

Data Management for your Water Quality Program

National Tribal Water Quality Conference
November 15, 2011

Agenda

- Data Management Considerations
 - Importance
 - Components
 - Approaches
- EPA National Monitoring Program Priorities
 - Data submission and data sharing
 - Water Quality Exchange and STORET

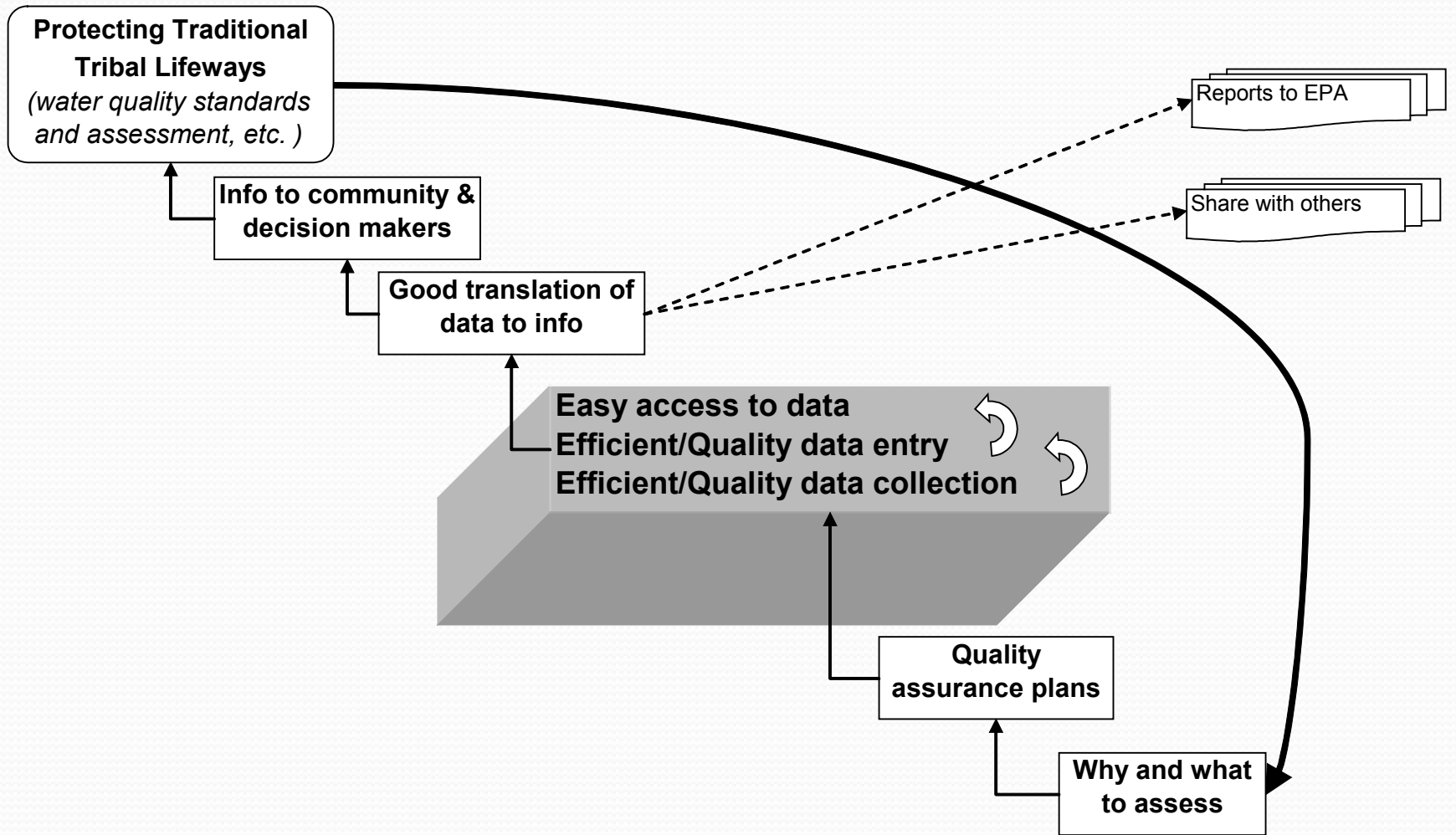
Data Management

- The process of organizing, storing, retrieving and maintaining the data you collect
- Having a data storage, management, and retrieval system is essential for every monitoring program

Importance

- An important link between effective monitoring efforts and informed data analysis for assessing water quality is DATA MANAGEMENT
- An important link between doing water quality restoration activities and determining their effectiveness is monitoring and more DATA MANAGEMENT

The Bigger Picture



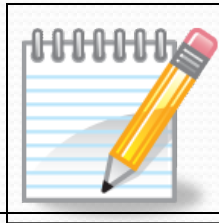
10 Elements of a Tribal Monitoring Strategy

- I. Monitoring Strategy
- II. Monitoring Objectives
- III. Monitoring Design
- IV. Core Indicators
- V. Quality Assurance
- VI. **Data Management**
- VII. Data Analysis/Assessment
- VIII. Reporting
- IX. Programmatic Evaluation
- X. General Support and Infrastructure

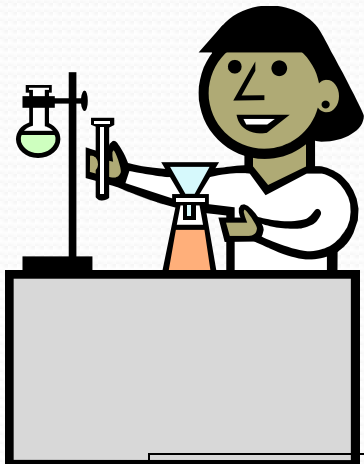
Data Management in Context



The life of a sample begins here



Field Sheets capture data



Labs generate data



Now what to do with all this data?

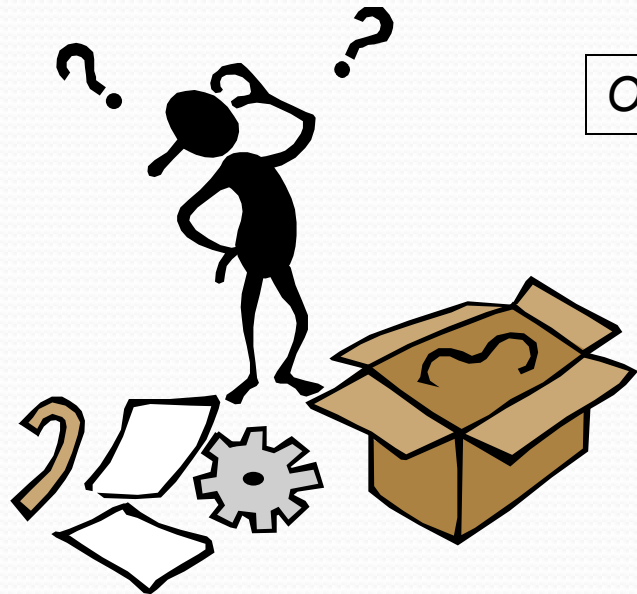
Essentials of data content

- What data do you have?
- Water Monitoring data consists of:
 - Where sample/measurement was collected
 - When it was collected
 - What was collected
 - How it was collected
 - Why it was collected
 - Who collected it
- It does not take a lot of information to create a good data set.

Some good questions to ask

- What do you want to do with the data?
 - Share it with others? Let multiple staff members access and change it?
 - Perform QA/QC?
 - Evaluate and assess for water quality condition?
 - Help prioritize your monitoring efforts?
- What kinds of reports do you need?
 - Graphs? Bar Charts? Trends?
- What resources do you have to manage your data?
 - Set up costs and maintenance costs

First, make sense of what you have



Organize data electronically

Use the tools you're familiar with:

- Access
- Excel
- Other higher-powered database management system (i.e. Oracle)

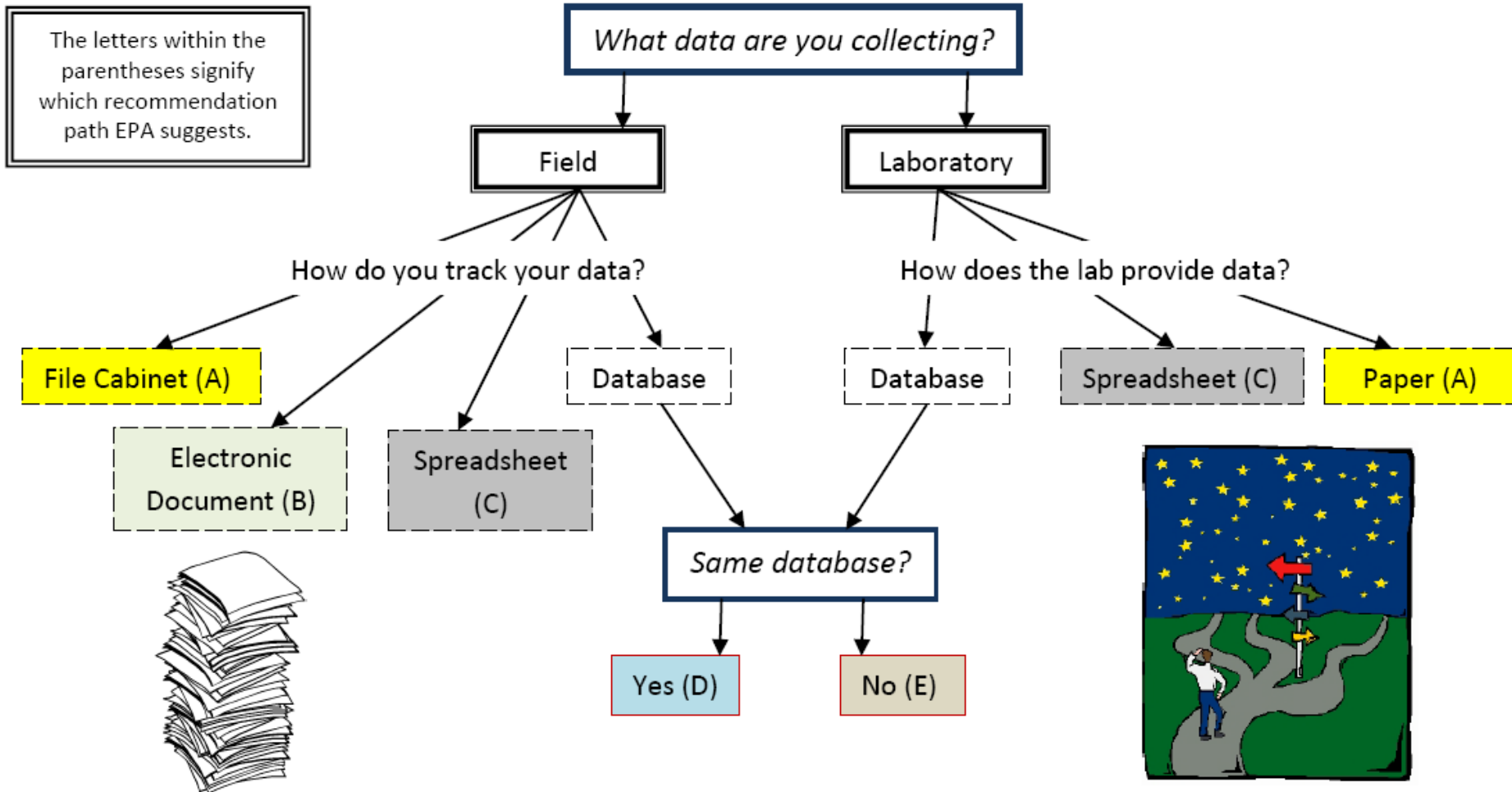
Have a plan for growth

Not only will your skill grow, but your data volume will grow. Be prepared for it.

Find out what's already available

Courtesy of: <http://epa.gov/region9/water/tribal/cwa-reporting.html>

Roadmap to Data Management



MS Excel

- Spreadsheet software that tracks data in columns and rows
- You can filter data, perform calculations on data, and show graphs
- Excel can enforce valid values or formats for data entry
- Many labs can share data in an Excel format
- Example of standard template: WQX Web Template
 - http://www.epa.gov/storet/wqx/wqxweb_downloads.html

Physical-chem Template.xls [Compatibility Mode] - Microsoft Excel

	O	P	Q	R	S	T	R
	<u>Characteristic Name</u>	<u>Method Speciation</u>	<u>Result Detection Condition</u>	<u>Result Value</u>	<u>Result Unit</u>	<u>Result Sample Fraction</u>	
1							
2	Dissolved oxygen (DO)			6.6	mg/l		Fit
3	Total dissolved solids			0.319	mg/l	Dissolved	Fit
4	pH			8.57	None		Fit
5	Salinity			0.24	mg/l		Fit
6	Temperature, water			70.16	deg F		Fit
7	Turbidity			35	NTU		Fit
8	Dissolved oxygen (DO)			8.52	mg/l		Fit
9	Total dissolved solids			0.313	mg/l	Dissolved	Fit
10	pH			8.95	None		Fit
11	Salinity			0.23	mg/l		Fit
12	Temperature, water			61.25	deg F		Fit
13	Dissolved oxygen (DO)			7.16	mg/l		Fit
14	Total dissolved solids			0.367	mg/l	Dissolved	Fit
15	pH			8.55	None		Fit
16	Salinity			0.27	mg/l		Fit
17	Temperature, water			49.46	deg F		Fit
18	Turbidity			43	NTU		Fit
19	Ammonia-nitrogen			0.9022	mg/l	Dissolved	Fit
20	Nitrate			7.2	mg/l	Dissolved	Fit
21	Nitrite			4.46	mg/l	Dissolved	Fit
22	Nitrogen-15			11.3	mg/l	Total	Fit
23	Ammonia-nitrogen			0.8022	mg/l	Dissolved	Fit
24	Nitrate			6.2	mg/l	Dissolved	Fit
25	Nitrite			Present Below Quantification Limit		Dissolved	Fit

Ready | 150%

MS Access

- A type of Relational Database Management System
- Data is stored in tables that can be related to each other via common IDs
- Data can be manipulated via Queries
- Data can be entered via Forms and retrieved via Reports

- Example of Access based data management system: NPSTORET (a National Park Service product)
 - <http://www.epa.gov/storet/otherapps.html>

NPSTORET Station Template

National Park Service
U.S. Department of the Interior

Water Resources Division
Fort Collins, CO



EXPERIENCE
YOUR
AMERICA

StationID: KIMO_3C3C for: Cumberland Piedmont Network

Sort by: Date of Last Edit **NPSTORET Station Entry Template** Jump to Station ID:

Main | Additional Info ... | Pictures

Station ID: KIMO_SC3C Name: Stonehouse Creek

Primary Type: River/Stream Est. Date: 12/17/2002 ...

Latitude: 35 8 33.8500 Longitude: 81 24 47.3002 Geo. Method: GPS Code (Pseudo Range) Differential
 - OR - North - OR - West Geo. Datum: North American Datum 1983

Decimal Degrees: 35.14273611 Latitude Decimal Degrees: 81.41313893 Longitude Map Scale:

Elevation: 205 Units: m Method: GPS Code (Pseudo Range) Differential Datum: Other

County: CHEROKEE State: SC HUC: 03050105 NRCS ID: NHD:

Water Depth: 0.15 Units: m

Station Description: This stream is recharged entirely by park lands and can be sampled at a culvert bridge 200 m upstream from its confluence with Kings Creek. Access is gained via a park road to the Stonehouse, which leads to the floodplain of Kings Creek. Access is easy and safe in all conditions 281

Travel Directions: From RRC site, return on Rockhouse Rd (SE) 400m then turn sharply right (SW) onto fire road, entering park and passing locked gate. Follow fire road 670m through a 90 degree turn to right (NW) then turn left (SW) onto another fire road and drive 150m to bridge over Stonehouse Creek, the site. 294

Station: 2 of 82 (Filtered) Add New Station Delete Station Close Station Import Station Export to SIM Sync Lat/Lon

Other Relational Databases

- Examples:
 - Oracle
 - SQL Server
- Data storage and retrieval is much more robust
- Can build custom applications to interact with the data
- Requires Database Administrator (DBA) and possibly hardware infrastructure

Data are valuable, plan for re-use



Electronic data are more valuable than data in file cabinets

The more data are re-used, the more valuable they become

Shared data are of even higher value

- Provide for better planning decisions
- Incentivize collaborative efforts
- Make the most use of the monitoring \$\$s being invested

EPA's National Monitoring Priorities

- Reporting on water quality conditions at national, state, and watershed levels
 - Through partnering with states, tribes, and other federal agencies
 - WQX and the STORET Data Warehouse
 - National Aquatic Resources Surveys
 - National Water Quality Monitoring Council
- Implementation of the state and tribal monitoring strategies
- Tracking program performance over time

Monitoring & Assessment

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Monitoring and Assessing Water Quality

Our nation's waters are monitored by state, federal, and local agencies, universities, dischargers, and volunteers. Water quality data are used to characterize waters, identify trends over time, identify emerging problems, determine whether pollution control programs are working, help direct pollution control efforts to where they are most needed, and respond to emergencies such as floods and spills.



- [National Aquatic Resource Surveys \(Statistical Surveys of the Quality of U.S. Waters\)](#)
- [Water Quality Conditions Report by the States \(ATTAINS database\)](#)
- [National Water Quality Inventory Reports \(Section 305\(b\) reports\)](#)
- [Storing and Managing Water Quality Data \(EPA's STORET/WQX System\)](#)
- [Mapping and Displaying Water Quality Information \(EPA's WATERS Website\)](#)
- [Monitoring, Assessment and Reporting Guidelines \(for States\)](#)
- [Assessing the Biological Condition of Waters](#)
- [Volunteer Water Monitoring \(Resources for Citizen Volunteer Monitoring Programs\)](#)
- [Outreach and Educational Materials/World Water Monitoring Day](#)

Features

- [National Lakes Assessment Report](#)
- [Seventh National Monitoring Conference, April 25-29, 2010](#)
- [Proceedings of the Sixth National Monitoring Conference, 2008](#)
- [National Aquatic Resource Surveys](#)
- [Submitting and Sharing Water Quality Data](#)
- [Electronic Integrated Reporting under Sections 305\(b\)/303\(d\) \(ATTAINS\)](#)
- [2004 Water Quality Report to Congress](#)
- [Volunteer Monitor, Volume 21, Number 1, Spring 2010. \(PDF\) \(20 pp, 1.8MB, About PDF\)](#)

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Enter your 5-digit ZIP code:

Implementation through 106



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Final CWA Section 106 Tribal Grant Guidance

Promoting Environmental Results

A final *Guidance on Awards of Grants to Indian Tribes under Section 106 of the Clean Water Act* is intended to help Tribal water quality program managers, staff, and other Tribal environmental decision makers design and implement effective and successful water quality programs. It also establishes procedures and guidelines for EPA Regions to consider when awarding and administering grants to federally recognized Tribes.

The final Guidance is designed to help Tribal water quality programs at various levels of sophistication and development. For new programs, it explains how to successfully initiate and develop a water quality program. For Tribes with well-established programs, it contains information on expanding a water quality program. To meet the needs of Tribes at all levels, the Guidance presents the basic steps a Tribe would take to collect the information it will need to make effective decisions about its program, its goals, and its future direction.

- [Final Guidance on Awards of Grants to Indian Tribes under Section 106 of the Clean Water Act \(PDF\)](#) (158pp., 2737Kb, [About PDF](#))

The STORET Program

- STORET: STOrage and RETrieval of water quality monitoring data



- EPA's STORET Program:
 - promotes sound data management practices
 - stores and maintains water quality data submitted by agencies/groups across the nation in the STORET Data Warehouse

The National STORET Data Warehouse

- Stores water data of all types (biological, chemical, physical) submitted by states, tribes, watershed groups, other federal agencies, and universities
- Web-enabled: Data are available -- and can be submitted -- using the Web
- Encourages data sharing at a national level



What is WQX?

- WQX defines the framework by which EPA compiles water quality monitoring data in the STORET Data Warehouse
- WQX is governed by a standardized format, so all data must comply with this format
- The WQX format allows anybody to share data regardless of what the original source of the data was

Glossary of Terms

Exchange Network

- Partnership among States, Tribes, and EPA to exchange environmental information

WQX

- Water Quality eXchange – The Water Quality data flow on the exchange network

WQX Web

- Web submission tool that utilizes the WQX data flow and framework

WQX Web Template

- Excel file that includes the standard data elements to be submitted via WQX Web

STORET Warehouse

- The central warehouse for all Water Quality data submitted to the EPA

Options for submitting data

- Submit the WQX Web excel template file to your regional project officer
- Use web-based tools to manually submit data to EPA
 - WQX Web
 - Other shared solutions
- Build your own tools to manually submit data to EPA
- Build tools using the technology and standards of the Exchange Network to automate data submission to EPA

The WQX Web Excel Template

- **Two Excel files:**

- Data dictionary file – Outlines the core WQX data elements needed for submittal of physical and chemical data and their associated formats and valid values
- Data entry file – Provides a place to enter data into these elements using the right formats and valid values
 - Puts data into a text file format that WQX Web can easily import

- **An optional tool if you're going to use WQX Web**

- If you have a spreadsheet or database that works for you, keep using it, and you can configure WQX Web to accept your data

- Can be downloaded from the STORET website:

- http://www.epa.gov/storet/wqx/wqxweb_downloads.html

The WQX Web submission tool

- Accepts basic input formats (i.e. Excel or Text files)
- Has translations for mapping data to WQX domain values or defaults
- Creates a WQX file that a user can send through WQX

The screenshot shows a web browser window displaying the WQX Web submission tool interface. The browser's address bar shows "Home". The page header includes the U.S. Environmental Protection Agency logo and the text "U.S. ENVIRONMENT". The main content area features a "Welcome!" message and a list of links for various features. A sidebar on the left contains navigation links for "Import Configurations", "Create New Dataset", "Datasets", "Lookup Tables", "Event Log", "Organizations", "Preferences", "User Information", and "Logout".

U.S. ENVIRONMENT

WQX Web
You are here: Home

Home

Welcome!

This tool will assist you with the creation of an XML file compatible with the Water Quality Exchange

The following links will assist you with the most common features of the application:

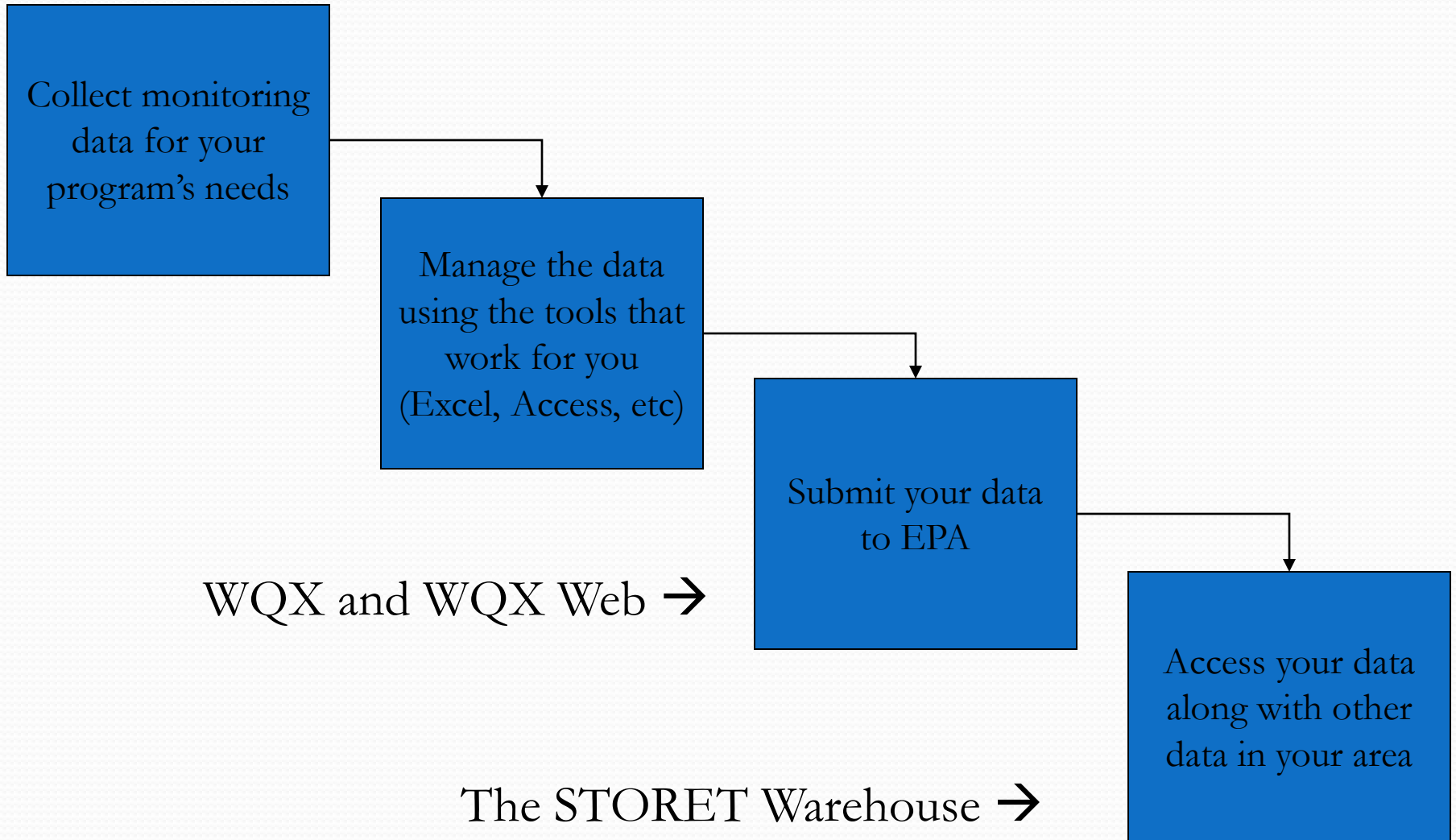
- [Create or Edit an Import Configuration](#): Create a reusable configuration that describes what your import file looks like and how it maps to WQX data elements.
- [Create a New Dataset](#): Create a set of data that will be the source for your WQX XML Submission File.
- [Continue with an Existing Dataset](#): Continue where you left off on an existing dataset.
- [Review Lookup Values](#): Review the list of allowed values for a specific domain or add values to organization-specific lists of values.

WQX
WATER QUALITY EXCHANGE

Import Configurations
Create New Dataset
Datasets
Lookup Tables
Event Log
Organizations
Preferences
User Information
Logout

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Overall Data Flow



Data in the STORET Warehouse

- Data in the STORET Warehouse gets refreshed once a week.
- Data can be accessed through a query tool at www.epa.gov/storet.
- EPA has created other tools for accessing the data in STORET:
 - My Waters Mapper
(<http://watersgeo.epa.gov/mwm/>)
 - MyEnvironment
(<http://www.epa.gov/myenvironment/>)
 - Surf Your Watershed
(<http://cfpub.epa.gov/surf/locate/index.cfm>)

Who uses the data?

- The general public
- Water resource managers
 - Tribes
 - Interstate commissions
 - State agencies
 - EPA and other federal agencies (e.g. USGS, NPS)
 - Universities

STORET/ WQX[Recent Additions](#) | [Contact Us](#) Search: All EPA

Go

You are here: [EPA Home](#) » [Water](#) » [OWOW](#) » [AWPD](#) » [STORET/ WQX](#) » [Data Download](#) » Warehouse as of 07/29/09**STORET Data Warehouse**

Data refreshed as of Wednesday May 18, 2011

Warehouse Refresh Cycle: Weekly - Every Wednesday Night 5:00pm Pacific Time

STORET Warehouse Watershed Summary

To know the HUC codes of your area, use this widget:

Find Your Watershed
Enter your ZIP:

[More info](#)

Features

[EnviroMapper for Water](#)
[Watershed Summary](#)
[Surf your Watershed](#)
[EPA Substance Registry System](#)
[Latest on Data Warehouse](#)
[Latest Change Log for Data Warehouse](#)

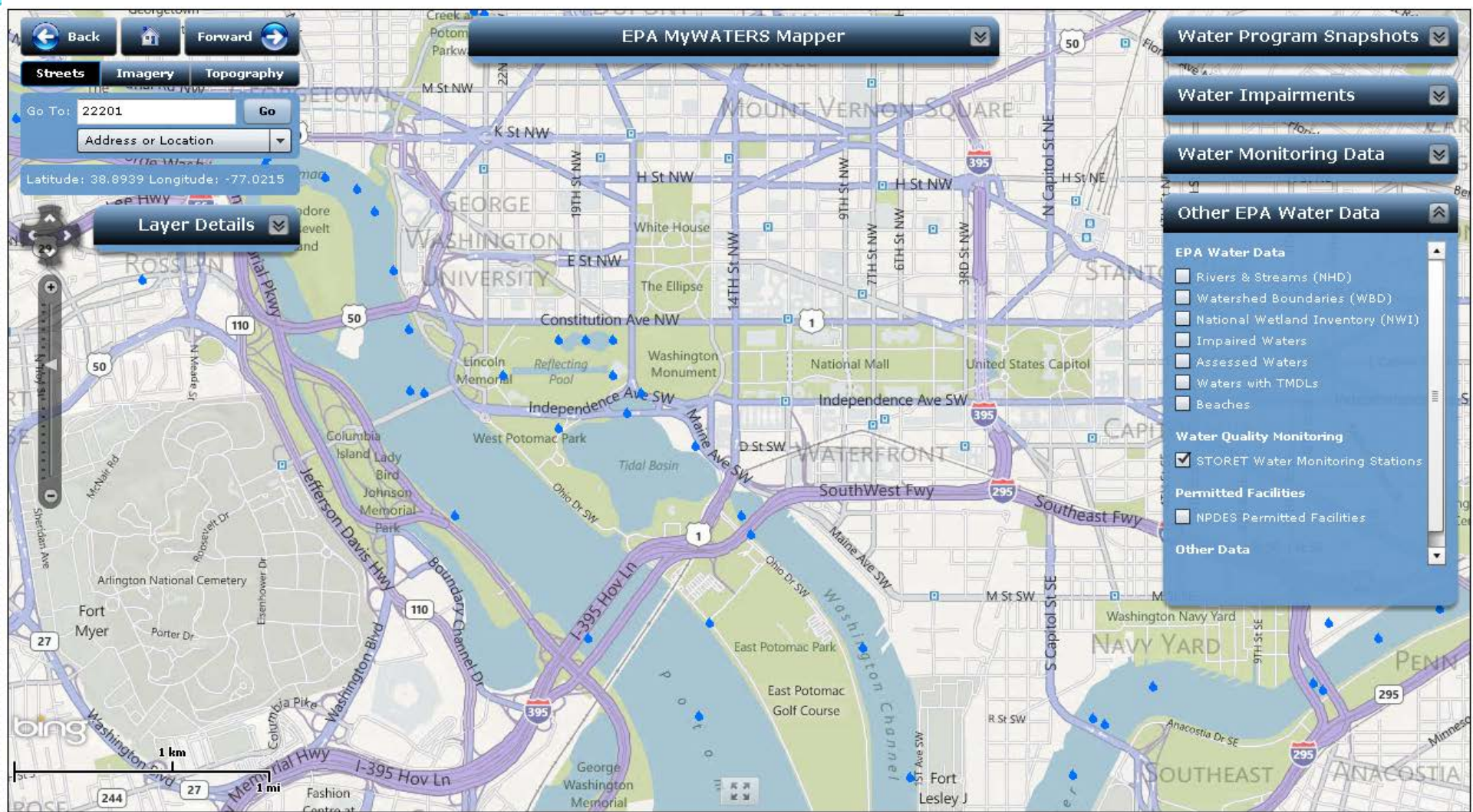
STORET Central Warehouse**STORET Station Descriptions**

- [Stations by Geographic Location](#)
- [Stations by Organization and Station ID](#)

STORET Results

(Physical/Chemical, Biological and Habitat Result Data)

- [Results by Geographic Location](#)
- [Results by Station](#)
- [Results by Project](#)



Text View of Data

Future Roll Out: NWIS/STORET Portal

- Ability to pull data from USGS National Water Information System (NWIS) and STORET from one query tool
- April 2012 roll out
- Sessions and presentations planned:
 - National Water Quality Monitoring Conference
 - Portland, OR
 - April 30 – May 4, 2012
 - <http://acwi.gov/monitoring/conference/2012/>



Water Quality Portal Alpha

Location Parameters

Bounding Box ?

North:

West: East:

South:

Distance within ?

miles from

Latitude:

Longitude:

Country: [select](#)

State: [select](#)

County: [select](#)

Site Parameters

Site Type: [select](#)

Organization ID: [select](#)

Site ID: ?

HUC: ?

Result Parameters

Sample Media: [select](#)

Characteristic Group: [select](#)

Characteristic: [select](#)

Start Date (MM-DD-YYYY)

after and before

File Format

data

- WQX-XML ?
- Comma-separated
- Tab-separated
- MS Excel

Excel 2003 and earlier versions have a limit of 65,536 rows. If your download file exceeds this limit, only the first 65,536 rows will open.

map

- Keyhole Markup Language (KML)

KML output is available for the "Download Sites Only" option.

Compress

zip

Note: input fields accept semicolon-delimited values (where valid)

Download Sites Only

Download Results

Show Request

Reset

Important Websites

- STORET and WQX website:
 - <http://www.epa.gov/storet/>
- EPA Monitoring and Assessment program website:
 - http://water.epa.gov/type/watersheds/monitoring/monitoring_index.cfm

Questions?

STORET Helpdesk

storet@epa.gov

1-800-424-9067

Kristen Gunthardt

gunthardt.kristen@epa.gov

202-566-1194