

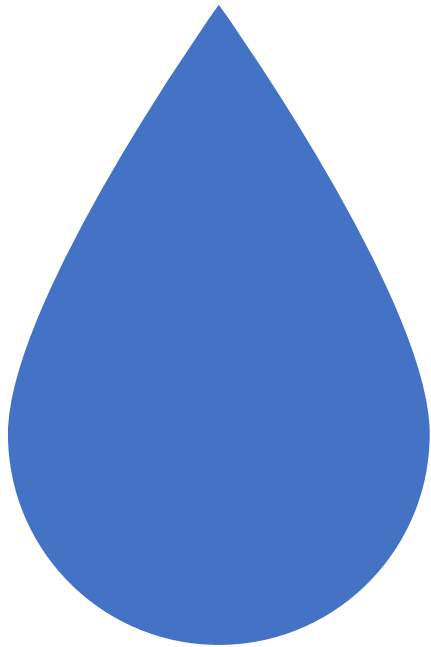


A Basic Introduction to Monitoring, Data & Assessment

Adam Griggs, Jesse Boorman-Padgett, Cristina Mullin PhD, Rob Cook

Environmental Protection Agency

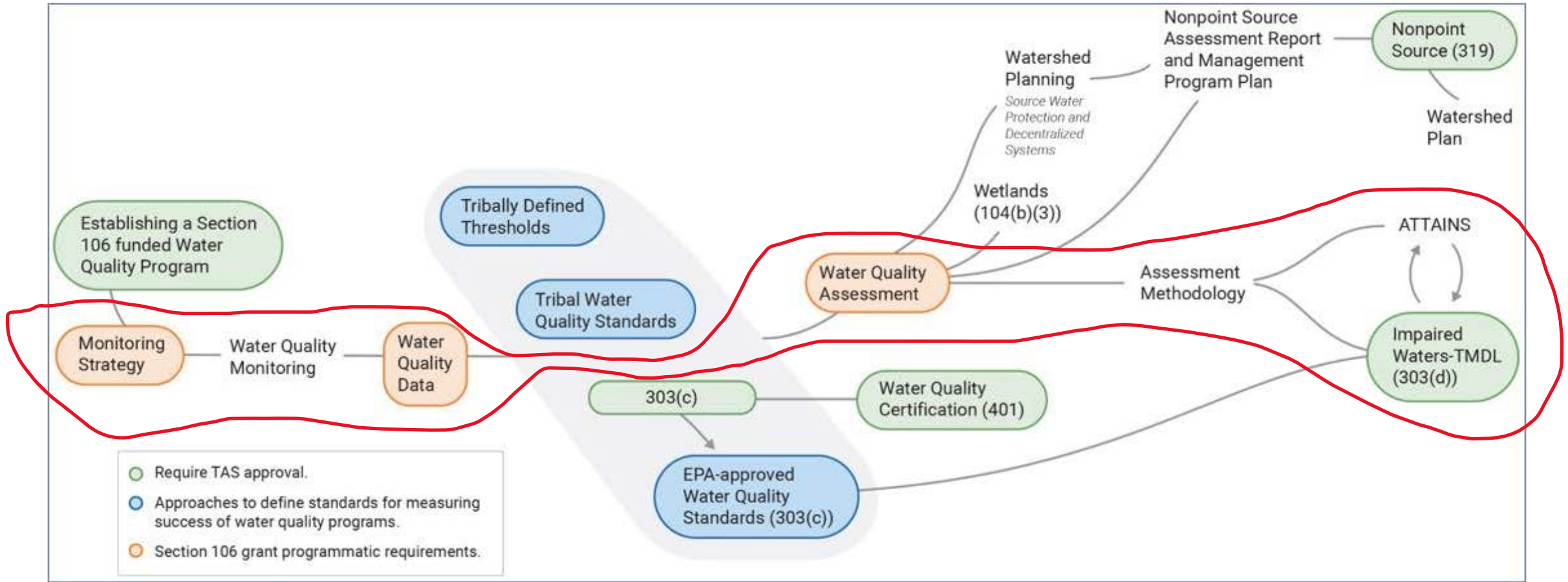
Monday, March 4th, 2024, 10:45am – 12:00pm



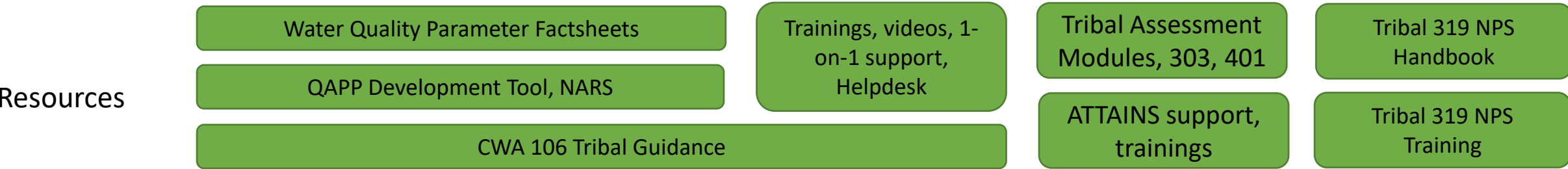
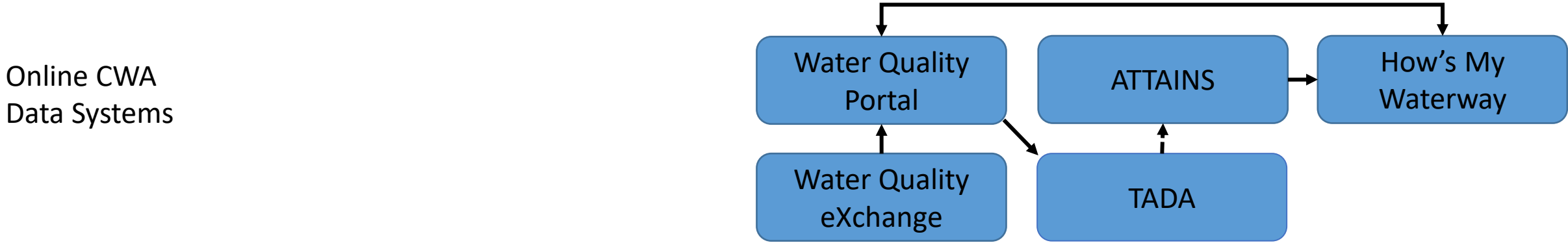
What we'll cover today

- Big picture – Intro to Monitoring, Data, and Assessment of Surface Waters (CWA)
- What CWA programs are part of Surface Water Assessment?
- More of the Science, Less of the Policy
- Cover the online systems that support surface water data

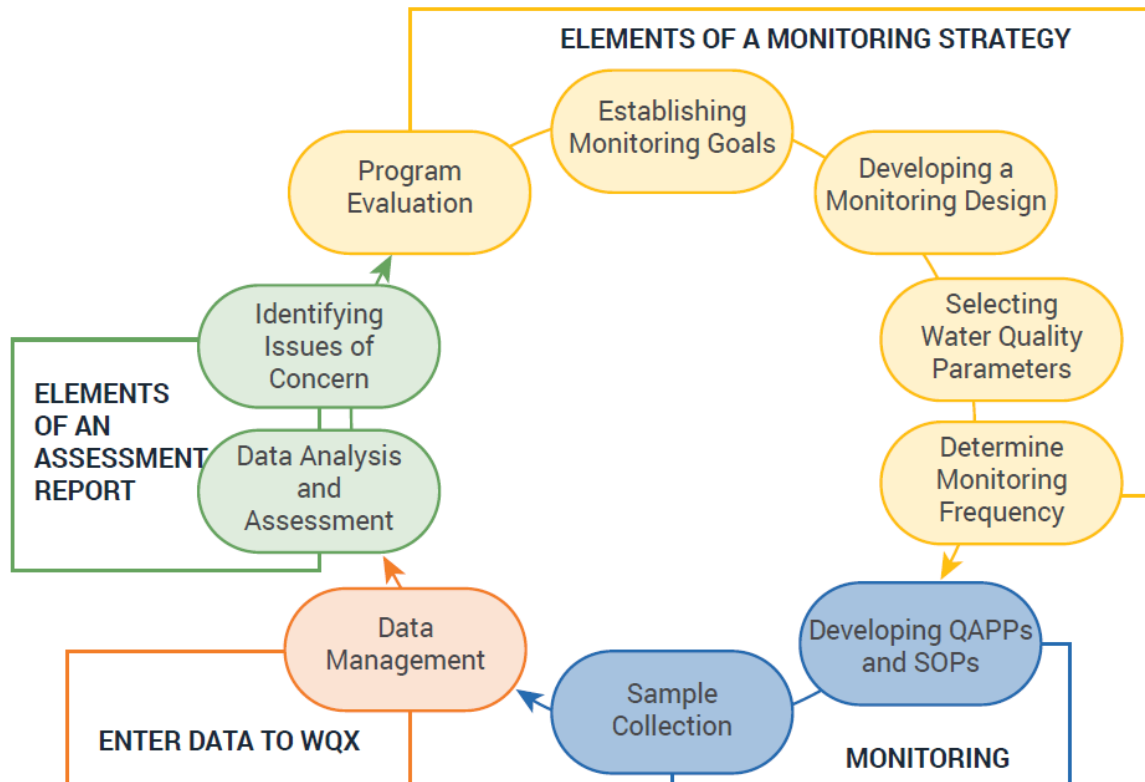
Clean Water Act - Tribal Program Road Map



Lifecycle of Data and Clean Water Act Implementation



Clean Water Act Section 106

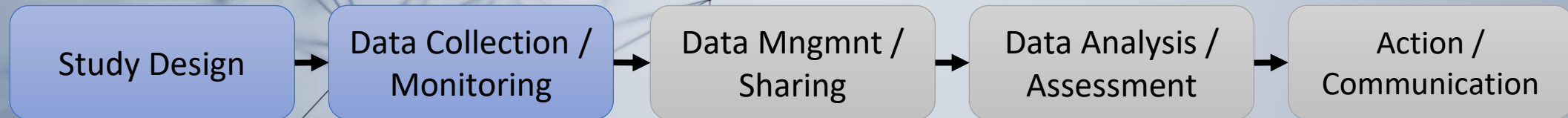


IK Data Sovereignty

The Section 106 Program is committed to respecting tribal Indigenous Knowledge sovereignty practices. Indigenous Knowledge informs many aspects of tribal water quality programs and the information shared by Indigenous Knowledge holders is owned by them.

Tribes that use Section 106 funds to collect Indigenous Knowledge will not be required to report that shared knowledge as part of their grant requirements. Tribes are expected to meet the three reporting requirements (Monitoring Strategy, water quality data submitted through WQX, and Water Quality Assessment, as described in Chapter 6) but are not expected to share the underlying Indigenous Knowledge used to inform water quality objectives and management practices.

Monitoring for Water Quality



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Why Monitor Water Quality?

- Characterize baseline conditions
- Determine suitability for certain uses
 - e.g. aquatic life or contact recreation
- Identify existing or emerging water quality problems
- Identify changes or trends over time (Worse? Better?)
- Measure effectiveness of efforts to maintain or improve water quality
- Develop water quality standards and/or assess compliance with standards



<https://creativecommons.org/licenses/by-sa/2.5/>
Richard Bartz, Munich aka Makro Freak Image:MFB.jpg - Own work

Monitoring may address one or all these objectives

Define Your Objectives BEFORE getting started on your monitoring approach!

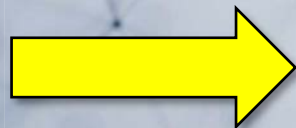
Why?

When Defining Your Objectives:

Maxed out the Lowe's credit card
but loving our new deck!



- *Be realistic about monitoring limitations*
 - Lack of resources/expertise to conduct a full spectrum contaminant analysis
 - Presently limited to use of a multi-probe device (dissolved oxygen, pH, temperature, specific conductance) and site observations/notes
- Staff time is limited – can only visit sites periodically
- These are real things, and every program experiences some sort of limitation whether it be:
 - a. Time
 - b. Money
 - c. Experience
 - d. All of the Above



Let's Talk About Objective-Driven Monitoring

Identifying your objective guides your monitoring approach

Why Monitor Water Quality?

- Characterize baseline conditions
- Determine suitability for certain uses
 - e.g. aquatic life or contact recreation
- Identify existing or emerging water quality problems
- Measure effectiveness of efforts to maintain or improve water quality
- Develop water quality standards and/or assess compliance with standards

- Where are you going to sample?
- How often are you going to sample?
- What parameters will be sampled?



Identifying your objective also guides your data evaluation approach

- How often are you going to sample?
- What parameters will be sampled?

Reminder that real-world limitations exist in the form of \$, time, experience. This is reality, so don't let limitations or the desire to have a perfect approach get in the way of progress

Let's Talk About Objective-Driven Monitoring

Types of Monitoring Designs

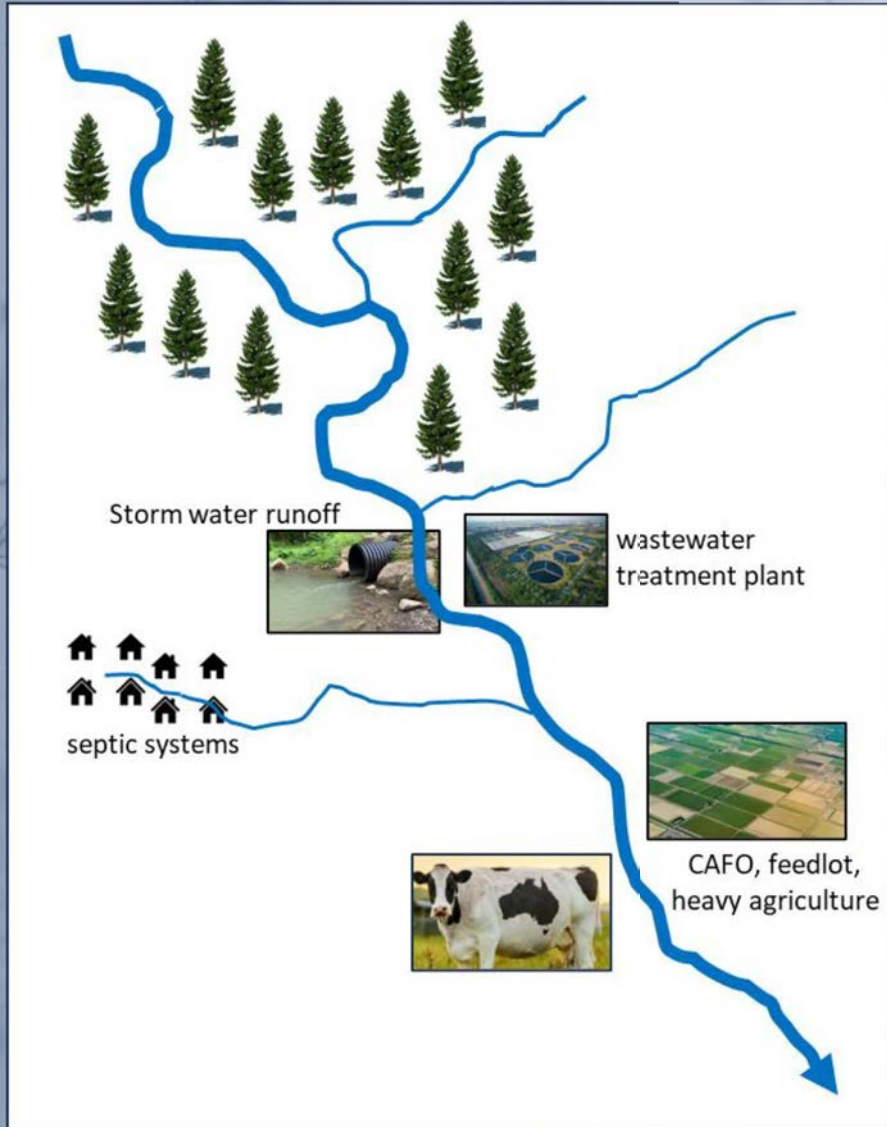


- We can't monitor everywhere, so we must monitor "smart."
- Types of monitoring designs include:
 - Statistically-valid surveys
 - Targeted monitoring
 - Fixed Site Network
 - Rotating basin
- EPA recommends that States/Tribes integrate a variety of designs to best meet the range of monitoring objectives and multiple decision needs.

Let's Talk About Objective-Driven Monitoring

Types of Monitoring Designs

- Types of monitoring designs include:
 - Statistically-valid surveys
 - Targeted monitoring
 - Fixed Site Network
 - Rotating basin



Document these things!

- Sampling Objectives
- Sampling Locations
- Sampling Frequency
- Parameters Sampled and Methods
- Data evaluation approach

Where should this information be housed?



Potential Resource:
EPA Regional
Technical Partners

**Quality
Assurance
Project
Plan**

Data Management

- Consider putting together a Data Management Plan
- Identify your raw data formats – lab reports, logger files, field forms, etc.
- Do you need to marry these datasets so they can work together?
- Data formats
- Metadata
- Data management technologies
- Data analysis/use



Standardized data formats

Matrix Style Dataset

- AKA “Flat” “Wide” “Tidy”

Each Characteristic
(measure) occupies its
own column



- Handy for analysis
- Compact
- Just the values
- Not the best way to manage your metadata though
- Requires a crosstab import config

Activity Identifier	Activity Start Date	Monitoring Location Identifier	Iron	Lead	Manganese
nwiswi.01.99208821	8/28/1992	USGS-04072050	1400	1.5	510
nwiswi.01.99208822	8/28/1992	USGS-04072050	1800	1.2	650
nwiswi.01.99208826	8/28/1992	USGS-04085110	2200	1.2	890
nwiswi.01.99208856	8/29/1992	USGS-04085475	1600	1.4	480
nwiswi.01.99407330	9/19/1994	USGS-04063700	120		250
nwiswi.01.99407332	9/19/1994	USGS-04063700	5000	1.2	2100
nwiswi.01.99407338	9/21/1994	USGS-04080798	1400	1.2	820
nwiswi.01.99407340	9/21/1994	USGS-04080798	1200	1	2400

Standardized data formats

Stacked Style Dataset - AKA “Tall” “Narrow”

All measures in one
column

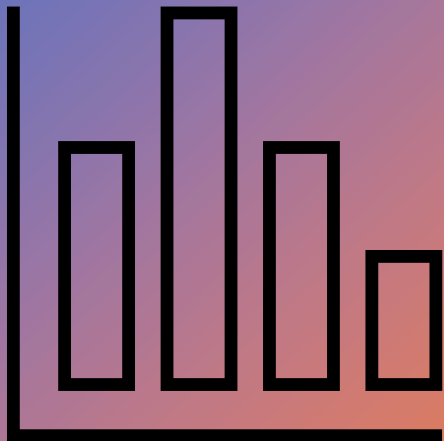


Additional information about those measures



- How data is stored/served by the WQP
- Good for data management
- Not ideal for data analysis
- Allows for metadata

Result Identifier	Characteristic Name	Sample Fraction	Measure Value	Unit
NWIS-114877794	Stream width measure		3	ft
NWIS-114877795	Temperature, water		16.8	deg C
NWIS-114877797	Stream flow, instantaneous		0.19	ft ³ /s
NWIS-114877798	Specific conductance	Total	696	<u>uS/cm @25C</u>
NWIS-114877799	Acidity, (H ⁺)	Total	0.00001	mg/l
NWIS-114877800	Oxygen	Dissolved	11.4	mg/l
NWIS-114877801	pH	Total	8.3	std units



Spreadsheets

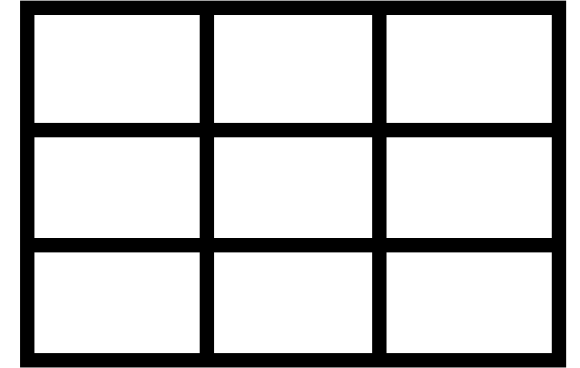
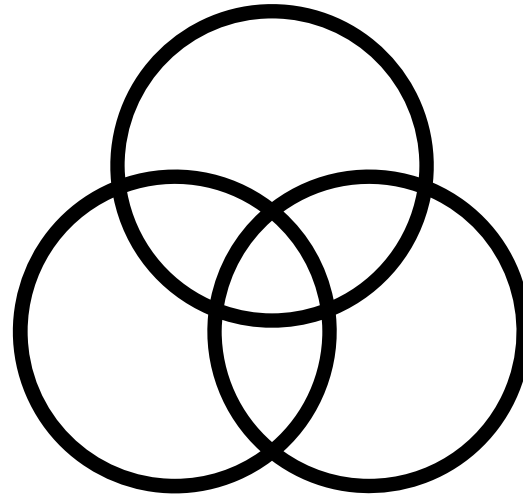
Manage datasets (not really a database)

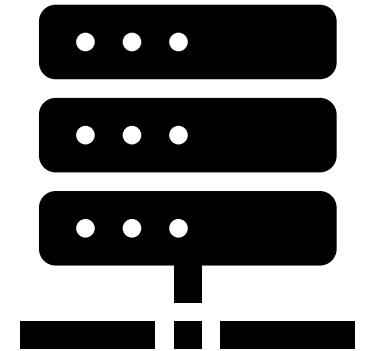
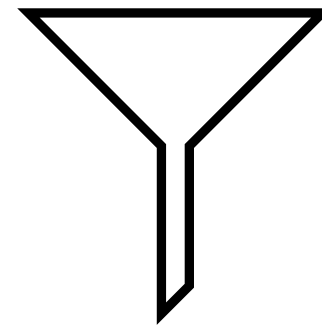
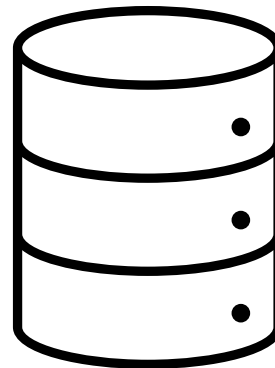
Very useful for manipulating, analyzing, organizing one dataset at a time

Expandable – Macros, external data, XML, data visualization

Relational Databases (light)

- MS Access (primarily)
- Entry-level database management
- Allows for the management of multiple tables of related data
- Connect, query, filter, update, or append data
- Ensure integrity of data quality/relationships
- Allows for front-end “forms” or “reports” or views of the data



A 3x3 grid representing a table with three columns and three rows. Each cell is empty, symbolizing a data table.

What do we mean by relational?

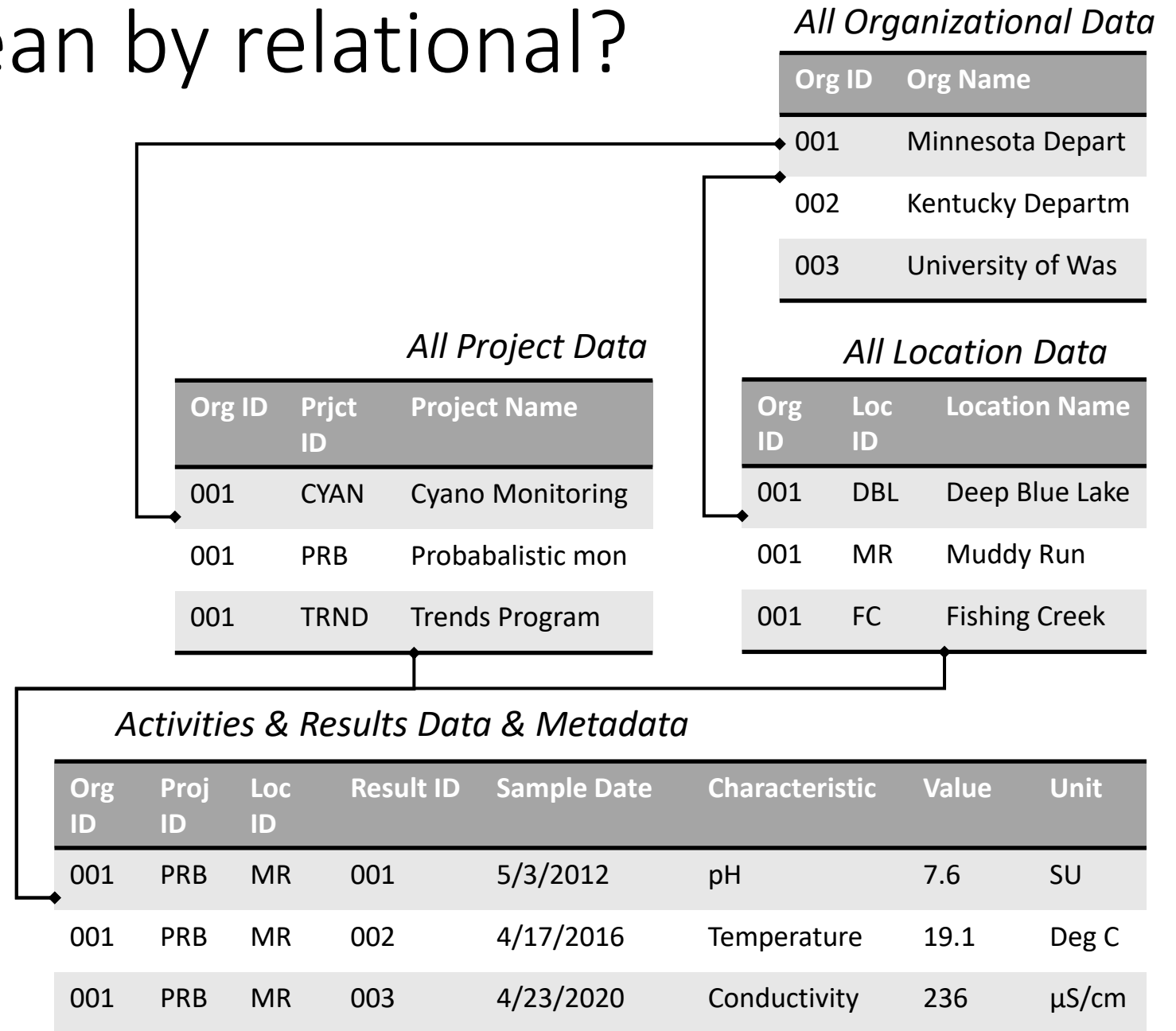
Data of different types are each managed in their own table

We establish relationships between certain pieces of information in the tables

The related pieces of information are often (but not always) ID or “key” fields

This allows for more detailed information to be stored in separate tables, allowing for useful queries of the database

Ex. This is what allows users to query across place, time, program, and result type in the WQP



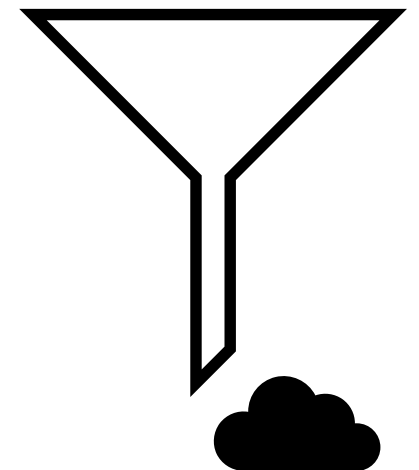
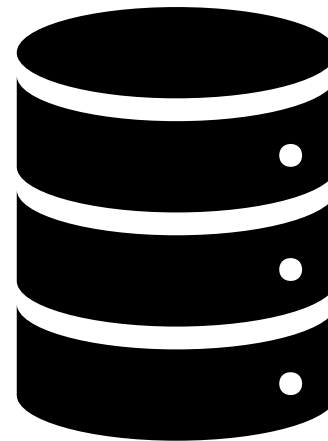
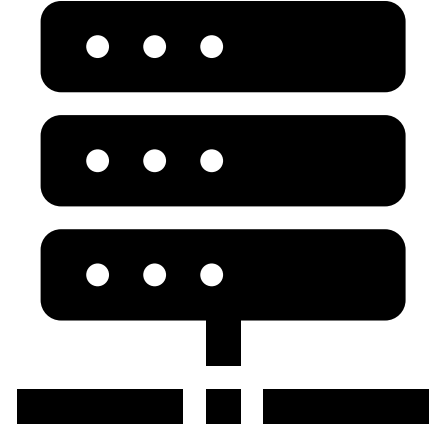
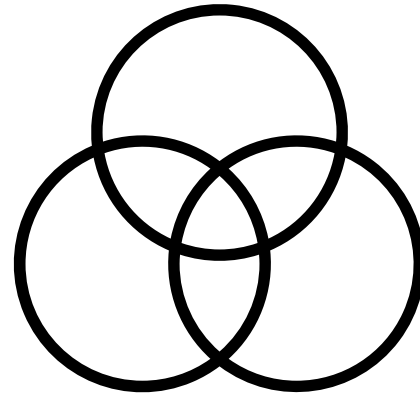
Relational Databases (Heavy)

Enterprise

These are fully customized Enterprise database solutions usually built in Oracle, SQL Server, or PostGres, as examples.

These systems are typically operated from a server or more commonly these days, in the Cloud.

These are typically built by developers, at some cost and may include front-ends for staff to access and manipulate.



Selecting a data management tool

Who needs to manage the data?

What resources are available?

How much data needs to be managed?

How often will you need to complete this task?

	Spreadsheets	Relational dB lite	Enterprise dB
Data Entry	√ (Can link forms)	√ (Can add forms)	Requires forms
Relational data	Some (Power Pivot)	√	√
Run queries		√	√
Manual data fixes	√	√	Dev req'd
Expertise required	Low	Medium	High
Costs required	Low	Low-Medium	Med-High
Ensure Data Integrity	Some	√	√

What Is WQX today?



WQX is a 'standardized' approach for sharing water quality monitoring data of various types



WQX defines a common data model for communicating water quality data (sample data)



Designed to be automated

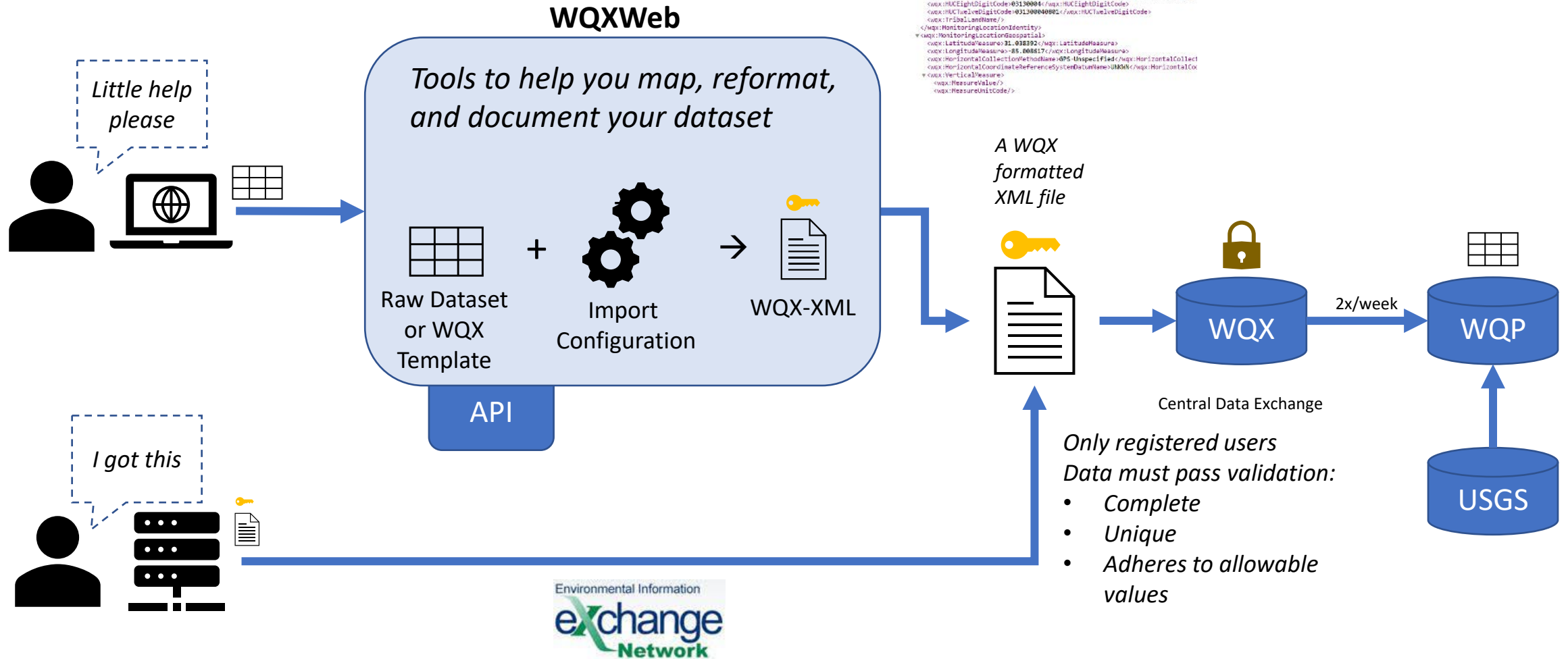


The structure of partner data systems don't matter, so long as they can map data to WQX standards



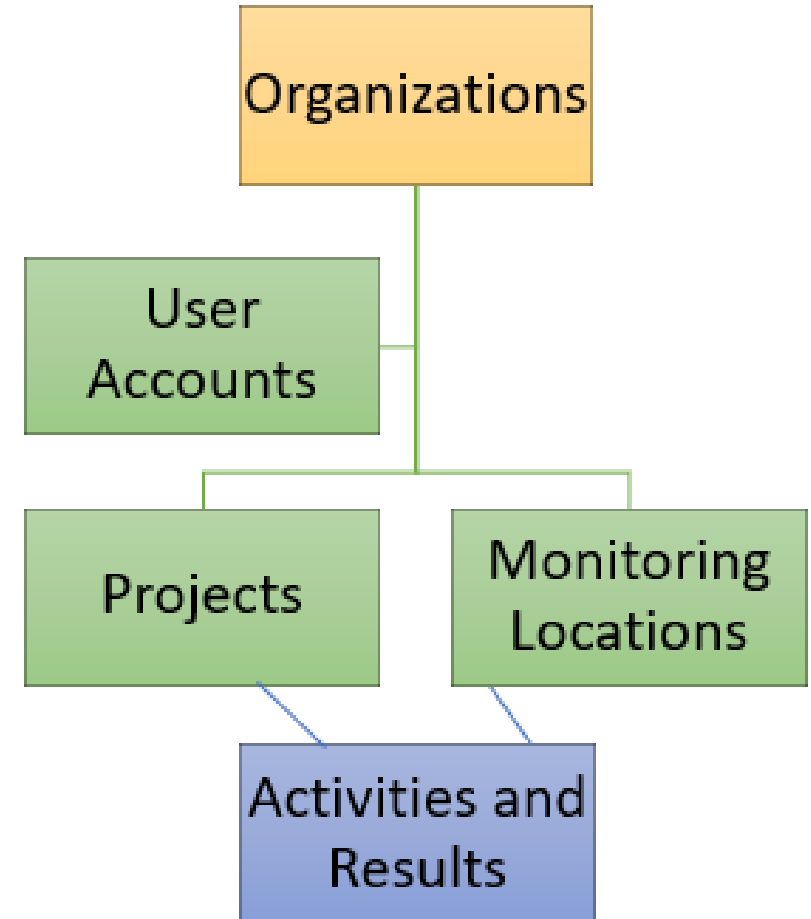
Many ways to prepare and submit data to WQX: including direct submissions, WQXWeb, and 3rd party apps

Ways to share your data to WQX



WQX hierarchy and terminology

- Organizations
 - All information is unique only to the organization
- User accounts
 - Multiple user accounts with different roles can be associated with an Organization
- Projects
 - Why you sampled
- Monitoring Locations
 - Where you sampled
- Activities and Results
 - Raw data referencing Orgs, Projects, & Monitoring Locations



WQX QAQC Service

WQX will provide a QAQC report upon your data upload

EXAMPLE QAQC REPORTS

The image shows two screenshots of Microsoft Excel spreadsheets. The top spreadsheet is titled 'QAQCResults.csv' and contains a table with columns for 'Activity', 'Station', 'Method', 'Parameter', 'Result', 'Unit', 'Status', 'Statistical', 'Analytical', and 'LastChang'. The bottom spreadsheet is titled 'QAQCLocations.csv' and contains a table with columns for 'Monitorin', 'Longitude', 'Latitude', 'Country', 'State', 'County', 'HUCEight', 'GEO_LATS', 'GEO_LON', 'GEO_COU', 'GEO_STA', 'GEO_COU', 'GEO_HUC', and 'GEO_REAC'.

Activity	Station	Method	Parameter	Result	Unit	Status	Statistical	Analytical	LastChang	Transacti
22010: 1/5/2022	Field Msr/	Water	KCP	Dissolved oxygen saturation	95.1	%	Final	8157	HACH	##### 4ef84a81
22010: 1/5/2022	Field Msr/	Water	KCP	Dissolved oxygen (DO)	6.15	mg/l	Final	8157	HACH	##### 4ef84a81
22010: 1/5/2022	Field Msr/	Water	KCP	pH	8.11	None	Final	8156	HACH	##### 4ef84a81
22010: 1/5/2022	Field Msr/	Water	KCP	Salinity	34.7	ppt	Final	8160	HACH	##### 4ef84a81
22010: 1/5/2022	Field Msr/	Water	KCP	Temperature, water	24.6	deg C	Final	2550	APHA	##### 4ef84a81
22010: 1/5/2022	Field Msr/	Water	KCP	Turbidity	4.85	NTU	Final	180.1	USEPA	##### 4ef84a81
22010: 1/5/2022	Sample-Rc	Water	KCP	Total Nitri: Filtered, fi as N	198.50	ug/l	Final	4500-N	APHA	##### 4ef84a81

Monitorin	Longitude	Latitude	Country	State	County	HUCEight	GEO_LATS	GEO_LON	GEO_COU	GEO_STA	GEO_COU	GEO_HUC	GEO_REAC
000152	Ala Moan: BEACH	21.29104	-157.855	#####	_5d4415b5-aed0-453a-9201-8eaab3b42bc	21.291	-157.855	UNITED	STHAWAII	200600001	2006000	2006000	
000159	Grays Bea BEACH	21.27719	-157.831	#####	_5d4415b5-aed0-453a-9201-8eaab3b42bc	21.277	-157.831	UNITED	STHAWAII	200600001	2006000	2006000	
000160	Tavern Be BEACH	21.27564	-157.826	#####	_5d4415b5-aed0-453a-9201-8eaab3b42bc	21.276	-157.826	UNITED	STHAWAII	200600001	2006000	2006000	
000169	Mokuleia : BEACH	21.58209	-158.193	#####	_5d4415b5-aed0-453a-9201-8eaab3b42bc	21.582	-158.193	UNITED	STHAWAII	200600001	2006000	2006000	
000171	Haleiwa B BEACH	21.59884	-158.104	#####	_5d4415b5-aed0-453a-9201-8eaab3b42bc	21.598	-158.104	UNITED	STHAWAII	200600001	2006000	2006000	
000172	Waimea B BEACH	21.63974	-158.064	#####	_5d4415b5-aed0-453a-9201-8eaab3b42bc	21.64	-158.064	UNITED	STHAWAII	200600001	2006000	2006000	
000173	Kawela Ba BEACH	21.69726	-158.009	#####	_5d4415b5-aed0-453a-9201-8eaab3b42bc	21.697	-158.009	UNITED	STHAWAII	200600001	2006000	2006000	

TADA [Home](#) [Reference](#) [Articles](#)

WQX QAQC Service User Guide

TADA Team
2023-09-15

Source: [vignettes/WQXValidationService.Rmd](#)

TADA Leverages the Water Quality eXchange (WQX) QAQC Service

This is an overview of the the WQX Quality Assurance and Quality Control (QAQC) data submission service, and how TADA leverages that service to flag potentially invalid data in the Water Quality Portal (WQP). It will cover: 1) an overview of all available WQX QAQC tests for data submissions, 2) which of these QAQC tests are also available in TADA for flagging potentially invalid WQP data, and 3) how to interpret and provide feedback on the validation reference tables referenced by WQX and TADA for this QAQC service.

Background

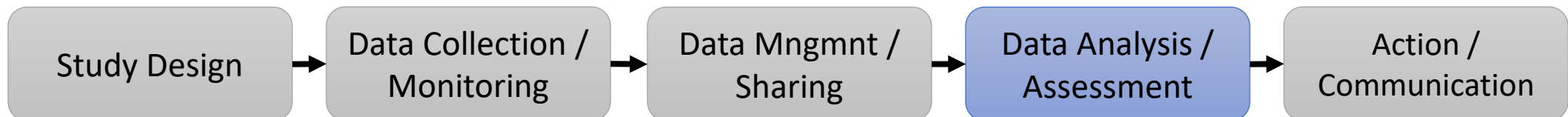
The WQX expectation for submissions is that users submit only QAQC'd data and utilize WQX elements to ensure the data is of "documented quality". The WQX team has historically hosted data quality working groups aimed at creating best practices and required data elements for WQX 3.0 for specific parameter groups such as nutrients, metals and biological data. These resources have supported users to submit data of documented quality. This approach has been

On this page

- TADA Leverage
- eXchange (WQ
- Background
- Available Tests
- Providing Feed
- Tables

Data Use – Analysis, Visualization, and Assessment

- What are the tools and resources available to help you analyze, visualize, and assess your data?
- Quick Intro to the Water Quality Portal
- Basics of Water Quality Assessment
- Intro to Tools for Automated Data Analysis (TADA)
- Intro to ATTAINS



Water Quality Portal (WQP)



Water quality monitoring data is foundational to being able to answer important questions

- Is my water safe?
- Is there enough?

Format is the same for everyone who wants to share data

- Water quality monitoring and data management is complicated
- Standardized, electronic data is more valuable than data in file cabinets (reusable, sharable, discoverable, interoperable, and includes important metadata)

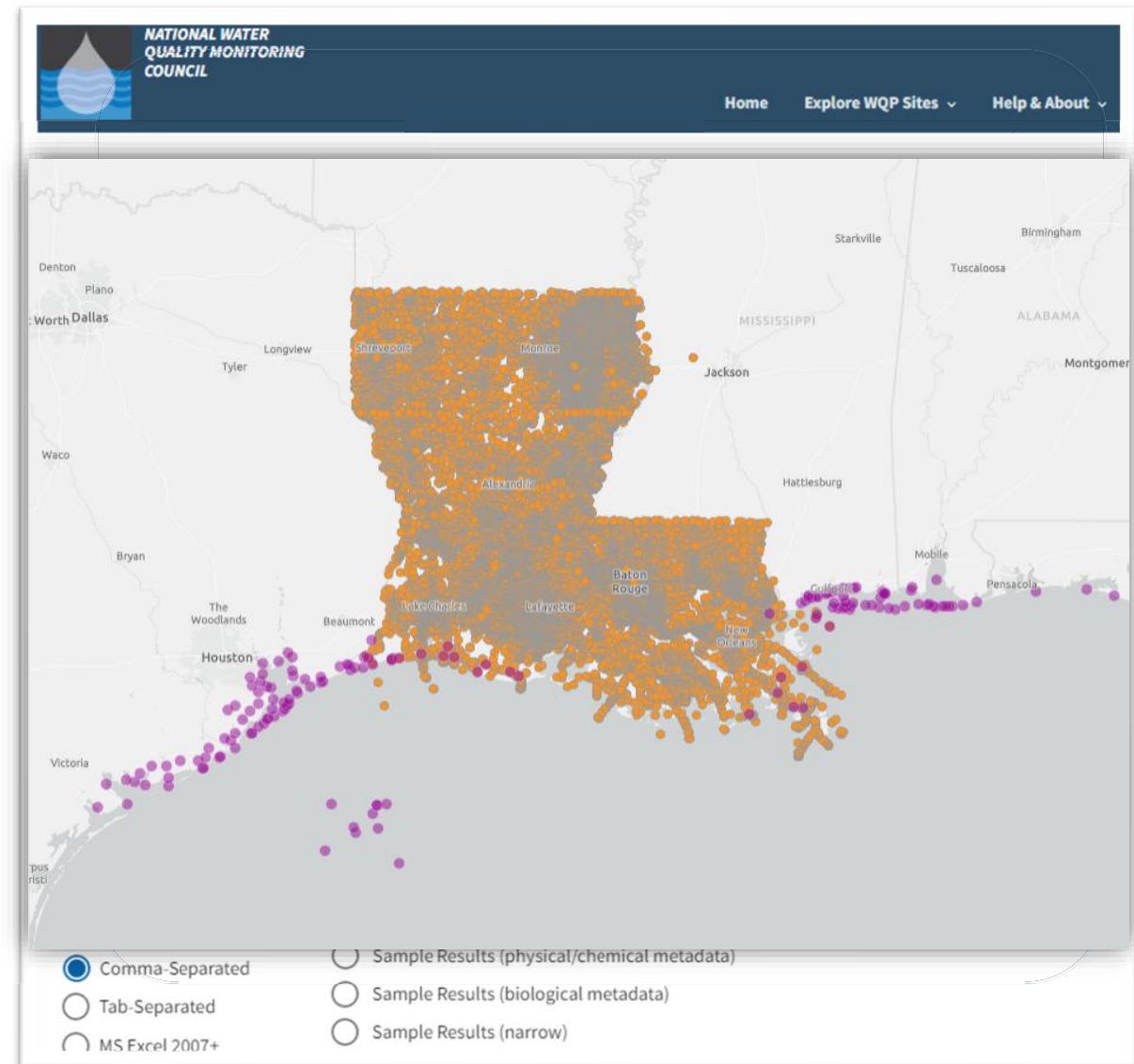
Usable data translates to knowledge, public awareness, and action

- Reuse adds value!
- Supports CWA assessments and other water quality research
- Serves as the backbone for water data tools like HMW

Water Quality Portal

Operated under An Interagency Cooperative agreement (USGS & EPA)

- Serves data from USGS, EPA, USDA, NPS in a standard WQX format
- # WQP: Data from >1,500 organizations
- # WQP: >420m records from >1m sites
- Serves data of All Water Types
- Includes a Graphical User Interface (GUI) & Web Services
- One of Our Integrated Systems (IOW HUB)
- DATA ServiceS can directly power analytics like those in HMW
- Growing Number of internal/external Tools built on top of this Primary data source



Retrieving data from the WQP

Several Options:

1. [WQP Web Interface](#)

- [WQP Demo on How to Download Data \(2015\)](#)
- [WQP Demo on How to Download Data \(2019\)](#)

2. [How's My Waterway](#)

3. TADA

How's My Waterway

The Water Quality Portal Website

The screenshot shows the 'Download Water Quality Data' page on the National Water Quality Monitoring Council website. It features a navigation bar with 'Home', 'Explore WQP Sites', and 'Help & About'. Below the navigation, there are 'Basic' and 'Advanced' tabs. The main heading is 'Download Water Quality Data'. A progress indicator shows '1 of 3 Location Parameters'. A text box explains: 'Specify location parameters to describe the spatial extent of the desired dataset. Additional options are available in the [Advanced Download](#). All fields are optional.' A 'Country' dropdown menu is set to 'All Countries'.

TADA

The screenshot shows the 'Option B: Query the Water Quality Portal (WQP)' interface. It includes a warning: 'Use the fields below to download a dataset directly from WQP. Fields with '(s)' in the label allow multiple selections. Hydrologic Units may be at any scale, from subwatershed to region. Howevr mindful that large queries may time out.' The form is divided into several sections: 'Date Range' with 'Start Date' (2023-09-20) and 'End Date' (2023-09-20) fields; 'Location Information' with 'State' (dropdown), 'County (pick state first)' (dropdown), and 'Hydrologic Unit' (text field with 'e.g. 020700100103'); 'Monitoring Location ID(s)' (text field with 'Start typing or use drop down menu'); and 'Metadata Filters' with 'Organization(s)', 'Project(s)', and 'Site Type(s)' text fields.

The screenshot shows the 'Download Data' interface with a date range selector from 1971 to 2023. Below the selector, there are checkboxes for 'Toggle All' and 'Expand All'. A table lists 'Characteristic Groups' and their corresponding 'Number of Measurements':

Characteristic Group	Number of Measurements
Biological, Algae, Phytoplankton	20
Biological, Fish	20
Information	348
Inorganics, Major, Metals	299
Inorganics, Major, Non-metals	812
Inorganics, Minor, Metals	1,021
Inorganics, Minor, Non-metals	250
Microbiological	108
Nutrient	989
Organics, Other	5,301
Organics, PCBs	235
Organics, Pesticide	2,102
Physical	3,223
Radiochemical	898
Sediment	120
Stable Isotopes	40
Total Measurements Selected:	15,788

At the bottom, there are links for 'Advanced Filtering' and 'Water Quality Portal User Guide', and a 'Download Selected Data' button.

Using Data from WQP Web Services

- Web services are URLs that provide the instructions from your query

Save the URL to your Query

URL of your data download

Use this web service URL in any data application that can read data, like MS Excel, R, Access, Arc Online, etc.

Query URL
Copy and share the URL of this query.

`https://www.waterqualitydata.us/#mimeType=csv&providers=NWIS&providers=STEWARDS&providers=STORET`

Station

`https://www.waterqualitydata.us/data/Station/search?
mimeType=csv&zip=yes&providers=NWIS&providers=STEWARDS&providers=STORET`

cURL

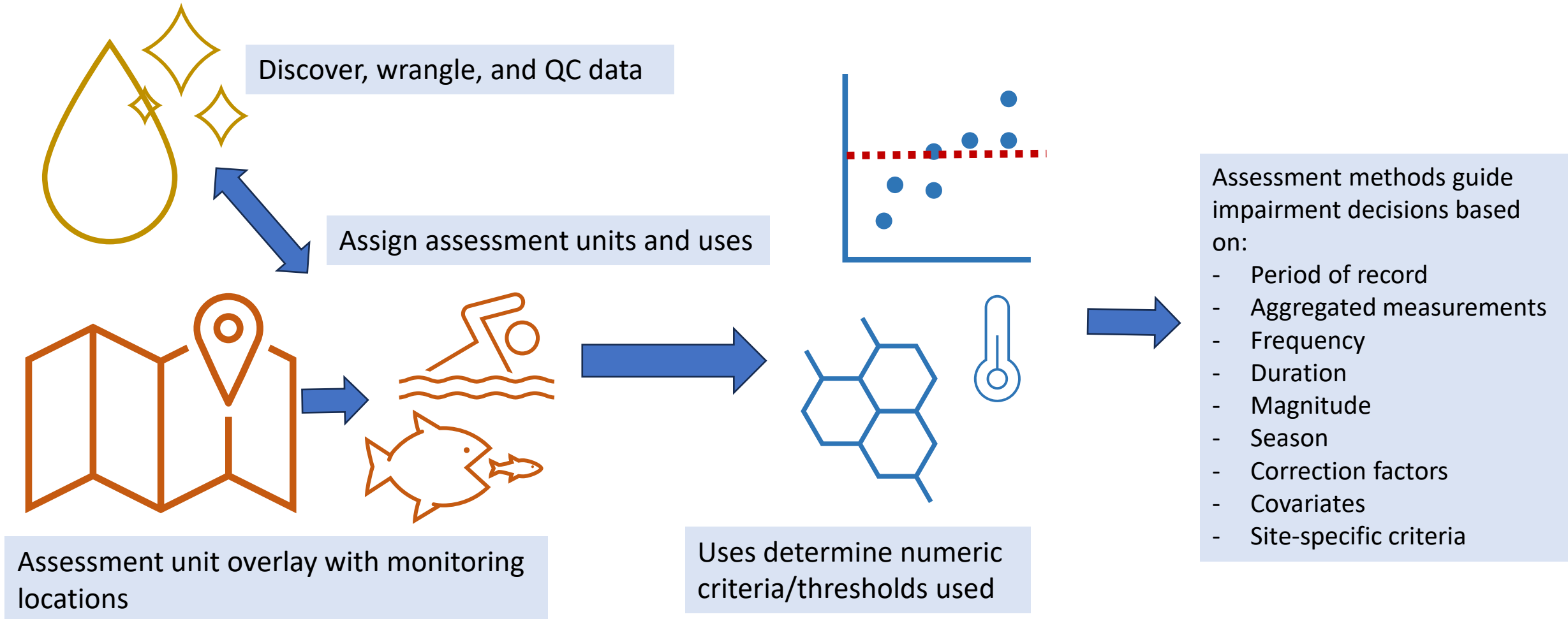
`curl -X POST --header 'Content-Type: application/json' --header 'Accept: application/zip' -d '{"providers":
["NWIS","STEWARDS","STORET"]}' 'https://www.waterqualitydata.us/data/Station/search?mimeType=csv&zip=yes'`

WFS GetFeature

`https://www.waterqualitydata.us/ogcservices/wfs/?
request=GetFeature&service=wfs&version=2.0.0&typeName=wqp_sites&SEARCHPARAMS=providers%3ANWIS%7CSTEWARDS%7C
STORET&outputFormat=application%2Fjson`

[Clear search](#) [Download](#)

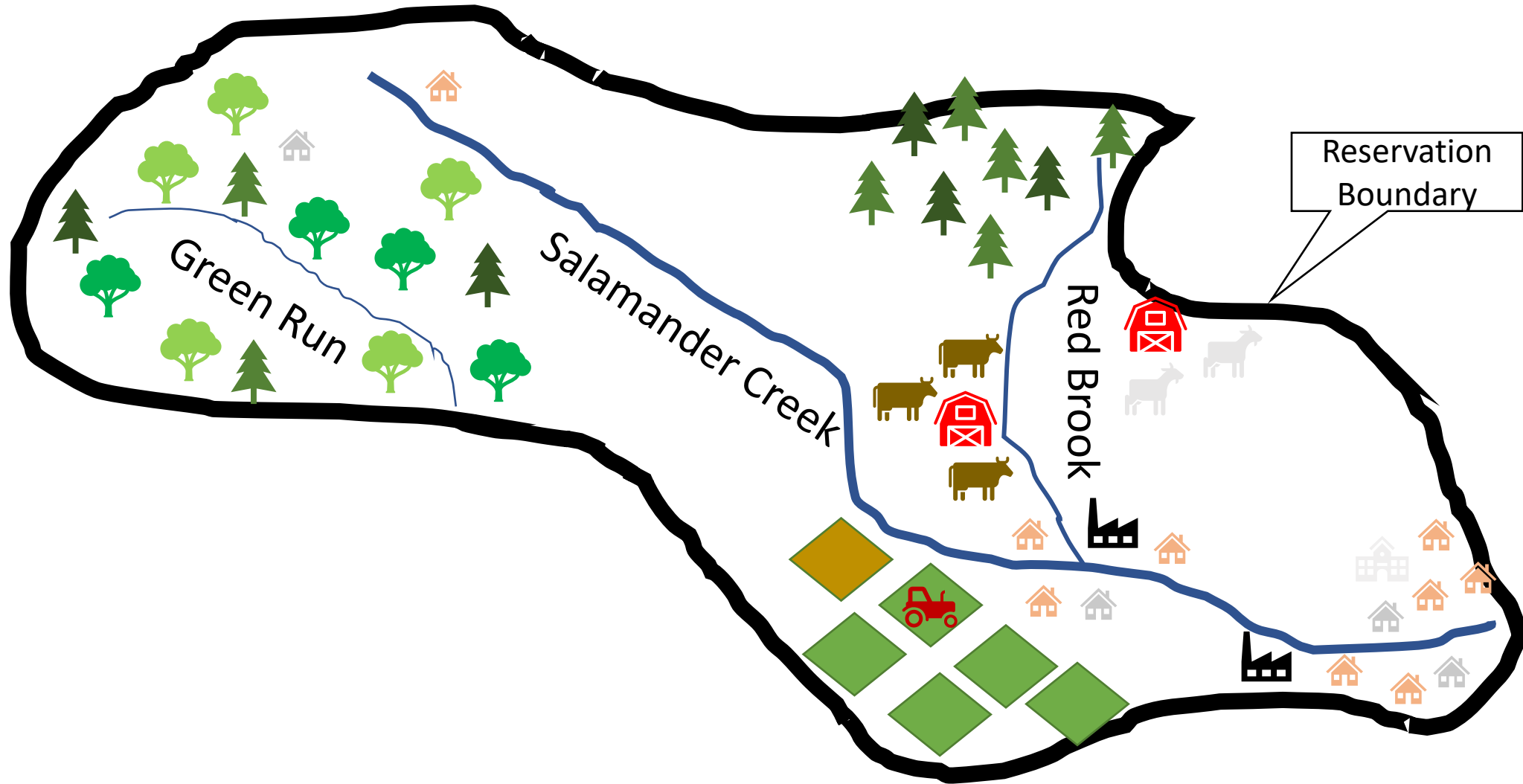
Basics of Water Quality Assessment



Document Your Process

- Define your Assessment Units
 - Points
 - Lines
 - Polygons
 - Combination of the Above
 - Which uses and parameters will be assessed for each water?
 - What criteria will be used to assess those parameters?
-
- What methods and decision rules will be applied?
 - Percentage (>10%)
 - Rate of recurrence (no more than once in 3 years)
 - Outside of a range ($x < y > z$)
 - Not to exceed (>x)
 - How many results are needed?

Determine How the Tribe Uses Tribal Waters



Salamander Creek: Numeric Criteria/Thresholds

Salamander Creek is designated for four uses that have the following numeric criteria:

Parameter	Unit	Type	Statistic	Exceedance	Aquatic Life Other Than Fish	Irrigation Water Supply	Public Drinking Water Source	Warmwater Habitat
Conductivity	uS/cm	Maximum	Instantaneous	10%	750	2,500	1,000	1,500
Dissolved oxygen	mg/L	Minimum	Instantaneous	None	5.0	--	--	5.0
Nitrate	mg/L	Maximum	Average*	None	1.5	100	10*	1.0
pH	SU	Range	Instantaneous	None	6.5<pH<9	--	--	6.5<pH<9
Total phosphorus	mg/L	Maximum	Average	None	0.1	--	--	0.3

** The nitrate criterion is instantaneous for the public drinking water source.*

Salamander Creek: Use Support Summary

Designated Use	Use Support	Probable Cause of Impairment
Aquatic Life Other Than Fish	Not	Conductivity and Total Phosphorus
Irrigation Water Supply	Full	--
Public Drinking Water Supply	Full	--
Warmwater Habitat	Not	Nitrate

EPA Criteria Search Tool

- Continuously updated (20-30 times a year) as EPA approves new or revised WQS
- Query by parameter or use
- Query within a tribe/state or across all

Search Criteria by State, Territory, or Authorized Tribe

Select the state, territory, or authorized tribe to generate the criteria table. Each criterion has a button that links to the source regulation to provide appropriate context.
Note: Selecting the button should open the regulation to the [PDF page](#). Otherwise, the source button indicates the appropriate page as indicated by the PDF file viewer.

Select a state, territory, authorized tribe, promulgated rule, or EPA recommended criteria.
 Pueblo of Tesuque (Region 6)

Show 10 entries

Parameter	Application	Criteria Magnitude
aluminum - CompTox	high quality coldwater fishery use (Aquatic Life • Acute)	750 µg/l
aluminum - CompTox	warm water fishery use (Aquatic Life • Acute)	750 µg/l
aluminum - CompTox	high quality coldwater fishery use (Aquatic Life • Chronic)	87 µg/l
aluminum - CompTox	warm water fishery use (Aquatic Life • Chronic)	87 µg/l
arsenic - CompTox	high quality coldwater fishery use (Aquatic Life • Acute)	340 µg/l
arsenic - CompTox	warm water fishery use (Aquatic Life • Acute)	340 µg/l
arsenic - CompTox	high quality coldwater fishery use (Aquatic Life • Chronic)	150 µg/l
arsenic - CompTox	warm water fishery use (Aquatic Life • Chronic)	150 µg/l

Select Water Quality Standards Information for a Specific State, Territory, or Tribe

Each state, territory, and authorized tribe has a page on this website containing information about their relevant WQS, including those in effect for CWA purposes. Other information may also be included (for example, contact information, federal promulgations, etc.). Select the state on the map or using the **Select state, territory, or authorized tribe** selector.



Select state, territory, or authorized tribe (*includes some tribes not yet authorized)
 -- select state, territory, or authorized tribe --

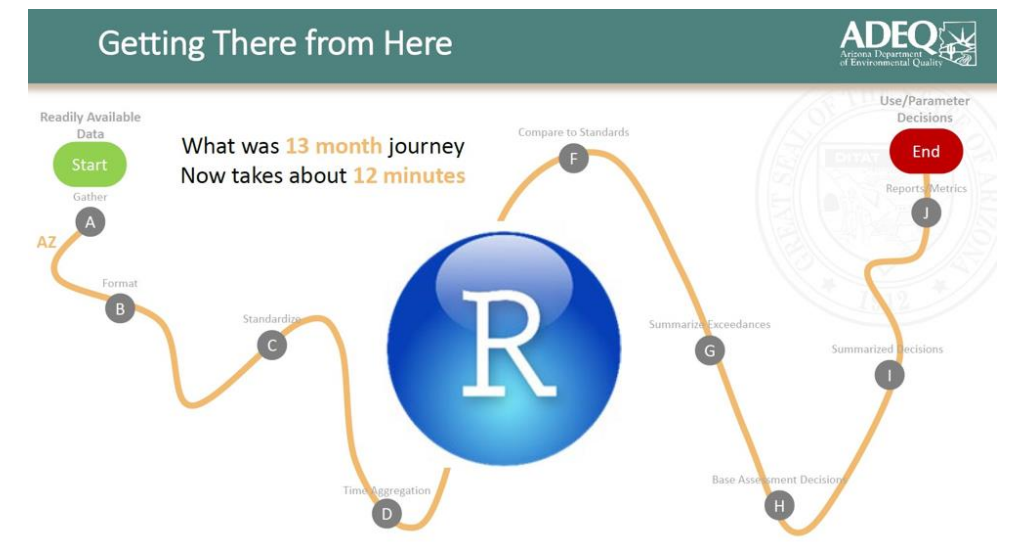
<https://www.epa.gov/wqs-tech/state-specific-water-quality-standards-effective-under-clean-water-act-cwa>

Performing analyses and assessments

- Open-source code (R or Python)
 - Can automate/streamline a wide variety of tasks and SAVE TIME
- Excel
- Any other software that works for you

Sac and Fox – ATTAINS Big 4 Excel Worksheet

Parameter	Monitoring Site	Longitude	Latitude	% for Determination ≥ 75% Required	# Samples Planned	# Samples Required	# Actual Sampled	Criteria Level (p21 OWQS) Chap 45 Numerical Criteria (MPN)	Geometric Mean (MPN)	Site Total Samples Exceeding	% Exceedance	Primary Body Contact/Recreation Beneficial Use Supporting Use < 10% Exceedance	Not Supporting Use > 10% Exceedance
Ecoli	Bellows Creek 001	35.631971	-96.893034	81%	18	13.5	15	406	126	9	40%	0%	40%
Ecoli	Deep Fork River	35.663321	-96.679904	96%	24	18	23	406	126	1	4%	4%	40%
Ecoli	Deep Fork River 002	35.642321	-96.822198	94%	18	13.5	17	406	126	0	0%	0%	40%
Ecoli	Deep Fork River 003	35.640511	-96.910903	94%	18	13.5	17	406	126	2	12%	0%	12%
Ecoli	Dry Creek 001	35.683963	-96.698034	78%	18	13.5	14	406	126	6	43%	0%	43%
Ecoli	Quappaw Creek 001	35.621020	-96.822178	78%	18	13.5	14	406	126	2	14%	0%	14%
Ecoli	Robinson Creek 001 *	35.608344	-96.733529	50%	18	13.5	9	406	126	6	67%	0%	67%
Ecoli	Veteran's Lake **	35.677712	-96.658111	96%	24	18	23	406	126	0	0%	0%	0%
Ecoli	Veteran's Lake 003 **	35.677534	-96.657402										
Ecoli	Veteran's Lake 004 **	35.677172	-96.658192										
Ecoli	Veteran's Lake 005 **	35.677518	-96.657291										
*	Robinson Creek 001												



TADA (Tools for Automated Data Analysis)



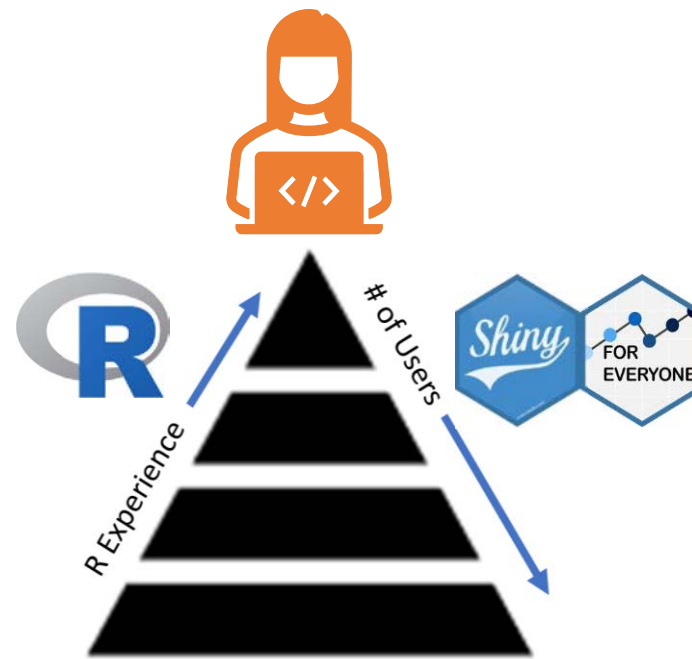
WQ Assessment



TADA Products

- Different tools for different users
 - [R Package](#) (coders)
 - [R Shiny Application](#) (non-coders)
- [User Guide](#) on GitHub Pages
- [EPA TADA Website](#)
- [R and R Shiny Learning Resources](#)
- Inventory of open-source R code and WQP tools
- Reach out to learn more!

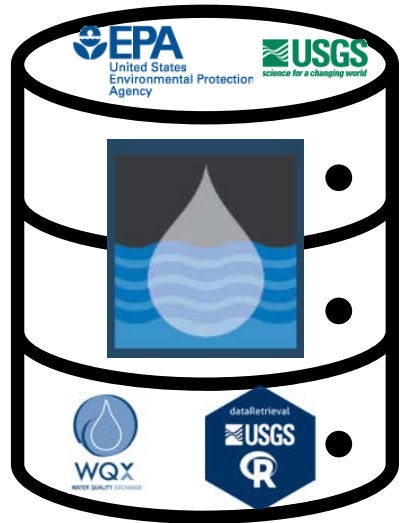
“Serve as a hub for an open-source water quality community”



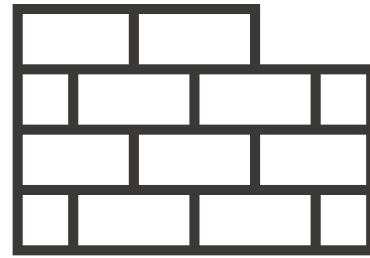
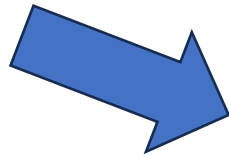
Working Group Mission
*To share and develop **R code** for evaluating and visualizing **WQP** data more efficiently through collaboration and open-source programming. This includes working together to find commonalities in assessment processes across the nation, creating flexible tools that can be easily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

TADA Module 1

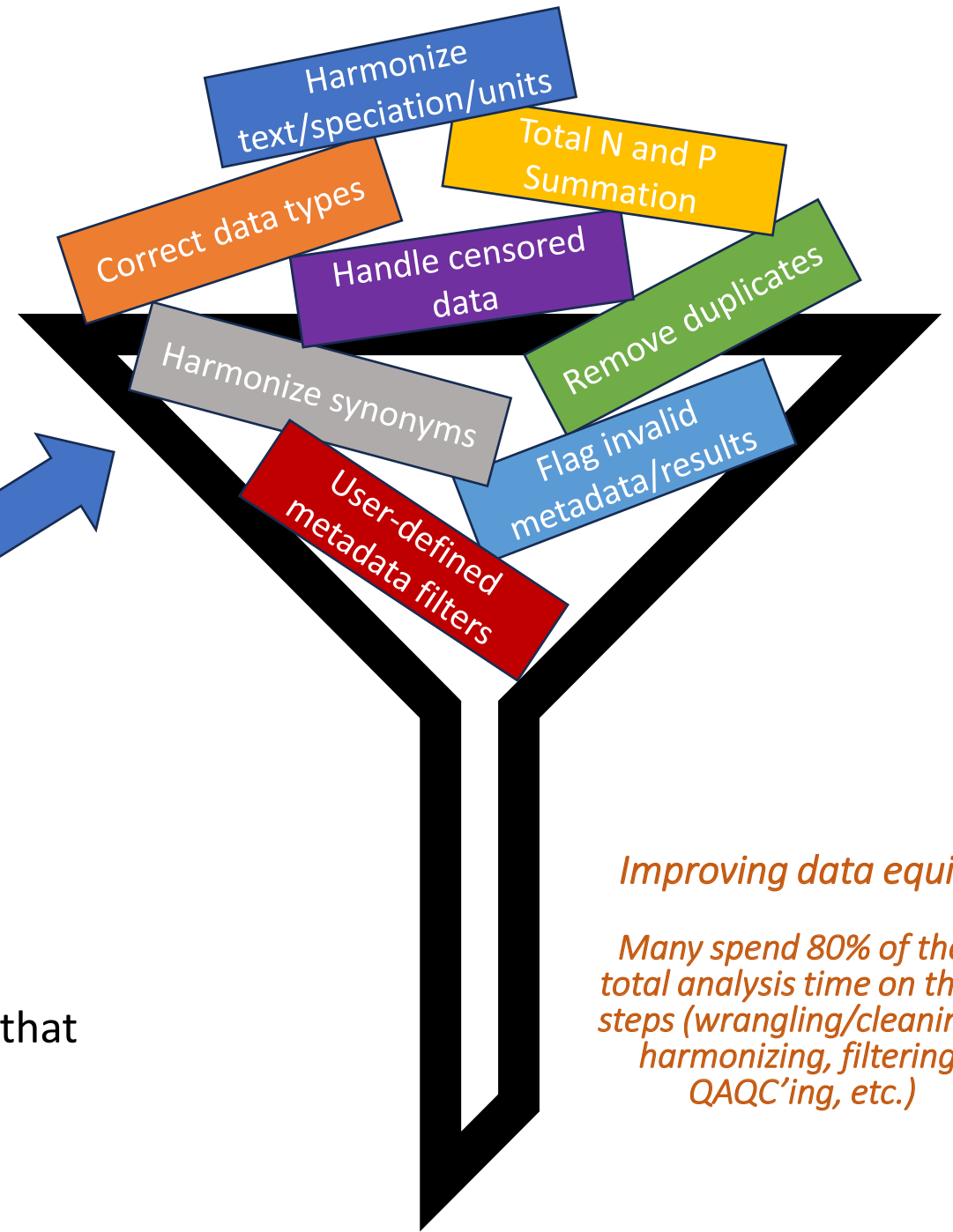
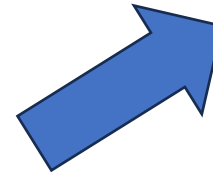
Retrieval & Data Quality Considerations



Retrieve data from WQP



Construct a unified dataset containing key metadata

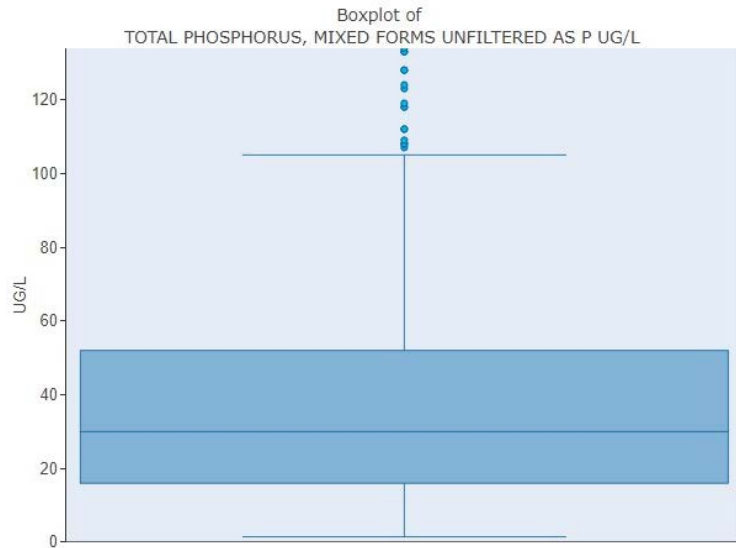
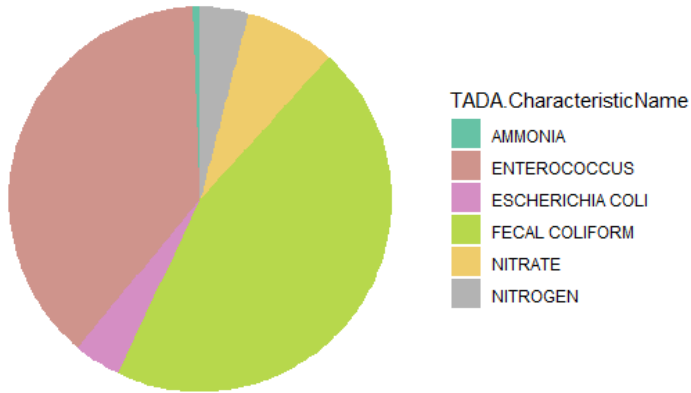


- Is the data of sufficient quality for my analysis?
- Is it relevant?
- Does it include key metadata?
- Can the data be harmonized and grouped in a way that makes sense for my analysis?
- Decision points to accept, reject, or qualify data

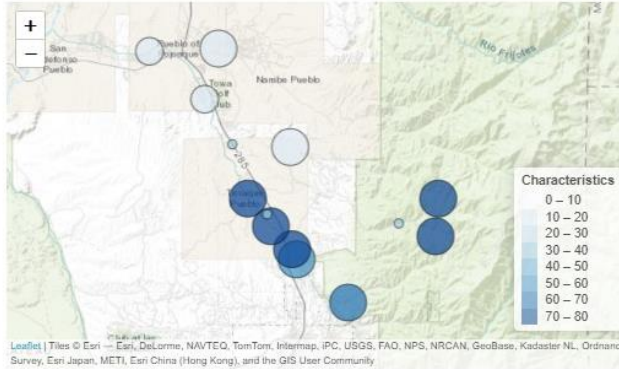
Improving data equity

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

TADA Visualizations



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

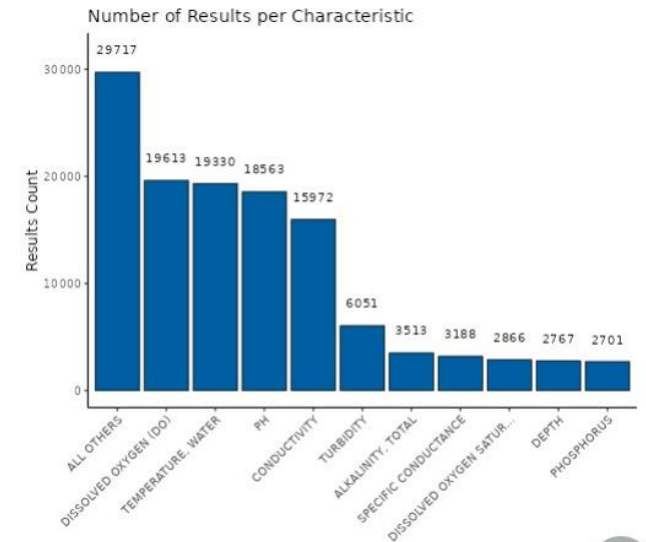
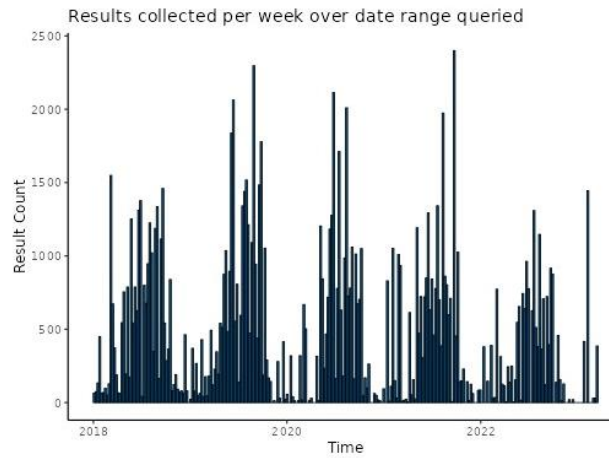


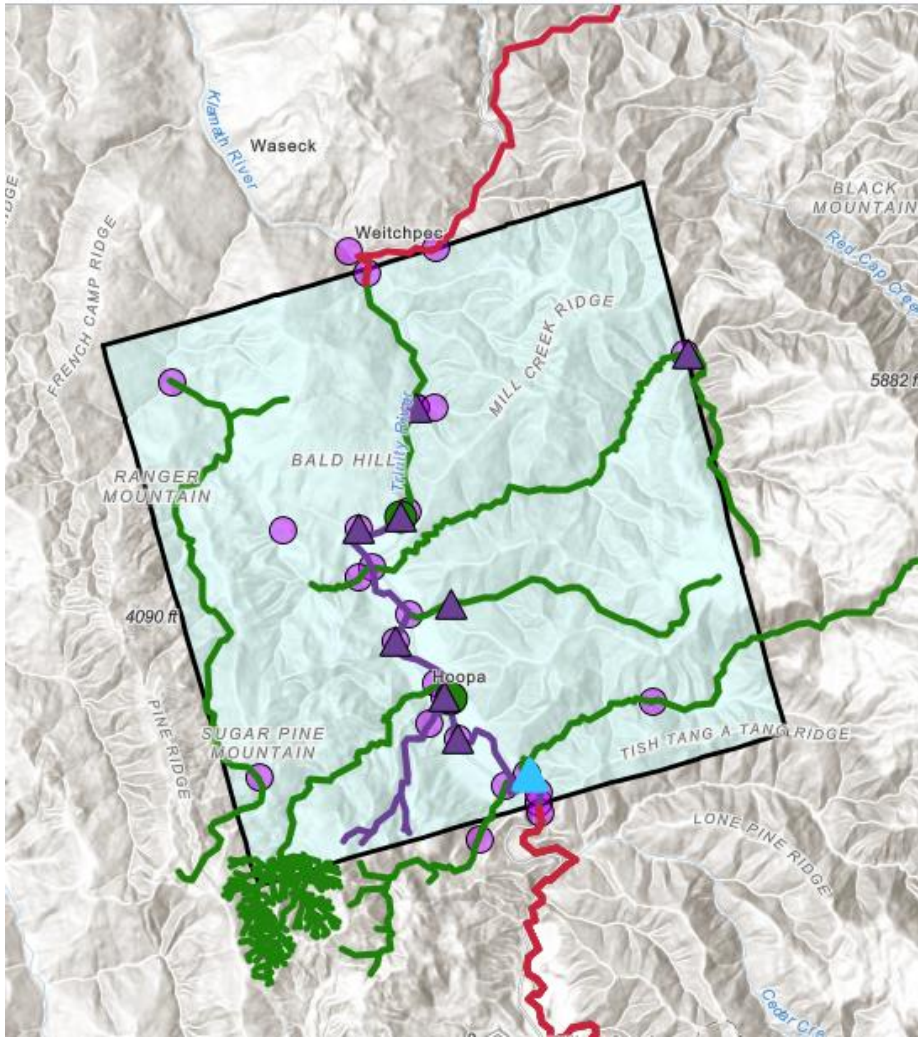
Show **10** entries

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



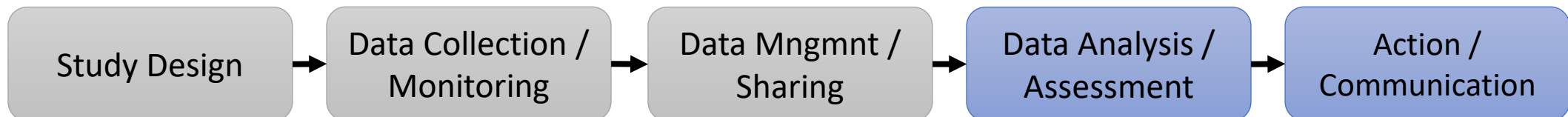


Data Analysis & Assessment Take-Aways

- Identify and evaluate all available data
- Document your assessment process
 - Monitoring locations
 - Assessment units and uses
 - Criteria or thresholds
 - Methodologies & decision rules
- Perform assessment
 - Review for quality through QAPP review and data screening (TADA can help with data screening)
 - Use any programs/tools that you are comfortable with

Assessment Reporting

- Reporting is done through 106 TARs/WQARs
- Some tribes have opted into submitting their TARs/WQARs through ATTAINS
- The Assessment and TMDL Tracking and Implementation System (ATTAINS) is EPA's system for storing water quality assessment data including:
 - State 303(d)/305(b) assessments and listings
 - Tribal 106 assessments
- ATTAINS data is shared with the public through How's My Waterway



Reporting: ATTAINS Tribal Pilot

- 2016-ATTAINS Tribal Pilot started
- October 2017-ATTAINS training for pilot tribes
- December 31, 2017-First ATTAINS submissions due from 13 pilot tribes
- Pilot tribes have continued to submit through ATTAINS

Objectives

- Test whether ATTAINS can serve as an alternate reporting mechanism for tribal water quality assessment reporting
- Capture programs as they exist, can be used regardless of whether tribe has WQS or TAS for 303(d)
- Understand the water quality on tribal lands



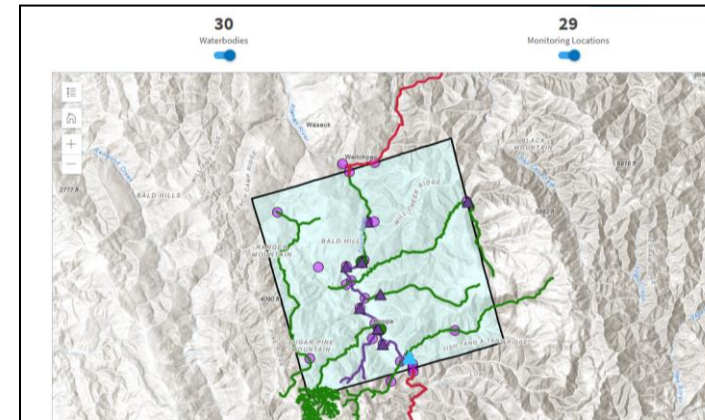
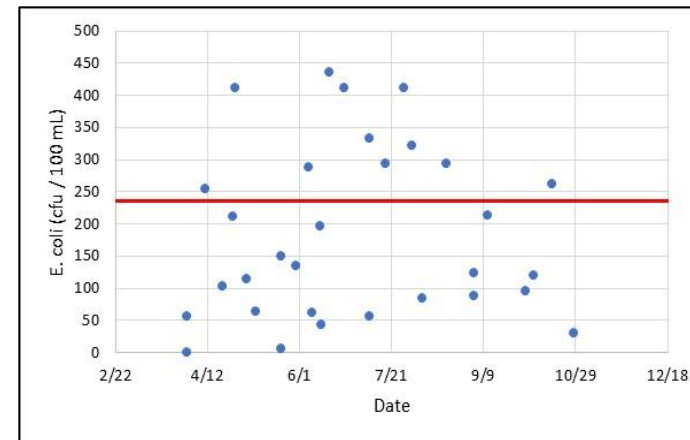
Why use ATTAINS?

1. WE USE IT!!!! Availability increases utility
2. Eliminates paper reporting
3. Reduces reporting time and burden
4. Aligns tribal and state assessment reporting
5. Prepares tribes interested in CWA 303(d) authority to make and report listing decisions



Where We Are Now

- 20 pilot and phase 1 tribes currently have data in ATTAINS
- Phase 2 tribes start reporting at the end of 2024
- ATTAINS is an accepted reporting mechanism in upcoming revised 106 guidance
- Created assessment trainings, parameter factsheets, & assessment methodologies
- Tribal data is How's My Waterway!



FACTSHEET ON WATER QUALITY PARAMETERS

Dissolved Oxygen

Dissolved oxygen (DO) is the amount of oxygen in water that is available to aquatic organisms. DO is necessary to support fish spawning, growth, and activity.

Why do we measure dissolved oxygen?

DO is an important indicator of the overall biological health of a waterbody and is required for a waterbody to support aquatic life. It is generally measured in the field along with water temperature, turbidity (clarity), specific conductance, and pH. This information is then assessed against water quality standards to determine whether the water is fit for aquatic life.

while other species such as aquatic worms and snails can tolerate lower DO concentrations. Hypoxic (low DO concentration) or anoxic (virtually no DO) conditions do not support fish or macroinvertebrate populations.

Figure 1 is a generalized illustration of how DO affects fish health – sensitivities vary by species. In the range labeled as “too low”, DO is too low to support fish. In the “stressful” range, DO conditions impede spawning and reproduction, and limit growth and activity. A higher DO is needed to be “supportive” of fish spawning, growth, and activity. Different levels of DO are required to support aquatic life depending on the species present and their stages of life (spawning, larvae, etc.). Trout, for example, require higher DO while carp can survive in lower DO conditions. Among the macroinvertebrates, many immature insects require a high DO content.

RANGE OF TOLERANCE FOR DISSOLVED OXYGEN IN FISH

mg/L Dissolved Oxygen

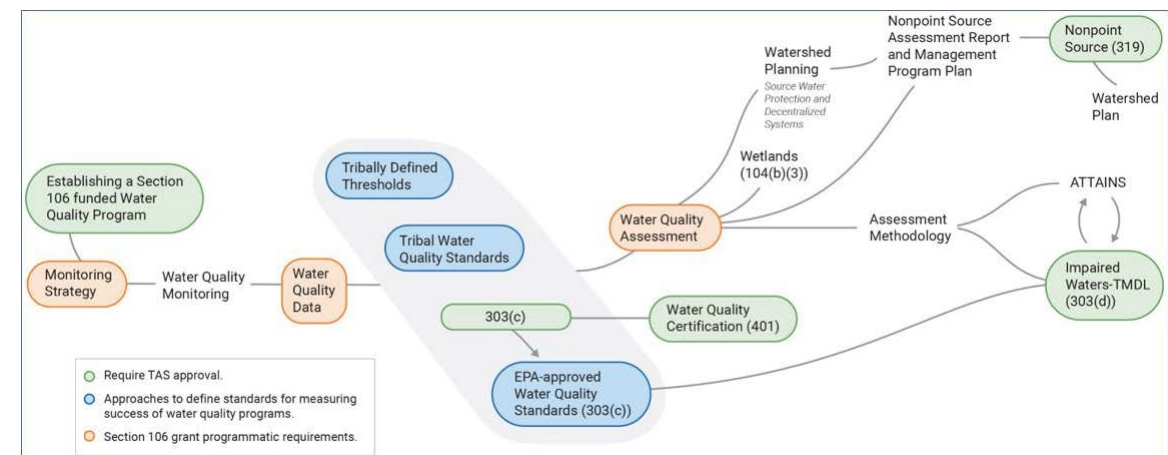
mg/L Dissolved Oxygen	Health Status
0 - 1.0	Too Low
1.0 - 3.0	Stressful
3.0 - 6.0	Supportive
6.0 - 8.0	Supportive
8.0 - 10.0	Supportive
10.0 - 12.0	Supportive

Figure 1. General freshwater fish tolerance for dissolved oxygen concentrations – tolerances vary by species.

What affects dissolved oxygen?

The primary sources of oxygen in surface waters are transfer of oxygen from the air and by plants and algae in the water due to photosynthesis. When the water is in equilibrium with the atmosphere and is holding as much DO as expected for the temperature, barometric pressure, and salinity conditions, it is said to be saturated. Aeration or photosynthesis can cause DO concentrations to become even higher and exceed saturation (the water becomes supersaturated).

For factsheets on other water quality parameters, visit: <https://www.cwa.gov/tribes/water-quality-parameters>
For more information about the CWA Section 106 Grants Program, visit: <https://www.epa.gov/cwa/section-106-grants-program>



What is How's My Waterway

- EPA's tool to provide the general public with information about the condition of their local waters
- Brings data in from a number of data systems including WQP and ATTAINS
- Displays information on 3 scales: Community (HUC12), State/Tribe, and National

The screenshot shows the EPA's 'How's My Waterway' website. At the top, the EPA logo and 'United States Environmental Protection Agency' are visible. Below the logo, there are navigation links for 'Environmental Topics', 'Laws & Regulations', and 'About EPA'. A search bar for 'Search EPA.gov' is located on the right. Further down, there are links for 'Glossary', 'Data', 'About', 'Educators', and 'Contact Us'. The main heading is 'How's My Waterway?' with the subtitle 'Informing the conversation about your waters.' Below this, there is a section titled 'Let's get started!' with a search input field labeled 'Search by address, zip code, or place...' and buttons for '>> Go' and 'Use My Location'. Underneath, there is a section 'Choose a place to learn about your waters:' with three buttons: 'Community', 'State & Tribal', and 'National'. Below that, there is a section 'Explore Topics:' with four blue buttons: 'Swimming' (with a swimmer icon), 'Eating Fish' (with a fork and fish icon), 'Aquatic Life' (with a fish icon), and 'Drinking Water' (with a glass icon). A 'DISCLAIMER' link is visible at the bottom left.

Tribal Data in How's My Waterway

- Tribal monitoring data has been in the Community page since the beginning
- Tribal assessment data was added to Community page in December 2020
- A cultural use group was added in April 2022
- Displays tribal and state data side-by-side
- Tribal pages launched December 2022

The screenshot displays the 'How's My Waterway' web application interface. At the top, there are tabs for 'State' and 'National'. Below these, there are search options: 'Go' and 'Use My Location'. The main map area shows a watershed boundary with several waterbodies and monitoring locations. A legend indicates that green circles represent 'Good' waterbody conditions and red circles represent 'Impaired' conditions. The sidebar on the right provides an 'Overview' of the 'Fond du Lac State Forest' watershed, identified by the watershed ID 'Perch Lake (040102011201)'. It includes a navigation menu with options like 'Overview', 'Swimming', 'Eating Fish', and 'Aqua'. Below the navigation, there is a section titled 'Your Waters: What We Know' which explains that water quality is monitored against EPA standards. It also displays statistics: 14 Waterbodies and 40 Monitoring Locations. A 'Waterbody Conditions' legend shows 14 Good and 40 Impaired waterbodies. At the bottom, a list of waterbodies is shown, including Annamahasing Creek (State Waterbody ID: MN04010201-A66), Bang (Long) Lake (Tribal Waterbody ID: FDL_101), and Corona (State Waterbody ID: MN09-0048-00).

Thank you!

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Wednesday Deeper Dives

Monitoring

Data Management & WQX

WQP & TADA

Assessment, ATTAINS, HMW