

OARS BACTERIA MONITORING SUMMARY 2025

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1. SUMMARY

Escherichia coli (*E. coli*) monitoring is critical for effective watershed management and recreational water protection. *E. coli* bacteria are an indicator of fecal contamination in water bodies (U.S. Geological Survey, 2018). OARS has been tracking *E. coli* levels on the Sudbury-Assabet-Concord watershed to identify *E. coli* levels at hot spots. In 2025, OARS tested 126 water samples for *E. coli* across 14 sites along the Assabet, Sudbury and Concord rivers, as well as River Meadow Brook in Lowell (a tributary to the Concord River) in Massachusetts, to evaluate where *E. coli* levels exceed any of the six safety thresholds for recreational uses, including swimming and boating. Volunteers collected samples at 14 sites on nine collection days from the mid-May to the mid-September 2025 on a biweekly schedule.

The Sudbury, Assabet and Concord Rivers are considered safe for secondary recreation, which includes boating and fishing but not eating the fish. Some sites, however, fail to meet safety thresholds for swimming. At three sites, *E. coli* exceeded the MA Surface Water Quality Standard based on primary contact (swimming) calculated by geomean of data: Rt. 135 in Ashland (SUD-236), Rogers St Bridge in Lowell (CND-009) and Lawrence St. in Lowell (RVM-001). These three areas do not offer public swimming areas. On the one tributary stream monitored in 2025, *E. coli* concentrations at the River Meadow Brook site at Lawrence St., Lowell (RVM-001) exceeded the Massachusetts Secondary Contact Recommendation (boating) calculated with the 5-Sample Running Geometric Mean. High-precipitation days during low-precipitation years tend to have highest median *E. coli* levels. OARS will continue to monitor bacteria levels and work with municipalities to provide data that informs decision-making for the health of the watershed.

2. INTRODUCTION

Escherichia coli (*E. coli*) pose a public health risk. High concentrations of the *E. coli* bacteria are an indicator of fecal water contamination (U.S. Geological Survey, 2018; OARS, 2024). Although most strains are harmless, some have the potential to make humans ill, depending on the strain (U.S. Geological Survey, 2018). Symptoms range from urinary tract infections, diarrhea and vomiting to kidney failure. Potential sources of *E. coli* include feces from humans, especially from failing septic systems or sewer pipe leaks. Feces can also come from warm-blooded animals, such as beavers and birds. *E. coli* can enter water bodies from runoff in stormwater, from either urban areas or from manure used in agriculture and fertilizers (USEPA, 2021).

OARS selected sites to identify and monitor bacteria hot spots. As such, the resulting record of *E. coli* concentrations is likely higher at the measured sites than the rest of the watershed. Sites were selected based on a combination of the presence of major roads nearby that could impact runoff inputs, an effort to monitor at least one site along the mainstem of each major river (Sudbury, Assabet and Concord) each year, recommendations and direct requests from municipal employees and their

partners, as well as feedback from volunteers living in the communities we serve. OARS looks forward to working with municipal employees and community members to adjust and grow our bacteria monitoring program to best serve communities throughout the watershed.

3. METHODS

3a.) Data Collection Methods

Volunteers collected samples between 6 and 8:30 am on a biweekly schedule between May 12th and September 15th, 2025. All data were processed according to the protocol outlined in OARS Quality Assurance Protocol Plan (available upon request), approved by the Massachusetts Department of Environmental Protection (MADEP). Volunteers stored bacteria sample bottles in labeled plastic bags in an iced cooler when not sampling, wore gloves when touching the bottle cap, and collected samples using a sampling basket, sampling pole, or wading method to capture flow near the river's center flow. Samples were delivered to a state-approved laboratory. One sample bottle was filled with sterile water and submitted to the laboratory for *E. coli* analysis as a quality control measure designed to confirm that the collection process did not introduce *E. coli* to surface water samples, at a frequency of 10% of the samples. Duplicate samples (filled with the same river water as the regular bacteria sample) were collected at a frequency of 10%, also to confirm that the testing process was consistent.

Table 1: OARS Bacteria Monitoring Sites List, 2025

OARS Site #	Waterbody	Description	Municipality	Lat/Lon
ABT-077	Lower Assabet River	USGS Maynard Gage	Maynard	42° 25' 55" / -71° 26' 59"
ABT-176	Upper Assabet River	Wheeler Road	Hudson	42° 23' 14" / -71° 33' 39"
CND-009	Lower Concord River	Rogers Street	Lowell	42° 38' 09" / -71° 18' 05"
CND-093	Upper Concord River	Concord River at Rt. 4	Billerica	42° 32' 09" / -71° 17' 57"
RVM-001	River Meadow Brook	645 Lawrence St.	Lowell	42° 37' 60" / -71° 18' 11"
SUD-144	Lower Sudbury River	Sudbury Landing	Framingham	42° 19' 32" / -71° 23' 51"
SUD-236	Upper Sudbury River	Chestnut Street	Ashland	42° 15' 27" / -71° 27' 18"
ABT-033	Lower Assabet River	Rte 62, W Concord	Concord	42° 27' 19" / -71° 23' 24"
ABT-079	Lower Assabet River	Walnut St Bridge	Maynard	42° 25' 51" / -71° 27' 12"
ABT-080	Lower Assabet River	Main St & Walnut	Maynard	42° 25' 54" / -71° 27' 19"
ABT-084	Lower Assabet River	Maynard Town Hall	Maynard	42° 25' 43" / -71° 27' 42"
ABT-089	Lower Assabet River	Rt. 117	Maynard	42° 25' 28" / -71° 28' 07"
SUD-177	Upper Sudbury	Kellog Street	Framingham	42° 23' 41" / -71° 25' 51"
SUD-004	Lower Sudbury	Nashawtuc Road	Concord	42° 27' 30" / -71° 21' 33"

3b.) Criteria to Evaluate Bacteria Exceedances

This report compares *E. coli* levels to recommended secondary contact levels (protective of boating) because the most frequent recreational use of the Assabet, Sudbury and Concord Rivers is boating and fishing. We also compare *E. coli* levels to primary contact levels because OARS' goal is for all reaches of the three rivers to be fishable and swimmable. To meet the swimmable goal, Massachusetts surface water quality criteria must be met.

E. Coli Primary Contact (Swimming) Criteria

After collecting data on *E. coli* levels in river water, OARS compares those levels to United States Environmental Protection Agency (USEPA) surface water quality criteria for *E. coli* adopted by Massachusetts (314 CMR 4.00, 2021). The criteria have two elements: 1.) "concentrations shall not exceed 126 colony-forming units (cfu) per 100 mL, calculated as the geometric mean of all samples collected within any 90-day or smaller interval." 2.) "No more than 10% of all such samples shall exceed 410 cfu per 100 mL" (Table 1). The criteria are based on the link between the amount of gastrointestinal illness caused by ingestion of surface water with varying levels of *E. coli* while swimming (USEPA, 2012). The goal of surface water criteria is to limit illness caused by ingestion of surface water while swimming.

E. Coli Secondary Contact (Boating) Recommendations

USEPA has also developed a methodology to derive secondary contact recommendations, which are recommended levels of *E. coli* in surface water based on other kinds of recreational activities, such as boating or fishing. Recommended boating levels are (geometric mean ≤ 630 CFU/100 mL; 90% of samples ≤ 1260 CFU/100 mL, Table 1). The secondary contact recommendations are five times higher than the primary contact criteria because the amount of water ingested by many non-swimming recreational activities, such as boating, is less than ingested while swimming (USEPA, 2022; USEPA 2024).

Beach Action Value

USEPA has also derived a Beach Action Value (BAV) of 235 CFU/100 mL (Table 1) as a tool that states may choose to use, "as a 'do not exceed' value for beach notification purposes (such as advisories)." (US EPA, 2012).

Table 1. <i>E. coli</i> (CFU/100 mL) Criteria and Recommendations		
Beach Action Value (swimming)	≤ 235 for a single sample	-
Acute Boating Limit	≤ 1260	-
Primary Contact (swimming)	≤ 126 , Geometric Mean	≤ 410 , 90% of samples
Secondary Contact (boating)	≤ 630 , Geometric Mean	≤ 1260 , 90% of samples

E. COLI RESULTS (2025)

Site #	Description	Town	River	12 May	27 May	16 Jun	30 Jun	14 Jul	28 Jul	18 Aug	2 Sep	15 Sep
ABT-033	Rt. 62 Pump Stn.	Concord	Assabet	147	82	172	155	99	52	63	52	28
ABT-077	USGS gage	Maynard	Assabet	162	68	248	156	72	116	613	172	142
ABT-079	Walnut St Bridge	Maynard	Assabet	185	102	113	162	144	378	579	345	387
ABT-080	Main St and Walnut St	Maynard	Assabet	249	111	108	111	125	172	435	308	112
ABT-084	Maynard Town Hall	Maynard	Assabet	172	93	105	135	81	58	50	16	102
ABT-089	Rt. 117	Maynard	Assabet	261	104	81	44	53	58	84	17	36
ABT-176	Wheeler Rd	Hudson	Assabet	345	140	326	436	236	158	125	135	148
SUD-004	Nashawtuc Rd	Concord	Sudbury	86	55	93	78	140	83	66	58	54
SUD-144	Sudbury Landing	Framingham	Sudbury	69	99	88	166	158	219	210	179	201
SUD-177	Kellog St	Framingham	Sudbury	131	133	328	291	272	76	50	42	70
SUD-236	Rt 135	Ashland	Sudbury	162	75	921	365	548	1986	167	261	210
CND-009	Rogers St Bridge	Lowell	Concord	199	120	178	326	580	186	411	387	178
CND-093	Rt 4 Carter Ave	Billerica	Concord	146	93	46	12	54	51	10	14	12
RVM-001	Lawrence St.	Lowell	River Meadow	144	411	488	1203	411	1414	649	687	219

Table Legend:

Dark Orange Highlighting: sample concentration exceeds recommended boating levels (Recommended that 90% of samples ≤ 1260 CFU/100 mL.)

Orange Highlighting: sample concentration exceeds Massachusetts Surface Water Quality Standard based on primary contact, such as swimming. (Recommended that 90% of samples ≤ 410 CFU/100 mL.)

Light Orange Highlighting: Sample concentrations exceeding the Beach Action Value (BAV) of 235 CFU/100 mL.

Three sites exceed the MA Surface Water Quality Standard based on primary contact (swimming) of 235 CFU/100 mL shown in bold, for geometric mean concentrations calculated with all samples: Rt. 135 in Ashland (SUD-236), Rogers St Bridge in Lowell (CND-009) and Lawrence St. in Lowell (RVM-001). These three areas are not widely used for swimming. *E. coli* concentrations at the site at Lawrence St., Lowell (RVM-001) exceeded the Massachusetts Secondary Contact Recommendation (boating) of 630 CFU/100 mL calculated with the 5-Sample Running Geometric Mean.

E. coli levels have remained below the Primary Contact (swimming) Threshold of Geometric Mean > 126 CFU/100 mL at five sites: ABT-033 (Assabet River at Route 62, Concord), ABT-084 (Assabet River at Maynard Town Hall), ABT-089 (Assabet River at Rt. 117, Maynard), CND-093 (Concord River at Carter Ave, Billerica), and SUD-004 (Sudbury River at Nashawtuc Rd, Concord). At all sites, however, at least one sample during the year 2025 exceeded the acute swimming threshold of < 235 CFU/110 mL.

Table 3. OARS <i>E. coli</i> (CFU/100 mL) Geomean of Results, 2025.												
Site #	Description	Town	Geomean of all Samples	Geomean 12 May	Geomean 27 May	Geomean 16 Jun	Geomean 30 Jun	Geomean 14 Jul	Geomean 28 Jul	Geomean 18 Aug	Geomean 2 Sep	Geomean 15 Sep
ABT-033	Rt. 62 Pump Station	Concord	81	nc	nc	nc	nc	126	102	97	76	54
ABT-077	USGS Gage	Maynard	156	nc	nc	nc	nc	125	117	182	169	166
ABT-079	Walnut St Bridge	Maynard	225	nc	nc	nc	nc	138	159	225	281	335
ABT-080	Main St and Walnut St	Maynard	168	nc	nc	nc	nc	133	123	162	200	200
ABT-084	Maynard Town Hall	Maynard	76	nc	nc	nc	nc	113	91	80	55	52
ABT-089	Rt. 117	Maynard	63	nc	nc	nc	nc	87	65	62	45	44
ABT-176	Wheeler Rd	Hudson	205	nc	nc	nc	nc	277	237	231	194	156
SUD-004	Nashawtuc Rd	Concord	76	nc	nc	nc	nc	86	86	89	81	75
SUD-144	Sudbury Landing	Framingham	144	nc	nc	nc	nc	110	138	160	185	192
SUD-177	Kellog St	Framingham	120	nc	nc	nc	nc	214	192	158	105	79
SUD-236	Rt. 135	Ashland	325	nc	nc	nc	nc	295	487	572	444	398
CND-009	Rogers St Bridge	Lowell	253	nc	nc	nc	nc	240	237	303	354	314
CND-093	Rt. 4 / Carter Ave	Billerica	32	nc	nc	nc	nc	53	43	27	22	22
RVM-001	Lawrence St.	Lowell	501	nc	nc	nc	nc	428	675	740	792	563

Table Legend:

Bold text: Geometric mean calculated from all samples

Dark Orange Highlighting: 5-Sample Running Geometric Mean concentrations exceeding the Massachusetts Secondary Contact Recommendation (boating) of 630 CFU/100 mL.

Light Orange Highlighting: 5-Sample Running Geometric Mean concentrations exceeding the Massachusetts Surface Water Quality Standard based on primary contact (swimming) of 235 CFU/100 mL shown in bold.

Purple Highlighting: Geometric mean concentrations (calculated with all samples) exceeding the Massachusetts Surface Water Quality Standard based on primary contact (swimming) of 235 CFU/100 mL shown in bold.

nc: not calculated

Table 4. OARS <i>E. coli</i> (CFU/100 mL) Geometric Mean of Results, 2019-2025.									
Site #	Description	River	2025 Geo- Mean	2024 Geo- Mean	2023 Geo- Mean	2022 Geo- Mean	2021 Geo- Mean	2020 Geo- Mean	2019 Geo- Mean
ABT-077	Waltham St, Maynard	Assabet	157	294	195	193	164	289	121
ABT-176	Wheeler Rd, Hudson	Assabet	214	228					
ABT-033	Route 62, Concord	Assabet	93	117					
ABT-079	Walnut St Bridge, Maynard	Assabet	210						
ABT-080	Main St & Walnut, Maynard	Assabet	177						
ABT-084	Maynard Town Hall	Assabet	74						
ABT-089	Rt. 117, Maynard	Assabet	67						
CND-009	Rogers St, Lowell	Concord	264	185	191	203	153	216	147
CND-093	Carter Ave, Billerica	Concord	36	26	51	9			
RVM-001	Lawrence St, Lowell	River Meadow	555	396	502	504	412	427	
SUD-004	Nashawtuc Rd, Concord	Sudbury	79						
SUD-144	Danforth St, Framingham	Sudbury	138	58					
SUD-177	Kellog St., Framingham	Sudbury	128						
SUD-236	Chestnut St, Ashland	Sudbury	343	174	186	201	169	348	151

Table 4. *E. coli* results for 14 sites in 2025 and eight historic data sites. Pink shading designates sites where *E. coli* levels exceed the Massachusetts Surface Water Quality Standards for Primary Contact (swimming) of geomean >126 CFU/100 mL.

For all seven years of bacteria data on record (2019-2025), all sites met the Secondary Contact Recommendations of ≤ 630 CFU/100 mL Geometric Mean of the annual data. The Sudbury, Assabet and Concord Rivers are, for the most part, boatable and safe for secondary recreation. In 2025, at seven of the fourteen sites, $> 25\%$ of single samples exceed the beach action value (BAV, or swimming limit) of 235 CFU/100 mL for a single sample: ABT-176 (Assabet River at Wheeler Rd, Hudson), CND-009 (Concord River at Rogers St Bridge, Lowell), RVM-001 (River Meadow Brook at Lawrence St, Lowell), SUD-236 (Sudbury River at Rt 135, Ashland), ABT-079 (Assabet River at Walnut St Bridge, Maynard), ABT-080 (Assabet River at Main St & Walnut, Maynard), SUD-177 (Sudbury River at Kellog Street, Framingham). OARS *E. coli* results since 2019 show that site RVM-001 at River Meadow Brook in Lowell has the highest *E. coli* levels recorded by OARS in the watershed (Figure 3).

In 2025, two sites have exceeded the MA Surface Water Quality Standards for Primary Contact (swimming) geomean > 126 CFU/100 mL: Rogers St, Lowell (CND-009) and Chestnut St, Ashland (SUD-236). At five sites, bacteria levels have remained below the Primary Contact (swimming) geomean of samples > 126 CFU/100 mL: ABT-033 (Assabet River at Route 62, Concord), ABT-084 (Assabet River at Maynard Town Hall), ABT-089 (Assabet River at Rt. 117, Maynard), CND-093 (Concord River at Carter Ave, Billerica), and SUD-004 (Sudbury River at Nashawtuc Rd, Concord). However, at all sites, at least one individual sample during the year 2025 exceeded the acute swimming threshold of < 235 CFU/110 mL. These sites are not popular swimming locations, and thus cannot be “closed to swimming” when acute swimming thresholds are exceeded.

In 2025, some sites along all rivers exceed the Beach Action Value (BAV) for single samples of 235 CFU/100 mL (Figure 2). Two samples exceed recommended boating levels (90% of samples ≤ 1260 CFU/100 mL), one at SUD-236 and one at RVM-001.

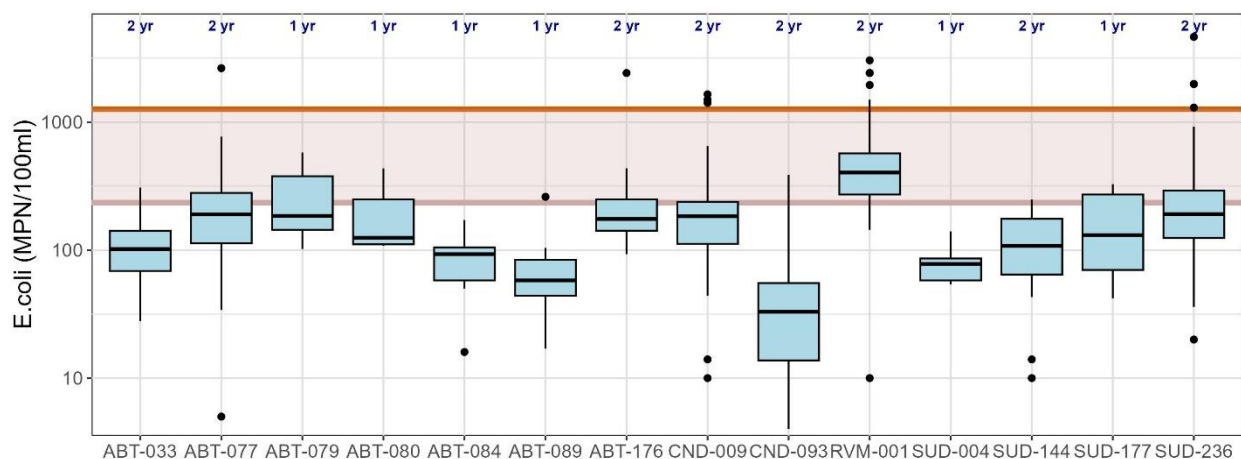


Figure 2. Boxplot of E. coli levels for fourteen sites across nine annual sampling events per year (2024 and 2025) compared to acute primary contact (swimming) safety thresholds and secondary contact (boating) recommendations.

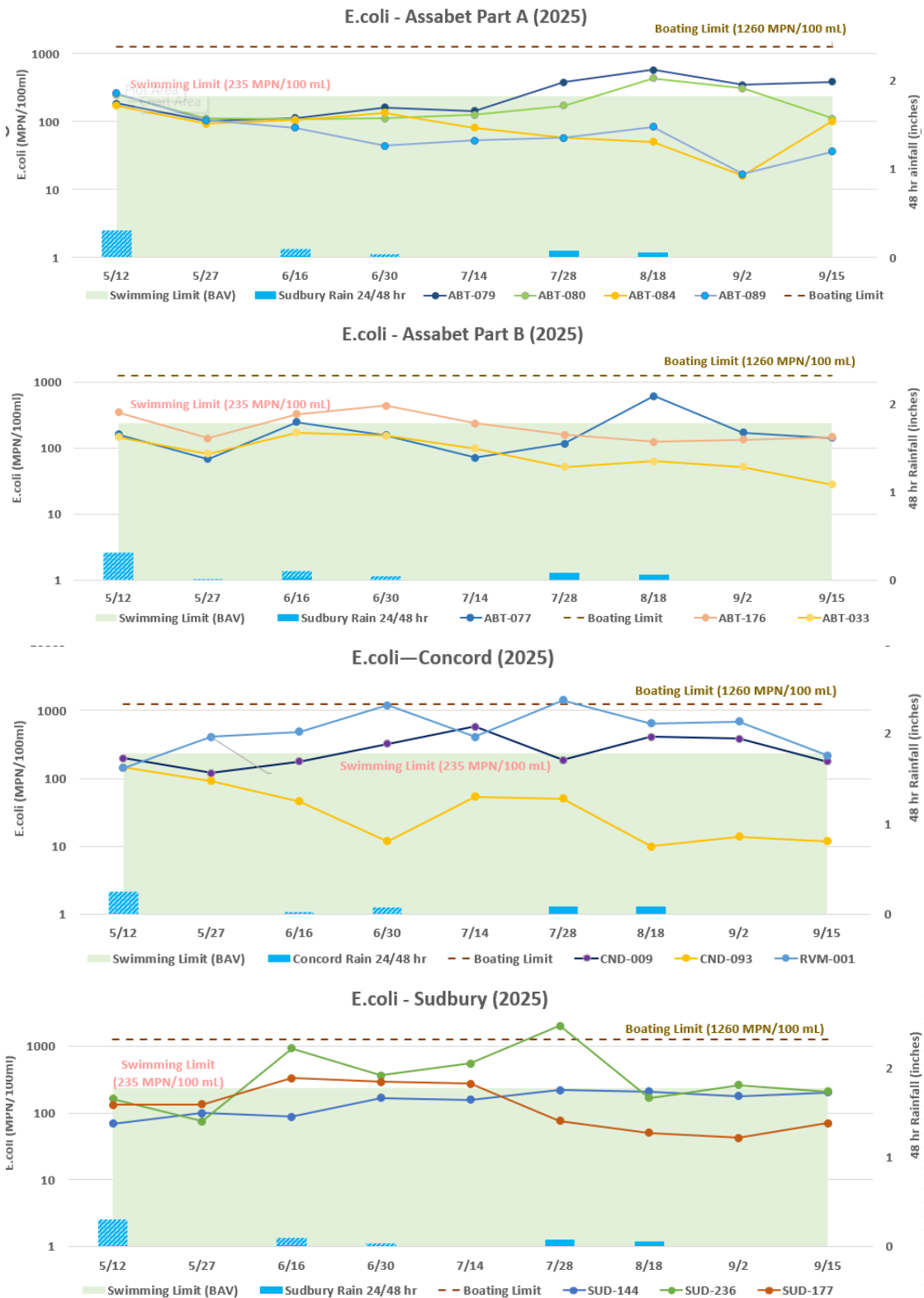


Figure 3. OARS' 2025 E. coli Results by River Section Compared to Primary Contact (Swimming) Limits and Secondary Contact (Boating) Recommendations.

DRY vs. WET WEATHER

High precipitation years tend to show low *E. coli* concentrations due to dilution, whereas low precipitation years tend to have higher overall *E. coli* concentrations. Seven years of OARS *E. coli* data (2019-2025) are available at ABT-077, CND-009, and SUD-236 illustrating this trend (Figure 4).

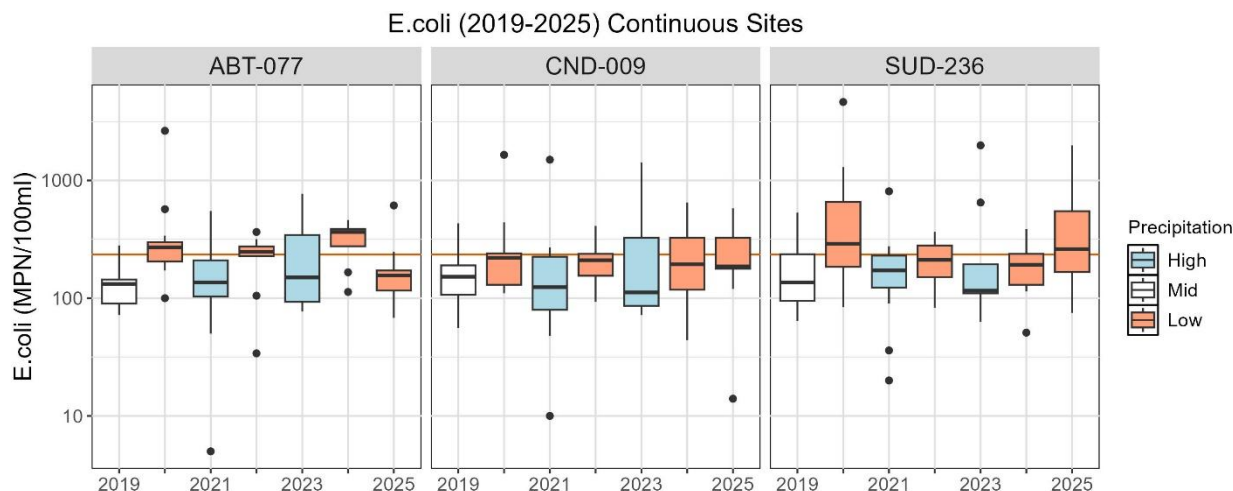


Figure 4. Seven years of OARS *E. coli* (CFU/100 mL) data at three sites show long-term trends for high and low-precipitation years.

High-precipitation days during low-precipitation years tend to have highest median *E. coli* levels. *E. coli* levels tend to be higher during/after wet weather events due to surface runoff of *E. coli* into water bodies. Figure 5 groups *E. coli* results based on the previous 48-hour precipitation (where wet weather is ≥ 0.10 in, dry weather < 0.10 in) (Figure 5). Sites with high *E. coli* concentrations during wet weather events likely have high contributions of *E. coli* from surface runoff, such as sites like CND-009, RVM-001 and SUD-236. Sites with high *E. coli* concentrations during dry events likely also have non-runoff sources, such as sanitary sewage, for sites like ABT-079 and RVM-001.

The Concord River Site CND-009 is upstream of a permitted combined sewage overflow at Warren Station in Lowell, MA (meaning that this site was not specifically placed to capture the effect of that combined sewage overflow). It is still possible that other sewage contamination could be present at this site.

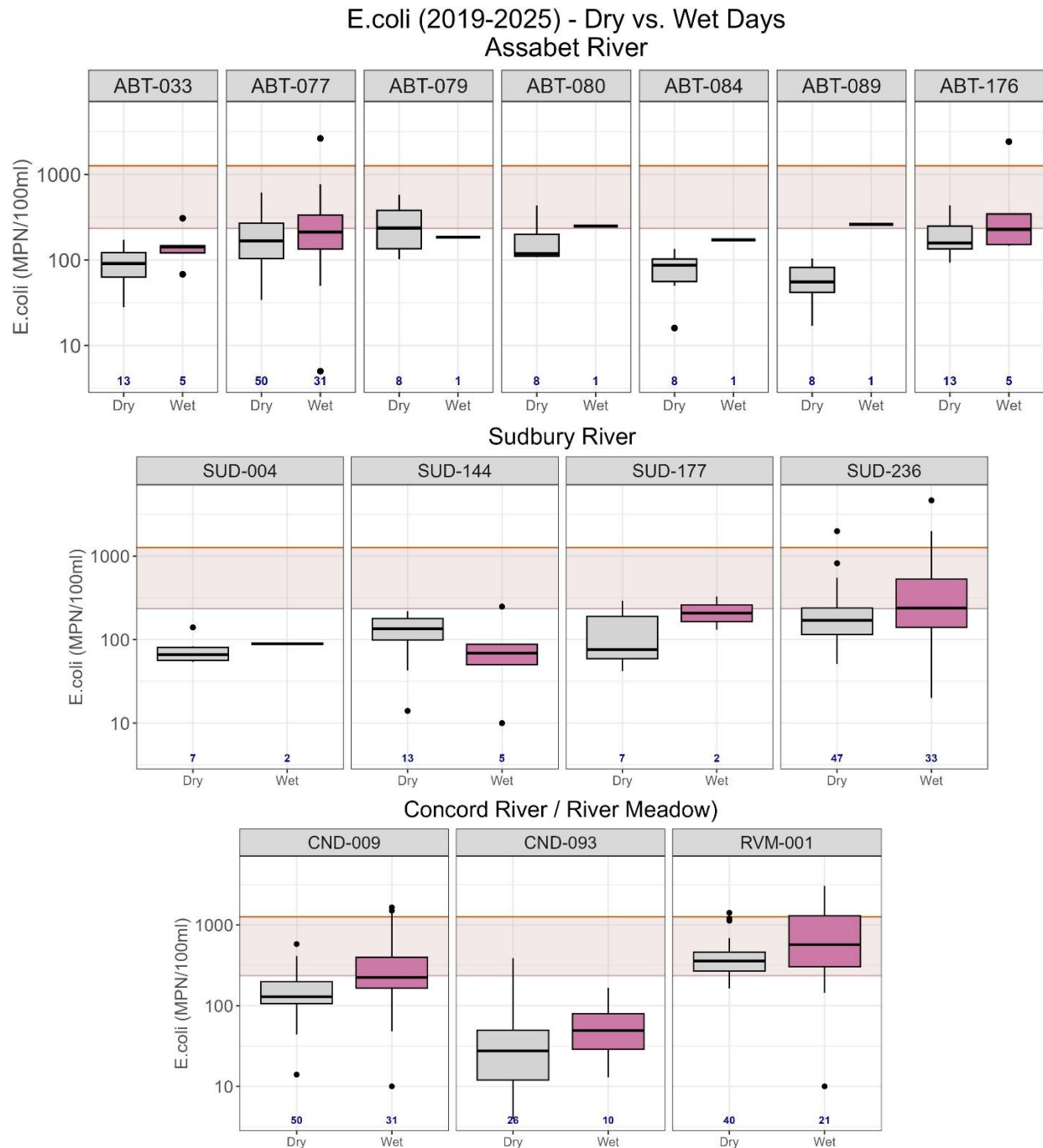


Figure 5. Boxplots of OARS E. coli results since 2019 by site, grouped by wet and dry sampling days. (Number of samples included at each site listed at the bottom). Each box extends from the 25th to 75th percentile of the data, and the whisker lines mark the upper and lower 25% of the data. Points indicate outliers.

CONCLUSIONS

2025 OARS bacteria data was collected at 14 sites on nine sampling days. Results confirm that all Concord, Assabet and Sudbury River sites are safe for secondary recreation such as boating. Not all sites on the three rivers are safe for swimming. In 2025, three sites exceeded the MA Surface Water Quality Standard based on primary contact (swimming) of 235 CFU/100 mL for geometric mean concentrations calculated with all samples: Rt. 135 in Ashland (SUD-236), Rogers St Bridge in Lowell (CND-009) and Lawrence St. in Lowell (RVM-001). These three areas are not widely used for swimming. OARS *E. coli* results since 2019 show that site RVM-001 at River Meadow Brook in Lowell has the highest *E. coli* levels recorded by OARS in the watershed (Figure 3), as *E. coli* concentrations exceeded the Massachusetts Secondary Contact Recommendation (boating) of 630 CFU/100 mL calculated with the 5-Sample Running Geometric Mean. High-precipitation days during low-precipitation years tend to have highest median *E. coli* levels. OARS will continue to work with municipalities to identify *E. coli* hot spots and provide reliable monitoring information for the health of the watershed.

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