

Water Quality Monitoring  
Rubric for Tier Determination and Inclusion of  
Data in the CMC Database



June 2020  
Version 1

## Introduction

The Alliance for the Chesapeake Bay (Alliance), Izaak Walton League of America (League), Dickinson College’s Alliance for Aquatic Resource Monitoring (ALLARM), and the University of Maryland Center for Environmental Science Integration and Application Network (UMCES IAN) (referred to as the Chesapeake Monitoring Cooperative (CMC) in this document) are partnering to provide technical, logistical, and outreach support for the integration of community-based monitoring data into the Chesapeake Bay Program (CBP) partnership. The integration of these data into CBP monitoring networks will provide additional cost-effective data and information that supports shared decision-making and adaptive management by the CBP partners focused on restoration of the Chesapeake Bay and its watershed. The Chesapeake Data Explorer was developed to house the volunteer-based data engaged in this project.

In the Chesapeake Data Explorer, datasets are classified into tiers to help inform data users on the potential uses of these data, outlined in Table 1. If data do not fit within the three tiers, they can be classified as *provisional*, *provisional tier 1*, and *provisional tier 2*.

Table 1: The tiers of data quality and potential data uses for field data.

TIERS	Potential Data Use
<i>Provisional</i>	Track groups collecting water quality monitoring data and to upgrade their methods and Quality Assurance processes into the Tiered Framework.
<i>Provisional Tier 1</i>	Tier 1 uses
Tier 1	Education, Environmental Health Screening, Targeting of Management Actions, Baseline Stream Health Assessment
<i>Provisional Tier 2</i>	Tier 2 uses
Tier 2	Education, Environmental Health Screening, Targeting of Management Actions, Environmental Health Report Cards
Tier 3	Chesapeake Bay Watershed trends and assessments to help inform policy and management decisions

Lab data are also categorized by tier classifications, outlined in Table 2. Due to the nature of lab sampling, any data analyzed in a laboratory setting is classified as Tier 2 data at a minimum. However, due the inconsistencies in lab methodologies and certifications across the watershed that need to be reconciled, data can be classified as *provisional tier 2*.

Table 2: The tiers of data quality and potential data use for lab data.

TIERS	Potential Data Use
<i>Provisional Tier 2</i>	Tier 2 uses
Tier 2	Education, Environmental Health Report Cards, Environmental Health Screening, Targeting of Management Actions
Tier 3	Chesapeake Bay Watershed trends and assessments to help inform policy and management decisions

There are many diverse monitoring practices throughout the Chesapeake Bay watershed. As a result, the Chesapeake Monitoring Cooperative (CMC) requires a process to examine new, existing and historic datasets and determine the quality of data integrated into the Data Explorer. This Rubric acts as a data classification tool to help CMC review the monitoring techniques, quality assurance measures, and metadata of these protocols. The Rubric, and corresponding tools such as checklists, will help to inform conversations with potential data contributors about data requirements. Finally, the Rubric will facilitate a process that the CMC will use to ensure that there are appropriate metadata associated with CMC datasets for data users to make informed choices.

Tier 3 data have separate data requirements that CMC is working with CBP’s Data Integrity Workgroup to define. As a result, this Rubric encompasses Tier 1 and Tier 2 data.

The Rubric serves two needs:

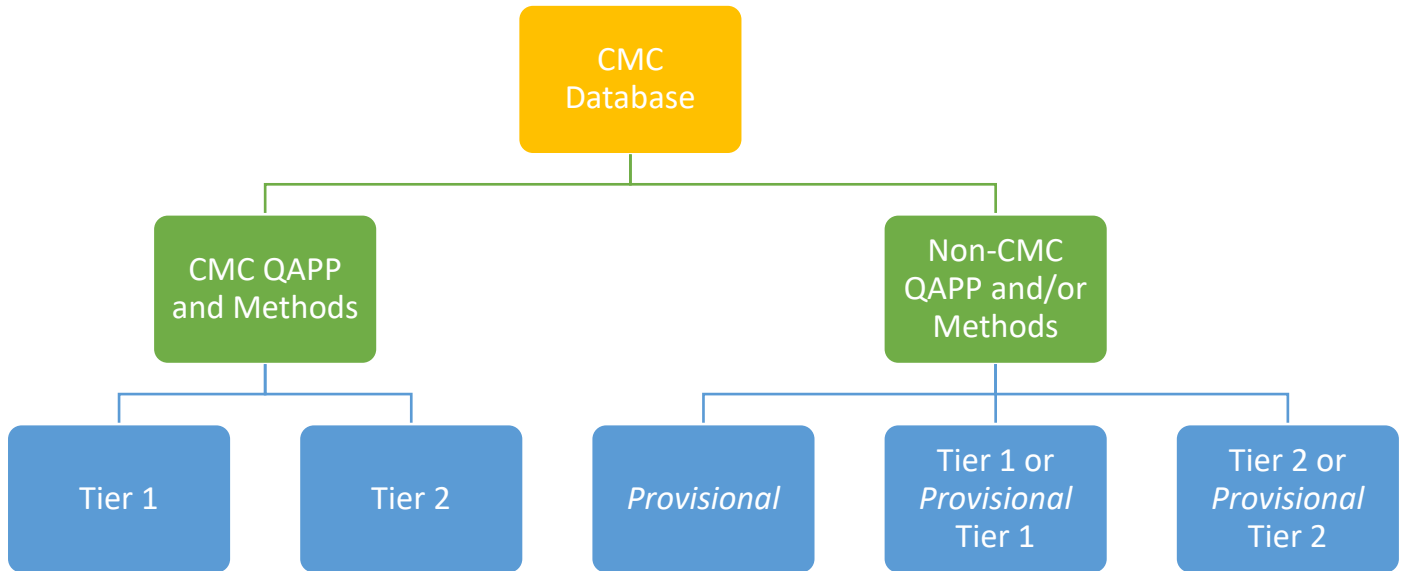
1. To determine if the data collected are suitable to be included in the CMC database and passed along to the Chesapeake Bay Program (minimum requirements)
2. To classify the data into tiers (specific requirements)

Once the Rubric is completed, a checklist of requirements and options should be generated for:

1. CMC service providers and program coordinators to review
2. Data users to have as a summary of data collection procedures

Monitoring groups who follow the CMC Quality Assurance Project Plans (QAPPs) developed for benthic macroinvertebrate, non-tidal, and tidal monitoring will be classified into tiers based on quality control procedures and equipment selections.

Monitoring groups who have existing monitoring programs and follow a different methodology or Quality Assurance Project Plan will be classified into tiers based on a review of the written standard operating procedures and quality assurance procedures. If the monitoring protocols do not meet the minimum requirements for Tier 1 and Tier 2, their data will be designated as *provisional*. There is a distinct difference among *provisional*, *provisional tier 1*, and *provisional tier 2* data, but in all *provisional*-associated cases, the data are missing metadata in order to most accurately inform the tier classification.



*Provisional Data*

Data are classified as *provisional* if the monitoring program does not meet the minimum requirements listed in this document to be considered tier 1, tier 2, *provisional tier 1*, or *provisional tier 2*. These data are used to document monitoring groups and are a stepping stone to integrating monitoring groups into the tiered framework. These data are not passed along to the Chesapeake Bay Program.

*Provisional Tier 1 and Tier 2*

The quality of the data for Tier 1/*provisional tier 1* and Tier 2/*provisional tier 2* are comparable, but not exact. Data assigned to *provisional tier 1* or *provisional tier 2* use methodologies or equipment equivalent to CMC protocols but are missing some metadata documentation or known QA process. This mainly applies to groups uploading historic datasets (datasets collected prior to 2017 or to a CMC certification training) and groups who have not attended a CMC certification or comparable training. Additionally, this classification applies to equipment or methods that are not listed in the CMC approved QAPPs and SOPs. These methods will be added to the QAPPs and SOPs during review periods if methodologies are found to be sound and comparable to CMC. *Provisional tier 1* and *provisional tier 2* data are passed through to the Chesapeake Bay Program.

Data users need to examine the study design (if available), QAPP (if available), standard operating procedures, and equipment specifications of *provisional*-associated data to determine whether the data collected are suitable for the desired end use.

Table 3: Justifications for tier changes based on program methods, equipment practices, and QA procedures.

Tier Designation: based on equipment used	Tier Change Options	Justification
Tier 2	<i>Provisional Tier 2</i>	1. Historic dataset that meets most of the QA procedures for tier 2 but may be missing an aspect because monitoring occurred prior to the CMC QAPP approval. Examples: <ul style="list-style-type: none"> <li>• Calibrations are performed, but not within 24 hours of each sampling event.</li> <li>• Post-sample checks not performed.</li> <li>• Field replicates (not performed at least 10% of the time).</li> </ul> 2. Current dataset where the group does not attend a CMC certification or comparable training. 3. Current dataset where the equipment/method is not listed in the CMC-approved SOP and is believed to be equivalent to Tier 2 data.
	Tier 1	1. Historic dataset that uses Tier 2 equipment but QA procedures are not implemented or known (Tier 2 equipment without QA procedures is equivalent to Tier 1 equipment with QA procedures). 2. Current dataset where QA procedures are missing or not adequate. Examples: <ul style="list-style-type: none"> <li>• Equipment not calibrated/standardized/verified according to timeframes identified in CMC QAPP</li> <li>• &lt;10% field replicates (non-tidal probes)</li> <li>• &lt;100% field replicates (kits)</li> <li>• Glassware for nutrients is not acid-washed</li> </ul>
	<i>Provisional</i>	Program does not meet the minimum requirements. Examples: <ul style="list-style-type: none"> <li>• No written methods/QA manual</li> <li>• No specified sampling frequency or site location</li> </ul>
Tier 1	<i>Provisional Tier 1</i>	1. Historic dataset that uses Tier 1 equipment, but QA procedures are not implemented or known. 2. Current dataset where the group does not attend a CMC certification or comparable training. 3. Current dataset where the equipment/method is not listed in the CMC-approved SOP and is believed to be equivalent to Tier 1 data.
	<i>Provisional</i>	Program does not meet the minimum requirements. Examples: <ul style="list-style-type: none"> <li>• No written methods/QA manual</li> <li>• No specified sampling frequency or site location</li> </ul>

Table 4: Tier definitions based on specific equipment and methodologies per parameter.

Parameter	Tier 1	Tier 2
Alkalinity	Colorimeter (not standardized): <ul style="list-style-type: none"> <li>Digital Checker Hanna HI 775</li> </ul>	Colorimeter (standardized; acid washed glassware): <ul style="list-style-type: none"> <li>Digital Checker Hanna HI 775</li> </ul> Titration Kit: <ul style="list-style-type: none"> <li>LaMotte (various)</li> </ul>
Ammonia-nitrogen		Lab analysis
Bacteria (E. coli)	Coliscan Easygel Kit	IDEXX Colilert (not in a lab) Lab analysis
Enterococcus		Lab analysis
Chlorophyll		Lab analysis
Conductivity	Meter/Probe (not calibrated)	Meter/Probe (calibrated): <ul style="list-style-type: none"> <li>LaMotte 1749</li> </ul>
Dissolved oxygen	Meter/Probe (not calibrated): <ul style="list-style-type: none"> <li>LaMotte 1761, YSI, Hydrolab</li> </ul> Winkler titration (not standardized) <ul style="list-style-type: none"> <li>LaMotte 5860</li> </ul>	Meter/Probe (calibrated): <ul style="list-style-type: none"> <li>LaMotte 1761, YSI, Hydrolab</li> </ul> Winkler titration (standardized): <ul style="list-style-type: none"> <li>LaMotte 5860</li> </ul>
Nitrate-nitrogen	Colorimetric Kit <ul style="list-style-type: none"> <li>Hach NI-14 1416100, LaMotte 3110, LaMotte 3354</li> </ul> Colorimeter (not standardized) <ul style="list-style-type: none"> <li>Hach</li> </ul>	Colorimeter or Spectrophotometer (standardized/calibrated; acid washed glassware): <ul style="list-style-type: none"> <li>Hach</li> </ul> Lab analysis
Nitrite-nitrate	Colorimeter (not standardized) <ul style="list-style-type: none"> <li>Digital Checker Hanna HI 707</li> </ul>	Colorimeter or Spectrophotometer (standardized/calibrated; acid washed glassware) <ul style="list-style-type: none"> <li>Digital Checker Hanna HI 707</li> </ul> Lab analysis
Orthophosphate	Colorimeter (not standardized) <ul style="list-style-type: none"> <li>Digital Checker Hanna HI 713</li> </ul> Colorimetric Kit: <ul style="list-style-type: none"> <li>Hach PO-19 224800, Hanna HI 38061</li> </ul>	Colorimeter or Spectrophotometer (standardized/calibrated; acid washed glassware): <ul style="list-style-type: none"> <li>Digital Checker Hanna HI 713</li> </ul> Lab analysis
pH	Colorimetric Kit (wide range): <ul style="list-style-type: none"> <li>LaMotte, Hach</li> </ul> Strips: <ul style="list-style-type: none"> <li>ColorpHast (2-9)</li> </ul> Meter (not calibrated)	Colorimetric Kit (narrow range): <ul style="list-style-type: none"> <li>LaMotte, Hach</li> </ul> Meter (calibrated): <ul style="list-style-type: none"> <li>Extech, Hanna, LaMotte, Oakton</li> </ul>
Phaeophytin		Lab analysis
Salinity	Meter/Probe (not calibrated) Refractometer Hydrometer	Meter/Probe (calibrated)
Silicate		Lab analysis
Total dissolved solids	Meter: <ul style="list-style-type: none"> <li>LaMotte 1749</li> </ul>	
Total suspended solids		Lab analysis
Total nitrogen		Lab analysis
Total Kjeldahl Nitrogen		Lab analysis
Total phosphorus		Lab analysis
Water clarity	Turbidity Test Kit: <ul style="list-style-type: none"> <li>LaMotte 7519</li> </ul> Secchi disk <ul style="list-style-type: none"> <li>Ben Meadows 224217</li> </ul> Transparency tube <ul style="list-style-type: none"> <li>Ben Meadows 111360</li> </ul>	Turbidimeter <ul style="list-style-type: none"> <li>Hach 2100P</li> </ul>
Water temperature	Thermometer/Thermistor (unverified)	Thermometer/Thermistor (annual verified)