

TABLE S1 Inland lake study sites and agencies responsible for sampling, 2010–12

Site No.	Site name	USGS Site Identification		Site description	Lake size (acres)	Maximum Depth (ft)	Sampled by
		Number ^a	Short name				
1	Alum Creek Reservoir at State Park Camper Beach	401409082584000	Alum Campers	Campers	3,269	60	USGS Columbus
2	Alum Creek Reservoir at State Park Beach North	401131082581300	Alum North	Popular bathing beach			USGS Columbus
3	Alum Creek Reservoir at State Park Beach center	401126082581300	Alum Central	Popular bathing beach			USGS Columbus
4	Atwood Lake Main Beach	403219081155500	Atwood Main	Popular bathing beach	1,540	30	MWCD ^b
5	Atwood Lake Boaters nr Islands	403232081151000	Atwood Islands	Boaters			MWCD
6	Atwood Lake Boaters nr cove	403252081144900	Atwood Cove	Boaters			MWCD
7	Buckeye Lake at State Park Brook's Park Beach	395405082310000	Buckeye Brooks	Small beach	2,873	14	USGS Columbus
8	Buckeye Lake at State Park Fairfield Beach	395520082281500	Buckeye Fairfield	Small beach			USGS Columbus
9	Buckeye Lake at State Park Crystal Beach	395557082283800	Buckeye Crystal	Small beach			USGS Columbus
10	CJ Brown Reservoir at State Park Camper Beach	395801083434700	Buck Creek Campers	Campers	1,970	50	CCCHD ^c
11	CJ Brown Reservoir at Main Beach North	395705083440100	Buck Creek North	Popular bathing beach			CCCHD
12	CJ Brown Reservoir at Main Beach South	395653083441200	Buck Creek South	Popular bathing beach			CCCHD
13	Lake at Eastview Park Beach at Celina	403304084323300	Eastview	Popular bathing beach			USGS in Celina
14	Grand Lake at State Park Campers Beach	403242084262500	GLSM Campers	Campers	12,896	16	USGS in Celina
15	Grand Lake at State Park West Beach at St. Marys	403235084253900	GLSM West	Small beach			USGS in Celina
16	Grand Lake at State Park East Beach at St. Marys	403229084251600	GLSM East	Small beach			USGS in Celina
17	Seneca Lake at Swimming Beach near Senecaville	395433081250100	Seneca	Popular bathing beach	3,550	31	MWCD
18	Tappan Lake Boaters at South Shore	402013081122700	Tappan South	Boaters			MWCD
19	Tappan Lake Boaters at Bontrager Bay	402004081115700	Tappan Bontrager	Boaters			MWCD
20	Tappan Lake at Main Swimmers Beach	401926081105100	Tappan Main	Popular bathing beach	2,350	34	MWCD
21	Unnamed ditch tributary to Tappan Lake	401910081111200	Tappan ditch	Ditch			MWCD
22	Tappan Lake Boaters at Beall Bay	401951081092400	Tappan Beall	Boaters			MWCD

^a Corresponds to the latitude and longitude plus two additional numbers (usually 00 unless there are multiple locations at the same site)

^b Muskingum Watershed Conservancy District

^c Clark County Combined Health District

TABLE S2 List of polymerase chain reaction targets, conditions ^a, and detection Limits.

Gene	Primers 5'-3'	Detection Limit (ng/μL)	Control DNA	Primer (μM)	Polymerase	PCR Buffer	MgCl ₂ (mM)	BSA (ug/uL)	Initial Denaturing	
									Temp. (°C)	Time (min: sec)
Shiga-toxin producing <i>E. coli</i> Multiplex PCR										
stx1	F: ACACTGGATGATCTCAGTGG R: CTGAATCCCCCTCCATTATG	0.1	ATCC 35150	0.05						
stx2	F: CCATGACAACGGACAGCAGTT R: CCTGTCAACTGAGCAGCACTTTG	0.1	ATCC 35150	0.05	ABI Amplitaq Gold	Buffer II	3	0.1	95	10:00
eaeA	F: GTGGCGAATACTGGCGAGACT R: CCCATTCTTTTCACCGTCC	0.1	ATCC 35150	0.05						
<i>E. coli</i> 16s rDNA	F: GGAAGAAGCTTGCTTCTTTGCTGAC R: AGCCCGGGGATTTACATCTGACTTA	0.1	ATCC 35150	0.025						
Pathogenic <i>E. coli</i>										
rfbO157	F: CGTGATGATGTTGAGTTG R: AGATTGGGTTGGCATTACTG	0.01	ATCC 35150	0.1	ABI Amplitaq Gold	Buffer II	2	0.1	95	10:00
STII	F:GCATCTATGTTCTTTTTTCTATTG R:GCAACCATTATTTGGGCG	0.001	cloned fragment	0.5	Promega GoTaq	Green Flexi	2	--	95	1:00
STh	F: CSCTCAGGATGCTAAACCAG R: TTAATAGCACCCGGTACAAGC		ATCC 35401	0.4	ABI Amplitaq Gold	Buffer II	2.5	0.1	96	3:00
LTIla	F:GGGTGTGCATTTTCAGCGAC R:CGTCCACCCGGAATATACCA	0.001	cloned fragment	0.5	Promega GoTaq	Green Flexi	2	--	95	1:00
<i>Campylobacter jejuni</i> and <i>Campylobacter coli</i>										
Campy 16s rDNA	F: ATCTAATGGCTTAACCATTAAC R: GGACGGTAAGTATTTAGTATT	0.01	ATCC 33291	0.5	Promega GoTaq	Green Flexi	3	--	95	10:00
<i>Shigella</i>										
ipaH	F: GTTCCTTGACCGCCTTTCCGATAC R: GCCGGTCAGCCACCCTC	0.01	ATCC 9290	0.25	ABI Amplitaq Gold	Buffer II	3	0.1	94	5:00
<i>Salmonella</i>										
invA	F: ACAGTGCTCGTTTACGACCTGAAT R: AGACGACTGGTACTGATCGATAAT	0.1	ATCC 14028	0.25	Promega GoTaq	Green Flexi	1.5	1	94	5:00
spvC	F: ACTCCTTGACACAACCAATGCGGA R: TGTCTTCTGCATTTGCCCACCATCA	0.1	ATCC 14028	0.5	Promega GoTaq	Green Flexi	1.5	0.3	94	5:00

^aAll concentrations are reported as final concentrations in 15 μL reactions, all reactions used 0.2 mM dNTPs

^bTouchdown annealing from 65 °C to 55 °C for the first 10 cycles, final 20 cycles 55 °C annealing temperature

TABLE S2 List of polymerase chain reaction targets, conditions ^a, and detection Limits.

Gene	Denaturing		Annealing		Extension		Final Extension		Reference	
	Cycles	Temp. (°C)	Time (Min: Sec)	Temp. (°C)	Time (Min)	Temp. (°C)	Time (Min)	Temp. (°C)		Time (Min)
Shiga-toxin producing <i>E. coli</i> Multiplex PCR										
stx1										
stx2										
eaeA	35	95	0:30	56	0:40	72	1:30	72	5:00	Duris et al., 2009
<i>E. coli</i> 16s rDNA										
Pathogenic <i>E. coli</i>										
rfbO157	30	94	0:30	53	0:30	72	0:30	72	5:00	Osek, 2003
STII	40	95	0:30	61	0:30	72	0:30	72	6:00	Khatib et al., 2003
STh	30	94	0:30	touch-down ^b	0:30	72	1:30	72	7:00	Jiang et al., 2007
LTIla	35	95	0:30	57	0:30	72	0:30	72	6:00	Jiang et al., 2007
<i>Campylobacter jejuni</i> and <i>Campylobacter coli</i>										
Campy 16s rDNA	35	95	0:30	61	1:30	72	1:00	72	10:00	Inglis and Kalischuck, 2003
<i>Shigella</i>										
ipaH	35	94	1:00	60	0:30	72	1:00	72	5:00	Islam et al., 1993
<i>Salmonella</i>										
invA	30	94	0:30	56.5	0:50	72	0:30	72	5:00	Chiu and Ou, 1996
spvC	30	94	0:30	53.5	0:50	72	1:00	72	10:00	Chiu and Ou, 1996

^aAll concentrations are reported as final concentrations in 15 μ L reactions, all reactions used 0.2 mM dNTPs

^bTouchdown annealing from 65 °C to 55 °C for the first 10 cycles, final 20 cycles 55 °C annealing temperature

TABLE S3 Sources of environmental data for predictive models for each lake^a

Site Nos.	Lake	Rainfall and wind speed and direction	Stream stage or discharge	Water surface elevation (lake or reservoir)	Solar radiation
1-3	Alum Creek	<ul style="list-style-type: none"> •NWS, Columbus Ohio State University Airport •USGS 03228805, Alum Creek at Africa •Radar, 17 cells 	•USGS 03228805, discharge	•USACE Alum Cr Reservoir nr Westerville (USGS 03228804)	•OARDC Delaware Station
4-6	Atwood Lake	<ul style="list-style-type: none"> •NWS, New Philadelphia, Harry Clever Field •USGS 03120500, McGuire Cr. at Leesville •Radar, 10 cells and 1 cell 	•USGS 03120500, stage		
7-9	Buckeye Lake	<ul style="list-style-type: none"> •NWS, Newark Heath Airport •USGS 395417082314200, Buckeye Lk nr Millersport •Radar, 15 cells 		•USGS 395417082314200, Buckeye Lake near Millersport	
10-12	Buck Creek	<ul style="list-style-type: none"> •NWS, Cox Dayton International Airport •USGS 395726083445400, Rain gage at CJ Brown Reservoir Dam •Radar, 12 cells and 1 cell 	•USGS 03267900, Mad River at Paris Pike at Eagle City, discharge	•USACE Clarence J. Brown Reservoir nr. Springfield (USGS 03268090)	•OARDC Western Station
13-16	Grand Lake St. Marys	<ul style="list-style-type: none"> •NWS, Lima Allen County Airport •USGS 04180988, St. Marys River at Rockford •USGS 403233084342200, Weather Station at Celina Water Plant •Radar, 18 cells 	•USGS 04180988, discharge		
18-22	Tappan Lake	<ul style="list-style-type: none"> •NWS, New Philadelphia, Harry Clever Field •USGS 03120500, McGuire Cr. at Leesville •Radar, 12 cells and 1 cell 	•USGS 03120500, stage		

^a USGS, U.S. Geological Survey; NWS, National Weather Service; USACE, U.S. Army Corps of Engineers; OARDC, Ohio Agricultural Research and Development Center

TABLE S4. Concentrations or detections of bacterial indicators, pathogens, and microbial source tracking (MST) markers in inland lake samples and associated predictive model variables, 2011 ^a

Date	Time	Site	Protozoan pathogens				Enteric viruses (gc/L)				Bacterial pathogens (presence=1, absence=0)												
			Cryptosporidium (oocysts/10 L)		Giardia (cysts/10 L)		Adenovirus		Enterovirus		STEC genes							Shigella	Salmonella				
			E. coli (MPN/100 mL)	Ultra-filter	Glass wool filter	Ultra-filter	Glass wool filter	Ultra-filter	Glass wool filter	Ultra-filter	Glass wool filter	Campy	eaeA	stx2	stx1	rfb01 57	LTIIa	STh	STII	shig (ipah)	invA	spvC	
7/11	9:19	Atwood AM	A 6	--	--	--	--	--	--	--	0												
7/31	8:47	Atwood AM	32	--	--	--	--	--	--	--	0												
7/31	12:41	Atwood PM	A 660	--	--	--	--	--	--	--	0												
8/27	14:00	Atwood PM	A 36	<0.2	<0.2	<0.2	<0.2	<2.2 E~b3.4	<11	<14		0	0	0	0	0	0	0	0	0	0	0	0
9/11	13:38	Atwood PM	210	0.2	<1.6	<0.1	<1.6	E~b39	<18	<91	<91	0	1	0	0	0	0	0	0	0	0	0	0
7/11	9:55	Buckeye Crystal	29	2	<0.2	<1	<0.2	<16	<1.2	<159	<12	0	0	1	0	0	0	0	0	0	1	0	0
7/17	7:05	Buckeye Crystal	58	--	--	--	--	--	--	--	--	0	0	0	0	0	0	0	0	0	1	0	1
7/24	7:10	Buckeye Crystal	130	--	--	--	--	--	--	--	--		1	0	0	0	0	0	0	1	0	1	
7/30	6:55	Buckeye Crystal	920	--	--	--	--	--	--	--	--		1	0	0	0	0	0	0	0	0	1	
8/8	8:22	Buckeye Crystal	24	--	--	--	--	--	--	--	--	0	1	0	0	0	0	0	0	0	0	0	
8/22	7:12	Buckeye Crystal	650	--	--	--	--	--	--	--	--	0	1	0	0	0	0	0	0	0	0	1	
8/30	8:10	Buckeye Crystal	A 740	<1.3	<0.3	<1.3	<0.3	<20	<1.8	<196	<18	0	1	0	0	0	0	0	0	0	0	0	
9/13	10:50	Buckeye Crystal	39	<0.3	<0.4	<0.3	<0.4	<18	<2.5	<91	<25	0	1	0	0	0	0	0	0	1	0	0	
6/28	11:51	Buckeye Fairfield	820	<1	0.2	<1	<0.2	<9.2	<1.2	<46	<6	0	1	0	0	0	0	0	0	0	0	0	
7/17	7:38	Buckeye Fairfield	19	--	--	--	--	--	--	--	--	0	1	0	0	0	0	0	0	0	0	0	
7/24	8:00	Buckeye Fairfield	210	--	--	--	--	--	--	--	--		1	0	0	0	0	0	0	0	0	1	
7/25	10:07	Buckeye Fairfield	210	0.5	<0.2	<0.5	<0.2	<8.2 E~b4.7	<42	<16		1	0	0	0	0	0	0	0	0	0	0	
7/30	7:35	Buckeye Fairfield	80	--	--	--	--	--	--	--	--		1	0	0	0	0	0	0	0	0	0	
8/8	8:02	Buckeye Fairfield	26	--	--	--	--	--	--	--	--	0	1	0	0	0	0	0	0	0	0	0	
8/22	8:00	Buckeye Fairfield	39	--	--	--	--	--	--	--	--	0	1	0	0	0	0	0	0	0	0	0	
9/6	9:33	Buckeye Fairfield	A 17	<0.5	<0.4	<0.5	<0.4	<16 E~b10	<77	<11		0	1	0	0	0	0	0	0	1	0	0	
6/29	10:23	Tappan Main	3	<0.4	<0.2	0.8	<0.2	<11	<6.9	<44	<69	0	0	0	0	0	0	0	0	1	0	0	
7/11	10:54	Tappan Main	201	--	--	--	--	--	--	--	--	0											
8/7	13:17	Tappan Main	122	<0.3	<0.1	<0.3	<0.1	<28	<3.6	<139	<18	0	1	0	0	0	0	0	0	1	0	0	
8/14	10:24	Tappan Main	96	--	--	--	--	--	--	--	--	0											
8/15	10:17	Tappan Main	21	0.3	<0.1	<0.3	<0.1	<3.6	<13	<36	<53	0											
6/29	13:51	Tappan ditch	34	<0.7	--	<0.7	--	<13	--	<128	--	0	0	0	0	0	0	0	0	1	0	0	
7/11	11:16	Tappan ditch	344	--	--	--	--	--	--	--	--	0											
8/7	17:53	Tappan ditch	2000	1.2	--	<0.3	--	<118	--	<1,100	--	0	0	0	0	1	0	0	0	0	0	1	
8/14	10:39	Tappan ditch	>2400	--	--	--	--	--	--	--	--	0											
8/15	13:10	Tappan ditch	ND	<0.4	<6	<0.4	<6	<14	<112	<139	<222	0											

^a A, average of two replicates; R, value reported was detected in one field replicate, but not in the second replicate; --, not done; E, estimated value; ~, duplicates do not check (Ct values); b, value was extrapolated below lowest method range or instrument linear range

^b The probability (in percent) of exceeding the single-sample bathing water standard of 235 CFU/100 mL. Probabilities above the established threshold probability (beach is posted with advisory) are italicized

TABLE S4. Concentrations or detections of bacterial indicators, pathogens, and microbial source tracking (MST) markers in inland lake samples and associated predictive model variables, 2011 ^a

Environmental and water-quality variables															Model output
Date	Time	Site	Rainfall				Airport Wind, 24 h		Field variables					Probability ^a	
			Airport rain, 24 h (in)	USGS gage, 24 h (in)	Radar, Ave Max 48 h weight (in)	Radar hourly total 24 h	Wind Alongshore 24 h	Wind Offshore 24 h	Water Temp (°C)	Conduc-tance	Wave height (in)	Turb (NTRU)	Birds		
7/11	9:19	Atwood AM	0.00	0.00	0.00	0.00	0.37	1.86	28.6	--	0.25	5.5	0	0	4.3
7/31	8:47	Atwood AM	0.01	0.00	0.03	0.00	-1.62	-0.78	29.0	200	0.5	10.3	0	0	10.2
7/31	12:41	Atwood PM	0.00	0.00	0.03	0.00	-1.62	-0.78	30.4	200	1.5	15.8	0	87	63.0
8/27	14:00	Atwood PM	0.01	0.01	0.00	0.00	-1.97	-0.74	26.0	201	4	16.9	4	20	20.6
9/11	13:38	Atwood PM	0.02	0.00	0.08	0.84	0.01	-0.9	24.4	202	6	12.5	30	0	4.3
7/11	9:55	Buckeye Crystal	0.00	0.00	0.00	0.00	1.87	0.32	29.1	315	0	22.3	31	0	18.4
7/17	7:05	Buckeye Crystal	0.00	0.00	0.00	0.00	2.31	2.36	27.3	312	0.25	24.3	0	0	13.8
7/24	7:10	Buckeye Crystal	1.00	1.79	--	22.96	1.99	-0.66	29.6	286	0	22.7	0	0	75.0
7/30	6:55	Buckeye Crystal	0.19	0.49	0.68	12.14	1.56	-3.24	29.5	287	0	29.4	0	0	38.8
8/8	8:22	Buckeye Crystal	0.29	0.35	0.56	7.45	1.46	-3.18	27.2	229	0	30.3	0	0	44.4
8/22	7:12	Buckeye Crystal	0.75	0.83	0.80	12.03	0.03	-2.4	25.5	286	0	27.5	3	0	74.3
8/30	8:10	Buckeye Crystal	0.00	0.00	0.00	0.00	-1.33	1.21	24.5	273	0.5	28	0	0	11.5
9/13	10:50	Buckeye Crystal	0.08	0.02	0.33	1.84	2.07	-1.41	26.5	288	0.5	33.2	4	0	43.3
6/28	11:51	Buckeye Fairfield	0.005	0.06	0.00	0.00	-2.55	-3.83	24.6	341	0	27.8	3	1	1.3
7/17	7:38	Buckeye Fairfield	0.00	0.00	0.00	0.00	-0.15	-3.3	26.5	343	0.25	29.7	130	0	5.7
7/24	8:00	Buckeye Fairfield	1.00	1.79	--	22.96	-1.93	-0.83	28.6	310	0.5	33.8	69	0	45.2
7/25	10:07	Buckeye Fairfield	0.03	0.69	1.33	5.81	-2.06	1.22	29.7	341	1	32.3	0	0	15.8
7/30	7:35	Buckeye Fairfield	0.19	0.49	0.68	12.14	-3.32	1.39	29.1	310	0.25	40.9	1	0	15.0
8/8	8:02	Buckeye Fairfield	0.29	0.35	0.56	7.45	-3.21	1.41	27.8	240	1	35.2	26	0	25.4
8/22	8:00	Buckeye Fairfield	0.75	0.83	0.80	12.03	-1.62	1.77	24.6	--	0.25	35.7	0	0	7.4
9/6	9:33	Buckeye Fairfield	0.07	0.02	0.47	1.42	5.46	5.15	22.0	305	7	36.5	4	0	1.6
6/29	10:23	Tappan Main	0.00	0.00	0.00	0.00	2.88	3.19	25.0	609	0	10.6	--	20	1.8
7/11	10:54	Tappan Main	0.00	0.00	0.00	0.00	-1.88	-0.3	29.7	616	0.25	12.9	31	0	29.6
8/7	13:17	Tappan Main	0.30	0.09	0.30	2.99	--	--	29.0	608	0.5	19.6	15	40	41.8
8/14	10:24	Tappan Main	0.875	1.37	1.24	15.12	-0.97	0.23	25.4	636	0	15.4	38	0	46.7
8/15	10:17	Tappan Main	0.49	0.03	0.84	4.94	2.46	1.53	25.0	601	3	13.8	8	0	22.8
6/29	13:51	Tappan ditch	0.00	0.00	0.00	0.00	--	--	24.6	554	--	23.1	0	0	--
7/11	11:16	Tappan ditch	0.00	0.00	0.00	0.00	--	--	26.4	572	--	34.6	50	0	--
8/7	17:53	Tappan ditch	0.30	0.09	0.30	2.99	--	--	28.8	461	--	32.2	0	0	--
8/14	10:39	Tappan ditch	0.875	1.37	1.24	15.12	--	--	22.0	464	--	77.8	0	0	--
8/15	13:10	Tappan ditch	0.49	0.03	0.84	4.94	--	--	--	530	--	20.2	0	0	--

^a A, average of two replicates; R, value reported was detected in one field replicate, but not in the second replicate; --, not done; E, estimated value; --, duplicates do not check (Ct values); b, value was extrapolated below lowest method range or instrument linear range

^a The probability (in percent) of exceeding the single-sample bathing water standard of 235 CFU/100 mL. Probabilities above the established threshold probability (beach is posted with advisory) are italicized