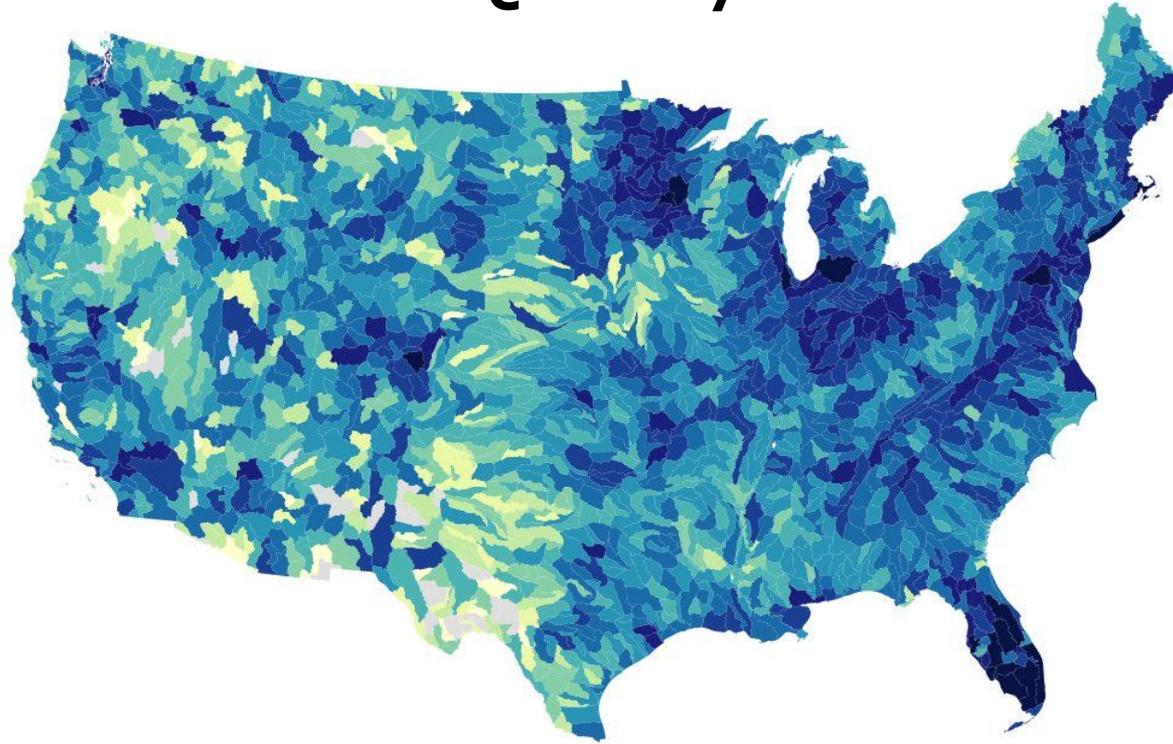


# Water Quality Portal



Laura Shumway, EPA Water Data Integration Branch

Jim Kreft USGS Water Mission Area

NWQMC Face-to-Face

November 6, 2018



# Water Quality Portal Background

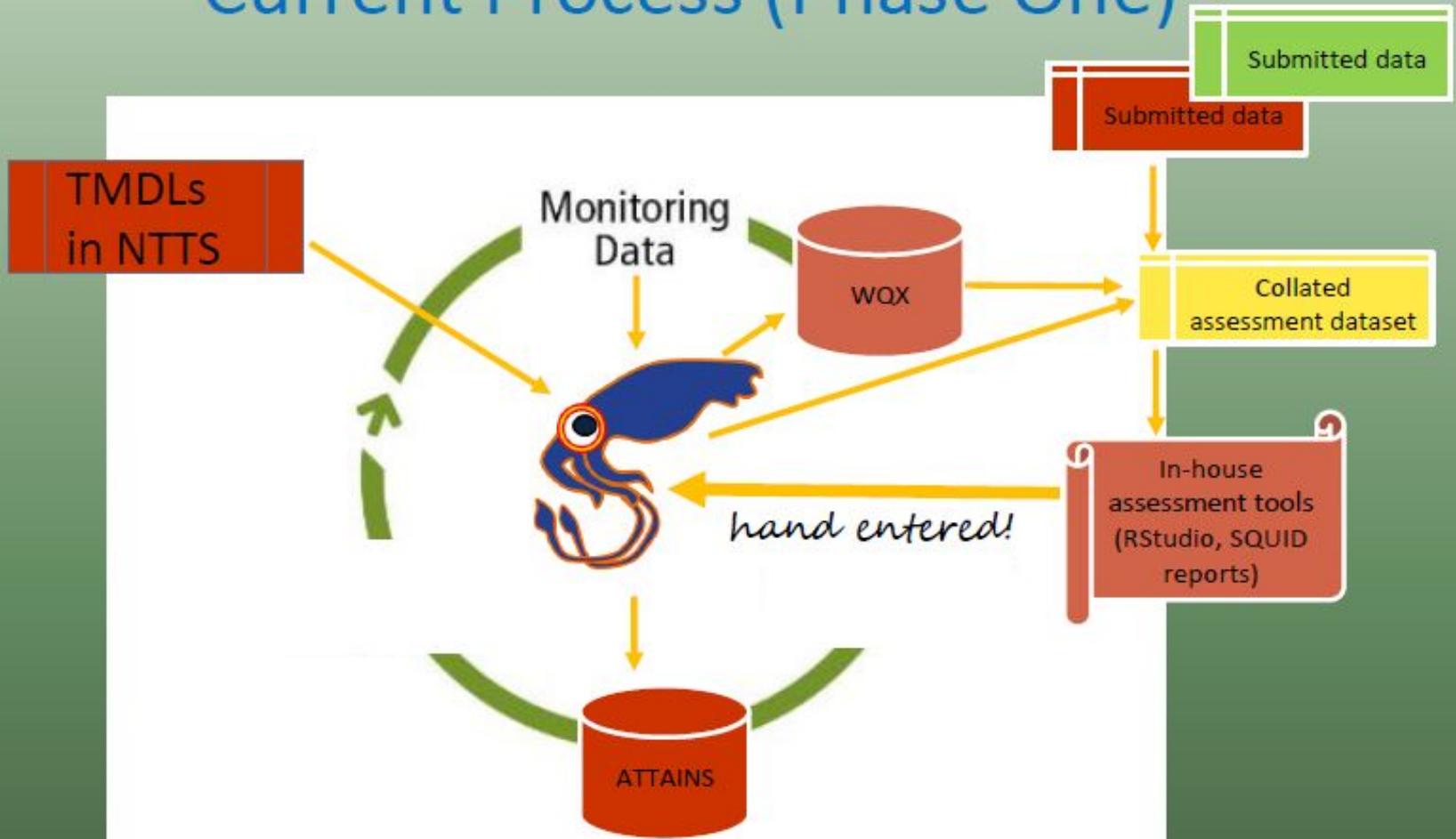
- The WQP **is** standalone web-service that allows users to easily download USGS, USEPA, and USDA water-quality data from a single website
- The WQP **is not** a system of record; instead it caches data from over 400 local, state, and federal databases for high (USGS-NWIS, USEPA-STORET, USDA-STEWARDS)
- The WQP **includes** water-quality data only (physical, chemical, biological, and monitoring site metadata)
- The WQP **does not include** climatic (precip/snowpack), hydrologic (flow, groundwater levels), or water-use data
- Data **must be** organized and formatted using the Water-Quality Exchange (WQX) template
- We **are implementing** WQP 5-yr strategic plan finalized in 2017

# Water Quality Portal Benefits

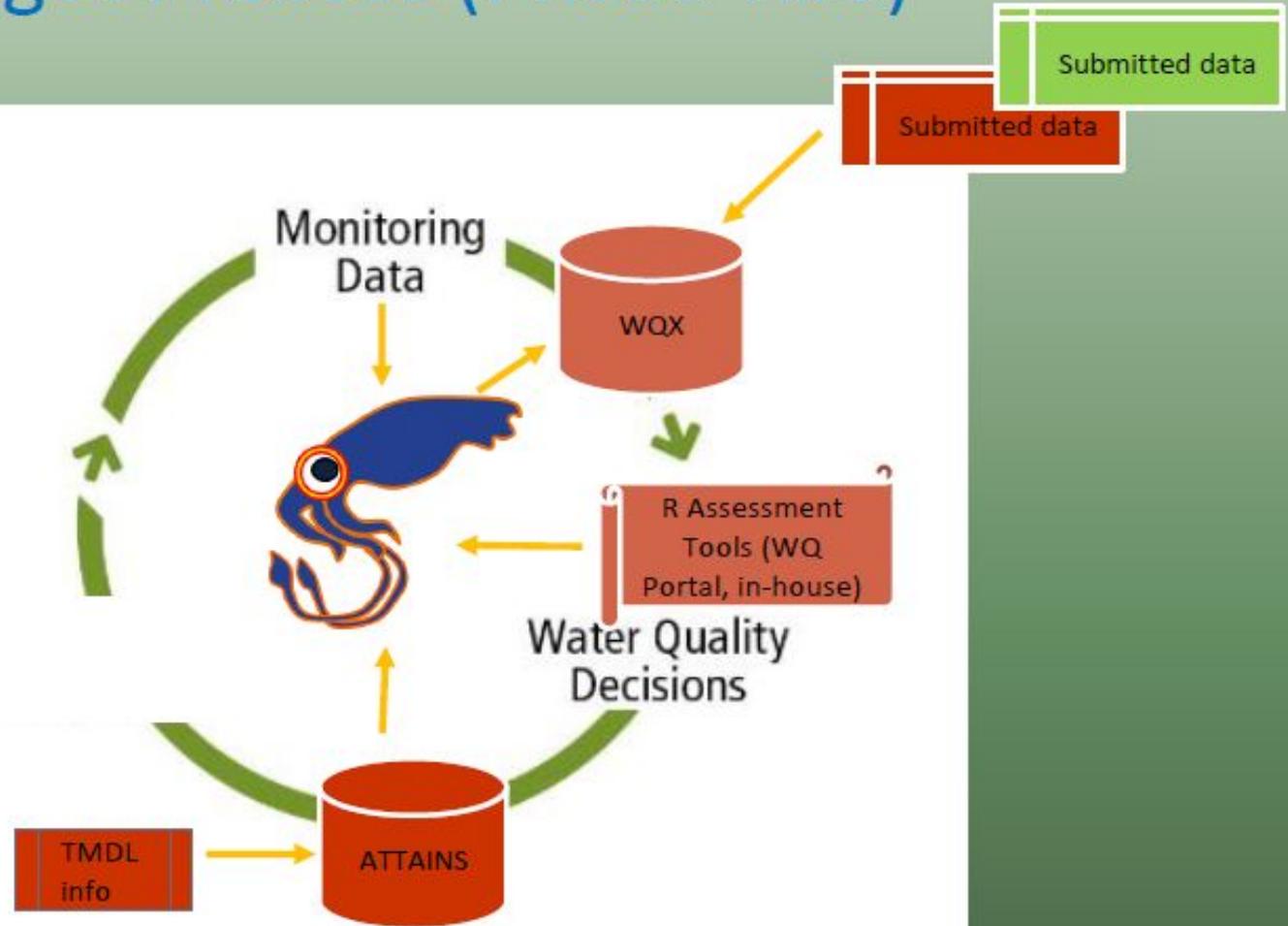
- One- Stop Data Shop (except for continuous)
  - Publicly available and easily accessible
- Standardized data protocol
- Standardized data output
- Easy to use interface with help desk
- Data updated regularly from sources
- Increases visibility of your data and your agency



# Current Process (Phase One)



# Target Process (Phase Two)

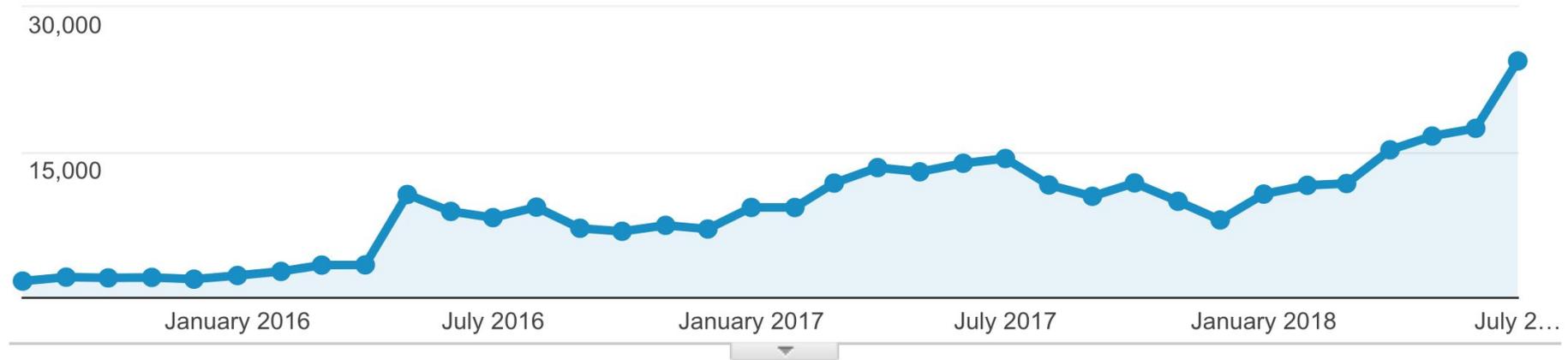


# Multiple Data Sources and Types

- Portal Data Records (347 million total)
  - USGS
    - Biodata: 1.4 million
    - NWIS: 103 million
  - EPA (STORET/WQX): 242 million
  - ARS/STEWARDS: 1.2 million
- Data Contributors
  - Federal- EPA, USGS, USCOE(regional), NPS, USBR(Regional) NOAA (DIVER In Progress!)
  - States and Territories- 50+ multiple in progress
  - Tribes- over 250
- Data Types
  - Physical/Chemical
  - Biological
  - Metrics
  - Activities
  - QA/QC
- Depends on the WQX Data Model

# Portal Usage- Visits

● Sessions



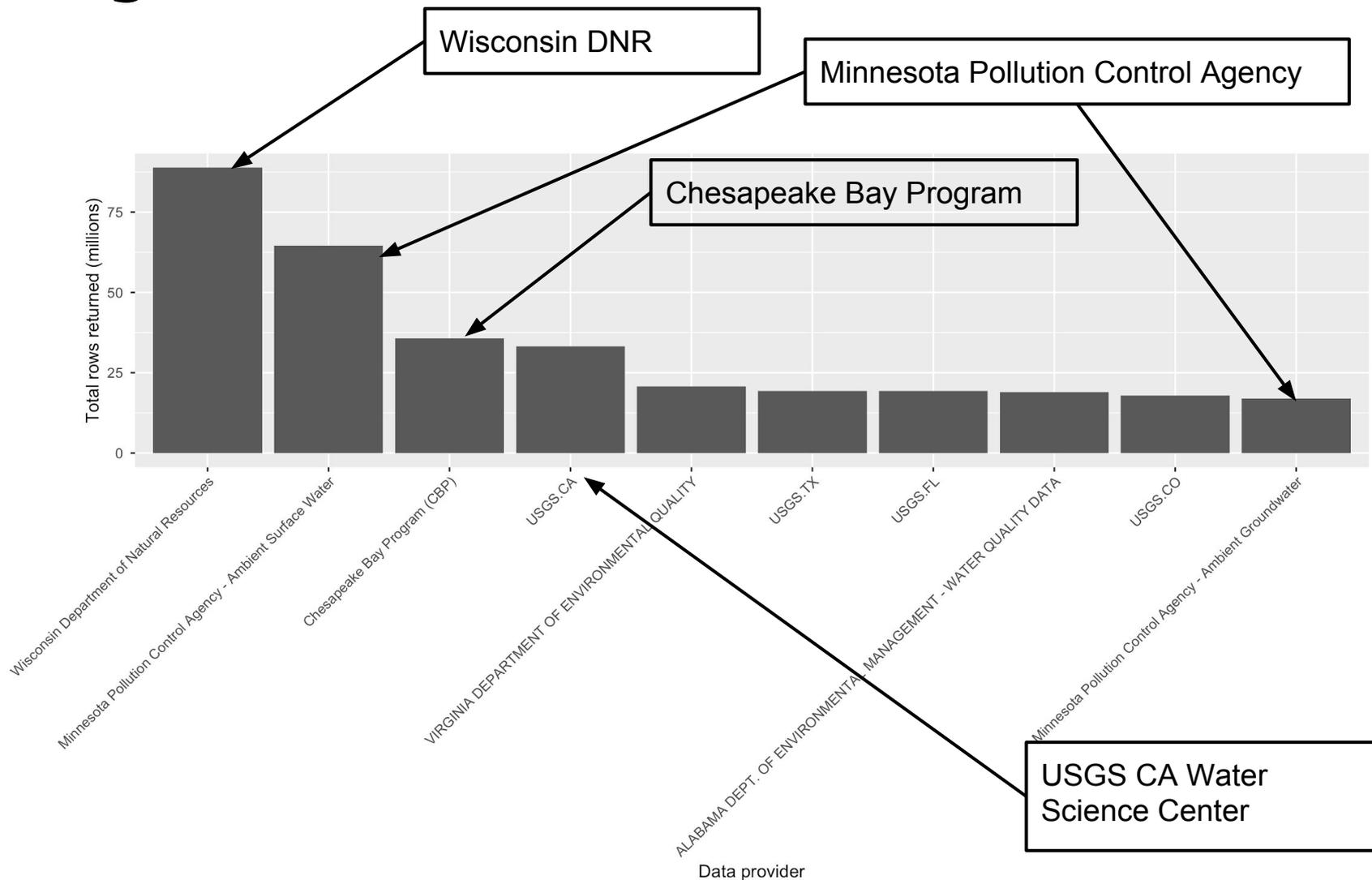
July 2018- 24K visits from 21K users, all time record!

August 2017-July 2018:

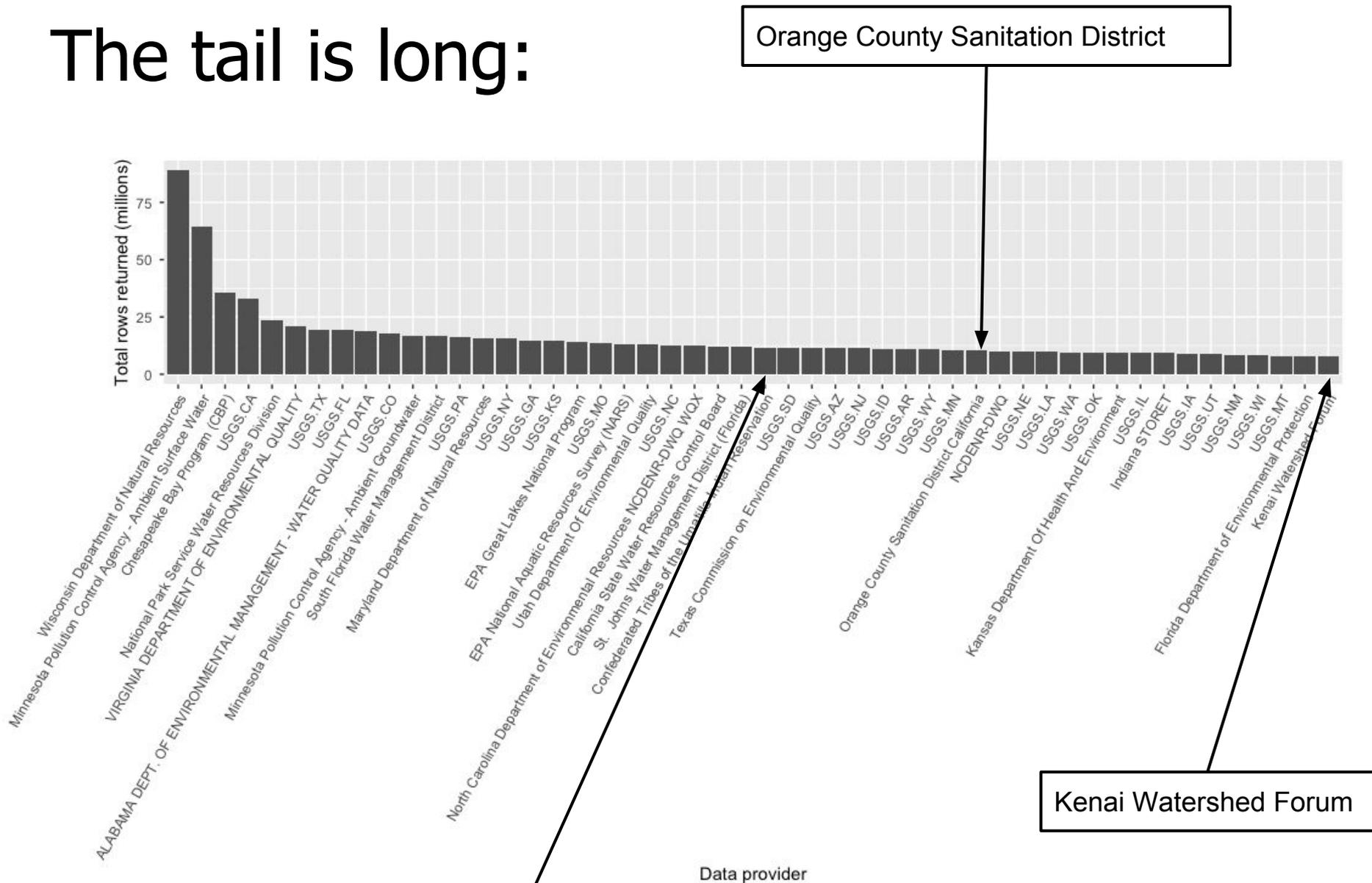
- New users: 126,195 (32% increase!)
- Returning users: 13,496 (32% increase!)
- Total sessions: 159,475 (29% increase!)

The WQP can now aggregate and present statistics on how often and how much any organization's data is being accessed

# Organization-level download stats



# The tail is long:



Orange County Sanitation District

Kenai Watershed Forum

Confederated Tribes of the Umatilla Indian Reservation

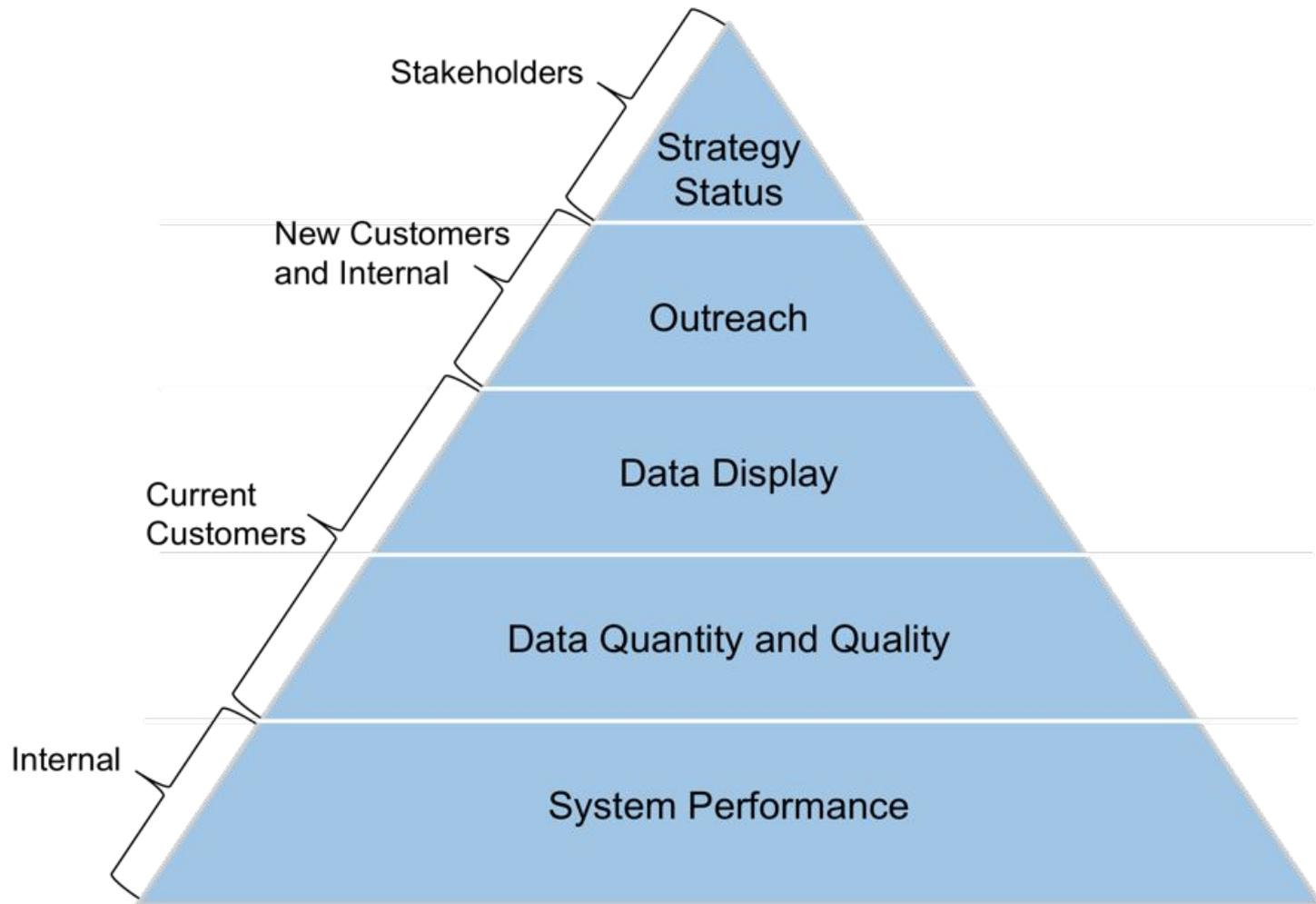
Data provider



# Internet of water

- **Standards**
  - WQX
  - OGC
- **Metadata**
- **Common Hydrography**
  - WBD/NHD are now one!
- **Discoverable/searchable**

# WQP Strategic Plan



# System Performance

Goals	Activity 2017-2019	Complete
1.1 Improve EPA delivery to Portal	STORET data transfer design plan <ul style="list-style-type: none"> <li>- <b>STORET decomissioned 6/28/18</b></li> <li>- <b>Monitoring System Performance</b></li> <li>- <b>Exploring more effective data loads</b></li> </ul>	Y
1.2 Improve USGS delivery to Portal	Work closely with NWIS modernization team to align the Portal with future USGS system state and requirements <ul style="list-style-type: none"> <li>- <b>Planned FY19-21</b></li> </ul>	
1.3 Assess Portal platform	Portal system platform update plan <ul style="list-style-type: none"> <li>- <b>Documentation and standardization</b></li> <li>- <b>Cloud readiness</b></li> </ul>	Y

# System Performance- future

Goals	Activity 2019-2021
1.4 Portal Interface Usability (note: data delivery prioritized over interface enhancements)	<ul style="list-style-type: none"> <li>● Usability testing</li> <li>● Adoption of US Web design standards</li> <li>● Advanced vs basic interface</li> <li>● Additional data display</li> </ul>
1.5 Alternative Download formats	<ul style="list-style-type: none"> <li>● Cloud-native public datasets (<a href="https://aws.amazon.com/opendata/public-datasets/">https://aws.amazon.com/opendata/public-datasets/</a>)</li> </ul>
1.6 Cloud migration	<ul style="list-style-type: none"> <li>● WQP is running on the cloud</li> </ul>
1.7 Facilitate Co-development	<ul style="list-style-type: none"> <li>● Non-USGS federal partners can collaboratively develop this system</li> </ul>
1.8 Connect to other systems	<ul style="list-style-type: none"> <li>● Internet of Water, other potential ACWI systems</li> </ul>
1.9 Maintain system performance	<ul style="list-style-type: none"> <li>● Maintain uptime consistently across platforms</li> <li>● Maintain download speeds,, allow for more concurrent users</li> </ul>
1.10 Enhance geospatial web services	<ul style="list-style-type: none"> <li>● Explore other data profiles and display</li> </ul>

# Data Quantity and Quality

Goals	Activity 2017-2019	Complete
2.1 Reduce data-in barriers	Hold (2) training webinars, (1) on-site training, update WQX Web tool <ul style="list-style-type: none"> <li>- <b>WQX web 2.80</b></li> <li>- <b>Training in NJ, TEN, TLEF. NWQMC Denver</b></li> </ul>	Y
2.2 All fifty states submit data	EPA will reach out to remaining states <ul style="list-style-type: none"> <li>- <b>Visited remaining states - New WQX API services to help</b></li> </ul>	
2.3 Biological data	Work with (3) states <ul style="list-style-type: none"> <li>- <b>Will be adopting biodata taxa tracking</b></li> <li>- <b>Working wi biodata to develop WQX 3.0 data requirements</b></li> <li>- Target biological experts for recommendations for schema revisions</li> </ul>	
2.4 Portal Services	Serve habitat, metrics, index data. <ul style="list-style-type: none"> <li>- <b>Now serve projects, Mon loc weighting, Organizations, user requested data profiles, attachments, summary services</b></li> </ul> Generate plan for integrating with continuous water-quality data. <ul style="list-style-type: none"> <li>- <b>Will release data appliance in 2018</b></li> <li>- <b>in USGS plan</b></li> </ul>	
2.5 Legacy STORET	Determine options for moving forward	Y
2.6 Data Quality	Identify data quality issues. Generate data quality plan. Begin addressing (2) issues. <ul style="list-style-type: none"> <li>- <b>Nutrients</b></li> <li>- <b>Metals</b></li> <li>- <b>QA requirements</b></li> <li>- <b>Coordinated WQ Mon &amp; Reporting groups</b></li> </ul>	Y
2.7 Expand QA Data from the Portal	Develop a plan to serve additional QA data <ul style="list-style-type: none"> <li>- <b>Portal now serves QA metadata and QAPP attachments</b></li> </ul>	
2.8 Explore error reporting approaches	Pilot approaches for reporting data issues	

# Data Quantity and Quality - future

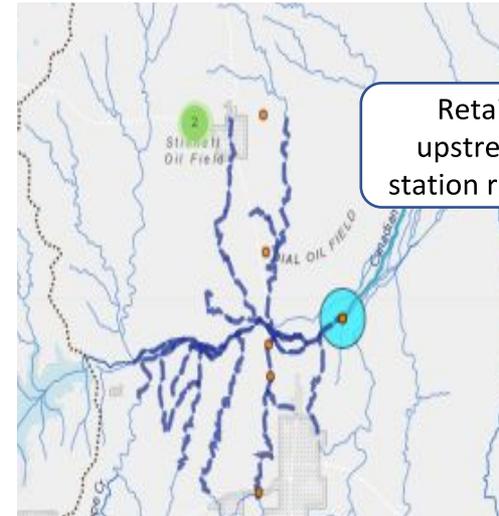
Goals	Activity 2019-2021
2.9 Statistical reports with download	Result ranges for each unique unit/characteristic combination
2.10 Data quality summary per station (see mock up)	Build station pages
2.11 Standardized data delivery	Unit and Characteristic conversion and standardization
2.12 Summarization services	<ul style="list-style-type: none"><li>• Monitoring Location</li><li>•</li></ul>
2.13 Support for Data DOIs/Data Packages	Generate citable artifact linked to organization
2.13 Track data completeness/fitness for use	<ul style="list-style-type: none"><li>• QAPP documented</li><li>• Statistics on metadata completeness</li><li>• Facilitate guidelines for evaluating data<ul style="list-style-type: none"><li>○ Work with different user communities to develop data evaluation guidelines and approaches</li><li>○</li><li>○ Be very careful about setting “tiers”, can</li></ul></li></ul>

# Canada R (TCFOMAIN-10035)

Retain header but simplify

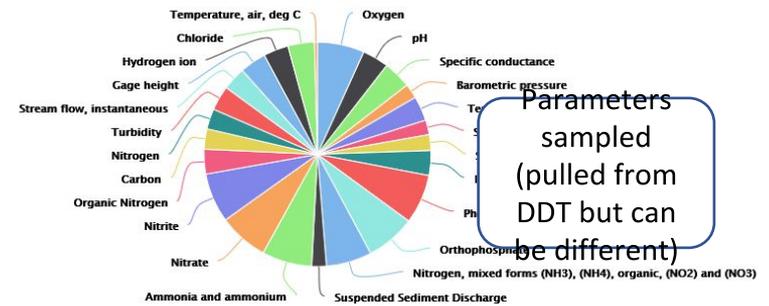
OrganizationIdentifier	TCEQMAIN
OrganizationFormaName	Texas Commission on Environmental Quality
MonitoringLocationIdentifier	TCEQMAIN-10035
MonitoringLocationName	CANADIAN R UPSTREAM OF FM2277
MonitoringLocationType	River/Stream
HUCEightDigitCode	11090106
LatitudeMeasure	35.7373
LongitudeMeasure	-101.3593
HorizontalCollectionMethod	Interpolation-Photo
HorizontalCoordinateReferenceSystemDatumName	NAD83
ProviderName	STORET

Retain station metadata report (but lets make it smaller?)

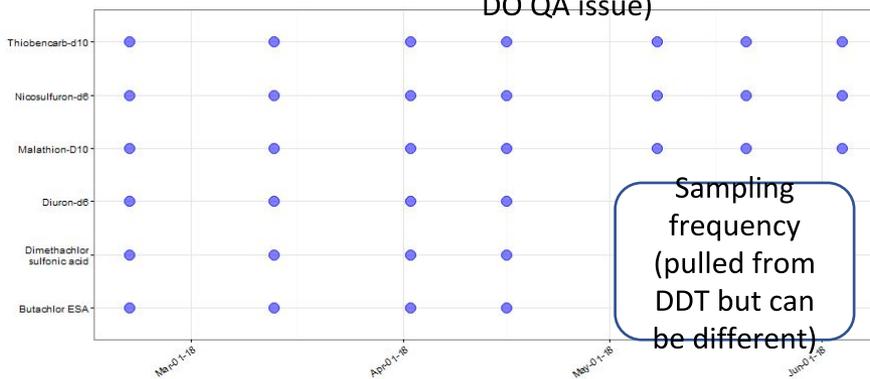


Characteristic	Unit	Speciation	Fraction	Min	Max	Mean
Total Nitrogen, mixed forms	mg/l	as N	Unfiltered	Not detected	25.6	0.4
pH	None		Unique	4.4	9.5	5.6
Dissolved Oxygen (DO)	mg/l			3.2	12.5	4.7
Dissolved Oxygen (DO)	NTU			4.9	11.8	6.3

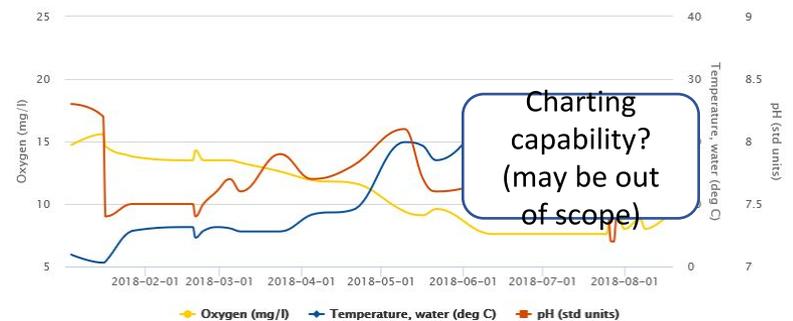
parameter combinations (for QA – see DO QA issue)



Parameters sampled (pulled from DDT but can be different)



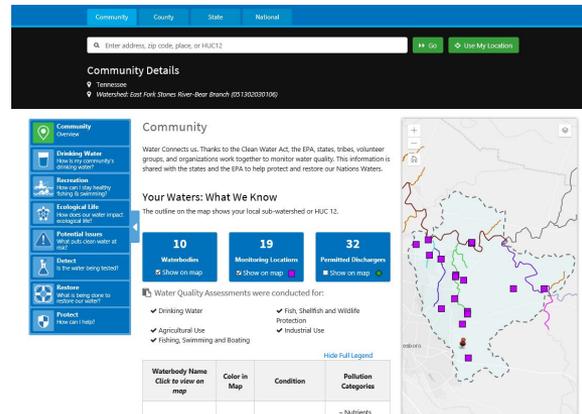
Sampling frequency (pulled from DDT but can be different)



Charting capability? (may be out of scope)

# Data Display

Goals	Activity 2017-2019	Complete
3.1 Portal Functions	Plan for new functions on data quality, monitoring trends and mapping <ul style="list-style-type: none"> <li>- <b>Station summary service</b></li> <li>- <b>Organization summary service</b></li> <li>- <b>To be developed: Period of record, and geospatial queries - HUC, county, state</b></li> </ul>	Y
3.2 Data Tools	Plan for (1) new analytical tool for data discovery or assessment. <ul style="list-style-type: none"> <li>- <b>DDT complete</b></li> <li>- <b>DAT in draft</b></li> </ul>	Y
3.3 WIS User Focus Group	Develop year two development goals	
3.4 Data summary display	WQP Data summarized at different scales and resolutions State → County and different size watersheds Organizational → monitoring location	



New summary services used in How's My Waterway 2.0!

# Outreach

Goals	Activity 2017-2019	Complete
4.1 Increase Council Knowledge	Develop outreach plan, factsheet and conduct (2) webinars <ul style="list-style-type: none"> <li>- <b>Communication plan</b></li> <li>- <b>Factsheet - How to use the WQP</b></li> <li>- <b>In progress- How to publish your data to the portal factsheet</b></li> </ul>	
4.2 Identify data users and uses	Develop data user community framework and (2) use case profiles <ul style="list-style-type: none"> <li>- <b>The WQP can now aggregate and present statistics on how often and how much any organization's data is being accessed</b></li> <li>- <b>Portal Bibliography</b></li> </ul>	
4.3 Identify new data suppliers	Identify (1) new federal partner and (3) new state data suppliers <ul style="list-style-type: none"> <li>- <b>NOAA</b></li> <li>- <b>Water Reporter</b></li> <li>- <b>Army Corps discussions</b></li> <li>- <b>Horizon oil group - promote portal</b></li> </ul>	Y
4.4 Write a peer reviewed paper about the Portal	Aim for publication in 2019 <ul style="list-style-type: none"> <li>- <b>In progress - Water Quality Portal Web Services</b></li> </ul>	
4.5 Promote the Portal at national scale meetings	Present at NWQMC, AGU, others <ul style="list-style-type: none"> <li>- <b>Presentations scheduled for NWQMC 2019, WEFTEC</b></li> </ul>	Y
4.6 Implement communication plan	<ul style="list-style-type: none"> <li>● See communication plan</li> </ul>	
4.7 Marketing	<ul style="list-style-type: none"> <li>● Produce and refine messages</li> <li>● Pilot messages</li> <li>● Create specific campaigns to reach target audiences</li> </ul>	
4.8 Improving outreach for data loading opportunities	<ul style="list-style-type: none"> <li>● Update WQP support pages</li> <li>● Keep WQP and WQX pages in sync</li> <li>● Track which organizations WQX team supports for onboarding, etc</li> </ul>	
4.9 More Outreach avenues	<ul style="list-style-type: none"> <li>● Regional and state monitoring councils</li> <li>● Regional data management coordinators</li> </ul>	



# Outreach

Goal	Activities
4.10 Establish Open Source User Community	<ul style="list-style-type: none"><li>● Share data tools and services</li><li>● Establish feedback loop for enhancements</li></ul>
4.11 Regional Outreach	<ul style="list-style-type: none"><li>● Facilitate materials for regional representatives for WQP outreach</li><li>●</li></ul>
4.12 User outreach at multiple levels	<ul style="list-style-type: none"><li>● Give data use examples at multiple levels of sophistication</li><li>●</li></ul>

# Over 100 publications cite the WQP

- A GIS-Based Compilation of Spring Locations and Geochemical Parameters in the Appalachian Landscape Conservation Cooperative (LCC) Region
- Global aquifers dominated by fossil groundwaters but wells vulnerable to modern contamination
- Large-scale modeled contemporary and future water temperature estimates for 10774 Midwestern U.S. Lakes
- A database of georeferenced nutrient chemistry data for mountain lakes of the Western United States.
- Late-Pleistocene precipitation  $\delta^{18}O$  interpolated across the global landmass
- Watershed-scale impacts of stormwater green infrastructure on hydrology, nutrient fluxes, and combined sewer overflows in the mid-Atlantic region
- [https://www.waterqualitydata.us/apps\\_using\\_portal/](https://www.waterqualitydata.us/apps_using_portal/)

# Strategy Status

Goals	Activity 2017-2019	Complete
5.1 Identify status of monitoring data/programs	Identify data partners and display needs. Develop (1) view or map display of water monitoring partners and data holdings	
5.2 Develop NMN Networks based on WQP Data	Develop surface-water quality network, among others, from WPA sites  - <b>Workgroup 3 - Lori Sprague</b>	
5.3 Identify new collaboration opportunities	Display active monitoring to support coordinated efforts	
5.4 Submitting organization reports	<ul style="list-style-type: none"> <li>• Submission status/Dashboard</li> <li>• Track organization submittals (start with council)</li> <li>• Organization summary report</li> <li>• Tracking which organizations are submitting data without a 106 grant requirement</li> </ul>	
5.5 Keep council informed on Portal use	<ul style="list-style-type: none"> <li>• Dashboard of usage statistics               <ul style="list-style-type: none"> <li>○ Downloads,</li> <li>○ Rows of data</li> <li>○ Users</li> </ul> </li> <li>• Dashboard of data holding summary               <ul style="list-style-type: none"> <li>○ Types</li> <li>○ locations</li> <li>○ etc</li> </ul> </li> </ul>	

# Breakout

- Discuss each of the 5 concepts
  - System Performance
  - Data Quality and Quantity
  - Data Display
  - Outreach
  - Strategy Status

# Questions?

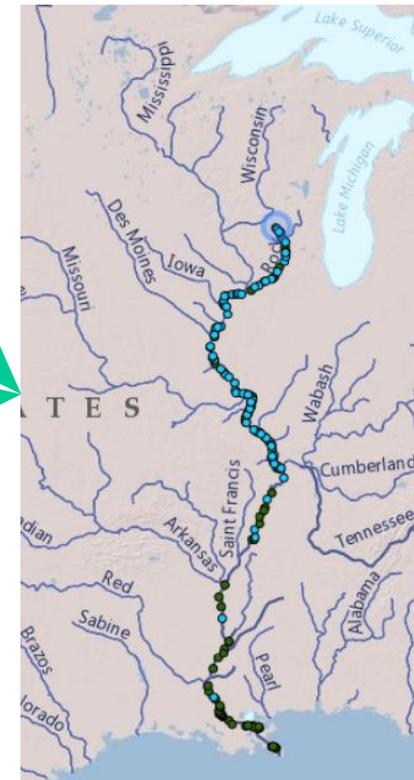
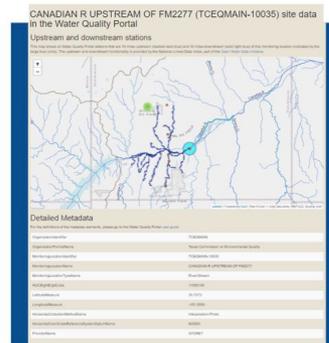
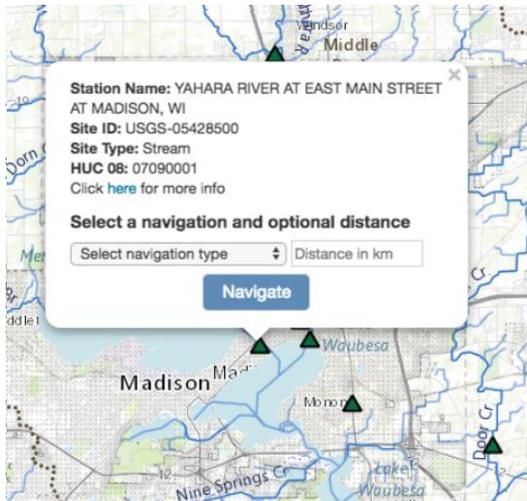
- [jkreft@usgs.gov](mailto:jkreft@usgs.gov)
- [Shumway.Laura@epa.gov](mailto:Shumway.Laura@epa.gov)

# Future challenges

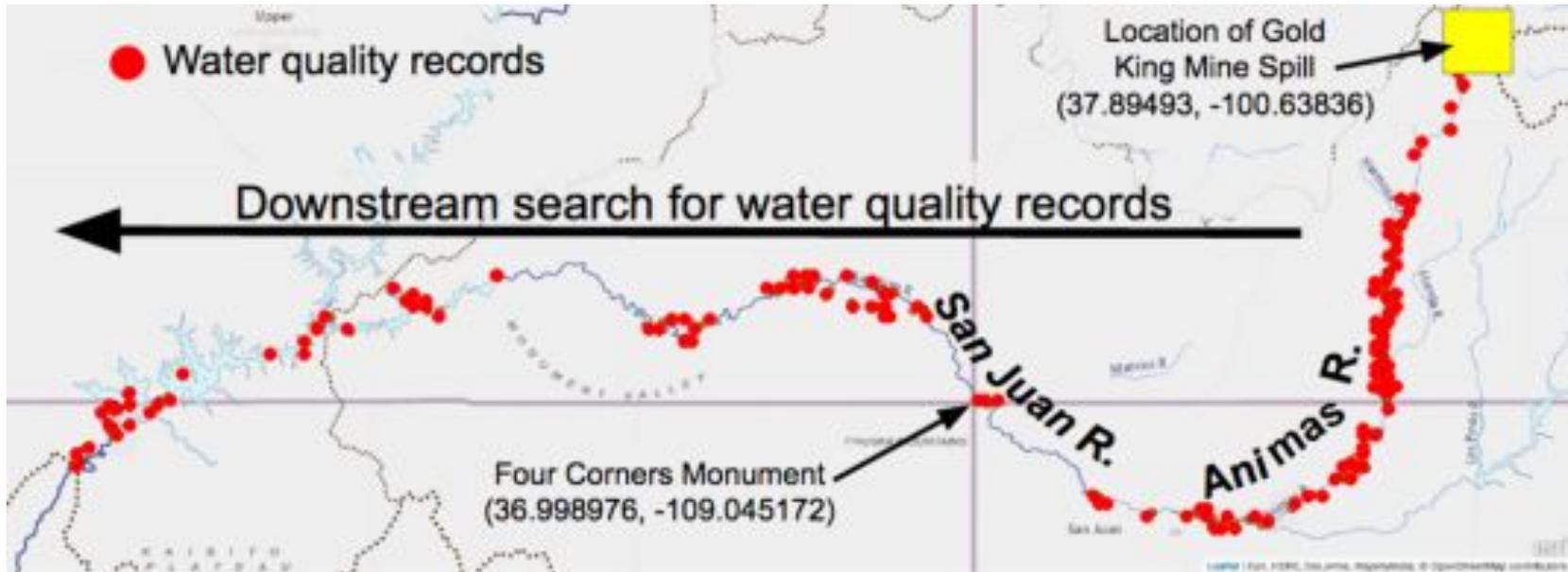
- Integration of network concept
- Integration with continuous monitoring data
  - WQP data model (WQX) is discrete focused
  - Continuous monitoring data is ever more important for water quality monitoring
  - Interagency integration of continuous data is an unsolved problem (though EPA has promising pilot work)

# Sites with Nutrient data, downstream from the Yahara River bridge

SITE PARAMETERS	SAMPLING PARAMETERS
Site Type: <input type="text" value="x Stream x"/> ?	Sample Media: <input type="text" value="All"/>
Organization ID: <input type="text" value="All"/> ?	Characteristic Group: <input type="text" value="x Nutrient"/>



# Leveraging Downstream Queries



Can answer questions in minutes that took days or weeks previously- see Young 2016

Water Resources Research

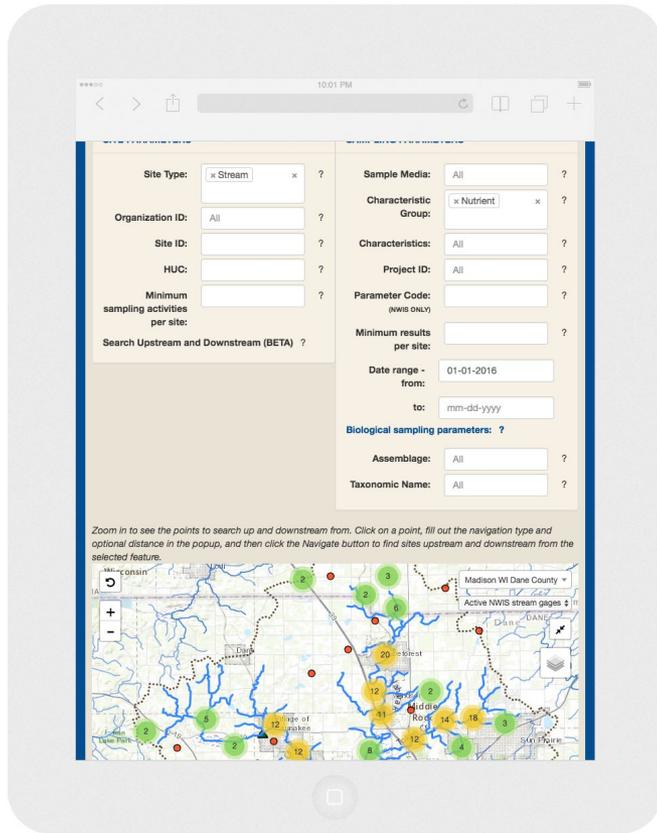
[Volume 53, Issue 2](#), pages 1735-1745, 12 FEB 2017 DOI: 10.1002/2016WR019993

<http://onlinelibrary.wiley.com/doi/10.1002/2016WR019993/full#wrcr22485-fig-0003>

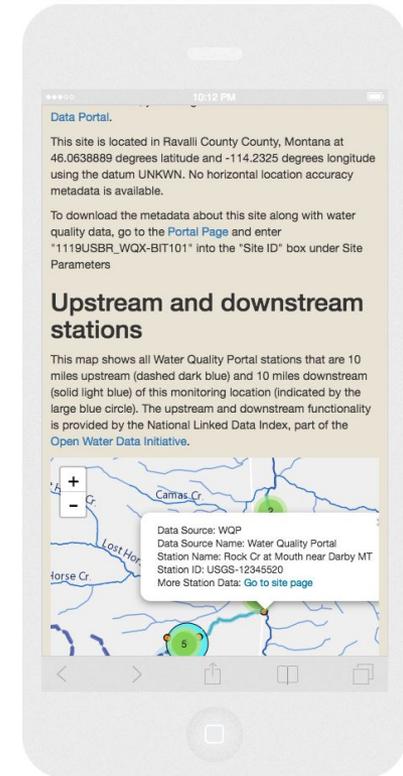
Young, Dwane, 2016 NWQMC

[https://acwi.gov/monitoring/conference/2016/2\\_wednesday\\_may4/G3/2-G3\\_Young\\_Portal\\_inTight\\_TimeFrames\\_secure.pdf](https://acwi.gov/monitoring/conference/2016/2_wednesday_may4/G3/2-G3_Young_Portal_inTight_TimeFrames_secure.pdf)

# Built Using Responsive Design



Water Quality Portal works on any device with a modern web browser



# FY18 goals

- System Performance
  - Explore hosting alternatives (e.g. cloud)
  - Continue incremental data loading improvements
- Data Quantity and Quality
  - Additional endpoints: Project, Indexes, Files
  - Continue discussions around data quality
  - Work with new organizations to submit data
- Data Display and discovery
  - Summarization service- lead to summary data on user-relevant pages
  - EPA team working on data analysis tool
- Outreach/Education
  - Portal Communication Plan (With NWQMC WIS)
  - Factsheets and other outreach materials
- Strategy and status- Continued discussion with NWQMC