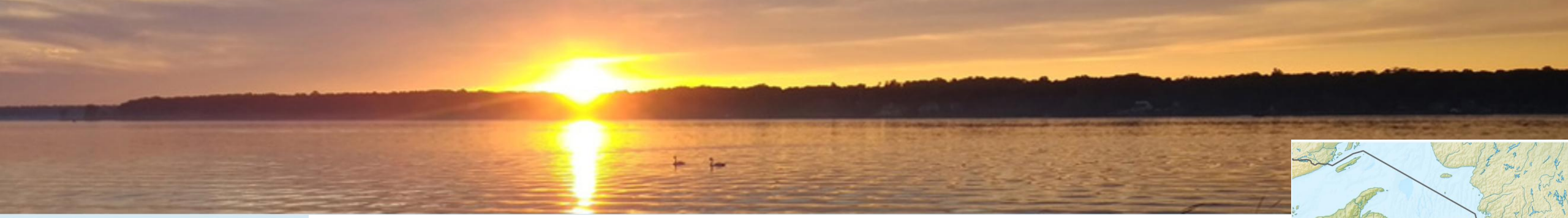


2025 White Lake Smart Buoy Updates & Data Analysis

(Using 1st full season of buoy data, Jun 6-Oct 12, comparing with 2024 GVSU/AWRI & CLMP Data)

Jim DeBoer – Chief Science Officer (CSO)

White Lake Association (WLA)

December 3, 2025

WLA Smart Buoy – Upgrades for 2026

- Thanks to an additional "Smart Buoy Upgrade" grant from EGLE ($6227, contract just completed), we will be adding the following sensors to our WLA Smart Buoy in 2026:
  - **Conductivity** – Measurement of dissolved salts from non-point source runoff
  - **Turbidity** – Measurement of sediment suspension, relative water visibility/clarity
  - **pH** – Measurement of acidic or basic tendencies of the water over the course of the season
- The upgrade grant also funded a "mid-depth" dissolved oxygen sensor rigging and data cable
  - This will enable us to move our bottom D.O. sensor to mid-depth once oxygen is depleted at the bottom OR add a 3rd dissolved oxygen sensor in the future (as funding allows)

White Lake Smart Buoy (above),
EXO Sonde Sensor Suite Example (belo

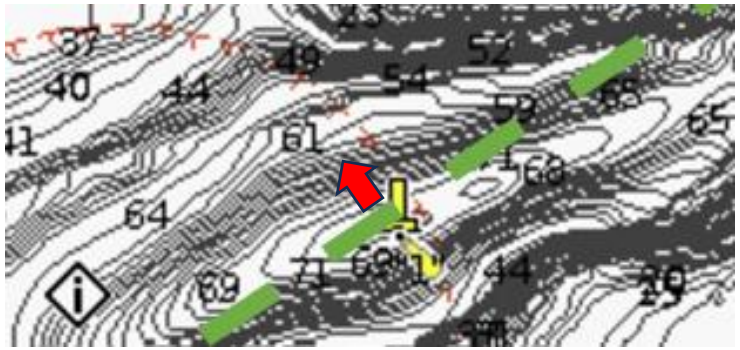
EXO pH, Turbidity, and Conductivity Sensors (left to right)

NexSens Clamp Kit, Splitter, and 10m Data Cable (left to right)

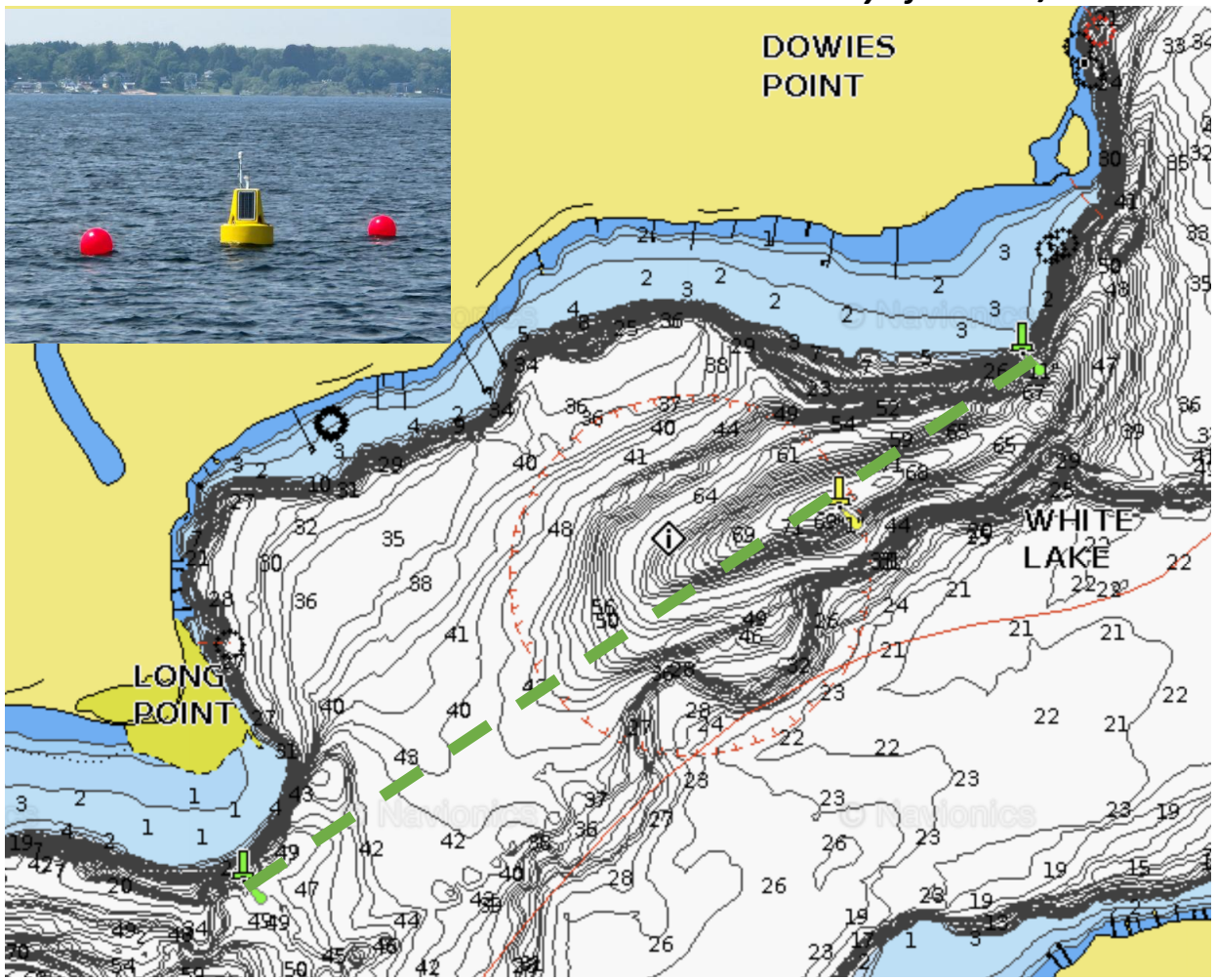
The WLA Smart Buoy will be even more capable in 2026, with all data made available to the community 24/7 via the "Public Portal"

WLA Smart Buoy – Adjustment for 2026

- The WLA Smart Buoy is close to the common navigation channel between the two green buoys
  - This placement was approved by the Coast Guard, US Army Corps, EGLE, and the Michigan DNR
  - This location has been added to marine maps
- We received messages this summer it was “hard to see” and in a “high traffic” spot
  - Tried increasing the intensity of the CG-approved flashing yellow light (already at max)
- The current plan is to move the buoy 50-100ft NW to remain in deep water (EGLE/WLA desire) while increasing spacing from the “green line”
  - We are also considering adding lights to the red mooring balls themselves to increase visibility



Courtesy of Garmin/Navionics



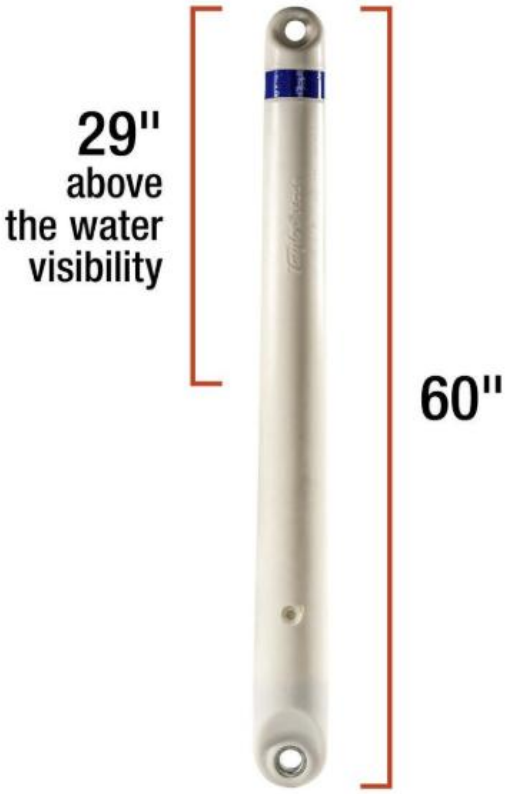
WLA will make efforts in 2026 to both move the buoy further from the navigation channel and increase visibility via brighter/additional lights that still meet Coast Guard color/flashing requirements

WLA Smart Buoy – “Winter Sticks” for Off-season

- Due to the potential for ice on White Lake in the location of the Smart Buoy, we need to plan for Smart Buoy removal and mooring line protection (to re-deploy in Spring 2026)
- Dan McCormick (South Shore Marina) recommends “Winter/Sully Sticks” as ice-resistant floats for the mooring lines
- John Hanson and a couple others will use John’s boat to pull the buoy and replace the mooring balls (TBD on moving location)
- Smart Buoy will be stored and sensors cleaned/capped in DeBoer’s garage

Specifications:

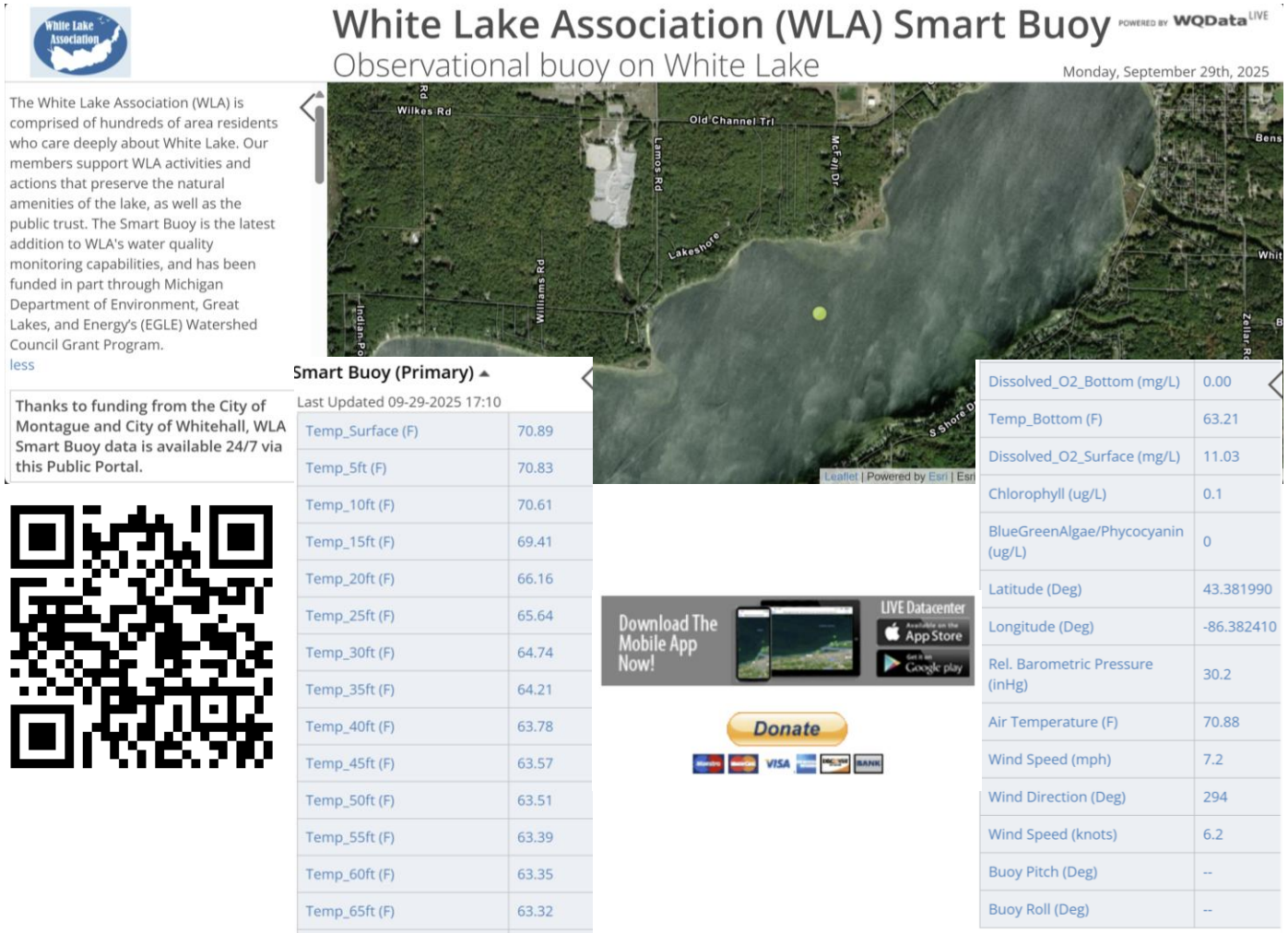
- Small Sully Stick:
  - Color: White
  - Dimensions (L x W): 31" x 6"
  - Buoyancy rating: 15 lbs
  - Offers 18" visibility above water line
- Large Sully Stick: ***Purchased 2, received 9/27***
  - Color: White
  - Dimensions (L x W): 60" x 6"
  - Buoyancy rating: 31 lbs
  - Offers 29" visibility above water line



The Snow Farmers (John Hanson) once again offered to help with Smart Buoy logistics – removed the Smart Buoy on Oct 12, replaced the Red Mooring Balls with Winter Sticks

WLA Smart Buoy – Public Portal for Real-time Data, 24/7

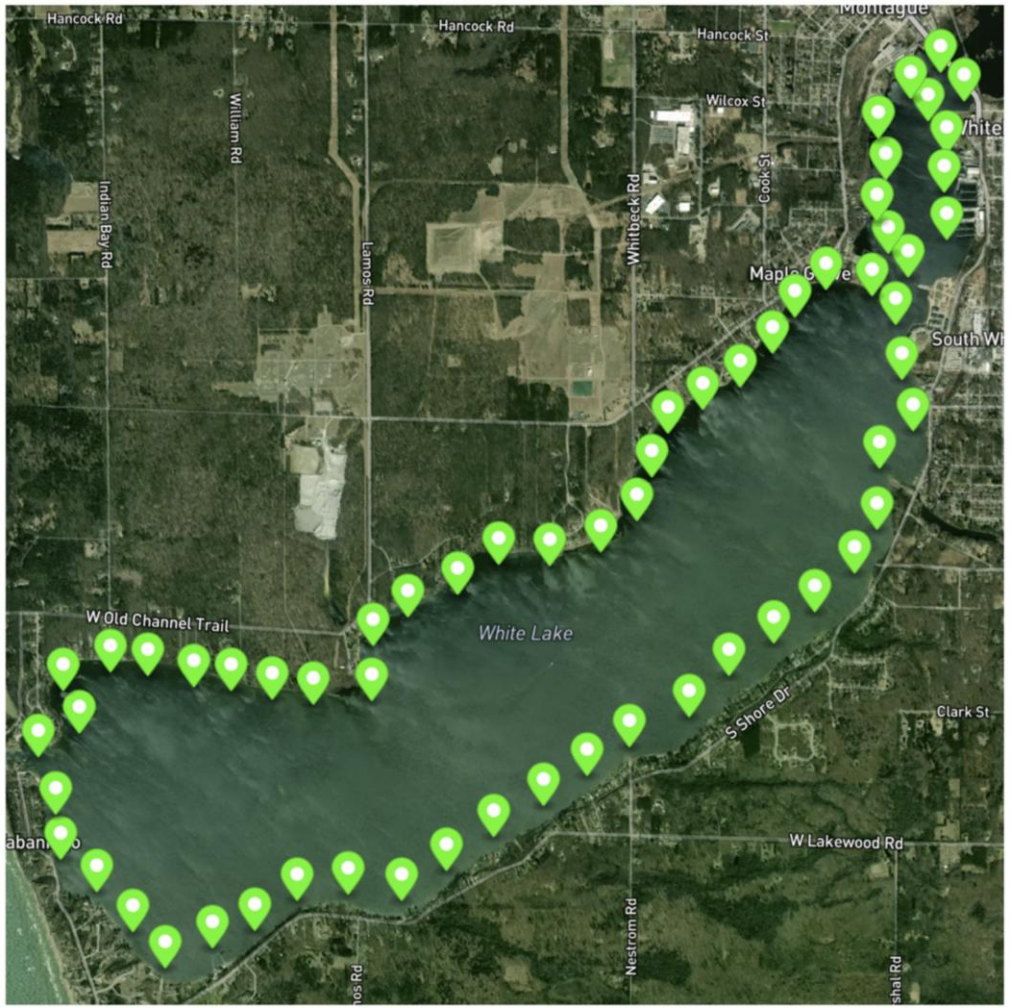
- Anyone can access the Public Portal for free via phone or computer using the following link (or QR code to the right):
  - https://www.wqdatalive.com/public/2305
- An App exists for iOS/Android, but it's fairly "buggy" at the moment
  - WLA will let members know if/when this changes/improves
- IF anyone wants access to ALL data collected by the Smart Buoy (can specify any parameters and date range):
  - Create an account on WQDataLive.com
  - Send WLA an email requesting "Collaborator" status
  - We have also posted a full .xls download of the 2025 raw data for likely parameters of interest (LARGE file since data every 10min)



The WLA Smart Buoy (funded by an EGLE grant) and "Public Portal" interface (funded by City of Montague and City of Whitehall) performed extremely well in 2025, both will be adjusted/upgraded in 2026

Score-the-Shore – GoPro Video Capture

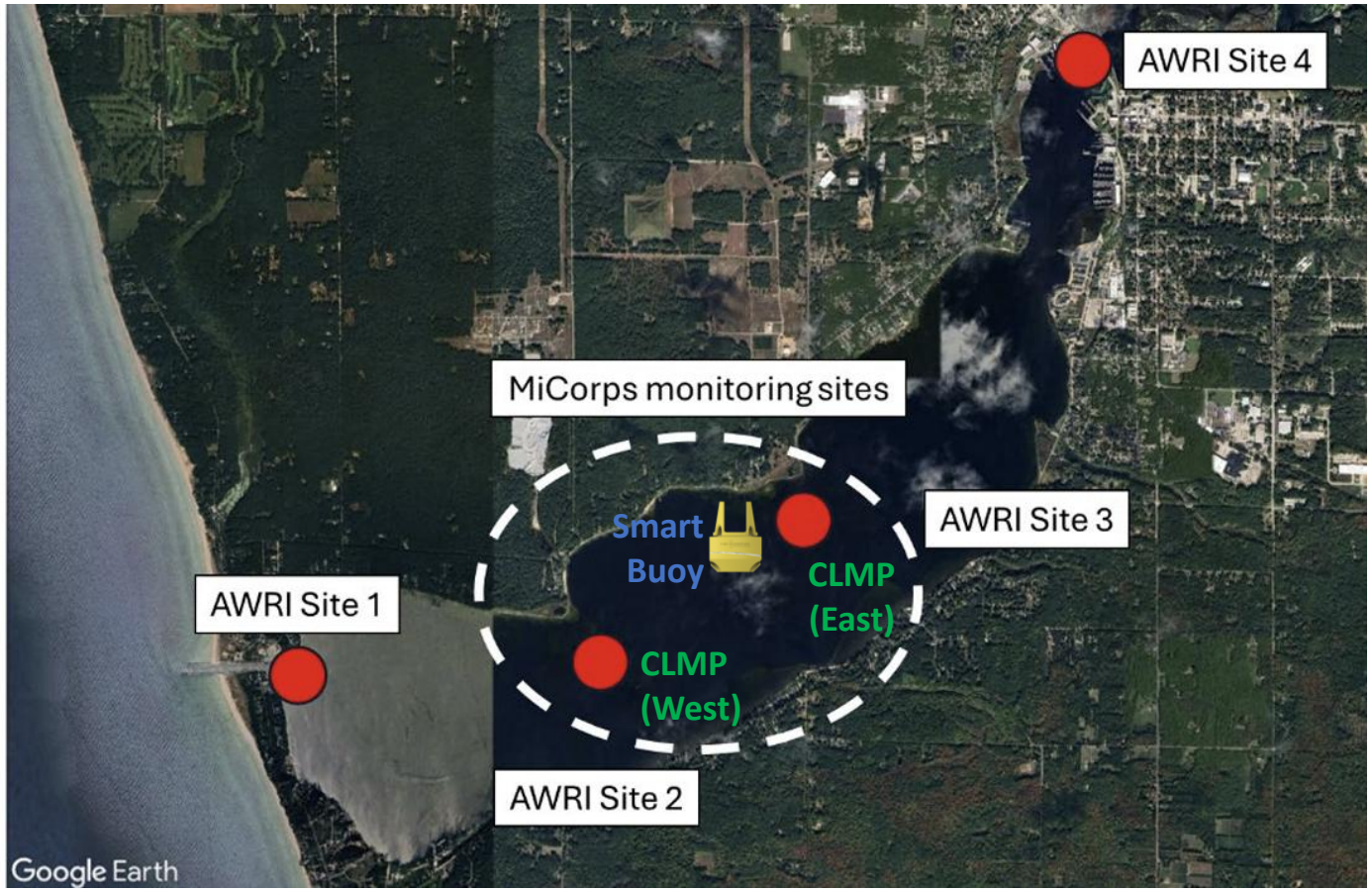
- GVSU-AI project team defined (61) ~1000ft segments around White Lake, following MiCorps/CLMP guidelines
- Each segment is defined by a set of start and end GPS waypoints, which DeBoer converted to .gpx file format and loaded into Garmin Navionics SW
  - Enabled auto-navigation with Garmin trolling motor, with GoPro video capture (61 separate videos captured)
  - Can use same GPS waypoints to define segments in drone imagery capture for additional perspective
- Bob/Sara captured additional video/imagery for the 2025 “repository”



Significant shoreline video/imagery capture in 2025 provides excellent material for potential follow-on GVSU AI project in the “off-season”, process established with lessons learned

Analysis Overview

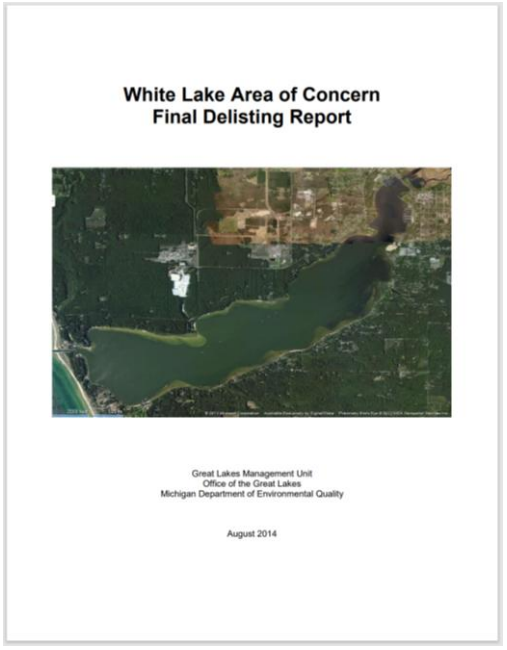
- The analysis focuses on (3) separate sources of data:
  - GVSU-AWRI “White Lake 2024 Monitoring Report” (4 sites)
  - 2024/2025 MiCorps Cooperative Lakes Monitoring Program (CLMP) Data (2 sites)
  - 2025 (Jun 5 – Sep 23) WLA “Smart Buoy” Data (1 site)



Courtesy of GVSU-AWRI “White Lake 2024 Monitoring Report”

The WLA Smart Buoy dramatically increased water quality monitoring capability in 2025, with further improvements planned for 2026

Motivation – WLA Monitoring Responsibilities/Goals


White Lake Area of Concern
Final Delisting Report

Great Lakes Management Unit
Office of the Great Lakes
Michigan Department of Environmental Quality

August 2014

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4.2 Eutrophication or Undesirable Algae, removed April 2012

The MDEQ accepted the locally-developed target for the Eutrophication and Undesirable Algae BUI as being functionally equivalent to the restoration criteria in the *Guidance*, while remaining within the scope of the AOC program. According to the White Lake PAC's criteria, the Eutrophication and Undesirable Algae BUI was to be considered restored when:

1) no waterbodies within the AOC are included on the list of impaired waters due to nutrients or excessive algal growths in the current Clean Water Act Water Quality and Pollution Control in Michigan: Section 303(d) and 305(b) Integrated Report; and

2) the following average annual concentrations/values meet criteria in White Lake after 5 years.

- *Total Phosphorus – 30 µg/l*
- *Chlorophyll a – 10 µg/l*
- *Secchi Disk depth ~2.0 m*
- *Trophic Status Index – 50-55*

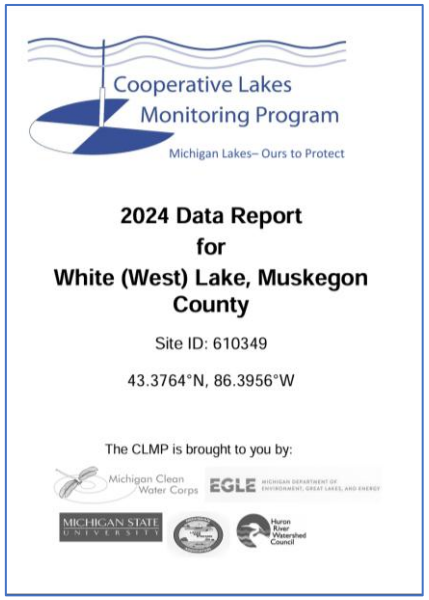
5. POST-DELISTING RESPONSIBILITIES AND MONITORING

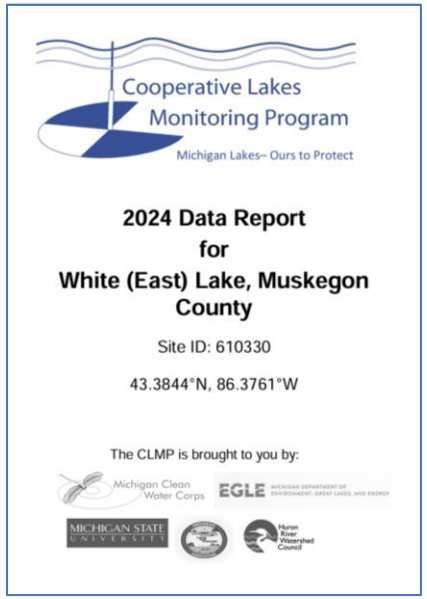
While AOC-based restoration work is complete and all eight BUIs have been removed from the White Lake AOC, it is prudent to monitor natural system recovery, particularly as it relates to wildlife. Relatively speaking, changes in wildlife habitat should be reflected in the populations and community assemblages within a short time period. The Muskegon Conservation District has agreed to conduct avian and amphibian population monitoring in consultation with Bird Studies Canada, and with the support of the MDEQ and the USEPA during 2014, 2015, and 2016. A final report will be submitted in early 2017 that chronicles the findings of the monitoring program which actually began in the area in 2006. It is anticipated that the results may show significant changes in both bird and frog communities, given their susceptibility to habitat alteration. White Lake wetland and riparian habitats appear to have improved during the period so far. This monitoring program is intended to demonstrate and quantify to what extent those improvements are changing faunal community makeup.

White Lake Association

Independent from the restoration of BUIs and delisting of the White Lake AOC, White Lake Association members voluntarily monitor water quality parameters at regular intervals, following protocols established through the Michigan Clean Water Corps. This includes tracking changes in the lake's nutrient concentrations and trophic status, assessing the lake's macrophyte community (including native and nuisance exotic species), and maintaining vigilance for potential introductions of invasive plant and animal species (including cyanobacteria).

Summary of 2024 White Lake Water Testing Results

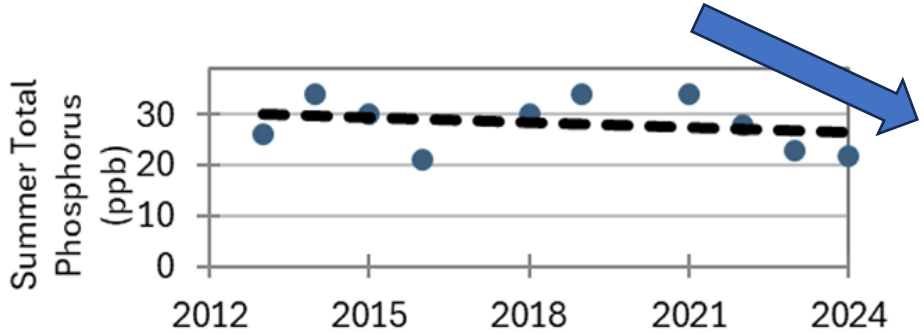




(Spring/Summer)

- *Total Phosphorus – 30 µg/l*
- *Chlorophyll a – 10 µg/l*
- *Secchi Disk depth ~2.0 m*
- *Trophic Status Index – 50-55*

WEST (LONG)	EAST (DOWIE)
14/21 ug/l	26/22 ug/l
6.4 ug/l	6.6 ug/l
2.8 m	2.9 m
47	47



Example of good downward trend (White Lake EAST Summer Phosphorus)

2024 water testing results (not available until Spring 2025, exception of Secchi) suggest White Lake remains in "good" health, no strong/worrisome trends, still meeting the 2014 de-listing requirements

Summary of 2024 Trophic Status Index (TSI)

Increasing weed/algae growth

Oligotrophic: Generally deep and clear lakes with little aquatic plant or algae growth. These lakes maintain sufficient dissolved oxygen in the cool, deep-bottom waters during late summer to support cold water fish, such as trout and whitefish.

Mesotrophic: Lakes that fall between oligotrophic and eutrophic. Mid-ranged amounts of nutrients.

Eutrophic: Highly productive eutrophic lakes are generally shallow, turbid, and support abundant aquatic plant growth. In deep eutrophic lakes, the cool bottom waters usually contain little or no dissolved oxygen. Therefore, these lakes can only support warm water fish, such as bass and pike.

Hypereutrophic: A specialized category of euthrophic lakes. These lakes exhibit extremely high productivity, such as nuisance algae and weed growth.

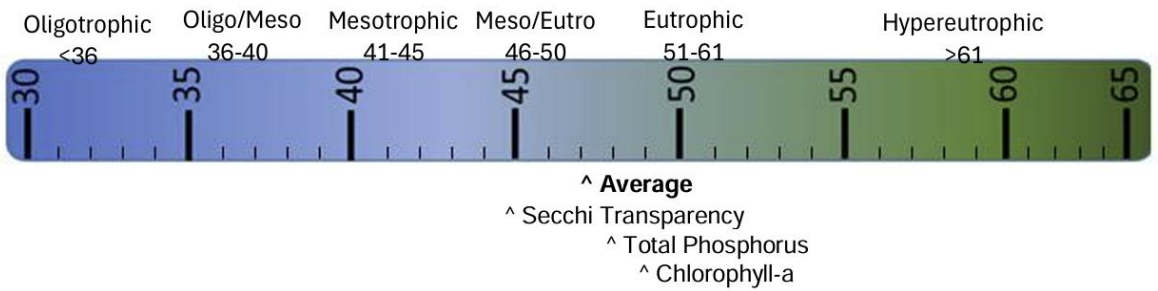
Secchi Depth (ft)	TSI Value
>30	<28
25	31
20	34
15	38
12	42
10	44
7.5	48
6	52
4	57
<3	>61

Chlorophyll-a (ppb)	TSI Value
<1	<31
2	37
3	41
4	44
6	48
8	51
12	55
16	58
22	61
>22	>61

Phosphorus (ppb)	TSI Value
<5	<27
6	30
8	34
10	37
12	40
15	43
18	46
21	48
24	50
32	54
36	56
42	58
48	60
>50	>61

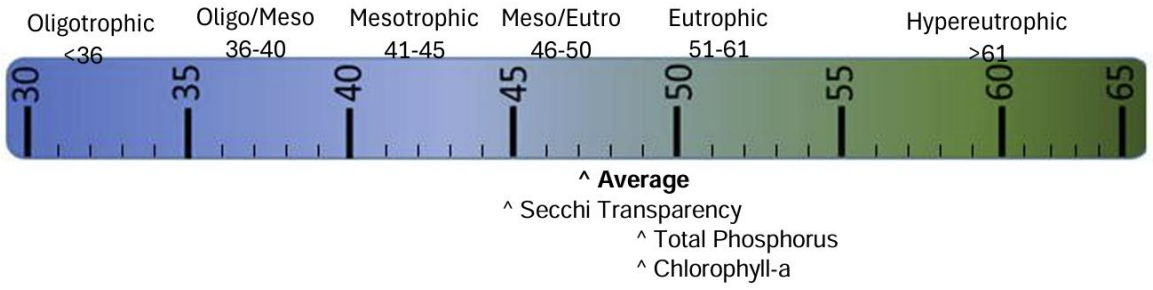
WHITE LAKE – WEST (LONG POINT)

TSI for White (West) Lake in 2024	
Average	47
Secchi Disk	45
Summer TP	48
Chlorophyll-a	49



WHITE LAKE – EAST (DOWIE POINT)

TSI for White (East) Lake in 2024	
Average	47
Secchi Disk	45
Summer TP	49
Chlorophyll-a	49



2024 Trophic Status Index (TSI) for both WEST and EAST sites is in the Mesotrophic/Eutrophic "mid-range", which continues a slight trend toward Mesotrophic (otherwise very stable over last 10-15 years)

Summary of 2025 CLMP Data Collection

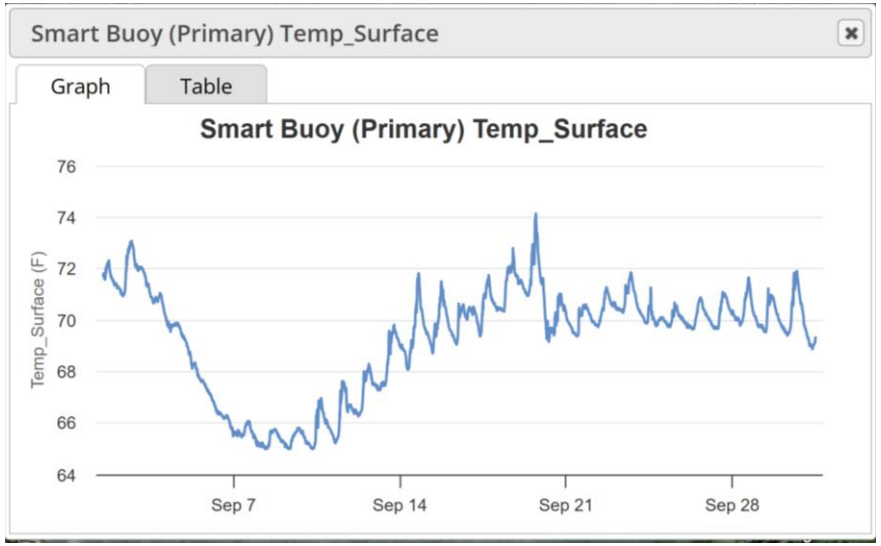
- After Spring Phosphorus collection in April (thanks, Greg/Debi!), there were **(10) total water sampling trips** to both West & East sites this summer:
  - All (10) collected Secchi, and Temperature / Dissolved Oxygen from surface to bottom(~55ft)
  - (5) of the (10) collections also included Chlorophyll-a sampling (monthly)
  - The last sample collection (Sept 11) also included Summer Phosphorus sampling
- Special thanks to Bob and Sara for supporting early and late water sampling in 2025, as well as making both deliveries of samples to downtown GR for MiCorps lab processing
- A final October sampling for Secchi/Temp/D.O would be "nice to have", but **Smart Buoy capability largely offsets the need to prioritize late collection**
- **Recommendation: Purchase 2nd YSI Pro20 Dissolved Oxygen meter to ease logistics**
- Volunteers are always welcome!

#	Collection Date Range	Collection Date	Secchi	Dissolved O2	Chlorophyll-a	Phosphorus	Boat	Crew Lead	Crew	Sun	Mon	Tue	Wed	Thur	Fr	Sat	
	Apr 27 - May 3													1	2	3	
	May 4 -10									4	5	6	7	8	9	10	MAY
	May 11-17									11	12	13	14	15	16	17	
1	May 18-24	18-May	X	X	X		Smart	Smart	Smarts	18	19	20	21	22	23	24	
	May 25-31									25	26	27	28	29	30	31	
2	Jun 1-7	7-Jun	X	X			Engblade	DeBoer	DeBoers	1	2	3	4	5	6	7	
	Jun 8-14									8	9	10	11	12	13	14	JUNE
3	Jun 15-21	16-Jun	X	X	X		DeBoer	DeBoer	DeBoers	15	16	17	18	19	20	21	
4	Jun 22-28	28-Jun	X	X			DeBoer	DeBoer	DeBoers	22	23	24	25	26	27	28	
	Jun 29 - Jul 5									29	30						
												1	2	3	4	5	
5	Jul 6-12	10-Jul	X	X			DeBoer	DeBoer	DeBoers	6	7	8	9	10	11	12	JULY
6	Jul 13-19	18-Jul	X	X	X		DeBoer	DeBoer	DeBoers	13	14	15	16	17	18	19	
	Jul 20-26									20	21	22	23	24	25	26	
7	Jul 27 - Aug 2	28-Jul	X	X			DeBoer	DeBoer	DeBoers	27	28	29	30	31			
															1	2	
	Aug 3-9									3	4	5	6	7	8	9	AUGUST
8	Aug 10-16	15-Aug	X	X	X		Smart	Smart	Smarts	10	11	12	13	14	15	16	
	Aug 17-23									17	18	19	20	21	22	23	
9	Aug 24-30	28-Aug	X	X			Smart	Smart	Smarts	24	25	26	27	28	29	30	
	Aug 31 - Sep 6									31							
											1	2	3	4	5	6	
10	Sep 7-13	11-Sep	X	X	X	X	Smart	Smart	Smarts	7	8	9	10	11	12	13	SEPTEMBER
	Sep 14-20									14	15	16	17	18	19	20	
11	Sep 21-27		X	X			TBD	TBD	TBD	21	22	23	24	25	26	27	
	Sep 28 - Oct 4									28	29	30					
													1	2	3	4	
12	Oct 5-11		X	X			TBD	TBD	TBD	5	6	7	8	9	10	11	OCTOBER
	Oct 12-18									12	13	14	15	16	17	18	
13	Oct 19-25		X	X			TBD	TBD	TBD	19	20	21	22	23	24	25	
	Oct 26-31									26	27	28	29	30	31		

The 2025 CLMP "manual, by boat" water sampling met all collection requirements, all samples have been submitted and data entered online to support MiCorps lab analysis – results expected Spring 2026

Summary of 2025 CLMP/Smart Buoy Data Trends

- We have to wait for CLMP Phosphorus, Chlorophyll-a, and Trophic Status updates (~Spring 2026)
- However, Secchi/temperature/dissolved oxygen collection and Smart Buoy data analysis suggests the following for 2025:
  - ***Water clarity (Secchi) is roughly the same as 2024*** (October collection would likely bump up our average)
  - ***Water temperature was relatively high*** (similar to previous years) with early summer slightly higher and late summer slightly lower than 2024, hitting a ***peak of 81.5 F on the surface (July 29***)
  - Dissolved oxygen followed similar trend as previous years, ***Smart Buoy enabled identification of date when bottom (~71ft) hit 0 (July 8)***
  - ***Observed temporary thermal turnover/mixing Sep 3-7***, which resulted in ~2wks of dissolved oxygen at the very bottom
  - Chlorophyll-a levels (from Smart Buoy, taken near surface, "worst case") were relatively low, ***with C-a reaching a peak of ~8 ug/l (July 1)***
  - We ***did NOT observe any toxic/blue-green algae*** (at Smart Buoy)
- **A deeper dive into the data can be seen in later slides, will be posting data and analysis to WLA website**



The WLA Smart Buoy has collected/recorded a massive amount of data that should continue to be analyzed over the off-season, and ultimately compared to 2025 CLMP results. Overall GREAT addition!

Other Ideas

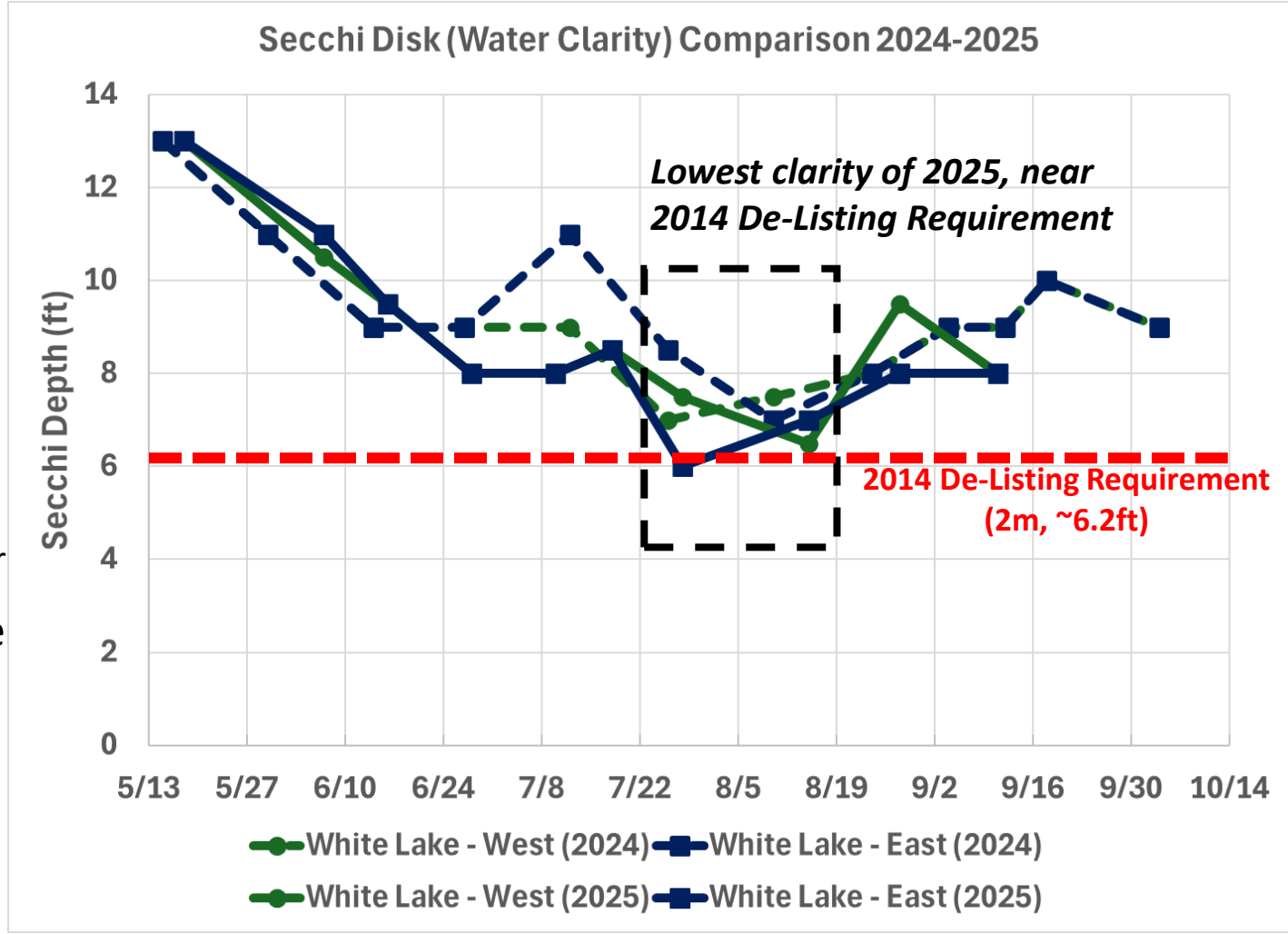
- Wave estimation HW mounted near shoreline/seawall to help quantify the impact of wake boats, support potential future ordinances and/or legislation
  - Wake boats have become a significant discussion topic, likely increasing in future
- Smaller buoy(s) that can be strategically placed/relocated in shallower water near marinas, bridge, upriver, etc.
  - Ideally, this would tie into the same “Public Portal” so accessible/viewable by all 24/7
  - More likely to catch the worst algae blooms, warning of toxic algae
- Updated White River Watershed Plan, funded by EGLE grant
  - See slides at end of presentation with background material, likely on hold due to shutdown
  - Regardless, recommend anyone interested reviewing the excellent, thorough 2009 WRWP Plan

Would love to hear from the community about other things WLA should pursue, or how you’d like to volunteer/help with all the exciting things going on!

Start of Detailed Data Analysis

Looking at Water Clarity (Secchi Disk)

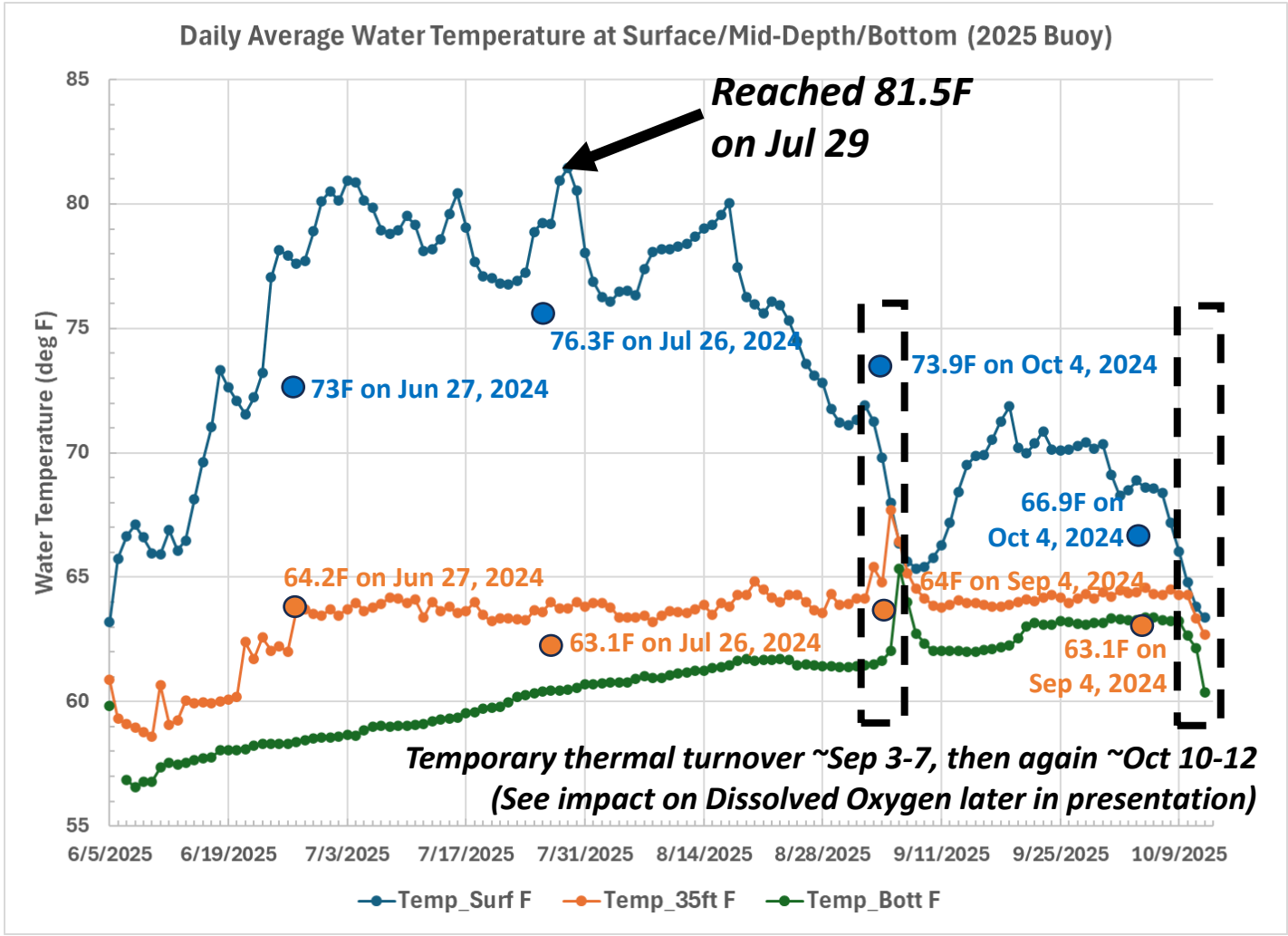
- Water clarity followed a similar trend to previous years
  - Max: 13ft (mid May), Min: 6ft (late July)
  - Comparable to 2024 data
- The White Lake East (Dowie's Point) clarity saw sharp drop in mid-late July
  - Not completely unexpected with higher temperatures and algae growth
  - See next slide for likely additional contributor
- The addition of a Turbidity sensor on the Smart Buoy in 2026 will enable us to quantify the relative amount of suspended sediment
  - This will NOT replace Secchi disk measurements, but interesting to compare



Secchi disk measurements continue to be a relatively simple, yet highly valuable means of assessing water clarity, will compare/correlate with new turbidity measurements on Smart Buoy in 2026

Looking at Temperature

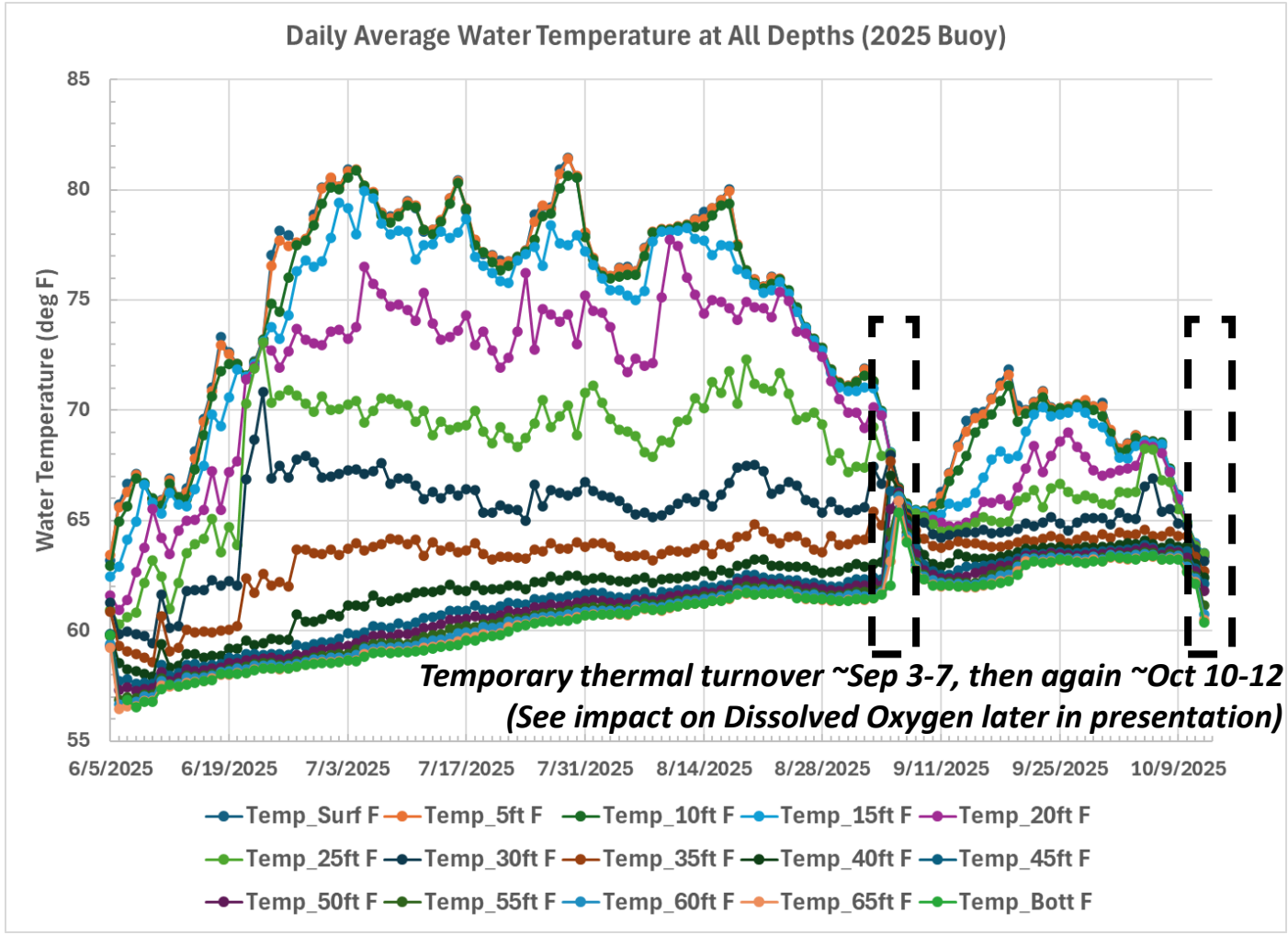
- 2025 Smart buoy temperature measurements are collected via a thermistor string that extends from the surface to the bottom
  - 0-70ft, every 5ft
  - This is similar resolution, but greater depth than our bi-weekly manual collections
  - Data is updated every 10 min
- 2025 daily averages are plotted here to give a sense of surface, mid-depth, and bottom temperature variation over Summer 2024
  - A much more gradual variation is observed on the bottom, as expected
- Experienced a temporary, thermal turnover in early Sept, then in Oct right before pulling the Smart Buoy



Surface and Mid-Depth temperatures were ABOVE 2024 levels for most of the summer. See turnovers in September and October.

Looking at (many more) Temperatures

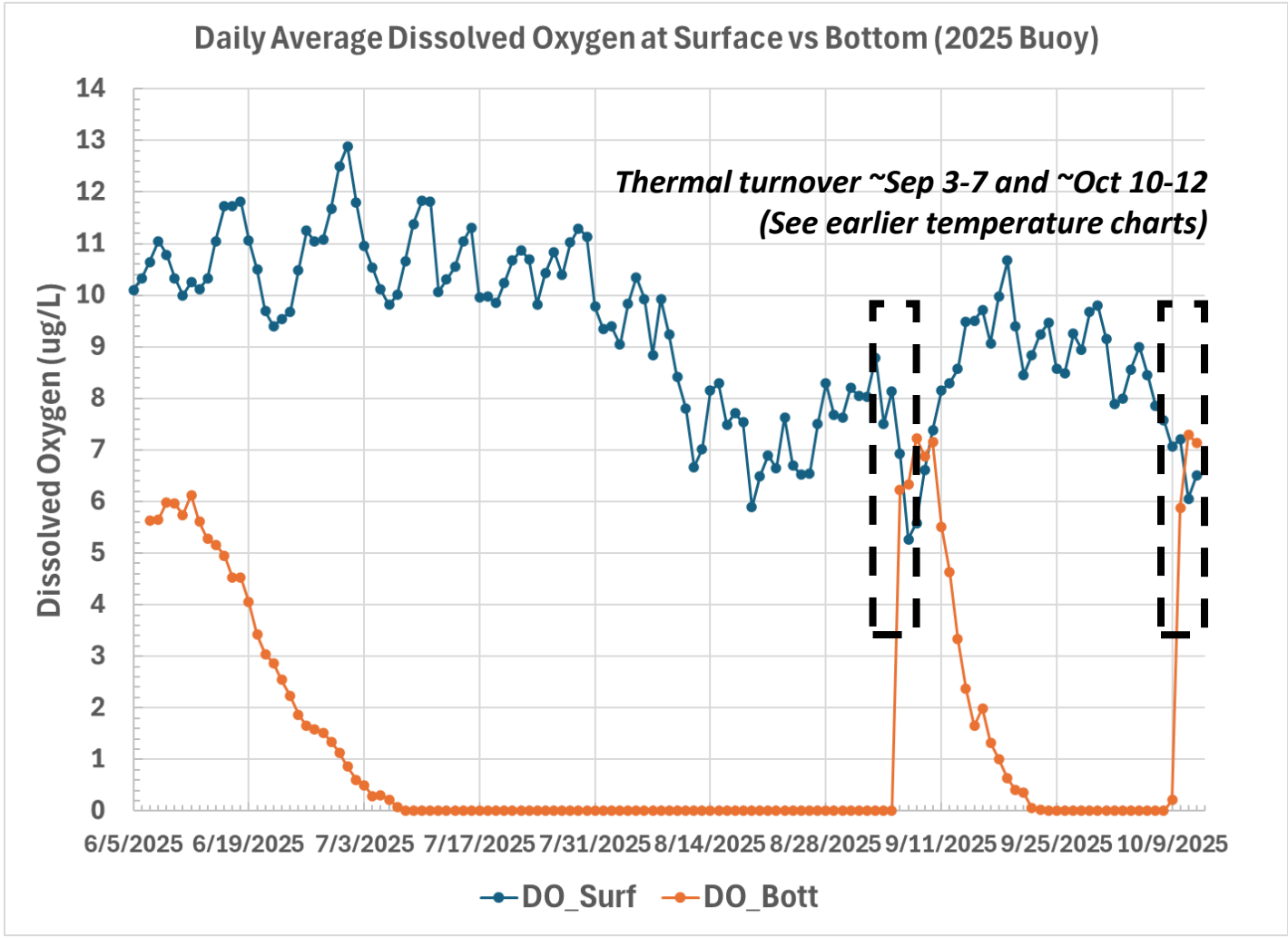
- Even after averaging daily temperatures at each point in thermistor string, one can see this is a massive data set
- Interesting spikes/variations can be seen in the 2025 data
  - A temporary "collapsing" of mid to shallow depth water column temperatures ~Jun 20
  - Strange behavior on Jun 5th is due to buoy deployment on that day (thermistor string was bundled on surface until ~Noon, where it then stabilized to temperatures at depth
- We were fortunate to observe the Fall thermocline inversion in early-mid Oct
  - Can clearly see "Summer Stratification" phase (relatively wide band of temperature between surface and bottom) and Fall turnover



As expected, we observed more uniform temperatures throughout the water column as mixing and turnover occured in October (right before pulling the Smart Buoy), may catch Spring turnover in 2026

Looking at Dissolved Oxygen

- Dissolved Oxygen at the bottom of White Lake (~71ft) reached 0 on ~Jul 8
  - This is the first time we've seen this data (all historical manual collections were made at the two CLMP sites, ~55ft depth)
- We observed early, temporary thermal turnover ~Sep 3-7 (see earlier charts)
  - This led to temporary recovery/uniformity of Dissolved Oxygen in the water column
- We observed similar behavior in the early-mid October timeframe during the "official" Fall turnover
  - This was part of the motivation to keep the buoy deployed through mid October



The high frequency and accuracy of dissolved oxygen measurements with the Smart Buoy at both the surface and bottom of the lake are extremely valuable for understanding conditions for plant and fish life

Looking at Manual vs Smart Buoy Temperature Measurements

- Manual water sampling involves reading temperatures from the Dissolved Oxygen (D.O.) probe as it is lowered into the water
- The exact date/time of a manual collection earlier this year near Dowie's Point (White Lake – EAST) provides the best direct comparison of temperature measurements
  - Selected July 28, 2025 (sample collected at 3:50 PM on a sunny afternoon)

From Manual Collection:

	18-May-25			7-Jun-25			16-Jun-25			28-Jun-25			10-Jul-25			18-Jul-25			28-Jul-25		
Depth (ft)	Temp (deg C)	Temp (deg F)	D.O. (mg/L)	Temp (deg C)	Temp (deg F)	D.O. (mg/L)	Temp (deg C)	Temp (deg F)	D.O. (mg/L)	Temp (deg C)	Temp (deg F)	D.O. (mg/L)	Temp (deg C)	Temp (deg F)	D.O. (mg/L)	Temp (deg C)	Temp (deg F)	D.O. (mg/L)	Temp (deg C)	Temp (deg F)	D.O
1	17	62.6	10.1	18.2	64.8	9.88	21.4	70.5	0	25.4	77.7	8.9	26	78.8	9.5	24.7	76.5	8.6	28.3	82.9	11.2
5	17	62.6	10.1	18.2	64.8	9.95	20.8	69.4	0	25.4	77.7	8.83	25.9	78.6	9.5	24.7	76.5	8.6	27.4	81.3	9.9
10	17	62.6	10.1	18	64.4	10	19.6	67.3	0	25.2	77.4	8.63	25.7	78.3	9.4	24.7	76.5	8.5	26.4	79.5	9.9
15	17	62.6	10	17.7	63.9	10.1	19.1	66.4	0	24.7	76.5	7.9	25.5	77.9	8.8	24.6	76.3	8.1	24.9	76.8	6.5
17.5	17	62.6	9.98	16.1	61.0	10.1	18.9	66.0	0	24.5	76.1	7.92	23.4	74.1	4.2	22.7	72.9	3	24.7	76.5	6.2
20	17	62.6	9.98	15.5	59.9	10.2	18.4	65.1	0	23.8	74.8	6.33	23.1	73.6	3.7	21.9	71.4	2.14	23.3	73.9	4.2
22.5	17	62.6	9.97	15.6	60.1	10.2	18	64.4	0	21.7	71.1	5.65	21.8	71.2	2.5	21.7	71.1	1.65	22.5	72.5	3
25	16.9	62.4	9.95	15.4	59.7	10.1	18	64.4	0	21.4	70.5	5.4	21	69.8	1.9	20.9	69.6	0.55	21.7	71.1	1.8
27.5	16.6	61.9	9.95	15.3	59.5	9.95	17	62.6	0	20.3	68.5	5.1	19.9	67.8	1.3	20.2	68.4	0.18	20.5	68.9	0.3
30	16.7	62.1	9.94	15.2	59.4	9.9	16.5	61.7	0	20.1	68.2	5.15	19.4	66.9	1.6	18.8	65.8	0.2	19.1	66.4	0.19
32.5	16.9	62.4	9.9	15	59.0	9.5	15.8	60.4	0	20	68.0	4.9	19.1	66.4	1.2	17.3	63.1	0.17	18.1	64.6	0.16
35	16.9	62.4	9.81	14.7	58.5	9.08	15.2	59.4	0	17.9	64.2	2.8	18.4	65.1	0.8	16.9	62.4	0.18	17.8	64.0	0.15
37.5	16.8	62.2	9.77	14.6	58.3	9.03	14.9	58.8	0	17	62.6	2.6	17	62.6	0.4	16.4	61.5	0.16	16.8	62.2	0.15
40	16.3	61.3	9.91	14.4	57.9	9.13	14.7	58.5	0	16.6	61.9	2.1	16.7	62.1	0.4	16.1	61.0	0.15	16.7	62.1	0.14
42.5	16.1	61.0	9.87	14.1	57.4	9	14.7	58.5	0	15.1	59.2	2.1	16	60.8	0.25	16	60.8	0.15	16.4	61.5	0.14
45	16	60.8	9.84	14	57.2	8.9	14.6	58.3	0	14.9	58.8	2	15.7	60.3	0.22	16	60.8	0.15	16.2	61.2	0.14
50	15.6	60.1	9.71	13.6	56.5	8.7	14.4	57.9	0	14.6	58.3	1.85	15.2	59.4	0.4	15.7	60.3	0.15	15.9	60.6	0.14
55				13.5	56.3	8.4	14.4	57.9	0	14.4	57.9	1.67	14.8	58.6	0.17	15.6	60.1	0.15	15.7	60.3	0.14
60													14.8	58.6	0.13	15.2	59.4	0.27	15.6	60.1	0.13

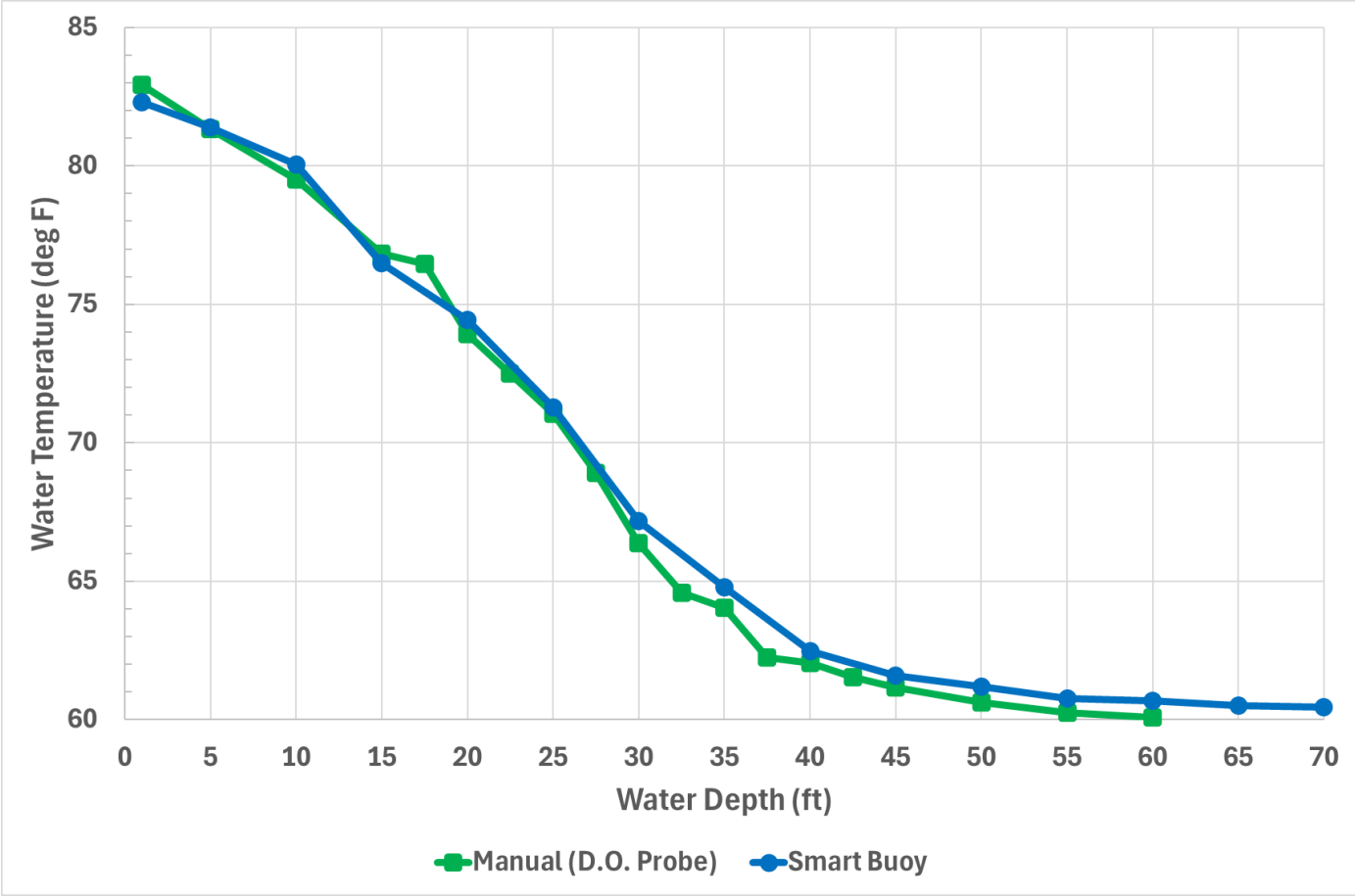
From Smart Buoy:

UTC Time	Temp_Surf	Temp_5ft	Temp_10ft	Temp_15ft	Temp_20ft	Temp_25ft	Temp_30ft	Temp_35ft	Temp_40ft	Temp_45ft	Temp_50ft	Temp_55ft	Temp_60ft	Temp_65ft	Temp_Bott
	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
7/28/2025 15:50	82.31	81.39	80.06	76.49	74.45	71.29	67.17	64.79	62.48	61.6	61.19	60.77	60.67	60.51	60.46

An initial glance suggests the measurements are very similar, plotting helps visualize the two measurements (different depth breakpoints)

Looking at Manual vs Smart Buoy Temperature Measurements, cont.

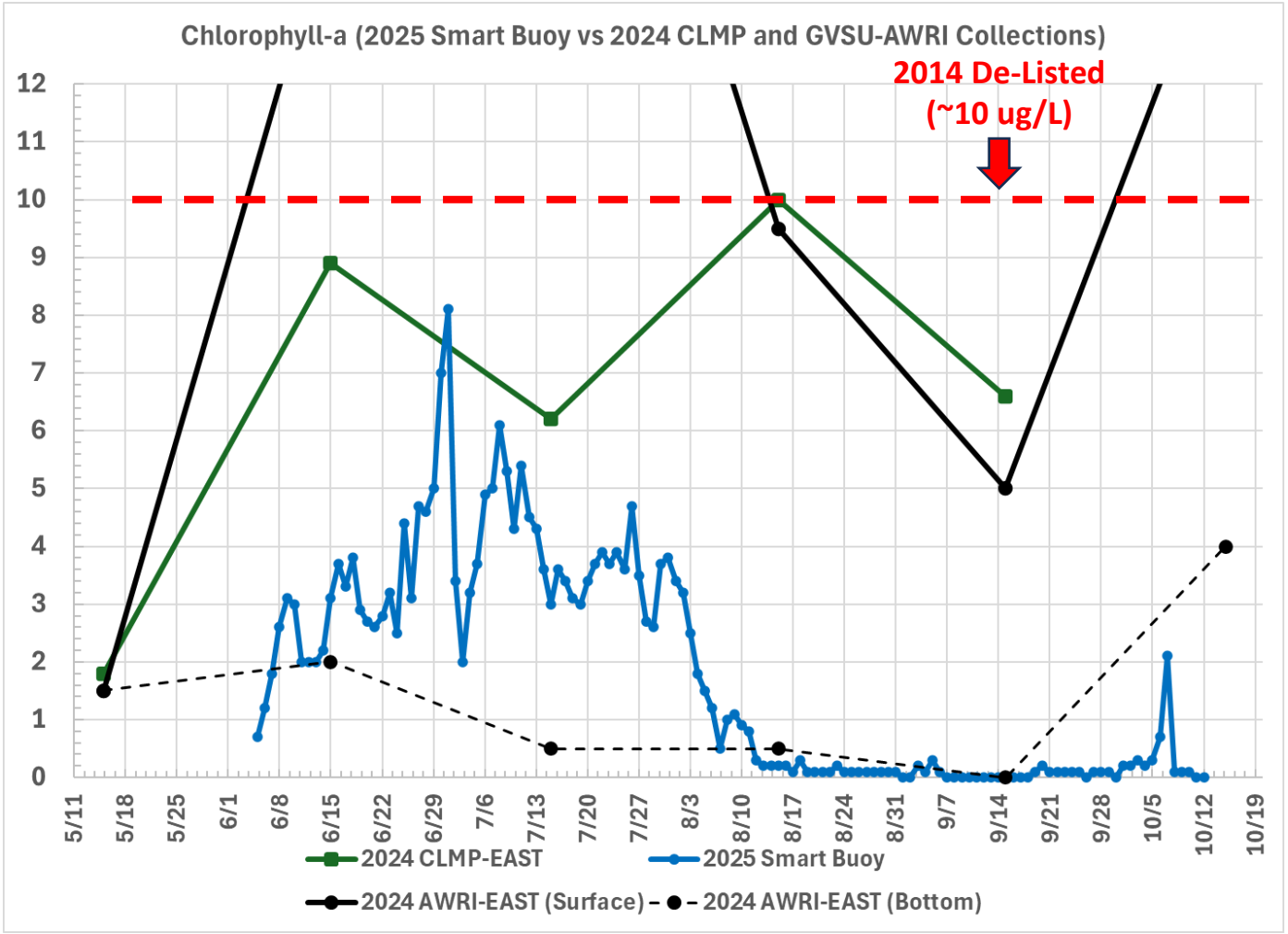
- The two measurement sources show excellent agreement
  - Largest differences are at depths that aren't common between the two sources
  - Some difference is expected due to different measurement locations
- Smart Buoy has advantage of deeper measurement (70ft), updated every 10 min



All temperature analysis thus far suggests high confidence in Smart Buoy thermistor accuracy and reliability

Looking at Chlorophyll-a

- 2025 Smart buoy measurements are all near the surface (typically “worst case” due to higher solar loading)
  - CLMP requires “composite depth sampling” (2X Secchi depth)
  - GVSU/AWRI reported surface and bottom sampling (large variation in C-a levels)
- All 2025 daily averages have been below delisting requirement of 10 ug/L
- All 2025 daily averages are well below 2024 CLMP-EAST and (especially) AWRI-EAST levels
  - Can specific day of sampling, relative volatility in June/July, and/or depth of sampling account for the large C-a discrepancies b/w CLMP & AWRI?



Buoy-based Chlorophyll-a levels are at or below levels in 2024, will be interesting to compare 2025 buoy data to eventual 2025 CLMP report. Also, AWRI saw spike in C-a in October ‘24 (similar with Buoy).

Start of Watershed Management Plan Discussion

White River Watershed Management Plan – Potential Update?

- The White River Watershed Partnership (WRWP) compiled an excellent, highly-detailed (667 pages!!) plan in 2009
  - Link: https://whiteriverwp.org/wp-content/uploads/2025/07/White-River-Watershed-Management-Plan-with-Appendices-1.pdf
  - Also posting to WLA website
- The plan contains valuable maps of the watershed, which is split into (10) "sub-watersheds" to organize analysis and implementation plans/goals
- **Funding sources exist to develop/update a watershed management plan, but still a significant endeavor**
  - Update the maps
  - Status progress toward original goals (7 for White Lake)
  - Revisit the target audience section
  - Re-focus priorities/efforts over next 10-15 years
  - All the above would likely be ~80% of the effort

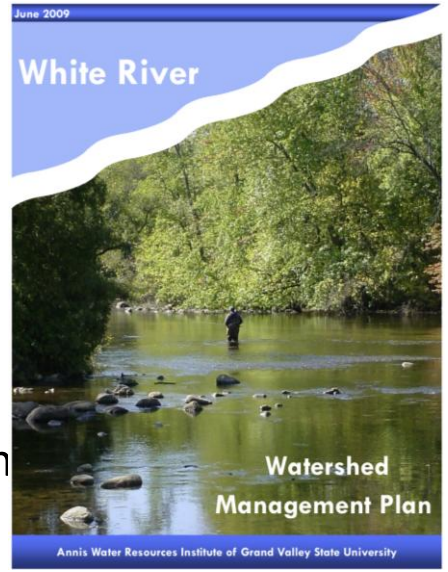


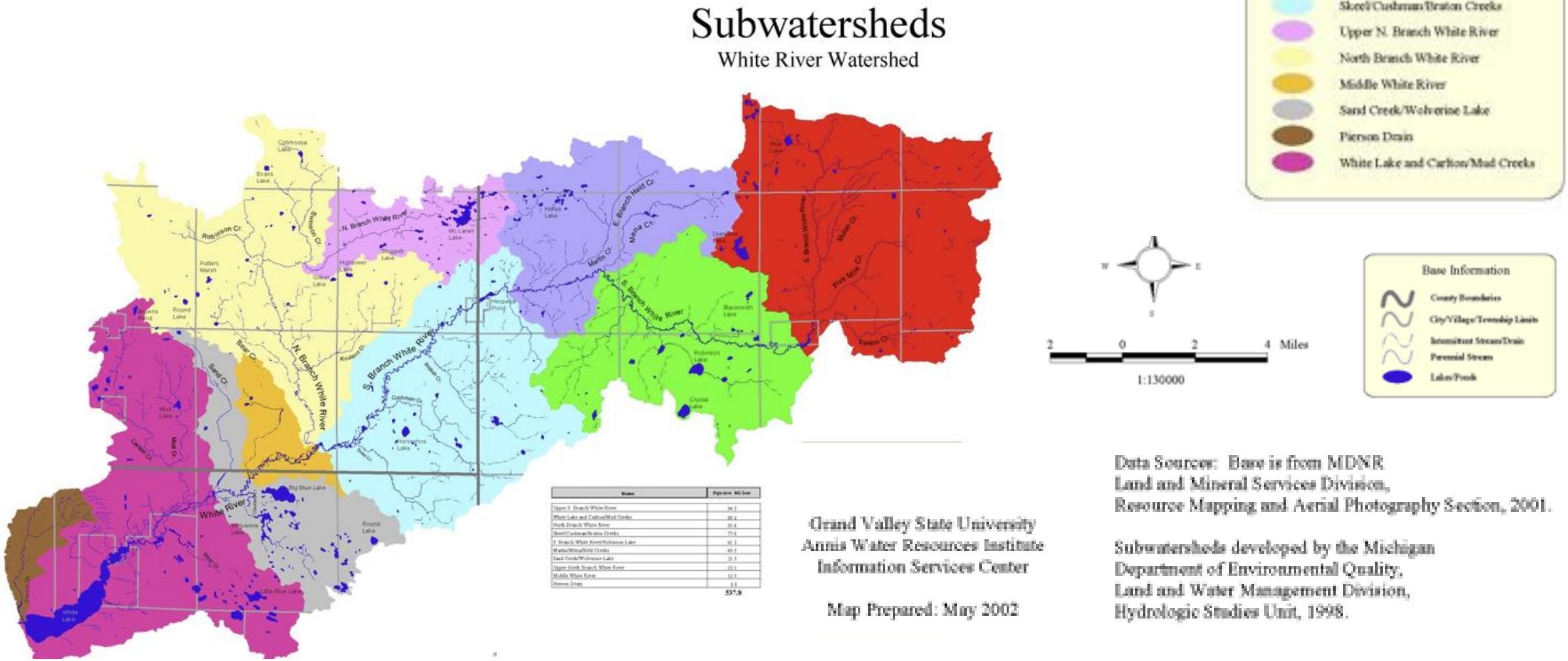
Figure 5. Individuals involved in the creation of the White River Watershed Management Plan. Pictured from left to right: Mary Fales (MDEQ), Jay Peasley (WRWP), Tom Hamilton (WRWP/WLPAC), Rich O'Neal (MDNR), Tom Thompson (WRWP), Phil Dakin (WLA), Ray Schinler (WRWP). Not pictured: Jeff Auch (MCD), Kelly Bishop (WRWP/NRCS), Terry Clark (WRWP), Dave Cordray (WRWP), Jim Cordray (WRWP), and Tom Walter (USFS). Photo taken by Nichol De Mol in 6/2008.

1.5 Who helps to develop a watershed management plan?

For a watershed management plan to be successful, there needs to be a dedicated group of local people involved in its creation. This involvement will ensure long-term success. In developing the White River Watershed Management Plan there were several committed individuals from the White River Watershed Partnership (WRWP), the White Lake Association (WLA), the White Lake Public Advisory Council (WLPAC), the Muskegon Conservation District (MCD), the Michigan Department of Environmental Quality (MDEQ), the Michigan Department of Natural Resources (MDNR), the Natural Resources Conservation Service (NRCS), and the United States Forest Service (USFS) (Figure 5). These partners are committed to carry out goals and objectives outlined in the plan to protect the White River Watershed.

The existing (2009) watershed management plan developed by WRWP is a fantastic, thorough document that WLA highly recommends reviewing and commenting on

White River Watershed Management Plan – Highlights



The White River Watershed is split into (10) "sub-watersheds", which enables identification of area-specific pollutants and prioritization based on criticality and need for protection

White River Watershed Management Plan – Highlights, cont.

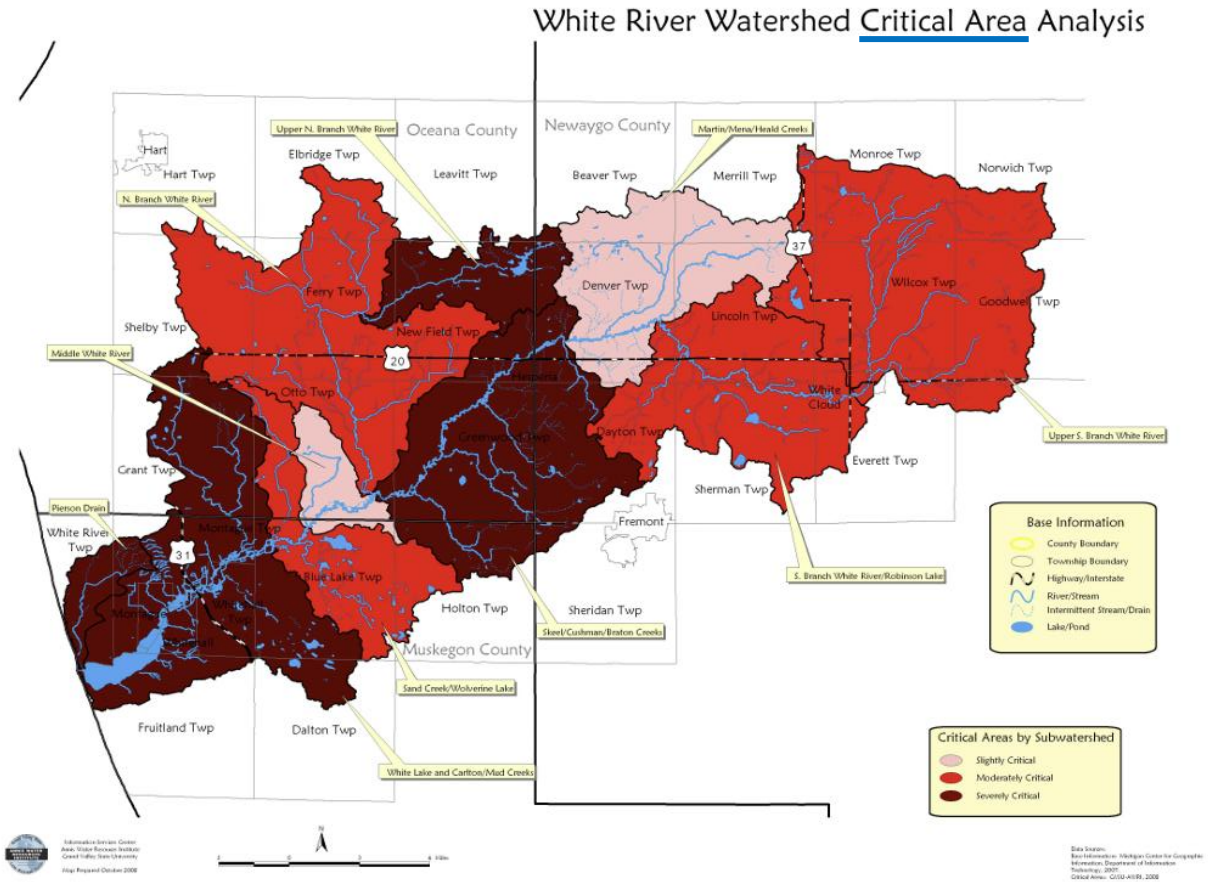


Figure 32. Critical Areas in the White River Watershed. Produced by AWRI-GVSU, October 2008.

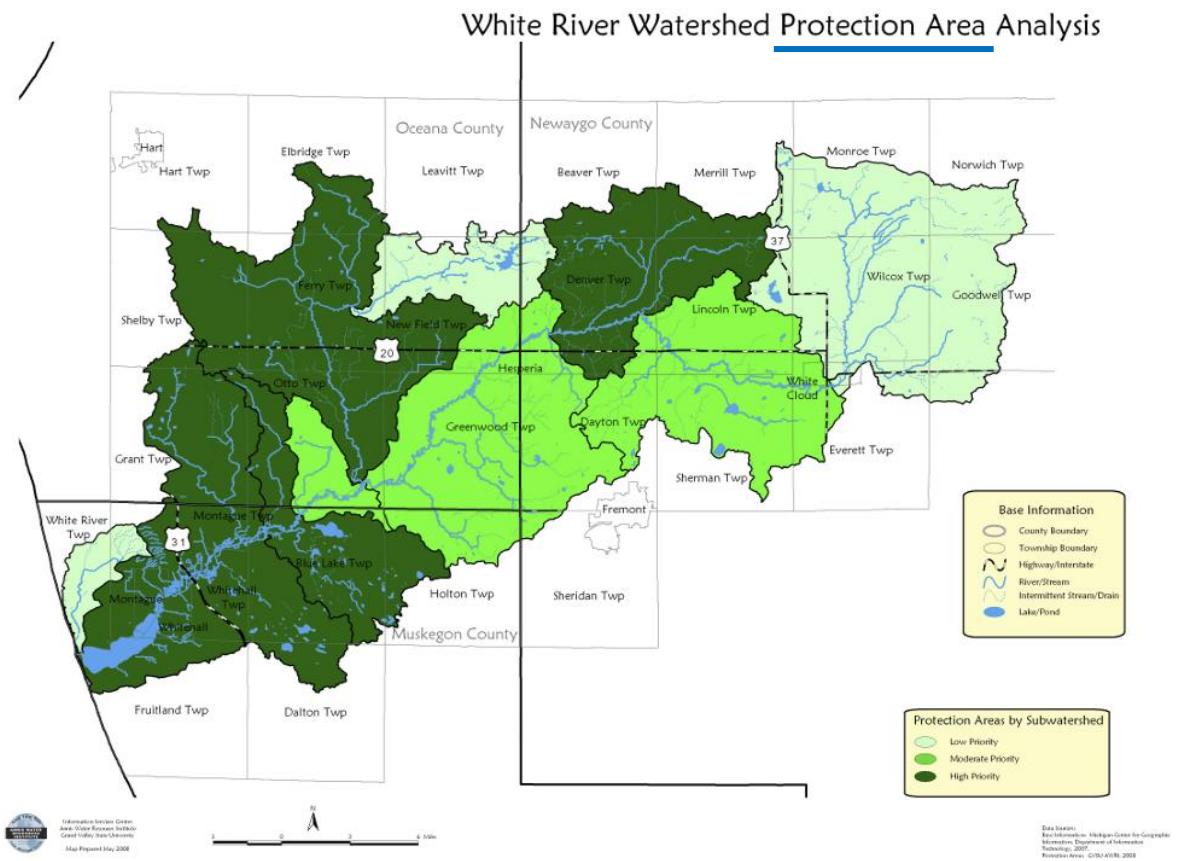
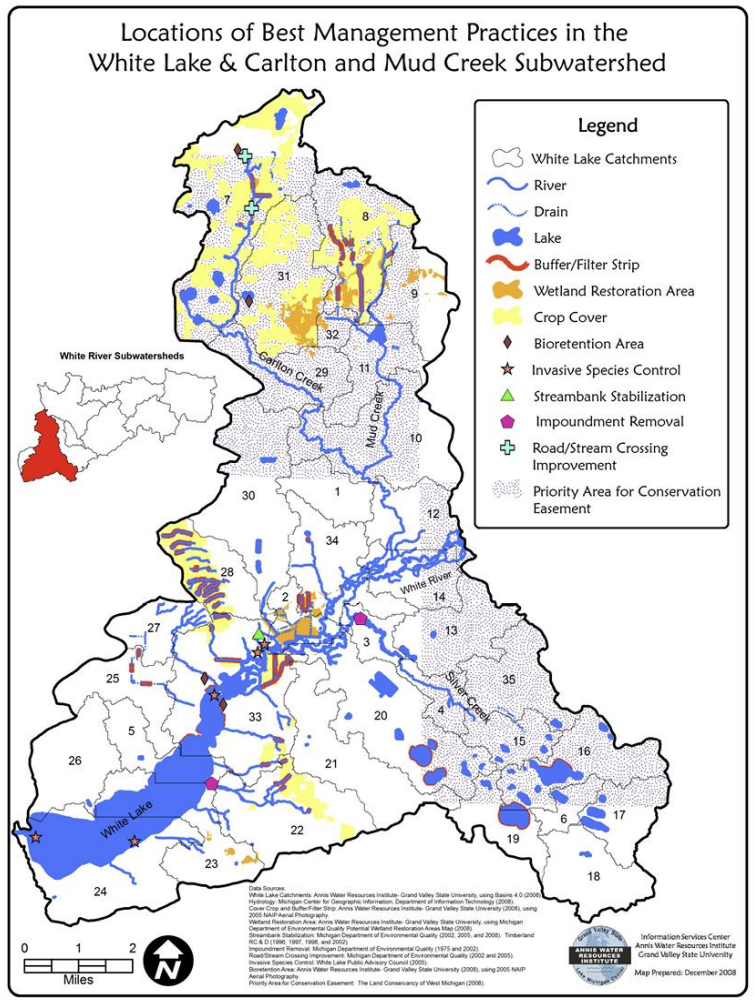


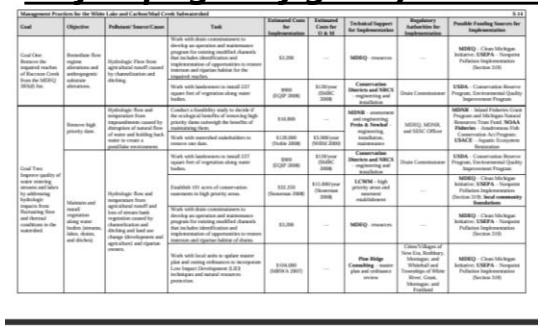
Figure 33. Protection Areas in the White River Watershed. Produced by AWRI-GVSU, May 2008.

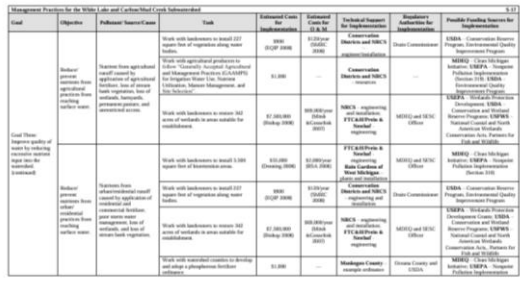
The White Lake & Carlton/Mud Creek sub-watershed was categorized in 2009 as BOTH a "Severely Critical" and "Prioritized Protection" area

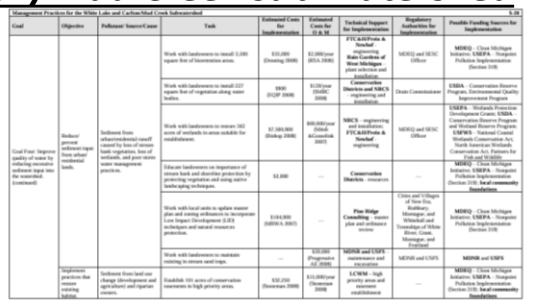
White River Watershed Management Plan – Highlights, cont.

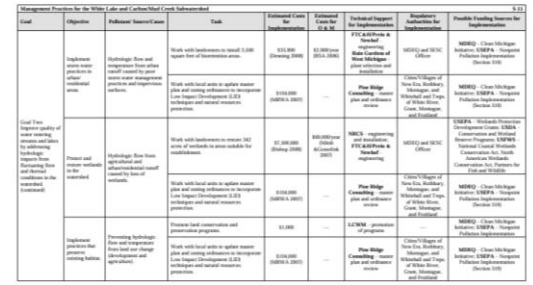


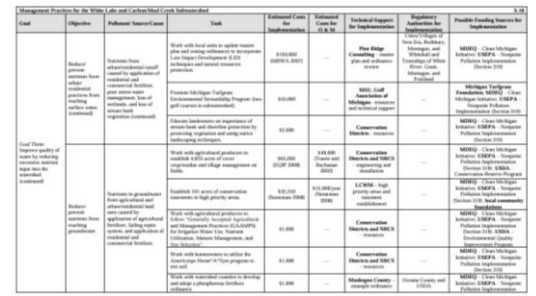
12 full pages of goals/action plans for the White Lake & Carlton/Mud Creek sub-watershed

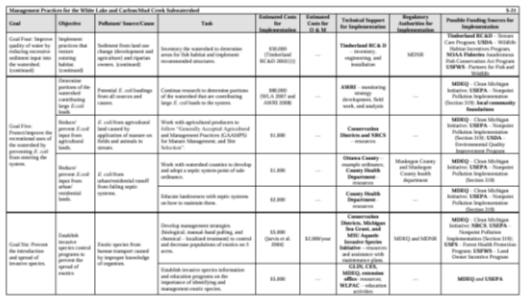


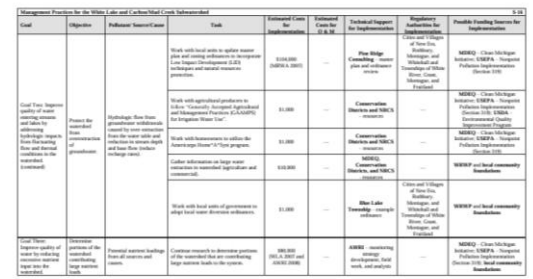


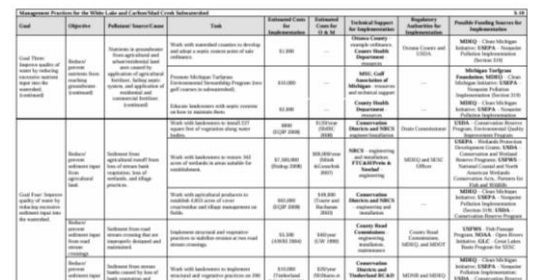


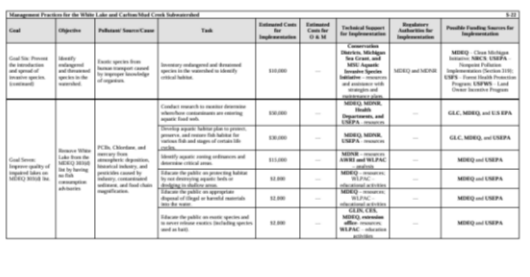








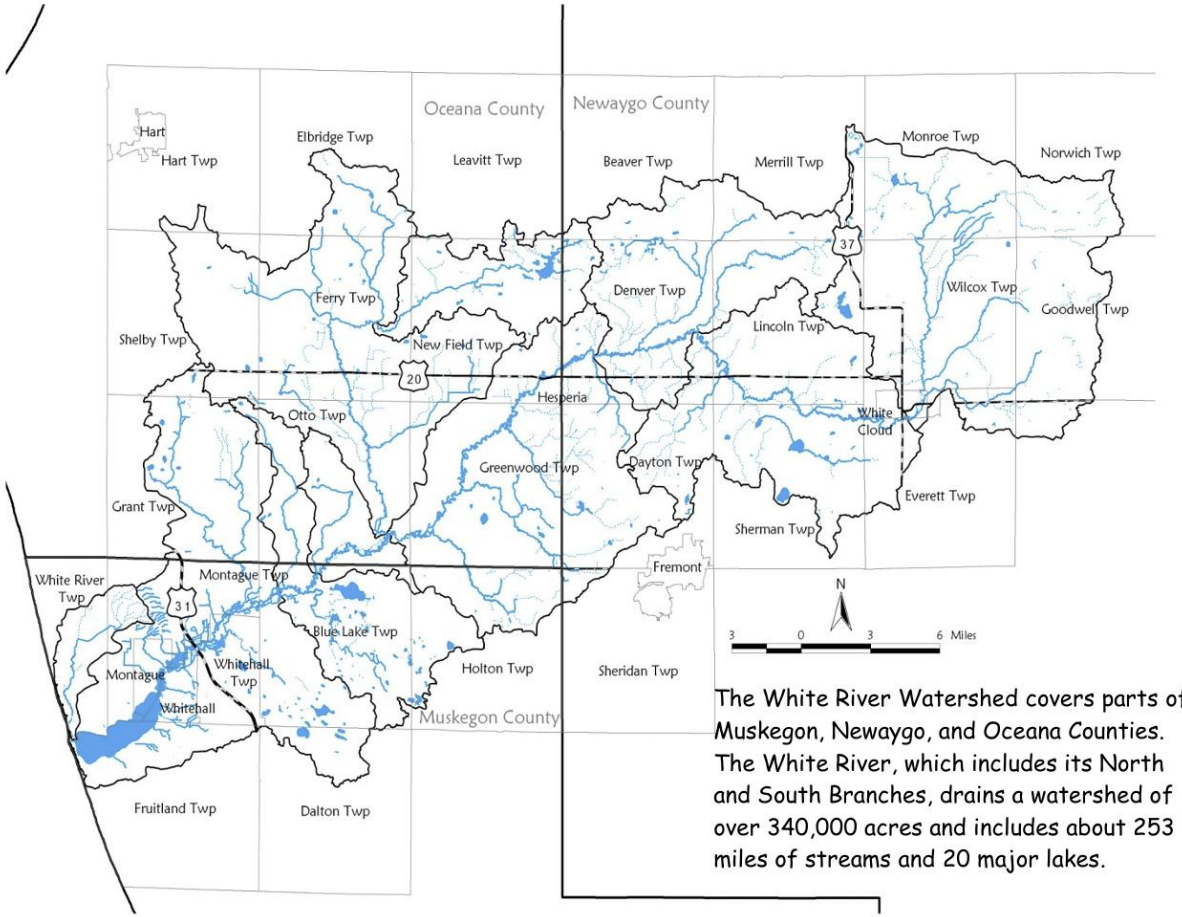




A highly detailed, phased "Best Management Practices" plan was developed for the White Lake & Carlton/Mud Creek sub-watershed area (7 top level "goals") – this should be reviewed/revisited

White River Watershed Management Plan – Highlights, cont.

White River Watershed



The White River Watershed covers parts of Muskegon, Newaygo, and Oceana Counties. The White River, which includes its North and South Branches, drains a watershed of over 340,000 acres and includes about 253 miles of streams and 20 major lakes.

12. For information about environmental issues, indicate how important the following **sources** are to you:

	Very Important	Somewhat important	Not important		Very Important	Somewhat important	Not important
Local officials	41.6	35.5	13.4	Environmental groups	**45.0**	36.6	9.1
State officials	40.5	41.8	9.3	University scientists	**42.0**	36.4	9.1
Federal officials	30.7	42.0	15.8	Fellow workers	17.3	39.6	25.1
Family and friends	35.3	42.8	11.2	Newspapers	31.2	**46.1**	12.6
Church leaders	12.5	30.5	**41.8**	TV and radio	34.9	42.6	12.8
Business leaders	19.9	39.6	27.0	Internet	23.4	37.7	24.7

17. Please indicate which of the following **ACTIONS** you believe are best at protecting water quality in the watershed:

	Most effective	Somewhat effective	Least effective	Not effective	Not sure
Stop mowing to allow **native plants** to grow at water's edge	21.4	**42.0**	7.2	7.6	**14.1**
Avoiding the use of **salt** to melt snow and ice	31.2	**45.4**	6.3	2.6	9.5
Quickly covering **exposed soil** with plants, seed or mulch	38.8	37.4	5.8	1.5	9.5
Reducing **pavement** or other hard surfaces on property	20.8	33.6	**18.8**	9.7	11.7
Testing soils before applying fertilizers	39.8	36.4	7.6	2.8	8.0
Using **fertilizers** without phosphorous	**53.0**	28.1	3.2	1.9	9.3
Avoiding the use of weed killers	44.2	30.5	8.0	2.0	10.6
Using **nontoxic** cleaning products	48.9	32.7	5.5	2.4	6.7
Pumping out a **septic tank** every 3 to 5 years	32.9	30.3	11.7	6.3	**14.5**
Promptly picking up **pet waste** when outdoors	22.1	25.8	**23.2**	**14.9**	9.3
Washing cars over grassy areas away from storm drains	26.4	**42.0**	12.8	3.0	8.9
Quickly repairing leaking **fluids** from cars	**57.1**	27.5	6.1	1.1	4.5
Paying more **attention** to water quality issues	**58.6**	31.0	1.3	1.1	3.7
Volunteering to **clean up** rivers and streams	37.7	**42.4**	5.8	1.7	5.9

A significant portion of the watershed management plan development consisted of a social survey and profile to gauge awareness/interest of the public in the health/value of the watershed

White River Watershed Management Plan – Highlights, cont.

- The earlier survey of **riparian landowners** highlight the critical role they will play in water quality improvements in the watershed. In contrast to other watershed residents, riparian owners were able to assess the condition of water quality plus they considered it the most important feature to protect. They viewed the goal for their property as a heritage to pass to their family and to maintain it in a natural condition. They believed the lack of information was the greatest barrier to protecting the river.
- There is a great **willingness to act in support** of the White River Watershed if residents know specifically what to do, as survey respondents often indicate. However, knowledge alone does not induce action. Individuals and organizations, as research has demonstrated, will take ownership and take action if they are clear about what must be done and if they have personal control over most aspects of the decisions. The effectiveness of actions to protect the watershed, as presented in the watershed survey, demonstrates the need to more thoroughly educate watershed residents about those practices they can implement.
- In the course of a lifetime, an individual may accumulate knowledge about water quality from a combination of schools, the Internet, other media, books, family and friends, outdoor activities, entertainment, and a wide range of other experiences. For a few motivated individuals, these **learning experiences** may eventually lead to taking true watershed actions.
- As these surveys suggest, watershed residents possess **local knowledge** that is specific and tuned into local conditions as they perceive them. While watershed planning has identified pollution sources and causes and reduced them further into discrete components for analysis and planning, local knowledge and local willingness to act will remain an integral component in how well the watershed will be managed and how successfully water quality can be improved.
- One of the main underlying themes that arose during the survey process is the great appreciation of the watershed's natural resources – including its water, wildlife, and forests – with the recognized need to protect and preserve them while securing economic viability and balancing development.
- Changing demographics many result in changing priorities in the watershed, perhaps impacting how actions to protect water quality will be valued relative to other priorities. It has been suggested that as income levels and education attainment rise, residents will more likely be engaged in their communities and, possibly, in watershed affairs. Whether **past trends** will be a factor in the future, such as expanding second home development in the watershed, is difficult to forecast

I really know nothing about the watershed as I **moved to this area** 3 1/2 years ago. I am concerned about over-building, waste, sewer, etc. We need to pay attention to our land so our future generations have a clean place to live. Maybe we need more info in school classes, public meetings, etc. To inform people how to treat our great earth. Sincerely,

One of my personal concerns with our water quality is how it directly affects the **edible quality** of our larger fish that are harvested out of the White River, especially White Lake. I am very apprehensive about consuming large fish due to the large amount of mercury, PCBs, and other toxins that are in the water and absorbed through the fish not to mention other wildlife. Even though I live less than a mile from White Lake, I do most of my fishing at other lakes that don't have the industrial past that White Lake has.

What are the affects of weekly **fireworks** on the lakes in the summer months?

We - you - they have to deal with the excess **nutrient - fertilizer runoff** from the wetland farms upriver from White Lake. Every year commercial "safe" weed killing operations are deposited in White Lake - making it a further chemical soup - settlement ponds, buffer plantings must be created and no q== pumping of "harmful" waters directly into W. River. A sensitive issue!! But necessary purchasing development rights ($) wiser use of lands?

The comment section from a survey conducted in 2009 shows several similar concerns/thoughts we are working with today (16 years later)

White River Watershed Management Plan – EGLE Grant

Watershed Planning RFP

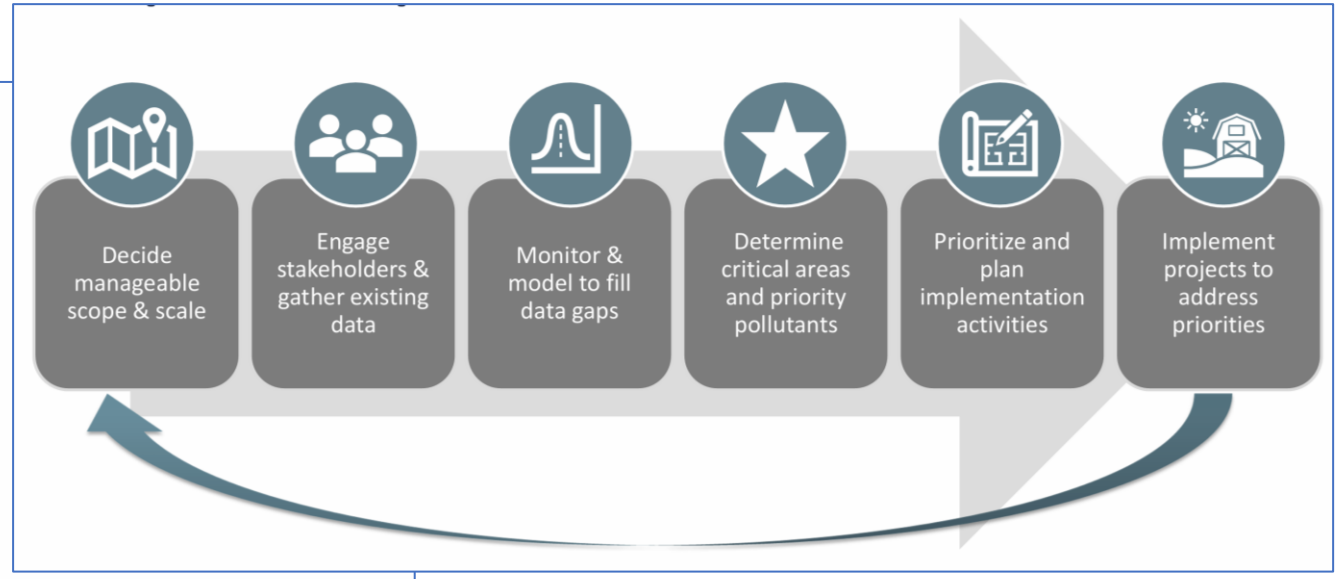
- About **$275,600** is available.
- Minimum Request: **$25,000**
- A minimum **10%** local match is required.

$25,000	+	$2,778	=	$27,778
Grant Request		*Local Match* (10% of project total)		*Project Total*

- **Update** an existing (less than 10 years old) plan -OR- produce a **new** plan.
- Timeline: 2-3 years

Michigan's
Nonpoint Source Program

EGLE



Should we try to submit a proposal for a multi-year, multi-partner update using EGLE grant funding (requires 10% match from another entity – Cities of Montague & Whitehall?)

White River Watershed Management Plan – EGLE Grant, cont.

Schedule

- RFP released Wednesday, September 3, 2025.
- Full proposals submitted by 11:59 pm on Monday, October 6, 2025 via email
- Anticipate awarding funds for successful projects Summer 2026.

Eligible Activities

- Consistent with NPS Program Plan.
- Activities to the develop or update an approvable plan. Examples include:
  - Stakeholder/Workgroup Meetings
  - Environmental and Social Monitoring
  - Inventories
  - Policy Reviews
  - Information and Education
  - Writing the Plan

All projects must:

- Result in a USEPA nine-element approvable watershed management plan.
- Be hydrologically based.
- Include a list of targeted pollutants.
- Consider wetlands (Appendix B).
- Include a shapefile.
  - Contact Peter Vincent for help, VincentP@Michigan.gov

Watershed Management Planning Guidance and Criteria

Three types of projects will be considered:

1. Development of new watershed management plans.
2. Complete updates of previously approved outdated watershed management plans (15+ years old).
3. Technical updates of current approved watershed management plans (less than 10 years old).

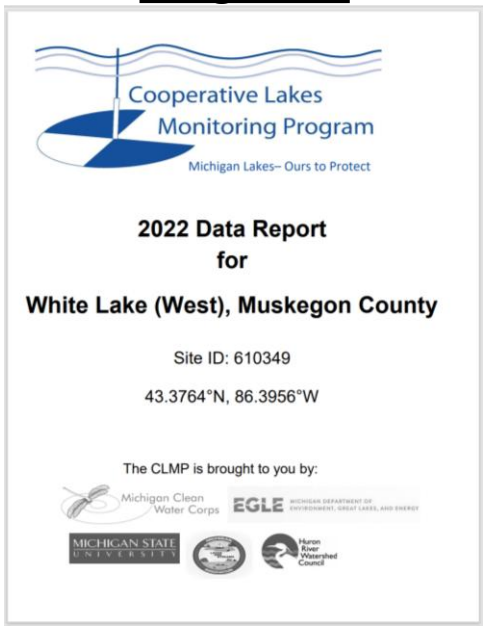
The rapidly approaching submittal deadline likely makes this a bridge too far, BUT it would be good to review and prepare material in order to submit a high quality proposal at this time in 2026

Backup/Reference Material

MiCorps Data Exchange – Data/Report Download

- ALL data for ALL lakes in the Cooperative Lakes Monitoring Program (CLMP) available online at the MiCorps Website:
  - Lake Search | MiCorps (https://data.micorps.net/view/lake/)
- CLMP Data Reports available to download:

Long Point


Cooperative Lakes Monitoring Program
Michigan Lakes– Ours to Protect

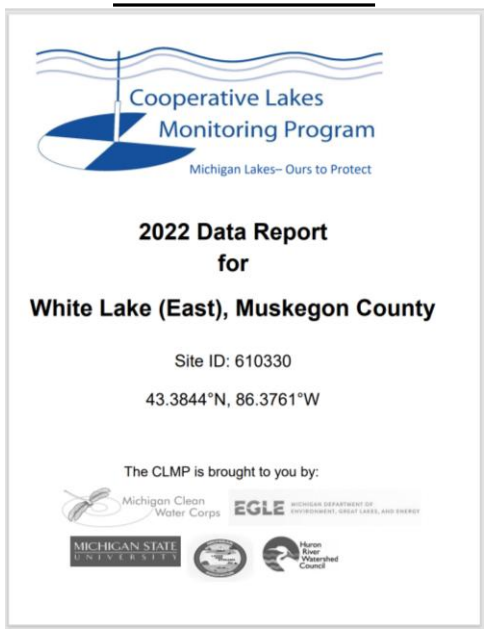
2022 Data Report
for
White Lake (West), Muskegon County

Site ID: 610349

43.3764°N, 86.3956°W

The CLMP is brought to you by:

Dowies Point


Cooperative Lakes Monitoring Program
Michigan Lakes– Ours to Protect

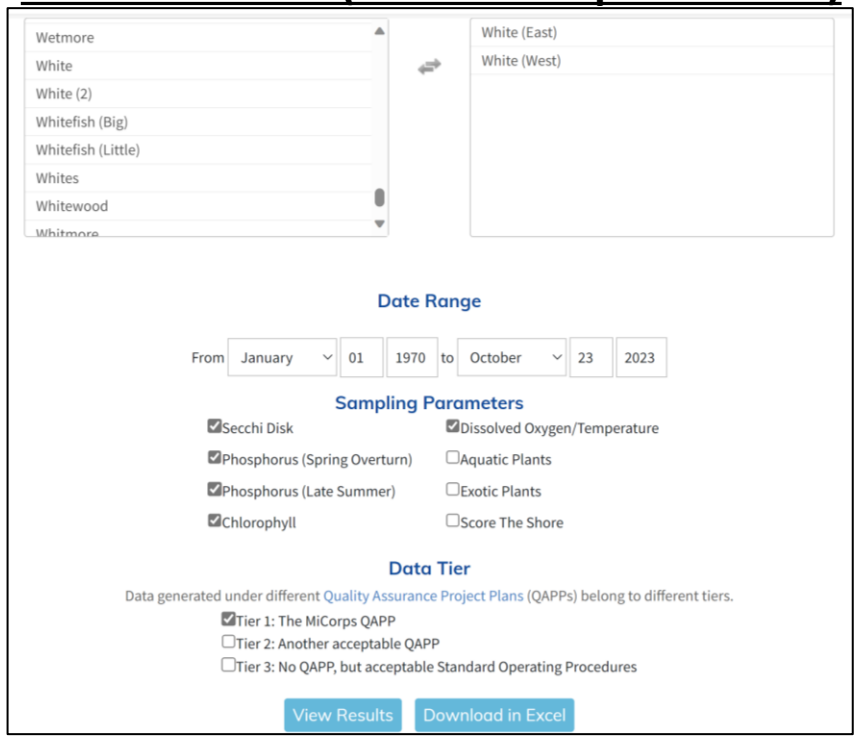
2022 Data Report
for
White Lake (East), Muskegon County

Site ID: 610330

43.3844°N, 86.3761°W

The CLMP is brought to you by:

Data Download (View or Output to Excel)

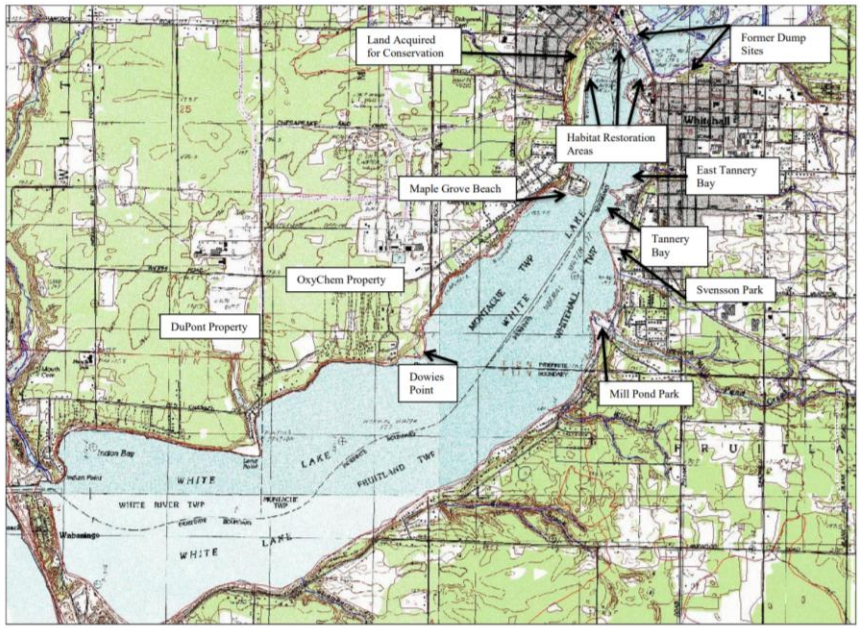


White Lake Area of Concern (AOC) History

2.3 Historical Information

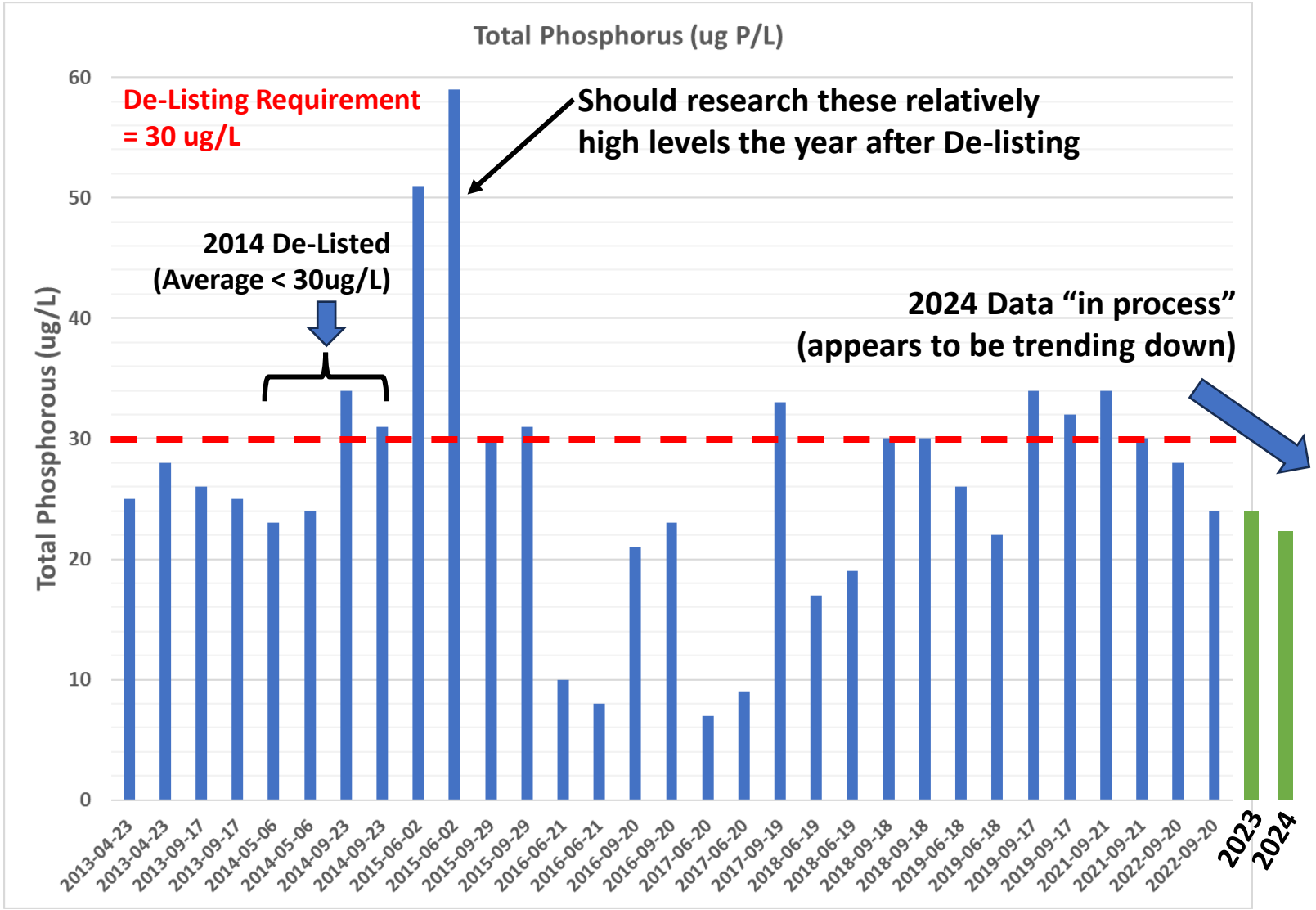
Over the years, much has been written and otherwise documented about the history of industrial and municipal pollution at White Lake. There is a great deal of information available from various sources regarding the cleanup and restoration efforts resulting in the delisting of the White Lake AOC. www.restoringwhitelake.com has a wealth of historical information and details of restoration projects completed at White Lake. It includes a timeline (Figure 3), which provides an abbreviated summary of important events that have impacted the lake and the community: http://restoringwhitelake.com/restoration_history_timeline.pdf. A 1968 Life Magazine article about extensive pollution throughout the Great Lakes includes dramatic photos and mentions White Lake, along with other future AOCs: http://restoringwhitelake.com/Life_BlightedGreatLakes_082368.pdf

At least two documentary films were made detailing industrial pollution and impacts to the surrounding communities. "The Tragedy of White Lake" was produced in 1978 and is available online here: http://www.youtube.com/watch?v=5d_J_05IjvU. "This is Not a Chocolate Factory" was produced in the early 2000s and can also be found online: http://www.youtube.com/watch?v=b5Oe1GzMjXg.



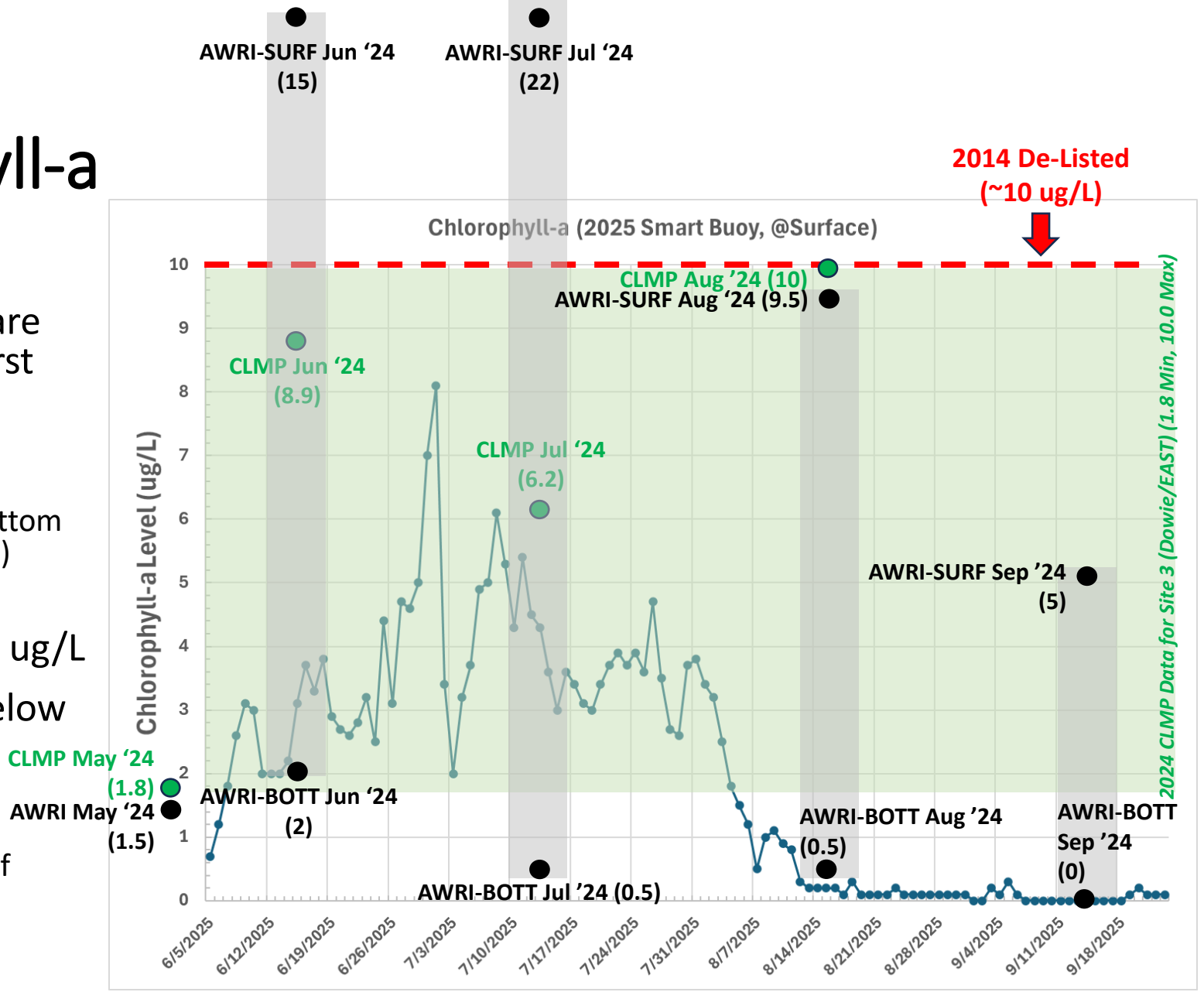
White Lake Historical Data Trends (Phosphorous)

- Varying Phosphorous levels since De-Listing, recently trending down



Looking at Chlorophyll-a

- 2025 Smart buoy measurements are all near the surface (typically "worst case" due to higher solar loading)
  - CLMP requires "composite depth sampling" (2X Secchi depth)
  - GVSU/AWRI reported surface and bottom sampling (large variation in C-a levels)
- All 2025 daily averages have been below delisting requirement of 10 ug/L
- All 2025 daily averages are well below 2024 CLMP-EAST and (especially) AWRI-EAST levels
  - Can specific day of sampling, relative volatility in June/July, and/or depth of sampling account for the large C-a discrepancies b/w CLMP & AWRI?



Buoy-based Chlorophyll-a levels are at or below levels in 2024, will be interesting to compare 2025 buoy data to eventual 2025 CLMP report. Also, AWRI saw spike in C-a at Site 3 in October '24 (check buoy).