progress.
- Adaptively manages and updates BMAP requirements.
- Supports local water quality initiatives through collaboration and technical assistance.
- Reviews, develops, and promotes state-of-the-art best management practices (BMPs) to improve water quality.
- Assists the Division of Water Restoration Assistance with reviewing and prioritizing water quality restoration projects.

Basic Elements of the QAMP

The QAMP explains both the process and criteria by which the quality system is managed. The plan addresses data quality objectives, data review, and data usability for BMAPs. It discusses how specific QA duties are assigned to responsible staff and is used as an instrument of internal communication to inform staff of current and future QA activities.

The Quality Plan should be used as a training document for new staff and as a reference for experienced staff. The plan and its revisions also serve as an archival record of the formal quality system.

It is important that all WPCS staff and consultants understand and follow the procedures and criteria described in this plan, and carry out their assigned responsibilities for the effective use of the quality system.

The elements of this plan are consistent with the DEP Quality Management Plan, QA Directive, and QA Rule (Chapter 62-160, F.A.C.). DEP will revise the WPCS Quality Plan as needed to ensure the consistent application of procedures and criteria for the generation or use of environmental data.

Policy Statement

WPCS policy is as follows:

- Use the best available, most scientifically valid, and legally defensible data for decisions affecting the protection of the environment.
- Have and implement the Quality System described in this document.
- Adaptively manage the Quality System to be consistent with provisions of the QAMP.
- Ensure that everyone in WPCS is properly trained to execute their assigned functions.
- Perform a yearly systematic assessment of QA activities, including any corrective actions, with the findings submitted to the Aquatic Ecology and QA Section (for inclusion in the Annual QA Report to the Secretary).

Ethics

All WPCS employees are held to high professional ethical standards in the performance of their duties. As part of the "New Employee Welcome Packet," all employees are required to read, understand, and sign an ethics statement attesting to their commitment to honesty and integrity in

the performance of their duties. In addition, all employees are required to complete an annual ethics training class online. Improper, unethical, or illegal actions will be dealt with according to the published DEP Administrative Directives.

Organization, Function, and Staff Responsibilities

Organization and Function

WPCS resides within DEAR. The function of WPCS is to develop collaborative water quality restoration plans with local stakeholders to implement TMDLs.

Staff Responsibilities

The Basin Coordinators develop BMAPs and maintain coordination with BMAP stakeholders. The coordinators ensure that the quality system is fully operational within the program, designate a Quality Assurance Officer (QAO), and provide general oversight.

WPCS staff evaluate the Data Quality Objectives (DQOs) (**Appendices B** and **C**) and Data Quality Indicators (DQIs) (**Appendix A**) to ensure they meet the section's needs, and periodically evaluate the effectiveness of staff's data quality activities. Program staff provide feedback to the QAO for improving the program quality system.

Anita Nash acts as the WPCS QAO, coordinates and participates in the quality evaluation of program data, and provides oversight to ensure that staff perform their QA functions. The QAO may delegate some responsibilities to properly trained and qualified staff, when appropriate. The QAO relies on quality assurance/quality control (QA/QC) procedures of other programs both within and outside DEAR to ensure that data providers follow the QA Rule (Chapter 62-160, F.A.C.). The QAO also ensures that corrective actions are implemented for data nonconformance incidents, as determined by an evaluation of the data against the program's Data Quality Objectives (DQOs).

WPCS staff routinely carry out data interpretation and the generation of DEP work products in a manner that ensures scientific defensibility and adherence to DEP rules and policies. WPCS managers receive a copy of the QA Report to the Secretary, and as needed, discuss findings with the QAO. The QAO also documents all program QA activities to the DEP Aquatic Ecology and Quality Assurance Section on a periodic basis.

WPCS staff are all responsible for coordinating BMAPs by engaging stakeholders to meet statutory requirements for the restoration of impaired waters. Coordinators must understand data gathering and assessment, and often data evaluations are done outside WPCS. Coordinators use these evaluations to continue progress toward meeting TMDLs.

Training for WPCS Staff

All staff are properly trained to perform their duties. WPCS professionals do not perform tasks without proper knowledge of the material and oversight or approval from managers or other DEAR professionals. Supervisors periodically assess staff performance in comparison with the policies and procedures of the unit.

Training procedures are as follows:

- All staff must take and pass the ethics course upon hire and must take and pass the ethics refresher course each year of employment.

- Upon receiving a new task, staff are mentored by senior staff inside and outside of the section to ensure appropriate methodologies are followed and data quality requirements are met.

Water Quality Data Review – DQOs and DQIs

WPCS understands the need to evaluate the quality and usefulness of environmental data prior to making decisions. Staff conduct the following review procedures to determine whether data are usable for determination of compliance with rules (see **Appendix A** for descriptions). These procedures are based on established DQOs and DQIs, and incorporate the concepts and criteria found in the DEP document *Process for Assessing Data Usability*, DEP-EA-001/07.[1] Staff use this document to evaluate data usability for BMAP needs.

In short, WPCS water quality DQOs are met if data providers follow DEP standard operating procedures (SOPs). WPCS water quality DQIs describe how to use data with data qualifiers as approved by each BMAP Coordinator. DQIs are documented by consultants (see **Appendix A**).

Staff also perform the following tasks:

- If data are deemed inappropriate for use based on failure to meet DQOs and follow state SOPs, coordinators do not use the data for BMAP purposes.

- If data deemed inappropriate for use for BMAP purposes are supplied by data providers who have committed to provide data for BMAP purposes:

    - Coordinators will call or email data providers to let them know their data are not usable and the reasons why.

1 https://www.flrules.org/gateway/readRefFile.asp?refId=2919&filename=usability_doc%5B1%5D.pdf

  - Coordinators will ask data providers to implement corrective measures per DEP SOPs in order to improve and meet DQOs so coordinators can accept future data from these providers for BMAP purposes.

  - Coordinators also orchestrate communication between data providers and DEAR sections that can further assist data providers in meeting DQOs as needed.

- Coordinators or their consultants use data for reports, handouts, or presentations to the public to show the status of water quality in BMAP watersheds.

- Consultants are bound to the same DQOs as WPCS staff.

Water Quality Data Repositories

WPCS staff and contractors use data from the following repositories for BMAP development and milestone comparisons:

- DEP Florida STOrage and RETrieval (STORET) Database.

- DEP Florida Watershed Information Network (WIN).

- Lake County Water Atlas.

- Orange County Water Atlas.

- University of Florida LakeWatch.

- Alachua County, direct communication.

Documentation

Since accurate documentation is a key factor for determining the success of QA activities, WPCS staff carry out the following record-keeping procedures for data review to ensure appropriate documentation.

Contract Management

WPCS ensures that the DEP contracts administered through WPCS are properly managed to assure appropriate data quality (**Appendix B**). Contract managers assure that the work is properly planned and executed, relevant to DEP environmental decision-making needs, and consistent with the DEP QA Rule and DEP SOPs. Staff managing contracts are trained DEP contract managers. WPCS staff ensure that contract development and review include the provisions of the QA rule and the instruction document, *Quality Assurance Process for*

Procurement of Sampling and Analytical Services (**Appendix C**), as appropriate per the tasks described in the contract.

For example, WPCS manages a contract with a consulting firm to do data analyses as needed per the tasks described above. When deliverables are provided, each staff member reviews the deliverable they requested for completion.

Audits and Corrective Actions

WPCS does not conduct audits of data providers but considers the audit results from other programs and entities where appropriate in determining data usability.

Purpose of WPCS Contribution to the QA Annual Report

The results of WPCS's assessment of QA efforts, including corrective actions, are relayed to the Aquatic Ecology and QA Section each year and included in the Annual QA Report to the Secretary.

Appendices

Appendix A: Water Quality Data Processing and Analysis

Methodology Documentation by Basin

St. Lucie River BMAP (Summary of detailed methods presented during meeting, not used in Annual Report, submitted October 2016)

Methods
• Data Download
Data were retrieved from STORET for the designated period of record (POR) for stations in the Basin Management Action Plan (BMAP) Monitoring Network.
Period of Record (POR)
Overall POR was 1/1/2008 through 7/1/2016
POR was based on a significant data gap for TN prior to 2008
• Data Processing (in order of operation)
Total Nitrogen (TN) concentration calculation
"Total Nitrogen" data was calculated for dates where both "Nitrite + Nitrate" and "Total Kjeldahl Nitrogen" data existed, but "Total Nitrogen" data did not. "Total Nitrogen" was calculated as the summation of "Total Kjeldahl Nitrogen" and "Nitrite + Nitrate".
If "Nitrogen Ion" data were available, but "Total Nitrogen" data were not, then it was understood that "Total Nitrogen" was expressed as "Nitrogen Ion" for that dataset.
If Nitrogen Ion is included, then a check was done to make sure that NOx + TKN sample dates matched
Sample Depth
If "surface water", "midwater", and "bottom" samples were collected at a station for the same parameter on the same day, then only the "surface water" sample was retained for analysis.
Only surface samples, which included samples collected at depths less than 1 m were used in analyses.
Data Qualifiers
Data with result qualifiers of "A", "F", "G", "H", "J", "K", "L", "N", "O", "T", "V", "Y", or "?" were not used in analysis, as per Table 1 Data Qualifier Codes in Rule 62-160.700, F.A.C. Quality Assurance.
Data with a result qualifier of "I" were only used if a corresponding Minimum Detection Level (MDL) was listed.
Data with a result qualifier of "U" were reviewed.
If not already present, a result qualifier of "U" was assigned to any data with a result value of "*Non-Detect".
Data with a result value of "*Not Reported" were deleted unless they also had a value qualifier of "U".
Data with a result qualifier of "U" were processed in accordance with Rule 62-303.320 (12), F.A.C. Aquatic Life-Based Water Quality Criteria Assessment. Results reported by a laboratory with the "U" data qualifier code were assessed as half the reported result or half the criterion (whichever was lower).
•Trend Analysis
Trend analyses were conducted for Tier I and II sites with appropriate data sufficiency for the ability to inspect whether trends exist for TP and TN concentration, throughout the selected PORs.
Two non-parametric statistical techniques were used to identify monotonic trend analyses, seasonal and regional Kendall Tau. Data are not required to conform to a particular distribution for non-parametric analyses. Non-parametric tests are also robust against outliers and large data gaps.
Seasonal Kendall test was used on TP and TN concentration data to identify trends on a seasonal basis.
For Seasonal Kendall test, available data covering the period from the designated POR were used.
Prior to trend analysis, the data were subjected to an autocorrelation function (ACF) test for two reasons:
to determine if serial correlation existed within the dataset and if so, whether it needed to be removed, and
detect the common "season" of the dataset, which was found to be the wet and dry season split within the water year June through May
Wet season was defined by the ACF as June through September, designated as season "1"

Dry season was defined by the ACF as November through May, designated as season "2"
These seasons were assigned as the seasons for the Seasonal Kendall trend test.
Regional Kendall test was used on TP and TN concentration data to identify trends on a regional basis.
For Regional Kendall test, available data covering the period from the designated POR were used.
Accounted for regional variability
Region 1: North Fork watershed and river stations
Region 2: South Fork watershed and river stations
Region 3: Watershed and river stations below SE03
Combined trend tests were conducted using both Seasonal and Regional Kendall tests
For all Kendall trend tests, statistical results were considered significant if the p-value was less than 0.05 (p-value < 0.05). The strength of the trend analysis result was described as the correlation coefficient, or Tau for the Kendall trend test, which represented how concentration and time tend to change together over the established POR. If the result was statistically significant (p-value < 0.05), then a negative value of Tau and slope represented a downward or decreasing trend indicated improvement, and a positive Tau and slope value suggested an increasing or upward trend, or a continuing decline in water quality conditions.

Alafia and Manatee Rivers BMAP (Summary of detailed methods used to develop presentation material for Annual Meeting, not used in Annual Report, submitted November 2016)

Methods
• Data Download
Data was downloaded from STORET.
Data was downloaded from 1/1/2001 onwards.
Data was downloaded for all sites within a WBID with Primary Types of River/Stream or Estuary.
Data was downloaded for "TMDL Relevant Parameters" listed in Table A-1 in Appendix A of the 2016 Alafia River BMAP Progress Report.

Data was checked against IWR Tool Run 52 to ensure that data for all pertinent sites was downloaded from STORET.

• Data Processing and Analyses
General data processing
Field replicate and field blank samples were not used in analysis.
Samples collected at depths greater than 0.6 m were not used in analysis.
Data with result qualifiers of "F", "G", "H", "J", "K", "N", "O", "T", "V", "Y", or "?" were not used in analysis, based on guidance from FFDEP TMDL assessment staff (Kevin O'Donnell).
Data with a result qualifier of "I" were only used if a corresponding MDL was listed.
Data with a result value of "*Not Reported" were deleted unless they also had a value qualifier of "U".
If not already present, a result qualifier of "U" was assigned to any data with a result value of "*Non-Detect".
If data existed for a station on the same day for the same parameter, it was considered to be a replicate sample and was removed from analysis.

Fecal Coliform Exceedance Analysis
Only fecal coliform and E. coli data collected between 1/1/2008 and 6/30/2016 were used in analysis. Enterococci data was not considered in the analysis because all WBIDs used in analysis were freshwater.
While fecal coliform and E. coli were both considered in the analysis, there were no available E. coli data within the analysis period of record. As a result, only fecal coliform data were used in the analysis.
Data with a result qualifier of "U" were assumed to be below the TMDL exceedance criteria for fecal coliform.
Data with a result value of "*Present>QL" were considered as exceeding the fecal coliform TMDL criteria because these samples were "too numerous to count".
Table 3 from 62-303 F.A.C was used to determine if the observed data were exceeding the exceedance criteria by more than 10% for the daily average fecal coliform data (62-302.533 F.A.C) with at least 90% confidence.

DO % Saturation Exceedance Analysis
Only DO % saturation data collected between 1/1/2008 and 6/30/2016 were used in analysis.
Measured DO % saturation data were compared with DO % saturation criteria adjusted for the specific time of day that the sample was collected. The adjusted DO % saturation criteria were calculated using the polynomial regression equations imbedded in the DO Calculator that are specific for SCI-2012 Bioregion (Peninsula for this WBID). The equations utilized time of day, measured DO concentration (mg/L), specific conductance (uS/cm), and standard barometric pressure (1 atm) to calculate the time adjusted DO % saturation criteria.
The observed DO % saturation and the DO % saturation criteria were compared to create the DO exceedance tables. Table 3 from 62-303 F.A.C was used to determine if the observed data were exceeding the exceedance criteria by more than 10% for the daily average DO % saturation data (62-302.533 F.A.C) with at least 90% confidence. Impairment status can be evaluated based on the exceedance tables and also on the Seasonal Mann-Kendall trend analysis results. If the trend analysis results show a decreasing trend, then DO may be considered impaired.
DO exceedances were not evaluated on an individual site basis. An evaluation was conducted to assess the level of DO impairment to determine the number of exceedances for the period in question (number of observed values below the adjusted DO % saturation criteria). All of the sites in each WBID were used to assess exceedances. See DO exceedance excel table for impairment status on a WBID scale.

TN, TP, and DO % Saturation Trend Analysis
Only data from 1/1/2001 to present were used in analysis.
If a site didn't have data through at least the last quarter of 2014, it was removed from analysis.
Following discussions with FDEP Assessment staff (Kevin O'Donnell), it was determined that data from Florida LAKEWATCH (21FLKWAT) data provider will not be used for trend analyses at this time to remain consistent with FDEP protocols. FDEP staff indicated that there may be errors with TN and/or TP for data that is currently in STORET, therefore the data will not be used in IWR Run 53.
Trend analyses were conducted for sites with appropriate data sufficiency (i.e. sufficient number of observations per year) for the ability to inspect if trends exist for TN, TP and DO throughout the selected PORs. Specifically, sites with sufficient long-term PORs with the required number of data points were selected for trend analyses for this effort. For a site to be used, at a minimum, an approximately quarterly sampling frequency was desired. Additionally, a site had to have data through at least one data point within the last quarter of 2014 to be used. Sites and associated data that did not meet the requirements at this time will be re-evaluated for data sufficiency and may be included in future analysis efforts if missing data are uploaded to STORET and meet the other requirements (e.g. this pertains specifically to Tampa Bay Water data that have not uploaded data since 2014year).
Data with a result qualifier of "U" were only used if a corresponding MDL was listed. If an MDL was listed, the result value was calculated as ½*MDL.
"Total Nitrogen" data was calculated for dates where both "Nitrite + Nitrate" and "Total Kjeldahl Nitrogen" data existed, but "Total Nitrogen" data did not. "Total Nitrogen" was calculated as the summation of "Total Kjeldahl Nitrogen" and "Nitrite + Nitrate".
If "surface water", "midwater", and "bottom" samples were taken at a station for the same parameter on the same day, then only the "surface water" sample was retained for analysis.
If the same parameter was sampled at a station within 7 days of each other, then one of the two samples was excluded from analysis because it was not considered as an independent sample.
For sites with a monthly sampling frequency: if two samples were collected in the same month but one of those sample dates fell within a day of either a previous or subsequent month with no data, then that sample data was used in either the prior or subsequent month. For example, if a sample was collected on January 7th and another sample was collected on January 31st, if no sample was collected in February, then the data collected on January 31st would be used for the February sample.

• Trend Analyses
Non-parametric statistical techniques were used to conduct monotonic and step trend analyses. Data are not required to conform to a particular distribution for non-parametric analyses. Non-parametric tests are also robust against outliers and large data gaps.

Seasonal Mann-Kendall test was used to identify monotonic trends in a statistically rigorous way for monthly and quarterly data (as described in Helsel, D.R. and R.M. Hirsch, 2002, Statistical Methods in Water Resources, USGS, as referenced in 62-302.533).
For Seasonal Mann-Kendall test, data from 1/1/2008 to present were used.
For monthly frequency data, the months of the year were used as seasons for the Seasonal Mann-Kendall test. If data were collected on a quarterly frequency for a site, then, then quarters 1 through 4 were used for the Seasonal Mann-Kendall test to remain consistent with FDEP assessment protocols.
Mann-Whitney test was used for step trend analysis to test whether significant differences were found between two PORs.
For Mann-Whitney, two periods of record were used.
TMDL Date Period: 1/1/2001 – 6/30/2008
Post TMDL Date Period: 7/1/2008 – Present
Mann-Kendall test was used to identify monotonic trends in a statistically rigorous way for data aggregated into annual geometric means (AGMs) on a WBID scale (rather than individual site basis as described above).
WBID data were pooled together and averaged for any parameter data within four days of one another (as per DEP assessment methodology). Annual geometric means were then computed for each WBID parameter. Annual geometric means were only calculated on the most recent year of data if that year had data through at least October. If a WBID only had stations sampled at a quarterly frequency, then annual geometric means were calculated on the most recent year of data if that year had at least three quarters of data.

Hillsborough River, Bayou Chico and Lower St. Johns River I&II BMAPs (Summary of detailed methods used to develop presentation material for Annual Meetings, not used in Annual Report, submitted 2016-2018)

Methods
• Data Download
Data were downloaded from STORET when available, otherwise data were obtained from IWR Run or from data providers on a case by case basis.
Data were downloaded for the POR specific to the 7.5-year rolling period of the corresponding reporting period, based on the IWR assessment methodology.
Data were downloaded for all sites listed in the corresponding BMAP Monitoring Network's WBID boundaries with Primary Types of River/Stream (indicating freshwater) or Estuary (indicating marine).
Data were downloaded for bacterial parameters: fecal coliform, *Escherichia coli* (*E. coli*, freshwater only), and *Enterococci* (marine only).
Rainfall data were also downloaded from STORET for the stations within the WBIDs of concern and within the specific POR.
Data were checked against most recent IWR Tool Run to ensure that data for all pertinent sites were downloaded from STORET.
• Data Processing and Analyses
General data processing
Duplicated data (same: date, time, and result value) were removed
Field replicate and field blank samples were not used in analysis.
Samples collected at depths greater than 0.6 m were not used in analysis.
Data with result qualifiers of "F", "G", "H", "J", "K", "N", "O", "T", "Q", "V", "Y", or "?" were not used in analysis, based on guidance from FFDEP TMDL assessment staff (Kevin O'Donnell).
Data with a result qualifier of "I" were only used if a corresponding MDL was listed.
Data with a result value of "*Not Reported" were deleted unless they also had a value qualifier of "U".
If not already present, a result qualifier of "U" was assigned to any data with a result value of "*Non-Detect".
If data existed for a station on the same day for the same parameter, but not the same time and result value, then values were averaged.
Bacteria Criteria Thresholds to Determine Impairment
Criteria are based on a monthly geometric mean (MGM) and a ten percent threshold value (TPTV).

The MGM is based on a minimum of either 5 samples (Class I) or 10 samples (Class III) taken over a 30-day period. Because of sample size, the criteria applicable to the BMAP are the TPTV.
A TPTV is an upper value not to be exceeded in 10 % or more of the samples during an assessment period.
Fecal coliform are used to assess both fresh and marine waters and the TPTV is 400 colony-forming units/100 milliliters (cfu/100mL)
E. coli were used to assess fresh waters and the TPTV is 410 cfu/100 mL.
Enterococci was used to assess Class III marine waters and the TPTV is 130 cfu/100 mL.
Fecal Bacteria Indicator (FIB) Exceedance Analysis
Only fecal coliform, *Enterococci*, and *E. coli* data collected during the reporting period were used in the analysis to assess progress towards meeting the FIB criterion.
Each year, the oldest 12 months of data is dropped off the data period reviewed the previous year, and the most recent 12 months of data is added to the dataset.
Data with a result qualifier of "U" were assumed to be below the TMDL exceedance criteria for fecal coliform.
Data with a result value of "*Present>QL" were considered as exceeding the fecal coliform TMDL criteria because these samples were "too numerous to count".
Table 3 from 62-303 F.A.C was used to determine if the observed data were exceeding the exceedance criteria by more than 10% for the daily average fecal coliform data (62-302.533 F.A.C) with at least 90% confidence.
The minimum number of exceedances is compared with the number of exceedances to determine if the IWR criterion is being met.
Additional Analyses
Time Series Plots (with each bacterial parameter and rainfall) and Summary Statistics (mean, median, minimum, and maximum) were provided for each of the BMAP Monitoring Network stations
Tables were created to show the total number of data points for the 7.5 year rolling assessment, number of exceedances for each bacteriological parameter, minimum number of exceedance to be considered impaired (by Table 3), and the calculated percentexceedance.
Beach Closure Analysis (pertains only to Bayou Chico BMAP)
Beach closure data were provided by the Florida Department of Health (FDOH in Escambia County) for Sanders Beach and Bayou Chico Beach stations (both Class III marine waterbodies).
Data is represented on a calendar year basis, except for the final year of analysis, which is through the end of the specific reporting period.
To assess and determine progress for the two beach WBIDs, the number of days under advisories or warnings issued during a calendar year is used.
Both stations were assessed using the impairment methodology in Subsection 62-303.460(1), F.A.C., which refers to beach advisories that meet the Verified List impairment methodology in Paragraph 62-303.360(1)(c), F.A.C.
This methodology states that a Class I, II, or III waterbody shall be placed on the Verified List if the water segment includes a bathing area for which a local health department or county government has issued closures, advisories, or warnings totaling 21 days or more during a calendar year (January through December), within the 7.5-year verified period, based on the bacteriological data. Meaning that if the site had more than 21 cumulative calendar days of beach closures in a given calendar year, then the criterion was exceeded for that year.

Caloosahatchee and Everglades West Coast BMAPs (Summary of detailed methods presented during both meetings, not used in Annual Reports, submitted February 2017)

Methods
• Data Download
Data were retrieved from STORET the last week of January 2017 for all stations in the Basin Management Action Plan (BMAP) Monitoring Network.
Period of Record (POR): All available data since 1/1/2000.
Overall POR was 1/13/2000 through 3/21/2016
Longest POR was 1/13/2000 through 3/21/2016 for Stations HENDGR20 and HENDGR30
Shortest POR was 10/26/2011 through 3/17/2016 for Station CBS 18.
Sufficiency: If a station did not have data through at least the 1st quarter of 2016, it was not included in analysis.

• Data Processing (in order of operation)

Total Nitrogen (TN) calculation

"Total Nitrogen" data was calculated for dates where both "Nitrite + Nitrate" and "Total Kjeldahl Nitrogen" data existed, but "Total Nitrogen" data did not. "Total Nitrogen" was calculated as the summation of "Total Kjeldahl Nitrogen" and "Nitrite + Nitrate".

If "Nitrogen Ion" data was available, but "Total Nitrogen" was not, then it was understood that "Total Nitrogen" was expressed as "Nitrogen Ion" for that dataset.

Sample Depth

If "surface water", "midwater", and "bottom" samples were collected at a station for the same parameter on the same day, then only the "surface water" sample was retained for analysis.

Only surface samples, which included samples collected at depths less than 1 m were used in analyses.

Data Qualifiers

Data with result qualifiers of "A", "F", "G", "H", "J", "K", "L", "N", "O", "T", "V", "Y", or "?" were not used in analysis, as per Table 1 Data Qualifier Codes in Rule 62-160.700, F.A.C. Quality Assurance.

Data with a result qualifier of "I" were only used if a corresponding Minimum Detection Level (MDL) was listed.

Data with a result qualifier of "U" were reviewed.

If not already present, a result qualifier of "U" was assigned to any data with a result value of "*Non-Detect".

Data with a result value of "*Not Reported" were deleted unless they also had a value qualifier of "U".

Data with a result qualifier of "U" were processed in accordance with Rule 62-303.320 (12), F.A.C. Aquatic Life-Based Water Quality Criteria Assessment. Results reported by a laboratory with the "U" data qualifier code were assessed as half the reported result or half the criterion (whichever was lower).

Sample Frequency

Samples collected on the same day at the same site were averaged by station.

To be treated as temporally-independent, samples must be collected at least four days apart.

A median value was calculated for samples collected within a four day period at the same station.

For sites with a monthly sampling frequency: if two samples were collected in the same month but one of those sample dates fell within a day of either a previous or subsequent month with no data, then that sample data was used in either the prior or subsequent month. For example, if a sample was collected on January 7th and another sample was collected on January 31st, if no sample was collected in February, then the data collected on January 31st would be used for the February sample.

Field replicate and field blank samples were not used in analysis.

•Trend Analysis

Trend analyses were conducted for sites with appropriate data sufficiency (i.e. sufficient number of observations per year) for the ability to inspect whether trends exist for TN, throughout the selected PORs. Specifically, sites with sufficient long-term PORs with the required number of data points were selected for trend analyses for this effort. For a site to be used, at a minimum, an approximately quarterly sampling frequency was desired. Additionally, a site had to have data with at least one data point within the first quarter of 2016 to be used. Sites and associated data that did not meet the requirements at this time will be re-evaluated for data sufficiency and may be included in future analysis efforts if missing data become available in STORET and meet the other requirements.

Two non-parametric statistical techniques were used to identify monotonic trend analyses in a statistically rigorous way, seasonal Mann-Kendall and Regional Mann-Kendall. Data are not required to conform to a particular distribution for non-parametric analyses. Non-parametric tests are also robust against outliers and large data gaps.

Seasonal Mann-Kendall test was used on TN data to identify trends on a seasonal basis.

For Seasonal Mann-Kendall test, available data covering the period from 1/1/2000 to 1/1/2017 was used.

For monthly frequency data, the months of the year were used as seasons for the Seasonal Mann-Kendall test.

Regional Mann-Kendall test was used to analyze the entire processed POR dataset using each station's respective sampling frequency (i.e. monthly) and also using the calculated annual geometric mean (AGM) TN data from 1/1/2000 to 1/1/2017. Regional Mann-Kendall test was used to identify trends for data aggregated into regions such as the Hendry Creek region and Imperial River region. The regionally defined scale was used rather than the seasonal aggregation on an individual site basis as described above.

Annual geometric means were calculated and analyzed for both calendar year and water year (June 1 – May 31).

For all Mann-Kendall tests, statistical results were considered significant if the p-value was less than 0.05 (p-value < 0.05). The strength of the trend analysis result is described as the correlation coefficient, or Tau for the Mann-Kendall test, which represents how TN concentration and time tend to change together over the established POR. If the result is statistically significant (p-value < 0.05), then a negative value of Tau represents a downward or decreasing trend indicating improvement, and a positive Tau value suggests an increasing or upward trend, or a continuing decline in water quality conditions.

Indian River Lagoon BMAP (from Technical Memorandum, submitted May 2017)

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) provided the data summaries for tributary station locations within the IRL (Indian River Lagoon) basin. The data were provided under separate cover in both Excel and Minitab format. Amec Foster Wheeler obtained the most current STORET data for stations IRLTBC, TC2, ODIX, and C25S50. NSL and FPF stations were provided by FDEP and were not in STORET format. STORET data were processed using the methods described below and only data that met quality control objectives were used in the analysis. Note that this data processing method was revised from the prior year's method so some values were slightly different.

Non-parametric statistical techniques were used to identify monotonic trend analyses in a statistically rigorous way with the Seasonal Mann-Kendall trend test. Data are not required to conform to a particular distribution for non-parametric analyses. Non-parametric tests are also robust against outliers and large data gaps.

METHODS

STORET Data was processed according to the following methods:

Data Processing (in order of operation)

Total Nitrogen (TN) calculation

"Total Nitrogen" data was calculated for dates where both "Nitrite + Nitrate" and "Total Kjeldahl Nitrogen" data existed, but "Total Nitrogen" data did not. "Total Nitrogen" was calculated as the summation of "Total Kjeldahl Nitrogen" and "Nitrite + Nitrate".

Sample Depth

If "surface water", "midwater", and "bottom" samples were collected at a station for the same parameter on the same day, then only the "surface water" sample was retained for analysis.

Only surface samples, which included samples collected at depths less than 1 m were used in analyses.

Data Qualifiers

Data with result qualifiers of "A", "F", "G", "H", "J", "K", "L", "N", "O", "T", "V", "Y", or "?" were not used in analysis, as per Table 1 Data Qualifier Codes in Rule 62-160.700, F.A.C. Quality Assurance and per guidance from Kevin O'Donnell in the Water Assessment Standards program.

Data with a result qualifier of "I" were only used if a corresponding Minimum Detection Level (MDL) was listed.

Data with a result qualifier of "U" were reviewed.

If not already present, a result qualifier of "U" was assigned to any data with a result value of "*Non-Detect".

Data with a result value of "*Not Reported" were deleted unless they also had a value qualifier of "U".

Data with a result qualifier of "U" were processed in accordance with Rule 62-303.320 (12), F.A.C. Aquatic Life-Based Water Quality Criteria Assessment. Results reported by a laboratory with the "U" data qualifier code were assessed as half the reported result or half the criterion (whichever was lower).

Sample Frequency

Samples collected on the same day at the same site were averaged by station.

To be treated as temporally-independent, samples must be collected at least four days apart.

A median value was calculated for samples collected within a four day period at the same station.

Field replicate and field blank samples were not used in analysis.

Lake Okeechobee BMAP (from Appendix E of 2016 Annual Report, submitted June 2017)

Methods

For this progress report, trend analyses were conducted on available data from stations within the Lake Okeechobee BMAP network using a variation of temporal and spatial attributes from an overall POR of January 1, 2009, to

December 31, 2016. The monitoring plan summarizes the analyses and results, and additional details are provided below.

TP and TN concentration data available in STORET were retrieved and processed for all stations in the BMAP network monitored by local entities. TP loading data for SFWMD individual stations were also obtained from SFWMD staff and draft trend analysis were completed. Further analyses will be completed for SFWMD stations in the BMAP monitoring network and included in future reports. The monitoring plan lists the stations used for trend analyses, including their respective sampling entity, available POR (within the overall POR), and number of samples used in the analyses.

Nonparametric statistical techniques were used to identify monotonic trend analyses in a statistically rigorous way with the Seasonal Kendall and Mann-Kendall trend tests. Seasonal Kendall tests were performed when sufficient data were available; otherwise only Mann-Kendall tests were performed for stations that did not have sufficient data. Data are not required to conform to a particular distribution for nonparametric analyses. Nonparametric tests are also robust against outliers and large data gaps, which were evident in some of the station datasets.

Because of the differences in data collection frequency by sampling entity, slight variations in trend analysis factors were necessary to appropriately analyze each particular dataset. The number of data points was limited each year in the POR. Therefore, trend analyses were conducted on TP and TN concentrations using (1) the entire processed POR dataset for each individual station incorporating season (attributed to the quarter that the sample was collected) as a factor, and (2) the entire processed POR dataset using data aggregated into AGMs using WY.

For all Mann-Kendall tests, statistical results were considered significant if the p-value was less than 0.05 (p-value < 0.05). The strength of the trend analysis result is described as the correlation coefficient, or Tau for the Mann-Kendall test, which represents how concentration or load and time tend to change together over the established POR. If the result is statistically significant

(p-value < 0.05), then a negative Tau value and slope represent a downward or decreasing trend indicating improvement, and positive Tau and slope values suggest an increasing or upward trend (decline in water quality conditions).

Caloosahatchee River BMAP (from Appendix E of 5-Year Review Report, submitted November 2017)

For this 5-Year Review, trend analyses were conducted on available data within an overall POR from May 1, 2007, to April 30, 2017, using stations recommended as Tier 1 in the revised Caloosahatchee Estuary BMAP network (as described in Appendix C of the 5-Year Review report). STORET and WIN data were processed using the methods described below, and only data that met QC objectives were used in the analyses. Nonparametric statistical techniques were used to identify monotonic trend analyses in a statistically rigorous way with the Mann-Kendall trend test. Data are not required to conform to a particular distribution for nonparametric analyses. Nonparametric tests are also robust against outliers and large data gaps. Section 2.3 in the main report summarizes the results; additional details on the methods are provided below.

Data Management and Processing

The Tier 1 tributary stations in the watershed were processed on an individual station basis to determine if the datasets were sufficient to meet the requirements for trend analysis. Stations that met the criteria were analyzed for trends. The Tier 1 estuary station data were aggregated into groups by WBIDs, processed, and then analyzed for trends on a WBID basis. All data from the Tier 1 stations in each of the three TMDL WBIDs (3240A, 3230B, and 3240C) were pooled to develop an aggregated dataset on a WBID basis. Table E-1 lists the stations initially selected for processing, including the data provider, latitude, longitude, waterbody type, and whether the station was grouped by WBID or analyzed on an individual station basis.

The WY established for this region is May 1 to April 30. May 1, 2007, to April 30, 2017, was selected as the general working POR for these water quality analyses to assess trends, and included a five-year data period prior to and after BMAP adoption in November 2012. The POR for some stations had to be modified to account for significant missing data (greater than one year).

Parameters selected for analysis were TN (or the required nitrogen species that allow for the calculation of TN) and TP. TN and TP data were retrieved from STORET for the stations listed in Table E-1, except for SFWMD Stations S79, CES03, CES04, CES05, CES06, and CES08, which were retrieved from WIN. After data were retrieved from STORET and WIN, the data were processed and analyzed using several QC checks (and industry standard statistical

diagnostics) that addressed the following items: depths of data collection, fatal qualifier codes, temporal independence, serial correlation, and seasonality.

During data processing of the initial set of Tier 1 tributary stations, an assessment was performed to determine data sufficiency by counting the number of viable data points (after the data were processed for QC), to assess major data gaps and approximate sampling frequencies. Table E-2 lists the POR and the number of samples collected at each individual station or in the WBIDs selected for analysis. Although May 2007 was initially selected as the working POR, none of the individual tributary stations had available data prior to May 2008 for TN or TP. Therefore, the working POR was shortened for the individual tributary stations to nine years for most of the stations with longer PORs. Table E-3 lists the POR and the number of samples compiled for each of the WBID datasets and Station S79 selected for analysis.

Based on a more detailed review of the individual station PORs and data gaps, it was found that four stations (Stations CALUSA0054FTM, CFMCARRELL, CFMMANUEL, and CFMWINKLER) had a number of data points collected in at least a five-year period. However, there were large data gaps in the PORs, and it was determined that those stations did not have enough data points in a five-consecutive year period, which is a minimum requirement for trend analysis. Therefore, those four stations were not used in further analyses (Table E-2). In addition, the data quality for TP data was insufficient for six stations in STORET (Stations 300, 400, 470, 540, 590, and 600). Therefore, only TN was further processed and analyzed for trends at those six stations. Two stations, CALUSA0024FTM and CALUSA0025FTM, had no data available prior to 2011. However, sufficient data were available to conduct further analyses, and so a shorter POR was analyzed for those stations. Finally, one station (18-6GR) had wide data gaps between November 2014 and April 2017. Data from June 2008 to November 2014 still met the minimum five-year data requirement, and that POR was used for subsequent processing and trend analysis.

After QC processing was completed and a near-final dataset was prepared for each station (or WBID), monthly means were calculated for datasets with more than one data point available in one given month. The monthly means were calculated to aid other analyses that were needed to further assess the data prior to trend analysis completion. These analyses included various time series analysis techniques, such as ACF and TSD, to review the potential for serial correlation and/or seasonality (i.e., seasonal patterns) that may affect the results of the trend analysis.

If months of data were missing from the specific time series for a dataset POR, then a variety of methods were used to fill the data gaps before the TSD analysis could be completed. The gap-filling methods used depended on the number of data points that had to be filled, and included multiple imputation and interpolation. This Appendix contains complete details of the specific steps and methodologies used for data processing and analysis.

Statistical Analyses

Only datasets that met the QC objectives mentioned above and described in this Appendix were ultimately used for trend analysis. Nonparametric statistical techniques were used to identify monotonic trends with the Mann-Kendall trend test. Nonparametric tests such as Mann-Kendall are robust against outliers and large data gaps, and data are not required to conform to a particular distribution for nonparametric analyses.

Prior to running trend analyses, it was necessary to conduct an ACF analysis to assess whether seasonality or serial correlation was impacting the data. For data showing seasonal pattern a TSD analysis was conducted to parse out any potential impacts of seasonality on the trend analyses. TSD requires the time series dataset to be complete, with no data gaps. Thus, before decomposing time series into seasonal and trend components, all data gaps should be filled with an appropriate value. For the purpose of these analyses, linear interpolation and the multiple imputation (MI) method were used to backfill datasets so that a TSD analysis could be conducted. Multiple imputation backfilling was only required for one station (22-7GR). This Appendix contains additional details on the MI methodology.

Data Download

TN and TP data from WIN and STORET:

Station S79.

Tier 1 Estuary WBIDs:

3240A (Stations: CALUSA0012FTM, CALUSA0014FTM, CES05, CES06, CES08).

3240B (Stations: CALUSA0010FTM, CES04).

3240C (CALUSA0006FTM, CALUSA0007FTM, CES03).

Tier 1 Tributary Stations: 300, 400, 470, 540, 590, 600, 16-3GR, 18-6GR,
20-9GR, 22-7GR, 23-5GR, 24-7GR, 25-GR20, 27-6GR, 27O-GR20, DEEPGR10, POWLGR20, BILLGR20, CFMMANUEL, CFMWINKLER, CFMCARRELL, CALUSA0025FTM, CALUSA0054FTM, CALUSA0024FTM.
Station data were retrieved from STORET and WIN for the designated POR for Tier 1 estuary and tributary stations:
POR:
Overall POR was May 1, 2007, to April 30, 2017.
Data Processing (in order of operation)
Nutrient Characteristic Selection:
TP: Phosphorus as P
TN: TN, Nitrogen Ion
If Nitrogen Ion not available: TN=TKN + (NO_2 + NO_3), TN=TKN+NO_3, TN =TKN+NO_2, or TN=TKN (best available)
Sample Depth:
If "surface water," "midwater," and "bottom" samples were collected at a station for the same parameter on the same day, then only the "surface water" sample was retained for analysis:
Only surface samples, which included samples collected at depths equal to/less than 1.0 meter (m), were used in the analyses.
Data Qualifiers:
Data with result qualifiers of "A," "F," "G," "H," "K," "L," "N," "O," "T," "V," "Y," or "?" were not used in the analysis, as per Table 1, Data Qualifier Codes, in Rule 62-160.700, F.A.C., Quality Assurance.
Data with result qualifier of "I" were only used if a corresponding minimum detection level (MDL) was listed:
Data with value of "*Present<QL" were not used in the analysis.
Data with result qualifier of "U" were reviewed:
If not already present, result qualifier of "U" was assigned to any data with a result value of "*Non-Detect."
Data with result value of "*Not Reported" were deleted unless they also had a value qualifier of "U."
Data with result value or qualifier that indicated values were below the MDL were reviewed within the dataset's POR. If it was determined that the analytical methods were changed during the POR, resulting in differences in the MDL, the highest MDL value was used as the uniform MDL for the entire POR.
Data with result qualifier of "U" were processed in accordance with Subsection 62-303.320(12), F.A.C., Aquatic Life-Based Water Quality Criteria Assessment. Results reported by a laboratory with the "U" data qualifier code were assessed as half the reported result or half the criterion (whichever was lower).
Field Blank samples were removed from Cape Coral station datasets (list of blanks provided by City of Cape Coral)
Estuary Data:
Station data were combined by WBID (parameters kept separate) for processing and analysis.
Tributary Data:
Station data were processed and analyzed on an individual basis.
Temporal Processing:
Same Day Average: If multiple surface water data points were collected on the same day, then values were averaged (including duplicates).
Monthly Time Series: If multiple data points existed within a month, the monthly average was calculated for each month.
Processing for Statistical Tests:
Data were processed according to the needs of each statistical test and formatted for use in the R statistical program. Specifically, R-Packages "Kendall" and "wql" were used to compute Mann-Kendall test statistics and Sen slope.
Sampling Frequency:
Monthly data series were used for analysis.
Missing data entries were populated with NA values to provide an equal number of points for each station and parameter.
Data Gap Filling:
If a test did not require continuous series, missing values were left as NA.
Linear Interpolation:

For tests that required continuous data series (e.g., TSD), linear interpolation was used to backfill the missing data for all gaps that were 1 month long.

MI:

For tests that required a continuous data series (e.g., TSD), gaps larger than 1 month, but less than 1 year, were filled using MI (only needed for 22-7GR TN). Unlike simple linear interpolation or a linear regression methodology, the MI method involves the backfilling of missing data with a set of plausible values (instead of just 1 value) based on Bayesian (probability-based) relationships. Rubin (1987) and Su et al. (2011) provide theoretical and implementation details about using MI for backfilling data gaps:

6 sets of probable values were produced for each missing value using MI.

The average of the 6 probable values was used to fill in the corresponding missing value.

Appropriate pre- and post-diagnostic checks were done to ensure the statistically valid implementation of multiple imputation method.

For tests that required a continuous data series, if data gaps of more than 1 year existed, then the series was truncated, and the longest available continuous series was used for trend analysis.

If a series did not have at least 5 years of continuous data, it was not used for trend analysis.

Statistical Analyses

Spatial Associations:

Time series plots of estuary WBIDs vs. Station S79.

Trend Analysis:

ACF:

Autocorrelation was conducted to evaluate seasonal patterns and/or serial correlation (monthly/bimonthly, quarterly, or annual seasons).

ACF was conducted first on monthly, non-gap-filled series to determine seasonality.

It was run again on the gap-filled and decomposed (see below) trend component of time series data to check for any serial correlation.

TSD:

If seasonality was evident from ACF plots on nongap-filled data, the time series was first backfilled using linear interpolation or MI (see Data Gap Filling) and subsequently decomposed into trend and seasonal components (based on annual seasonality patterns and assuming a fixed seasonal component).

The trend component from the TSD was extracted, checked for serial-correlation (no stations were found to have serial correlation in the trend component), and Mann-Kendall test was conducted to determine the presence of monotonic trends.

Mann-Kendall Test:

Before running Mann-Kendall test, the time series data were checked for serial correlation and seasonality using ACF.

If serial correlation was evident in ACF, first-order differencing (i.e., creating a new time-series by the subtraction of consecutive terms in the time-series) was done to remove serial correlation prior to conducting Mann-Kendall test:

Mann-Kendall tests were conducted on monthly, non-gap-filled, and non-decomposed series if no seasonality was evident (after the removal of serial correlation if present).

The slope value was obtained from conducting Mann-Kendall on the initial non-gap-filled, non-decomposed series.

The tau and p-value were obtained from conducting Mann-Kendall on the first order differencing resultant series

For time-series with evident seasonality, the Mann-Kendall test was conducted on the decomposed trend component to identify positive or negative significant trends independent of seasonal effects.

Period of Record (POR)

POR for overall trend analysis data: January 1, 2006 – June 30, 2017

POR for Deep Creek/Lake Ashby step trend analysis: January 1, 2002 - June 30, 2017

Table E-1. Initial list of stations selected for processing

SFWMD = South Florida Water Management District; ID = Identification; WBID = Segment with waterbody identification number

Data Provider	Station ID	Latitude	Longitude	Waterbody Type	Grouped by WBID or Analysis Type
SFWMD	S79	26.72293	-81.6932	Estuary	Individual Estuary
DEP	CALUSA0014FTM	26.529	-82.0177	Estuary	Grouped – 3240A
DEP	CALUSA0013FTM	26.52389	-82.0044	Estuary	Grouped – 3240A
DEP	CALUSA0012FTM	26.53831	-81.9452	Estuary	Grouped – 3240A
SFWMD	CES05	26.6366	-81.8887	Estuary	Grouped – 3240A
SFWMD	CES06	26.5823	-81.9102	Estuary	Grouped – 3240A
SFWMD	CES08	26.5233	-81.992	Estuary	Grouped – 3240A
DEP	CALUSA0010FTM	26.662	-81.8594	Estuary	Grouped – 3240B
SFWMD	CES04	26.6817	-81.8338	Estuary	Grouped – 3240B
DEP	CALUSA0007FTM	26.69683	-81.7965	Estuary	Grouped – 3240C
DEP	CALUSA0006FTM	26.71933	-81.7386	Estuary	Grouped – 3240C
SFWMD	CES03	26.71669	-81.7606	Estuary	Grouped – 3240C
City of Cape Coral	400	26.60004	-81.9412	Tributary	Individual Tributary
City of Cape Coral	470	26.57763	-81.9438	Tributary	Individual Tributary
City of Cape Coral	540	26.55265	-81.9734	Tributary	Individual Tributary
City of Cape Coral	300	26.63661	-81.9305	Tributary	Individual Tributary
City of Cape Coral	590	26.54393	-82.0107	Tributary	Individual Tributary
City of Cape Coral	600	26.54282	-82.0033	Tributary	Individual Tributary
City of Ft. Myers	CFMMANUEL	26.62714	-81.88	Tributary	Individual Tributary
City of Ft. Myers	CFMWINKLER	26.60407	-81.8838	Tributary	Individual Tributary
City of Ft. Myers	CFMCARRELL	26.6114	-81.884	Tributary	Individual Tributary
DEP	CALUSA0054FTM (former CALUSA0023FTM and 28020109)	26.69287	-81.7674	Tributary	Individual Tributary
DEP	CALUSA0024FTM	26.73004	-81.7017	Tributary	Individual Tributary
DEP	CALUSA0025FTM	26.6671	-81.8965	Tributary	Individual Tributary
Lee County	27-6GR	26.74015	-81.7369	Tributary	Individual Tributary
Lee County	20-9GR	26.70413	-81.8447	Tributary	Individual Tributary
Lee County	27O-GR20	26.74029	-81.7557	Tributary	Individual Tributary
Lee County	23-5GR	26.71575	-81.8086	Tributary	Individual Tributary
Lee County	24-7GR	26.71507	-81.7998	Tributary	Individual Tributary
Lee County	POWLGR20	26.68313	-81.8774	Tributary	Individual Tributary
Lee County	18-6GR	26.69142	-81.8589	Tributary	Individual Tributary
Lee County	DEEPGR10	26.53916	-81.9185	Tributary	Individual Tributary
Lee County	16-3GR	26.65997	-81.8977	Tributary	Individual Tributary
Lee County	22-7GR	26.71514	-81.822	Tributary	Individual Tributary
Lee County	25-GR20	26.71496	-81.78	Tributary	Individual Tributary
Lee County	BILLGR20	26.65424	-81.8404	Tributary	Individual Tributary

Table E-2. Summary of POR and data availability for tributary stations

N/A = Not applicable.
* Only includes useful POR start/end. Other data exist past this endpoint but were not used in analyses.
** Station did not have five consecutive years of data in STORET. Data were not used for trend analysis from these stations.

WBID	Station	Parameter	POR Start	POR End	Number of Samples
3240A2	300	TN	May-08	Mar-17	107
3240A2	300	TP	N/A	N/A	0
3240A1	400	TN	May-08	Mar-17	105
3240A1	400	TP	N/A	N/A	0
3240A1	470	TN	May-08	Mar-17	106
3240A1	470	TP	N/A	N/A	0
3240A1	540	TN	May-08	Mar-17	102
3240A1	540	TP	N/A	N/A	0
3240A1	590	TN	May-08	Mar-17	106
3240A1	590	TP	N/A	N/A	0
3240A1	600	TN	May-08	Mar-17	98
3240A1	600	TP	N/A	N/A	0
3240O	16-3GR	TN	May-08	Apr-17	106
3240O	16-3GR	TP	May-08	Apr-17	106
3240O	18-6GR	TN	Jun-08	Nov-14*	86
3240O	18-6GR	TP	Jun-08	Nov-14*	86
3240F	20-9GR	TN	May-08	Apr-17	107
3240F	20-9GR	TP	May-08	Apr-17	107
3240F	22-7GR	TN	May-08	Jan-17	96
3240F	22-7GR	TP	May-08	Jan-17	96
3240Q	23-5GR	TN	May-08	Apr-17	107
3240Q	23-5GR	TP	May-08	Apr-17	107
3240M	24-7GR	TN	May-08	Apr-17	107
3240M	24-7GR	TP	May-08	Apr-17	107
3240M	25-GR20	TN	May-08	Nov-14*	78
3240M	25-GR20	TP	May-08	Nov-14*	78
3240M	27-6GR	TN	May-08	Apr-17	107
3240M	27-6GR	TP	May-08	Apr-17	107
3240M	27O-GR20	TN	May-08	Feb-17	106
3240M	27O-GR20	TP	May-08	Feb-17	106
3240J	BILLGR20	TN	May-08	Apr-17	108
3240J	BILLGR20	TP	May-08	Apr-17	108
3236A	CALUSA0024FTM	TN	Jan-11	Apr-17	76
3236A	CALUSA0024FTM	TP	Jan-11	Apr-17	76
3236A	CALUSA0025FTM	TN	Jan-11	Apr-17	76
3236A	CALUSA0025FTM	TP	Jan-11	Apr-17	76
3236A	CALUSA0054FTM	TN	Mar-13	Apr-17**	9
3236A	CALUSA0054FTM	TP	Mar-13	Apr-17**	9

WBID	Station	Parameter	POR Start	POR End	Number of Samples
3236A	CFMCARRELL	TN	Jan-13	Dec-16**	48
3236A	CFMCARRELL	TP	May-08	Dec-16**	74
3236A	CFMMANUEL	TN	May-08	Dec-16**	74
3236A	CFMMANUEL	TP	May-08	Dec-16**	74
3236A	CFMWINKLER	TN	Jan-13	Dec-16**	48
3236A	CFMWINKLER	TP	May-08	Dec-16**	74
3236A	DEEPGR10	TN	May-08	Apr-17	108
3236A	DEEPGR10	TP	May-08	Apr-17	108
3236A	POWLGR20	TN	May-08	Apr-17	105
3236A	POWLGR20	TP	May-08	Apr-17	105

Table E-3. Summary of POR and data availability for WBID datasets

WBID	Parameter	POR Start	POR End	Number of Samples
3240A	TN	May-07	Apr-17	120
3240A	TP	May-07	Apr-17	119
23240B	TN	May-07	Sep-16	106
23240B	TP	May-07	Sep-16	107
3240C	TN	May-07	Sep-16	120
3240C	TP	May-07	Sep-16	107
S79	TN	May-07	Oct-16	102
S79	TP	May-07	Oct-16	102

Draft Harney-Monroe BMAP (From Appendix A of Draft 5-Year Review Report, submitted January 2018)

Methods

Data Download

Water quality data were provided by SJRWMD staff (Pamela Way)

Water Quality Stations Used: SRS, ECH, SRN, CLH, LH-OW-NE, LH-OW-SE, ASH, LA-OW-S, DMC, DCR-MRD, OW-SJR-1, SJR-415, LM-OW-NE, LM-OW-S, OW-2, OW-4, OW-6

For trend analysis, station data were grouped as follows:

Group	Name (Location)	Stations
1	SRS (Outlet of MSJR to USJR)	SRS
2	ECH (Econ River before SJR at SR-426)	ECH
3	SRN (Near input to Lake Harney at SR-46)	SRN
4	Lake Harney	CLH, LH-OW-NE, LH-OW-SW
5a	Deep Creek	DCR-MRD, DMR
5b	Lake Ashby	ASH, LA-OW-S
6	OW-SJR-1 (SJR between Harney and Jesup)	OW-SJR-1
7	SJR-415 (SJR between Jesup and Monroe)	SJR-415
8	Lake Monroe	LMAC, LM-OW-NE, LM-OW-S
9	SJR-DPP (Outfall from Monroe and FPL plant)	SJR-DPP

Data Processing
Nutrient Characteristic Selection
Total Phosphorus (TP): TP Total
Total Nitrogen (TN): TN Calculated
Chlorophyll-a (Chl-a): Chl-a corrected
Sample Depth (all data)
Data with sample depths within 0.5 m of the bottom of the water body were not used for analysis
Data Qualifiers (all data)
Data with result qualifiers of ".", "?", "0", "1", "2", "3", "4", "5", "A", "B", "F", "G", "H", "J", "K", "L", "N", "O", "Q", "T", "V", "Y" were not used in analysis, as per SJRWMD 2016 Status and Trends Report, and FDEP Table 1 Data Qualifier Codes in Rule 62-160.700, F.A.C. Quality Assurance.
Data valued with a result qualifier of "I" were used as recorded.
Temporal Independence Processing
Same Day Average: If multiple samples were collected on the same day, the values were averaged
Monthly Time Series: If multiple data points existed within a month, the average of all data points was calculated for each month.
Data for Time Series Plots
Data for each parameter at each station were kept as a separate series
All sample values were used (without temporal independence processing)
Data for Trend Analysis
Data for geographically related stations were merged (by parameter) to improve completeness of data series (e.g. all stations within a lake were grouped)
Processing for Statistical Tests
Data were processed according to the needs of each statistical test and formatted for use in the R statistical program.
Statistical Analysis
Trend Analysis
Autocorrelation function (ACF):
Autocorrelation function was conducted to evaluate seasonal patterns or serial correlation (monthly/bi-monthly, quarterly, or annual seasons)
For purposes of Seasonal Kendall analysis, statistically significant correlation on the 12^{th} month lag was considered to be representative of serial correlation
Statistically significant correlation on the 6^{th} and 12^{th} month lags were considered to be representative of seasonality.
Seasonal Kendall Tau Test:
Statistical Test Description:
A nonparametric statistical test that does not require data to conform to a specific distribution and is not sensitive to outliers or data gaps
Identifies monotonic trends in the datasets
Yields statistical significance value and direction of trend (increasing or decreasing)
Accounts for seasonal data patterns (using months as seasons)
Use in Harney-Monroe Analysis:
Serial correlation was identified with ACFs prior to trend analysis
USGS Fortran code for Seasonal Kendall Tau Test used to produce tau, p-value, adjusted p-value, and Sen slope
P-value used for series with no serial correlation detected
Adjusted p-value used if serial correlation was identified
Tau, P-value, and slope used to interpret significance and direction of monotonic trend
Step-Trend Analysis
Compared medians and data trends before and after cessation of biosolids applications onto sites near Deep Creek and Lake Ashby
Separated monthly TN and TP series into "before" and "after" periods (biosolids application ended in 2011)
Period during biosolids application, but before cessation (2002-2011)
Period after cessation of biosolids application (2012-2017)
Boxplots generated to show difference in medians before and after cessation

Mann-Whitney statistical test performed to determine significance of difference in medians before and after cessation
LOWESS curves added to scatterplots to show differences in trends before and after cessation
Compared results of stations upstream and downstream of biosolids application site
Not directly connected and upstream stations: DMR, Lake Ashby (pooled data from LA-OW-S and ASH to improve data sufficiency), respectively
Station downstream of biosolids application site: DCR-MRD
Cross Correlation Function (CCF)
Cross correlation performed to evaluate relationships and lag times between parameter concentrations at adjacent stations
Lake Jesup stations: OW-2, OW-4, and OW-6
Upstream river station: OW-SJR-1
Downstream River station: SJR-415
Common POR (2006-2017)

Appendix B: Quality Assurance Process for Procurement of Sampling and Analytical Services

1. Department contracts for sampling or analytical services, including research projects, must include quality assurance (QA) requirements.
    a. Sampling services include the collection of sample media (e.g., water, sediment, soils, chemical wastes) or biological organisms.
    b. Analytical services include analysis, observation or measurement activities conducted in the field or in a laboratory.
    c. QA requirements must be included in the Contracts as an attachment that is incorporated by reference in the Contract. Note: Additional QA requirements may be included in the Contract Scope of Services. Such additional QA requirements in the Scope of Services must be described in specific, numbered tasks and deliverables.
    d. Contact the Aquatic Ecology and Quality Assurance Section (AEQAS) for any questions about QA requirements.
2. Steps for inclusion of QA Requirements in a Department Contract
    a. Contract Initiation – If sampling or analytical services are included in the contract, a QA approval signature from the AEQAS is required on the Contract Initiation Form (CIF), Part 1. Prior to routing to AEQAS for a QA signature, make sure that all appropriate QA check boxes in Part 1 of the CIF are completed.
    b. Scope of Services Development – During consultation with the Contractor and during development of the Scope of Services, the DEP Contract manager should provide the appropriate QA Requirements Attachment to the Contractor (see 2.c., below).
        i. Review the QA Requirements with the Contractor. Make sure that the Contractor understands the QA Requirements and can meet them for the proposed Scope of Services.
        ii. Any changes to the QA Requirements negotiated with the Contractor must be reviewed and approved by the Department's Contract manager and AEQAS.
        iii. For research projects, during the Scope of Services development and well before Contract execution, the Contractor must provide information for review by the Department's Contract manager and AEQAS about proposed methodology for sampling, analysis, quality control, and experimental data evaluation procedures.
        iv. The Scope of Services must include appropriate QA Deliverables. Template language for QA deliverables for both Standard and Research QA Requirements (see below) are in the attached QA Deliverables Template Language.
    c. QA Requirements Attachment – One of two documents for QA Requirements is used as an attachment for Department Contracts, depending on whether the Standard or Research QA check boxes are denoted in Part 1 of the CIF (or whether the grant will be funding a research project). Select the appropriate document per the following:
        i. Include the attached Standard QA Requirements as Attachment E if the sampling activities will be conducted according to the DEP Standard Operating Procedures (SOPs) and the laboratory analyses will be performed by a certified laboratory accredited by the Florida Department of Health (FDOH) Environmental Laboratory Certification Program. NOTE: For DEP Contracts, DEP SOPs and certified labs are utilized in most cases.
        ii. Include the attached Research QA Requirements as Attachment E if sampling activities will NOT be conducted according to the DEP SOPs and laboratory analyses will NOT be performed by a certified laboratory. See 2.b.iii., above.
        iii. Contact AEQAS for assistance with editing one of the above QA Requirements documents if the proposed Scope of Services for the sampling and/or analysis services to be provided by the Contractor does not appear to conform to either of the choices above (or seems to be a hybrid of the choices).
        iv. NOTE: AEQAS review and approval is required for all edited QA Requirements documents.

d. Quality Assurance Plan (QA Plan) – Contractors providing sampling and analytical services to the Department must submit a QA Plan upon execution of the Contract, and obtain approval for the QA Plan from the Department's Contract manager before starting project work. The attached Standard QA Plan Template may be used if the Standard QA Requirements Attachment is included in the Contract, and the attached Research QA Plan Template may be used if the Research QA Requirements are included in the Contract. The Contract manager must review the QA Plan for conformance with the Contract Scope of Services and the Contract QA Requirements attachment (with review assistance from AEQAS staff, as needed). This submittal requirement is specified in the QA Requirements document attached to the Contract (see 2.c, above) and as part of the Deliverables in the Scope of Services (see 2.b.iv., above).
e. Exception to QA Plan Requirement – The Contract manager may opt to not require a QA Plan for Contractors who will not be designing a sampling scheme or a research project and are only providing standard sampling and/or analytical services to the Department. In those cases, the Contract shall include the Standard QA Attachment, but state that the requirements of Section 6 of the Attachment are waived and a QA Plan is not required.
f. Contract Execution – Approval for the QA Requirements and QA Plan type for the contract requires a signature from the AEQAS on the Contract Initiation Form (CIF), Part2.

Appendix C: Contract Attachment G – Quality Assurance Requirements

All sampling and analyses performed under this Contract must conform to the requirements set forth in Chapter 62-160, Florida Administrative Code (F.A.C.) and "Requirements for Field and Analytical Work performed for the Department of Environmental Protection under Contract" (DEP-QA-002/02), February 2002.

LABORATORIES

The CONTRACTOR shall ensure that all laboratory testing activities are performed by laboratories certified by the Florida Department of Health Environmental Laboratory Certification Program (DoH ELCP) for all applicable matrix/method/analyte combinations to be measured. For non-potable water matrix, the certification requirement is considered satisfied if the laboratory is certified for the contracted analyte in at least one method that uses the same analytical technology as the contract-proposed method.

If the laboratory is not certified for some or all of the proposed test measurements, the laboratory shall apply for certification within one month of Contract execution. Within six months of Contract execution, the laboratory shall be fully certified for all applicable matrix/method (or analytical technology)/analyte combinations to be performed. Regardless of when the laboratory receives certification, the laboratory must implement all applicable standards of the National Environmental Laboratory Accreditation Conference (NELAC) upon Contract execution.

Laboratories shall maintain certification as specified in item 2.a above during the life of the Contract. Should certification for an analyte or test method be lost, all affected tests shall be immediately sub-contracted to a laboratory with current DoH ELCP certification in the appropriate matrix/method/analyte combination(s). The CONTRACTOR shall notify the DEP contract manager in writing before any change to a sub-contracted laboratory is made.

A copy of the DoH ELCP Certificate and the associated list of specific fields of accreditation for each contracted or sub- contracted laboratory shall be provided to the DEP contract manager upon Contract execution or upon receiving DoH certification (see items 2.a and 2.b above).

The CONTRACTOR shall ensure that an acceptable initial demonstration of capability (IDOC), as described in Appendix C of Chapter 5 of the NELAC Standards is performed. Each laboratory that performs any of the proposed matrix/method (or analytical technology)/analyte combination(s) must have the requisite IDOC documentation and supporting laboratory records. IDOCs shall be performed and shall meet the contract specified requirements for precision, accuracy, and the method detection limit (MDL) and/or practical quantitation limit(PQL) before the test procedure is used to generate data for this Contract. If requested by the Department, documentation that supports the IDOC shall be made available for review.

When performance test samples are not required by DoH ELCP for certification, the laboratory shall obtain, analyze and evaluate performance test samples, standard reference materials (SRM) or other externally assayed quality control (QC) samples, hereinafter known collectively as quality control check (QCC) samples.

The laboratory shall ensure that the selected QCC samples(s) represent all matrix/method/analyte combinations that are not subject to certification requirements.

These samples shall be analyzed at six-month intervals and the results shall be within the acceptable range established by the QCC sample provider.

Before providing analytical services for this Contract, the laboratory must provide to the DEP contract manager the results of the QCC sample(s) and the associated acceptable range(s) as established by the QCC sample provider. The submitted results must be from QCC samples that have been completed within the previous six months prior to the submission date.

Any non-standard laboratory procedures or methods that are proposed for use (i.e., those not approved by DEP for standard environmental analyses) shall be submitted for review and approval in accordance with DEP-QA-001/01, "New and Alternative Analytical Laboratory Methods," February 1, 2004. These procedures or methods shall be approved by the DEP contract manager before use under this Contract and must be cited or described in the required planning document (see Section 6).

The CONTRACTOR shall ensure that Practical Quantitation Limits (PQLs) and Method Detection Limits (MDLs) required by the Contract are listed in the planning document (see Section 6).

The CONTRACTOR shall ensure that the selected laboratory test methods listed in the planning document can provide results that meet the Contract data quality objectives.
The CONTRACTOR shall ensure that all laboratory testing procedures follow the analytical methods as approved in the planning document (see Section 6).
The CONTRACTOR shall ensure that the all laboratory quality control measures are consistent with Chapter 5 of the NELAC standards.
In addition, the CONTRACTOR shall ensure that the quality control requirements specified in the attached addenda are followed.
The CONTRACTOR shall ensure that all sample results are calculated according to the procedures specified in the analytical methods approved in the planning document.

FIELD ACTIVITIES

"Sample" refers to samples that have been either collected or analyzed under the terms of this Contract.
The CONTRACTOR shall ensure that all sample collection and field testing activities are performed in accordance with the Department's "Standard Operating Procedures for Field Activities" (DEP-SOP-001/01, March 31, 2008).
The specific standard operating procedures (SOPs) to be used for this Contract shall be cited in the planning document (see Section 6).
Any non-standard field procedure shall be submitted for review and approval to the DEP contract manager in accordance with section FA 2000 of DEP-SOP-001/01. All non-standard procedures and methods must be approved by the DEP contract manager before use under this Contract and must be cited or described in the planning document.
Per the quality control measures outlined in the DEP SOPs (FQ 1000 and the calibration requirements of the FT-series for field testing), the CONTRACTOR shall ensure that the following field quality controls (and any additional quality control measures specified in the addenda) are incorporated into the project design:
Matrix-Related Quality Controls - The CONTRACTOR shall ensure that the laboratory is provided with sufficient sample volume to analyze at least one set of matrix spikes and either matrix spike duplicates or laboratory duplicates as follows:
The first time a sample from a sample collection matrix (see Table FA 1000-1) is collected;
One in each additional 20 samples of the sample collection matrix, after the first 20 samples; and
The last time samples are collected for the sample collection matrix.
Field-Generated Quality Control (QC) Blanks – Blanks associated with field activities as defined in FQ 1210 of the DEP SOPs shall be collected according to the requirements of FQ 1230.
If an analyte detected in the sample is also found in any field-generated QC blank that is associated with the sample, the CONTRACTOR shall investigate and attempt to determine the cause of the QC blank contamination. The outcome of this investigation shall be reported and shall include a discussion of the corrective measures taken to minimize future occurrences of QC blank contamination.
If an analyte detected in the sample is also found in any field-generated QC blank that is associated with the sample, the CONTRACTOR shall ensure that the analyte in the affected sample is reported as estimated ("J" with a narrative explanation) unless the analyte concentration in the affected sample is at least 10 times the reported QC blank value concentration.

REPORTING, DOCUMENTATION AND RECORDS RETENTION

The CONTRACTOR shall ensure that all laboratory and field records as outlined in Rules 62-160.240 and .340, F.A.C. are retained for a minimum of five years after the project completion.
All field and laboratory records that are associated with work performed under this Contract shall be organized so that any information can be quickly and easily retrieved for inspection, copying or distribution.
The CONTRACTOR shall ensure that all laboratory reports are issued in accordance with NELAC requirements. These reports shall be submitted to the DEP contract manager and shall include the following information:
☐ Laboratory sample identification (ID) and associated Field ID
☐ Analytical/test method
☐ Parameter/analyte name
☐ Analytical result (including dilution factor)

☐Result unit
☐Applicable DEP Qualifiers per Table 1 of Chapter 62-160, F.A.C.
☐Result comment(s) to include corrective/preventive actions taken for any failed QC measure (e.g., QC sample, calibration failure, etc.) or other problem related to the analysis of the samples
☐Date and time of sample preparation (if applicable)
☐Date and time of sample analysis
☐Results of laboratory verification of field preservation
☐Sample matrix
☐DoH ELCP certification number for each laboratory (must be associated with the test result(s) generated by the laboratory)
☐MDL
☐PQL
☐Sample type (such as blank type, duplicate type, etc.)
☐Field and laboratory QC blank results:
Laboratory QC blank analysis results as required by the method, NELAC Chapter 5 and the planning document (see Section 6 below);
Field quality control results including trip blanks, field blanks, equipment blanks, and field duplicates (or replicates) as specified in the planning document (see Section 6)
☐Results of sample matrix spikes, laboratory duplicates or matrix spike duplicates, as applicable
☐Results of surrogate spike analyses (if performed)
☐Results of laboratory control samples (LCS)
☐Link between each reported quality control measure (e.g., QC blanks, matrix spikes, LCS, duplicates, calibration failure, etc.) and the associated sample result(s)
☐Acceptance criteria used to evaluate each reported quality control measure
The CONTRACTOR shall ensure that the following field-related information is reported to the DEP contract manager:
☐Site and/or facility name, address and phone number
☐Field ID for each sample container and the associated analytes (test methods) for which the container was collected
☐Date and time of sample collection
☐Sample collection depth
☐Sample collection method identified by the DEP SOP number, where applicable
☐If performed, indicate samples that were filtered
☐Field test measurement results:
DEP SOP number (FT-series), where applicable
Parameter name
Result
Result unit
Applicable Data Qualifiers per Table 1 of Chapter 62-160, F.A.C.
☐Narrative comments discussing corrective/preventive actions taken for any failed QC measure (e.g., blank contamination, meter calibration failure, split sample results, etc.), unacceptable field measurement or other problems related to the sampling event.
The Department reserves the right to request some or all of the laboratory or field information in an electronic format (Microsoft Word, Microsoft Excel, Microsoft Access, etc.) or paper format.

AUDITS

AUDITS BY THE DEPARTMENT – Pursuant to Rule 62-160.650, F.A.C., the Department may conduct audits of field and/or laboratory activities. In addition to allowing Department representatives to conduct onsite audits, the CONTRACTOR, upon request by the Department, must provide all field and laboratory records pertinent to the contracted field and laboratory activities. If an audit by the Department results in a determination that the reported data are not usable for the purpose(s) or do not meet the data quality objectives specified by the Contract, the DEP contract manager shall pursue remedies available to the Department, including those outlined in Section 8 below.

PLANNING REVIEW AUDITS –
Initial: Prior to the completion of the sampling and analysis events and as specified under each task assignment issued, the CONTRACTOR and all associated subcontractors shall review the planning document (see Section 6 below) relative to the completed field and laboratory activities to determine if the data quality objectives are being met, identify any improvements to be made to the process, and refine the sampling and/or analytical design or schedule. Within one month of the review, a summary of the review, including any corrective action plans or amendments to the planning document, shall be sent to the DEP contract manager and a copy shall be maintained with the permanent project records.
Ongoing: Planning reviews as described in item (i) above shall occur annually.
QUALITY SYSTEMS AUDITS – The CONTRACTOR and all subcontractors shall ensure that any required laboratory and field quality system and management systems audits are performed according to the respective Quality Manuals for each contracted and sub-contracted entity. These audits shall be documented in the CONTRACTOR's and subcontractors' records.
STATEMENTS OF USABILITY – As a part of the audit process and the final report, the CONTRACTOR shall provide statements about data usability relative to the Contract Data Quality Objectives and Data Quality Indicators specified in the planning document, this attachment and the addenda.
The CONTRACTOR shall ensure that all acceptance and usability criteria required by this Contract not specified above are listed in the planning document.
The CONTRACTOR shall ensure that the results of all quality control measures described above are evaluated according to the acceptance criteria listed in this attachment, the addenda and the planning document.
The CONTRACTOR shall ensure that all sample results are evaluated according to the additional usability criteria specified in the planning document.

PLANNING DOCUMENT
The CONTRACTOR shall submit the planning document identified below to the DEP contract manager no later than 120 days prior to the commencement of field and laboratory activities. Failure to submit the planning document in this required timeframe shall result in a delay of approval to begin work until the document has been submitted to the Department and approved by the DEP contract manager. The document shall be submitted as a *Sampling and Analysis Plan (or project proposal).* The plan shall discuss the information contained in the document "Requirements for Field and Analytical Work Performed for the Department of Environmental Protection Under Contract", DEP-QA-002/02.
The CONTRACTOR and subcontractors may submit a version of the planning document to the Department for approval no more than three times. If the CONTRACTOR fails to obtain approval for the planning document after the third (final) submission to the Department, the DEP contract manager may suspend or terminate the Contract.
The DEP Contract number shall appear on the title page of the submitted planning document. Within forty-five (45) days of receipt of the properly identified planning document by the Department, the Department shall review and either approve the planning document or provide comments to the CONTRACTOR and affected subcontractors as to why the planning document is not approved. If further revisions are needed, the CONTRACTOR shall then have fifteen (15) days from the receipt of review comments to respond. The Department shall respond to all revisions to the planning document within thirty (30) days of receipt of any revisions.
If the review of the planning document by the Department is delayed, through no fault of the CONTRACTOR, beyond sixty (60) days after the planning document is received by the Department, the CONTRACTOR shall have the option, after the planning document is approved, of requesting and receiving an extension in the term of the Contract for a time period not to exceed the period of delayed review and approval. This option must be exercised at least sixty (60) days prior to the current termination date of the Contract.
Work may not begin for specific Contract tasks until approval has been received by the CONTRACTOR from the DEP contract manager. Sampling and analysis for the Contract may not begin until the planning document has been approved.
Once approved, the CONTRACTOR shall follow the protocols specified in the approved planning document including, but not limited to:
☐Ensuring that all stated quality control measures are collected, analyzed and evaluated for acceptability;
☐Using only the protocols approved in the planning document; and

☐Using only the equipment approved in the planning document.

If any significant changes in procedures or test methods, changes in equipment, changes in subcontractor organizations or changes in key personnel occur, the CONTRACTOR shall submit appropriate revisions of the planning document to the DEP contract manager for review. The proposed revisions may not be implemented until they have been approved by the DEP contract manager. If the CONTRACTOR fails to submit the required revisions, the DEP contract manager may suspend or terminate the Contract. These amendments shall be

Provided in a new planning document.

Provided as amended sections of the current planning document.

Documented through written or electronic correspondence with the DEP contract manager and incorporated into the approved planning document

DELIVERABLES

The following lists the expected schedule for the deliverables that are associated with the Quality Assurance requirements of this Contract:

Copy of DoH ELCP Certificate(s) and the associated list(s) of specific fields of accreditation, per item 2.d above.

Copies of the QCC sample results per item 2.f. above.

Non-standard laboratory or field procedures – The CONTRACTOR shall submit to the DEP contract manager all required information necessary for review of non-standard procedures per items 2.g. and 3.c. above.

Reports of planning review audits as specified in item 5.b. above.

Statements of Usability as specified in item 5.d. above.

Planning document per Section 6, above.

CONSEQUENCES

Failure to comply with any requirement of this attachment may result in:

Immediate termination of the Contract.

Withheld payment for the affected activities.

Contract suspension until the requirement(s) has been met.

A request to refund already disbursed payments.

A request to redo work affected by the non-compliant activity.

Other remedies available to the Department.

Addendum 1: Quality Control Requirements for Laboratories Performing Chemical Analysis

In addition to the quality control requirements outlined in Chapter 5 of the NELAC Standards, the following quality control measures shall be implemented for this Contract. Note: "Sample" refers to samples that have been either collected or analyzed under the terms of this Contract.

Matrix-Related Quality Control Samples - The CONTRACTOR shall ensure that samples associated with this Contract are used for matrix spikes, and either laboratory duplicates or matrix spike duplicates. The laboratory shall analyze these samples:
The first time samples from a sample collection matrix (see Table FA 1000-1) are submitted to the laboratory under this Contract for analysis. The laboratory shall select one or more of the received samples for use in composition of the matrix spike and duplicates.
After the first 20 samples from the sample collection matrix have been analyzed, at least one matrix spike and either laboratory duplicates or matrix spike duplicates shall be composed using a sample or samples selected from each additional 20 samples of the sample collection matrix submitted to the laboratory.
The last time samples from the sample collection matrix are received and analyzed. The laboratory shall select one or more of the received samples for use in composition of the matrix spike and duplicates.
Spike levels must be at the concentrations specified in item 3 below.
If the selected sample concentration is expected to be below the Contract-specified practical quantitation limit (PQL) listed in the planning document, then matrix spike duplicates must be used.
Per NELAC Chapter 5 requirements, as least one Laboratory Control Sample (LCS; also known as Laboratory Fortified Blank) shall be prepared, analyzed and evaluated with each batch of 20 samples or less.
The acceptance criteria for the LCS shall be specified in the planning document.
If the LCS is unacceptable, the samples associated with the LCS shall be reprocessed with a new LCS. If the samples cannot be reprocessed, the data must be appropriately qualified.
For applicable analytes denoted in the planning document, a QC check sample, standard reference material (SRM) or other quality control sample, hereinafter identified collectively as quality control check samples (QCCS), shall be processed with each sample preparation batch and analyzed for evaluation according to the acceptance limits established for the QCCS.
Analysis of a QCCS is required for but not limited to the following analyses:
Chlorophyll – the assay for the QCCS or its original formulation shall have been determined by an organization external to the laboratory ;
Biochemical oxygen demand (BOD) or carbonaceous BOD (CBOD) – the method-specified glucose/glutamic acid check solution shall be used; and,
Copper in seawater – the QCCS shall be any seawater-matrix SRM assayed by an organization external to the laboratory.
If the QCCS is unacceptable, the samples associated with the QCCS shall be reprocessed with a new QCCS. If the samples cannot be reprocessed, the data must be appropriately qualified for all contracted samples in the preparation batch.
Spiking/Fortification Requirements - All spike fortifications must take place prior to any required sample preparation steps (e.g., sample extraction, sample digestion, pH adjustment, etc.). The final concentration of any spike fortification shall be at the applicable level identified below.
If any of the samples in the preparation batch are non-detect (i.e., below the MDL specified in the planning document), the spiking level must not be greater than 2 times the Contract-specified PQL.
The concentration of a spiked sample cannot exceed 5 times the highest concentration of any contracted sample in the preparation batch.
Evaluation of Matrix Spikes - The results of matrix spikes must meet the acceptance criteria specified by the Contract and listed in the planning document or the data must be appropriately qualified.
If the failure is reported to be due to *sample* matrix interference, the laboratory shall document the process by which this conclusion is determined.

Evaluation of Laboratory Duplicate/Replicate Samples – All replicate samples (sample duplicates, matrix spike duplicates, LCS duplicates or other replicates) must be evaluated for a precision criterion not to exceed 20 % RPD. This criterion shall be listed in the planning document.
In the event that laboratory replicate agreement is not observed, the laboratory must investigate the poor precision and report the results with appropriate qualifiers and/or comments.
Instrument Calibration – In addition to calibration procedures specified in the analytical methods listed in the planning document, the CONTRACTOR shall ensure that the following requirements are met:
All sample results shall be chronologically bracketed between acceptable calibration verifications.
Initial Calibration Requirements
The minimum number of calibration standards required to calibrate each instrument used for the contracted analyses shall conform to the analytical method approved in the planning document. If the minimum number of calibration standards is not specified in the method, the number must be specified in the planning document and shall be consistent with the NELAC Chapter 5 standards.
Unless otherwise specified by the method, all sample results shall be based on the initial calibration curve responses. If linear regressions are used, the correlation coefficient shall be equal to or greater than 0.995 for all regressions.
Immediately after performing an initial calibration, the accuracy of the calibration shall be verified using a second source. A second source may be a standard, a Standard Reference Material (SRM), or other sample type with a verified concentration such as a QC Check Sample. Standards must have been prepared from a different lot or vendor.
The acceptance criteria for second-source verifications shall be specified in the planning document.
Sample analysis cannot proceed if an initial calibration is unacceptable.
Continuing Calibration Requirements:
When an initial calibration is not performed on the day of analysis, a continuing calibration standard shall be analyzed, evaluated and determined to be acceptable prior to analyzing samples.
A continuing calibration standard shall be analyzed and evaluated at the end of the analytical run.
The acceptance criteria for continuing calibration verifications shall be specified in the planning document.
For each analytical run, the analytical sensitivity must be evaluated using a continuing calibration standard prepared at the Contract-specified PQL. The analyzed value of this standard must be within 70% – 130% of the expected value. If this PQL check fails, the blank and associated sample results must be reported as "estimated" per Chapter 62-160, F.A.C. unless the affected results are at least 10 times the absolute value of the observed bias of the PQL check.
If continuing calibration verification fails, samples not chronologically bracketed by acceptable calibration verifications must be reanalyzed or appropriately qualified.
Sample results below the Contract-specified PQL and above the highest calibration standard shall be appropriately qualified.
Quality Control Blanks
If a Contracted analyte is detected in any analytical QC blank, the sample results that are associated with the blank must be reported with the appropriate qualifier from Chapter 62-160, F.A.C., unless the affected sample concentrations are at least 10 times higher than the calculated QC blank concentration.
Sample results must be chronologically bracketed with acceptable beginning and ending analytical QC blanks.
If a Contracted analyte is detected in the field blank, equipment blank or trip blank, the result must be confirmed by reanalyzing a new aliquot of the blank unless the sample concentration results associated with the blank are at least 10 times the calculated blank concentration. The laboratory must investigate the blank contamination to determine that positive blank results are not due to a laboratory error and report the affected samples and field-generated blank results with appropriate qualifiers and/or comments.
If any quality control measure or calibration verification fails (including those specified above), samples that are associated with the failure must be reanalyzed, if possible. Sample data that are associated with a failed quality control measure or calibration must be appropriately qualified as specified in Chapter 62-160, F.A.C. An explanatory comment must be attached to the final report for each result that has a qualifier code other than U, I, or A. Any additional qualifier codes used but not explicitly listed in Chapter 62-160, F.A.C. must be identified and defined in the report.

The reported MDL and PQL for each sample must be adjusted for dilution factors and any relevant preparation weights and volumes.
For all organic analyses using either gas chromatography or HPLC, analytes with concentrations above the method detection limit shall be confirmed by at least one of the qualitative identification measures listed below. Confirmation must occur the first time an analyte is detected at a sampling point.

☐ Second column/same detector
☐ Second column/alternate detector
☐ Same column/alternate detector
☐ Mass spectrometry
☐ Alternate wavelength

Addendum 2: Quality Control Requirements for Laboratories Performing Microbiological Testing

In addition to the quality control requirements outlined in Chapter 5 of the NELAC Standards, the following quality control measures shall be implemented for this Contract. Note: "Sample" refers to samples that have been either collected or analyzed under the terms of this Contract.

All microbiological analyses must conform to the requirements for facilities, personnel qualifications, equipment specifications and quality control measures discussed in *AWWA Standard Methods, section 9020 (*all acceptable editions*)*

Holding Times – Any sample that exceeds the holding time specified in 40 CFR Part 136 (for non-potable water) or 40 CFR Part 141 (for drinking water compliance) must be appropriately qualified with a "Q". The holding begins with the sample collection date and time and ends with the date and time of the placement of the processed sample into or on the applicable growth medium.

For non-potable water, the maximum transport time to the laboratory is 6 hours and samples should be processed within 2 hours of receipt at the laboratory. For purposes of contractual services and to determine compliance with this requirement, the Department will allow no greater than 6 hours from time of collection to the time of receipt by the laboratory AND no greater than 8 hours from time of collection to the placement of the processed sample into or on the applicable growth medium

All samples that are either received after 6 hours OR placed into or on growth medium after 8 hours will be considered outside of holding time and must be qualified with a "Q" qualifier.

All samples that exceed the method-specified incubation period (range of minimum to maximum) shall be qualified with a "J" qualifier.

For drinking water compliance, the time from sample collection to placement of the processed sample into or on the applicable growth medium may not exceed 30 hours.

All samples that are processed after 30 hours will be considered outside of holding time and must be qualified with a "Q" qualifier.

All samples that exceed the method-specified incubation period (range of minimum to maximum hours) shall be qualified with a "J" qualifier.

In order to evaluate the holding time for each sample, the following information shall be documented.

Date and time of sample collection

Date and time of laboratory receipt of the sample

Date and time the analysis begins – (The time at which the sample is placed in or on the appropriate media for incubation).

Date and time incubation begins

Date and time analysis ends - The date and time incubation ends and plates/tubes are read.

Dilutions for membrane filter analysis - In order to achieve the recommended range of target organisms (20 – 60 colony forming units (CFU) for fecal coliform, enterococci and fecal streptococcus or 20 – 80 for total coliforms and E.coli), multiple dilutions of a sample must be run. While the general history of a sample site may be well known, the water will be influenced by many environmental factors at any one time.

A minimum of 3 dilutions will be run for each sample analysis (except blanks). The three dilution volumes may vary according to the range of expected values or an understanding of the environmental conditions at the time of sampling. Waters of a higher quality (low microbial density) may benefit from a dilution series of 100 mL, 50 mL, and 25 mL of sample volume, whereas, lower quality waters (high microbial density) might require only 10 mL, 1.0 mL, and

mL. Use a 100 mL dilution for all blanks (including field and equipment blanks). Table 1 provides suggested volumes for varying water sources and has been adapted from Table 9222:III, *Standard Methods,* 20th Edition, and can be used for microbiological samples:

Table 1: Suggested sample dilutions

Water Source	Dilutions (sample volume, mL)
Equipment, field blanks	100
Lakes, reservoirs, rivers	100, 50, 10 or 50, 10, 25
Wells, springs	100, 50, 10 or 100, 50, 25
Water supply intake	50, 10, 1
Natural bathing waters	50, 10, 1
Sewage treatment plant	10, 1, 0.1
Farm ponds, rivers	1, 0.1, 0.01
Stormwater runoff	1, 0.1, 0.01
Raw municipal sewage	0.1, 0.01, 0.001
Feedlot runoff	0.1, 0.01, 0.001
Sewage sludge	0.01, 0.001, 0.0001

QUALITY CONTROL BLANKS

The number and types of blanks to be run shall follow method requirements with these modifications:

If the membrane filter technique is used, the sample set(s) shall be associated with a beginning and ending filtration blank processed within a time period not to exceed 30 minutes. The environmental field samples shall be filtered after the beginning blank and before the ending blank.

If filtration funnels are not sanitized by U light between samples, additional sterility blanks shall be filtered after every 10 samples processed within the 30-minute set

The results of any blank must be < 1 CFU/100 mL or the associated sample results must be reported with the appropriate qualifier from Chapter 62-160, F.A.C. ("V" for filtration blanks and "J" for field-generated blanks).

Laboratory Quality Control Duplicates

At least 10% of the samples (or one per test run) shall be duplicated.

All duplicate results shall be evaluated per method specifications using the precision criterion. The range of the transformed duplicates shall not exceed the precision criterion established by the laboratory. In the event that laboratory duplicate agreement is not observed, the laboratory must investigate the poor precision and report the results with appropriate qualifiers and/or comments.

Field Quality Control Duplicates or Replicates - In the event that agreement (less than or equal the laboratory established precision criterion) is not observed between results from field-generated replicate samples, the laboratory must investigate the replicate analyses to determine that poor precision is not due to a laboratory error and report the results with appropriate qualifiers and/or comments. The laboratory shall use the analytical method specifications for precision control as a guide to evaluation of the field-generated replicate results.

Colony Counts

In addition to the requirements listed below, all analytical results shall be calculated by the procedures established in the microbiological method(s) approved for the Contract and listed in the planning document.

The laboratory shall make every attempt to ensure that colony counts are in the method-specified ideal range (20 – 60 colony forming units (CFU) for fecal coliform, enterococci and fecal streptococcus or 20 – 80 for total coliforms and E.coli). Reported values from colony plate counts outside this range shall be qualified with a "B" (unless the reported value is from a 100 mL sample and the count is less than 20).

If all counts are above 60, the result shall be calculated and reported from the highest dilution. This result must be reported as "estimated".

Calculating Raw Data for Final Reporting - Standard Methods and EPA Methods offer slightly differing guidance on the calculation and reporting of microbiological data. Although this guidance is not intended to capture every scenario possible in the calculation and reporting of the test data, the most common scenarios are discussed with the emphasis on reporting the data result, the dilution factor, and the data qualifier. For detailed discussions on additional scenarios, see the applicable method.

Interpretation of Standard Methods and EPA Method calculations:

CFU/100 mL= $\frac{C \times 100}{}$

Where,
V
CFU/100 mL = Number of enterococci or fecal coliform colony forming units per 100 mL of sample.
C = Total number of positive colonies counted on all acceptable dilutions.
V = Total volume, equal to the sum of all acceptable dilutions (sample volumes used, in mL
When one dilution in a series has a count within the ideal CFU range (see above):
Use the count from the dilution that is within range to calculate the final result in the equation above.
When more than one dilution in a series has an acceptable count within the ideal range use the applicable method below. Since this calculation is not a laboratory sample replicate, do not use an "A" qualifier.

Standard Methods - Use the sum of all dilutions within the ideal range and the sum of the counts from all dilutions in the ideal range in the equation above.
EPA Methods - Independently calculate a final value for each dilution within the ideal range in the equation above and report the average of these values.
When no dilutions fall within the ideal range:
For both methods: A "B" qualifier is not required if all dilutions were less than the lower acceptable limit (20 CFUs), and one of the dilutions was 100 mL. For this situation, report the calculated value from the 100 mL dilution without a "B".
Standard Methods - Use the sum of all dilutions in the equation to calculate the final result. Include dilutions that have a zero count. Report the final result with a "B" qualifier.
EPA Methods:
If all counts are under the lower acceptable limit (20 CFUs) or are both above and below the limit, choose the dilution with the count that is closest to the ideal range to calculate final result and report with a "B" qualifier.
If all counts are above the upper acceptable limit (60 or 80 CFUs), use the dilution with the smallest volume filtered to calculate final result and report with a "B" qualifier.
If counts from all dilutions are zero:
(1) For both methods - Use "1" as the total number of colonies counted and use only the highest filtration volume as total volume in the equation above to calculate final result. Report with a "U" qualifier.
If there are >200 target colonies in all dilutions:
For both methods - Use the upper limit of the ideal range (60 or 80) and the smallest filtration volume in mL to calculate an estimated final result. Report with a "Z" qualifier.
If there are >200 non-target colonies, or if the colonies are not distinct enough to count (confluent growth) in all dilutions:
(1) For both methods - Report as "No Result" with a "Z" qualifier.
Use of Dilution Factor (DF) field
Use the following equation to determine dilution factor for all samples:
DF = 100
V
Verification
Where,
DF = Dilution Factor
V = Total volume (sum of dilutions in mL used in final calculation)
Frequency
Independently verify at least 10 isolated colonies from a positive sample per month.
Verify atypical colonies of different morphological types to check for false negatives.
Also, verify any ambiguous colonies as needed.
Procedure
Use aseptic techniques to transfer growth from each colony into individual tubes. For 10 colonies, there should be 10 tubes total, for each verification test media.
See Table 2 for the method requirements for fecal coliform and Enterococci. Follow the method requirements for all others.

Table 2: Verification Tests

The response bolded in parentheses indicate a positive result for each test.

Method	Test	Test	Test	Test	Test	Test
Enterococci EPA 1600	BHI Agar Slant 35 ± 0.5°C 48 ± 3 h (use growth for gram staining)	BHI 35 ± 0.5°C 24 ± 2 h (turbidity)	Gram stain (gram positive cocci)	BHI 45 ± 0.5°C 48 ± 3 h (turbidity)	BEA 35 ± 0.5°C 48 ± 3 h (growth w/ black/brown precipitate)	BHI w/6.5% NaCl 35 ± 0.5°C 48 ± 3 h (turbidity)
Fecal Coliforms SM9222D	LTB 35 ± 0.5°C 48 ± 3 h (turbidity and gas)	EC 44.5 ± 0.2°C 24 ± 2 h (turbidity and gas)				

Reporting
Adjust colony counts for the original positive sample based on percent of colonies verified positive.
(1) For example: A sample dilution has a colony count of 30 fecal coliforms. Ten of these positive blue colonies were used in the verification tests, but only 8 verified positive for both EC and LTB. This means only 80% were verified positive and therefore the final count of 30 is adjusted by 80% to 24 colonies.
For verified samples, report as "Verified" in the comment field.
Data Qualifier Codes - The use of Data Qualifier Codes is not discussed in the methods, but the Department's QA-Rule 62- 160 F.A.C. requires that data qualifiers be used when the data is being submitted to the State. The purpose of the Data Qualifier Codes is to communicate the reliability of the reported data to the consumer. Table 3 identifies those Data Qualifier codes that are generally associated with microbiological data reporting. Others may apply. The laboratory must apply any applicable data qualifiers as listed in Table 1 of the Quality Assurance Rule (62-160, F.A.C.)
Any data point which is derived from any analysis other than the direct calculation of the number of colonies on a membrane filter that were within the recommended range of the method must be qualified with one or more of the Data Qualifier Codes listed below.
Any result associated with a failed QC test must be reported with applicable data qualifiers.
Any result that is associated with a failure to meet test requirements (e.g., holding time, incubation time, etc.) shall also be qualified with applicable data qualifiers.
Failure to report data with appropriate data qualifier codes will be returned to the laboratory without payment for services until corrections are made.

Table 3: Typical Data Qualifier Codes to Be Used When Reporting Microbiological Data to DEP under the Overflow Purchase Order or Contract (others may apply)

Qualifier		62-160 Regulatory Meaning (rule) or Contract Requirement/Interpretation (contract)
A	Rule	Value reported is the arithmetic mean (average) of two or more determinations. This code shall be used if the reported value is the average of results for two or more discrete and separate samples. These samples shall have been processed and analyzed independently. Do not use this code if the data are the result of replicate analysis on the same sample aliquot, extract or digestate.
A	*Contract Requirement*	*Two or more replicates of the same volume of sample are run and the data averaged.*
B	Rule	Results based upon colony counts outside the acceptable range. This code applies to microbiological tests and specifically to membrane filter colony counts. The code is to be used if the colony count is generated from a plate in which the total number of coliform colonies is outside the method indicated ideal range. This code is not to be used if a 100 mL sample has been filtered and the colony count is less than the lower value of the ideal range.
B	*Contract Requirement*	*Based on colony counts outside the method specified range of 20 – 60 colonies per membrane filter. This code is not required if a 100 mL sample has been run, the density reported is below 20 and only this sample value was reported.*
J	Rule	Estimated value. A "J" value shall be accompanied by a detailed explanation to justify the reason(s) for designating the value as estimated. Where possible, the organization shall report whether the actual value is estimated to be less than or greater than the reported value. A "J" value shall not be used as a substitute for K, L, M, T, V, or Y, however, if additional reasons exist for identifying the value as an estimate (e.g., matrix spiked failed to meet acceptance criteria), the "J" code may be added to a K, L, M, T, V, or Y. Examples of situations in which a "J" code must be reported include: instances where a quality control item associated with the reported value failed to meet the established quality control criteria (the specific failure must be identified); instances when the sample matrix interfered with the ability to make any accurate determination; instances when data are questionable because of improper laboratory or field protocols (e.g., composite sample was collected instead of a grab sample); instances when the analyte was detected at or above the method detection limit in a blank other than the method blank (such as calibration blank or field-generated blanks and the value of 10 times the blank value was equal to or greater than the associated sample value); or instances when the field or laboratory calibrations or calibration verifications did not meet calibration acceptance criteria.
J	*Contract Requirement*	*In addition to the above examples, other "J" code situations are: quality control duplicate failures, ongoing precision recovery (OPR) spike failures, matrix spike failures, incubation period or temperature failures, other QC check failures.*
O	Rule	Sampled, but analysis lost or not performed.
O	*Contract Requirement*	*Sample taken but analysis lost, invalidated, or not performed.*

Qualifier		62-160 Regulatory Meaning (rule) or Contract Requirement/Interpretation (contract)
Q	Rule	Sample held beyond the accepted holding time. This code shall be used if the value is derived from a sample that was prepared or analyzed after the approved holding time restrictions for sample preparation or analysis.
Q	*Contract Requirement*	*Sample received after 6 hours OR analyzed beyond 8 hours.*
U	Rule	Indicates that the compound was analyzed for but not detected. This symbol shall be used to indicate that the specified component was not detected. The value associated with the qualifier shall be the laboratory method detection limit. Unless requested by the client, less than the method detection limit values shall not be reported (see "T" above).
U	*Contract Requirement*	*Organism was analyzed for but not detected.*
V	Rule	Indicates that the analyte was detected at or above the method detection limit in both the sample and the associated method blank and the value of 10 times the blank value was equal to or greater than the associated sample value. Note: unless specified by the method, the value in the blank shall not be subtracted from associated samples.
V	*Contract Requirement*	*Analyte was detected in both samples and method blank. Use this code when the sample result is less than or equal to 10 times the value of the blank. Do not subtract the value of the blank from the sample result.*
Y	Rule	The laboratory analysis was from an improperly preserved sample. The data may not be accurate.
Z	Rule	Too many colonies were present for accurate counting. Historically, this condition has been reported as "too numerous to count" (TNTC). The "Z" qualifier code shall be reported when the total number of colonies of all types is more than 200 in all dilutions of the sample. When applicable to the observed test results, a numeric value for the colony count for the microorganism tested shall be estimated from the highest dilution factor (smallest sample volume) used for the test and reported with the qualifier code.
Z	*Contract Requirement*	*Colonies on plate too numerous to count (TNTC). Results shall be reported as the maximum recommended count of typical target colonies (60 CFU /lowest volume used x 100 mL). If atypical, non-target, spreading colonies or other interferences occur where typical target organisms cannot be determined, report "No Result" in the results column and "Z" in the Data Qualifier column.*