PADEP Continuous Instream Monitoring Data Management and QA/QC with Aquarius Software

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2025 NATIONAL TRAINING WORKSHOP ON WATER QUALITY DATA, ASSESSMENT, AND PLANS

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Breakout session: Continuous Monitoring: Approaches to Data Management and Quality Control

1. All continuous instream monitoring (CIM) field and quality control protocols can be accessed in the PADEP Monitoring Book in Chapter 4.3, Continuous Data Collection Protocol
2. This chapter on continuous data collection covers site selection, monitor deployment, calibration, field maintenance, data evaluation and correction, and reporting. Today I'll cover data management, evaluation, correction, and grading using Aquarius software.
3. Aquarius is a water data management software from parent company Aquatic Informatics https://aquaticinformatics.com/products/aquarius-environmental-water-data-management/
4. Of the many applications for Aquarius, one is CIM data management.
5. PADEP chose Aquarius primarily to be consistent with USGS protocols. During the development of our CIM program, much coordination was done with our partners at the PA Water Science Center and we wanted to be able to use USGS and DEP data interchangeably by following similar procedures for data collection and evaluation
6. PADEP's Aquarius license is expensive and costs about $60,000 per year
7. The most common DEP CIM data collection suite is water temp, SpC, DO (% saturation and concentration), pH, stage (corrected for atmospheric pressure), and turbidity
8. Aquarius is web-browser based. We most often use chrome
9. The first step required to manage data in Aquarius is creating a site
    a. We have chosen our unique identifier to be the COMID of the NHD Flowline where the data were collected. Additional descriptive attributes can be added
    b. Note that we do not adjust for Daylight Savings Time to account for deployments spanning DST and non-DST adjustments
10. After your site is created, you need to create time series entries for each measured and derived parameter.
    a. **Basic Time Series -** Measured parameters (like pH, SpC, water temp, etc.) are observed directly and not dependent on other parameters
    b. **Derived Time Series -** Parameters like DO saturation and stage are dependent upon other measured parameters and a calculation to derive values (e.g. atmospheric pressure influence on stage)
    c. Users have the ability to publish time series or keep internal – this has implications for the web portal that will be covered later
11. After creating time series, the next step is to upload CIM data. You can import individual flat files that are exported from sondes – or compiled flat files of all data collected at a site.

    a. Users can customize a 'configuration' to use for all imports at a site which saves time

12. Once CIM data are uploaded, discrete measurements that were collected with a field meter during field visits are also uploaded

13. Once data are uploaded, it's time for evaluation, grading, and corrections. We use a toughbook in the field and record information during field visits in a standardized spreadsheet. Then after returning to the office:
    a. We sum the total error from each of the following component to evaluate, correct, and grade CIM data in Aquarius:
        i. Discrete - checks compared to a calibrated handheld field meter
            1. Evaluated with side-by-side readings during field visits
        ii. Fouling - Sensors can accumulate debris, sediment, or biological growth
            1. Evaluated by pre and post-cleaning readings during field visits
        iii. Calibration - drift of sensors in periods following deployment and calibration events
            1. Evaluated by calibration checks during field visits

14. Aquarius allows users convenient tools to correct and grade CIM data
    a. grades are determined by summing 3 error components, comparing against established rating criteria
        i. Tables 6&7 on p. 4-79 of Monitoring Book

15. Data usage for analysis and reporting
    a. Aquarius allows users to connect to servers using an API time series client to query CIM data directly from R. This makes analysis workflows smooth for R users

16. PADEP produces CIM reports in HTML format. Our web page allows these reports to be viewed. And Aquarius has a web portal that we can integrate into our website to allow the public to view available CIM data
    a. https://www.pa.gov/agencies/dep/programs-and-services/water/clean-water/water-quality/continuous-instream-monitoring-reports.html
    b. https://padep.aquaticinformatics.net/