TADA (Tools for Automated Data Analysis)

Cristina Mullin, PhD

Water Data Integration Branch

EPA Office of Water

TADA Team

- *Cristina Mullin, Team Lead*
- *Shelly Thawley*
- *Elise Hinman, PhD (ORISE Fellow)*
- *Trip Hook (Skills Marketplace, EPA OLEM)*
- *Katie Healy (Skills Marketplace, EPA ARD)*

TADA Working Group (~100 volunteers)

Agenda

- Presentation (~25 min)
- Hands-on/Q&A (~65 min)

EPA Water Data Integration Branch (WDIB) Products Supporting the Clean Water Act

Reusable

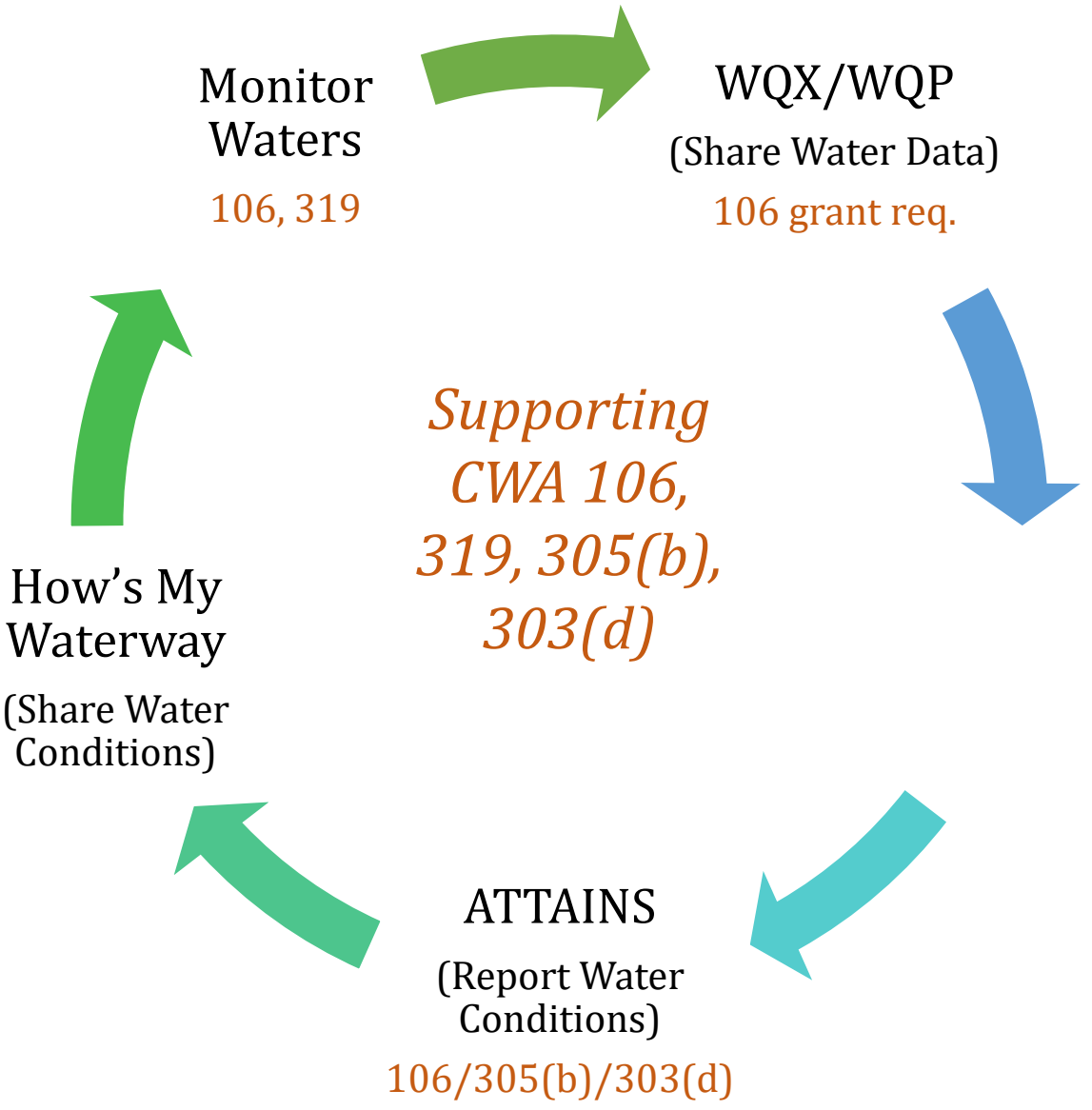
Interoperable

Accessible

Findable

Internet of Water Principles (Data Standards and Interoperability)

- Water Quality Data (WQX/WQP)
- Hydrography (NHDPlus)
- Assessment Decisions (ATTAINS)



Broader Impacts

Centralized tools (like TADA and HMW) have potential to greatly reduce total government costs

- State and tribal agencies
- EPA regions
- EPA HQ
- USGS, other federal agencies
- Applicable even beyond water

Improving data equity

- TADA makes the WQX QAQC service available on the WQP side
- Organizations can use TADA to help find and address data quality issues and then fix them in WQX/WQP

Well received by enthusiastic, engaged user community (open source/collaborative effort from start = more use product)

More efficient assessments may lead to more time for other things, or more waters being assessed! (Or anything else of importance to entity!)

Developing **TADA** as an **R package** and series of **user-friendly web apps (R Shiny)**

- Open-source
- Efficient, reproducible workflows
- Community driven requirements
  - Accessible
  - Standardized but flexible
  - Highly customizable
- Designed to work with Water Quality Portal data
  - Companion to USGS's **dataRetrieval** package

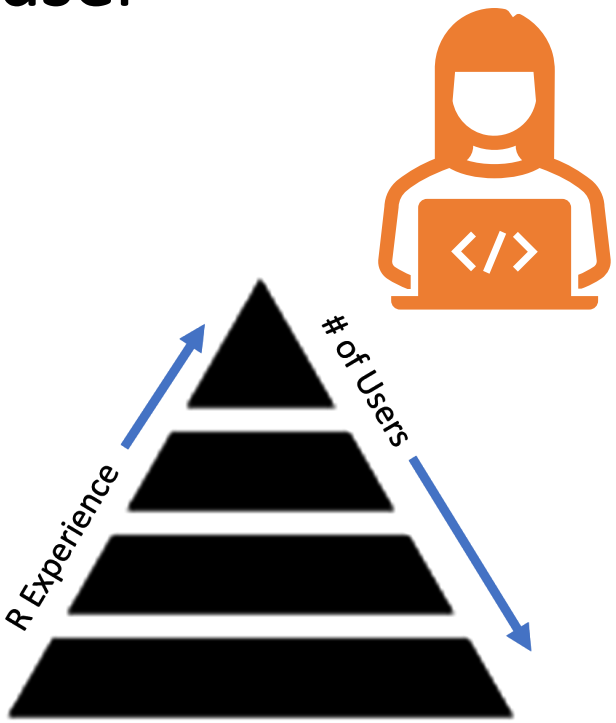
NATIONAL WATER QUALITY MONITORING COUNCIL

EPA United States Environmental Protection Agency

USGS science for a changing world

WQX WATER QUALITY EXCHANGE

dataRetrieval USGS R

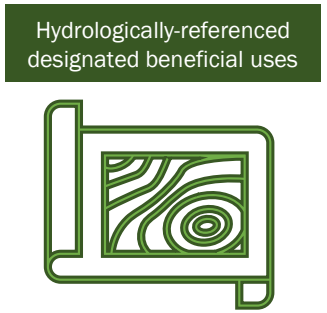


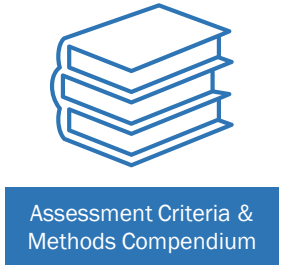
Tools vary in…

- Scope
- Application
- Stage of development

“Serve as a hub for an open-source water quality community”

Working Group Mission Statement: To share and develop **R code** for evaluating and visualizing **WQP** data more efficiently though collaboration and open-source programming. This includes working together to find commonalities in assessment processes across the nation, creating flexible tools that can be easily customized to work within existing workflows, supporting each other in learning R, and ensuring products will be accessible to organizations most in need.





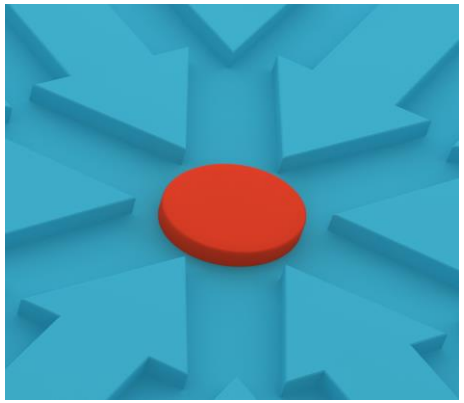
“Automating 80% of the workload is helpful”

Inventory of Open-Source R Tools for Water Analyses

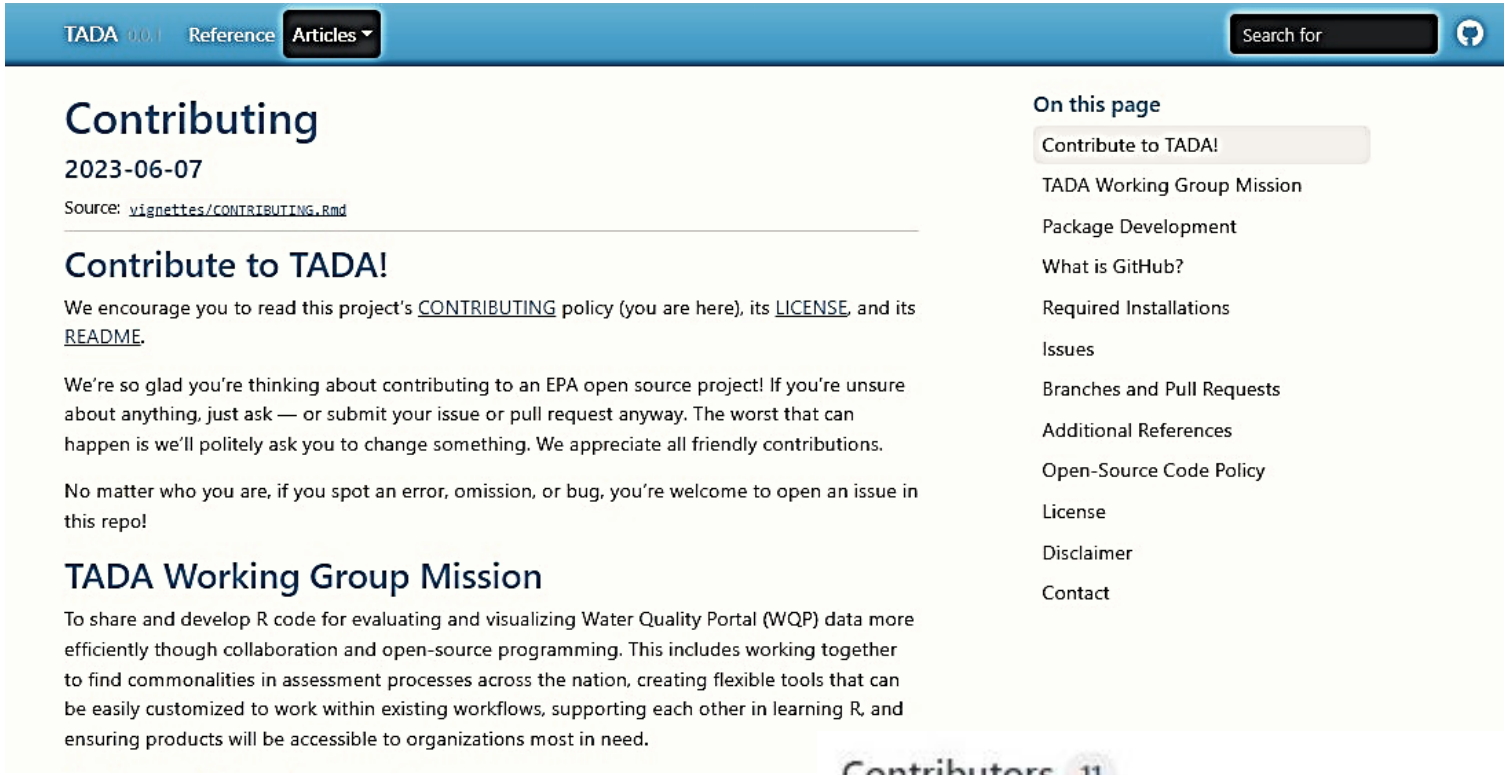
- Over 50 resources to learn from, and build on
- Working Group helps share knowledge, examples, and set priorities
- Faster progress through collaboration and iteration (learning from each other)

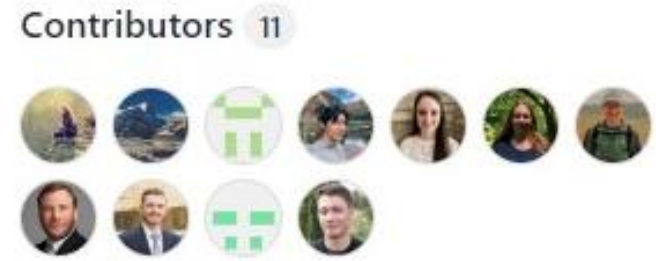
Involving end users in the development process

Agile & Community Development via GitHub

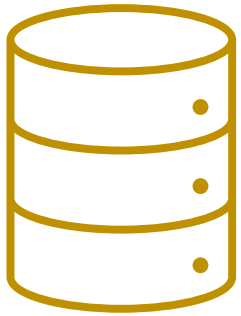


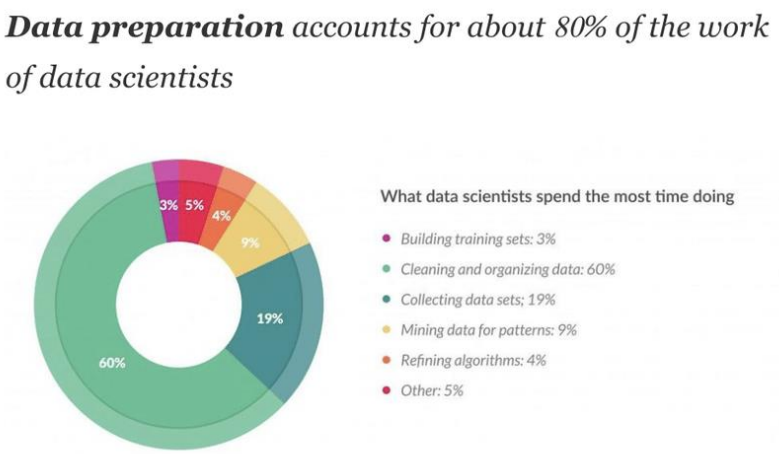
- GitHub: setting stage for community participation (two public repositories)
  - Community can be anyone
  - EPA/ORISE initial development
  - Contract to support subject experts with varying R skills





https://usepa.github.io/TADA/articles/CONTRIBUTING.html

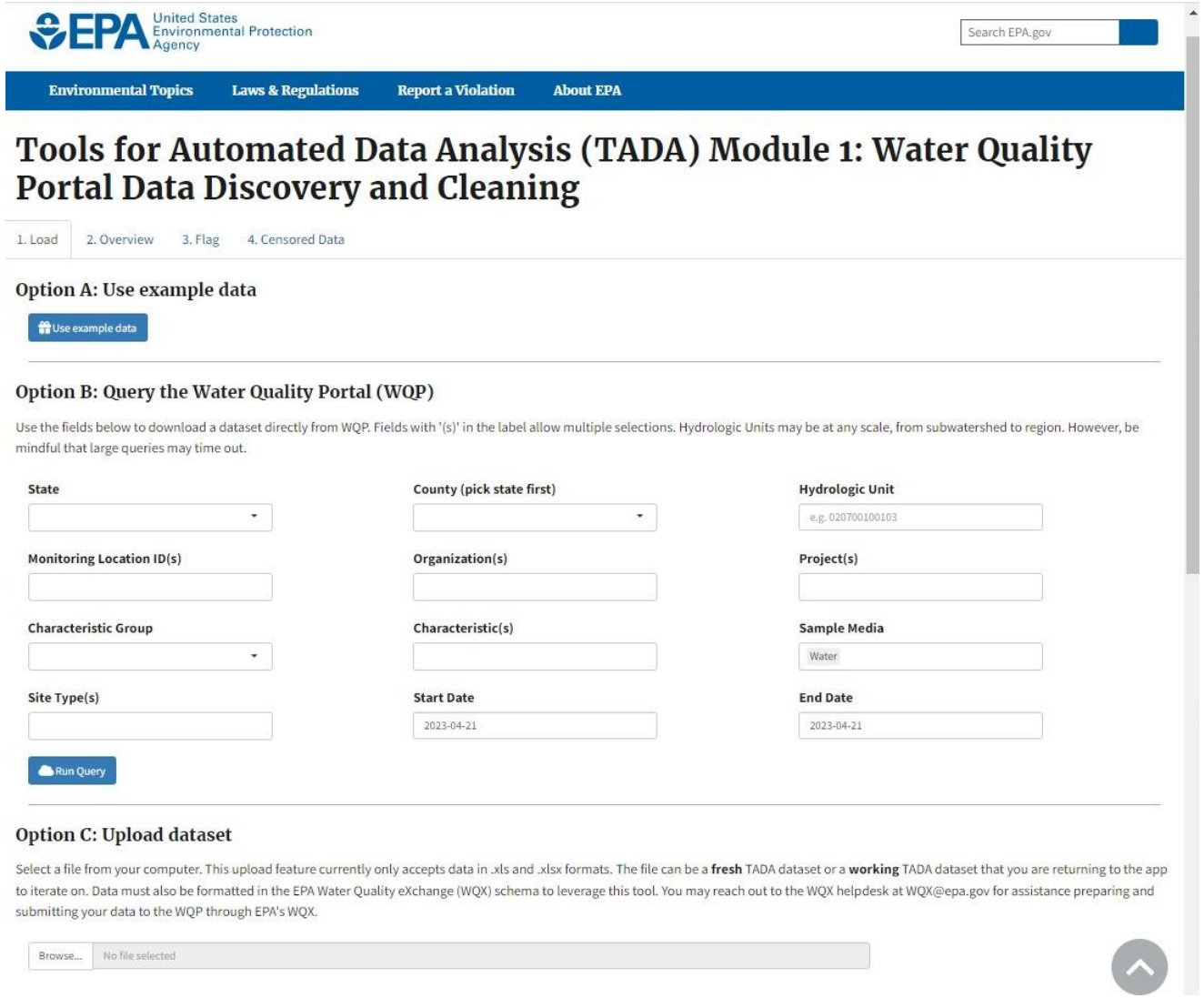




Module 1: Data Discovery and Wrangling

In Progress

Finding readily available data



Water Quality Portal (WQP)

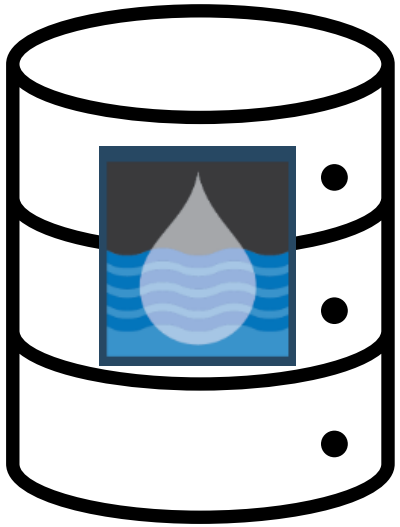
NATIONAL WATER QUALITY MONITORING COUNCIL

EPA United States Environmental Protection Agency

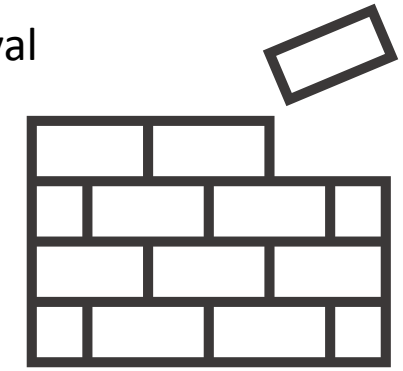
USGS science for a changing world

WQX WATER QUALITY EXCHANGE

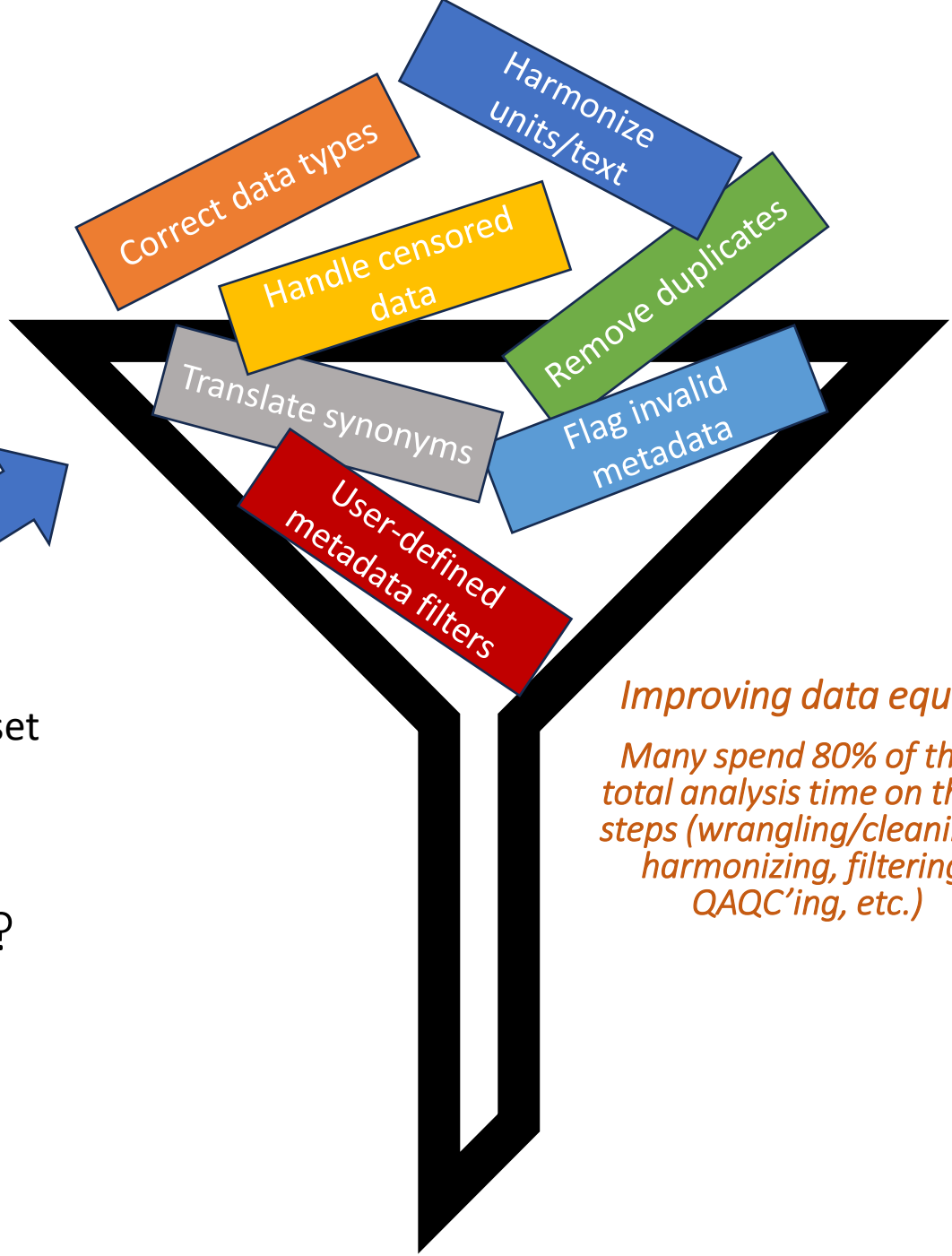
dataRetrieval USGS R



USGS's dataRetrieval functions



Constructing a unified dataset containing key metadata



Improving data equity

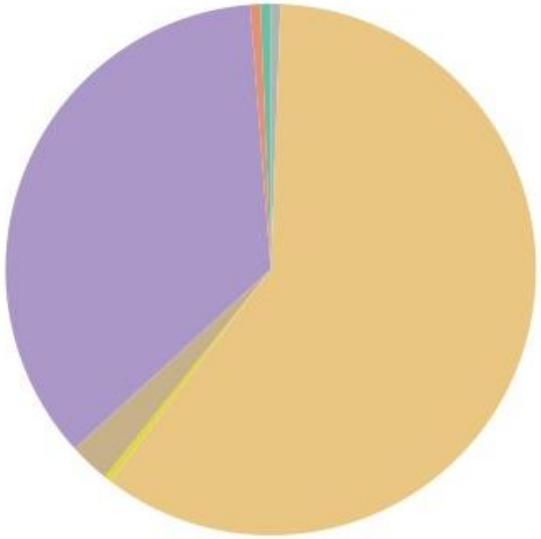
Many spend 80% of their total analysis time on these steps (wrangling/cleaning – harmonizing, filtering, QAQC'ing, etc.)

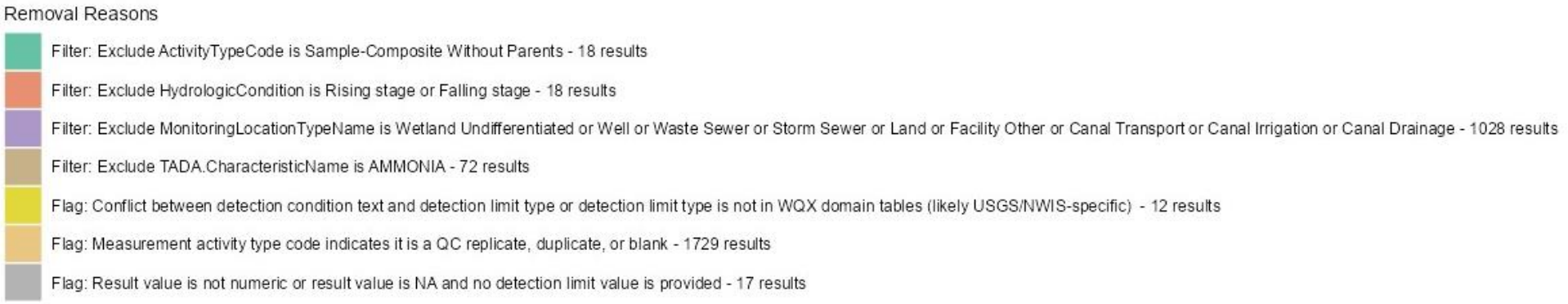
Are the data of sufficient quality for my analysis?

What harmonization and formatting steps are needed to use the data?

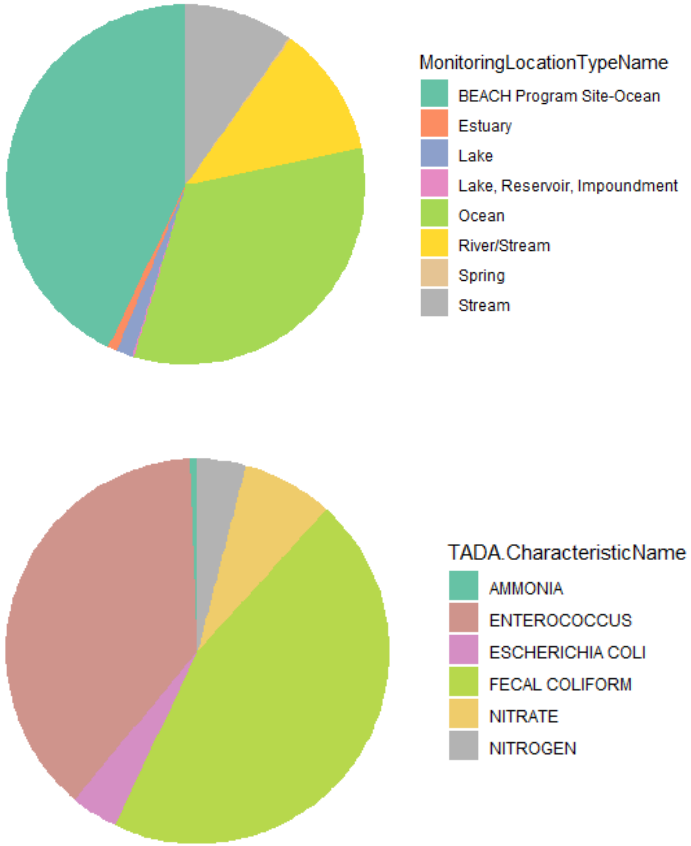
Summary of User Decisions

TADA.Remove	TADA.RemovalReason
TRUE	Flag: Measurement activity type code indicates it is a QC replicate, duplicate, or blank
TRUE	Filter: Exclude ActivityTypeCode is Sample-Composite Without Parents
TRUE	Filter: Exclude HydrologicCondition is Rising stage or Falling stage
FALSE	
TRUE	Filter: Exclude MonitoringLocationTypeName is Wetland Undifferentiated or Well or Waste Sewer or Storm Sewer or Land or Facility Other or Canal Transport or Canal Irrigation or Canal Drainage
TRUE	Flag: Result value is not numeric or result value is NA and no detection limit value is provided, Flag: Measurement activity type code indicates it is a QC replicate, duplicate, or blank
FALSE	
TRUE	Flag: Result value is not numeric or result value is NA and no detection limit value is provided
TRUE	Flag: Measurement activity type code indicates it is a QC replicate, duplicate, or blank, Filter: Exclude MonitoringLocationTypeName is Wetland Undifferentiated or Well or Waste Sewer or Storm Sewer or Land or Facility Other or Canal Transport or Canal Irrigation or Canal Drainage

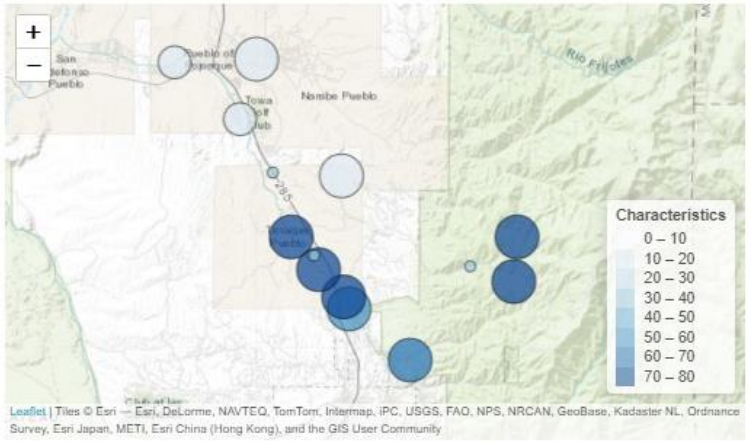




Data Visualization



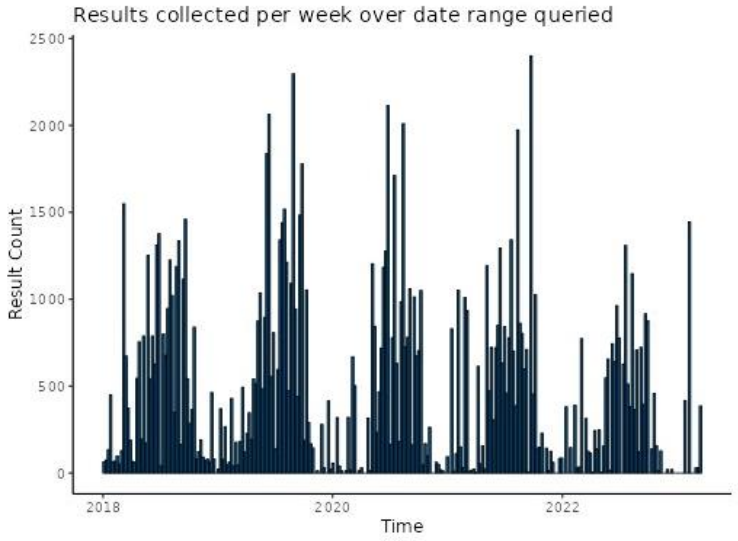
Your dataset contains **131,106** unique results from **221** monitoring location(s) and **6** unique organization(s).

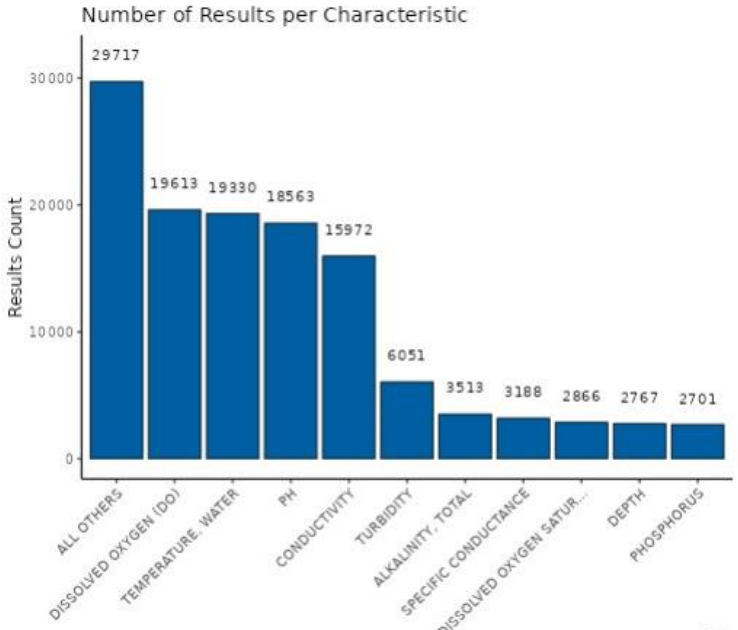


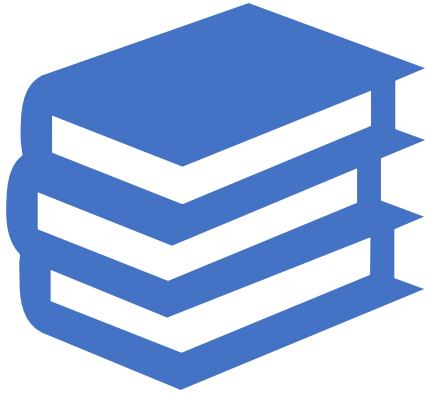
Show 10 entries

OrganizationFormalName	Result_Count
Chickasaw Nation Environmental Service	4580
Fond du Lac Band of Chippewa (MN)	20176
Pueblo Of Tesuque	6795
Pueblo of Pojoaque	1181
Red Lake DNR	81734
Sac and Fox Nation (Tribal)	9815

Showing 1 to 6 of 6 entries Previous 1 Next





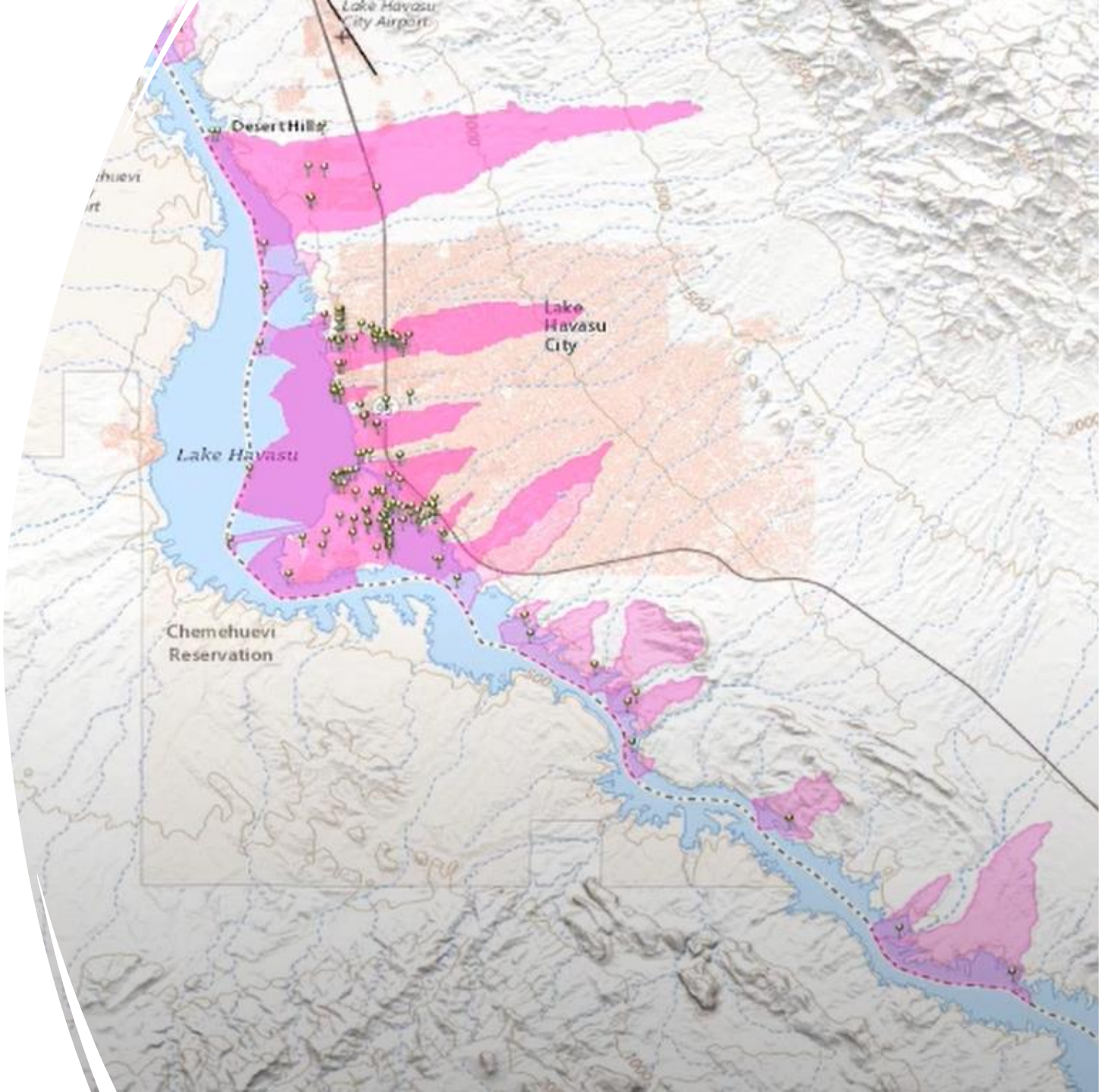


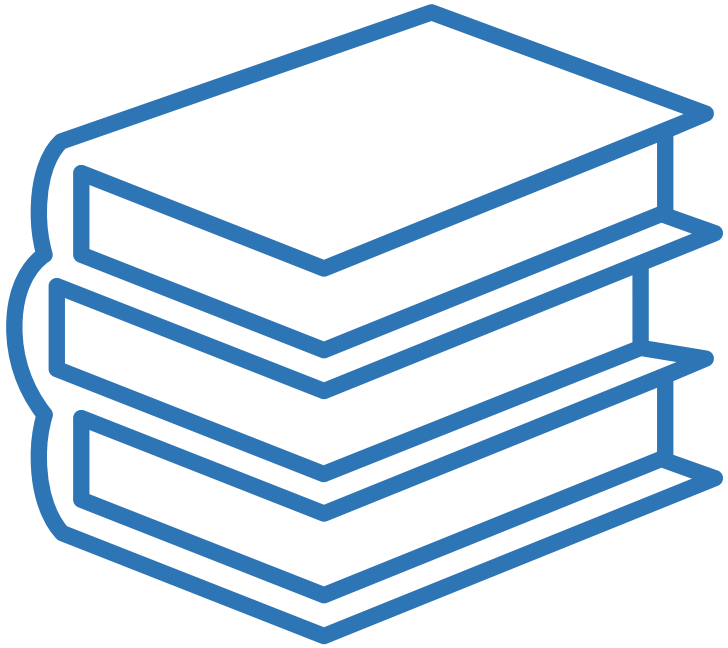
Module 2: Spatial Aggregation & Use Assignments

Vision

Associating Water Quality Criteria, Assessment Units & Uses with WQP Stations

- Integrate ATTAINS





Module 3: Assessment Criteria and Methodologies

Vision

Identified Requirements/Priorities

Scope

- Focusing on quantitative (numeric) water data in the WQP to start
- Focusing on frequently assessed parameters
- Common assessment processed and methodologies

Arsenic	Nickel
Boron	Nitrate
Chlorophyll a	Total Nitrogen, mixed forms
Chromium	pH
Chromium(VI)	Total Phosphorus, mixed forms
Cadmium	Depth, Secchi disk depth
Copper	Selenium
Dissolved oxygen (DO)	Silver
Dissolved oxygen saturation	Temperature, water
Escherichia coli	Total suspended solids
Lead	Chromium(III)
Mercury	Zinc

Common Methodologies

- Spatial aggregation – assessment unit and station level assessments
- Characteristic specific assessment start and end dates
- Magnitude, duration (temporal aggregation)
- Criteria context – upper or lower limit, range
- n-day mean, n-day mean maximum or mean minimum, n-hour mean, geometric mean, arithmetic mean, n-day rolling average
- Frequency criteria (e.g., 10% rule, 1-in-3 years rule applied using binomial test or percentile)
- Custom input equations needed to calculate criteria (e.g., for ammonia and certain metals)
- Incorporating depth
- Acute vs chronic
- Seasonality

Integrate Criteria Search Tool

https://www.epa.gov/wqs-tech/state-specific-water-quality-standards-effective-under-clean-water-act-cwa

Under development

- Does not include narrative standards, duration and frequency, or methodologies
- This compilation is continuously updated as EPA approves new or revised WQS

Users can:

- Query by parameter, application or criteria magnitude value
  - Direct application = designated uses
  - Indirect application = specific waterbody, all other waters, or a class of waters of the parameter
- Query within a state or across all states
- Find National Recommended Water Quality Criteria (304A)
- More detailed webpages for each State, Territory, or Authorized Tribe
- Download as a "flat" spreadsheet file to support custom searches and analyses
- Find source document linking the criterion to EPA-approved state regulation

Module 4: Bringing it all together

Vision

Conceptual Example

DO and AQU

1 row of the DefineCriteriaAndMethods file

Joined data frame with WQP results, station/AU, and use data

Magnitude and Duration Analysis

A

Characteristic	Use	Duration-Result Value	Duration-Criteria	Magnitude-Criteria Value	Magnitude-Criteria Context	Y= meeting criteria; N=not meeting criteria
DO	AQU	5 mg/L	7-day average	3 mg/L	LowerLimit	Y
DO	AQU	7 mg/L	7-day average	3 mg/L	LowerLimit	Y

Magnitude and duration analysis results will be available for all parameter and use combinations

Frequency Analysis (PARAM_ATTAINMENT_CODE)

B

Characteristic	Use	Freq-result (# or % not meeting magnitude and duration criteria)	Freq-criteria	PARAM_ATTAINMENT_CODE	ParameterStatus
DO	AQU	0	1 in 3 years	Meeting criteria	Meeting criteria

Frequency analysis results will be available for all parameter and use combinations

pH and AQU

1 row of the DefineCriteriaAndMethods file

Joined data frame with WQP results, station/AU, and use data

Magnitude and Duration Analysis

Characteristic	Use	Duration-Result Value	Duration-Criteria	Magnitude-Criteria Value	Magnitude-Criteria Context	Y= meeting criteria; N=not meeting criteria
pH	AQU	3	30-day Min	6-8	Range	N
pH	AQU	5	30-day Min	6-8	Range	N

Frequency Analysis (PARAM_ATTAINMENT_CODE

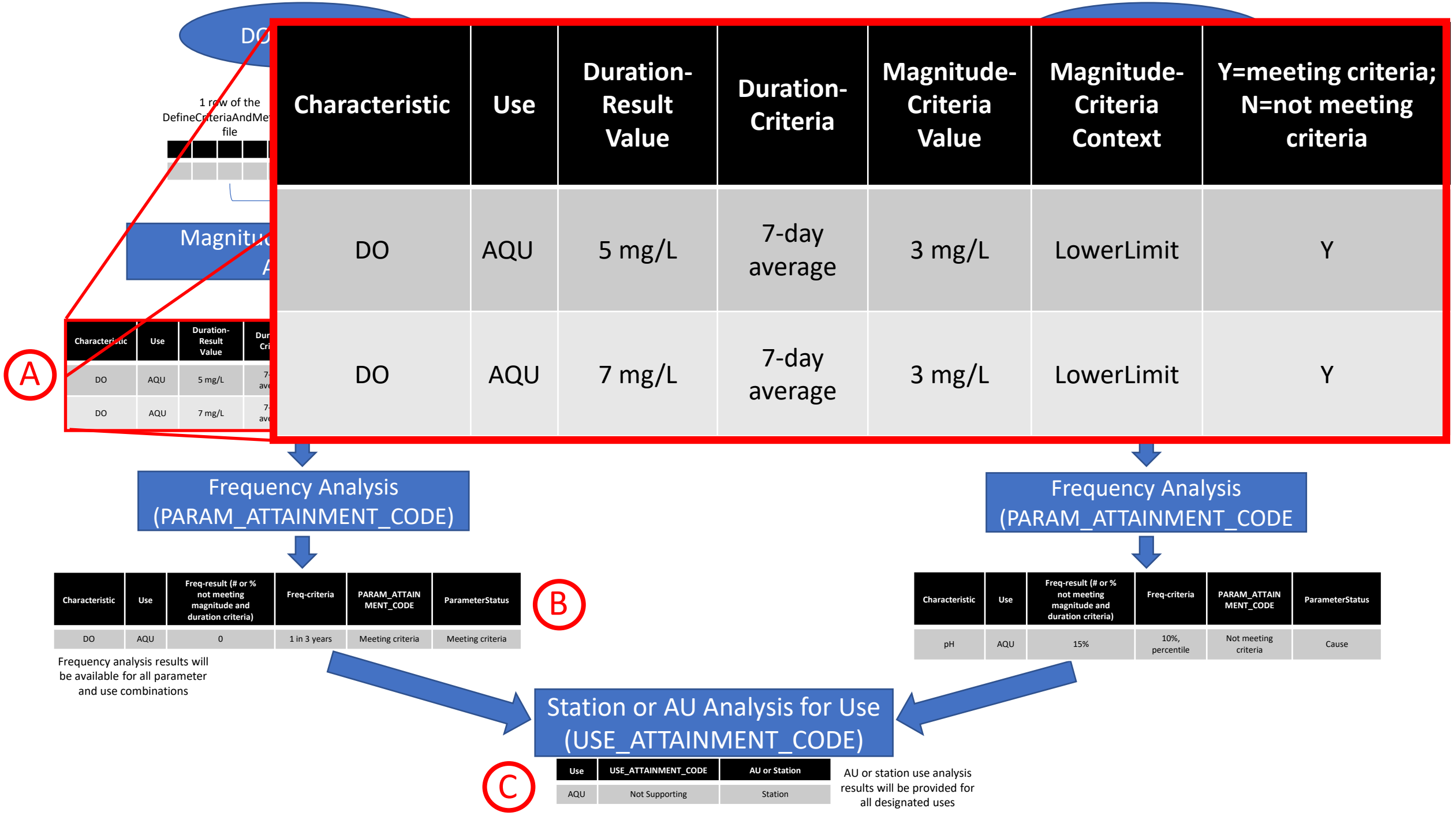
Characteristic	Use	Freq-result (# or % not meeting magnitude and duration criteria)	Freq-criteria	PARAM_ATTAINMENT_CODE	ParameterStatus
pH	AQU	15%	10%, percentile	Not meeting criteria	Cause

Station or AU Analysis for Use (USE_ATTAINMENT_CODE)

C

Use	USE_ATTAINMENT_CODE	AU or Station
AQU	Not Supporting	Station

AU or station use analysis results will be provided for all designated uses


DO
1 row of the DefineCriteriaAndMe file
Magnitu A
A
Characteristic
Use
Duration-Result Value
Dur Cri
DO
AQU
5 mg/L
7-
ave
DO
AQU
7 mg/L
7-
ave
Characteristic
Use
Duration-Result Value
Duration-Criteria
Magnitude-Criteria Value
Magnitude-Criteria Context
Y=meeting criteria; N=not meeting criteria
DO
AQU
5 mg/L
7-day average
3 mg/L
LowerLimit
Y
DO
AQU
7 mg/L
7-day average
3 mg/L
LowerLimit
Y
Frequency Analysis (PARAM_ATTAINMENT_CODE)
Frequency Analysis (PARAM_ATTAINMENT_CODE
Characteristic
Use
Freq-result (# or % not meeting magnitude and duration criteria)
Freq-criteria
PARAM_ATTAINMENT_CODE
ParameterStatus
DO
AQU
0
1 in 3 years
Meeting criteria
Meeting criteria
B
Frequency analysis results will be available for all parameter and use combinations
Characteristic
Use
Freq-result (# or % not meeting magnitude and duration criteria)
Freq-criteria
PARAM_ATTAINMENT_CODE
ParameterStatus
pH
AQU
15%
10%, percentile
Not meeting criteria
Cause
Station or AU Analysis for Use (USE_ATTAINMENT_CODE)
C
Use
USE_ATTAINMENT_CODE
AU or Station
AQU
Not Supporting
Station
AU or station use analysis results will be provided for all designated uses

DO

1 row of the DefineCriteriaAndMe file

Magnitud A

Characteristic	Use	Duration-Result Value	Dur Cri
DO	AQU	5 mg/L	7- ave
DO	AQU	7 mg/L	7- ave

A

Characteristic	Use	Duration-Result Value	Duration-Criteria	Magnitude-Criteria Value	Magnitude-Criteria Context	Y=meeting criteria; N=not meeting criteria
pH	AQU	3	30-day Min	6-8	Range	N
pH	AQU	5	30-day Min	6-8	Range	N

Frequency Analysis (PARAM_ATTAINMENT_CODE)

Characteristic	Use	Freq-result (# or % not meeting magnitude and duration criteria)	Freq-criteria	PARAM_ATTAINMENT_CODE	ParameterStatus
DO	AQU	0	1 in 3 years	Meeting criteria	Meeting criteria

B

Frequency analysis results will be available for all parameter and use combinations

Frequency Analysis (PARAM_ATTAINMENT_CODE

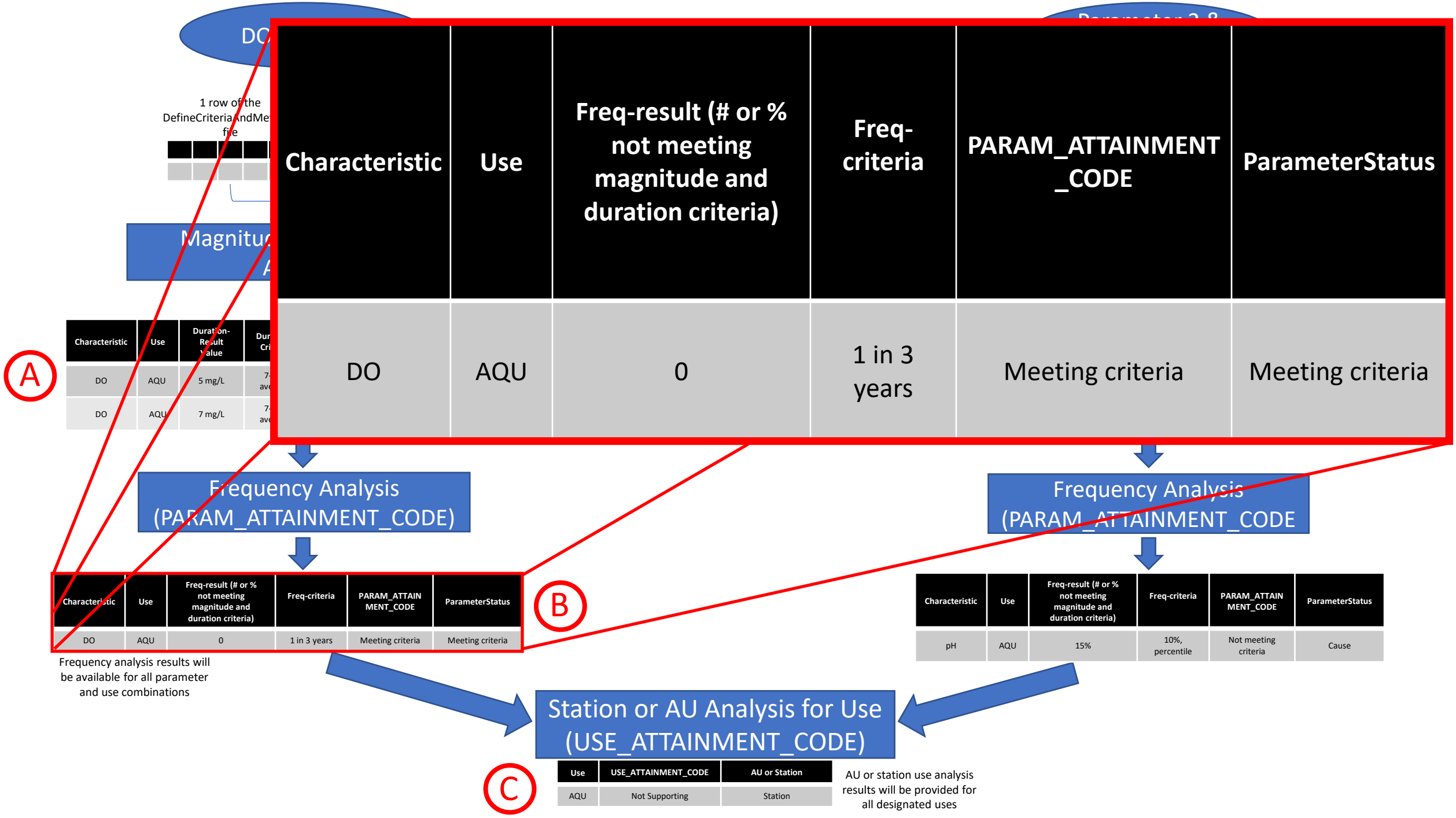
Characteristic	Use	Freq-result (# or % not meeting magnitude and duration criteria)	Freq-criteria	PARAM_ATTAINMENT_CODE	ParameterStatus
pH	AQU	15%	10%, percentile	Not meeting criteria	Cause

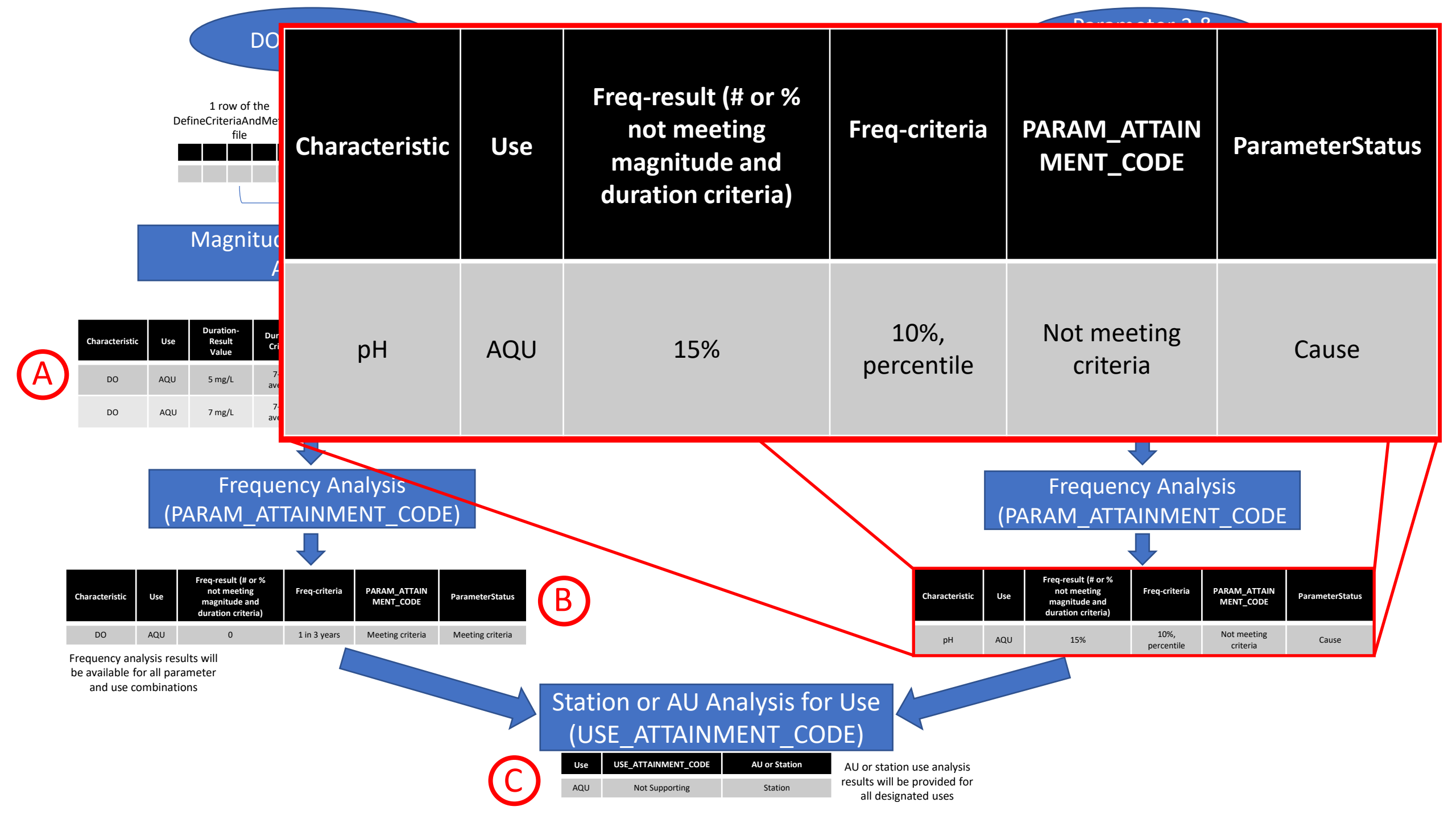
Station or AU Analysis for Use (USE_ATTAINMENT_CODE)

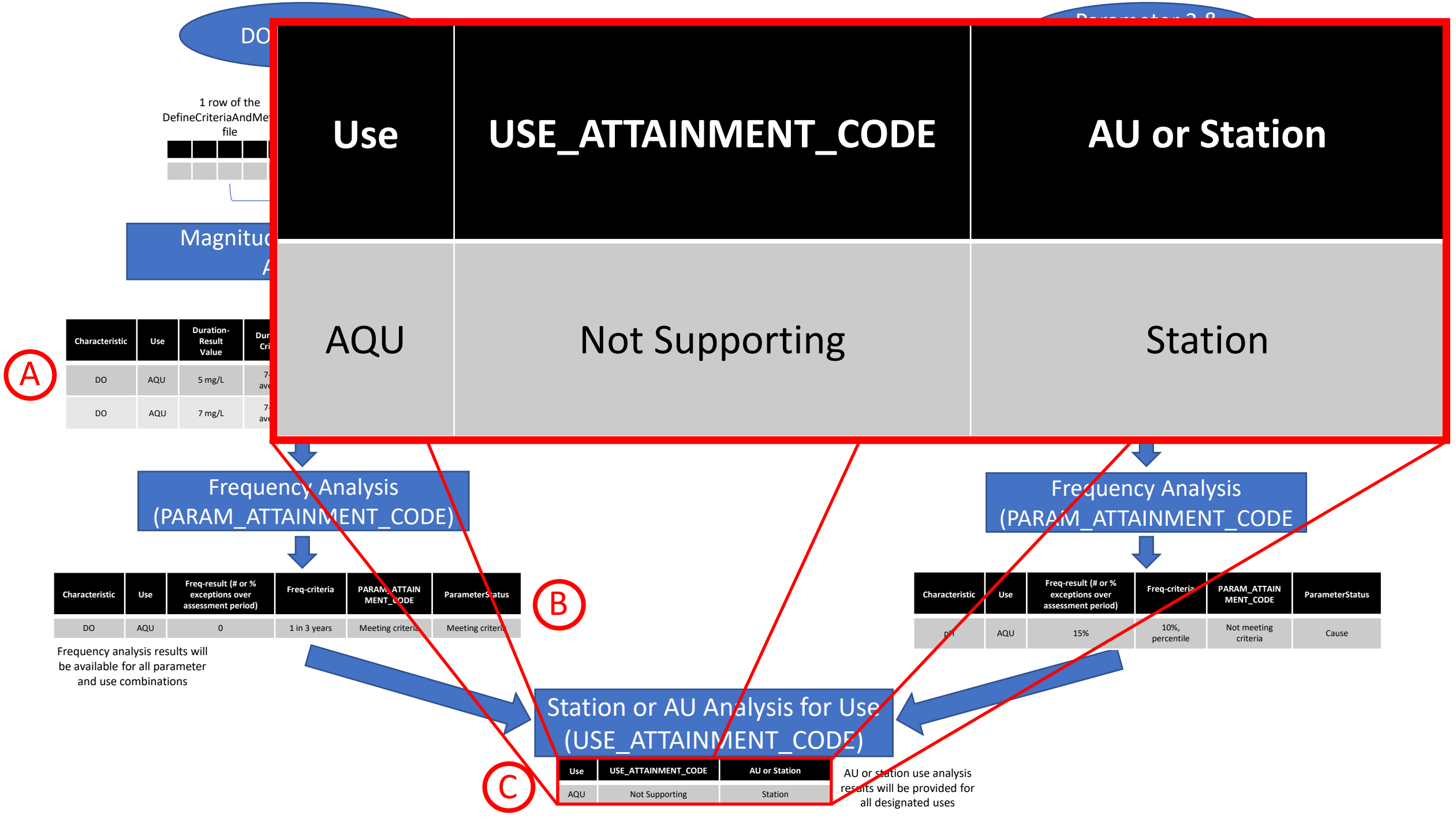
C

Use	USE_ATTAINMENT_CODE	AU or Station
AQU	Not Supporting	Station

AU or station use analysis results will be provided for all designated uses

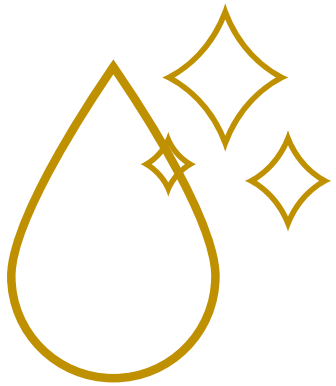

DO
1 row of the DefineCriteriaAndMe fine
Magnitu A
Characteristic
Use
Duration-Result Value
DO
AQU
5 mg/L
DO
AQU
7 mg/L
A
Characteristic
Use
Freq-result (# or % not meeting magnitude and duration criteria)
Freq-criteria
PARAM_ATTAINMENT_CODE
ParameterStatus
DO
AQU
0
1 in 3 years
Meeting criteria
Meeting criteria
Frequency Analysis (PARAM_ATTAINMENT_CODE)
Frequency Analysis (PARAM_ATTAINMENT_CODE
Characteristic
Use
Freq-result (# or % not meeting magnitude and duration criteria)
Freq-criteria
PARAM_ATTAINMENT_CODE
ParameterStatus
DO
AQU
0
1 in 3 years
Meeting criteria
Meeting criteria
B
Characteristic
Use
Freq-result (# or % not meeting magnitude and duration criteria)
Freq-criteria
PARAM_ATTAINMENT_CODE
ParameterStatus
pH
AQU
15%
10%, percentile
Not meeting criteria
Cause
Frequency analysis results will be available for all parameter and use combinations
Station or AU Analysis for Use (USE_ATTAINMENT_CODE)
C
Use
USE_ATTAINMENT_CODE
AU or Station
AQU
Not Supporting
Station
AU or station use analysis results will be provided for all designated uses


DO
1 row of the DefineCriteriaAndMe file
Magnitud
A
Characteristic
Use
Freq-result (# or % not meeting magnitude and duration criteria)
Freq-criteria
PARAM_ATTAIN MENT_CODE
ParameterStatus
pH
AQU
15%
10%, percentile
Not meeting criteria
Cause
A
Characteristic
Use
Duration-Result Value
DO
AQU
5 mg/L
DO
AQU
7 mg/L
Frequency Analysis (PARAM_ATTAINMENT_CODE)
Frequency Analysis (PARAM_ATTAINMENT_CODE
Characteristic
Use
Freq-result (# or % not meeting magnitude and duration criteria)
Freq-criteria
PARAM_ATTAIN MENT_CODE
ParameterStatus
DO
AQU
0
1 in 3 years
Meeting criteria
Meeting criteria
B
Characteristic
Use
Freq-result (# or % not meeting magnitude and duration criteria)
Freq-criteria
PARAM_ATTAIN MENT_CODE
ParameterStatus
pH
AQU
15%
10%, percentile
Not meeting criteria
Cause
Frequency analysis results will be available for all parameter and use combinations
Station or AU Analysis for Use (USE_ATTAINMENT_CODE)
C
Use
USE_ATTAINMENT_CODE
AU or Station
AQU
Not Supporting
Station
AU or station use analysis results will be provided for all designated uses


DO
1 row of the DefineCriteriaAndMe file
Magnitud
A
Characteristic
Use
Duration-Result Value
DO
AQU
5 mg/L
DO
AQU
7 mg/L
A
Use
USE_ATTAINMENT_CODE
AU or Station
AQU
Not Supporting
Station
Frequency Analysis (PARAM_ATTAINMENT_CODE)
Characteristic
Use
Freq-result (# or % exceptions over assessment period)
Freq-criteria
PARAM_ATTAINMENT_CODE
ParameterStatus
DO
AQU
0
1 in 3 years
Meeting criteria
Meeting criteria
B
Frequency analysis results will be available for all parameter and use combinations
Frequency Analysis (PARAM_ATTAINMENT_CODE
Characteristic
Use
Freq-result (# or % exceptions over assessment period)
Freq-criteria
PARAM_ATTAINMENT_CODE
ParameterStatus
pH
AQU
15%
10%, percentile
Not meeting criteria
Cause
Station or AU Analysis for Use (USE_ATTAINMENT_CODE)
C
Use
USE_ATTAINMENT_CODE
AU or Station
AQU
Not Supporting
Station
AU or station use analysis results will be provided for all designated uses

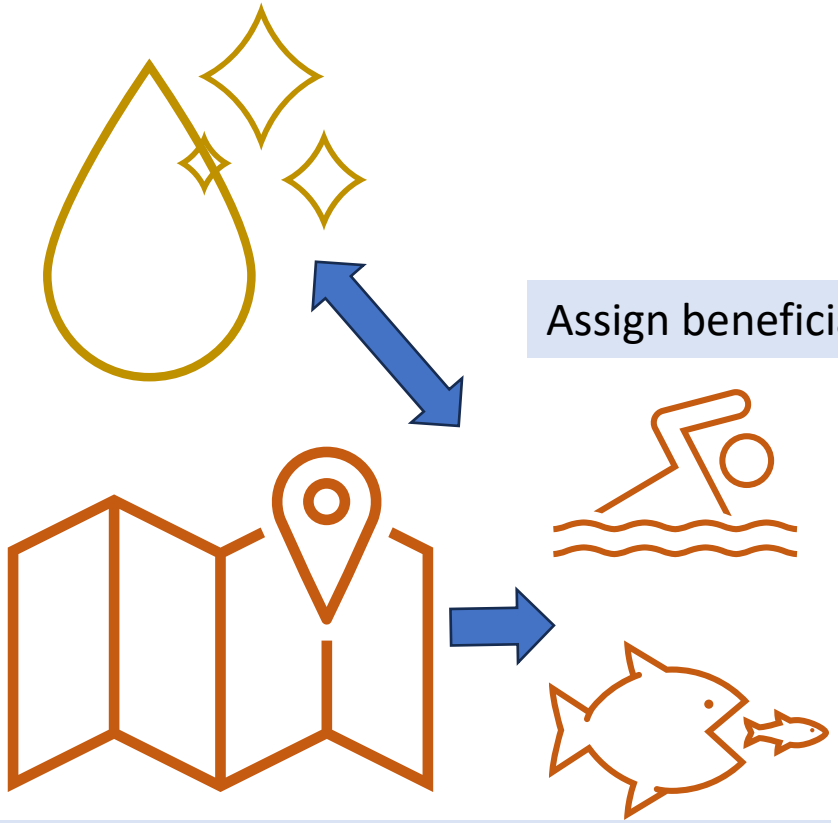
Wrap Up: TADA Vision

QC'd data



Wrap Up: TADA Vision

QC'd data

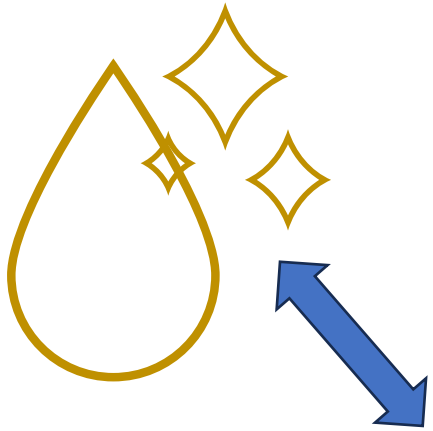


Assign beneficial uses

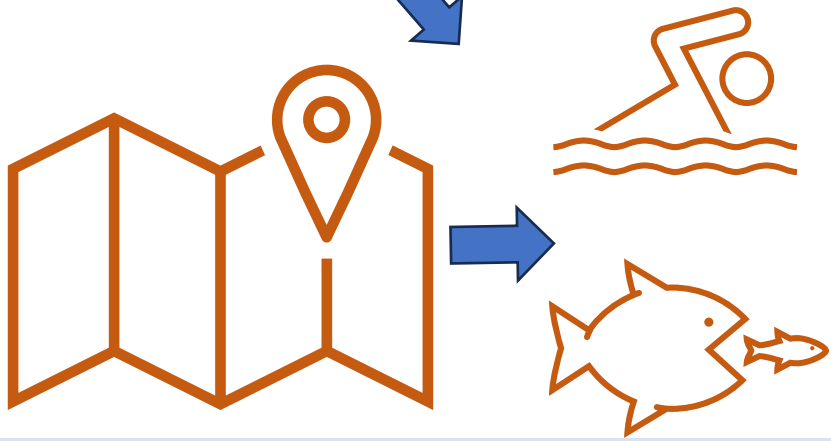
Assessment unit overlay with monitoring locations

Wrap Up: TADA Vision

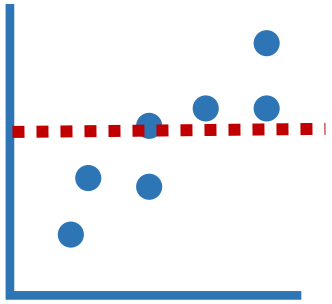
QC'd data



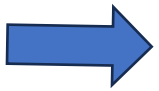
Assign beneficial uses



Assessment unit overlay with monitoring locations



Beneficial uses determine numeric criteria used

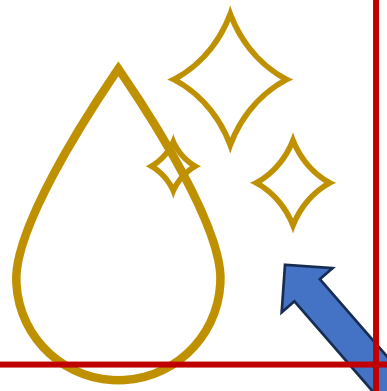


Assessment methods guide impairment decisions based on:

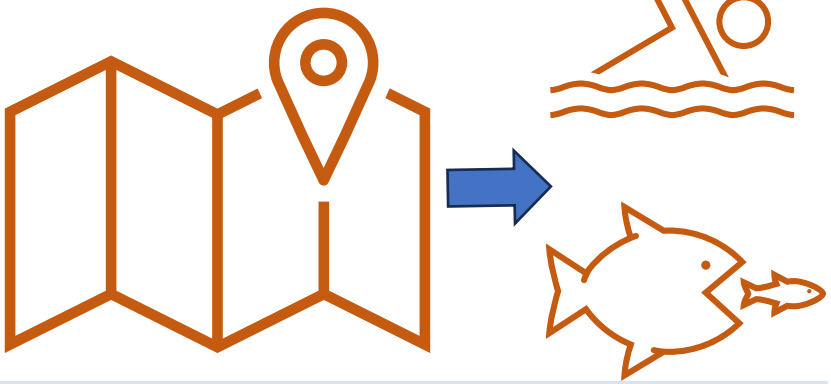
- Period of record
- Aggregated measurements
- Frequency
- Duration
- Magnitude
- Season
- Correction factors
- Covariates
- Site-specific criteria

Wrap Up: TADA Vision

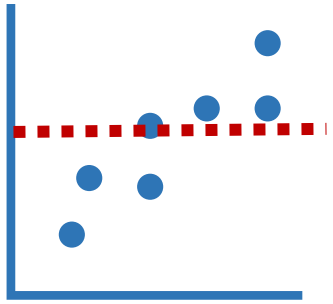
QC'd data



Assign beneficial uses



Assessment unit overlay with monitoring locations



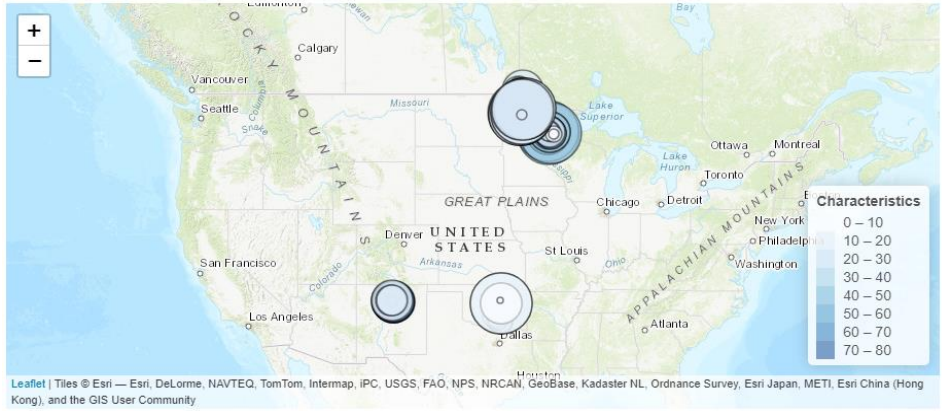
Beneficial uses determine numeric criteria used

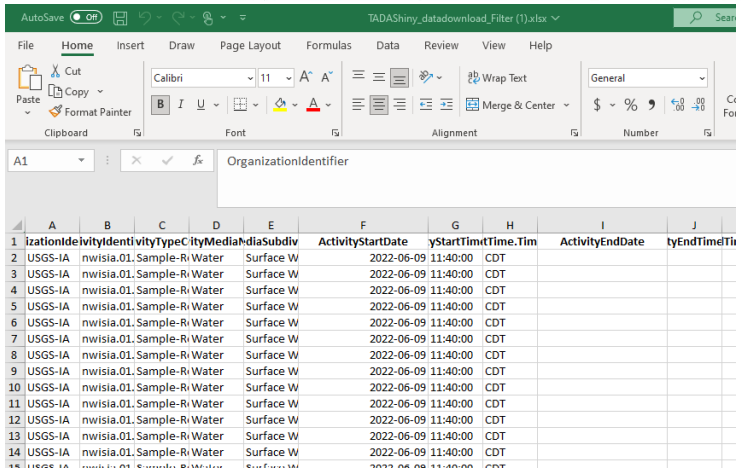
Assessment methods guide impairment decisions based on:

- Period of record
- Aggregated measurements
- Frequency
- Duration
- Magnitude
- Season
- Correction factors
- Covariates
- Site-specific criteria

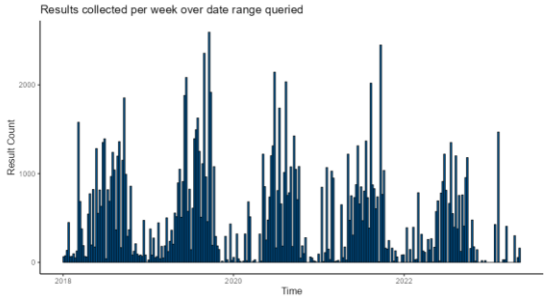
Wrap Up: TADA Vision

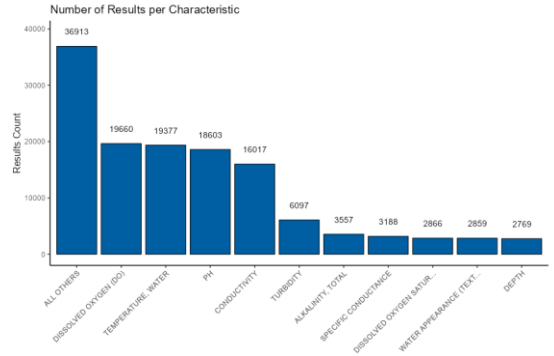
Power happens in the spreadsheets

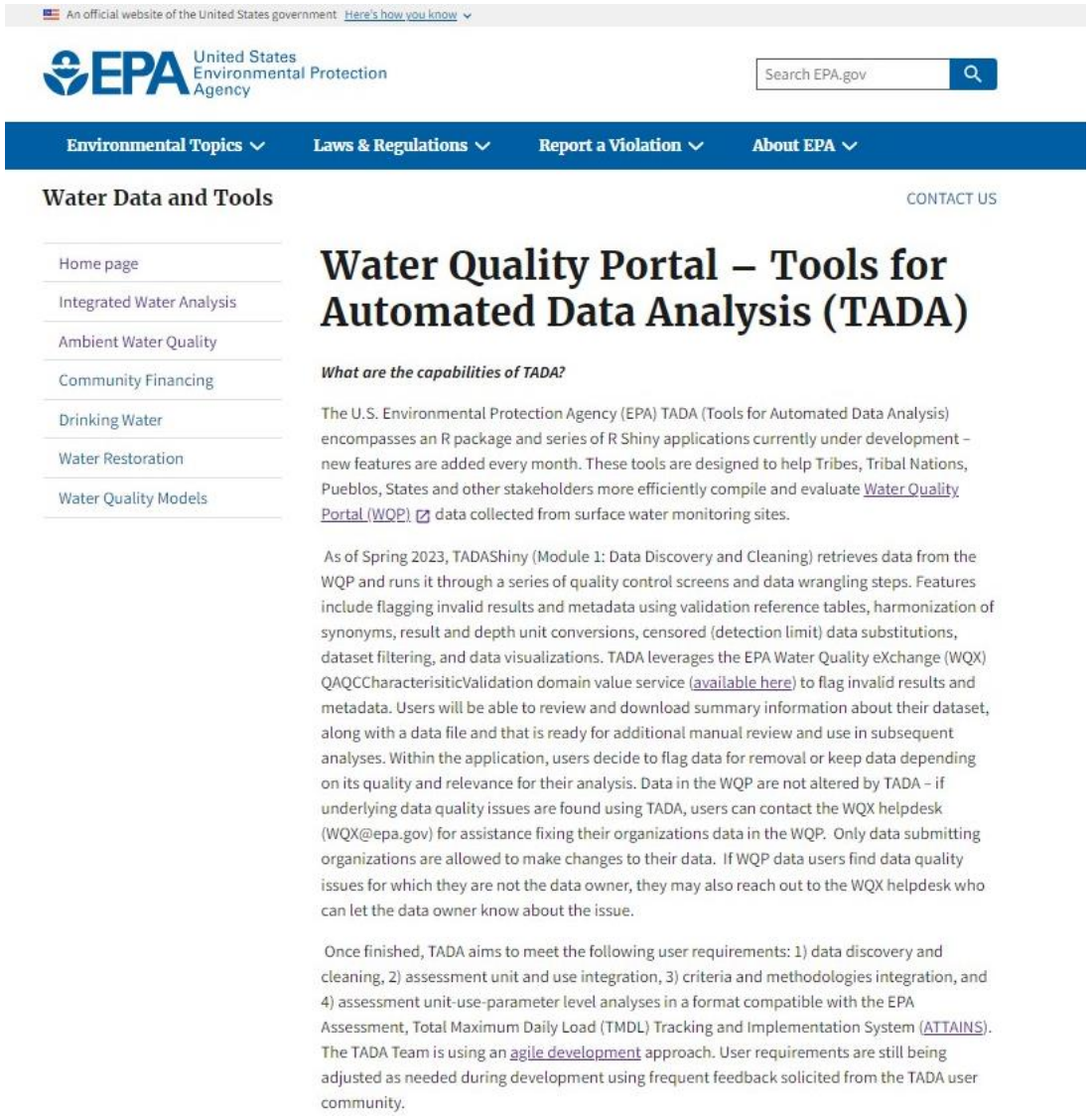




Visualization/ Review, Exploration, Customization







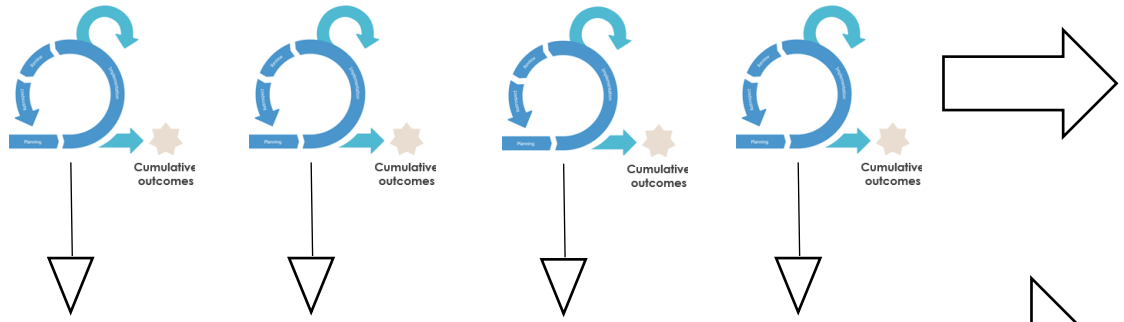
Current TADA Products

- Different tools for different users
  - R Package (coders)
  - R Shiny Application (non-coders)
- User Guides on GitHub Pages
- EPA TADA Website
- Inventory of Open Source and/or Publicly Available Tools that Use WQP Data/Services
- R and R Shiny Learning Resources for Water Community, Collaborative Effort Between TADA Working Group & North American Lake Management Society (NALMS)
- TADA Master List of Requirements (four modules)

TADA Project Timeline

Waterfall: Gather requirements & design tool architecture (perform research & stakeholder engagement)

Agile development: Share modules after each step of development, perform usability testing, seek continuous feedback, make improvements, train and assist users, and maintain TADA over time



September 2020

Assemble project team, begin TADA conceptualization and management

Jan 2021

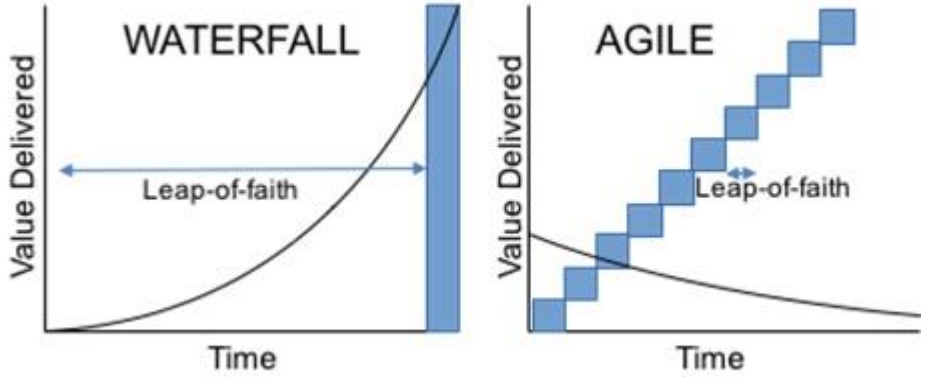
TADA Working Group start date (two tracks – 2 meeting per month)

August 2021

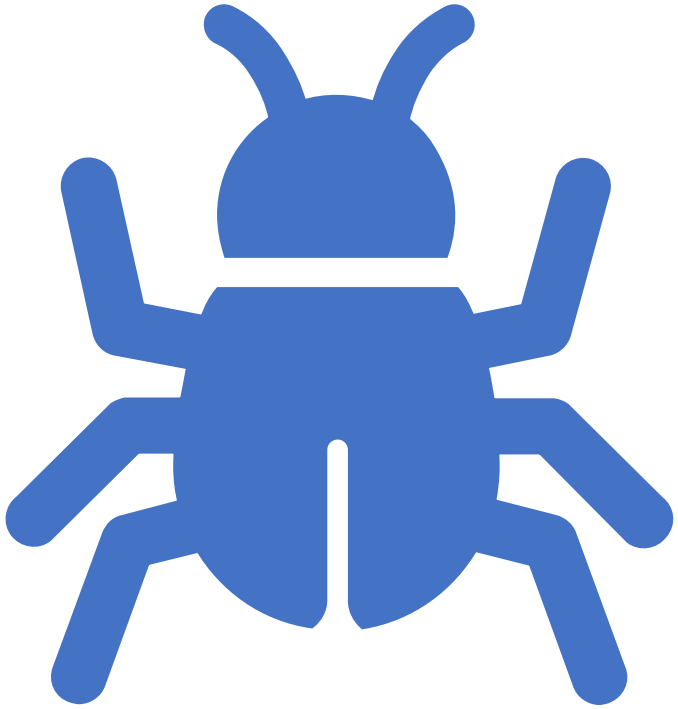
TADA Working Group (single track – growing quickly)

Host regular meetings with open-source water quality data analysis community to deploy tool

June 2023



https://commons.wikimedia.org/wiki/File:Waterfallvsagile.jpg



For Today's Training

- TADA Package Vignette: https://usepa.github.io/TADA/articles/TADAModule1.html
- TADA Shiny App: https://github.com/USEPA/TADAShiny
- Bug Form: https://forms.gle/PoTCXEeVAaTnEgLs6
- Feedback Form: https://forms.gle/MAcieQUCqsqywMLY7

Thank you for attending!

- Contact Cristina: mullin.Cristina@epa.gov
- We want your feedback! We are always looking for users to test our products and features
  - Bug/Error Report
  - Feedback Form
  - Submit Issue on GitHub
    - TADA R Package
    - TADA Shiny

EXTRA SLIDES BEYOND

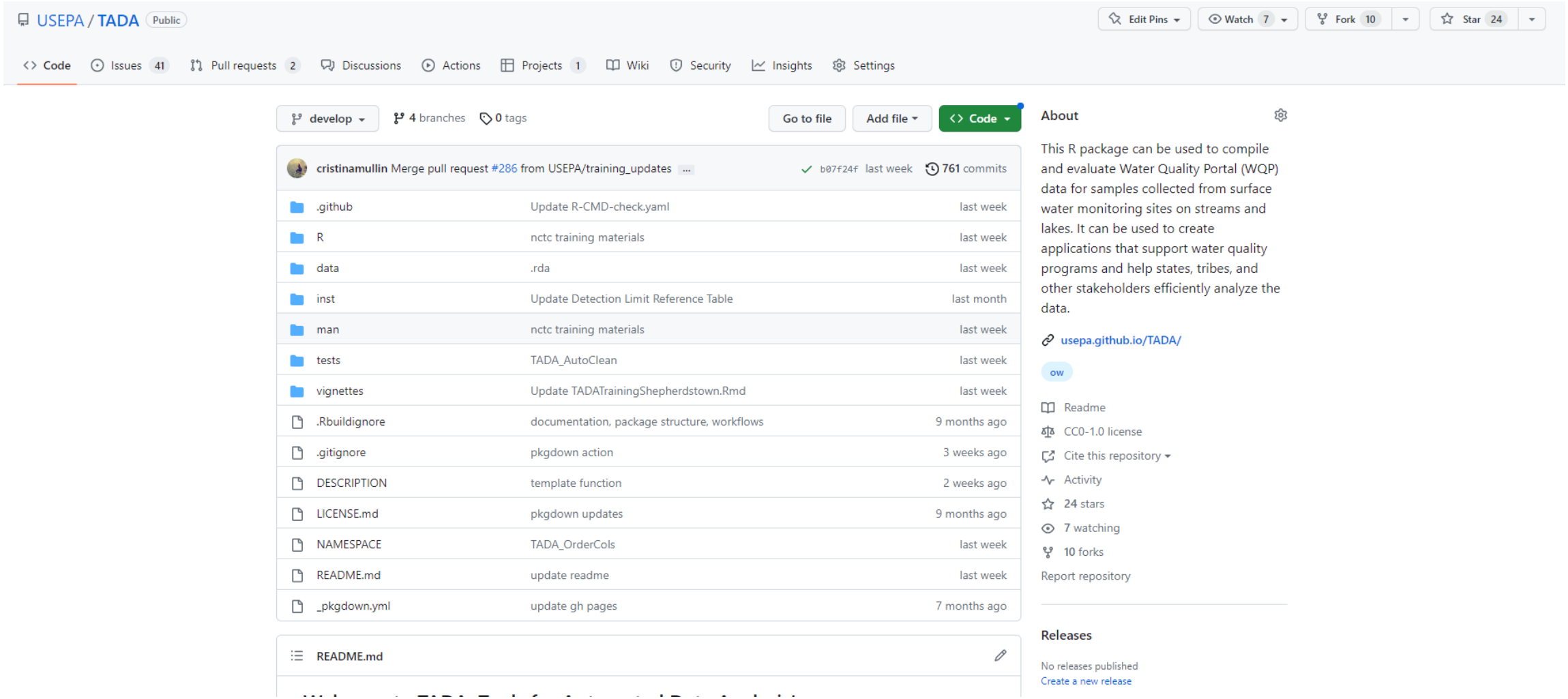
An official website of the United States government Here's how you know

Water Quality Portal – Tools for Automated Data Analysis (TADA)

What are the capabilities of TADA?

The U.S. Environmental Protection Agency (EPA) TADA (Tools for Automated Data Analysis) encompasses an R package and series of R Shiny applications currently under development – new features are added every month. These tools are designed to help Tribes, Tribal Nations, Pueblos, States and other stakeholders more efficiently compile and evaluate Water Quality Portal (WQP) data collected from surface water monitoring sites.

As of Spring 2023, TADAShiny (Module 1: Data Discovery and Cleaning) retrieves data from the WQP and runs it through a series of quality control screens and data wrangling steps. Features include flagging invalid results and metadata using validation reference tables, harmonization of synonyms, result and depth unit conversions, censored (detection limit) data substitutions, dataset filtering, and data visualizations. TADA leverages the EPA Water Quality eXchange (WQX) QAQCCharacterisiticValidation domain value service (available here) to flag invalid results and metadata. Users will be able to review and download summary information about their dataset, along with a data file and that is ready for additional manual review and use in subsequent analyses. Within the application, users decide to flag data for removal or keep data depending on its quality and relevance for their analysis. Data in the WQP are not altered by TADA – if underlying data quality issues are found using TADA, users can contact the WQX helpdesk (WQX@epa.gov) for assistance fixing their organizations data in the WQP. Only data submitting organizations are allowed to make changes to their data. If WQP data users find data quality issues for which they are not the data owner, they may also reach out to the WQX helpdesk who


USEPA / TADA Public
Edit Pins
Watch 7
Fork 10
Star 24
Code
Issues 41
Pull requests 2
Discussions
Actions
Projects 1
Wiki
Security
Insights
Settings
develop
4 branches
0 tags
Go to file
Add file
Code
cristinamullin Merge pull request #286 from USEPA/training_updates ...
b07f24f last week
761 commits
.github Update R-CMD-check.yaml last week
R nctc training materials last week
data .rda last week
inst Update Detection Limit Reference Table last month
man nctc training materials last week
tests TADA_AutoClean last week
vignettes Update TADATrainingShepherdstown.Rmd last week
.Rbuildignore documentation, package structure, workflows 9 months ago
.gitignore pkgdown action 3 weeks ago
DESCRIPTION template function 2 weeks ago
LICENSE.md pkgdown updates 9 months ago
NAMESPACE TADA_OrderCols last week
README.md update readme last week
_pkgdown.yml update gh pages 7 months ago
README.md
About
This R package can be used to compile and evaluate Water Quality Portal (WQP) data for samples collected from surface water monitoring sites on streams and lakes. It can be used to create applications that support water quality programs and help states, tribes, and other stakeholders efficiently analyze the data.
usepa.github.io/TADA/
ow
Readme
CC0-1.0 license
Cite this repository
Activity
24 stars
7 watching
10 forks
Report repository
Releases
No releases published
Create a new release

Welcome to TADA: Tools for Automated Data Analysis!

We encourage you to read this package's CONTRIBUTING, LICENSE, and README files (you are here).

Tools for Automated Data Analysis, or TADA, is a draft R package being developed to help States, Tribes, Tribal Nations, Pueblos, and other stakeholders more efficiently compile and evaluate Water Quality Portal (WQP) data collected from surface water monitoring sites. TADA is both a stand-alone R package, and a building block to support development of the TADA R Shiny application.

We encourage stakeholders to test the functionality and provide feedback. Moreover, open source software provides an avenue for water quality data originators and users to develop and share code, and we welcome your contributions! More information on how to contribute can be found in the CONTRIBUTING file. This file explains how users can contribute to the R package by submitting a pull request or issue to request a change or provide feedback. We hope to build a collaborative community dedicated to this effort where contributors can discover, share and build the package functionality over time.

More about the TADA Project

Installation

You can install and load the most recent version of the TADA R Package from GitHub by running:

```
library (remotes)
remotes::install_github("USEPA/TADA", ref = "develop", dependencies = TRUE)
```

Water Quality Portal

Links

Browse source code

License

Full license

CC0

Citation

Citing TADA

Developers

Cristina Mullin
Author, maintainer

Michelle Thawley
Author

Jacob Greif
Author

Laura Shumway
Author

Elise Hinman
Author

Kathleen Healy
Author

Contributing

2023-06-08

Source: vignettes/CONTRIBUTING.Rmd

Contribute to TADA!

We encourage you to read this project's CONTRIBUTING policy (you are here), its LICENSE, and its README.

We're so glad you're thinking about contributing to an EPA open source project! If you're unsure about anything, just ask — or submit your issue or pull request anyway. The worst that can happen is we'll politely ask you to change something. We appreciate all friendly contributions.

No matter who you are, if you spot an error, omission, or bug, you're welcome to open an issue in this repo!

TADA Working Group Mission

To share and develop R code for evaluating and visualizing Water Quality Portal (WQP) data more efficiently though collaboration and open-source programming. This includes working together to find commonalities in assessment processes across the nation, creating flexible tools that can be easily customized to work within existing workflows, supporting each other in learning R, and ensuring products will be accessible to organizations most in need.

Package Development

This article will walk through how to contribute to the TADA package via a pull request workflow. This is also not a complete guide to R package development (a comprehensive guide is R Packages), instead this is meant as more of a checklist for the general steps. Several references are included at the bottom for more information on R-package development and git workflows.

What is GitHub?

GitHub is a third-party website that offers version-controlled repositories that developers and

On this page

Contribute to TADA!
TADA Working Group Mission
Package Development
What is GitHub?
Required Installations
Issues
Branches and Pull Requests
Additional References
Open-Source Code Policy
License
Disclaimer
Contact

Function reference

All functions

`AboveNationalWQXUpperThreshold()`
Check Result Value Against WQX Upper Threshold

`AggregatedContinuousData()`
Check for Aggregated Continuous Data

`BelowNationalWQXLowerThreshold()`
Check Result Value Against WQX Lower Threshold

`GetActivityTypeRef()`
Update Activity Type Reference Table

`GetDetCondRef()`
Update Result Detection Condition Reference Table

`GetDetLimitRef()`

reviewed by the TADA team. Once approved, updates are then merged into the develop branch. However, you are welcome to download any branch you'd like using the `ref` input in `install_github` (see code chunk above). This functionality is mainly only useful to TADA package developers/contributors.

The following code block ensures the additional packages needed to run the code in this RMarkdown document are loaded. However, users may also use the `package name:: package function` notation to avoid the list of `library()` calls.

```
# Load tidyverse
if(!"tidyverse"%in%installed.packages()){
  install.packages("tidyverse")
}
library(tidyverse)
```

Help pages

All TADA R package functions have their own individual help pages, listed on the Function reference page on the GitHub site. Users can also access the help page for a given function in R or RStudio using the following format (example below): `?TADA::[name of TADA function]`

```
?TADA::TADAdataRetrieval
```

On this page

- Welcome!
- Customize or contribute
- Install and setup
- Help pages
- Upload data
- Initial data review
- Data flagging
- Censored data handling
- Data exploration
- TADA R Shiny Modules

Install and setup

Users can install the TADA package from GitHub into their R library using the `remotes` package. Copy and paste the code below into your R or RStudio console to download and install.

TADA package relies on other packages, therefore you may be prompted in the console to update dependency packages that have more recent versions available. If you see this prompt, it is recommended to update all of them (enter 1 into the console).

```
# Install TADA
if(!"remotes"%in%installed.packages()){
  install.packages("remotes")
}
remotes::install_github("USEPA/TADA", ref="develop")
library(TADA)
```

It's that easy! The most stable branch for TADA right now is the develop branch. Contributors generally create their own branches based on develop, make some improvements, and then submit a pull request to be reviewed by the TADA Team. Once approved, updates are then merged into the develop branch. However, you are welcome to download any branch you'd like using the `ref` input in `install_github` (see code chunk above). This functionality is mainly only useful to TADA package developers/contributors.

On this page

- Welcome!
- Customize or contribute
- Install and setup
- Help pages
- Upload data
- Initial data review
- Data flagging
- Censored data handling
- Data exploration
- TADA R Shiny Modules