

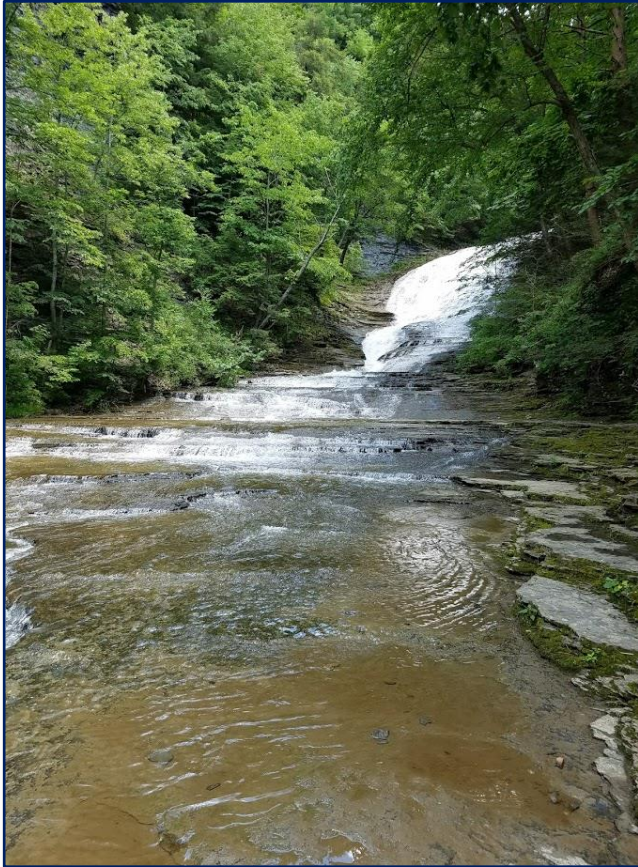
Monitoring Water Quality with the WiseH2O Mobile App: Driftless Area Project



Dan Dauwalter, Ph.D., TU National
Carter Borden, Ph.D., MobileH2O, LLC
TU Webinar, April 10, 2024

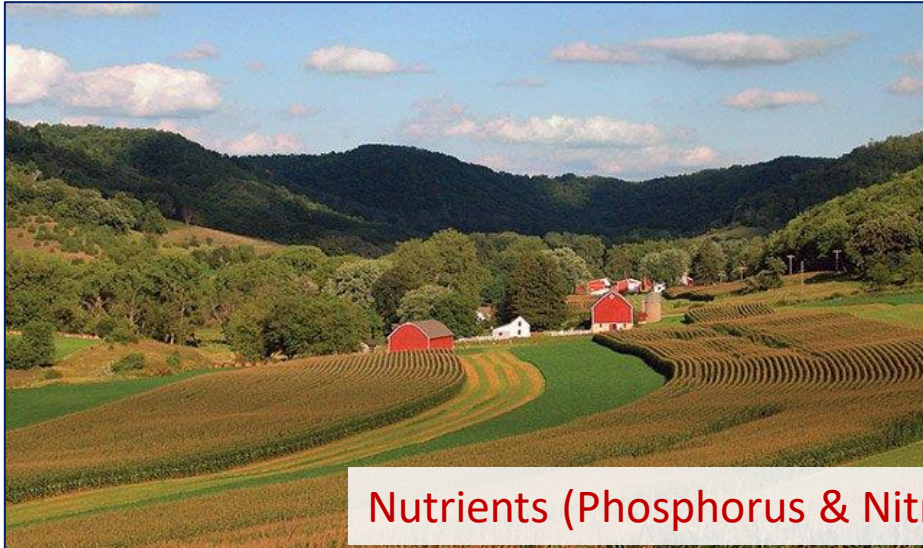


Introduction - The Problem

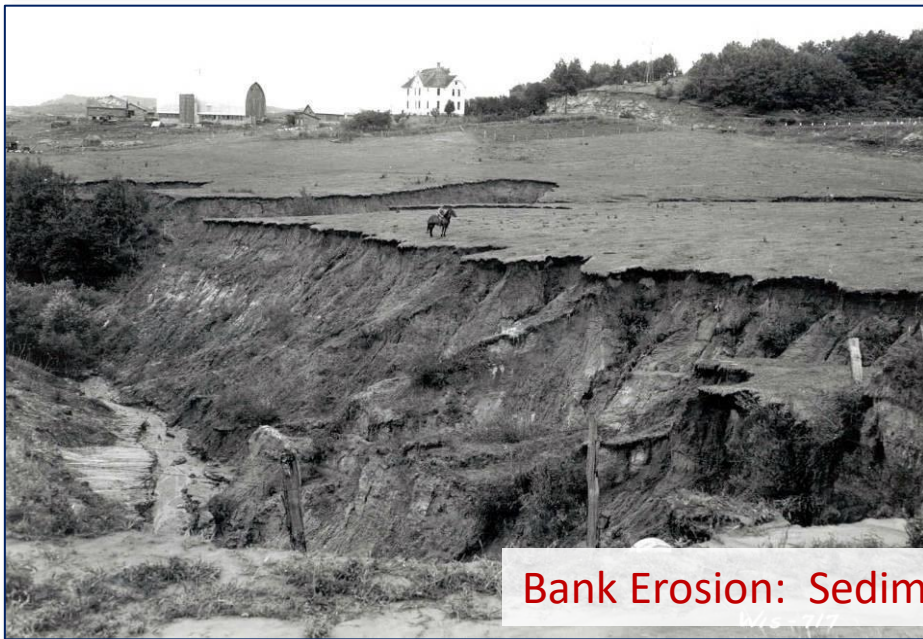


- **Poor water quality** impairs fish habitat
- Traditional water quality **monitoring** can be **expensive** and **limited** in scope
- **Lack of data** limits our understanding of where rivers need protection and restoration
- The ability to **target resources** is **restricted** without access to accurate information

Water Quality Problems in the Driftless Area



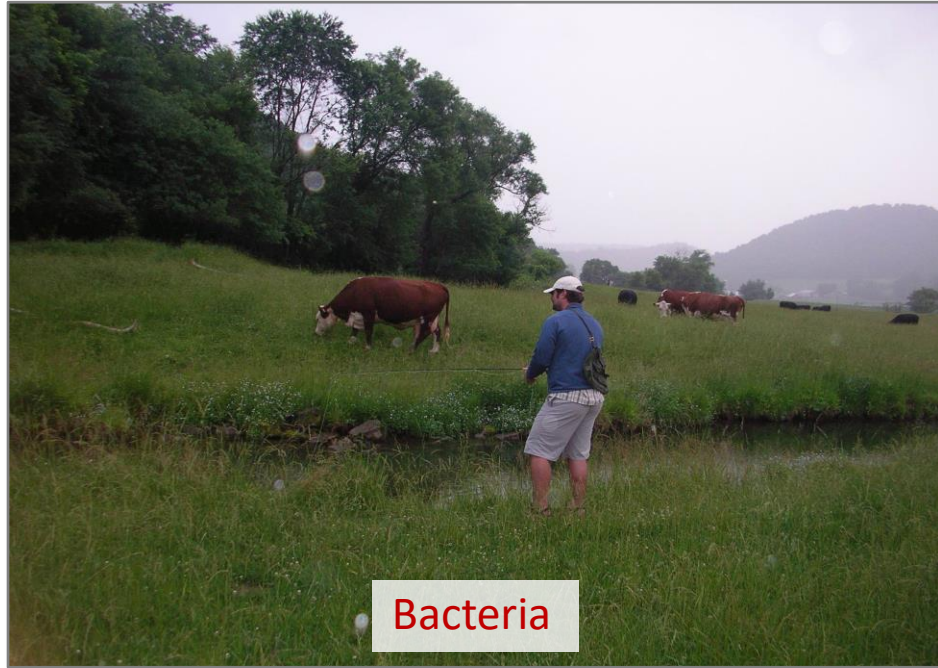
Nutrients (Phosphorus & Nitrogen), Herbicides, Pesticides



Bank Erosion: Sedimentation and Turbidity



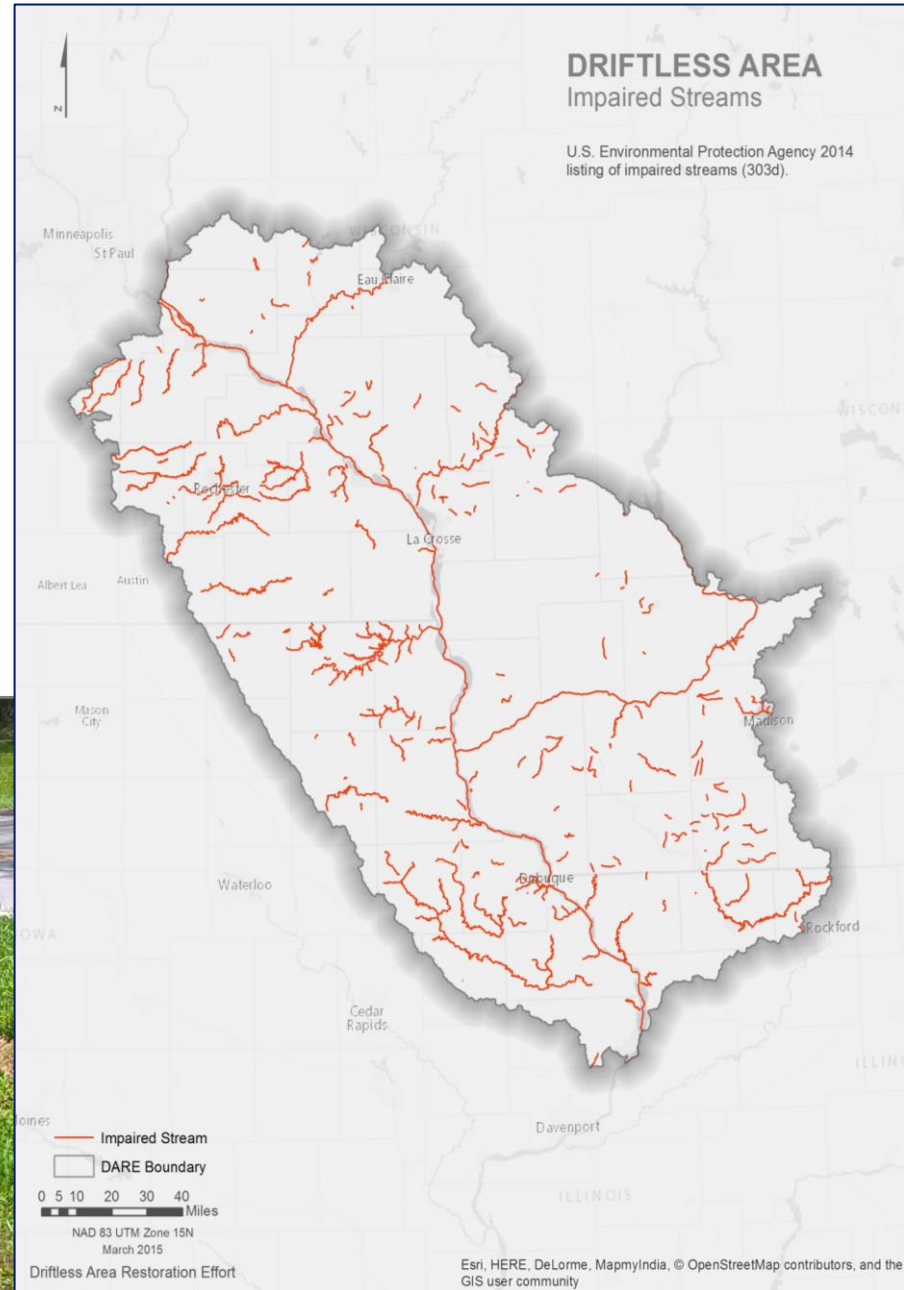
Water Quality Problems in the Driftless Area



Bacteria



Bank Erosion: Sedimentation and Turbidity

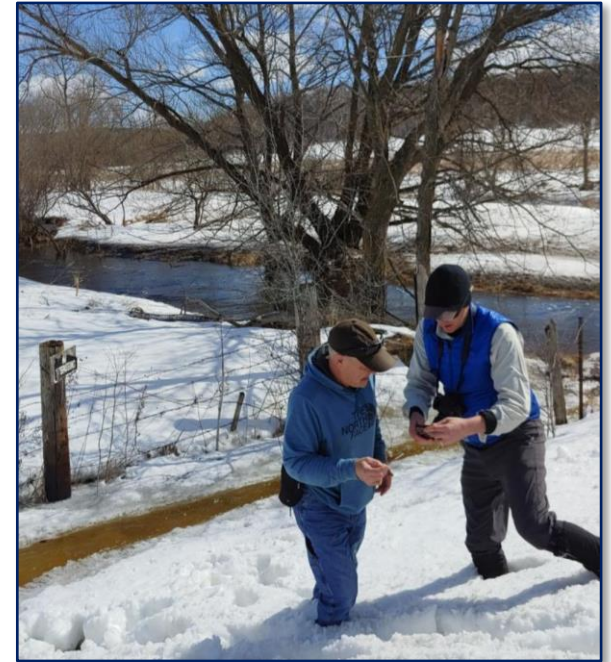


Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

Driftless Angler Science Program Overview

TU and Partner Benefits

- Large data set generated with low-cost
- Characterize WQ/habitat conditions
- Map WQ “hot spots”
- Recruitment tool to reach technologically engaged anglers
- Data for strategic conservation investments with partners
 - Spatial analysis for strategic restoration projects
 - Brook trout stream habitat characterization
 - Nutrient management
 - Kinnikinnic Dam Removal monitoring



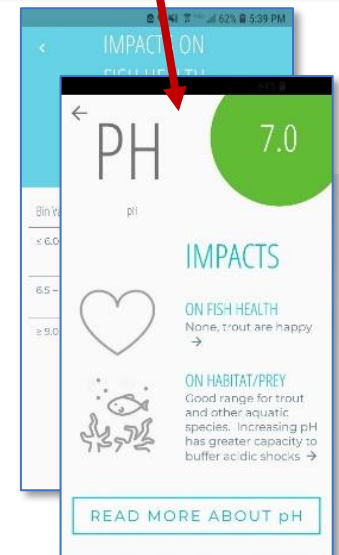
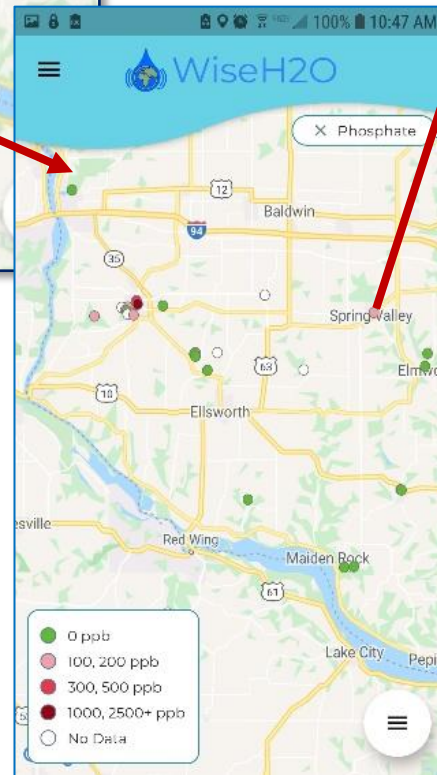
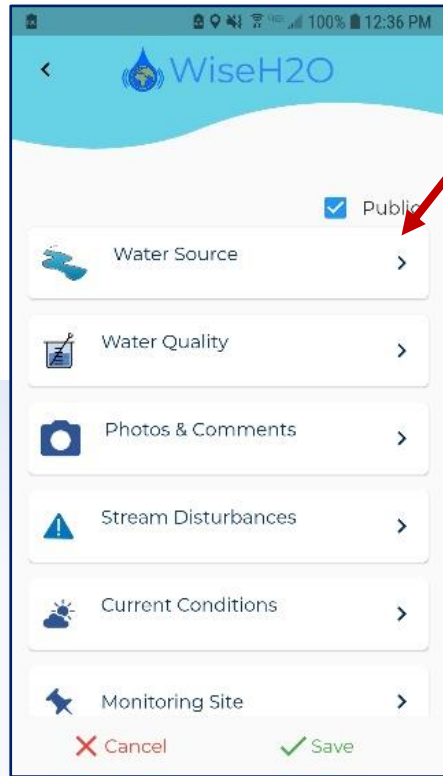
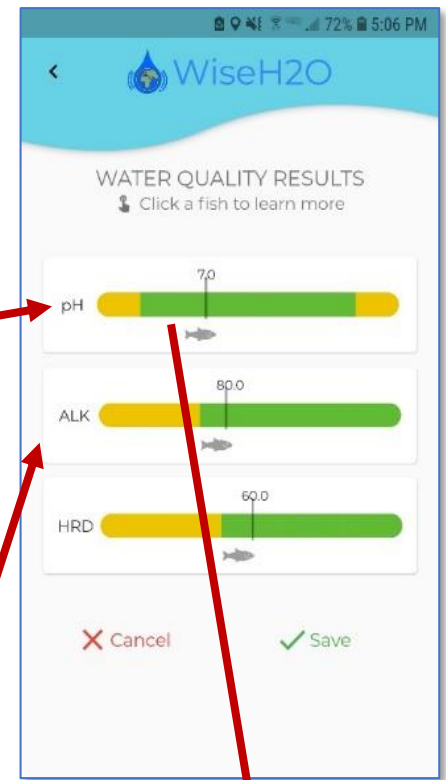
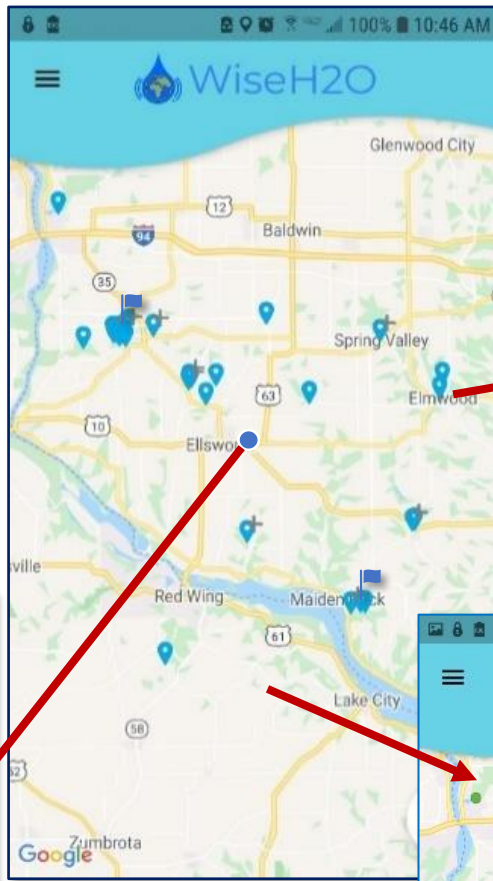
Driftless Angler Science Program Overview

Anglers Benefit

- Real-time water quality results
- Maps of analytical results
- Greater awareness of causes of the poor water quality
- A feeling of contributing to a greater cause
- Long-term, better fishing



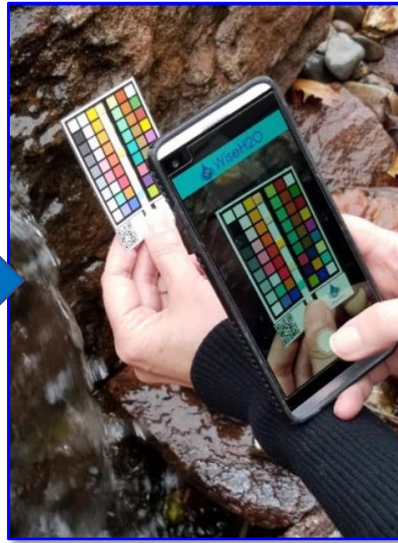
WiseH2O™ mApp



WiseH2O mApp

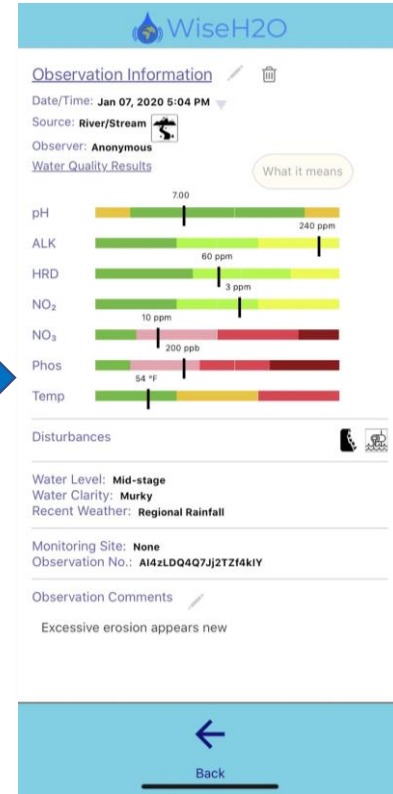
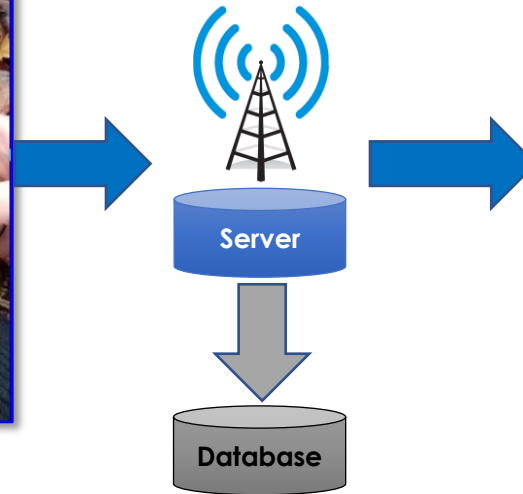


Dip a test strip



Take a photo

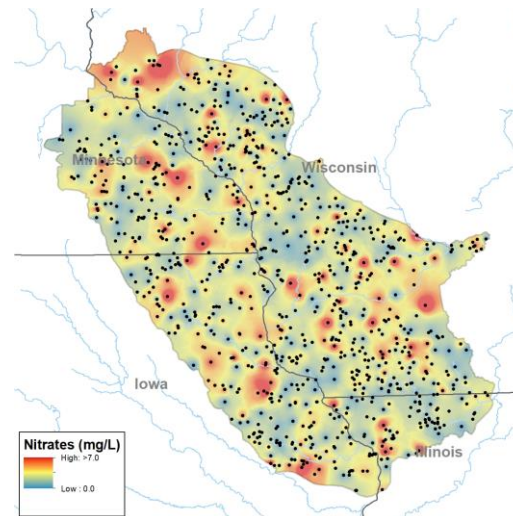
30 SECONDS











Get results

Water Management Agency:

- Logs results, locations, metadata to database
- Trigger alerts
- Scientific studies on water quality conditions



Angler Monitoring Observations

Analyte/ Observation	Range	Method
Alkalinity	0, 40, 80, 120, 180, 240 mg/L	
Hardness	0, 30, 60, 120, 180 mg/L	
pH	6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0	
Nitrate-Nitrogen (NO ₃)	0,1,2,5,10,20,50 mg/L	
Nitrite-Nitrogen (NO ₂)	0,0.15,0.3,1.0,1.5,3.0 mg/L	
Orthophosphate	0, 0.1, 0.2, 0.3, 0.5, 1.0, 2.5 mg/L	
Stream Disturbance	Fish Barrier, Bank Erosion, Trash, Drain Outflow, Algal Bloom, Fish Kill, Livestock in River	
Temperature	0-100 °F (user's thermometer)	

Actionable Data Framework



Step 1: Initial WiseH2O observation



↓ If value is alarming, then:

Step 2: Replicate WiseH2O observations

↓ If replicate observations continue to be alarming, then:

Step 3: Confirm with sample to certified lab

↓ If lab-based sample confirms alarming WiseH2O observations, then:

Step 4: Report to regulatory agency or authority



TU Involvement/Results: 2019-2023

DRIFTLESS AREA OBSERVATIONS

2020-23 Observations (as of Oct 31st)

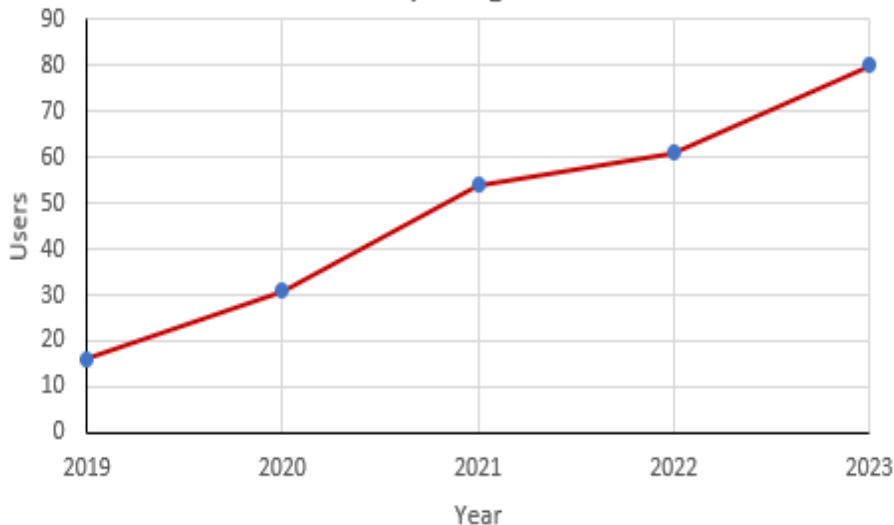
Overall	Number	Percentage
Target	2000	100%
Observations	1849	92%
Remaining	151	8%

92%



Participation

Participating Users



Use Metrics

- 1849 observations
- 146 contributing individuals
- TU Chapter members from 9/15
- Super Chapters
 - Hiawatha
 - Kiap-TU-WISH (Monitoring Network)
 - Twin Cities (Monitoring Network)
- Outputs: Database, Reports, Website, DA Scorecard
- Non-TU Organizations
 - Kinnic Corridor Collaboration
 - WI, MN DNRs
 - USFWS
 - St Mary's U. Upper Iowa U.
 - Holeman Middle School

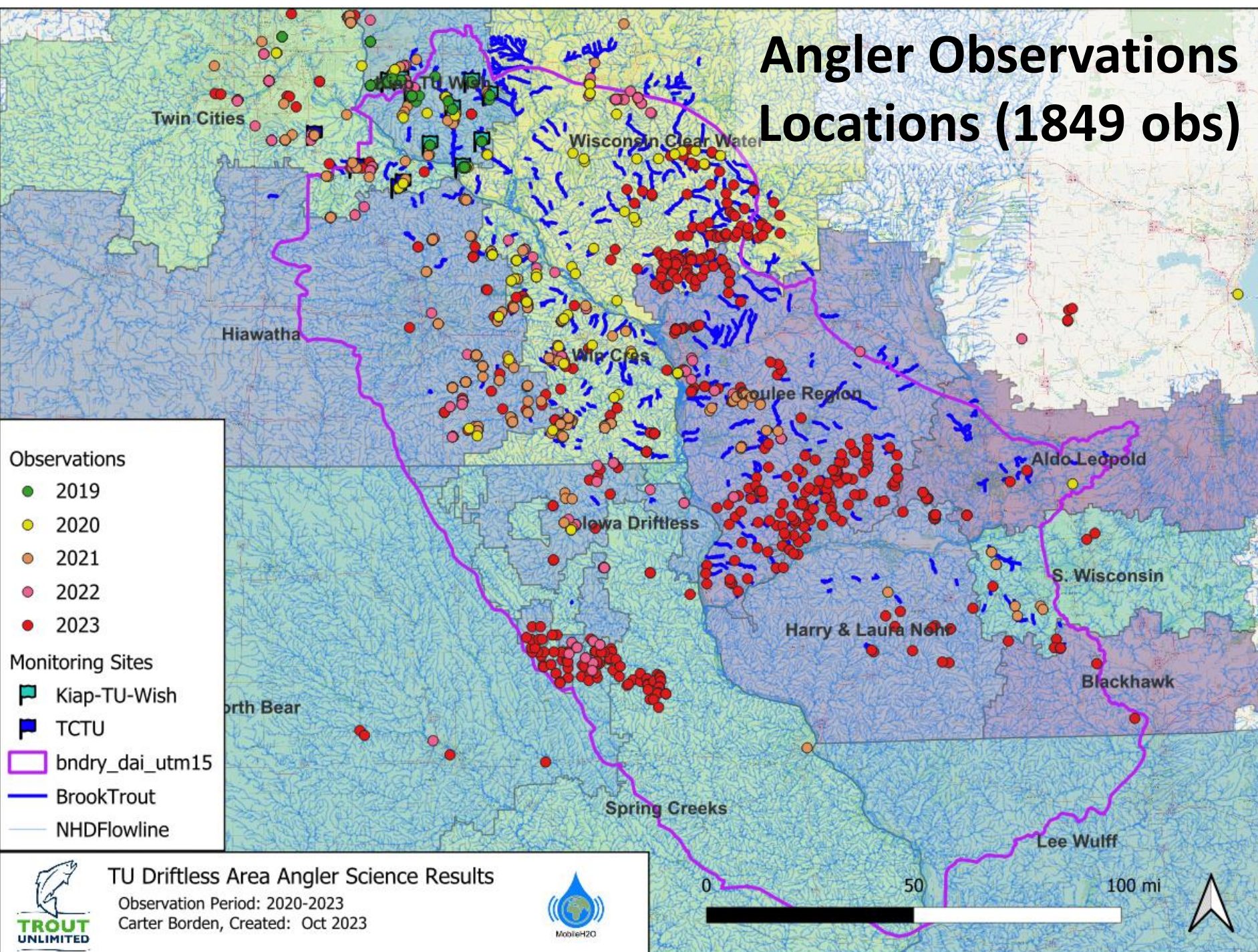
Angler Observations Locations (1849 obs)

Observations

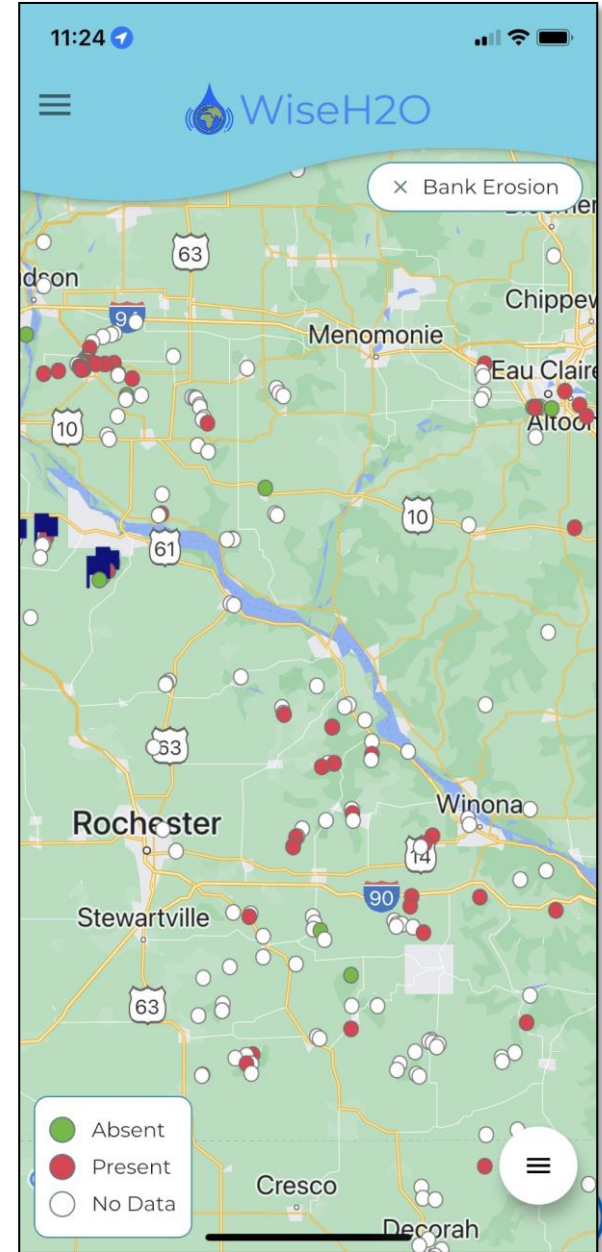
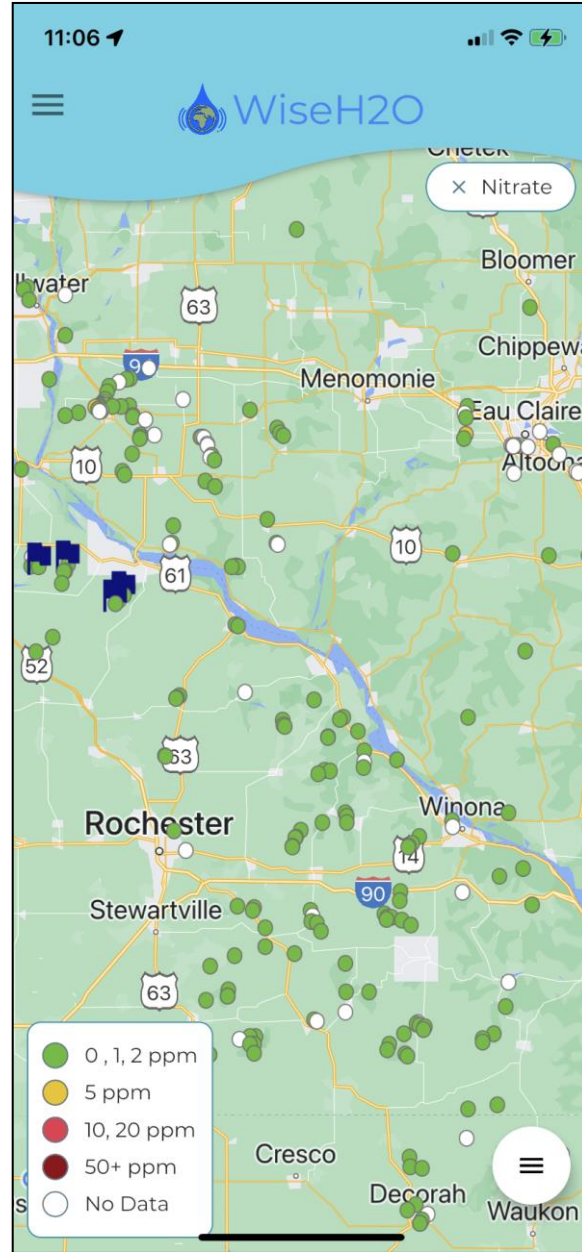
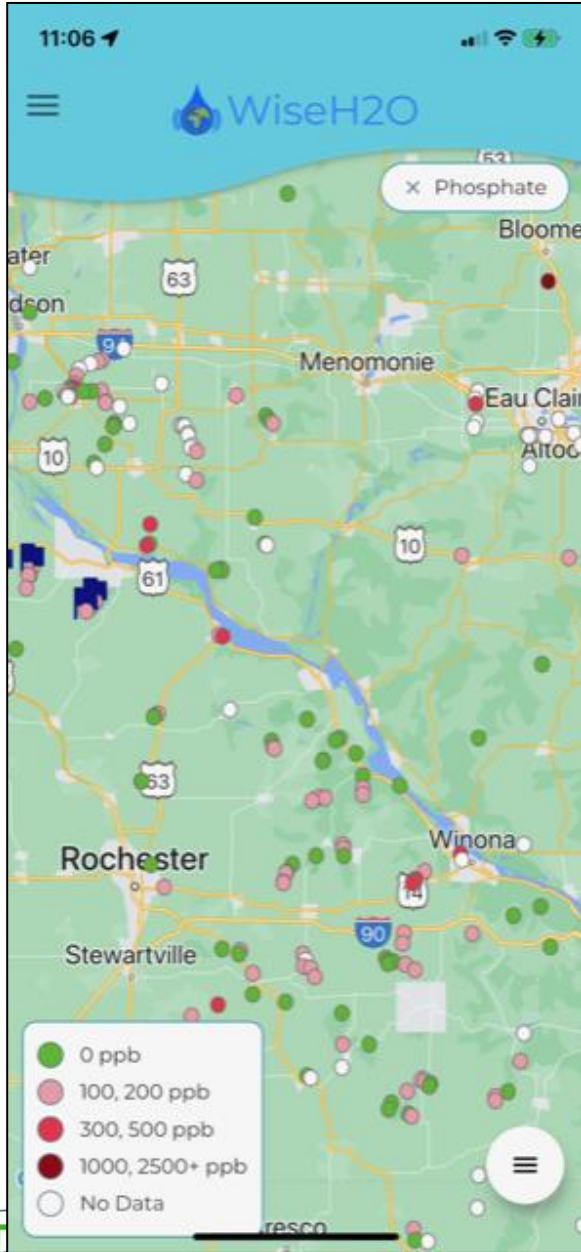
- 2019
- 2020
- 2021
- 2022
- 2023

Monitoring Sites

- Kiap-TU-Wish
- TCTU
- bndry_dai_utm15
- BrookTrout
- NHDFlowline



Output: Ortho-Phos, NO₃, Bank Erosion



Angler Science Driftless Program Webpage

MOBILEH2O, LLC

HOME WISEH2O APP ISSUES SERVICES PROJECTS SHOP BLOG ABOUT US CONTACT US

Projects

- ANGLER SCIENCE DRIFTLESS AREA PROGRAM
- 2020 ANGLER SCIENCE DRIFTLESS AREA REPORT
- 2019 ANGLER SCIENCE DRIFTLESS AREA REPORT
- CROWDSOURCING WATER QUALITY

Angler Science Driftless Area Program

You're going to be out fishing, so while streamside why not help TU characterize water quality conditions and identify stream disturbances throughout the Driftless Area by making an observation with the WiseH2O App. Not already participating? See below for how to get started with the WiseH2O app. Tips and instructions on the WiseH2O app use are available [here](#).

SEPTEMBER WISEH2O WATER QUALITY BLITZ

Thanks to the 28 individuals who made 88 observations during the September WiseH2O Water Quality Blitz. When making an observation, these individuals automatically became entered into the Blitz contest. We are currently determining the winners who will receive TU Swap. Winners will be notified by email by October 20th.

Current Blitz Stats	
Observations	88
Observers	28

Observations stats for September WiseH2O Water Quality Blitz

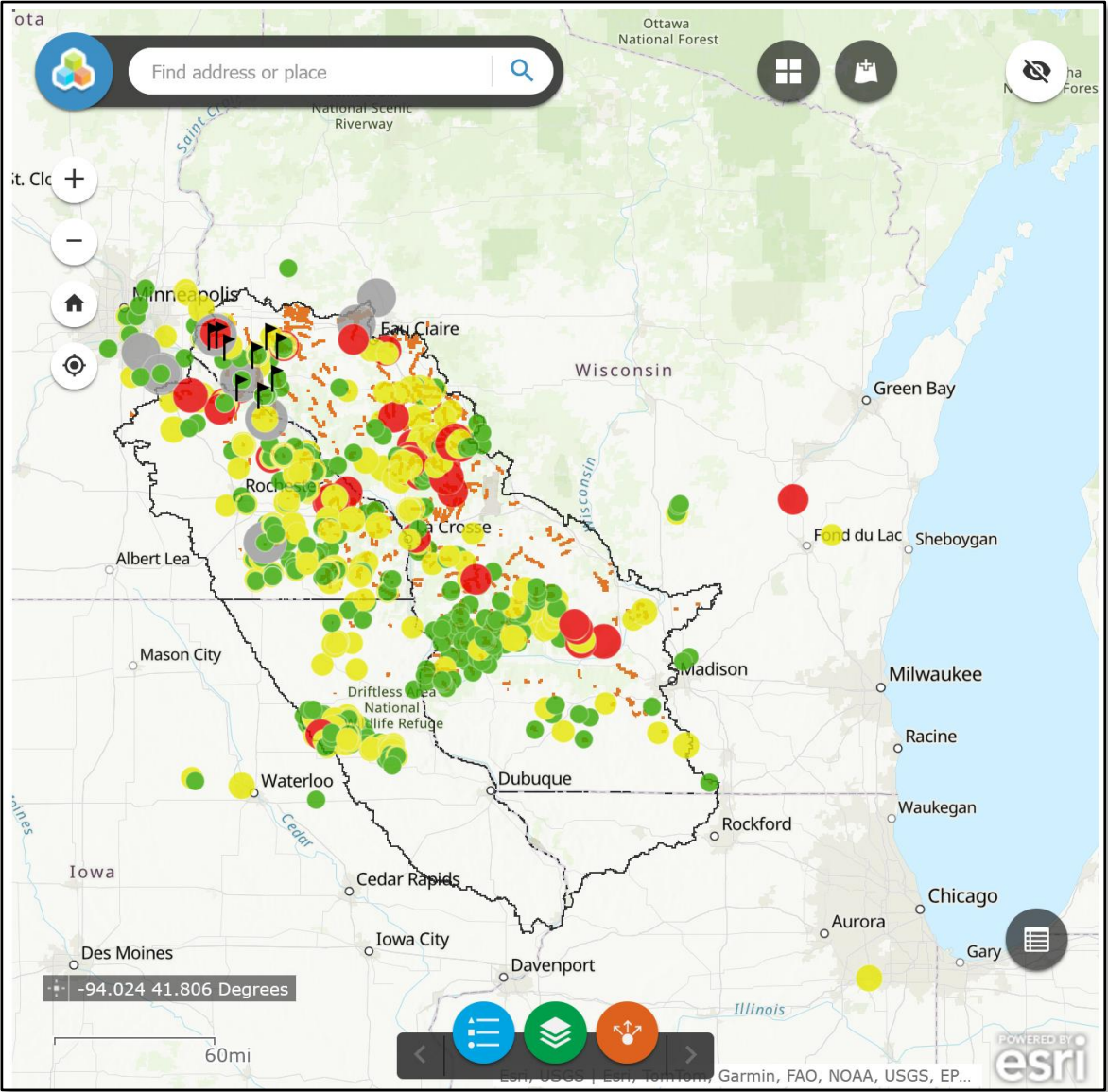
These observations really help in characterizing the water quality conditions



<https://www.mobileh2o.com/driftlessprogram>



Output: Trout Unlimited Visualization Tool



<https://www.mobileh2o.com/driftlessprogram>

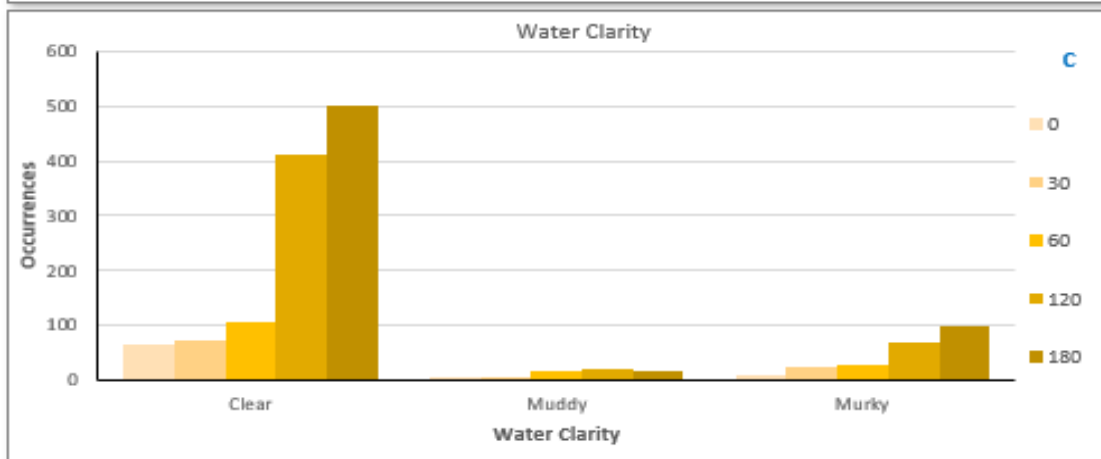
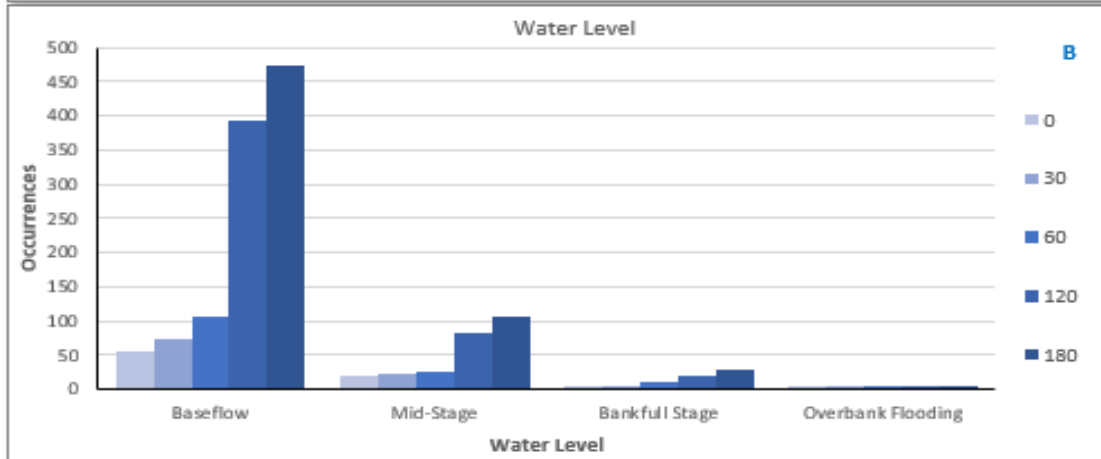
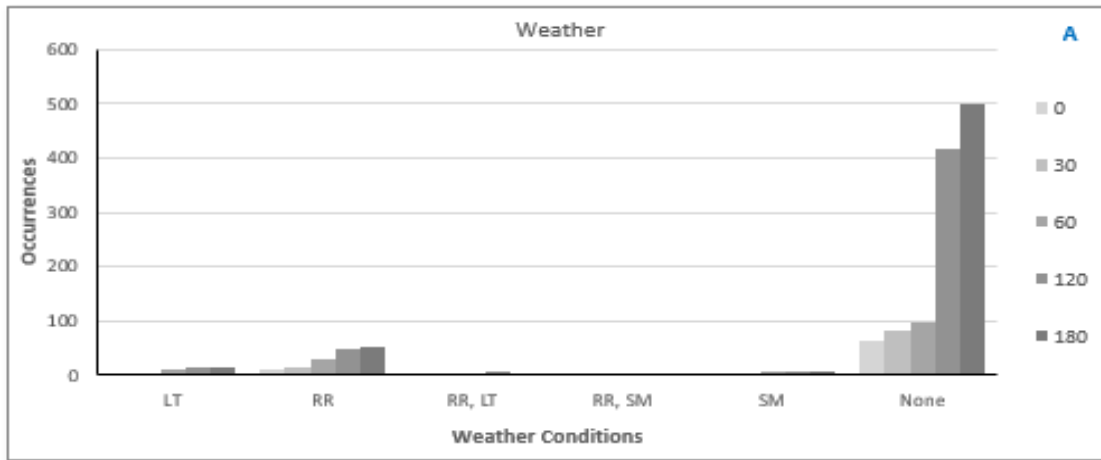


Output: TU DARE Database (MS EXCEL)

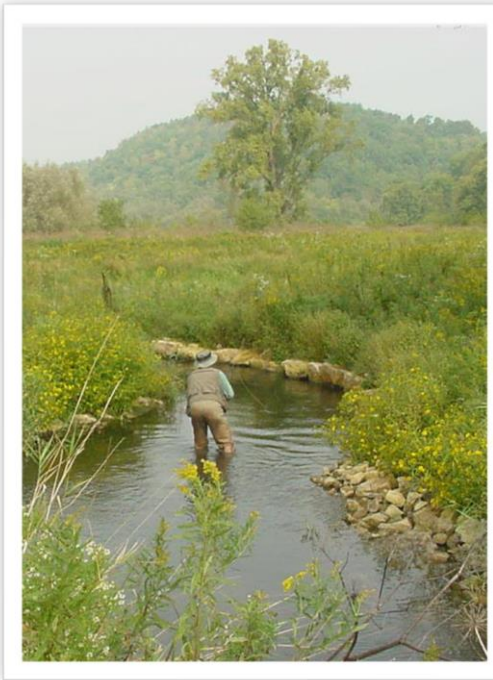
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	TU DARE Angler Science DB													
2	Database	Dev: DBParsing_231030_v01.xlsm												
3	Download	10/30/2023												
4	Observations	1849												
5	Year Load	2023												
6	Load Raw Data													
			UTC Correction											
			-6											
7	Database	ObsNo	Observation Date/Time-UTC	Observation Date/Time-Local	Observation Date-Local	Year	No.	ObserverID	Monitoring Site	Longitude	Latitude	Zonal	Photo No.	Photo Fl.
8	Dev: DBParsing_231030_v01.xlsm	MRNTYkhu8QIwuvK3HQb6	10/28/23 20:14	10/28/23 14:14	10/28/2023	2023	10	JxS3JH9frrZM0ZdJV8qFZYONE3P2		-92.32249335	44.70522929			0
9	Dev: DBParsing_231030_v01.xlsm	kfkil7sRs87KXyKERxY	10/28/23 19:48	10/28/23 13:48	10/28/2023	2023	10	JxS3JH9frrZM0ZdJV8qFZYONE3P2		-92.23901167	44.72865591			0
10	Dev: DBParsing_231030_v01.xlsm	xoPhcHXtYvS4kKwKB1	10/28/23 19:45	10/28/23 13:45	10/28/2023	2023	10	JxS3JH9frrZM0ZdJV8qFZYONE3P2		-92.23899518	44.72866522			0
11	Dev: DBParsing_231030_v01.xlsm	YJIKWVhS2ZPMIPu10IU4	10/27/23 21:05	10/27/23 15:05	10/27/2023	2023	10	bmxwg22L1hbcfniR6e24EvkK5u2		-93.1214565	45.081449			0
12	Dev: DBParsing_231030_v01.xlsm	vbxLDVBvtqXxYUvNASZk	10/27/23 19:05	10/27/23 13:05	10/27/2023	2023	10	VQ9bNtztGcXOEuaXrEAeyLFT103		-92.2940657	43.7281014			0
13	Dev: DBParsing_231030_v01.xlsm	6PNJtATmibspPEZcXmRY	10/27/23 18:28	10/27/23 12:28	10/27/2023	2023	10	VQ9bNtztGcXOEuaXrEAeyLFT103		-92.3421818	43.6030668			0
14	Dev: DBParsing_231030_v01.xlsm	rnRFKew2FTkiGixptDI	10/26/23 20:20	10/26/23 14:20	10/26/2023	2023	10	VQ9bNtztGcXOEuaXrEAeyLFT103		-91.5810877	43.6414112			0
15	Dev: DBParsing_231030_v01.xlsm	egyOxen07yNdurJTLtd	10/26/23 19:47	10/26/23 13:47	10/26/2023	2023	10	VQ9bNtztGcXOEuaXrEAeyLFT103		-91.3732213	43.60381			0
16	Dev: DBParsing_231030_v01.xlsm	b8IjWknc7s9eS45eX2ev	10/26/23 19:22	10/26/23 13:22	10/26/2023	2023	10	VQ9bNtztGcXOEuaXrEAeyLFT103		-91.4131015	43.540564			0
17	Dev: DBParsing_231030_v01.xlsm	Tvq6qW5whwvEJHNxS9vH	10/26/23 18:47	10/26/23 12:47	10/26/2023	2023	10	VQ9bNtztGcXOEuaXrEAeyLFT103		-91.5698377	43.5022716			0
18	Dev: DBParsing_231030_v01.xlsm	olmdVogbv0BRlYlWk74n	10/26/23 18:07	10/26/23 12:07	10/26/2023	2023	10	VQ9bNtztGcXOEuaXrEAeyLFT103		-91.8133731	43.5976344			0
19	Dev: DBParsing_231030_v01.xlsm	m0uFQXteJrglF9yDXXk	10/20/23 19:53	10/20/23 13:53	10/20/2023	2023	10	wOnBJTAV2CZK06CRnR5OUK45EDv1		-89.29856312	42.75131479	2023-10-20 14:53:1'		1
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21	Dev: DBParsing_231030_v01.xlsm	wcvwL0ayysZjPjalmKV	10/19/23 16:54	10/19/23 10:54	10/19/2023	2023	10	1KBGtvFeSbEVNlbt9Ehqt007u2		-91.91698638	42.46256234			0
22	Dev: DBParsing_231030_v01.xlsm	j9vSKOdrvHPyXW9XOUmv	10/17/23 17:46	10/17/23 11:46	10/17/2023	2023	10	7fp9e0NK1RTWOUXKfPn9oieJe1W2		-92.5046593	44.2664409	2023-10-17 12:46:0'		1
23	Dev: DBParsing_231030_v01.xlsm	9l8WlQmapp7mmCIPpau	10/16/23 20:42	10/16/23 14:42	10/16/2023	2023	10	wOnBJTAV2CZK06CRnR5OUK45EDv1		-89.3652347	43.95028523			1
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28	Dev: DBParsing_231030_v01.xlsm	Y3l6fosqGfUV5qnXowX3	10/15/23 19:29	10/15/23 13:29	10/15/2023	2023	10	VCf2q8lFBSOalbmxiMqir15xKfn2	Plum Creek @ Plum City Park	-92.18960356	44.63287698			0
29	Dev: DBParsing_231030_v01.xlsm	DReDL14L5UHEdMlMnb15	10/15/23 15:09	10/15/23 9:09	10/15/2023	2023	10	VCf2q8lFBSOalbmxiMqir15xKfn2	Pine Creek @ County Rd. AA	-92.28396142	44.54225052			0
30	Dev: DBParsing_231030_v01.xlsm	CtjA8lUndzYjMmutjKdZ	10/11/23 19:59	10/11/23 13:59	10/11/2023	2023	10	7fp9e0NK1RTWOUXKfPn9oieJe1W2		-90.8342297	43.6055385	2023-10-11 14:59:0'		1
31	Dev: DBParsing_231030_v01.xlsm	q058dK62NGGMqRkXdyR	10/11/23 19:13	10/11/23 13:13	10/11/2023	2023	10	7fp9e0NK1RTWOUXKfPn9oieJe1W2		-90.8449307	43.5431262	2023-10-11 14:13:1'		1
32	Dev: DBParsing_231030_v01.xlsm	JG6KlIa2280wsZAnz2r	10/11/23 18:53	10/11/23 12:53	10/11/2023	2023	10	7fp9e0NK1RTWOUXKfPn9oieJe1W2		-90.8273976	43.5595381	2023-10-11 13:53:3'		1
33	Dev: DBParsing_231030_v01.xlsm	sxa6Xgm7Oxka13uYqLB	10/11/23 18:24	10/11/23 12:24	10/11/2023	2023	10	wOnBJTAV2CZK06CRnR5OUK45EDv1		-89.9858827	42.89303153	2023-10-11 13:24:1'		1
34	Dev: DBParsing_231030_v01.xlsm	z0GHk7C9XVfUEZzXwK6C	10/11/23 18:11	10/11/23 12:11	10/11/2023	2023	10	wOnBJTAV2CZK06CRnR5OUK45EDv1		-89.98566394	42.89315569	2023-10-11 13:11:1'		1
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36	Dev: DBParsing_231030_v01.xlsm	psi4oTl03xuoHaGU8Pnu	10/11/23 14:17	10/11/23 8:17	10/11/2023	2023	10	5E4Yqji6nO193vOJEyE5nV3v33		-92.382459	43.6874041			0
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39	Dev: DBParsing_231030_v01.xlsm	OnkxUWpHfZzX9mHyBCG	10/10/23 16:56	10/10/23 10:56	10/10/2023	2023	10	5E4Yqji6nO193vOJEyE5nV3v33		-92.8096531	45.0759822			0
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41	Dev: DBParsing_231030_v01.xlsm	YhoSyrGtBqe2pmywA3PG	10/10/23 15:46	10/10/23 9:46	10/10/2023	2023	10	5E4Yqji6nO193vOJEyE5nV3v33		-92.8443317	45.0707242			0
42	Dev: DBParsing_231030_v01.xlsm	RzuiImnUoW743lIal7hI	10/10/23 14:48	10/10/23 8:48	10/10/2023	2023	10	5E4Yqji6nO193vOJEyE5nV3v33		-92.8443643	45.0707216			0



Hardness Concentrations (ppm)



Output: Driftless Area Angler Science Reports





Driftless Area Angler Science: 2020 Annual Report

Carter Borden (MobileH2O, LLC)
Kent Johnson (Trout Unlimited)
Dan Dauwalter (Trout Unlimited)







July 2021







Output: Report Analysis of WQ Conditions

Analyte	Water Quality Summary ^a	Fishery Condition	Trout and Coldwater Ecosystem Impacts
Alkalinity [ppm CaCO ₃]	Min: 0 Median: 80 Max: 240 N: 72		High alkalinity concentrations provide buffering capacity to offset increasing acid levels (decreasing pH) in streams [1]. Pierce County trout streams have higher alkalinity concentrations, so are less likely to become acidic (Table 5).
Hardness [ppm CaCO ₃]	Min: 0 Median: 60 Max: 180 N: 72		Lower hardness concentrations can increase the toxicity of some metals (e.g. Cd, Hg) in fish [1]. Based on the higher hardness concentrations observed, Pierce County trout streams exhibit moderately hard to hard water conditions (Table 8).

Alkalinity Impact on Trout and Coldwater Ecosystems

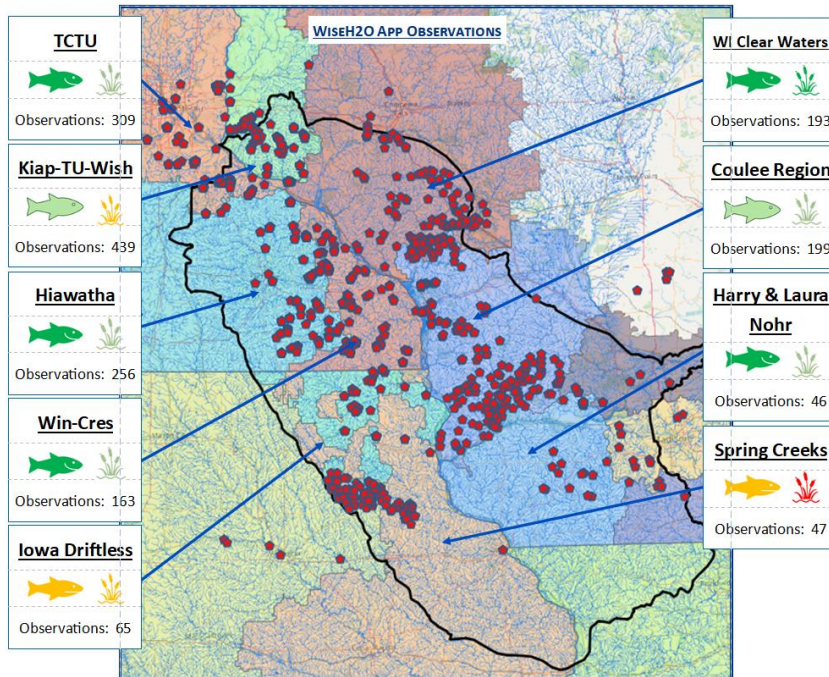
Bin Value (ppm)	Fishery Condition ^a	Trout and Coldwater Ecosystem Impacts
0		<i>Direct:</i> Low alkalinity concentrations may increase the uptake of trace metals (e.g. cadmium) in fish.
40		<i>Habitat/Prey:</i> Streams with lower alkalinity concentrations are more susceptible to acidic shocks from wastewater discharges, agricultural runoff, and acid rainfall.
80		<i>Direct:</i> No direct impact from alkalinity.
120		<i>Habitat/Prey:</i> Higher alkalinity concentrations in streams create a greater buffering capacity against acidic stressors, such as wastewater discharges, agricultural runoff, and acid rainfall.
180		
240		

^a Fisheries condition:  Good  Fair  Poor  Lethal

Output: Driftless Area Scorecard



During the 2020-2023 fishing seasons, 1788 observations of **water quality** and **habitat conditions** were made in the Trout Unlimited Driftless Area Angler Science Program. Primary issues addressed by the study include nutrient loading, stream temperatures, and stream disturbances. This scorecard summarizes the overall fisheries conditions from observations and if habitat issues were locating TU involvement can benefit the regional fisheries.



INDICATORS



Overall Conditions



Habitat Issues

INDICATOR CONDITIONS



Poor



Average



Good



Great



ISSUES AND ACTIONS

DRIFTLESS AREA TU CHAPTERS	NUTRIENTS	WATER TEMP.	STREAM DISTURBANCE	ISSUES /RESTORATION POTENTIAL
Kiap-TU-WISH				Bank erosion located opportunities for stream restoration and Trash involves cleanup projects.
TUTC				Excess nutrients: Few observations with high NO3/orthophosphate (Opportunity increase stream buffer zones width). Bank erosion observations identified for stream restoration.
Hiawatha				Excess nutrients: Few observations with high NO3/orthophosphate (Opportunity increase stream buffer zones width). Bank erosion observations identified for stream restoration.
WI. Clear Water				Bank erosion and fish barriers located opportunities for stream restoration and barrier removal.
Win-Cres				Bank erosion and fish barriers located opportunities for stream restoration and barrier removal.
Coulee Region				Bank erosion and fish barriers located opportunities for stream restoration and barrier removal.
Iowa Driftless				Excess nutrients: Few observations with high NO3/orthophosphate (Opportunity increase stream buffer zones width). Bank erosion located opportunities for stream restoration and Trash involves cleanup projects.
Harry & Laura Nohr				Bank erosion and fish barriers located opportunities for stream restoration and barrier removal. Livestock in water degrades stream bank vegetation.
Spring Creeks				Bank erosion and fish barriers located opportunities for stream restoration and barrier removal. Livestock in water degrades banks.

ABOUT THE DATA: The assessment is based on 1788 observations made throughout the Driftless Area using the WiseH2O™ app. Observation information reported by the app includes alkalinity, hardness, nitrate, nitrite, orthophosphate, pH, water temperature and clarity, and stream disturbances. Information is posted to the cloud, allowing water quality screening data to be crowd-sourced across broad geographies



GET INVOLVED: You're going to be out fishing, so while streamside why not help TU characterize water quality conditions and identify stream disturbances throughout the Driftless Area by making an observation with the WiseH2O App. Not already participating? Visit the project page on the MobileH2O website to find out more: <https://www.mobileh2o.com/driftlessprogram>. Or contact Dan Dauwalter (Daniel.Dauwalter@tu.org) or Carter Borden (carter@mobileh2o.com).

SPONSORS The Driftless Area Angler Science Program are made possible through the generous support of the U.S. Fish & Wildlife Service (USFWS), TU's Driftless Area Restoration Effort, and the National Fish and Wildlife Foundation with participation by numerous Trout Unlimited chapters, state councils and individuals, Minnesota DNR, and Wisconsin DNR.

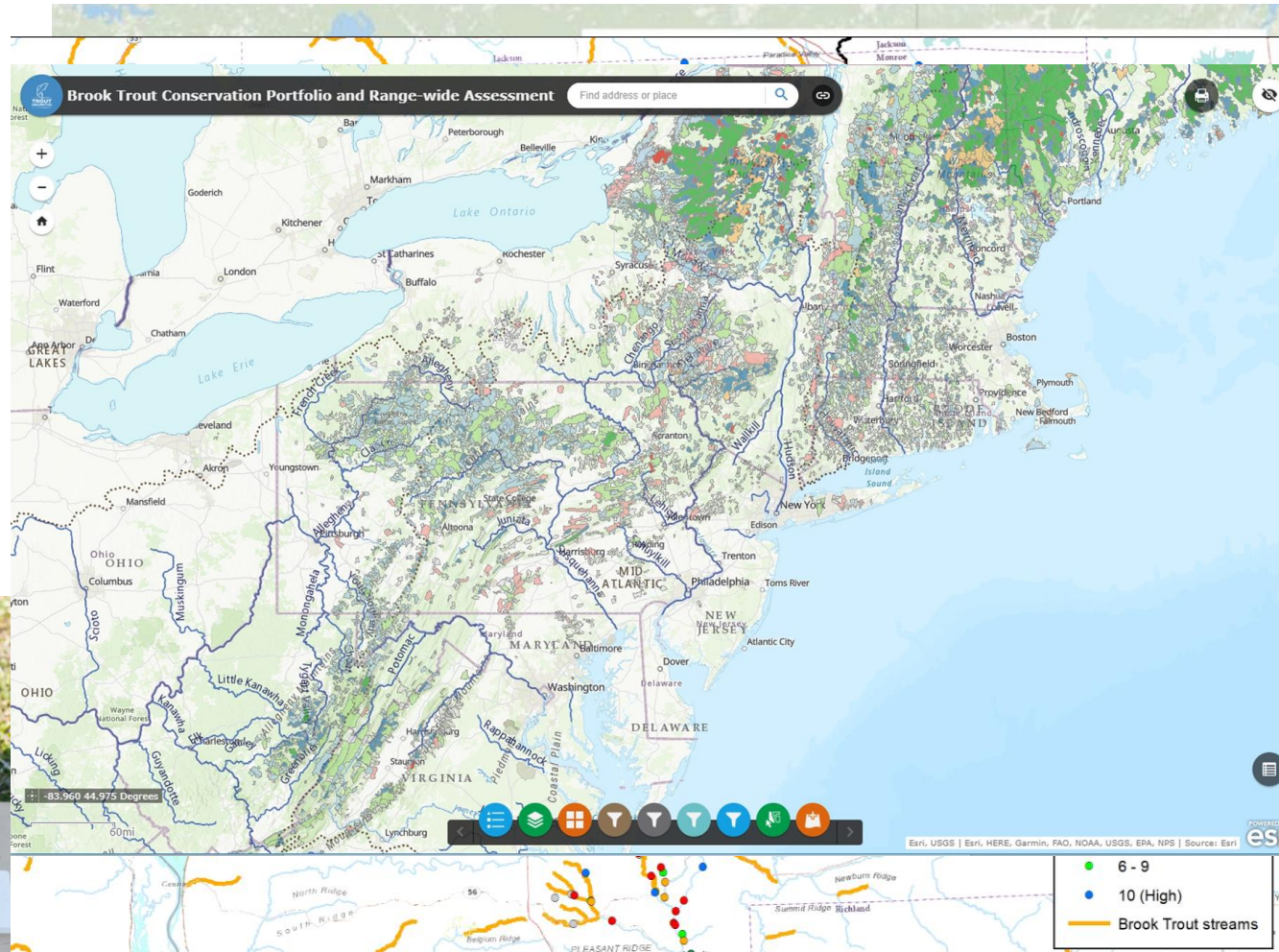


Putting Data to Use: Brook Trout Conservation Portfolio

Culvert Surveys (2023 – 2024)



WiseH2O Water Quality (2019 – 2024)



Online Resources

www.MobileH2O.com

- How to use the app ([WiseH2O App](#))
 - *Videos*
 - *How to manual*
- “Get Started Guide” individuals/groups: ([Projects=>Angler Science Report](#))
- Monitoring Plan Development: ([Projects=>2019 Angler Science Report](#))
- Driftless Angler Program ([Projects](#))
 - *2019-2023 Angler Science in the Driftless Area*
 - *Angler Science Driftless Area Program*
 - *Driftless Area Score Card*
 - *Database & documentation*
- Overview of Crowdsourcing ([Projects](#))
- More strips: ([Shop](#))
- Education
 - *Blog*
 - *WQ issues: Issues (in progress)*

<https://www.mobileh2o.com/driftlessprogram>



Troubleshooting the App

Online Help

App => Tutorials

- *How to Guide*



www.MobileH2O.com => [WiseH2O App](#)

- *Videos*
- *How to Guide*

Direct Help

Carter Borden (208) 972-7906 carter@mobileh2o.com

Dan Dauwalter (208) 345-8339 Daniel.Dauwalter@tu.org

2024 Goals

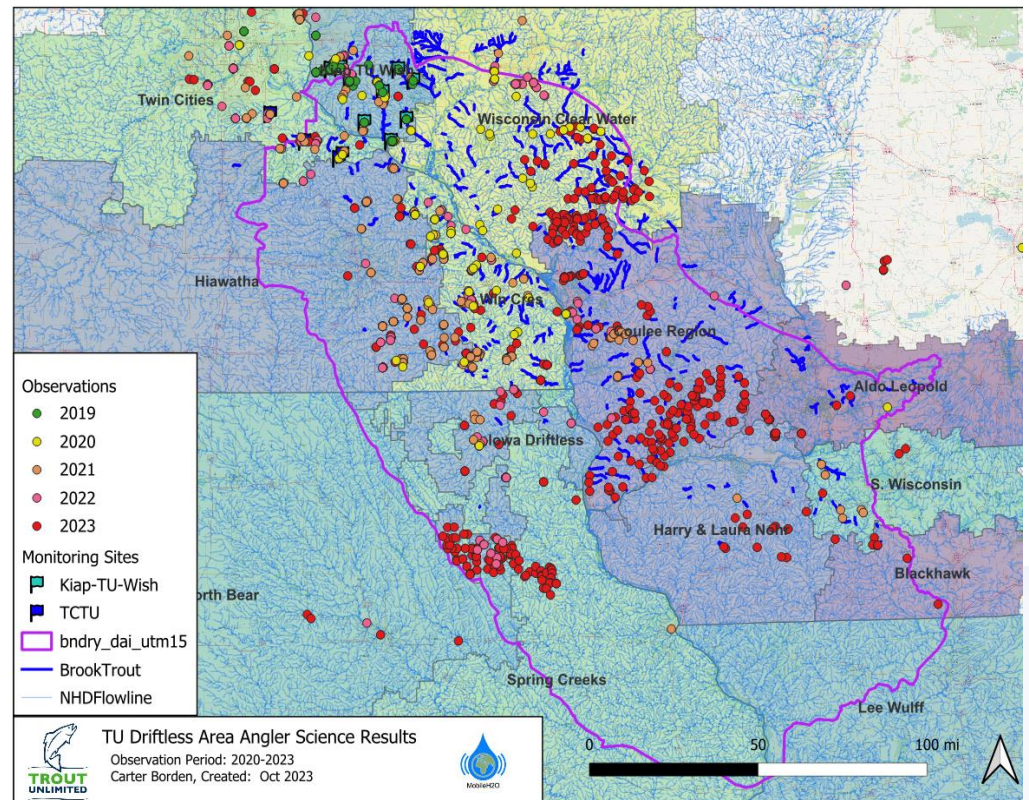
- Maintain level of observations in northern Driftless
- Expand TU Chapters, Organizations in the Driftless
- >2750 observations
- Spatially cover all Driftless
- Post goals/monitoring status online

DRIFTLESS AREA OBSERVATIONS

2020-24 Observations (as of Oct 31st)

	Overall	Number	Percentage
Target		2750	100%
Observations		1849	67%
Remaining		901	33%

67%



Angler Observations Locations (1849 obs)

Zumbro River tributaries
Root River watershed abv
Whalan
Harmony area streams

Sauk County
Monroe County
Buffalo County
Eau Claire County
Dunn County

Jones County
Jackson County
northern Clinton County

Lowery Creek
Black Earth Creek
Williams Barneveld Ck
Smith Conley Creek
Pompey Pillar Creek

- Brook Trout Streams Obs
- GIS-TUDA231030a
- bndry_dai_utm15
- BrookTrout



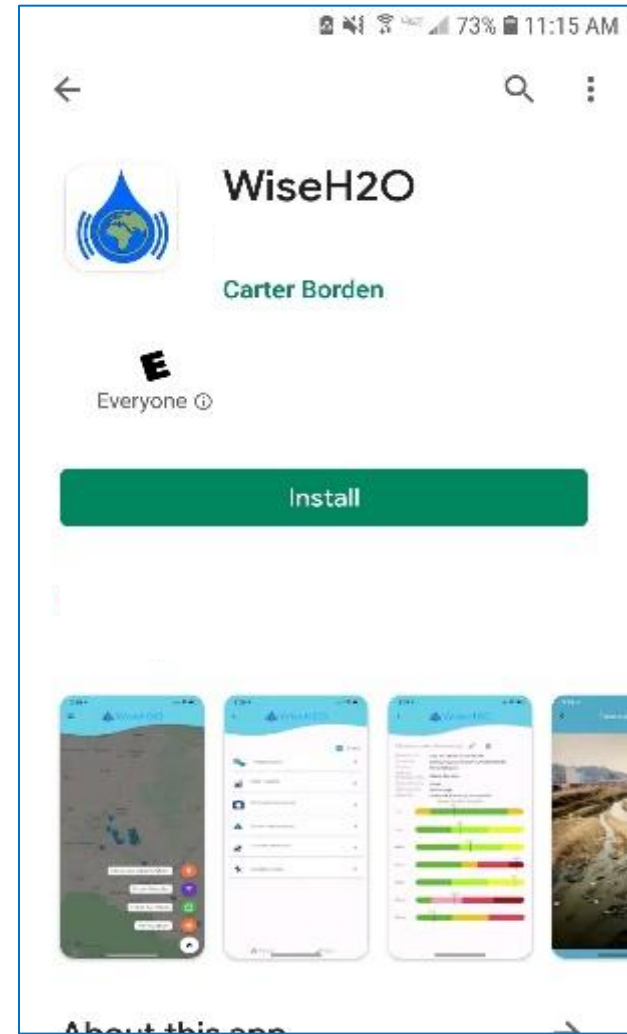
TU Driftless Area Angler Science Results

Observation Period: 2020-2023
Carter Borden, Created: Oct 2023

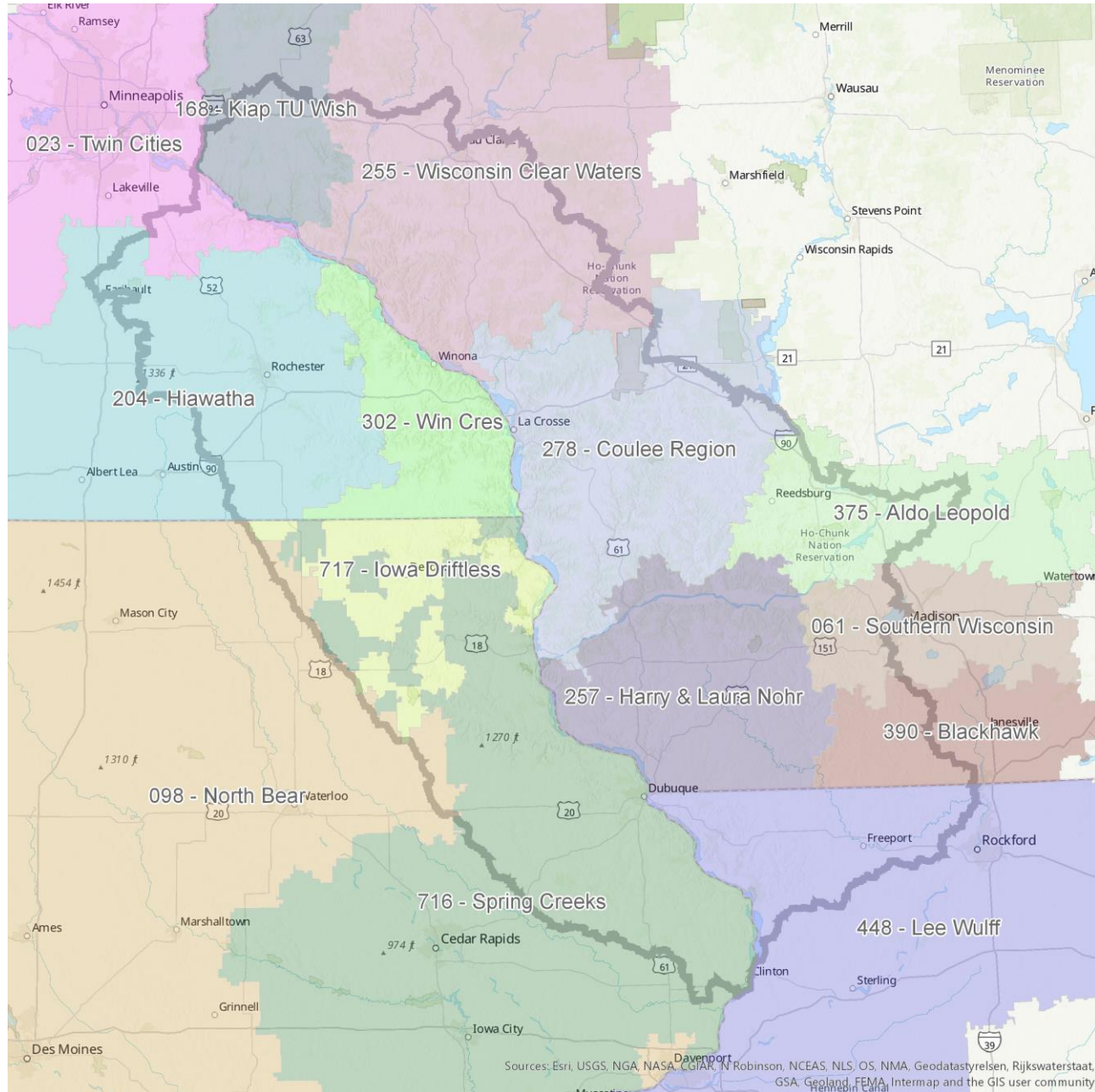


Getting Involved: Individuals

1. Download the WiseH2O App
2. Review online training
3. Obtain water quality test kits
4. Register affiliation (optional)
5. Get sampling/learn



TU Chapters: Driftless Area



Getting Involved: TU Chapter/Organizations

1. Select a Group Liaison
2. Solicit Participants
3. Download the WiseH2O App
4. Review online training
5. Obtain water quality test kits
6. Develop a monitoring plan (optional)
7. Participants register affiliation (optional)
8. Get sampling

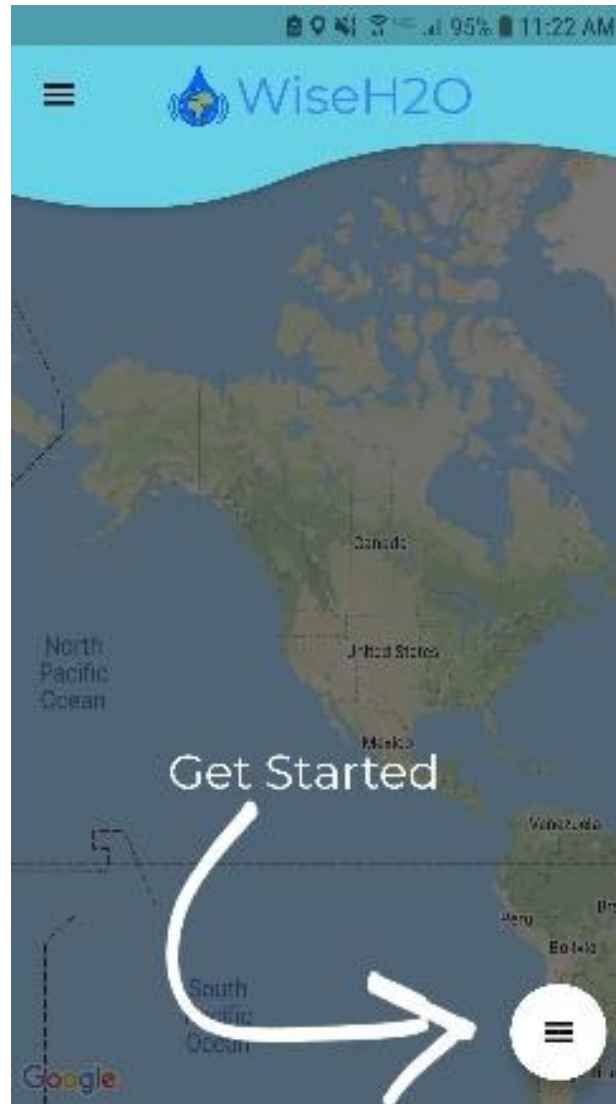


Programs Sponsors



Questions?





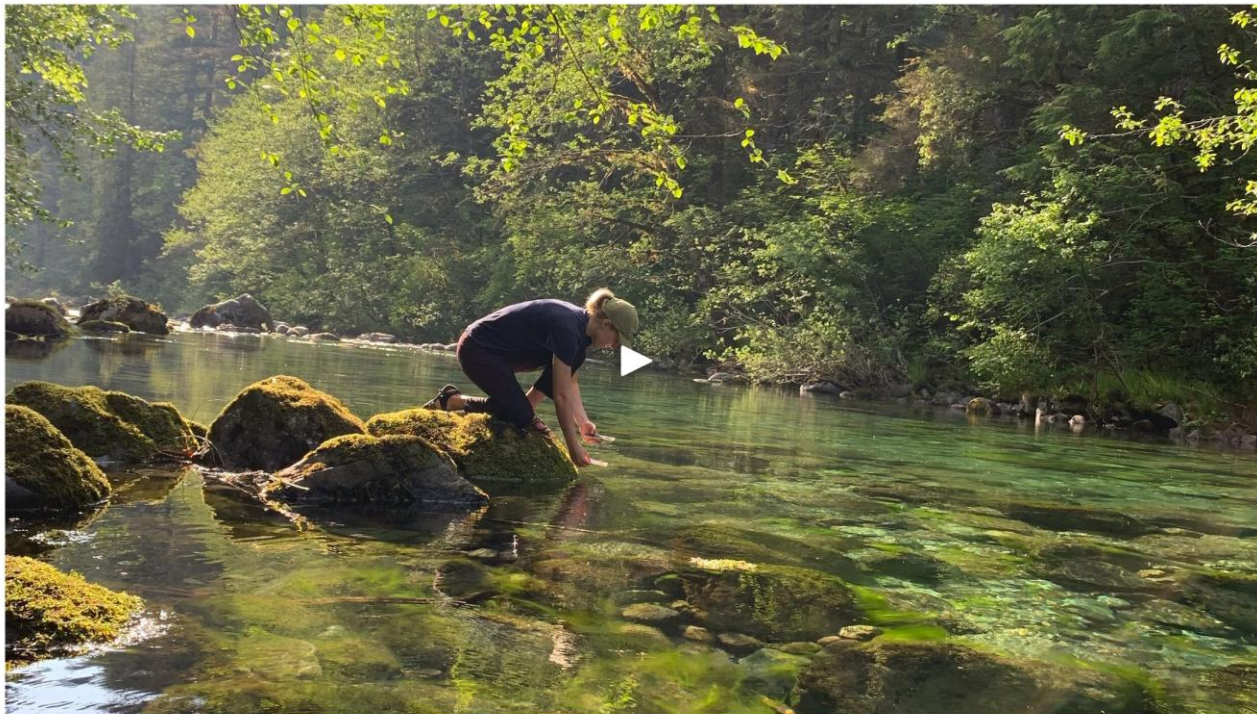
WiseH2O_{TM} Intro



WiseH2O: User Guide & Tutorials



CLICK HERE TO LEARN HOW TO DOWNLOAD AND USE THE WISEH2O™ APP

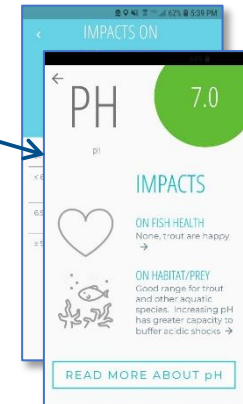
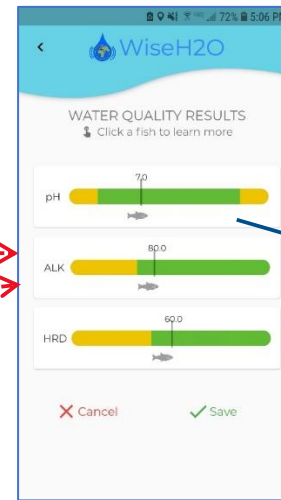
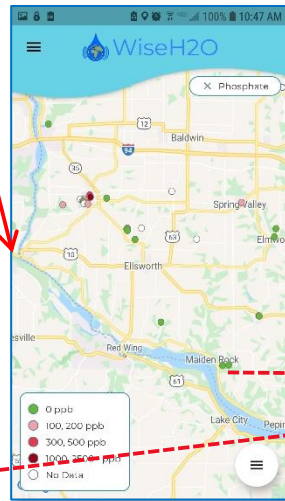
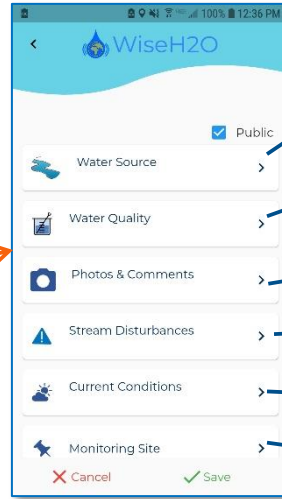
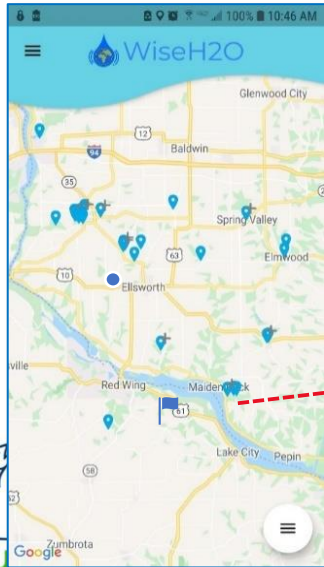
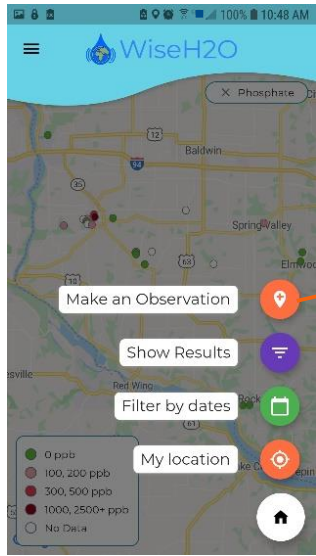


Tutorial for the WiseH2O app

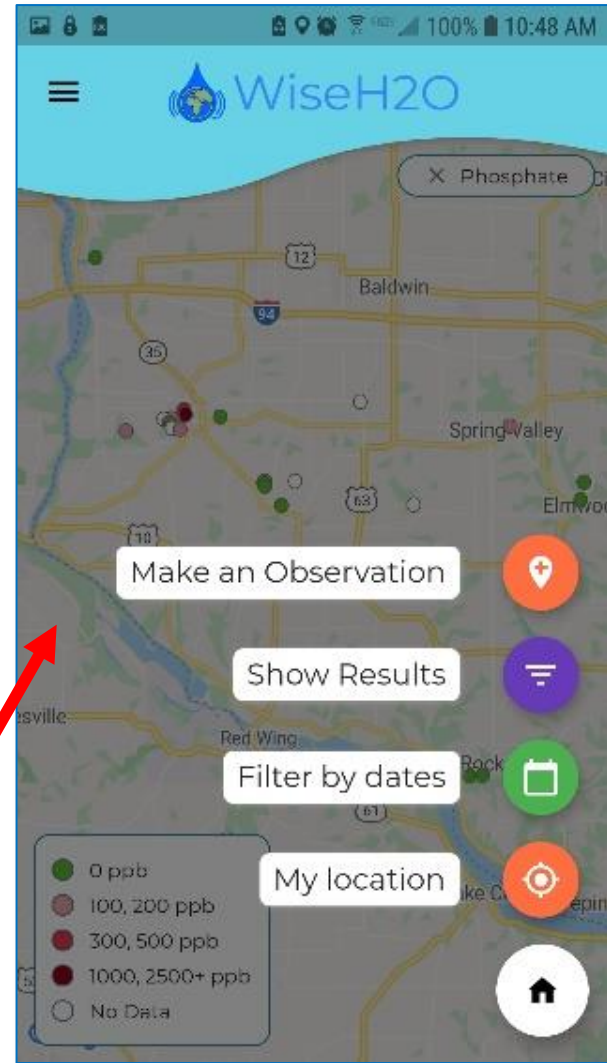
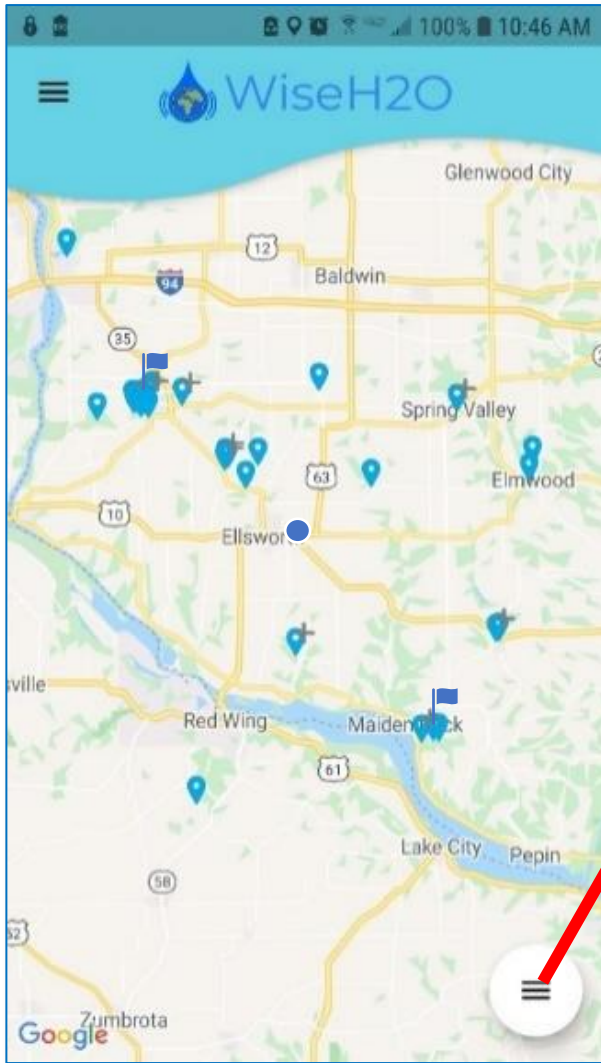
<https://www.mobileh2o.com/mh2oapp/>



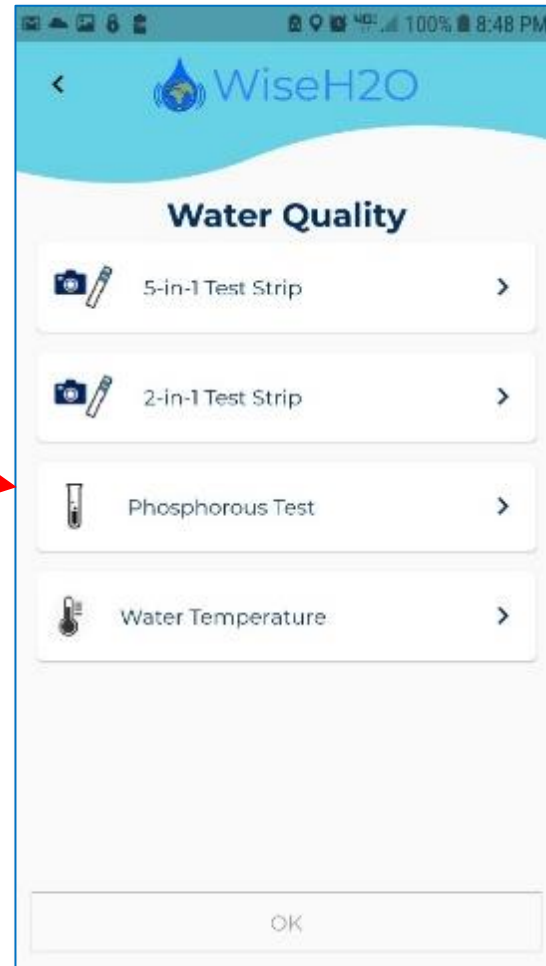
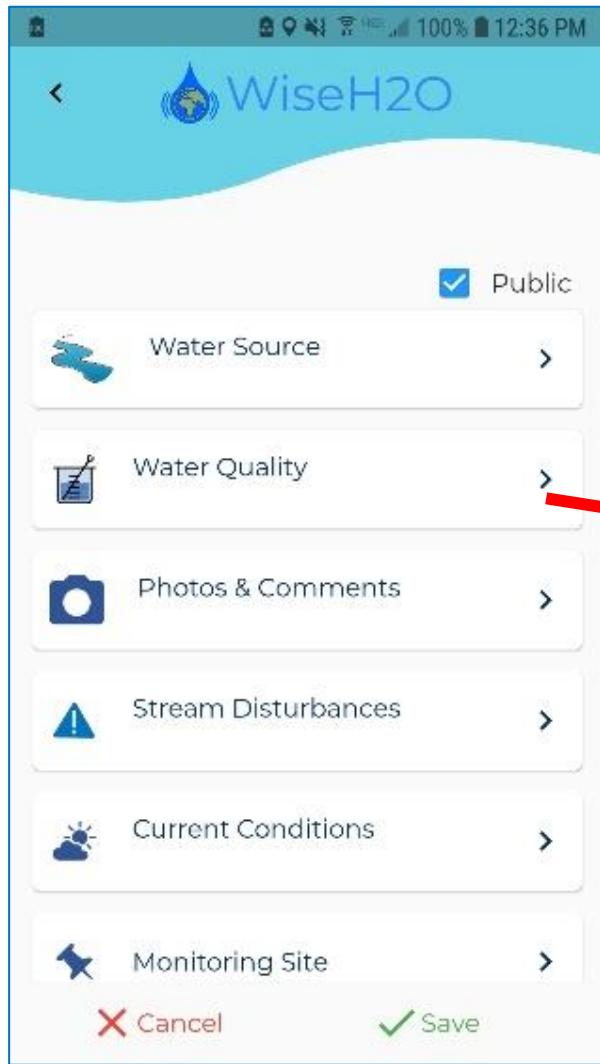
WiseH2O: mApp Overview



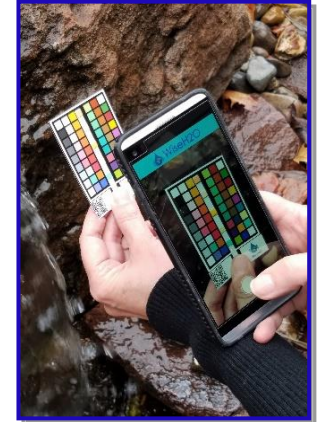
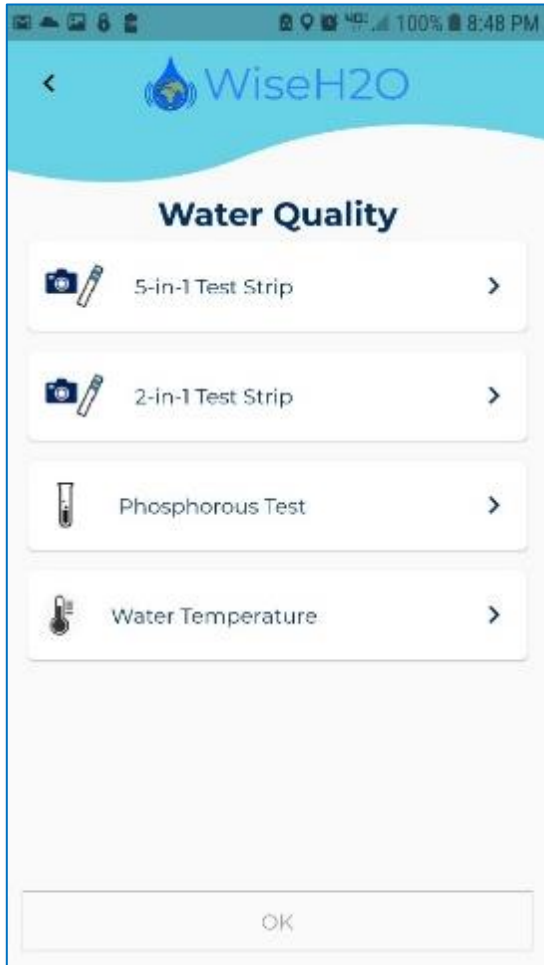
WiseH2O: Home/Option Pages



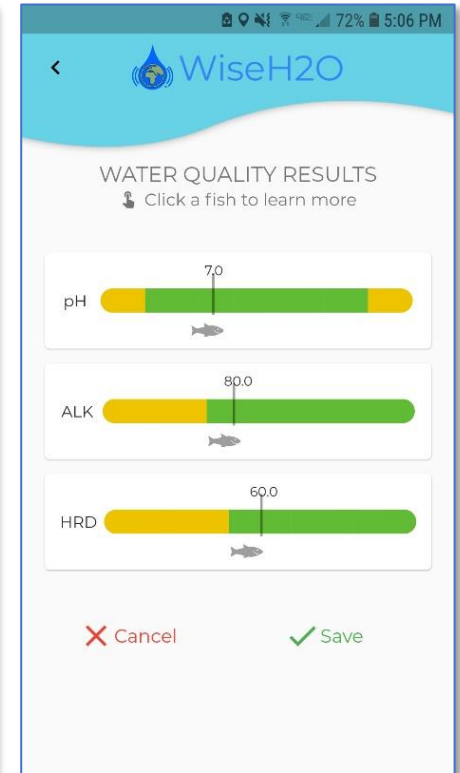
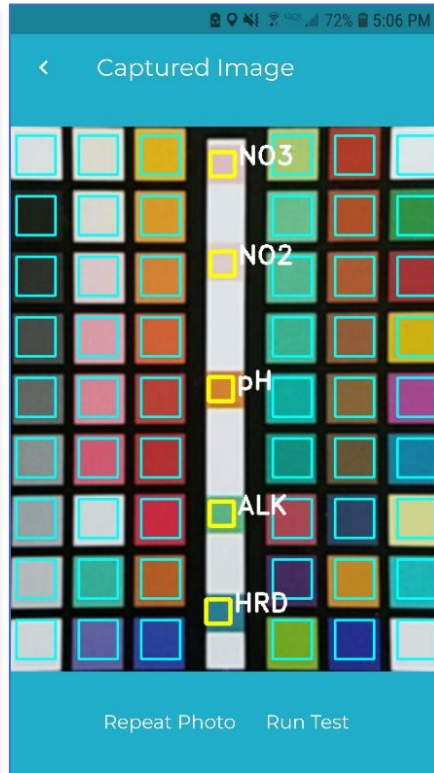
WiseH2O: Observation



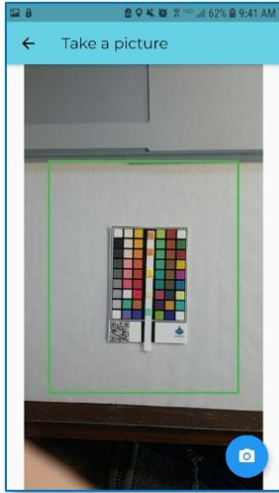
WiseH2O: Water Quality



WiseH2O: 5n1, 2n1 Strips



WiseH2O: Image Capture Best Practices



Camera too far away



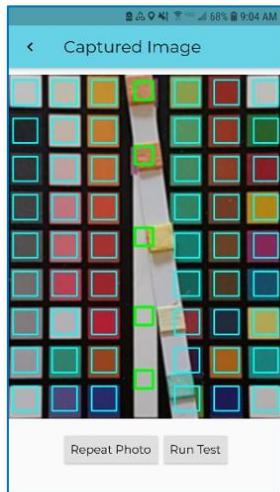
Camera too close



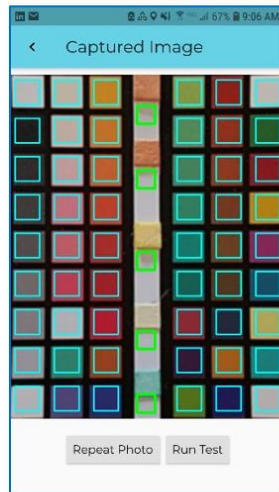
Strip not aligned



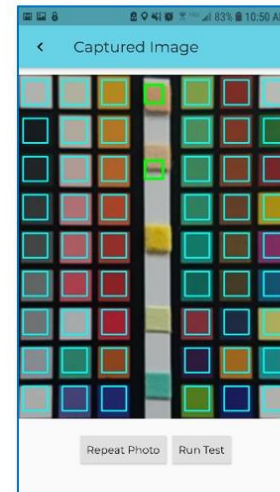
Shadow across image.
Take photo in full shade.



Test strip not aligned

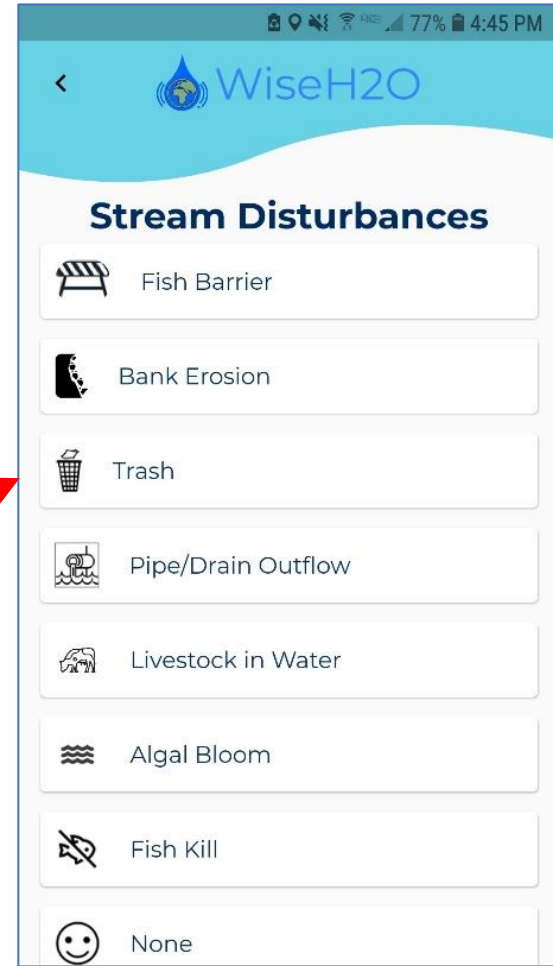
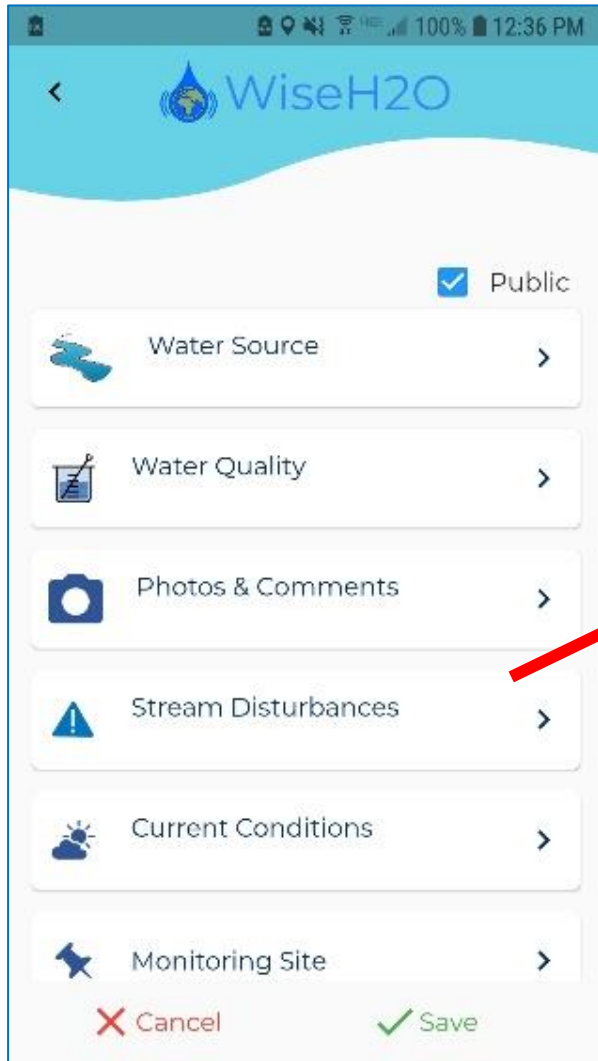


Test strip pads not aligned

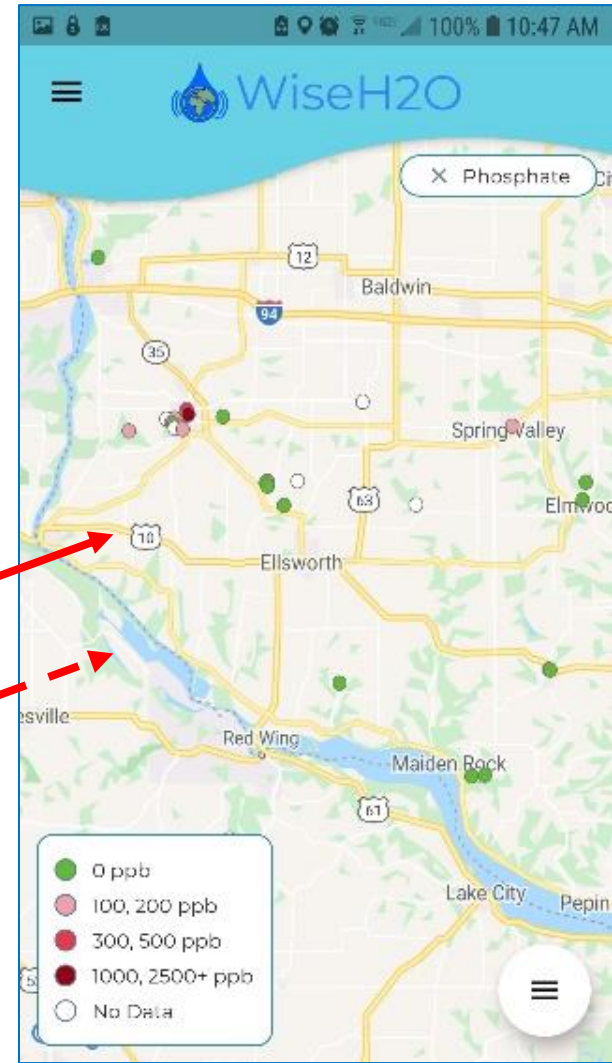
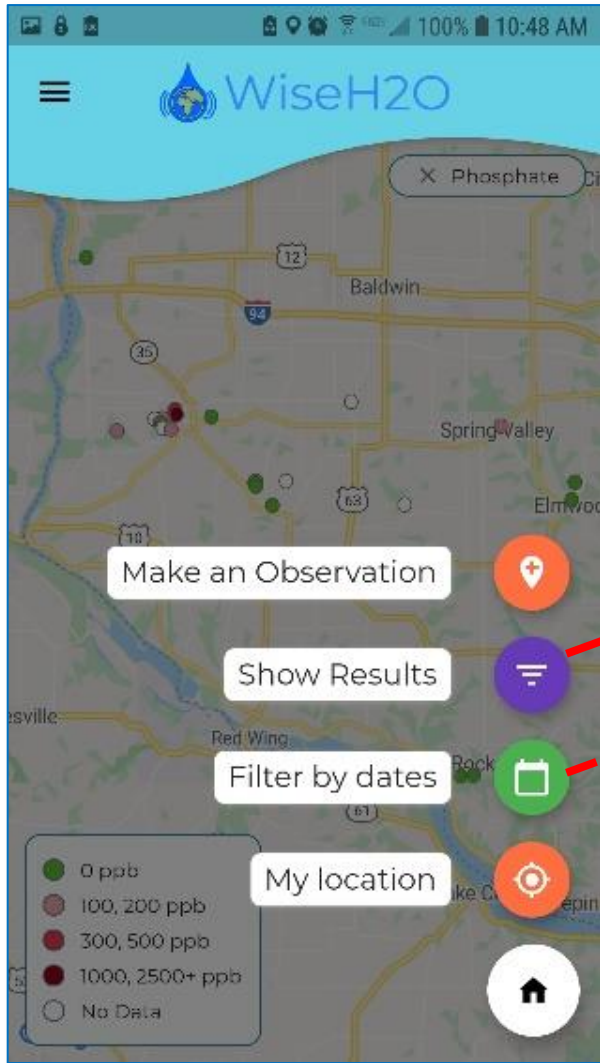


Wrong test! Calibration boxes
must match test pads. Switch
tests.

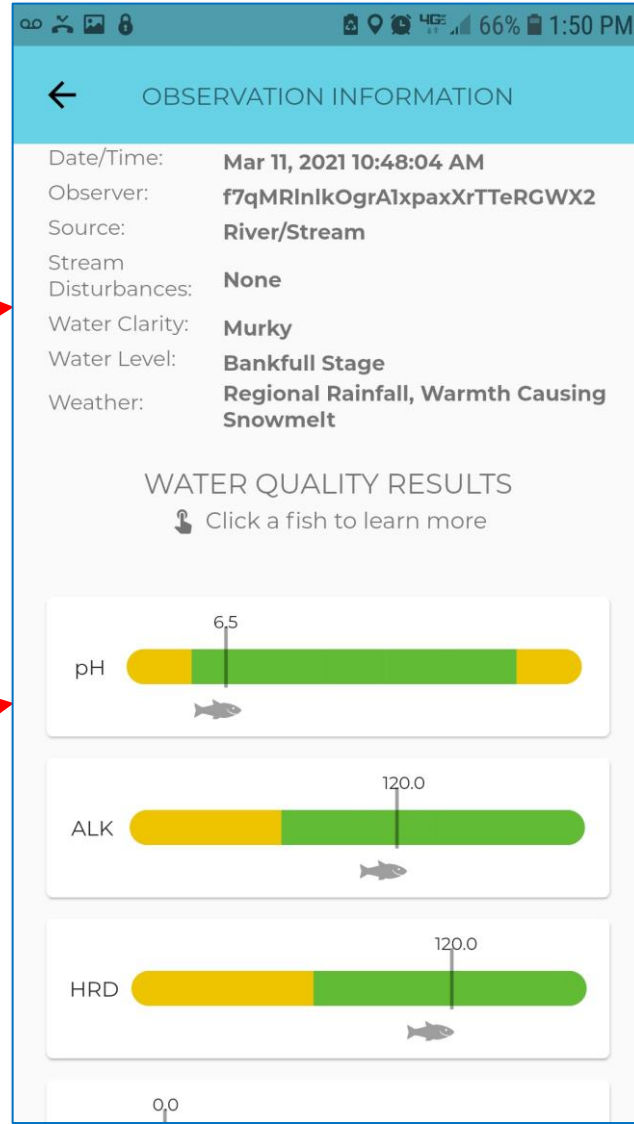
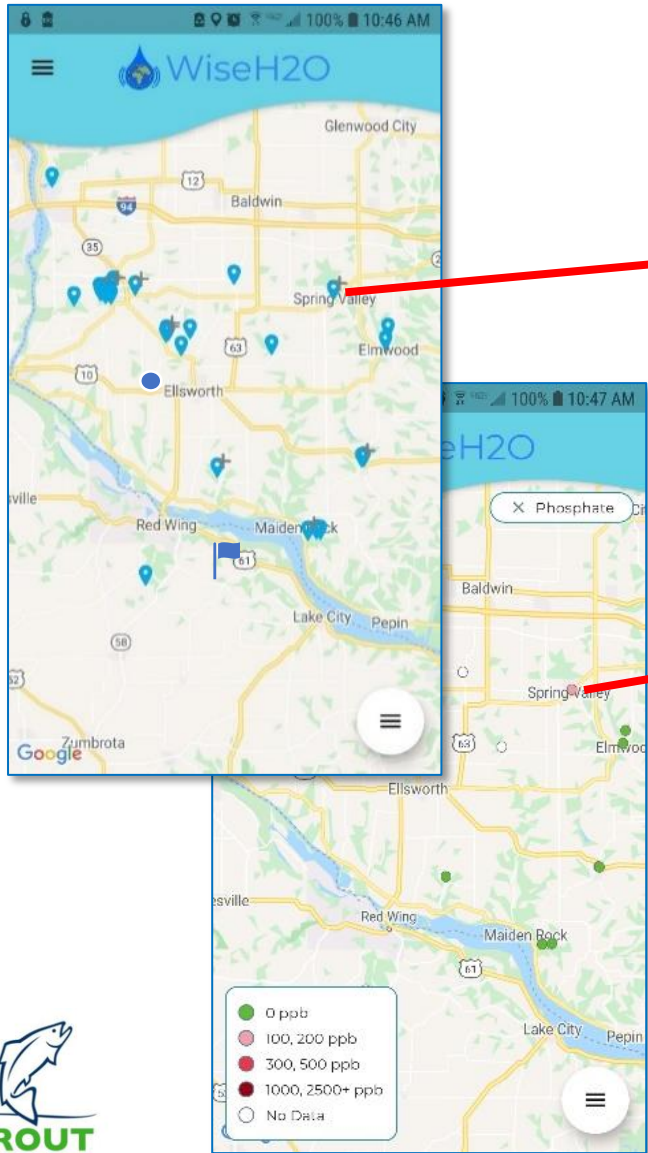
WiseH2O: Observation



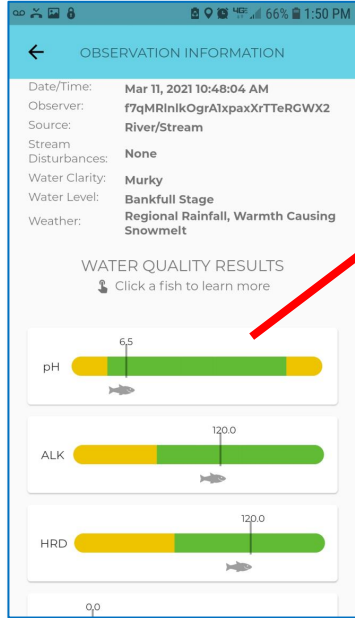
WiseH2O: Regional Results



WiseH2O: Site Results



WiseH2O: Educational



PH
pH

7.0

IMPACTS

ON FISH HEALTH
None, trout are happy →

ON HABITAT/PREY
Good range for trout and other aquatic species. Increasing pH has greater capacity to buffer acidic shocks →

[READ MORE ABOUT pH](#)

IMPACTS ON FISH HEALTH

Bin Value	Trout Health	Trout Health Impacts
≤ 6.0	Fair	Trout become vulnerable to fungal infections and heavy metals
6.5 – 8.5	Good	None, trout are happy
≥ 9.0	Fair	Trout die at pH levels above 9.6

pH

Water acidity and alkalinity are influenced by underlying geologic composition, nearby soils, precipitation events, and human activities (e.g., mining, agricultural runoff, industrial discharge). Precipitation is slightly acidic from its interaction with CO₂ in the atmosphere (average pH ~ 5.6 pristine conditions). As this acidic precipitation percolates through the underlying soils and rocks, it dissolves minerals that alter water chemistry and change pH.

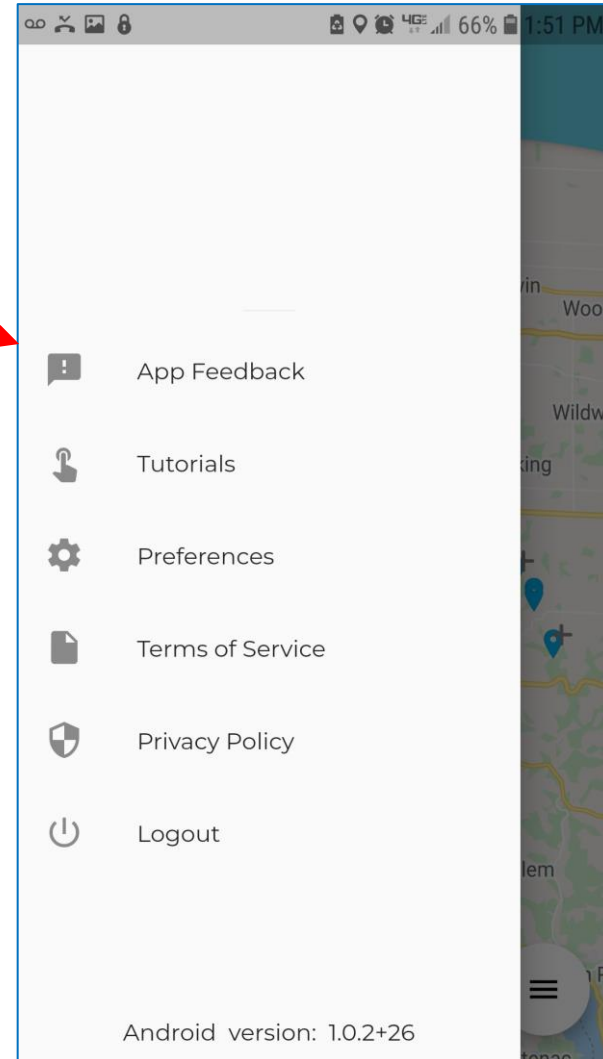
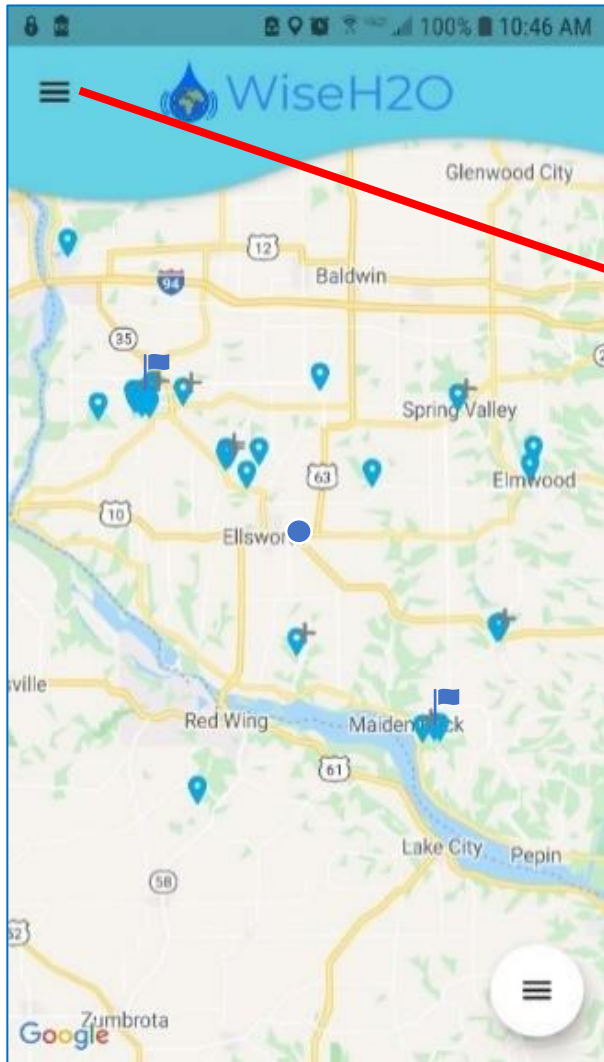
Fish Health: Low pH levels, trout are vulnerable to fungal infections and toxicity from heavy metals and ammonia. High pH levels are lethal to

IMPACTS ON HABITAT/PREY

Bin Value	Ecosystem Conditions	Aquatic Ecosystem Impacts
≤ 6.0	Fair	Trout habitat is susceptible to acidic shocks
6.5 – 9.0	Good	Good range for trout and other aquatic species. Increasing pH has greater capacity to buffer acidic shocks



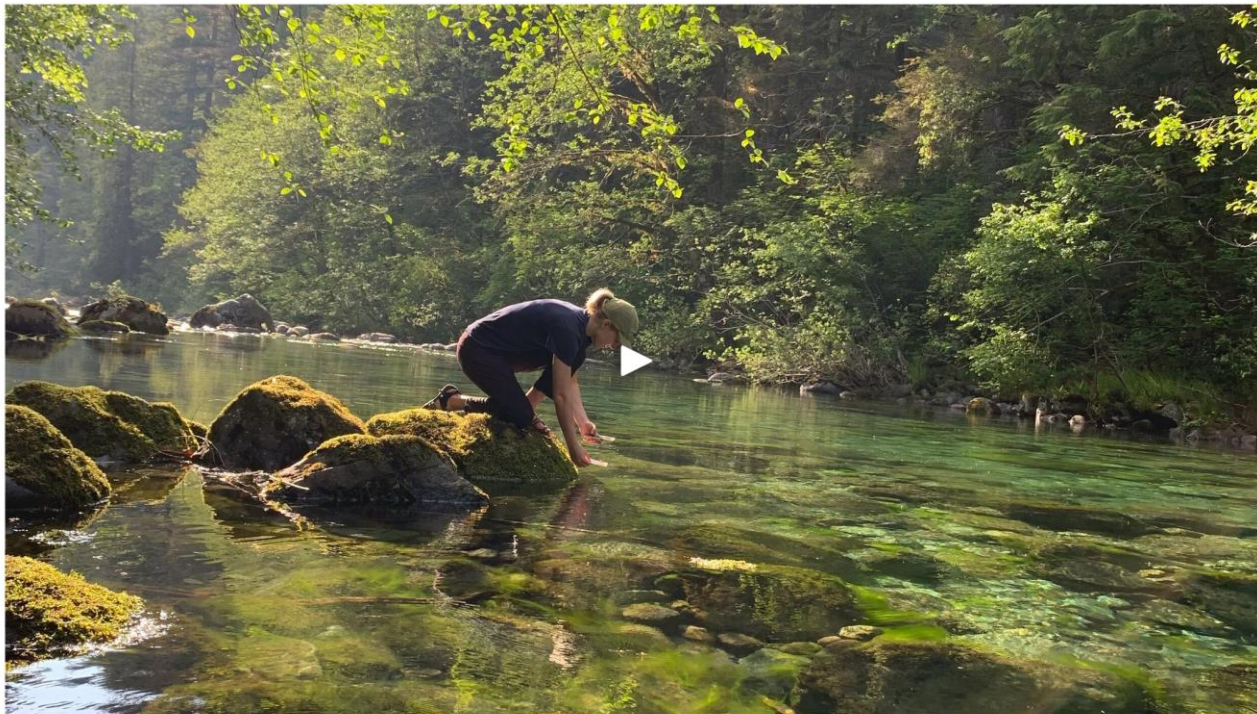
WiseH2O: Preferences



WiseH2O: User Guide & Tutorials



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<https://www.mobileh2o.com/mh2oapp/>

