Table 5. Dissolved concentrations of trace elements and stable-isotope ratios in surface-water and groundwater samples from a lake, springs, County, New York, 2009–11.

[Analytes measured by the U.S. Geological Survey National Water Quality Laboratory unless otherwise noted; concentrations in micrograms per liter, (mg/L) unless Be, beryllium; B, boron; Cd, cadmium; Cr, chromium; Co, cobalt; Cu, copper; Fe, iron; Pb, lead; Li, lithium; Mn, manganese; Mo, molybdenum; Ni, nickel; N, nitrogen; isotope ratio of hydrogen-2 to hydrogen-1; $\delta^{18}O$, stable isotope ratio of oxygen-18 to oxygen-16, relative to Vienna Standard Mean Ocean Water standard; $\delta^{34}S$, stable ganic carbon relative to the Vienna Pee Dee Belemnite standard; SI, saturation index]

Well identifier	Date	Sample time	Al	Ba 2	Be .004	Cd .005	Cr .01	Co	Cu	Fe	Pb	Li	Mn
U1626	12/15/2009	1500	E2.9	26	<0.01	E0.01	0.24	0.23	E0.96	290	<0.03	0.8	79
U1627	6/23/2009	1200	<4.0	29	<0.02	<0.02	E0.07	0.07	35.1	4	0.81	1.6	0.2
U1627	4/1/2010	0900	11.8	24	<0.01	<0.02	E0.11	0.05	E0.78	<6	<0.03	1.2	<0.3
U1637	8/31/2010	1400	190	140	0.014	0.029	0.34	0.3	<1.0	420	0.26	2.9	630
U1641	4/20/2010	1300	<17.0	83	<0.06	<0.10	<0.60	2.2	<5.0	92	<0.15	4.3	130
U1641	4/20/2010	1301	<17.0	84	<0.06	<0.10	<0.60	2.0	<5.0	91	<0.15	4.2	130
U1663	8/31/2010	1400	7.8	54	E0.01	0.04	<0.120	0.068	E0.92	2.3	<0.03	90	41
U1673	11/30/2011	1200	<2.2	240	<0.006	<0.02	<0.07	0.08	2.8	24	0.15	2.9	260
U1670	11/30/2011	1000	<2.2	180	<0.006	<0.02	<0.07	0.03	0.95	34	0.08	3	190
U1632	9/14/2009	1730	E3.6	13	<0.02	E0.01	0.19	0.08	<1.0	<4	<0.06	<1.0	16
U1633	9/15/2009	1200	<4.0	15	<0.02	0.03	0.33	0.04	<1.0	E2	<0.06	E0.7	18
U1667	9/15/2009	1400	20	14	E0.02	E0.02	0.21	0.07	<1.0	53	0.11	E0.7	19
U1668	7/1/2009	1300	15.9	14	<0.02	<0.02	<0.12	0.1	2.5	248	<0.06	E0.7	21
U1666	6/23/2009	1400	<4.0	25	<0.02	<0.02	<0.12	0.08	E0.77	<4	<0.06	1.8	<0.2
U1666	3/31/2010	1600	E1.9	23	<0.01	<0.02	E0.08	0.06	<1.0	<6	<0.03	2.3	<0.3
U1665	3/31/2010	1200	7.9	14	<0.01	E0.01	E0.10	0.03	<1.0	6	E0.02	<0.4	9.8
Lippman Lake effluent	6/24/2009	1330	--	--	--	--	--	--	--	--	--	--	--
Lippman Lake effluent	7/2/2009	1300	28	10	<0.02	E0.01	0.14	0.10	<1.0	317	0.16	E0.7	51
Lippman Lake effluent	9/1/2009	1230	--	--	--	--	--	--	--	--	--	--	--
Lippman Lake effluent	9/16/2009	1300	34	19	<0.02	<0.02	E0.10	0.08	<1.0	34	<0.06	3.7	2.1
Lippman Lake effluent	10/13/2009	1515	--	--	--	--	--	--	--	--	--	--	--
Lippman Lake effluent	12/15/2009	1000	140	6	<0.01	<0.02	<0.12	0.12	<1.0	142	0.05	1.2	86
Lippman Lake effluent	4/1/2010	1200	58	7	<0.01	<0.02	E0.06	0.49	<1.0	58	E0.03	1.6	48
01366400	6/23/2009	0930	6.1	26	<0.02	<0.02	<0.12	E0.01	1.3	E4	<0.06	<1.0	1.7
01366400	9/1/2009	1030	26	29	0.02	E0.02	E0.08	0.02	18.1	6	0.34	E0.6	3.2
01366400	10/13/2009	1420	--	--	--	--	--	--	--	--	--	--	--
01366400	10/13/2009	1425	--	--	--	--	--	--	--	--	--	--	--
01366400	12/22/2009	1110	4.8	26	E0.01	<0.02	0.18	0.03	E0.94	E5	E0.02	0.4	1.5
01366400	4/1/2010	1000	17	30	E0.01	0.02	<0.12	0.02	E0.86	8	E0.02	0.5	5.2
U1625	6/24/2009	1100	<4.0	42	<0.02	<0.02	<0.12	0.02	10.7	<4	0.23	7.2	0.2
U1625	12/14/2009	1000	<3.4	130	<0.01	E0.01	<0.12	0.37	1.1	E5	0.44	20	13
U1625	4/7/2011	1900	11.2	24	<0.006	<0.016	0.11	0.068	1.1	54	0.028	4.4	7.6
U1629	6/24/2009	0800	<20.0	230	<0.10	<0.10	<0.60	<0.10	<5.0	146	<0.30	320	260
U1629	4/7/2011	1100	7.1	140	<0.006	<0.02	<0.06	0.17	<0.5	1,500	0.062	55	450
U1629	4/7/2011	0900	3.2	120	<0.006	0.016	0.11	0.1	<0.5	570	0.22	20	380
U1628	7/2/2009	1000	E3.5	32	<0.02	<0.02	E0.09	0.12	E0.69	17	E0.04	5.2	2.0
U1630	9/15/2009	1700	<4.0	49	<0.02	<0.02	<0.12	0.11	<1.0	260	<0.06	310	81
U1631	9/16/2009	1000	400	43	<0.02	0.02	<0.12	0.20	<1.0	230	<0.06	100	600
U1631	9/16/2009	1001	<4.0	44	<0.02	0.02	<0.12	0.19	<1.0	230	<0.06	101	660
U1631	12/14/2009	1630	<3.4	43	<0.01	0.35	<0.12	0.60	<1.0	370	<0.03	91	490
U1647	4/21/2010	1300	<34	97	<0.12	<0.20	<1.2	2.2	<10.0	40	<0.30	320	300
U7017	9/20/2011	1200	<1.7	240	0.009	<0.02	<0.06	<0.02	<0.5	1,800	0.032	120	150
U3772	9/20/2011	1200	1.8	1,120	<0.006	<0.02	0.077	<0.02	<0.5	91	<0.02	80	26
U1645	9/21/2011	1200	4.2	130	<0.006	<0.02	0.19	0.03	<0.5	630	<.01	29	150
U1644	9/21/2011	1200	6.6	480	0.008	<0.02	<0.06	<0.02	<0.5	94	<0.015	730	330

[1]Analyzed at the U.S. Geological Survey (USGS) Isotope Laboratory, Menlo Park, Calif.

[2]Analyzed at the USGS Reston Stable Isotope Laboratory, Reston, Va.

and wells in the Wawarsing study area, and for the Rondout Reservoir at the influent to the Rondout–West Branch Tunnel in Lackawack, Ulster

otherwise noted; --, not measured; NA, not applicable; <, less than; E, estimated value below minimum reporting level; Al, aluminum; Sb, antimony; As, arsenic; Ba, barium; Se, selenium; Ag, silver; Sr, strontium; Tl, thallium; U, uranium; V, vanadium; Zn, zinc; $^{87}Sr/^{86}Sr$, stable isotope ratio of strontium-87 to strontium-86; d, delta; δ^2H, stable isotope ratio of sulfur-34 to sulfur-32 of sulfate relative to the Vienna Canyon Diablo Troilite standard; $\delta^{13}C$ of DIC, stable isotope ratio of C-13 to C-12 of dissolved inor-

Mb	Ni	Ag	Sr	Tl	V	Zn	Sb	As	B	Se	U	δ^2H in water (per mil)	$\delta^{18}O$ in water (per mil)	$\delta^{34}S$ of SO_4^{2-} (per mil)	$\delta^{13}C$ of DIC (per mil)	$^{87}Sr/^{86}Sr$ (per mil)[1]
M	0.89	<0.010	52	E0.01	<0.16	E1.4	E0.03	0.13	6	0.06	0.01	-52.9	-8.44	9.36	-22.1	0.71214
0.3	0.48	<0.008	160	<0.04	0.24	3.2	0.10	0.37	15	0.40	0.76	-51.3	-8.15	-2.95	-16.6	0.71139
0.2	0.34	M	130	<0.02	0.22	<2.8	0.08	0.27	11	0.35	0.86	-71.0	-10.7	-3.72	-16.7	0.71136
6.6	0.97	<0.01	1,400	<0.02	0.35	E2.2	0.27	2.5	10	E0.036	1.2	-59.0	-9.24	-1.95	-14.0	0.70909
1.0	1.7	<0.1	1,220	<0.10	<0.80	<14	E0.23	2.1	E9	<0.20	0.29	-58.4	-9.23	0.34	-11.0	0.70916
1.1	1.5	<0.1	1,200	<0.10	<0.80	<14	E0.25	2.0	E9	<0.20	0.27	--	--	0.48	-11.3	0.70913
7.5	0.28	<0.01	340	<0.02	<0.16	<2.8	0.5	1.6	280	E0.026	0.092	-61.9	-9.34	8.8	-14.0	0.71164
0.48	0.30	<0.005	130	<0.01	<0.080	8.3	<0.03	5.9	6	<0.030	0.20	-55.2	-8.97	0.61		0.7108
0.68	0.26	<0.005	120	<0.01	<0.080	6.2	<0.03	6.4	6	<0.030	0.30	-55.7	-8.97	-5.08		0.71069
M	0.33	<0.008	35	<0.04	E0.09	2,000	<0.04	0.17	5	0.09	E0.01	-56.2	-8.89	2.23	--	0.71227
M	0.42	<0.008	22	<0.04	<0.16	5,300	<0.04	0.17	7	E0.05	<0.01	-55.7	-8.96	3.09	--	0.71176
M	0.64	<0.008	23	<0.04	E0.15	E2.0	<0.04	0.26	6	0.07	E0.00	-54.9	-8.82	3.36	--	0.71196
0.1	0.22	<0.008	55	<0.04	1.4	<2.0	E0.02	0.37	E3	E0.06	0.03	-54.0	-8.71	3.72	--	0.71223
0.1	0.47	<0.008	130	<0.04	E0.10	<2.0	0.09	0.33	19	0.3	0.46	-50.4	-8.01	-6.84	-17.7	0.71552
0.2	0.38	<0.010	150	<0.02	E0.09	<2.8	0.07	0.24	13	0.25	0.91	-68.5	-10.4	-6.97	-15.5	0.71148
M	0.37	<0.010	19	<0.02	E0.09	<2.8	0.07	0.18	9	0.06	E0.01	-67.9	-10.5	2.79	-23.5	0.71352
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M	0.36	<0.008	28	<0.04	0.26	2.0	E0.02	0.53	4	0.10	0.01	-47.8	-7.60	1.76	-8.17	0.71209
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0.5	0.77	<0.008	120	<0.04	E0.13	<2.0	0.13	2.3	17	0.08	0.32	-40.1	-5.99	-3.17	--	0.71125
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M	0.52	<0.010	44	<0.02	<0.16	<2.8	E0.03	0.21	6	E0.03	0.02	-56.7	-8.98	3.71	-18.2	0.71259
M	0.43	<0.010	47	<0.02	<0.16	<2.8	0.06	0.34	9	0.05	0.04	-67.2	-10.3	1.15	-13.1	0.7119
M	0.34	<0.008	16	<0.04	<0.16	2.3	E0.03	0.18	5	<0.06	0.01	-58.4	-9.14	3.36		0.71416
M	0.45	M	16	<0.04	<0.16	5.1	0.05	0.27	4	E0.05	0.02	-55.3	-8.76	4.16	-13.8	0.71392
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M	0.48	<0.010	19	<0.02	<0.16	E1.6	E0.04	0.28	4	0.04	0.01	-55.7	-8.64	4.26	-13.9	0.71419
M	0.34	<0.010	17	<0.02	<0.16	E2.1	E0.03	0.18	4	E0.03	0.02	-62.7	-9.58	4.16	-12.9	0.71424
0.5	0.37	<0.008	150	<0.04	<0.16	E1.8	0.05	0.18	11	0.10	0.33	-57.9	-9.08	-8.44	-12.7	0.71416
1.1	3.3	<0.010	1,000	<0.02	E0.11	3.7	0.12	0.25	44	0.16	2.00	-54.5	-8.61	-11.5	-15.1	0.712
0.52	2.3	<0.005	90	<0.01	<0.08	1.6	0.063	0.2	6.9	0.091	0.09	-63.4	-9.75	--	--	0.71198
0.6	<0.60	<0.040	590	<0.20	<0.80	<10.0	<0.20	<0.30	65	E0.24	0.04	-56.2	-8.99	0.99	-13.1	0.71158
1.0	8.4	<0.005	280	<0.01	<0.80	2.1	<0.027	0.027	22	<0.03	0.16	-55.9	-8.86	--	--	0.71129
1.0	4.4	<0.005	230	<0.01	<0.80	62	<0.027	0.057	18	<0.03	0.22	-55.9	-8.86	--	--	0.71151
1.1	0.81	<0.008	380	<0.04	1.6	<2.0	0.06	0.97	21	0.47	0.77	-61.8	-9.70	25.4	-9.68	0.70983
2.9	0.57	M	--	<0.04	<0.16	2.1	<0.04	1.4	284	<0.06	0.12	-67.8	-10.3	28.6	--	0.70919
9.9	1.4	M	17,700	<0.04	E0.12	<2.0	<0.04	3.9	97	E0.03	0.58	-64.4	-10.1	25.3	--	0.70901
10.9	1.3	M	17,800	<0.04	E0.12	<2.0	<0.04	4.0	112	<0.06	0.64	-64.6	-10.0	25.3	--	0.70900
11.8	3.9	M	19,800	<0.02	0.34	<2.8	<0.05	6.1	92	<0.04	0.56	-64.9	-9.98	25.7	-12.0	0.70902
3.2	2.5	<0.1	13,800	<0.20	1.9	<28.0	<0.54	8.3	269	<0.40	0.48	-64.8	-10.1	31.6	-16.6	0.70947
0.12	<0.09	<0.005	180	<0.010	<0.080	3.4	<0.027	1.2	190	<0.030	0.006	-60.8	-9.52	--	-11	0.71277
0.16	<0.09	<0.005	580	<0.01	<0.080	1.8	<0.03	0.67	150	<0.030	0.03	-59.0	-9.26	--	-17.3	0.71367
1.5	0.33	<0.005	850	<0.01	<0.080	2.9	<0.03	10	43	<0.030	0.34	-58.2	-8.97	-9.66	-14.3	0.71136
2.0	0.15	<0.005	2,170	<0.01	0.10	<1.4	<0.03	5.3	290	<0.030	0.11	-63.8	-9.77	-1.88	-17.5	0.71195

National Primary Drinking Water Regulations

	Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from long-term[3] exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L)[2]
OC	Acrylamide	TT[4]	Nervous system or blood problems; increased risk of cancer	Added to water during sewage/ wastewater treatment	zero
OC	Alachlor	0.002	Eye, liver, kidney or spleen problems; anemia; increased risk of cancer	Runoff from herbicide used on row crops	zero
R	Alpha/photon emitters	15 picocuries per Liter (pCi/L)	Increased risk of cancer	Erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as alpha radiation	zero
IOC	Antimony	0.006	Increase in blood cholesterol; decrease in blood sugar	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder	0.006
IOC	Arsenic	0.010	Skin damage or problems with circulatory systems, and may have increased risk of getting cancer	Erosion of natural deposits; runoff from orchards; runoff from glass & electronics production wastes	0
IOC	Asbestos (fibers >10 micrometers)	7 million fibers per Liter (MFL)	Increased risk of developing benign intestinal polyps	Decay of asbestos cement in water mains; erosion of natural deposits	7 MFL
OC	Atrazine	0.003	Cardiovascular system or reproductive problems	Runoff from herbicide used on row crops	0.003
IOC	Barium	2	Increase in blood pressure	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits	2
OC	Benzene	0.005	Anemia; decrease in blood platelets; increased risk of cancer	Discharge from factories; leaching from gas storage tanks and landfills	zero
OC	Benzo(a)pyrene (PAHs)	0.0002	Reproductive difficulties; increased risk of cancer	Leaching from linings of water storage tanks and distribution lines	zero
IOC	Beryllium	0.004	Intestinal lesions	Discharge from metal refineries and coal-burning factories; discharge from electrical, aerospace, and defense industries	0.004
R	Beta photon emitters	4 millirems per year	Increased risk of cancer	Decay of natural and man-made deposits of certain minerals that are radioactive and may emit forms of radiation known as photons and beta radiation	zero
DBP	Bromate	0.010	Increased risk of cancer	Byproduct of drinking water disinfection	zero
IOC	Cadmium	0.005	Kidney damage	Corrosion of galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints	0.005
OC	Carbofuran	0.04	Problems with blood, nervous system, or reproductive system	Leaching of soil fumigant used on rice and alfalfa	0.04
OC	Carbon tetrachloride	0.005	Liver problems; increased risk of cancer	Discharge from chemical plants and other industrial activities	zero
D	Chloramines (as Cl_2)	MRDL=4.0[1]	Eye/nose irritation; stomach discomfort; anemia	Water additive used to control microbes	MRDLG=4[1]
OC	Chlordane	0.002	Liver or nervous system problems; increased risk of cancer	Residue of banned termiticide	zero
D	Chlorine (as Cl_2)	MRDL=4.0[1]	Eye/nose irritation; stomach discomfort	Water additive used to control microbes	MRDLG=4[1]
D	Chlorine dioxide (as ClO_2)	MRDL=0.8[1]	Anemia; infants, young children, and fetuses of pregnant women: nervous system effects	Water additive used to control microbes	MRDLG=0.8[1]
DBP	Chlorite	1.0	Anemia; infants, young children, and fetuses of pregnant women: nervous system effects	Byproduct of drinking water disinfection	0.8
OC	Chlorobenzene	0.1	Liver or kidney problems	Discharge from chemical and agricultural chemical factories	0.1
IOC	Chromium (total)	0.1	Allergic dermatitis	Discharge from steel and pulp mills; erosion of natural deposits	0.1
IOC	Copper	TT[7]; Action Level=1.3	Short-term exposure: Gastrointestinal distress. Long-term exposure: Liver or kidney damage. People with Wilson's Disease should consult their personal doctor if the amount of copper in their water exceeds the action level	Corrosion of household plumbing systems; erosion of natural deposits	1.3
M	Cryptosporidium	TT[7]	Short-term exposure: Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	zero

LEGEND

- D — Disinfectant
- DBP — Disinfection Byproduct
- IOC — Inorganic Chemical
- M — Microorganism
- OC — Organic Chemical
- R — Radionuclides

	Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from long-term[3] exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L)[2]
M	Turbidity	TT[7]	Turbidity is a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (e.g., whether disease-causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites and some bacteria. These organisms can cause short term symptoms such as nausea, cramps, diarrhea, and associated headaches.	Soil runoff	n/a
R	Uranium	30µg/L	Increased risk of cancer, kidney toxicity	Erosion of natural deposits	zero
OC	Vinyl chloride	0.002	Increased risk of cancer	Leaching from PVC pipes; discharge from plastic factories	zero
M	Viruses (enteric)	TT[7]	Short-term exposure: Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	zero
OC	Xylenes (total)	10	Nervous system damage	Discharge from petroleum factories; discharge from chemical factories	10

LEGEND

D	Disinfectant	IOC	Inorganic Chemical	OC	Organic Chemical
DBP	Disinfection Byproduct	M	Microorganism	R	Radionuclides