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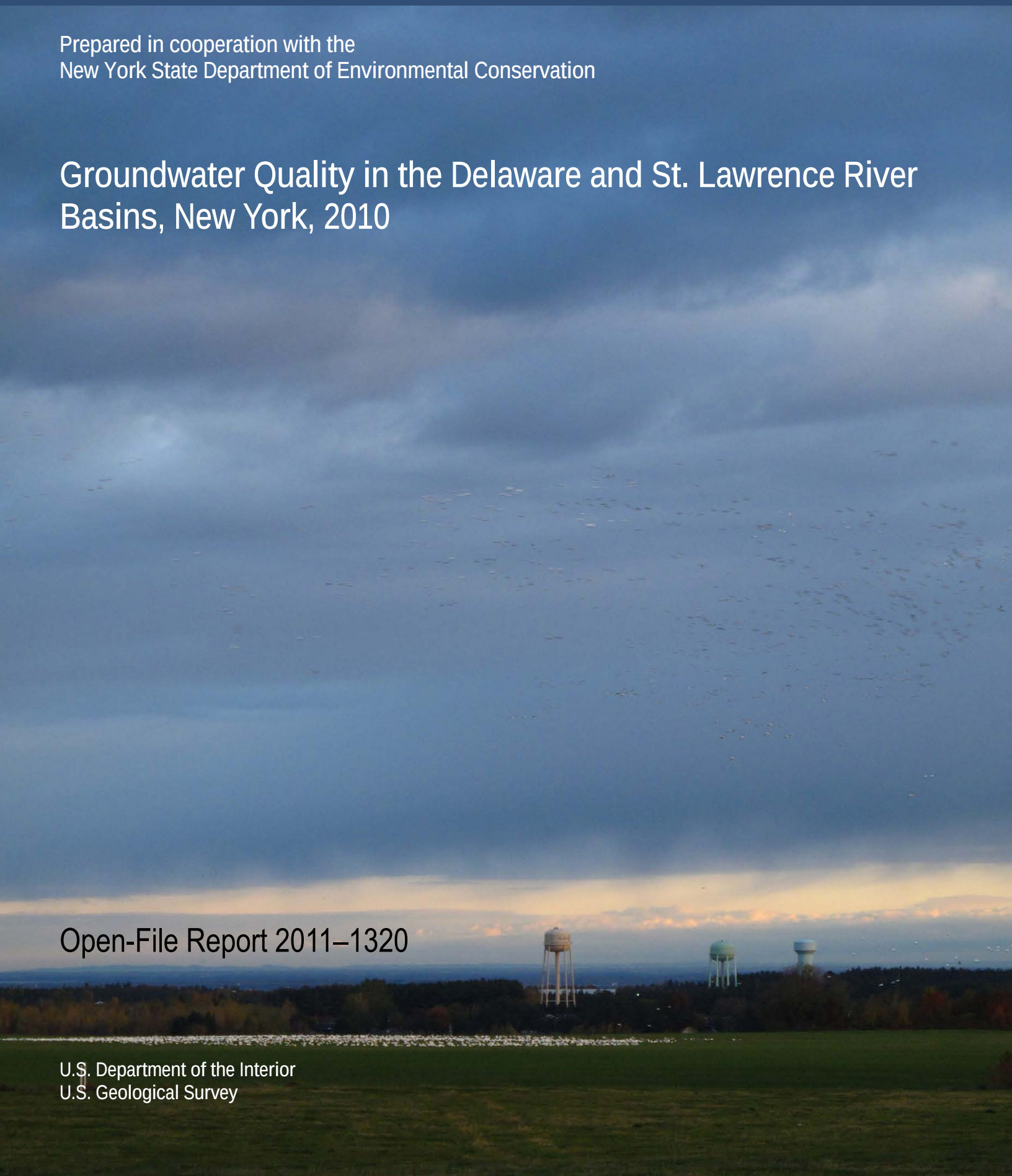
Groundwater Quality in the Delaware and St. Lawrence River Basins, New York, 2010



Open-File Report 2011–1320

U.S. Department of the Interior
U.S. Geological Survey

Cover. Snow geese and water towers, Malone, New York.

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By Elizabeth A. Nystrom

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U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
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U.S. Geological Survey
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Conversion Factors, Datum, and Acronyms

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	0.004047	square kilometer (km^2)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
gallon (gal)	3.785	liter (L)
liter (L)	0.2642	gallon (gal)
	Flow rate	
gallon per minute (gal/min)	0.06309	liter per second (L/s)
	Pressure	
inch of mercury at 60ºF (in Hg)	3.377	kilopascal (kPa)
	Radioactivity	
picocurie per liter (pCi/L)	0.037	becquerel per liter (Bq/L)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:
°F=(1.8×°C)+32
Vertical coordinate information is referenced to the insert North American Vertical Datum of 1988 (NAVD 88).
Elevation, as used in this report, refers to distance above the vertical datum.
Horizontal coordinate information is referenced to North American Datum of 1983 (NAD 83).
Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25°C).
Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).
Radiochemical activities are given in picocuries per liter (pCi/L).

Acronyms used in this report

AMCL	Alternative maximum contaminant level
CFCL	USGS Chlorofluorocarbon Laboratory
CFU	Colony-forming units
CIAT	2-Chloro-4-isopropylamino-6-amino-*s*-triazine
LRL	Laboratory reporting level
MCL	Maximum contaminant level
NAD 83	North American Datum of 1983
NAVD 88	North American Vertical Datum of 1988
NWQL	USGS National Water Quality Laboratory
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
SDWS	Secondary drinking-water standards
THM	Trihalomethane
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOC	Volatile organic compound

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Groundwater Quality in the Delaware and St. Lawrence River Basins, New York, 2010

By Elizabeth A. Nystrom

Abstract

Water samples were collected from 10 production and domestic wells in the Delaware River Basin in New York and from 20 production and domestic wells in the St. Lawrence River Basin in New York from August through November 2010 to characterize groundwater quality in the basins. The samples were collected and processed by standard U.S. Geological Survey procedures and were analyzed for 147 physiochemical properties and constituents, including major ions, nutrients, trace elements, pesticides, volatile organic compounds (VOCs), radionuclides, and indicator bacteria.

The Delaware River Basin covers 2,360 square miles in New York, and is underlain mainly by shale and sandstone bedrock with other types of bedrock present locally. The bedrock is overlain by till in much of the basin, but surficial deposits of saturated sand and gravel are present in some areas. Five of the wells sampled in the Delaware study area are completed in sand and gravel deposits, and five are completed in bedrock. Groundwater in the Delaware study area was typically neutral or slightly acidic; the water typically was soft. Bicarbonate, chloride, and calcium were the major ions with the greatest median concentrations; the dominant nutrient was nitrate. Strontium, barium, iron, and boron were the trace elements with the highest median concentrations. Radon was detected in all samples with activities greater than 300 picocuries per liter; the greatest radon activities were in samples from bedrock wells. Four pesticides, all herbicides or their degradates, were detected in four samples at trace levels; five VOCs, including four trihalomethanes and tetrachloromethane, were detected in two samples. Coliform bacteria were detected in five samples, but fecal coliform bacteria and *Escherichia coli (E. coli)* were not detected in any samples from the Delaware study area.

The St. Lawrence River Basin covers 5,650 square miles in New York. The St. Lawrence River Basin in New York is underlain by crystalline, carbonate, and sandstone bedrock. The bedrock is overlain by till or lacustrine and marine deposits in much of the basin. Surficial deposits of saturated sand and gravel are present locally, but most wells in the basin are completed in bedrock. Five of the wells sampled in the St. Lawrence study area are completed in sand and gravel deposits, and 15 are completed in bedrock. Groundwater in the St. Lawrence study area was typically neutral or slightly basic; the water typically was hard. Bicarbonate, sulfate, and calcium were the major ions with the greatest median concentrations; the dominant nutrient was nitrate. Strontium, iron, barium, and boron were the trace elements with the highest median concentrations. Radon was detected in two-thirds of samples with activities greater than 300 picocuries per liter; the greatest radon activities were in samples from bedrock wells. Seven pesticides, including 5 herbicides, an herbicide degradate, and an insecticide, were detected in 11 samples at trace levels; 3 VOCs (tetrachloroethene, toluene, and trichloromethane, or chloroform) were detected in 2 samples. Coliform bacteria were detected in 7 samples, and *E. coli* were detected in two samples in the St. Lawrence study area.

Water quality in both study areas is generally good, but concentrations of some constituents equaled or exceeded current or proposed Federal or New York State drinking-water standards. The standards exceeded are color (one sample in the St. Lawrence study area), pH (three samples in the Delaware study area), sodium (one sample in the St. Lawrence study area), total dissolved solids (one sample in the St. Lawrence study area), aluminum (one sample in the Delaware study area and one sample

in the St. Lawrence study area), iron (seven samples in the St. Lawrence study area), manganese (one sample in the Delaware study area and five samples in the St. Lawrence study area), gross alpha radioactivity (one sample in the St. Lawrence study area), radon-222 (10 samples in the Delaware study area and 14 samples in the St. Lawrence study area), and bacteria (5 samples in the Delaware study area and 10 samples in the St. Lawrence study area). *E. coli* bacteria were detected in samples from two wells in the St. Lawrence study area. Concentrations of chloride, fluoride, sulfate, nitrate, nitrite, antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, selenium, silver, thallium, zinc, and uranium did not exceed existing drinking-water standards in any of the samples collected.

Introduction

The Federal Clean Water Act Amendments of 1977 require biennial reports from states on the chemical quality of surface water and groundwater within their boundaries (U.S. Environmental Protection Agency, 1997). In 2002, the U.S. Geological Survey (USGS), in cooperation with the New York State Department of Environmental Conservation (NYSDEC), developed a program to evaluate groundwater quality throughout the major river basins in New York on a rotating basis. The program parallels the NYSDEC Rotating Intensive Basin Study program, which evaluates surface-water quality in 2 or 3 of the 14 major river basins in the State each year. The groundwater-quality program began in 2002 with a pilot study in the Mohawk River Basin and has continued throughout upstate New York since then (table 1). Sampling completed in 2008 represents the conclusion of a first round of groundwater-quality sampling throughout New York State (excluding Long Island, which is monitored through local county programs). Groundwater-quality sampling was conducted in 2010 in the Delaware, Genesee, and St. Lawrence River Basins; these basins also were sampled in 2005 as part of this study.

Table 1. Previous groundwater-quality studies and reports.

Study area	Year	Report	Reference
Mohawk River Basin	2002	Water-Data Report NY-02-1	Butch and others, 2003
Chemung River Basin	2003	Open-File Report 2004-1329	Hetcher-Aguila, 2005
Lake Champlain Basin	2004	Open-File Report 2006-1088	Nystrom, 2006
Susquehanna River Basin	2004	Open-File Report 2006-1161	Hetcher-Aguila and Eckhardt, 2006
Delaware River Basin	2005	Open-File Report 2007-1098	Nystrom, 2007b
Genesee River Basin	2005	Open-File Report 2007-1093	Eckhardt and others, 2007
St. Lawrence River Basin	2005	Open-File Report 2007-1066	Nystrom, 2007a
Mohawk River Basin	2006	Open-File Report 2008-1086	Nystrom, 2008
Western New York	2006	Open-File Report 2008-1140	Eckhardt and others, 2008
Central New York	2007	Open-File Report 2009-1257	Eckhardt and others, 2009
Upper Hudson River Basin	2007	Open-File Report 2009-1240	Nystrom, 2009
Chemung River Basin	2008	Open-File Report 2011-1112	Risen and Reddy, 2011a
Eastern Lake Ontario Basin	2008	Open-File Report 2011-1074	Risen and Reddy, 2011b
Lower Hudson River Basin	2008	Open-File Report 2010- 1197	Nystrom, 2010
Lake Champlain Basin	2009	Open-File Report 2011- 1180	Nystrom, 2011
Susquehanna River Basin	2009		

Purpose and Scope

This report presents the findings of the 2010 study in the Delaware River Basin, in which 10 groundwater-quality samples were collected from August through November 2010, and in the St. Lawrence River Basin, in which 20 groundwater-quality samples were collected from August through October 2010. The report (1) describes the hydrogeologic setting, sampled wells, and the methods of site selection, sample collection, and chemical analysis, (2) presents discussions of the analytical results for physiochemical properties and concentrations of major ions, nutrients, trace elements, pesticides, volatile organic compounds (VOCs), radionuclides, and indicator bacteria, and (3) presents comparisons of the

results of this study with results for selected wells in the Delaware and St. Lawrence River Basins that were sampled in 2005 (Nystrom, 2007a and 2007b).

Hydrogeologic Setting of the Delaware River Basin in New York

The Delaware River Basin encompasses approximately 12,700 square miles (mi^2) in New York, Pennsylvania, New Jersey, and Delaware. This study addressed the 2,360-mi^2 part of the Delaware River Basin that lies within New York (hereafter referred to as the "Delaware study area"; fig. 1). The Delaware study area contains parts of eight counties, including most of Delaware and Sullivan Counties, part of Broome, Orange, and Ulster Counties, and small parts of Chenango, Greene, and Schoharie Counties (fig. 1).

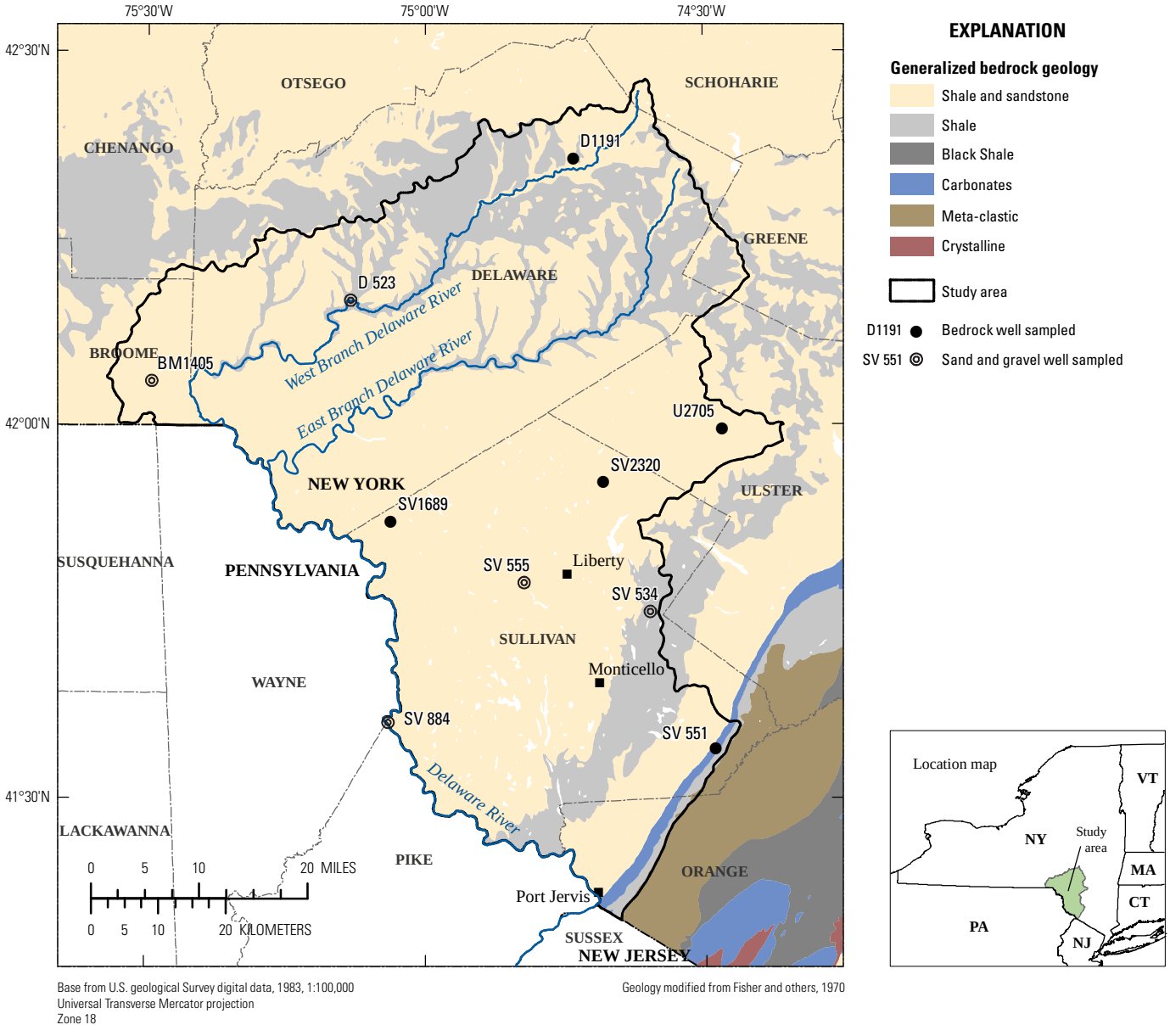

Figure 1. Generalized bedrock geology of the Delaware River Basin, New York, and locations of wells sampled in 2010.

The highest elevations in the Delaware study area are more than 4,000 ft above the North American Vertical Datum of 1988 (NAVD 88) along the eastern edge of the basin; the lowest elevation (approximately 420 ft) in the basin is at the Delaware River's exit from New York State at Port Jervis (fig. 1). The Delaware study area is predominantly forested, especially in upland areas, with urban and agricultural areas mainly in valleys and other low-lying areas (Vogelmann and others, 2001). Urban centers and adjacent developed areas in the Delaware study area include Port Jervis, Monticello, and Liberty (fig. 1).

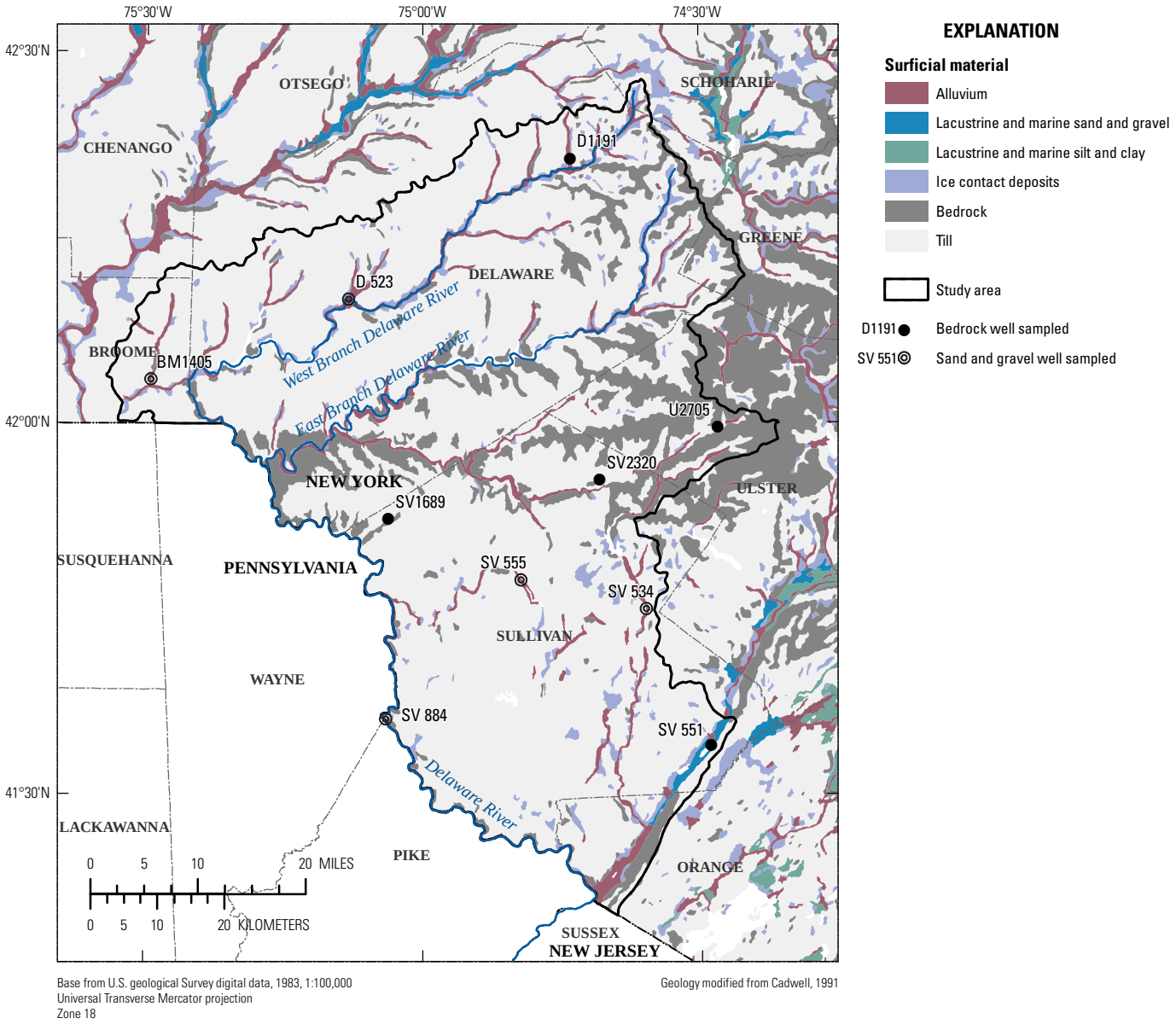

Figure 2. Generalized surficial geology of the Delaware River Basin, New York, and locations of wells sampled in 2010.

Bedrock in the Delaware study area (fig. 1) is mainly sedimentary sandstone and shale with a narrow (less than 10 mi wide) band of carbonate rocks that runs parallel to the southeastern edge of the basin. Wells completed in the sandstone and shale generally produce small to moderate yields of 10 to 100 gal/min (Barksdale, 1970). The surficial material (fig. 2) throughout the study area was deposited

primarily during the Pleistocene epoch when the Wisconsin glaciers covered most of the Northeast (Isachsen and others, 2000). Till was deposited by glaciers over most of the study area; alluvial, glaciofluvial, and ice-contact sand and gravel deposits are present mainly in valleys. Till generally has low yields of water, whereas the well sorted valley deposits form important aquifers in the basin that may produce yields of 1,000 gal/min or more (Barksdale, 1970).

Hydrogeologic Setting of the St. Lawrence River Basin in New York

The St. Lawrence River forms the outlet of the Great Lakes Basin, the largest fresh surface-water system in the world (Government of Canada and U.S. Environmental Protection Agency, 1995), draining 296,000 mi^2 in the United States and Canada. This study addressed the 5,650-mi^2 part of the St. Lawrence River Basin that lies downstream from Lake Ontario within New York (hereafter referred to as the "St. Lawrence study area"), excluding the Lake Champlain/Richelieu River Basin (fig. 3). The St. Lawrence study area contains all or part of eight counties, including all of St. Lawrence County, most of Franklin County, and portions of Clinton, Essex, Hamilton, Herkimer, Jefferson, and Lewis Counties (fig. 3). The highest elevations in the St. Lawrence study area are more than 4,000 ft above NAVD 88 along the southeastern edge of the basin in the Adirondack Mountains (fig. 3); the lowest elevations (approximately 150 ft) are present along the northern edge of the study area in the St. Lawrence Valley. The portion of the St. Lawrence study area in the Adirondack Mountains is predominantly forested; agricultural and urban areas in the study area are present mainly in the St. Lawrence Valley (Vogelmann and others, 2001).

Bedrock in the St. Lawrence study area (fig. 3) is mainly crystalline, but two wide bands of carbonate and sandstone bedrock are present along the northern edge of the basin. The surficial material (fig. 4) throughout the study area was deposited primarily during the Pleistocene epoch when the Wisconsin glaciers covered most of the Northeast (Isachsen and others, 2000). Till was deposited by glaciers over much of the study area, but large lacustrine and marine deposits are present, especially in the western part of the study area. Alluvial, glaciofluvial, and ice-contact sand and gravel deposits are present mainly in valleys. Sand and gravel deposits generally produce the highest yields in the St. Lawrence study area, but the sandstone and carbonate aquifers along the northern edge of the basin in the St. Lawrence Valley (fig. 3) also produce moderate yields (Great Lakes Basin Commission, 1975). The crystalline bedrock in the Adirondack Mountains generally produces the lowest yields of the aquifers in the basin. Most wells in the St. Lawrence study area are completed in bedrock; production wells are completed in sand and gravel deposits where they are present.

Methods of Investigation

The methods used in this study, including (1) well-selection criteria, (2) sampling methods, and (3) analytical methods, were designed to maximize data precision, accuracy, and comparability. Groundwater-sample collection and processing followed standard USGS procedures as documented in the National Field Manual for the Collection of Water-Quality Data (U.S. Geological Survey, variously dated). Samples were analyzed by documented methods at the USGS National Water Quality Laboratory (NWQL) in Denver, CO, and other laboratories.

Well Selection

Wells were selected to provide adequate spatial coverage of the study area with emphasis on areas of greatest groundwater use. The final selection of each well was based on the availability of well-construction data and hydrogeologic information for the well and its surrounding area. The study did not target specific municipalities, industries, or agricultural practices. The 30 wells selected for sampling (figs. 1 to 4) represent forested, developed, and agricultural areas. The characteristics of the wells sampled and the type of land cover surrounding each well are listed in tables 2 (Delaware study area) and 3 (St. Lawrence study area). The depths of the wells, the geologic units from which samples were

collected, and the numbers of production and domestic wells are summarized in tables 4 and 5. Five wells sampled in 2010 (one well, SV1689, in the Delaware study area and four wells, F543, F573, ST378, and ST950, in the St. Lawrence study area) were also sampled in 2005 (Nystrom, 2007a and 2007b).

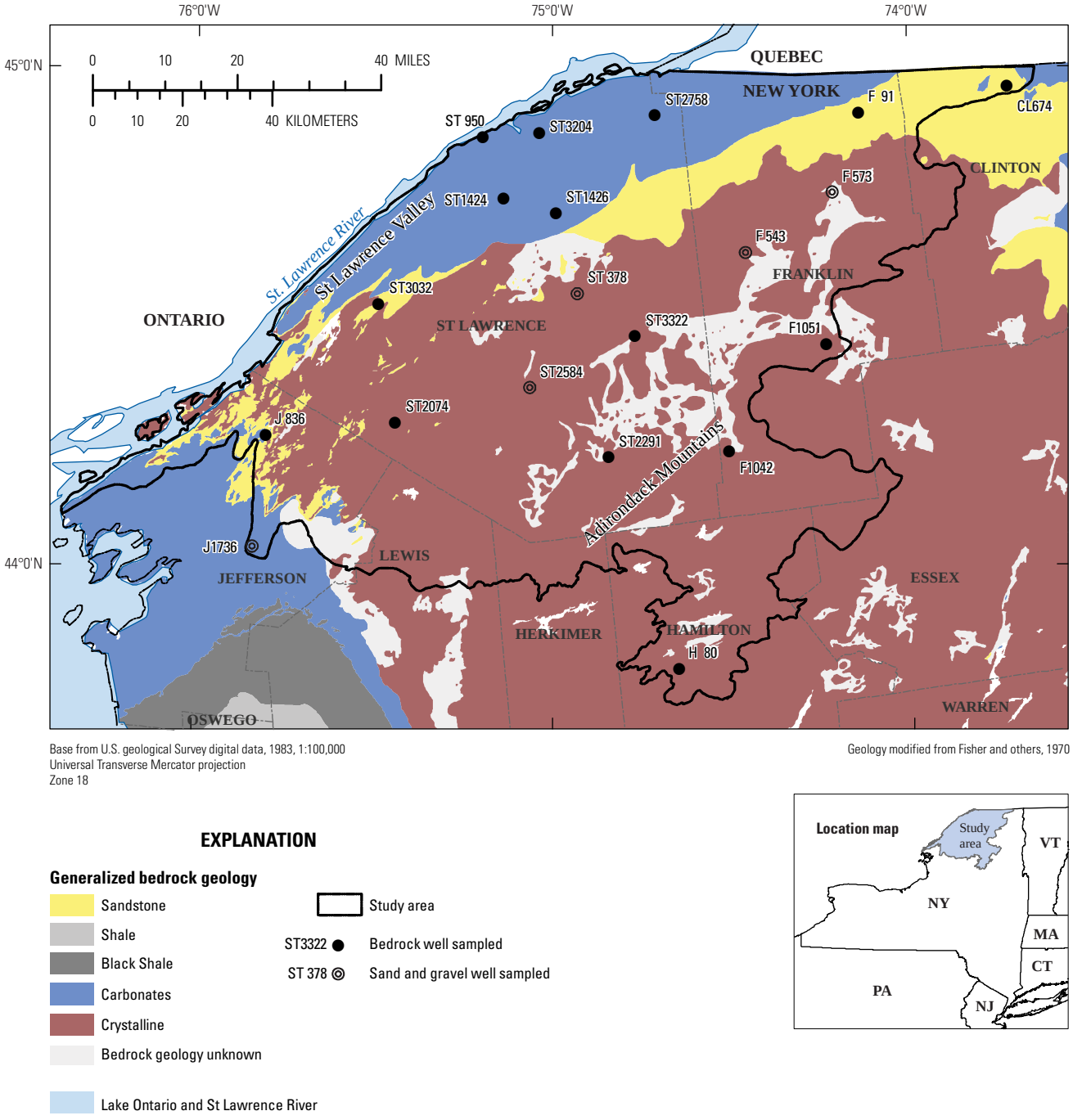

Figure 3. Generalized bedrock geology of the St. Lawrence River Basin, New York, and locations of wells sampled in 2010.

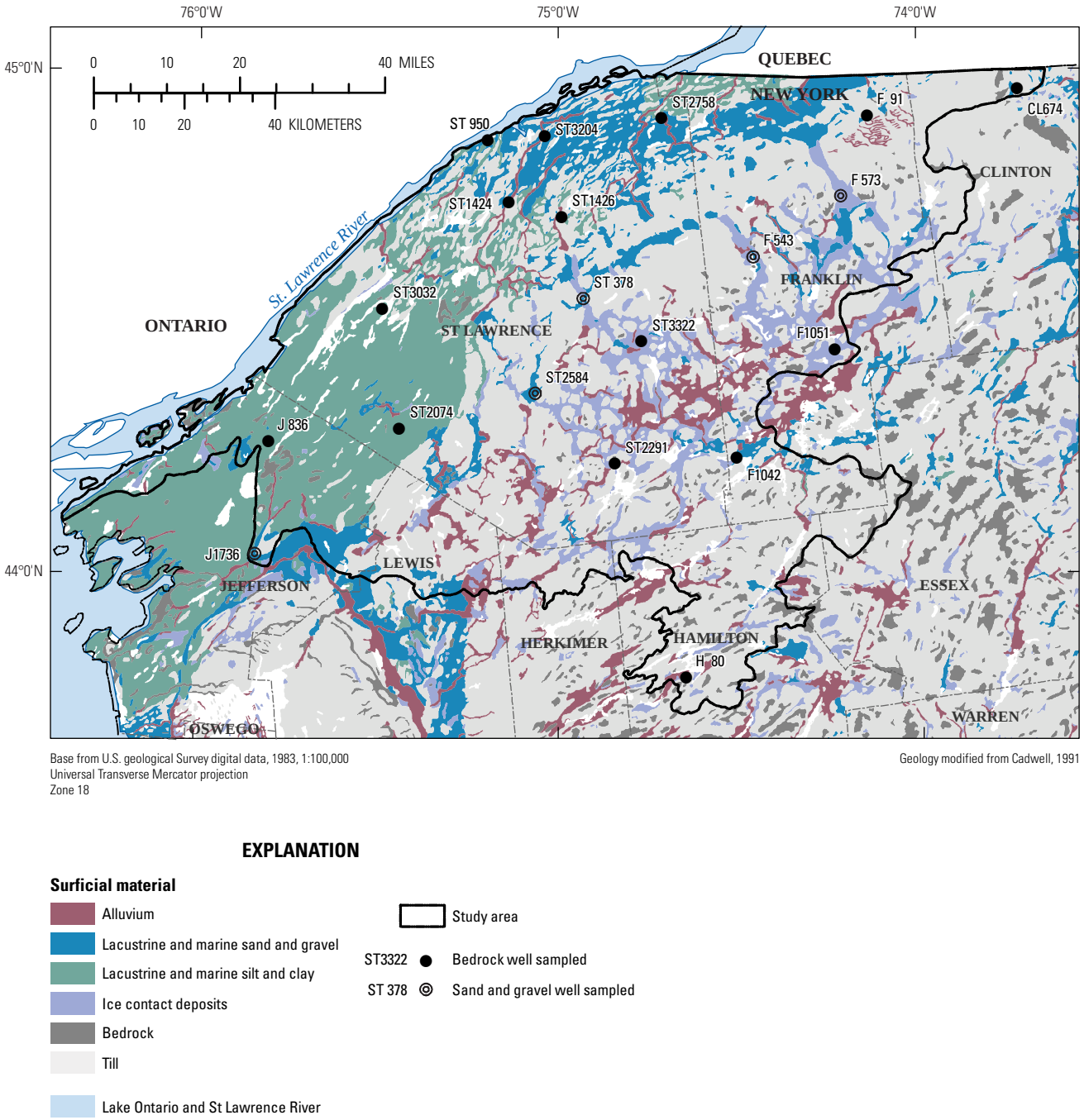

Figure 4. Generalized surficial geology of the St. Lawrence River Basin, New York, and locations of wells sampled in 2010.

The domestic wells were selected on the basis of information from the NYSDEC Water Well program, which began in 2000. The program requires that licensed well drillers file a report with NYSDEC containing basic information about each well drilled, such as well and casing depth, diameter, yield, and a hydrogeologic log. Inspection of well-completion reports identified about 450 wells as potential sampling sites. The well owners were each sent a letter that included a request for permission to sample the well and a questionnaire about the well. Well owners who granted permission were contacted later by phone to verify well information and to arrange a convenient time for sampling.

Production wells considered for sampling were identified through the U.S. Environmental Protection Agency (USEPA) Safe Drinking Water Information System and the NYSDEC Water Well program. Town officials and (or) water managers were sent letters requesting permission to sample a well, and follow-up phone calls were made to arrange a time for sampling. Well information, such as depth, was provided by water managers if a well-completion report was unavailable. The aquifer type indicated for sampled wells was verified through inspection of published geologic maps, including Fisher and others (1970) and Cadwell (1991)

Sample Collection and Analytical Methods

Samples were collected and processed in accordance with documented USGS protocols (U.S. Geological Survey, variously dated). The samples were collected before any water-treatment system to be as representative of the aquifer water quality as possible. Most samples from domestic wells were collected from a spigot near the pressure tank; samples from production wells were collected at the spigot or faucet used for collection of raw-water samples by water managers. Detailed sample collection methods are documented in Nystrom (2010).

Samples were analyzed for 147 physiochemical properties and constituents, including major ions, nutrients, trace elements, pesticides and pesticide degradates, VOCs, radionuclides, and bacteria. Physiochemical properties such as water temperature, pH, dissolved oxygen concentration, and specific conductance were measured at the sampling site. Major ions, nutrients, total organic carbon, trace elements, radon-222, pesticides and pesticide degradates, and VOCs were analyzed at the USGS NWQL in Denver, CO. Selected dissolved gases were measured at the USGS Chlorofluorocarbon Laboratory (CFCL) in Reston, VA. Gross alpha and gross beta radioactivities were measured at Eberline Services in Richmond, CA. Indicator bacteria were analyzed at the New York State Department of Health (NYSDOH) certified OCL Analytical Services, in Bloomingburg, NY and Life Science Laboratories in Waddington, NY. More information about the analytical methods used can be found in Nystrom (2010).

Table 2. Information on wells from which water samples were collected in the Delaware River Basin, New York, 2010.

[--, unknown; well types: P, production; D, domestic. Land cover categories: D, developed; F, forested; A, agricultural; W, open water; WL, wetlands. Well locations are shown in figures 1 and 2]

Well number[1]	Date sampled	Well depth, feet below land surface	Casing depth, feet below land surface	Well type	Bedrock type	Land cover[2], percentage by category, within 0.5-mile radius surrounding the well				
						D	F	A	W	WL
Sand and gravel wells										
BM1405	10/25/2010	100	100	D		10	53	37		
D523	9/30/2010	38	28	P		67	14	13	1	5
SV534	10/27/2010	42	34	P		14	51	30	3	2
SV555	11/15/2010	49	37	P		8	71	6	1	14
SV884	8/24/2010	60	57	P		26	57		16	1
Bedrock wells										
D1191	8/24/2010	327	40	D	Shale and sandstone	2	88		8	2
SV551	10/28/2010	550	--	P	Carbonate	15	44	18	1	22
SV1689	10/7/2010	380	10	D	Shale and sandstone	4	96			
SV2320	9/27/2010	320	10	D	Shale and sandstone	2	63	18		17
U2705	9/29/2010	240	40	D	Shale and sandstone	1	93			6

[1] BM, Broome County; D, Delaware County; SV, Sullivan County; U, Ulster County.

[2] Determined from the National Land Cover Data set (Vogelmann and others, 2001).

Quality Control Samples

In addition to the 30 groundwater samples, 1 blank sample and 2 concurrent replicate samples were collected for quality assurance. No constituents exceeded laboratory reporting levels (LRLs) in the blank sample. The variability between replicate samples was greatest for unfiltered trace elements. The only VOC or pesticide detected in the replicate samples was simazine, which was detected in samples from one well at a concentration of 0.003 micrograms per liter (µg/L) in the regular sample and 0.004 µg/L in the replicate sample.

Table 3. Information on wells from which water samples were collected in the St. Lawrence River Basin, New York, 2010.

[--, unknown; well types: P, production; D, domestic; M, municipal. Land cover categories: D, developed; F, forested; A, agricultural; W, open water; WL, wetlands. Well locations are shown in figures 3 and 4]

Well number[1]	Date sampled	Well depth, feet below land surface	Casing depth, feet below land surface	Well type	Bedrock type	Land cover[2], percentage by category, within 0.5-mile radius surrounding the well				
						D	F	A	W	WL
Sand and gravel wells										
F543	8/31/2010	90	78	M		8	60	14	6	12
F573	10/18/2010	236	152	P		7	80	5		8
J1736	8/11/2010	41	20	P		32	13	44		11
ST378	8/12/2010	65	54	P		13	61	8	12	6
ST2584	8/10/2010	58	60	D		4	70	17	1	8
Bedrock wells										
CL674	10/19/2010	90	34	D	Sandstone	3	64	32		1
F91	10/19/2010	170	150	P	Sandstone	5	28	59		8
F1042	8/17/2010	242	66	D	Crystalline		72	1	16	11
F1051	8/31/2010	305	22	D	Crystalline	2	36	1	57	4
H80	9/1/2010	500	--	P	Crystalline	1	50	2		46
J836	8/18/2010	60	18	D	Sandstone	7	44	34	6	9
ST950	8/18/2010	280	42	P	Carbonate	35	8	14	40	3
ST1424	10/18/2010	182	29	P	Carbonate	13	7	60	9	11
ST1426	8/30/2010	207	22	P	Carbonate	14	43	23	6	14
ST2074	8/10/2010	100	20	D	Crystalline	3	39	48		10
ST2291	8/11/2010	216	48	D	Crystalline	8	63	3	20	6
ST2758	8/30/2010	80	27	P	Carbonate	4	42	27	4	23
ST3032	8/16/2010	243	20	D	Sandstone	4	6	60		30
ST3204	8/16/2010	60	49	D	Carbonate	3	40	40	6	11
ST3322	8/17/2010	145	42	D	Crystalline	1	71	1	9	18

[1] CL, Clinton County; F, Franklin County; H, Hamilton County; J, Jefferson County; ST, St. Lawrence County.

[2] Determined from the National Land Cover Data set (Vogelmann and others, 2001)

Table 4. Summary of information on wells from which water samples were collected in the Delaware River Basin, New York, 2010.

[bls, below land surface]

Type of well	Number of wells		
	Production	Domestic	Total
Wells completed in sand and gravel (depth 38 to 100 feet bls)	4	1	5
Wells completed in bedrock (depth 240 to 550 feet bls)	1	4	5
Carbonate bedrock	1	0	1
Shale and sandstone bedrock	0	4	4
Total number of wells	5	5	10

Table 5. Summary of information on wells from which water samples were collected in the St. Lawrence River Basin, New York, 2010.

[bls, below land surface]

Type of well	Number of wells		
	Production & municipal	Domestic	Total
Wells completed in sand and gravel (depth 41 to 236 feet bls)	4	1	5
Wells completed in bedrock (depth 60 to 500 feet bls)	6	9	15
Carbonate bedrock	4	1	5
Sandstone bedrock	1	3	4
Crystalline bedrock	1	5	6
Total number of wells	10	10	20

Groundwater Quality

Many of the constituents for which the groundwater samples were analyzed were not detected in any sample. Some concentrations are reported as "estimated." Estimated concentrations are typically reported when the detected value is less than the established LRL or when recovery of a compound has been shown to be highly variable (Childress and others, 1999). Concentrations of some constituents exceeded maximum contaminant levels (MCLs) or secondary drinking-water standards (SDWS) set by the USEPA (U.S. Environmental Protection Agency, 2009) or NYSDOH (New York State Department of Health, 2007). MCLs are enforceable standards for finished water in public water supplies; they are not enforceable for private homeowner wells but are presented here as a standard for evaluation of the water-quality results. SDWS are nonenforceable drinking-water standards that typically relate to aesthetic concerns such as taste, odor, or staining of plumbing fixtures.

Groundwater Quality in the Delaware River Basin, New York

The results of analyses of the 10 groundwater samples collected in the Delaware study area during August through November 2010 are presented in tables 1-1 through 1-9 in appendix 1. Of the 147 constituents and physiochemical properties analyzed for, 79 were not detected at levels greater than the LRLs in samples from the Delaware study area (appendix table 1-1). Results for the remaining 68 constituents and properties that were detected in the Delaware study area are presented in appendix 1, tables 1-2 through 1-9.

Physiochemical Properties

All of the samples from the Delaware study area had a color of less than (<) 1 platinum-cobalt (Pt-Co) unit (table 6 and appendix table 1-2), and none exceeded the NYSDOH MCL and USEPA SDWS of 15 Pt-Co units. Dissolved oxygen concentration ranged from <0.3 to more than 9.6 mg/L. Sample pH was typically near neutral or slightly acidic (median 6.6 for all wells) and ranged from 5.6 to 7.7. The pH of four samples was lower than the USEPA SDWS range for pH (6.5 to 8.5); two of the samples were from sand and gravel wells, and one was from a bedrock well. Specific conductance ranged from 44 to 375 microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25°C); the median conductance was 216 µS/cm at 25°C. Water temperature ranged from 8.2 to 14.9°C; the median temperature was 10.4°C. Methane was detected in 4 of the 10 samples with a maximum concentration of 0.014 mg/L.

Table 6. Drinking-water standards and summary statistics for physiochemical properties of groundwater samples from the Delaware River Basin, New York, 2010.

[All concentrations in unfiltered water except as noted; Pt-Co units, platinum-cobalt units; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25 degrees Celsius; ºC, degrees Celsius; --, not applicable; <, less than; E, estimated concentration]

			Summary statistics and concentrations						
				Sand and gravel aquifers (5 samples)			Bedrock aquifers (5 samples)		
Constituent	Drinking-water standard	Number of samples exceeding standard	Median (all samples)	Minimum	Median	Maximum	Minimum	Median	Maximum
Color, filtered, Pt-Co units	[1]15	0	<1	<1	<1	<1	<1	<1	<1
Carbon dioxide, mg/L	--	--	25.2	4.7	31.0	76.5	2.4	23.2	32.1
Dissolved oxygen, mg/L	--	--	5.6	.5	1.6	7.2	<.3	7.2	9.6
pH	[1]6.5-8.5	4	6.6	5.6	6.5	7.6	5.6	6.8	7.7
Specific conductance, µS/cm	--	--	216	176	278	355	44	99	375
Temperature, ºC	--	--	10.4	9.3	11.6	14.9	8.2	9.7	12.6
Argon, mg/L	--	--	.7145	.5759	.7115	.7739	.6763	.7175	.8252
Nitrogen gas, mg/L	--	--	19.65	16.05	19.92	22.39	17.37	19.38	23.88
Methane, mg/L	--	--	<.0005	<.0005	E.0002	.0010	<.0005	<.0005	.014

[1] U.S. Environmental Protection Agency Secondary Drinking Water Standard.

Major Ions

The anions detected in the highest concentrations were bicarbonate (median concentration 66 mg/L, maximum concentration 122 mg/L) and chloride (median concentration 22.2 mg/L, maximum concentration 52.3 mg/L) (table 7 and appendix table 1-3). The cation detected in the highest concentration was calcium (median concentration 17.0 mg/L, maximum concentration 44.6 mg/L). The median concentrations of most major ions were greater in samples from sand and gravel wells than in samples from bedrock wells, especially chloride (median 31.5 mg/L in sand and gravel wells and 4.08 mg/L in bedrock wells) and sodium (19.3 mg/L in sand and gravel wells and 3.60 mg/L in bedrock wells). Water samples from the Delaware study area were generally soft (0 to 60 mg/L as $CaCO_3$; Hem, 1985) with a median hardness of 56.4 mg/L as $CaCO_3$. Five samples were soft (0 to 60 mg/L as $CaCO_3$), three samples were moderately hard (61 to 120 mg/L as $CaCO_3$), and two samples were hard (121 to 180 mg/L as $CaCO_3$). Alkalinity ranged from 9 to 100 mg/L as $CaCO_3$; the median was 54 mg/L of $CaCO_3$. Dissolved solids ranged from 34 to 235 mg/L with a median of 128 mg/L. The concentrations of sodium, chloride, fluoride, sulfate, and dissolved solids did not exceed established MCLs in any sample (table 7).

Table 7. Drinking-water standards and summary statistics for concentrations of major ions in groundwater samples from the Delaware River Basin, New York, 2010.

[All concentrations are in milligrams per liter in filtered water; --, not applicable; <, less than; ºC, degrees Celsius; CaCO3, calcium carbonate]

	Constituent	Drinking-water standard	Number of samples exceeding standard	Summary statistics and concentrations: Median (all samples)	Sand and gravel aquifers (5 samples): Minimum	Sand and gravel aquifers (5 samples): Median	Sand and gravel aquifers (5 samples): Maximum	Bedrock aquifers (5 samples): Minimum	Bedrock aquifers (5 samples): Median	Bedrock aquifers (5 samples): Maximum
Cations	Calcium	--	--	17.0	9.62	18.8	40.7	3.90	13.5	44.6
	Magnesium	--	--	3.00	1.54	4.26	8.76	1.15	1.79	12.5
	Potassium	--	--	.96	1.03	1.58	2.79	.36	.70	.89
	Sodium	[4]60	0	12.4	10.9	19.3	43.2	.76	3.60	15.7
Anions	Bicarbonate	--	--	66	23	79	122	11	52	115
	Chloride	[2,3]250	0	22.2	29.7	31.5	52.3	1.25	4.08	14.7
	Fluoride	[1]4.0 [2]2.2 [3]2	0	.06	.04	.07	.13	<.08	.06	.11
	Silica	--	--	5.62	4.04	5.78	7.89	3.30	4.52	10.6
	Sulfate	[2,3]250	0	8.24	7.51	10.2	15.6	4.50	6.18	93
Hardness as $CaCO_3$		--	--	56.4	30.4	69.4	138	14.5	41.1	163
Alkalinity as $CaCO_3$		--	--	54	19	65	100	9	43	94
Dissolved solids, dried at 180ºC		[3]500	0	128	108	154	199	34	67	235

[1] U.S. Environmental Protection Agency Maximum Contaminant Level.

[2] New York State Department of Health Maximum Contaminant Level.

[3] U.S. Environmental Protection Agency Secondary Drinking Water Standard.

[4] U.S. Environmental Protection Agency Drinking Water Advisory Taste Threshold.

Nutrients and Total Organic Carbon

The dominant nutrient detected in the Delaware study area was nitrate (table 8 and appendix table 1-4). Concentrations of ammonia ranged from <0.010 to 0.046 mg/L as nitrogen (N). Concentrations of nitrite plus nitrate ranged from <0.04 to 1.54 mg/L as N; the median concentration was 0.55 mg/L as N. The concentration of nitrate plus nitrite did not exceed the USEPA and NYSDOH MCL of 10 mg/L as N in any sample. Nitrite was detected in two samples with a maximum concentration of 0.009 mg/L as N; the concentration of nitrite did not exceed the MCL (1 mg/L as N) in any sample. Orthophosphate concentrations ranged from 0.009 to 0.038 mg/L as phosphorus (P). Total organic carbon was detected in 9 of the 10 samples; the maximum concentration was 1.2 mg/L.

Table 8. Drinking-water standards and summary statistics for concentrations of nutrients in groundwater samples from the Delaware River Basin, New York, 2010.

[All concentrations in milligrams per liter in filtered water except as noted. N, nitrogen; P, phosphorus; --, not applicable; <, less than; E, estimated concentration]

Constituent	Drinking-water standard	Number of samples exceeding standard	Summary statistics and concentrations: Median (all samples)	Sand and gravel aquifers (5 samples): Minimum	Sand and gravel aquifers (5 samples): Median	Sand and gravel aquifers (5 samples): Maximum	Bedrock aquifers (5 samples): Minimum	Bedrock aquifers (5 samples): Median	Bedrock aquifers (5 samples): Maximum
Ammonia plus organic N, as N	--	--	<0.10	<0.05	<0.10	0.08	<0.05	<0.10	0.12
Ammonia (NH_3), as N	--	--	<.020	<.010	<.010	<.020	<.010	<.020	.046
Nitrite plus nitrate (NO_2 + NO_3), as N	[1,2]10	0	.55	.35	.70	1.54	<.04	.46	1.25
Nitrite (NO_2), as N	[1,2]1	0	<.002	<.001	<.002	.009	<.001	<.002	.004
Orthophosphate (PO_4), as P	--	--	.016	.010	.019	.034	.009	.013	.038
Total organic carbon (TOC), unfiltered	--	--	E.6	<.3	.4	1	E.4	.6	1.2

[1] U.S. Environmental Protection Agency Maximum Contaminant Level.

[2] New York State Department of Health Maximum Contaminant Level.

Trace Elements

The trace elements present in the highest median concentrations in the samples were strontium (median 124 µg/L), barium (median 46.3 µg/L), iron (median 28 µg/L in unfiltered water; 4 µg/L estimated in filtered water), and boron (median 17 µg/L) (table 9 and appendix table 1-5). The highest detected concentration of a trace element was 3,680 µg/L for strontium in a sample from a bedrock well. The concentration of aluminum in one sample from a bedrock well, 200 µg/L, exceeded the low end of the USEPA SDWS for aluminum of 50 µg/L and equaled the high end of 200 µg/L. The concentration of manganese in one unfiltered sample (145 µg/L) and one filtered sample (112 µg/L) exceeded the USEPA SDWS of 50 µg/L; the NYSDOH MCL of 300 µg/L was not exceeded in any sample. Drinking-water standards for antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, mercury, selenium, silver, thallium, zinc, and uranium were not exceeded; additionally, mercury and thallium were not detected in any sample (appendix table 1-1).

Table 9. Drinking-water standards and summary statistics for concentrations of trace elements in groundwater samples from the Delaware River Basin, New York, 2010.

[All concentrations in micrograms per liter in unfiltered water except as noted. <, less than; E, estimated concentration; --, not applicable]

Constituent	Summary statistics and concentrations								
	Drinking-water standard	Number of samples exceeding standard	Median (all samples)	Sand and gravel aquifers (5 samples)			Bedrock aquifers (5 samples)		
				Minimum	Median	Maximum	Minimum	Median	Maximum
Aluminum	[3]50-200	1	E7	<3	E4	13	3	25	200
Antimony	[1,2]6	0	<.4	<.2	<.4	.2	<.2	<.4	<.4
Arsenic	[1,2]10	0	.56	.47	.54	1.5	.28	.62	1.9
Barium	[1,2]2,000	0	46.3	42.9	51.8	138	23.1	31.6	98.1
Beryllium	[1,2]4	0	<.04	<.02	<.04	.03	<.02	<.04	E.03
Boron, filtered	--	--	17	11	18	33	3.6	16	40
Cadmium	[1,2]5	0	<.05	<.04	<.05	.06	<.04	<.04	<.05
Chromium	[1,2]100	0	<.42	<.21	<.42	.32	<.21	<.42	.58
Cobalt	--	--	.02	<.04	.02	.04	<.02	.06	.14
Copper	[3]1,000	0	7.3	1.2	4.5	25.5	1.2	12.7	36.8
Iron, filtered	[2,3]300	0	E4	<3	6	19	<6	E3	5
Iron	[2,3]300	0	28	E9	24	118	10	33	271
Lead	[4]15	0	.49	.05	.45	1.80	.25	.57	1.23
Lithium	--	--	2.6	E.2	2.6	11.7	1.0	8.7	14
Manganese, filtered	[2]300 [3]50	0 1	3.8	1.2	11.3	112	<.2	2.1	5.3
Manganese	[2]300 [3]50	0 1	7.2	1.6	12.2	145	3.4	5	11.5
Mercury	[1,2]2	0	<.010	<.005	<.005	<.010	<.005	<.010	<.010
Molybdenum	--	--	<.1	<.1	<.1	.2	<.1	.1	2.0
Nickel	--	--	.27	<.12	.20	3.7	E.23	.38	.70
Selenium	[1,2]50	0	.11	<.05	.15	.26	<.05	.11	.29
Silver	[2,3]100	0	<.02	<.01	<.01	.03	<.01	E.01	.06
Strontium	--	--	124	48.5	81.1	306	20.9	246	3,680
Thallium	[1,2]2	0	<.12	<.06	<.06	<.12	<.06	<.12	<.12
Zinc	[2,3]5,000	0	5.2	<2.4	6.7	18.8	2.4	2.9	79.0
Uranium	[1,2]30	0	.137	E.014	.085	.501	E.027	.311	.900

[1] U.S. Environmental Protection Agency Maximum Contaminant Level.

[2] New York State Department of Health Maximum Contaminant Level.

[3] U.S. Environmental Protection Agency Secondary Drinking Water Standard.

[4] U.S. Environmental Protection Agency Treatment Technique.

Pesticides

Four pesticides and pesticide degradates were detected in four samples (appendix table 1-6); all were broadleaf herbicides or their degradates. Pesticides were detected in three samples from sand and gravel wells and in one sample from a bedrock well. All pesticide concentrations were in hundredths or thousandths of micrograms per liter; the constituent detected with the highest concentration (maximum 0.059 µg/L) was atrazine. The most frequently detected pesticides were the herbicide degradate CIAT (2-chloro-4-isopropylamino-6-amino-*s*-triazine, detected in four samples with an estimated maximum concentration of 0.077 µg/L) and the herbicide atrazine (detected in three samples with a maximum concentration of 0.059 µg/L). Simazine (an herbicide) was detected in two samples with a maximum

concentration of 0.003 µg/L, and prometon (an herbicide) was detected in one sample. One sample from a sand and gravel well had detections of four pesticides. Another sample had detections of three pesticides, and a third had detections of two pesticides. The bedrock well sample in which a pesticide was detected had a single pesticide detection. No pesticide concentrations exceeded established drinking-water standards; pesticide degradates currently are not regulated.

Volatile Organic Compounds

Five VOCs were detected in samples from two wells (appendix table 1-7); one sample from a production well finished in sand and gravel had detections of five VOCs, and one sample from a bedrock well had a detection of one VOC. The VOCs detected include four trihalomethanes (THMs) and tetrachloromethane. THMs are byproducts that form when chlorine or bromine are used as disinfectants; they are also used as solvents. Trichloromethane (chloroform) was detected in two samples with a maximum concentration of 0.3 µg/L; the remaining THMs, including bromodichloromethane, tribromomethane, and dibromochloromethane, were detected in only one sample from a sand and gravel well. The maximum VOC concentration detected was 1.2 µg/L of dibromochloromethane. The concentration of total THMs did not exceed the NYSDOH and USEPA MCLs of 80 µg/L. Tetrachloromethane, a solvent, was detected in one sample from a sand and gravel well with a concentration of 0.8 µg/L, which did not exceed the NYSDOH and USEPA MCLs of 5 µg/L.

Radionuclides

Gross alpha activity ranged from non-detectable levels to 1.7 pCi/L; the median activity was 0.7 pCi/L (table 10 and appendix table 1-8). The gross alpha activity did not exceed the NYSDOH and USEPA MCLs for gross alpha of 15 pCi/L in any sample. Gross beta activities ranged from non-detectable levels to 2.5 pCi/L. The USEPA and NYSDOH MCLs for gross beta are expressed as a dose of 4 millirem per year. Radon-222 activities in the water samples ranged from 410 to 1,670 pCi/L; the median was 870 pCi/L. The highest radon activities (more than 1,000 pCi/L) were in samples from bedrock wells. Radon is currently not regulated in drinking water; however, the USEPA has proposed a two-part standard for radon in drinking water: (1) a 300 pCi/L MCL for areas that do not implement an indoor-air radon mitigation program, and (2) an alternative MCL (AMCL) of 4,000 pCi/L for areas that do (U.S. Environmental Protection Agency, 1999). Activities in all of the samples exceeded the proposed MCL, but none exceeded the proposed AMCL.

Table 10. Drinking-water standards and summary statistics for concentrations of radionuclides in groundwater samples from the Delaware River Basin, New York, 2010.

[All activities in picocuries per liter in unfiltered water except as noted. mrem/yr, millirem per year; --, not applicable; <, less than]

			Summary statistics and activities						
				Sand and gravel aquifers (5 samples)			Bedrock aquifers (5 samples)		
Constituent	Drinking-water standard	Number of samples exceeding standard	Median (all samples)	Minimum	Median	Maximum	Minimum	Median	Maximum
Gross alpha radioactivity	[1,2]15	0	0.7	<0.67	<0.96	1.2	0.3	0.9	1.7
Gross beta radioactivity	[1,2]4 mrem/yr	--	<.14	<1.1	2.0	2.5	<.86	<1.3	1.1
Radon-222	[3]300 [4]4,000	10 0	870	410	870	930	790	1,090	1,670

[1] U.S. Environmental Protection Agency Maximum Contaminant Level.

[2] New York State Department of Health Maximum Contaminant Level.

[3] U.S. Environmental Protection Agency Proposed Maximum Contaminant Level.

[4] U.S. Environmental Protection Agency Proposed Alternative Maximum Contaminant Level.

Bacteria

Coliform bacteria were detected in five samples (appendix table 1-9) with a maximum of 70 colony-forming units (CFUs) per 100 mL; one of the positive results was in a presence/absence analysis and the remaining four were in most-probable-number defined-substrate analysis. Two samples with total coliform detections were from sand and gravel wells, and three were from bedrock wells. The NYSDOH and USEPA MCLs for total coliform bacteria are exceeded when 5 percent of samples of finished water collected in 1 month test positive for total coliform (if 40 or more samples are collected per month) or when two samples test positive for total coliform (if fewer than 40 samples are collected per month). Fecal coliform and *Escherichia coli (E. coli)* were not detected in any sample. The heterotrophic plate count ranged from <1 CFU per mL to 7,000 CFU per mL. The USEPA MCL for the heterotrophic plate count is 500 CFU/mL; this limit was exceeded in one sample from a sand and gravel well.

Well sampled in 2005 and 2010

One of the wells sampled in 2010 (well SV1689) was sampled previously in 2005 as part of this study. Of the 147 constituents and physiochemical properties that samples were analyzed for in 2010, 140 were common to 2005 and 2010 analyses (appendix tables 1-10 through 1-13).

Groundwater Quality in the St. Lawrence River Basin, New York

The results of analyses of the 20 groundwater samples collected in the St. Lawrence study area during August through October 2010 are presented in tables 2-1 through 2-9 in appendix 2. Of the 147 constituents and physiochemical properties analyzed, 77 were not detected at levels greater than the LRLs in samples from the St. Lawrence study area (appendix table 1-1). Results for the remaining 70 constituents and properties that were detected in the St. Lawrence study area are presented in appendix 2, tables 2-2 through 2-9.

Physiochemical Properties

The color of samples ranged from <1 to 35 Pt-Co units; the median sample color was <1 Pt-Co units (table 11 and appendix table 2-2). The color of one sample from a bedrock well, 35 Pt-Co units, exceeded the NYSDOH MCL and USEPA SDWS of 15 Pt-Co units. Dissolved oxygen concentration ranged from <0.05 to 9.7 mg/L. Sample pH was typically near neutral or slightly basic (median 7.6 in all wells) and ranged from 6.5 to 8.5. All pH samples met the USEPA SDWS range for pH of 6.5 to 8.5. Specific conductance ranged from 75 to 1,280 µS/cm at 25°C; the median conductance was 328 µS/cm at 25°C. Water temperature ranged from 7.3 to 13.8°C; the median temperature was 10.0°C. Methane was detected in nine samples with a maximum concentration of 1.49 mg/L.

Table 11. Drinking-water standards and summary statistics for physiochemical properties of groundwater samples from the St. Lawrence River Basin, New York, 2010.

[All concentrations in unfiltered water except as noted. Pt-Co units, platinum-cobalt units; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25 degrees Celsius; ºC, degrees Celsius; --, not applicable; <, less than]

Constituent	Drinking-water standard	Number of samples exceeding standard	Summary statistics and concentrations: Median (all samples)	Sand and gravel aquifers (5 samples): Minimum	Sand and gravel aquifers (5 samples): Median	Sand and gravel aquifers (5 samples): Maximum	Bedrock aquifers (15 samples): Minimum	Bedrock aquifers (15 samples): Median	Bedrock aquifers (15 samples): Maximum
Color, filtered, Pt-Co units	[1]15	1	<1	<1	<1	2	<1	<1	35
Carbon dioxide, mg/L	--	--	7.0	2.7	9.8	30.4	.5	7.2	49.2
Dissolved oxygen, mg/L	--	--	2.3	.2	5.7	7.4	<.05	1.0	9.7
pH	[1]6.5-8.5	0	7.6	6.5	7.2	8.2	6.7	7.6	8.5
Specific conductance, µS/cm	--	--	328	96	208	1,280	75	363	669
Temperature, ºC	--	--	10.0	7.3	10.0	11.0	8.6	10.1	13.8
Argon, mg/L	--	--	.7851	.7173	.7389	.7738	.7183	.8370	.9192
Nitrogen gas, mg/L	--	--	22.32	18.93	20.02	23.84	19.33	24.76	28.24
Methane, mg/L	--	--	<.0005	<.0005	<.0005	.212	<0.0005	<.0007	1.49

[1] U.S. Environmental Protection Agency Secondary Drinking Water Standard.

Major Ions

The anions detected in the highest concentrations were bicarbonate (median concentration 209 mg/L, maximum concentration 406 mg/L) and sulfate (median concentration 16.6 mg/L, maximum concentration 78.5 mg/L) (table 12 and appendix table 2-3). The cation detected in the highest concentration was calcium (median concentration 34.6 mg/L, maximum concentration 108 mg/L). The median concentrations of all major ions except silica were greater in samples from bedrock wells than in samples from sand and gravel wells, especially sodium (median 3.53 mg/L in sand and gravel wells and 12.54 mg/L in bedrock wells) and sulfate (9.56 mg/L in sand and gravel wells and 23.0 mg/L in bedrock wells). The concentration of sodium in one sample from a sand and gravel well, 105 mg/L, exceeded the USEPA Drinking Water Advisory Taste Threshold of 60 mg/L. Water samples from the St. Lawrence study area were generally hard (121 to 180 mg/L as $CaCO_3$; Hem, 1985), with a median hardness of 145 mg/L as $CaCO_3$. Five samples were soft (0 to 60 mg/L as $CaCO_3$), four samples were moderately hard (61 to 120 mg/L as $CaCO_3$), five samples were hard (121 to 180 mg/L as $CaCO_3$), and six samples were very hard (greater than 180 mg/L as $CaCO_3$). Alkalinity ranged from 31 to 333 mg/L as $CaCO_3$; the median was 140 mg/L as $CaCO_3$. Dissolved solids ranged from 55 to 756 mg/L with a median of 196 mg/L; the dissolved solids in one sample from a sand and gravel well, 756 mg/L, exceeded the USEPA SDWS of 500 mg/L. The concentrations of chloride, fluoride, and sulfate did not exceed established MCLs in any sample (table 12).

Table 12. Drinking-water standards and summary statistics for concentrations of major ions in groundwater samples from the St. Lawrence River Basin, New York, 2010.

[All concentrations are in milligrams per liter in filtered water; --, not applicable; E, estimated concentration; ºC, degrees Celsius]

	Constituent	Drinking-water standard	Number of samples exceeding standard	Summary statistics and concentrations: Median (all samples)	Sand and gravel aquifers (5 samples) Minimum	Sand and gravel aquifers (5 samples) Median	Sand and gravel aquifers (5 samples) Maximum	Bedrock aquifers (15 samples) Minimum	Bedrock aquifers (15 samples) Median	Bedrock aquifers (15 samples) Maximum
Cations	Calcium	--	--	34.6	9.03	23.2	108	8.37	45.7	75.2
	Magnesium	--	--	11.2	3.21	7.77	36.2	1.69	12.8	37.9
	Potassium	--	--	1.42	.69	.86	4.08	.43	1.45	13.8
	Sodium	[4]60	1	8.44	2.76	3.53	105	2.21	12.4	32.2
Anions	Bicarbonate	--	--	209	39	109	359	38	174	406
	Chloride	[2,3]250	0	6.62	3.72	6.24	206	.36	7.01	58.4
	Fluoride	[1]4.0 [2]2.2 [3]2	0	.28	E.06	.08	.57	.06	.28	.95
	Silica	--	--	11.6	9.62	12.3	14.9	6.26	11.3	18.9
	Sulfate	[2,3]250	0	16.6	7.48	9.56	78.5	2.89	23.0	49.5
Hardness as $CaCO_3$		--	--	145	35.8	91.8	419	29	165	344
Alkalinity as $CaCO_3$		--	--	140	32	89	294	31	143	333
Dissolved solids, dried at 180ºC		[3]500	1	196	69	120	756	55	218	384

[1] U.S. Environmental Protection Agency Maximum Contaminant.

[2] New York State Department of Health Maximum Contaminant Level.

[3] U.S. Environmental Protection Agency Secondary Drinking Water Standard.

[4] Level U.S. Environmental Protection Agency Drinking Water Advisory Taste Threshold.

Nutrients and Total Organic Carbon

The dominant nutrient detected in the St. Lawrence study area was nitrate (table 13 and appendix table 2-4). Concentrations of ammonia ranged from <0.010 to 0.350 mg/L as N. Concentrations of nitrite plus nitrate ranged from <0.02 to 3.91 mg/L as N; the median concentration was 0.09 mg/L as N. The concentration of nitrate plus nitrite did not exceed the USEPA and NYSDOH MCL of 10 mg/L as N in any sample. Nitrite was detected in five samples with a maximum concentration of 0.011 mg/L as N; the concentration of nitrite did not exceed the MCL (1 mg/L as N) in any sample. Orthophosphate concentrations ranged from an estimated concentration of 0.006 to 0.089 mg/L as P. Total organic carbon was detected in all but 2 of the 20 samples; the maximum concentration was 2.2 mg/L.

Table 13. Drinking-water standards and summary statistics for concentrations of nutrients in groundwater samples from the St. Lawrence River Basin, New York, 2010.

[All concentrations in milligrams per liter in filtered water except as noted. N, nitrogen; P, phosphorus; --, not applicable; <, less than; E, estimated]

Constituent	Drinking-water standard	Number of samples exceeding standard	Summary statistics and concentrations: Median (all samples)	Sand and gravel aquifers (5 samples): Minimum	Sand and gravel aquifers (5 samples): Median	Sand and gravel aquifers (5 samples): Maximum	Bedrock aquifers (15 samples): Minimum	Bedrock aquifers (15 samples): Median	Bedrock aquifers (15 samples): Maximum
Ammonia plus organic N, as N	--	--	E0.06	<0.05	<0.10	E0.06	<0.05	E0.10	0.63
Ammonia (NH_3), as N	--	--	<.020	<.010	<.020	.026	<.010	E.020	.350
Nitrite plus nitrate (NO_2 + NO_3), as N	[1,2]10	0	.09	<.04	.23	.92	<.02	.06	3.91
Nitrite (NO_2), as N	[1,2]1	0	<.002	<.001	<.002	E.001	<.001	<.002	.011
Orthophosphate (PO_4), as P	--	--	.012	E.008	.009	.015	E.006	.015	.089
Total organic carbon (TOC), unfiltered	--	--	.6	<.3	E.4	.7	<.6	.7	2.2

[1] U.S. Environmental Protection Agency Maximum Contaminant Level.

[2] New York State Department of Health Maximum Contaminant Level.

Trace Elements

The trace elements present in the highest median concentrations in the samples were strontium (median 210 µg/L), iron (median 116 µg/L in unfiltered water; 23 µg/L in filtered water), barium (median 47.0 µg/L), and boron (median 20 µg/L) (table 14 and appendix table 2-5). The highest detected concentration of a trace element, 6,360 µg/L, was of strontium in a sample from a sand and gravel well. The concentration of aluminum in one sample, 1,310 µg/L, exceeded the USEPA SDWS for aluminum of 200 µg/L. The concentrations of iron in seven unfiltered samples and three filtered samples exceeded the NYSDOH and USEPA MCLs of 300 µg/L. The concentration of manganese in five unfiltered samples and four filtered samples exceeded the USEPA SDWS of 50 µg/L; the concentration of manganese in one unfiltered sample exceeded the NYSDOH MCL of 300 µg/L. Drinking-water standards for antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, selenium, silver, thallium, zinc, and uranium were not exceeded; additionally, thallium was not detected in any sample (appendix table 2-1).

Table 14. Drinking-water standards and summary statistics for concentrations of trace elements in groundwater samples from the St. Lawrence River Basin, New York, 2010.

[All concentrations in micrograms per liter in unfiltered water except as noted. <, less than; E, estimated concentration; --, not applicable]

Constituent	Drinking-water standard	Number of samples exceeding standard	Summary statistics and concentrations: Median (all samples)	Sand and gravel aquifers (5 samples): Minimum	Sand and gravel aquifers (5 samples): Median	Sand and gravel aquifers (5 samples): Maximum	Bedrock aquifers (15 samples): Minimum	Bedrock aquifers (15 samples): Median	Bedrock aquifers (15 samples): Maximum
Aluminum	[3]50-200	1	<6	<3	<6	<6	<3	<6	1,310
Antimony	[1,2]6	0	<.4	<.2	<.4	<.4	<.2	<.4	E.4
Arsenic	[1,2]10	0	.80	<.18	.46	1.4	.18	.83	2.3
Barium	[1,2]2,000	0	47.0	8.3	19.5	103	<.6	53.8	329
Beryllium	[1,2]4	0	<.04	<.02	<.04	<.04	<.02	<.04	.13
Boron, filtered	--	--	20	3.4	7.6	236	3.6	32	174
Cadmium	[1,2]5	0	<.04	<.04	<.04	<.05	<.04	<.04	E.04
Chromium	[1,2]100	0	<.42	<.42	E.23	0.58	<.21	<.42	2.6
Cobalt	--	--	<.04	<.02	<.04	0.39	<.02	.03	.81
Copper	[3]1,000	0	2.0	<1.4	2.4	195	<.70	1.8	24.3
Iron, filtered	[2,3]300	3	23	<3	E5	100	<3	51	491
Iron	[2,3]300	7	116	<5	56	137	<5	274	3,910
Lead	[4]15	0	.16	<.04	.16	0.49	<.04	.16	1.50
Lithium	--	--	4.3	.5	1.3	32.8	1.1	6.0	25.7
Manganese, filtered	[2]300 [3]50	0 4	7.4	<.2	1.9	61.7	.2	9.2	272
Manganese	[2]300 [3]50	1 5	8.8	<.4	3.0	66.8	<.4	15.7	308
Mercury	[1,2]2	0	<.010	<.005	<.010	<.010	<.005	<.010	E.010
Molybdenum	--	--	1.0	.1	.7	.7	.2	1.8	5.2
Nickel	--	--	<.36	<.12	<.36	1.0	<.12	<.36	3.0
Selenium	[1,2]50	0	<.10	<.10	E.05	.10	<.05	<.10	.25
Silver	[2,3]100	0	<.02	<.01	<.02	E.01	<.01	<.02	E.01
Strontium	--	--	210	30.2	62.7	6,360	26.8	285	2,820
Thallium	[1,2]2	0	<.12	<.06	<.12	<.12	<.06	<.12	<.12
Zinc	[2,3]5,000	0	3.0	<2.4	3.0	10.1	<2.0	3.1	23.1
Uranium	[1,2]30	0	.387	.047	.325	.726	.050	.410	4.25

[1] U.S. Environmental Protection Agency Maximum Contaminant Level.

[2] New York State Department of Health Maximum Contaminant Level.

[3] U.S. Environmental Protection Agency Secondary Drinking Water Standard.

[4] U.S. Environmental Protection Agency Treatment Technique.

Pesticides

Seven pesticides and pesticide degradates were detected in 11 samples (appendix table 2-6). Six of the pesticides detected were herbicides or their degradates, and one was an insecticide. Pesticides were detected in three samples from sand and gravel wells and in eight samples from bedrock wells. Most pesticide concentrations were in hundredths or thousandths of micrograms per liter; the constituent detected with the highest concentration (estimated 0.11 µg/L) was disulfoton.

The most frequently detected pesticides were the insecticide disulfoton (detected in five samples from bedrock wells) and the herbicide degradate CIAT (2-chloro-4-isopropylamino-6-amino-*s*-triazine,

detected in four samples with an estimated maximum concentration of 0.031 µg/L). The remaining five pesticides (atrazine, benfluralin, metolachlor, simazine, and terbacil), all herbicides, were detected in one sample each. Three samples had detections of two pesticides, and eight samples had detections of one pesticide. No pesticide concentrations exceeded established drinking-water standards; pesticide degradates currently are not regulated.

Volatile Organic Compounds

Three VOCs were detected in samples from two bedrock wells (appendix table 2-7). The VOCs detected include tetrachloroethene, toluene, and trichloromethane. One well (H80) had detections of two VOCs (tetrachloroethene and toluene), and one well (F1051) had one VOC detection (trichloromethane). Each VOC was detected in only one sample. Tetrachloroethene, a solvent, was detected at a concentration of 0.1 µg/L, which did not exceed the NYSDOH and USEPA MCLs of 5 µg/L. Toluene was detected at a concentration of 0.1 µg/L, which did not exceed the NYSDOH MCL of 5 µg/L or the USEPA MCL of 1,000 µg/L. Trichloromethane (chloroform), a trihalomethane, was detected at a concentration of 0.2 µg/L, which did not exceed the NYSDOH and USEPA MCLs of 80 µg/L.

Radionuclides

Gross alpha activity ranged from non-detectable levels to 16 pCi/L; the median activity was <1.8 pCi/L (table 15 and appendix table 2-8). The gross alpha activity exceeded the NYSDOH and USEPA MCLs for gross alpha of 15 pCi/L in one sample. Gross beta activities ranged from non-detectable levels to 16.1 pCi/L. Radon-222 activities in the water samples ranged from 17 to 2,580 pCi/L; the median was 520 pCi/L. The highest radon activities (over 1,000 pCi/L) were in samples from bedrock wells. Activities in 14 of the samples exceeded the proposed MCL for radon, but none exceeded the proposed AMCL.

Table 15. Drinking-water standards and summary statistics for activities of radionuclides in groundwater samples from the St. Lawrence River Basin, New York, 2010.

[All activities in picocuries per liter in unfiltered water except as noted. mrem/yr, millirem per year; --, not applicable; <, less than]

			Summary statistics and activities						
				Sand and gravel aquifers (5 samples)			Bedrock aquifers (15 samples)		
Constituent	Drinking-water standard	Number of samples exceeding standard	Median (all samples)	Minimum	Median	Maximum	Minimum	Median	Maximum
Gross alpha radioactivity	[1,2]15	1	<1.8	<0.55	<1.8	1.2	<.39	<1.8	16
Gross beta radioactivity	[1,2]4 mrem/yr	--	1.8	<1	.9	4.1	<.85	2.7	16.1
Radon-222	[3]300 [4]4,000	14 0	520	227	710	940	17	520	2,580

[1] U.S. Environmental Protection Agency Maximum Contaminant Level.

[2] New York State Department of Health Maximum Contaminant Level.

[3] U.S. Environmental Protection Agency Proposed Maximum Contaminant Level.

[4] U.S. Environmental Protection Agency Proposed Alternative Maximum Contaminant Level

Bacteria

Coliform bacteria were detected in seven samples (appendix table 2-9) with a maximum of more than 200 CFU per 100 mL. One sample with total coliform bacteria detections was from sand and gravel wells, and six were from bedrock wells. *E. coli* were present in two samples. The heterotrophic plate

count ranged from <1 CFU per mL to 600 CFU/mL. The USEPA MCL for the heterotrophic plate count is 500 CFU/mL; this limit was exceeded in two samples from bedrock wells and possibly was exceeded in samples from three additional wells (in which the heterotrophic plate count was quantified as greater than a given number).

Wells sampled in 2005 and 2010

Four of the wells sampled in 2010 (wells F543, F573, ST378, and ST950) were sampled previously in 2005 as part of this study. Of the 147 constituents and physiochemical properties that samples were analyzed for in 2009, 140 were common to 2005 and 2010 analyses (appendix tables 2-10 through 2-13). The differences between 2005 and 2010 results for a single well were typically smaller than those between the results from different wells; there were no consistent overall trends in concentrations.

Summary

Groundwater samples were collected from August through November 2010 from 10 wells in the Delaware River Basin and 20 wells in the St. Lawrence River Basin in New York to characterize the groundwater quality. Sample collection and analysis followed standard USGS procedures and other documented procedures. Samples were analyzed for physical properties and concentrations of major ions, nutrients, trace elements, pesticides, volatile organic compounds (VOCs), radionuclides, and bacteria. Many of the 147 constituents were not detected in any of the samples.

The depths of sand and gravel wells sampled in the Delaware study area range from 38 to 100 ft below land surface; the bedrock wells are 240 to 550 ft deep and typically are completed in sandstone and shale bedrock. Five of the 10 wells sampled are production wells; 5 are domestic wells. The samples generally indicated good water quality, although properties and concentrations of some constituents—pH, aluminum, manganese, radon-222, and bacteria—equaled or exceeded primary, secondary, or proposed drinking-water standards. The constituents most frequently detected in concentrations exceeding drinking-water standards were radon-222 (all 10 samples had concentrations greater than the USEPA proposed MCL of 300 pCi/L), coliform bacteria (5 samples with detections), and pH (3 samples with pH lower than the USEPA SDWS). Sample pH was typically near neutral or slightly acidic. The water typically was soft, but hardness ranged from soft to hard. The ions detected in the highest median concentrations were bicarbonate, chloride, and calcium. The dominant nutrient was nitrate; concentrations of nitrate and nitrite did not exceed established drinking-water standards. Strontium was the trace element with the highest median concentrations. Radon-222 activities in all 10 samples exceeded a proposed MCL, but none exceeded the proposed AMCL. Four pesticides and pesticide degradates were detected in four samples. Three samples were from sand and gravel wells, and one was from a bedrock well; all were trace-level detections of broadleaf herbicides or their degradates. Five VOCs were detected in two samples, including four trihalomethanes (disinfection byproducts) and tetrachloromethane. Coliform bacteria were detected in five samples. Fecal coliform and *E. coli* bacteria were not detected in any sample.

The depths of sand and gravel wells sampled in the St. Lawrence study area range from 41 to 236 ft below land surface; the bedrock wells are 60 to 500 ft deep and are completed in crystalline, carbonate, or sandstone bedrock. Ten of the 20 wells sampled are production or municipal wells, and 10 are domestic wells. The samples generally indicated good water quality, although properties and concentrations of some constituents—color, sodium, total dissolved solids, aluminum, iron, manganese, gross alpha radioactivity, radon-222, and bacteria—equaled or exceeded primary, secondary, or proposed drinking-water standards. The constituents most frequently detected in concentrations exceeding drinking-water standards are radon-222 (14 samples with concentrations greater than the USEPA proposed MCL of 300 pCi/L), coliform bacteria (7 samples with detections), iron (7 unfiltered samples with concentrations greater than the USEPA SDWS and NYSDOH MCL of 300 µg/L), and manganese (5

unfiltered samples with concentrations greater than the USEPA SDWS of 50 µg/L). Sample pH typically was near neutral or slightly basic. The water hardness ranged from soft to very hard; more samples were hard than were soft. The ions detected in the highest median concentrations were bicarbonate, sulfate, and calcium. The dominant nutrient was nitrate; concentrations of nitrate and nitrite did not exceed established drinking-water standards. Strontium was the trace element with the highest median concentrations. The highest radon-222 activities were in samples from bedrock wells (maximum 2,580 pCi/L). Seven pesticides and pesticide degradates were detected in 11 samples; most detections were of broadleaf herbicides or their degradates at trace levels. Pesticides were detected in three samples from sand and gravel wells and eight samples from bedrock wells. Three VOCs (tetrachloroethene, toluene, and trichloromethane) were detected in two samples from bedrock wells. Coliform bacteria were detected in seven samples, and *E. coli* bacteria were detected in two samples.

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Appendix 1: Results of Water-Sample Analyses in the Delaware River Basin

The following tables summarize results of the chemical analyses of the 10 samples collected in the Delaware River Basin in New York from August through November 2010.

Table 1-1. Constituents that were not detected in groundwater samples collected in the Delaware River Basin, New York, 2010.

[NWIS, National Water Information System; WY, water year, the 12-month period from October 1 through September 30 of the following year. The water year is designated by the calendar year in which it ends]

U.S. Geological Survey NWIS parameter code	Constituent	Laboratory reporting level	
		WY10	WY11
Trace Elements in unfiltered water, in micrograms per liter			
71900	Mercury	0.010	0.005
01059	Thallium	.12	.06
Pesticides in filtered water, in micrograms per liter			
82660	2,6-Diethylaniline	.006	.006
49260	Acetochlor	.010	.010
46342	Alachlor	.008	.008
34253	*alpha*-HCH	.004	.004
82686	Azinphos-methyl	.120	.120
82673	Benfluralin	.014	.014
04028	Butylate	.004	.004
82680	Carbaryl	.060	.060
82674	Carbofuran	.060	.060
38933	Chlorpyrifos	.010	.004
82687	*cis*-Permethrin	.014	.010
04041	Cyanazine	.022	.022
82682	DCPA	.008	.008
62170	Desulfinylfipronil	.012	.012
39572	Diazinon	.005	.006
39381	Dieldrin	.009	.008
82677	Disulfoton	.04	.04
82668	EPTC	.002	.006
82663	Ethalfluralin	.006	.006
82672	Ethoprop	.016	.016
62169	Desulfinylfipronil amide	.029	.029
62167	Fipronil sulfide	.013	.012
62168	Fipronil sulfone	.024	.024
62166	Fipronil	.018	.018
04095	Fonofos	.004	.005
39341	Lindane	.004	.004
82666	Linuron	.060	.060
39532	Malathion	.016	.016
82667	Methyl parathion	.008	.008
39415	Metolachlor	.014	.014
82630	Metribuzin	.012	.012
82671	Molinate	.003	.004
82684	Napropamide	.008	.008
34653	*p,p*'-DDE	.002	.002
39542	Parathion	.020	.020
82669	Pebulate	.016	.016
82683	Pendimethalin	.012	.012
82664	Phorate	.020	.020

Table 1-1. Constituents that were not detected in groundwater samples collected in the Delaware River Basin, New York, 2010.—Continued

[NWIS, National Water Information System; WY, water year, the 12-month period from October 1 through September 30 of the following year. The water year is designated by the calendar year in which it ends]

U.S. Geological Survey NWIS parameter code	Constituent	Laboratory reporting level	
		WY10	WY11
Pesticides in filtered water, in micrograms per liter--continued			
82676	Propyzamide	.004	.004
04024	Propachlor	.006	.006
82679	Propanil	.010	.010
82685	Propargite	.02	.02
82670	Tebuthiuron	.03	.03
82665	Terbacil	.024	.024
82675	Terbufos	.02	.02
82681	Thiobencarb	.016	.016
82678	Triallate	.006	.005
82661	Trifluralin	.018	.018
Volatile organic compounds in unfiltered water, in micrograms per liter			
34506	1,1,1-Trichloroethane	.1	.1
77652	1,1,2-Trichloro-1,2,2-trifluoroethane	.1	.1
34496	1,1-Dichloroethane	.1	.1
34501	1,1-Dichloroethene	.1	.1
34536	1,2-Dichlorobenzene	.1	.1
32103	1,2-Dichloroethane	.2	.2
34541	1,2-Dichloropropane	.1	.1
34566	1,3-Dichlorobenzene	.1	.1
34571	1,4-Dichlorobenzene	.1	.1
34030	Benzene	.1	.1
34301	Chlorobenzene	.1	.1
77093	*cis*-1,2-Dichloroethene	.1	.1
34668	Dichlorodifluoromethane	.2	.2
34423	Dichloromethane	.2	.2
81576	Diethyl ether	.2	.2
81577	Diisopropyl ether	.2	.2
34371	Ethylbenzene	.1	.1
50005	Methyl *tert*-pentyl ether	.2	.2
85795	*m*-Xylene plus *p*-xylene	.2	.2
77135	*o*-Xylene	.1	.1
77128	Styrene	.1	.1
50004	*tert*-Butyl ethyl ether	.1	.1
78032	Methyl *tert*-butyl ether	.2	.2
34475	Tetrachloroethene	.1	.1
34010	Toluene	.1	.1
34546	*trans*-1,2-Dichloroethene	.1	.1
39180	Trichloroethene	.1	.1
34488	Trichlorofluoromethane	.2	.2
39175	Vinyl chloride	.2	.2

Table 1-2. Physiochemical properties of groundwater samples collected in the Delaware River Basin, New York, 2010.

[mg/L, milligrams per liter; µS/ cm @ 25°C, microsiemens per centimeter at 25 degrees Celsius; (00080), U.S. Geological Survey National Water Information System parameter code; <, less than. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 1 and 2]

Well number[1]	Color, platinum-cobalt units (00080)	Carbon dioxide, mg/L (00405)	Dissolved oxygen, mg/L (00300)	pH, field, standard units (00400)	Specific conductance, field, **µS/cm @ 25°C** (00095)
Sand and gravel wells					
BM1405	<1	4.7	1.6	7.6	327
D523	<1	31.0	.5	**6.4**	278
SV534	<1	76.5	6.1	**5.6**	176
SV555	<1	37.2	1.1	6.5	232
SV884	<1	16.6	7.2	6.8	355
Bedrock wells					
D1191	<1	23.2	5.0	6.8	200
SV551	<1	2.4	<.3	7.7	375
SV1689	<1	10.1	7.2	6.9	99
SV2320	<1	27.2	8.8	**6.3**	66
U2705	<1	32.1	9.6	**5.6**	44

Well number[1]	Water temperature, field, degrees Celsius (00010)	Argon, unfiltered, mg/L (82043)	Dissolved nitrogen gas, unfiltered, mg/L (00597)	Hydrogen sulfide odor field, (71875)	Methane, unfiltered, mg/L (76994)
Sand and gravel wells					
BM1405	10.9	0.7739	22.39	Absent	E0.0002
D523	14.9	.5759	16.05	Absent	.0008
SV534	11.6	.7115	18.99	Absent	<.0005
SV555	9.3	.7108	20.25	Absent	<.0005
SV884	11.9	.7245	19.92	Absent	.0010
Bedrock wells					
D1191	9.8	.7242	19.98	Absent	<.0005
SV551	12.6	.8252	23.88	Absent	.014
SV1689	9.1	.7175	19.38	Absent	<.0005
SV2320	9.7	.6949	18.47	Absent	<.0005
U2705	8.2	.6763	17.37	Absent	<.0005

[1] BM, Broome County; D, Delaware County; SV, Sullivan County; U, Ulster County.

Table 1-3. Concentrations of major ions in groundwater samples collected in the Delaware River Basin, New York, 2010.

[mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; (00900), U.S. Geological Survey National Water Information System parameter code; <, less than; E, estimated concentration; °Celsius; degrees Celsius. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 1 and 2]

Well number[1]	Hardness, filtered, mg/L as $CaCO_3$ (00900)	Calcium, filtered, mg/L (00915)	Magnesium, filtered, mg/L (00925)	Potassium, filtered, mg/L (00935)	Sodium, filtered, mg/L (00930)	Acid neutralizing capacity, unfiltered, mg/L as $CaCO_3$ (90410)	Alkalinity, filtered, fixed endpoint, laboratory, mg/L as $CaCO_3$ (29801)
Sand and gravel wells							
BM1405	138	40.7	8.76	1.23	10.9	100	100
D523	51.4	15.2	3.23	1.94	29.6	43	43
SV534	30.4	9.62	1.54	1.58	19.3	19	19
SV555	87.1	27.9	4.26	1.03	13.6	64	65
SV884	69.4	18.8	5.42	2.79	43.2	75	75
Bedrock wells							
D1191	61.4	20.0	2.78	.70	15.7	70	70
SV551	163	44.6	12.5	.89	11.3	94	94
SV1689	41.1	13.5	1.79	.73	3.60	42	43
SV2320	29.0	9.04	1.55	.52	.76	26	26
U2705	14.5	3.90	1.15	.36	1.75	10	9

Well number[1]	Bicarbonate, filtered, fixed endpoint, laboratory, mg/L (29805)	Chloride, filtered, mg/L (00940)	Fluoride, filtered, mg/L (00950)	Silica, filtered, mg/L (00955)	Sulfate, filtered, mg/L (00945)	Dissolved solids, dried at 180°C, filtered, mg/L (70300)
Sand and gravel wells						
BM1405	122	31.5	0.13	7.89	12.9	186
D523	52	46.3	E.05	5.47	8.97	154
SV534	23	29.7	.04	4.04	10.2	108
SV555	79	30.7	.07	5.78	7.51	139
SV884	92	52.3	.09	7.67	15.6	199
Bedrock wells						
D1191	85	14.7	.09	7.46	6.18	116
SV551	115	5.63	.11	10.6	93.0	235
SV1689	52	1.25	.06	4.52	7.28	67
SV2320	32	1.30	<.08	4.28	5.80	39
U2705	11	4.08	<.08	3.30	4.50	34

[1] BM, Broome County; D, Delaware County; SV, Sullivan County; U, Ulster County.

Table 1-4. Concentrations of nutrients and organic carbon in groundwater samples collected in the Delaware River Basin, New York, 2010.

[N, nitrogen; P, phosphorus; mg/L, milligrams per liter; (00623), U.S. Geological Survey National Water Information System parameter code; <, less than; E, estimated concentration. Well locations are shown in figures 1 and 2]

Well number[1]	Ammonia plus organic-N, filtered, mg/L as N (00623)	Ammonia, filtered, mg/L as N (00608)	Nitrate plus nitrite, filtered, mg/L as N (00631)	Nitrite, filtered, mg/L as N (00613)	Ortho-phosphate, filtered, mg/L as P (00671)	Organic carbon, unfiltered, mg/L (00680)
Sand and gravel wells						
BM1405	<0.05	<0.010	0.35	0.009	0.016	<0.3
D523	E.07	<.020	.70	<.002	.034	1.0
SV534	.08	<.010	1.54	<.001	.019	.9
SV555	<.05	<.010	.58	<.001	.010	.4
SV884	<.10	<.020	1.33	<.002	.023	E.4
Bedrock wells						
D1191	<.10	<.020	1.25	.004	.009	.6
SV551	.12	.046	<.04	<.002	.013	1.2
SV1689	<.05	<.010	.46	<.001	.009	.9
SV2320	<.10	<.020	.14	<.002	.038	E.4
U2705	<.10	<.020	.52	<.002	.015	E.6

[1] BM, Broome County; D, Delaware County; SV, Sullivan County; U, Ulster County.

Table 1-5. Concentrations of trace elements in groundwater samples collected in the Delaware River Basin, New York, 2010.

[µg/L, micrograms per liter; (01105), U.S. Geological Survey National Water Information System parameter code; <, less than; E, estimated concentration. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 1 and 2]

Well number[1]	Aluminum, unfiltered, µg/L (01105)	Antimony, unfiltered, µg/L (01097)	Arsenic, unfiltered, µg/L (01002)	Barium, unfiltered, µg/L (01007)	Beryllium, unfiltered, µg/L (01012)	Boron, filtered, µg/L (01020)	Cadmium, unfiltered, µg/L (01027)	Chromium, unfiltered, µg/L (01034)
Sand and gravel wells								
BM1405	<3	0.2	1.5	51.8	<0.02	33	<0.05	0.32
D523	E5	<.4	.54	42.9	<.04	19	<.04	<.42
SV534	13	<.2	.50	102	.03	18	.06	.29
SV555	<3	<.2	.47	138	<.02	11	<.05	<.21
SV884	E4	<.4	.57	49.7	<.04	16	<.04	<.42
Bedrock wells								
D1191	25	<.4	1.9	98.1	<.04	38	<.04	<.42
SV551	3	<.2	1.1	31.6	<.02	40	<.05	.22
SV1689	50	<.2	.62	23.1	<.02	16	<.05	<.21
SV2320	**200**	<.4	.50	31.2	<.04	3.9	<.04	.58
U2705	9	<.4	.28	41.8	E.03	3.6	<.04	<.42

Table 1-5. Concentrations of trace elements in groundwater samples collected in the Delaware River Basin, New York, 2010.—Continued

[µg/L, micrograms per liter; (01037), U.S. Geological Survey National Water Information System parameter code; <, less than; E, estimated concentration. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 1 and 2]

Well number[1]	Cobalt, unfiltered, µg/L (01037)	Copper, unfiltered, µg/L (01042)	Iron, filtered, µg/L (01046)	Iron, unfiltered, µg/L (01045)	Lead, unfiltered, µg/L (01051)	Lithium, unfiltered µg/L (01132)	Manganese, filtered, µg/L (01056)	Manganese, unfiltered, µg/L (01055)
Sand and gravel wells								
BM1405	0.02	1.7	<3	118	0.05	11.7	**112**	**145**
D523	E.02	4.5	E4	E9	.45	E.2	21.8	23.0
SV534	.04	25.5	13	19	1.80	.3	3.6	3.2
SV555	.03	1.2	19	24	.48	2.6	11.3	12.2
SV884	<.04	9.9	6	44	.40	2.6	1.2	1.6
Bedrock wells								
D1191	.06	4.7	<6	33	.57	8.7	2.1	11.5
SV551	<.02	1.2	5	10	.25	14.0	5.3	5.0
SV1689	.08	12.7	3	84	.50	9.3	<.2	3.4
SV2320	.14	21.5	E3	271	1.23	1.7	.3	9.5
U2705	<.04	36.8	<6	11	.58	1.0	4.0	4.8

[1] BM, Broome County; D, Delaware County; SV, Sullivan County; U, Ulster County.

Well number[1]	Molybdenum, unfiltered, µg/L (01062)	Nickel, unfiltered, µg/L (01067)	Selenium, unfiltered, µg/L (01147)	Silver, unfiltered, µg/L (01077)	Strontium, unfiltered, µg/L (01082)	Zinc, unfiltered, µg/L (01092)	Uranium, unfiltered, µg/L (28011)
Sand and gravel wells							
BM1405	0.2	0.20	0.15	<0.01	306	18.8	0.501
D523	<.1	E.22	.16	.03	48.5	5.2	E.014
SV534	<.1	3.7	.11	<.01	53.2	14.8	.035
SV555	<.1	<.12	<.05	<.01	166	<2.4	.094
SV884	<.1	<.36	.26	<.02	81.1	6.7	.085
Bedrock wells							
D1191	2.0	E.23	.29	<.02	246	2.4	.900
SV551	.7	.47	<.05	.06	3,680	5.2	.549
SV1689	.1	.31	.11	<.01	276	2.9	.311
SV2320	<.1	.70	.11	E.01	42.1	79.0	.180
U2705	<.1	.38	E.06	E.01	20.9	2.7	E.027

[1] BM, Broome County; D, Delaware County; SV, Sullivan County; U, Ulster County.

Table 1-6. Concentrations of pesticides detected in groundwater samples collected in the Delaware River Basin, New York, 2010.

[µg/L, micrograms per liter; CIAT, 2-chloro-4-isopropylamino-6-amino-*s*-triazine (04040), U.S. Geological Survey National Water Information System parameter code; <, less than; E, estimated concentration; M, presence verified but not quantified. Well locations are shown in figures 1 and 2]

Well number[1]	CIAT, filtered, µg/L (04040)	Atrazine, filtered, µg/L (39632)	Prometon, filtered, µg/L (04037)	Simazine, filtered, µg/L (04035)
Sand and gravel wells				
BM1405	<0.006	<0.008	<0.01	<0.006
D523	E.008	E.003	M	E.002
SV534	E.077	.059	<.01	.003
SV555	<.006	<.008	<.01	<.006
SV884	E.023	.009	<.01	<.006
Bedrock wells				
D1191	E.003	<.007	<.01	<.006
SV551	<.006	<.008	<.01	<.006
SV1689	<.006	<.008	<.01	<.006
SV2320	<.014	<.007	<.01	<.006
U2705	<.014	<.007	<.01	<.006

[1] BM, Broome County; D, Delaware County; SV, Sullivan County; U, Ulster County.

Table 1-7. Concentrations of volatile organic compounds detected in groundwater samples collected in the Delaware River Basin, New York, 2010.

[µg/L, micrograms per liter; (32101), U.S. Geological Survey National Water Information System parameter code; <, less than. Well locations are shown in figures 1 and 2]

Well number[1]	Bromodichloro-methane, unfiltered, µg/L (32101)	Tribromo-methane, unfiltered, µg/L (32104)	Dibromochloro-methane, unfiltered, µg/L (32105)	Tetrachloro-methane, unfiltered, µg/L (32102)	Trichloro-methane, unfiltered, µg/L (32106)
Sand and gravel wells					
BM1405	<0.1	<0.2	<0.2	<0.2	<0.1
D523	<.1	<.2	<.2	<.2	<.1
SV534	<.1	<.2	<.2	<.2	<.1
SV555	<.1	<.2	<.2	<.2	<.1
SV884	.5	1.0	1.2	.8	.3
Bedrock wells					
D1191	<.1	<.2	<.2	<.2	<.1
SV551	<.1	<.2	<.2	<.2	<.1
SV1689	<.1	<.2	<.2	<.2	.1
SV2320	<.1	<.2	<.2	<.2	<.1
U2705	<.1	<.2	<.2	<.2	<.1

[1] BM, Broome County; D, Delaware County; SV, Sullivan County; U, Ulster County.

Table 1-8. Activities of radionuclides in groundwater samples from the Delaware River Basin, New York, 2010.
[pCi/L, picocuries per liter; (01519), USGS National Water Information System parameter code; <, less than. **Bold** values equal or exceed one or more existing or proposed drinking-water standards. Well locations are shown in figures 1 and 2]

Well number[1]	Gross alpha radioactivity, unfiltered, pCi/L (01519)	Gross beta radioactivity, unfiltered, pCi/L (85817)	Radon-222, unfiltered, pCi/L (82303)
Sand and gravel wells			
BM1405	1.0	<1.1	**930**
D523	<.79	2.2	**870**
SV534	<.67	2.0	**410**
SV555	1.2	1.4	**870**
SV884	<.96	2.5	**660**
Bedrock wells			
D1191	1.7	1.1	**820**
SV551	1.0	<1.4	**790**
SV1689	.9	<1	**1,210**
SV2320	.5	<1.3	**1,670**
U2705	.3	<.86	**1,090**

[1] BM, Broome County; D, Delaware County; SV, Sullivan County; U, Ulster County.

Table 1-9. Bacteria in groundwater samples collected in the Delaware River Basin, New York, 2010.
[CFU, colony-forming unit; mL, milliliter; MPN, most probable number; (99596), U.S. Geological Survey National Water Information System parameter code; --, not analyzed; <, less than; U, absent; M, present. **Bold** values indicate detections of coliform bacteria. Well locations are shown in figures 1 and 2]

Well number[1]	*Escherichia coli*, Colilert, unfiltered, Presence/Absence (99596)	*Escherichia coli*, defined substrate, unfiltered, MPN/100mL (50468)	Fecal coliform, membrane filtration, unfiltered, CFU/100mL (61215)	Heterotrophic plate count, unfiltered, CFU/mL (31692)	Total coliform, Colilert, unfiltered, Presence/Absence (99595)	Total coliform, defined substrate, unfiltered, MPN/100mL (50569)	Total coliform, membrane filtration, unfiltered, CFU/100mL (61213)
Sand and gravel wells							
BM1405	--	<1	<5	1	--	<1	<20
D523	--	<1	<5	**7,000**	--	**15**	**50**
SV534	--	<1	<5	1	--	**3**	--
SV555	--	<1	<5	2	--	<1	--
SV884	U	--	--	--	U	--	--
Bedrock wells							
D1191	U	<1	<5	<1	**M**	--	33
SV551	--	<1	<5	5	--	<1	--
SV1689	--	<1	<5	6	--	**70**	--
SV2320	--	<1	<5	1	--	<1	<20
U2705	--	<1	<5	2	--	**3**	<20

[1] BM, Broome County; D, Delaware County; SV, Sullivan County; U, Ulster County.

Table 1-10. Physiochemical properties and concentrations of major ions, nutrients, and bacteria in groundwater samples collected in the Delaware River Basin, New York, 2005 and 2010.

[NWIS, National Water Information System; mg/L, milligrams per liter, µS/cm, microsiemens per centimeter at 25 degrees Celsius, $CaCO_3$, calcium carbonate; ºC, degrees Celsius; N, nitrogen; P, phosphorus; CFU, colony-forming unit; mL, milliliter; <, less than, E, estimated concentration; --, not analyzed; U, not detected]

U.S. Geological Survey NWIS parameter code	Constituent	Well SV1689	
		2005	2010
00080	Color, filtered, platinum-cobalt units	8	<1
00300	Dissolved oxygen, unfiltered, mg/L	7.2	7.2
00400	pH, unfiltered	6.9	6.9
00095	Specific conductance, unfiltered, µS/cm	96	99
00010	Temperature, unfiltered, degrees Celsius	8.6	9.1
00900	Hardness, filtered, mg/L as $CaCO_3$	40.1	41.1
00915	Calcium, filtered, mg/L	13.2	13.5
00925	Magnesium, filtered, mg/L	1.74	1.79
00935	Potassium, filtered, mg/L	.70	.73
00930	Sodium, filtered, mg/L	4.75	3.60
90410	Acid neutralizing capacity, unfiltered, fixed end point, lab, mg/L as $CaCO_3$	38	42
29801	Alkalinity, filtered, fixed end point, laboratory, mg/L as $CaCO_3$	38	43
29805	Bicarbonate, filtered, fixed end point, laboratory, mg/L	46	52
00940	Chloride, filtered, mg/L	1.08	1.25
00950	Fluoride, filtered, mg/L	E.05	.06
00955	Silica, filtered, mg/L	4.72	4.52
00945	Sulfate, filtered, mg/L	7.29	7.28
70300	Dissolved solids, dried at 180ºC, filtered, mg/L	60	67
00623	Ammonia plus organic-N, filtered, mg/L as N	<.10	<.05
00608	Ammonia, filtered, mg/L as N	<.04	<.010
00631	Nitrate plus nitrite, filtered, mg/L as N	.53	.46
00613	Nitrite, filtered, mg/L as N	<.008	<.001
00671	Orthophosphate, filtered, mg/L as P	<.02	.009
00680	Organic carbon, unfiltered, mg/L	<1.0	.9
31691	*Escherichia coli*, unfiltered, CFU per 100 mL	--	U
61215	Fecal coliform, unfiltered, CFU per 100 mL	<1	<5
31692	Heterotrophic plate count, unfiltered, CFU per mL	86	6
	Total coliform, unfiltered, CFU per 100 mL	3	70

Table 1-11. Concentrations of trace elements and radionuclides in groundwater samples in the Delaware River Basin, New York, 2005 and 2010.

[NWIS, National Water Information System; µg/L, micrograms per liter, pCi/L, picocuries per liter; <, less than, E, estimated concentration]

U.S. Geological Survey NWIS parameter code	Constituent	Well SV1689	
		2005	2010
01105	Aluminum, unfiltered, µg/L	1,100	50
01097	Antimony, unfiltered, µg/L	E.1	<.2
01002	Arsenic, unfiltered, µg/L	1.5	.62
01007	Barium, unfiltered, µg/L	36.6	23.1
01012	Beryllium, unfiltered, µg/L	.09	<.02
01020	Boron, filtered, µg/L	15	16
01027	Cadmium, unfiltered, µg/L	.05	<.05
01034	Chromium, unfiltered, µg/L	1.9	<.21
01037	Cobalt, unfiltered, µg/L	2.24	.08
01042	Copper, unfiltered, µg/L	16.0	12.7
01046	Iron, filtered, µg/L	E4	3
01045	Iron, unfiltered, µg/L	2,150	84
01051	Lead, unfiltered, µg/L	4.64	.50
01132	Lithium, unfiltered, µg/L	10.5	9.3
01056	Manganese, filtered, µg/L	E.4	<.2
01055	Manganese, unfiltered, µg/L	141	3.4
71900	Mercury, unfiltered, µg/L	<.010	<.005
01062	Molybdenum, unfiltered, µg/L	E.1	.1
01067	Nickel, unfiltered, µg/L	3.27	.31
01147	Selenium, unfiltered, µg/L	E.06	.11
01077	Silver, unfiltered, µg/L	<.16	<.01
01082	Strontium, unfiltered, µg/L	220	276
01059	Thallium, unfiltered, µg/L	<.18	<.06
01092	Zinc, unfiltered, µg/L	12	2.9
82303	Radon-222, unfiltered, pCi/L	1,280	1,210
28011	Uranium, unfiltered, µg/L	.539	.311

Table 1-12. Concentrations of pesticides in groundwater samples collected in the Delaware River Basin, New York, 2005 and 2010.

[NWIS, National Water Information System; µg/L, micrograms per liter; <, less than]

U.S. Geological Survey NWIS parameter code	Constituent	Well SV1689	
		2005	2010
82660	2,6-Diethylaniline, filtered, µg/L	<0.006	<0.006
04040	2-Chloro-4-isopropylamino-6-amino-*s*-triazine (CIAT), filtered, µg/L	<.006	<.006
49260	Acetochlor, filtered, µg/L	<.006	<.010
46342	Alachlor, filtered, µg/L	<.005	<.008
34253	*alpha*-HCH, filtered, µg/L	<.005	<.004
39632	Atrazine, filtered, µg/L	<.007	<.008
82686	Azinphos-methyl, filtered, µg/L	<.050	<.120
82673	Benfluralin, filtered, µg/L	<.010	<.014
04028	Butylate, filtered, µg/L	<.004	<.004
82680	Carbaryl, filtered, µg/L	<.041	<.060
82674	Carbofuran, filtered, µg/L	<.020	<.060
38933	Chlorpyrifos, filtered, µg/L	<.005	<.004
82687	*cis*-Permethrin, filtered, µg/L	<.006	<.010
04041	Cyanazine, filtered, µg/L	<.018	<.022
82682	DCPA, filtered, µg/L	<.003	<.008
62170	Desulfinylfipronil, filtered, µg/L	<.012	<.012
39572	Diazinon, filtered, µg/L	<.005	<.006
39381	Dieldrin, filtered, µg/L	<.009	<.008
82677	Disulfoton, filtered, µg/L	<.02	<.04
82668	EPTC, filtered, µg/L	<.004	<.006
82663	Ethalfluralin, filtered, µg/L	<.009	<.006
82672	Ethoprop, filtered, µg/L	<.005	<.016
62169	Desulfinylfipronil amide, filtered, µg/L	<.029	<.029
62167	Fipronil sulfide, filtered, µg/L	<.013	<.012
62168	Fipronil sulfone, filtered, µg/L	<.024	<.024
62166	Fipronil, filtered, µg/L	<.016	<.018
04095	Fonofos, filtered, µg/L	<.003	<.005
39341	Lindane, filtered, µg/L	<.004	<.004
82666	Linuron, filtered, µg/L	<.035	<.060
39532	Malathion, filtered, µg/L	<.027	<.016

Table 1-12. Concentrations of pesticides in groundwater samples collected in the Delaware River Basin, New York, 2005 and 2010.—Continued

[NWIS, National Water Information System; µg/L, micrograms per liter; <, less than]

U.S. Geological Survey NWIS parameter code	Constituent	Well SV1689	
		2005	2010
82667	Methyl parathion, filtered, µg/L	<0.015	<0.008
39415	Metolachlor, filtered, µg/L	<.006	<.014
82630	Metribuzin, filtered, µg/L	<.006	<.012
82671	Molinate, filtered, µg/L	<.003	<.004
82684	Napropamide, filtered, µg/L	<.007	<.008
34653	*p,p'*-DDE, filtered, µg/L	<.003	<.002
39542	Parathion, filtered, µg/L	<.010	<.020
82669	Pebulate, filtered, µg/L	<.004	<.016
82683	Pendimethalin, filtered, µg/L	<.022	<.012
82664	Phorate, filtered, µg/L	<.011	<.020
04037	Prometon, filtered, µg/L	<.01	<.01
82676	Propyzamide, filtered, µg/L	<.004	<.004
04024	Propachlor, filtered, µg/L	<.025	<.006
82679	Propanil, filtered, µg/L	<.011	<.010
82685	Propargite, filtered, µg/L	<.02	<.02
04035	Simazine, filtered, µg/L	<.005	<.006
82670	Tebuthiuron, filtered, µg/L	<.02	<.03
82665	Terbacil, filtered, µg/L	<.034	<.024
82675	Terbufos, filtered, µg/L	<.02	<.02
82681	Thiobencarb, filtered, µg/L	<.010	<.016
82678	Triallate, filtered, µg/L	<.006	<.005
82661	Trifluralin, filtered, µg/L	<.009	<.018

Table 1-13. Concentrations of volatile organic compounds in groundwater samples collected in the Delaware River Basin, New York, 2005 and 2010.

[NWIS, National Water Information System; µg/L, micrograms per liter, <, less than. **Bold** values indicate detected concentrations]

U.S. Geological Survey NWIS parameter code	Constituent	Well SV1689	
		2005	2010
34506	1,1,1-Trichloroethane, unfiltered, µg/L	<0.1	<0.1
77652	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113), unfiltered, µg/L	<.1	<.1
34496	1,1-Dichloroethane, unfiltered, µg/L	<.1	<.1
34501	1,1-Dichloroethene, unfiltered, µg/L	<.1	<.1
34536	1,2-Dichlorobenzene, unfiltered, µg/L	<.1	<.1
32103	1,2-Dichloroethane, unfiltered, µg/L	<.2	<.2
34541	1,2-Dichloropropane, unfiltered, µg/L	<.1	<.1
34566	1,3-Dichlorobenzene, unfiltered, µg/L	<.1	<.1
34571	1,4-Dichlorobenzene, unfiltered, µg/L	<.1	<.1
34030	Benzene, unfiltered, µg/L	<.1	<.1
32101	Bromodichloromethane, unfiltered, µg/L	<.1	<.1
32104	Tribromomethane, unfiltered, µg/L	<.2	<.2
34301	Chlorobenzene, unfiltered, µg/L	<.1	<.1
77093	*cis*-1,2-Dichloroethene, unfiltered, µg/L	<.1	<.1
32105	Dibromochloromethane, unfiltered, µg/L	<.2	<.2
34668	Dichlorodifluoromethane, unfiltered, µg/L	<.2	<.2
34423	Dichloromethane, unfiltered, µg/L	<.2	<.2
81576	Diethyl ether, unfiltered, µg/L	<.2	<.2
81577	Diisopropyl ether, unfiltered, µg/L	<.2	<.2
34371	Ethylbenzene, unfiltered, µg/L	<.1	<.1
50005	Methyl *tert*-pentyl ether, unfiltered, µg/L	<.2	<.2
85795	*m*- + *p*-Xylene, unfiltered, µg/L	<.2	<.2
77135	*o*-Xylene, unfiltered, µg/L	<.1	<.1
77128	Styrene, unfiltered, µg/L	<.1	<.1
50004	*tert*-Butyl ethyl ether, unfiltered, µg/L	<.1	<.1
78032	Methyl *tert*-butyl ether (MTBE), unfiltered, µg/L	<.2	<.2
34475	Tetrachloroethene, unfiltered, µg/L	<.1	<.1
32102	Tetrachloromethane, unfiltered, µg/L	<.2	<.2
34010	Toluene, unfiltered, µg/L	<.1	<.1
34546	*trans*-1,2-Dichloroethene, unfiltered, µg/L	<.1	<.1
39180	Trichloroethene, unfiltered, µg/L	<.1	<.1
34488	Trichlorofluoromethane (CFC-11), unfiltered, µg/L	<.2	<.2
32106	Trichloromethane, unfiltered, µg/L	<.1	**.1**
39175	Vinyl chloride, unfiltered, µg/L	<.2	<.2

Appendix 2: Results of Water-Sample Analyses in the St. Lawrence River Basin

The following tables summarize results of the chemical analyses of the 20 samples collected in the St. Lawrence River Basin in New York from August through October 2010.

Table 2-1. Constituents that were not detected in groundwater samples collected in the St. Lawrence River Basin, New York, 2010.

[NWIS, National Water Information System; WY, water year, the 12-month period from October 1 through September 30 of the following year. The water year is designated by the calendar year in which it ends]

U.S. Geological Survey NWIS parameter code	Constituent	Laboratory reporting level	
		WY10	WY11
Trace Elements in unfiltered water, in micrograms per liter			
01059	Thallium	0.12	0.06
Pesticides in filtered water, in micrograms per liter			
82660	2,6-Diethylaniline	.006	.006
49260	Acetochlor	.010	.010
46342	Alachlor	.008	.008
34253	*alpha*-HCH	.004	.004
82686	Azinphos-methyl	.120	.120
04028	Butylate	.004	.004
82680	Carbaryl	.060	.060
82674	Carbofuran	.060	.060
38933	Chlorpyrifos	.010	.004
82687	*cis*-Permethrin	.014	.010
04041	Cyanazine	.022	.022
82682	DCPA	.008	.008
62170	Desulfinylfipronil	.012	.012
39572	Diazinon	.005	.006
39381	Dieldrin	.009	.008
82668	EPTC	.002	.006
82663	Ethalfluralin	.006	.006
82672	Ethoprop	.016	.016
62169	Desulfinylfipronil amide	.029	.029
62167	Fipronil sulfide	.013	.012
62168	Fipronil sulfone	.024	.024
62166	Fipronil	.018	.018
04095	Fonofos	.004	.005
39341	Lindane	.004	.004
82666	Linuron	.060	.060
39532	Malathion	.016	.016
82667	Methyl parathion	.008	.008
82630	Metribuzin	.012	.012
82671	Molinate	.003	.004
82684	Napropamide	.008	.008
34653	*p,p*'-DDE	.002	.002
39542	Parathion	.020	.020
82669	Pebulate	.016	.016
82683	Pendimethalin	.012	.012
82664	Phorate	.020	.020
04037	Prometon	.01	.01

Table 2-1. Constituents that were not detected in groundwater samples collected in the St. Lawrence River Basin, New York, 2010.—Continued

[NWIS, National Water Information System; WY, water year, the 12-month period from October 1 through September 30 of the following year. The water year is designated by the calendar year in which it ends]

U.S. Geological Survey NWIS parameter code	Constituent	Laboratory reporting level	
		WY10	WY11
Pesticides in filtered water, in micrograms per liter--continued			
82676	Propyzamide	.004	.004
04024	Propachlor	.006	.006
82679	Propanil	.010	.010
82685	Propargite	.02	.02
82670	Tebuthiuron	.03	.03
82675	Terbufos	.02	.02
82681	Thiobencarb	.016	.016
82678	Triallate	.006	.005
82661	Trifluralin	.018	.018
Volatile organic compounds in unfiltered water, in micrograms per liter			
34506	1,1,1-Trichloroethane	.1	.1
77652	1,1,2-Trichloro-1,2,2-trifluoroethane	.1	.1
34496	1,1-Dichloroethane	.1	.1
34501	1,1-Dichloroethene	.1	.1
34536	1,2-Dichlorobenzene	.1	.1
32103	1,2-Dichloroethane	.2	.2
34541	1,2-Dichloropropane	.1	.1
34566	1,3-Dichlorobenzene	.1	.1
34571	1,4-Dichlorobenzene	.1	.1
34030	Benzene	.1	.1
32101	Bromodichloromethane	.1	.1
32104	Tribromomethane	.2	.2
34301	Chlorobenzene	.1	.1
77093	*cis*-1,2-Dichloroethene	.1	.1
32105	Dibromochloromethane	.2	.2
34668	Dichlorodifluoromethane	.2	.2
34423	Dichloromethane	.2	.2
81576	Diethyl ether	.2	.2
81577	Diisopropyl ether	.2	.2
34371	Ethylbenzene	.1	.1
50005	Methyl *tert*-pentyl ether	.2	.2
85795	*m*-Xylene plus *p*-xylene	.2	.2
77135	*o*-Xylene	.1	.1
77128	Styrene	.1	.1
50004	*tert*-Butyl ethyl ether	.1	.1
78032	Methyl *tert*-butyl ether	.2	.2
32102	Tetrachloromethane	.2	.2
34546	*trans*-1,2-Dichloroethene	.1	.1
39180	Trichloroethene	.1	.1
34488	Trichlorofluoromethane	.2	.2
39175	Vinyl chloride	.2	.2

Table 2-2. Physiochemical properties of groundwater samples collected in the St. Lawrence River Basin, New York, 2010.

[mg/L, milligrams per liter; µS/ cm @ 25°C, microsiemens per centimeter at 25 degrees Celsius; (00080), U.S. Geological Survey National Water Information System parameter code; <, less than; --, not analyzed. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 3 and 4]

Well number[1]	Color, platinum-cobalt units (00080)	Carbon dioxide, mg/L (00405)	Dissolved oxygen, mg/L (00300)	pH, field, standard units (00400)	Specific conductance, field, **µS/cm @ 25°C** (00095)
Sand and gravel wells					
F543	2	19.7	6.3	6.5	96
F573	<1	2.7	7.4	8.2	208
J1736	<1	30.4	.2	7.2	1,280
ST378	<1	2.8	3.0	8.2	197
ST2584	<1	9.8	5.7	7.2	208
Bedrock wells					
CL674	<1	7.0	7.5	7.5	318
F91	<1	7.3	8.4	7.6	337
F1042	<1	1.9	9.7	8.4	80
F1051	2	.5	.1	8.4	131
H80	2	1.1	6.0	8.3	146
J836	10	49.2	1.6	6.7	438
ST950	<1	12.8	4.5	7.6	600
ST1424	<1	9.9	<.3	7.6	562
ST1426	2	13.0	<.05	7.5	655
ST2074	5	13.9	.2	7.2	393
ST2291	<1	2.4	8.3	8.5	75
ST2758	<1	2.6	<.05	8.0	363
ST3032	5	--	.1	7.4	573
ST3204	<1	39.3	.1	7.2	669
ST3322	**35**	1.1	1.0	8.1	98

[1] CL, Clinton County; F, Franklin County; H, Hamilton County; J, Jefferson County; ST, St. Lawrence County.

Table 2-2. Physiochemical properties of groundwater samples collected in the St. Lawrence River Basin, New York, 2010. —Continued

[mg/L, milligrams per liter; µS/ cm @ 25°C, microsiemens per centimeter at 25 degrees Celsius; (00080), U.S. Geological Survey National Water Information System parameter code; <, less than; --, not analyzed; E, estimated concentration. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 3 and 4]

Well number[1]	Water temperature, field, degrees Celsius (00010)	Argon, unfiltered, mg/L (82043)	Dissolved nitrogen gas, unfiltered, mg/L (00597)	Hydrogen sulfide odor field, (71875)	Methane, unfiltered, mg/L (76994)
Sand and gravel wells					
F543	11.0	0.7635	20.56	Absent	<0.0005
F573	7.3	.7173	18.93	Absent	<.0005
J1736	10.4	.7738	23.84	Absent	.212
ST378	9.0	.7234	19.58	Absent	<.0005
ST2584	10.0	.7389	20.02	Absent	E.0005
Bedrock wells					
CL674	9.9	.8380	25.32	Present	.0031
F91	13.8	.7341	19.48	Absent	<.0005
F1042	9.0	.7851	21.59	Absent	<.0005
F1051	10.0	.7183	19.33	Absent	.0007
H80	8.6	.8795	26.28	Absent	.0015
J836	13.1	.7958	22.32	Absent	<.0005
ST950	9.3	.9029	27.76	Present	<.0005
ST1424	10.1	.9129	27.76	Absent	<.0005
ST1426	8.6	.8360	24.85	Absent	.0045
ST2074	10.7	.8425	24.79	Absent	.0011
ST2291	12.4	.8039	22.46	Absent	<.0005
ST2758	10.6	.8444	24.74	Present	.873
ST3032	10.8	--	--	Absent	--
ST3204	13.0	.8410	24.84	Absent	1.49
ST3322	8.9	.7561	20.44	Absent	<.0005

[1] CL, Clinton County; F, Franklin County; H, Hamilton County; J, Jefferson County; ST, St. Lawrence County.

Table 2-3. Concentrations of major ions in groundwater samples collected in the St. Lawrence River Basin, New York, 2010.

[mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; (00900), U.S. Geological Survey National Water Information System parameter code; E, estimated concentration; °Celsius, degrees Celsius. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 3 and 4]

Well number[1]	Hardness, filtered, mg/L as $CaCO_3$ (00900)	Calcium, filtered, mg/L (00915)	Magnesium, filtered, mg/L (00925)	Potassium, filtered, mg/L (00935)	Sodium, filtered, mg/L (00930)	Acid neutralizing capacity, unfiltered, mg/L as $CaCO_3$ (90410)	Alkalinity, filtered, fixed endpoint, laboratory, mg/L as $CaCO_3$ (29801)
Sand and gravel wells							
F543	35.8	9.03	3.21	0.69	3.24	32	32
F573	101	27.7	7.77	.72	3.53	98	94
J1736	419	108	36.2	4.08	**105**	295	294
ST378	91.8	23.2	8.22	.86	2.76	89	89
ST2584	80.9	22.9	5.77	1.68	8.95	61	62
Bedrock wells							
CL674	158	41.4	13.2	1.45	3.85	146	143
F91	165	45.7	12.3	1.20	4.14	136	138
F1042	32.4	10.2	1.69	.43	3.04	31	31
F1051	53.2	18.4	1.78	.45	7.93	67	67
H80	60.4	20.6	2.19	.75	7.28	57	58
J836	169	50.8	10.2	2.94	20.8	145	144
ST950	254	53.4	29.2	4.03	29.5	240	239
ST1424	220	49.2	23.7	3.60	32.2	200	205
ST1426	299	68.4	31.1	2.33	21.2	223	218
ST2074	172	47.8	12.8	1.68	13.9	141	141
ST2291	29.0	8.37	1.97	.83	2.86	31	31
ST2758	132	27.7	15.3	4.50	25.0	155	155
ST3032	223	54.8	21.0	13.8	25.0	248	245
ST3204	344	75.2	37.9	1.39	12.4	342	333
ST3322	43.7	11.2	3.85	.54	2.21	46	45

[1] CL, Clinton County; F, Franklin County; H, Hamilton County; J, Jefferson County; ST, St. Lawrence County.

[2] Bicarbonate values calculated from alkalinity.

Table 2-3. Concentrations of major ions in groundwater samples collected in the St. Lawrence River Basin, New York, 2010.—Continued

[mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; (29805), U.S. Geological Survey National Water Information System parameter code; E, estimated concentration; °Celsius, degrees Celsius. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 3 and 4]

Well number[1]	Bicarbonate[2], filtered, fixed endpoint, laboratory, mg/L (29805)	Chloride, filtered, mg/L (00940)	Fluoride, filtered, mg/L (00950)	Silica, filtered, mg/L (00955)	Sulfate, filtered, mg/L (00945)	Dissolved solids, dried at 180ºC, filtered, mg/L (70300)
Sand and gravel wells						
F543	39	3.72	E0.06	14.9	7.48	69
F573	115	6.24	.08	9.62	9.96	120
J1736	359	206	.57	12.3	78.5	**756**
ST378	109	4.37	E.06	9.70	9.56	117
ST2584	76	19.6	.43	12.8	8.52	126
Bedrock wells						
CL674	174	3.98	.12	10.1	23.0	191
F91	168	7.01	.06	12.3	16.9	201
F1042	38	.39	.36	16.2	6.80	55
F1051	82	1.00	.28	12.2	2.89	89
H80	71	1.30	.95	10.8	16.4	99
J836	176	31.2	.13	9.77	34.2	251
ST950	292	31.9	.51	11.9	46.7	352
ST1424	250	31.2	.34	7.85	49.5	304
ST1426	266	58.4	.28	10.5	37.8	372
ST2074	172	13.6	.70	14.6	40.5	242
ST2291	38	1.53	.14	18.9	5.78	59
ST2758	189	17.8	.78	10.0	14.4	218
ST3032	299	23.1	.09	6.26	23.9	320
ST3204	406	2.68	.17	15.6	38.4	384
ST3322	55	.36	.32	11.3	5.09	60

[1] CL, Clinton County; F, Franklin County; H, Hamilton County; J, Jefferson County; ST, St. Lawrence County.

[2] Bicarbonate values calculated from alkalinity

Table 2-4. Concentrations of nutrients and organic carbon in groundwater samples collected in the St. Lawrence River Basin, New York, 2010.

[N, nitrogen; P, phosphorus; mg/L, milligrams per liter; (00623), U.S. Geological Survey National Water Information System parameter code; <, less than; E, estimated concentration. Well locations are shown in figures 3 and 4]

Well number[1]	Ammonia plus organic-N, filtered, mg/L as N (00623)	Ammonia, filtered, mg/L as N (00608)	Nitrate plus nitrite, filtered, mg/L as N (00631)	Nitrite, filtered, mg/L as N (00613)	Ortho-phosphate, filtered, mg/L as P (00671)	Organic carbon, unfiltered, mg/L (00680)
Sand and gravel wells						
F543	<0.10	<0.020	0.92	<0.002	0.011	E0.6
F573	<.05	<.010	.23	<.001	.015	<.3
J1736	E.06	.026	<.04	E.001	.008	.7
ST378	<.10	<.020	.09	<.002	.009	E.3
ST2584	E.06	<.020	.63	<.002	E.008	E.4
Bedrock wells						
CL674	<.05	.017	<.02	<.001	.027	.6
F91	.06	<.010	3.91	<.001	.019	.6
F1042	<.10	<.020	.48	<.002	.035	E.3
F1051	<.10	<.020	E.03	<.002	.089	.8
H80	<.10	<.020	.10	.003	.011	E.4
J836	.11	.023	.09	<.002	E.008	2.1
ST950	.21	.130	<.04	<.002	.016	.9
ST1424	.14	.117	<.02	<.001	.007	.7
ST1426	E.10	.074	<.04	<.002	.008	E.6
ST2074	.13	E.020	.47	.005	.015	1.6
ST2291	<.10	<.020	.06	<.002	.022	<.6
ST2758	.18	.136	<.04	<.002	.024	1.4
ST3032	.63	.350	.20	.011	E.006	2.2
ST3204	.12	.046	<.04	<.002	.013	1.2
ST3322	E.05	<.020	.28	E.002	E.008	E.3

[1] CL, Clinton County; F, Franklin County; H, Hamilton County; J, Jefferson County; ST, St. Lawrence County.

Table 2-5. Concentrations of trace elements in groundwater samples collected in the St. Lawrence River Basin, New York, 2010.

[µg/L, micrograms per liter; (01105), U.S. Geological Survey National Water Information System parameter code; <, less than; E, estimated concentration. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 3 and 4]

Well number[1]	Aluminum, unfiltered, µg/L (01105)	Antimony, unfiltered, µg/L (01097)	Arsenic, unfiltered, µg/L (01002)	Barium, unfiltered, µg/L (01007)	Beryllium, unfiltered, µg/L (01012)	Boron, filtered, µg/L (01020)	Cadmium, unfiltered, µg/L (01027)	Chromium, unfiltered, µg/L (01034)
Sand and gravel wells								
F543	<6	<0.4	<0.18	8.3	<0.04	7.6	<0.04	<0.42
F573	<3	<.2	1.1	19.5	<.02	3.4	<.05	.58
J1736	<6	<.4	1.4	103	<.04	236	<.04	<.42
ST378	<6	<.4	.46	52.3	<.04	7.1	<.04	E.23
ST2584	<6	<.4	.32	12.8	<.04	12	<.04	E.27
Bedrock wells								
CL674	<3	<.2	1.3	53.8	<.02	8.9	<.05	<.21
F91	<3	<.2	1.3	18.1	<.02	10	<.05	.69
F1042	<6	<.4	.18	<.6	<.04	5.4	<.04	.60
F1051	7	<.4	.83	E.5	<.04	32	<.04	<.42
H80	37	<.4	.19	5.4	<.04	21	<.04	<.42
J836	19	<.4	1.0	70.1	<.04	50	<.04	E.21
ST950	<6	<.4	.75	108	<.04	162	<.04	<.42
ST1424	<3	<.2	1.5	41.6	<.02	168	<.05	<.21
ST1426	<6	<.4	2.2	119	<.04	54	<.04	<.42
ST2074	**1,310**	<.4	.78	217	.13	174	<.04	2.6
ST2291	E5	<.4	.23	1.1	<.04	3.6	<.04	1.0
ST2758	<6	<.4	.41	329	<.04	164	<.04	<.42
ST3032	11	E.4	.93	168	<.04	50	E.04	2.5
ST3204	<6	<.4	2.3	121	<.04	20	<.04	<.42
ST3322	14	<.4	.24	1.0	<.04	4.7	<.04	E.21

[1] CL, Clinton County; F, Franklin County; H, Hamilton County; J, Jefferson County; ST, St. Lawrence County.

Table 2-5. Concentrations of trace elements in groundwater samples collected in the St. Lawrence River Basin, New York, 2010.—Continued

[µg/L, micrograms per liter; (01105), U.S. Geological Survey National Water Information System parameter code; <, less than; E, estimated concentration. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 3 and 4]

Well number[1]	Cobalt, unfiltered, µg/L (01037)	Copper, unfiltered, µg/L (01042)	Iron, filtered, µg/L (01046)	Iron, unfiltered, µg/L (01045)	Lead, unfiltered, µg/L (01051)	Lithium, unfiltered, µg/L (01132)	Manganese, filtered, µg/L (01056)	Manganese, unfiltered, µg/L (01055)
Sand and gravel wells								
F543	<0.04	195	8	56	0.48	1.0	1.9	3.0
F573	<.02	2.4	<3	<5	<.04	1.3	.3	<.4
J1736	.39	<1.4	100	137	E.07	32.8	**61.7**	**66.8**
ST378	<.04	2.2	<6	<9	.16	.5	<.2	<.8
ST2584	<.04	48.9	E5	106	.49	2.4	1.9	3.1
Bedrock wells								
CL674	.08	1.3	96	127	.04	2.2	**136**	**142**
F91	.03	24.3	<3	<5	.12	1.1	.2	<.4
F1042	<.04	1.8	<6	59	E.05	1.5	E.2	.9
F1051	E.03	4.3	<6	<9	.13	1.3	9.2	9.1
H80	<.04	<1.4	<6	52	.12	6.0	3.0	3.6
J836	.81	7.4	**491**	**2,150**	.64	6.8	29.6	33.7
ST950	<.04	2.2	36	45	.99	23.1	8.0	8.5
ST1424	<.02	<.70	195	**334**	<.04	20.5	29.3	32.6
ST1426	.68	<1.4	127	274	.33	8.3	**112**	**117**
ST2074	.74	11.9	51	**2,500**	1.03	11.9	40.2	**115**
ST2291	<.04	1.9	74	**326**	.16	1.2	1.4	5.9
ST2758	<.04	<1.4	10	15	E.05	25.7	4.5	4.8
ST3032	.41	3.1	E4	**3,910**	.46	5.2	**272**	**308**
ST3204	.28	<1.4	**421**	**434**	.24	6.0	24.4	26.9
ST3322	.13	<1.4	**396**	**2,260**	1.50	3.4	6.8	15.7

[1] CL, Clinton County; F, Franklin County; H, Hamilton County; J, Jefferson County; ST, St. Lawrence County.

Table 2-5. Concentrations of trace elements in groundwater samples collected in the St. Lawrence River Basin, New York, 2010.—Continued

[µg/L, micrograms per liter; (01105), U.S. Geological Survey National Water Information System parameter code; <, less than; E, estimated concentration. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 3 and 4]

Well number[1]	Mercury, unfiltered, µg/L (71900)	Molybdenum, unfiltered, µg/L (01062)	Nickel, unfiltered, µg/L (01067)	Selenium, unfiltered, µg/L (01147)	Silver, unfiltered, µg/L (01077)	Strontium, unfiltered, µg/L (01082)	Zinc, unfiltered, µg/L (01092)	Uranium, unfiltered, µg/L (28011)
Sand and gravel wells								
F543	<0.010	0.1	E0.21	<0.10	E0.01	30.2	E1.9	0.047
F573	<.005	.7	<.12	.10	<.01	76.3	<2.4	.374
J1736	<.010	.7	1.0	E.05	<.02	6,360	3.6	.726
ST378	<.010	.5	<.36	E.08	<.02	40.3	3.0	.325
ST2584	<.010	.7	<.36	<.10	<.02	62.7	10.1	.308
Bedrock wells								
CL674	<.005	2.8	<.12	<.05	<.01	214	3.1	.410
F91	<.005	.2	<.12	.06	<.01	205	23.1	.302
F1042	<.010	2.6	<.36	<.10	<.02	30.9	E1.3	.452
F1051	<.010	3.4	<.36	<.10	<.02	59.8	3.8	.946
H80	<.010	5.2	<.36	.25	<.02	202	7.6	1.07
J836	<.010	.2	2.0	E.06	<.02	285	7.0	.333
ST950	<.010	.9	<.36	<.10	<.02	2,360	3.2	.097
ST1424	<.005	4.7	<.12	<.05	<.01	2,030	<2.4	.400
ST1426	<.010	4.0	1.2	<.10	<.02	1,010	<2.0	1.62
ST2074	E.010	1.2	1.9	E.08	E.01	2,820	8.7	4.25
ST2291	<.010	.4	<.36	<.10	<.02	26.9	E1.1	.109
ST2758	<.010	.8	<.36	.25	<.02	948	E1.0	.050
ST3032	[2]<.010	1.2	3.0	<.10	<.02	1,160	7.1	1.86
ST3204	<.010	4.3	.76	<.10	<.02	1,280	E1.3	.468
ST3322	<.010	1.8	.39	<.10	<.02	26.8	3.0	.159

[1] CL, Clinton County; F, Franklin County; H, Hamilton County; J, Jefferson County; ST, St. Lawrence County.

[2] Mercury in ST3032 in filtered water, parameter code 71890

Table 2-6. Concentrations of pesticides detected in groundwater samples collected in the St. Lawrence River Basin, New York, 2010.

[µg/L, micrograms per liter; CIAT, 2-chloro-4-isopropylamino-6-amino-*s*-triazine; (04040), U.S. Geological Survey National Water Information System parameter code; <, less than; E, estimated concentration; M, presence verified but not quantified. Well locations are shown in figures 3 and 4]

Well number[1]	CIAT, filtered, µg/L (04040)	Atrazine, filtered, µg/L (39632)	Benfluralin, filtered, µg/L (82673)	Disulfoton, filtered, µg/L (82677)	Metolachlor, filtered, µg/L (39415)	Simazine, filtered, µg/L (04035)	Terbacil, filtered, µg/L (82665)
Sand and gravel wells							
F543	<0.014	<0.007	<0.014	<0.04	<0.014	<0.006	<0.024
F573	<.006	<.008	<.014	<.04	<.014	<.006	<.024
J1736	E.001	<.007	<.014	<.04	<.014	<.006	<.024
ST378	<.014	<.007	E.001	<.04	<.014	<.006	<.024
ST2584	E.002	<.007	<.014	<.04	<.014	<.006	<.024
Bedrock wells							
CL674	<.006	<.008	<.014	<.04	<.014	<.006	<.024
F91	E.003	<.008	<.014	<.04	.002	<.006	<.024
F1042	<.014	<.007	<.014	<.04	<.014	<.006	<.024
F1051	<.014	<.007	<.014	E.01	<.014	<.006	<.024
H80	<.014	<.007	<.014	E.01	<.014	<.006	<.024
J836	<.014	<.007	<.014	<.04	<.014	<.006	<.024
ST950	<.014	<.007	<.014	<.04	<.014	<.006	<.024
ST1424	<.006	<.008	<.014	<.04	<.014	<.006	<.024
ST1426	<.014	<.007	<.014	M	<.014	<.006	<.024
ST2074	<.014	<.007	<.014	<.04	<.014	.003	<.024
ST2291	<.014	<.007	<.014	<.04	<.014	<.006	<.024
ST2758	<.014	<.007	<.014	E.02	<.014	<.006	<.024
ST3032	E.031	.011	<.014	<.20	<.014	<.006	<.024
ST3204	<.014	<.007	<.014	<.04	<.014	<.006	<.024
ST3322	<.014	<.007	<.014	E.11	<.014	<.006	E.007

[1] CL, Clinton County; F, Franklin County; H, Hamilton County; J, Jefferson County; ST, St. Lawrence County.

Table 2-7. Concentrations of volatile organic compounds detected in groundwater samples collected in the St. Lawrence River Basin, New York, 2010.

[µg/L, micrograms per liter; (34475), U.S. Geological Survey National Water Information System parameter code; <, less than. Well locations are shown in figures 3 and 4]

Well number[1]	Tetrachloro-ethene, unfiltered, µg/L (34475)	Toluene, unfiltered, µg/L (34010)	Trichloro-methane, unfiltered, µg/L (32106)
Sand and gravel wells			
F543	<0.1	<0.1	<0.1
F573	<.1	<.1	<.1
J1736	<.1	<.1	<.1
ST378	<.1	<.1	<.1
ST2584	<.1	<.1	<.1
Bedrock wells			
CL674	<.1	<.1	<.1
F91	<.1	<.1	<.1
F1042	<.1	<.1	<.1
F1051	<.1	<.1	.2
H80	.1	.1	<.1
J836	<.1	<.1	<.1
ST950	<.1	<.1	<.1
ST1424	<.1	<.1	<.1
ST1426	<.1	<.1	<.1
ST2074	<.1	<.1	<.1
ST2291	<.1	<.1	<.1
ST2758	<.1	<.1	<.1
ST3032	<.1	<.1	<.1
ST3204	<.1	<.1	<.1
ST3322	<.1	<.1	<.1

[1] CL, Clinton County; F, Franklin County; H, Hamilton County; J, Jefferson County; ST, St. Lawrence County.

Table 2-8. Activities of radionuclides in groundwater samples from the St. Lawrence River Basin, New York, 2010.

[pCi/L, picocuries per liter; (01519), USGS National Water Information System parameter code; <, less than; --, not analyzed. **Bold** values equal or exceed one or more existing or proposed drinking-water standards. Well locations are shown in figures 3 and 4]

Well number[1]	Gross alpha radioactivity, unfiltered, pCi/L (01519)	Gross beta radioactivity, unfiltered, pCi/L (85817)	Radon-222, unfiltered, pCi/L (82303)
Sand and gravel wells			
F543	1.0	<1	**890**
F573	1.2	.9	**420**
J1736	<1.8	4.1	227
ST378	<.55	.9	**710**
ST2584	<.61	1.9	**940**
Bedrock wells			
CL674	1.1	1.7	**610**
F91	<.92	<1.1	**390**
F1042	<.39	.8	**2,580**
F1051	2.0	<.85	17
H80	2.1	1.4	**740**
J836	<1	3.6	**1,020**
ST950	3.0	4.4	137
ST1424	2.8	5.0	164
ST1426	6	2.7	**1,440**
ST2074	**16**	10	**2,390**
ST2291	<.51	.9	**460**
ST2758	<1.1	4.5	**340**
ST3032	<1.2	16.1	--
ST3204	<1.8	2.9	**580**
ST3322	<.54	<1.3	48

[1] CL, Clinton County; F, Franklin County; H, Hamilton County; J, Jefferson County; ST, St. Lawrence County.

Table 2-9. Bacteria in groundwater samples collected in the St. Lawrence River Basin, New York, 2010.

[CFU, colony-forming unit; mL, milliliter; (31691), U.S. Geological Survey National Water Information System parameter code; <, less than; >, greater than; --, not analyzed. **Bold** values indicate detections of coliform bacteria or exceed one or more drinking-water standards. Well locations are shown in figures 3 and 4]

Well number[1]	*Escherichia coli*, unfiltered, Presence/Absence (84385)	Fecal coliform, membrane filtration, unfiltered, CFU/100mL (61215)	Heterotrophic plate count, unfiltered, CFU/mL (31692)	Total coliform, membrane filtration, unfiltered, CFU/100mL (61213)
Sand and gravel wells				
F543	Absent	<2	3	**3**
F573	Absent	<2	<1	<1
J1736	Absent	<2	**>300**	<1
ST378	Absent	<2	1	<1
ST2584	Absent	<2	6	<1
Bedrock wells				
CL674	Absent	<1	150	**270**
F91	Absent	<1	2	<1
F1042	Absent	<2	**600**	<1
F1051	Absent	<2	1	**21**
H80	Absent	<2	10	**20**
J836	**Present**	<2	29	**>200**
ST950	Absent	<2	<1	<1
ST1424	Absent	<2	<1	<1
ST1426	Absent	<2	290	<4
ST2074	**Present**	<2	**>300**	**>200**
ST2291	Absent	<2	<1	<1
ST2758	Absent	<2	**540**	**20**
ST3032	--	--	--	--
ST3204	Absent	<2	1	<1
ST3322	Absent	<2	**>150**	<1

[1] CL, Clinton County; F, Franklin County; H, Hamilton County; J, Jefferson County; ST, St. Lawrence County.

Table 2-10. Physiochemical properties and concentrations of major ions, nutrients, and bacteria in groundwater samples collected in the St. Lawrence River Basin, New York, 2005 and 2010.

[NWIS, National Water Information System; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25 degrees Celsius; $CaCO_3$, calcium carbonate; ºC, degrees Celsius; N, nitrogen; P, phosphorus; CFU, colony-forming unit; mL, milliliter; <, less than; E, estimated concentration; U, not detected; lab, laboratory]

U.S. Geological Survey NWIS parameter code	Constituent	Well F543		Well F573		Well ST378		Well ST950	
		2005	2010	2005	2010	2005	2010	2005	2010
00080	Color, filtered, platinum-cobalt units	5	2	2	<1	<1	<1	<1	<1
00300	Dissolved oxygen, unfiltered, mg/L	--	6.3	8.8	7.4	9.2	3.00	1.2	4.5
00400	pH, unfiltered	--	6.5	7.9	8.2	7.8	8.2	7.3	7.6
00095	Specific conductance, unfiltered, µS/cm	99	96	208	208	191	197	613	600
00010	Temperature, unfiltered, degrees Celsius	9.4	11.0	7.3	7.3	9.2	9.0	9.2	9.3
00900	Hardness, filtered, mg/L as $CaCO_3$	41.8	35.8	99.4	101	94.4	91.8	264	254
00915	Calcium, filtered, mg/L	11.1	9.03	27.3	27.7	24.5	23.2	55.1	53.4
00925	Magnesium, filtered, mg/L	3.40	3.21	7.56	7.77	8.08	8.22	30.7	29.2
00935	Potassium, filtered, mg/L	.66	.69	.66	.72	.91	.86	3.70	4.03
00930	Sodium, filtered, mg/L	2.59	3.24	3.24	3.53	2.50	2.76	25.6	29.5
90410	Acid neutralizing capacity, unfiltered, fixed end point, lab, mg/L as $CaCO_3$	33	32	89	98	86	89	206	240
29801	Alkalinity, filtered, fixed end point, laboratory, mg/L as $CaCO_3$	33	32	91	94	86	89	206	239
29805	Bicarbonate, filtered, fixed end point, laboratory, mg/L	40	39	111	115	105	109	251	292
00940	Chloride, filtered, mg/L	3.32	3.72	6.26	6.24	3.48	4.37	30.0	31.9
00950	Fluoride, filtered, mg/L	E.07	E.06	E.06	.08	E.10	E.06	.59	.51
00955	Silica, filtered, mg/L	14.4	14.9	9.76	9.62	10.2	9.70	12.7	11.9
00945	Sulfate, filtered, mg/L	7.42	7.48	9.53	9.96	9.41	9.56	49.8	46.7
70300	Dissolved solids, dried at 180ºC, filtered, mg/L	73	69	110	120	112	117	359	352
00623	Ammonia plus organic-N, filtered, mg/L as N	<.10	<.10	E.07	<.05	E.09	<.10	.21	.21
00608	Ammonia, filtered, mg/L as N	<.04	<.020	<.04	<.010	<.04	<.020	.12	.130
00631	Nitrate plus nitrite, filtered, mg/L as N	.93	.92	.23	.23	.17	.09	<.06	<.04
00613	Nitrite, filtered, mg/L as N	<.008	<.002	<.008	<.001	<.008	<.002	<.008	<.002
00671	Orthophosphate, filtered, mg/L as P	<.02	.011	<.02	.015	<.02	.009	<.02	.016
00680	Organic carbon, unfiltered, mg/L	<1.0	E.6	<1.0	<.3	<1.0	E.3	1.1	.9
31691	*Escherichia coli*, unfiltered, CFU per 100 mL	U	U	U	U	U	U	U	U
61215	Fecal coliform, unfiltered, CFU per 100 mL	U	<2	U	<2	U	<2	U	<2
31692	Heterotrophic plate count, unfiltered, CFU per mL	10	3	14	<1	<1	1	<1	<1
	Total coliform, unfiltered, CFU per 100 mL	U	3	U	<1	U	<1	U	<1

Table 2-11. Concentrations of trace elements and radionuclides in groundwater samples collected in the St. Lawrence River Basin, New York, 2005 and 2010.

[NWIS, National Water Information System; µg/L, micrograms per liter, pCi/L, picocuries per liter; <, less than, E, estimated concentration]

U.S. Geological Survey NWIS parameter code	Constituent	Well F543		Well F573		Well ST378		Well ST950	
		2005	2010	2005	2010	2005	2010	2005	2010
01105	Aluminum, unfiltered, µg/L	4	<6	3	<3	E1	<6	<2	<6
01097	Antimony, unfiltered, µg/L	<.2	<.4	<.2	<.2	<.2	<.4	<.2	<.4
01002	Arsenic, unfiltered, µg/L	E.09	<.18	.46	1.1	.16	.46	.28	.75
01007	Barium, unfiltered, µg/L	7.0	8.3	18.3	19.5	45.6	52.3	97.1	108
01012	Beryllium, unfiltered, µg/L	<.06	<.04	<.06	<.02	<.06	<.04	<.06	<.04
01020	Boron, filtered, µg/L	E6.8	7.6	E4.2	3.4	7.2	7.1	132	162
01027	Cadmium, unfiltered, µg/L	E.02	<.04	<.04	<.05	<.04	<.04	<.04	<.04
01034	Chromium, unfiltered, µg/L	.43	<.42	.98	.58	.36	E.23	.11	<.42
01037	Cobalt, unfiltered, µg/L	.063	<.04	.076	<.02	.088	<.04	.210	<.04
01042	Copper, unfiltered, µg/L	71.6	195	12.0	2.4	.8	2.2	1.6	2.2
01046	Iron, filtered, µg/L	7	8	<6	<3	<6	<6	48	36
01045	Iron, unfiltered, µg/L	37	56	<6	<5	E4	<9	49	45
01051	Lead, unfiltered, µg/L	.22	.48	<.06	<.04	1.41	.16	E.03	.99
01132	Lithium, unfiltered, µg/L	.8	1.0	1.0	1.3	E.6	.5	21.6	23.1
01056	Manganese, filtered, µg/L	3.4	1.9	<.6	.3	<.6	<.2	7.7	8.0
01055	Manganese, unfiltered, µg/L	2.8	3.0	<.6	<.4	<.6	<.8	8.1	8.5
71900	Mercury, unfiltered, µg/L	<.010	<.010	<.010	<.005	<.010	<.010	<.010	<.010
01062	Molybdenum, unfiltered, µg/L	E.2	.1	.7	.7	.5	.5	1.4	.9
01067	Nickel, unfiltered, µg/L	.56	E.21	.29	<.12	.56	<.36	1.04	<.36
01147	Selenium, unfiltered, µg/L	<.4	<.10	.10	.10	<.4	E.08	<.08	<.10
01077	Silver, unfiltered, µg/L	<.16	E.01	<.16	<.01	<.16	<.02	<.16	<.02
01082	Strontium, unfiltered, µg/L	27.8	30.2	73.4	76.3	35.0	40.3	2,160	2,360
01059	Thallium, unfiltered, µg/L	<.18	<.12	<.18	<.06	<.18	<.12	<.18	<.12
01092	Zinc, unfiltered, µg/L	E1	E1.9	E1	<2.4	4	3.0	E1	3.2
82303	Radon-222, unfiltered, pCi/L	860	890	430	420	680	710	150	137
28011	Uranium, unfiltered, µg/L	.042	.047	.314	.374	.285	.325	.133	.097

Table 2-12. Concentrations of pesticides in groundwater samples collected in St. Lawrence River Basin, New York, 2005 and 2010.

[NWIS, National Water Information System; µg/L, micrograms per liter; <, less than; E, estimated concentration. **Bold** value indicates detected concentration]

U.S. Geological Survey NWIS parameter code	Constituent	Well F543		Well F573		Well ST378		Well ST950	
		2005	2010	2005	2010	2005	2010	2005	2010
82660	2,6-Diethylaniline, filtered, µg/L	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
04040	2-Chloro-4-isopropylamino-6-amino-*s*-triazine (CIAT), filtered, µg/L	<.006	<.014	<.006	<.006	<.006	<.014	<.006	<.014
49260	Acetochlor, filtered, µg/L	<.006	<.010	<.006	<.010	<.006	<.010	<.006	<.010
46342	Alachlor, filtered, µg/L	<.005	<.008	<.005	<.008	<.005	<.008	<.005	<.008
34253	*alpha*-HCH, filtered, µg/L	<.005	<.004	<.005	<.004	<.005	<.004	<.005	<.004
39632	Atrazine, filtered, µg/L	<.007	<.007	<.007	<.008	<.007	<.007	<.007	<.007
82686	Azinphos-methyl, filtered, µg/L	<.050	<.120	<.050	<.120	<.050	<.120	<.050	<.120
82673	Benfluralin, filtered, µg/L	<.010	<.014	<.010	<.014	<.010	**E.001**	<.010	<.014
04028	Butylate, filtered, µg/L	<.004	<.004	<.004	<.004	<.004	<.004	<.004	<.004
82680	Carbaryl, filtered, µg/L	<.041	<.060	<.041	<.060	<.041	<.060	<.041	<.060
82674	Carbofuran, filtered, µg/L	<.020	<.060	<.020	<.060	<.020	<.060	<.020	<.060
38933	Chlorpyrifos, filtered, µg/L	<.005	<.010	<.005	<.004	<.005	<.010	<.005	<.010
82687	*cis*-Permethrin, filtered, µg/L	<.006	<.014	<.006	<.010	<.006	<.014	<.006	<.014
04041	Cyanazine, filtered, µg/L	<.018	<.022	<.018	<.022	<.018	<.022	<.018	<.022
82682	DCPA, filtered, µg/L	<.003	<.008	<.003	<.008	<.003	<.008	<.003	<.008
62170	Desulfinylfipronil, filtered, µg/L	<.012	<.012	<.012	<.012	<.012	<.012	<.012	<.012
39572	Diazinon, filtered, µg/L	<.005	<.005	<.005	<.006	<.005	<.005	<.005	<.005
39381	Dieldrin, filtered, µg/L	<.009	<.009	<.009	<.008	<.009	<.009	<.009	<.009
82677	Disulfoton, filtered, µg/L	<.02	<.04	<.02	<.04	<.02	<.04	<.02	<.04
82668	EPTC, filtered, µg/L	<.004	<.002	<.004	<.006	<.004	<.002	<.004	<.002
82663	Ethalfluralin, filtered, µg/L	<.009	<.006	<.009	<.006	<.009	<.006	<.009	<.006
82672	Ethoprop, filtered, µg/L	<.005	<.016	<.005	<.016	<.005	<.016	<.005	<.016
62169	Desulfinylfipronil amide, filtered, µg/L	<.029	<.029	<.029	<.029	<.029	<.029	<.029	<.029
62167	Fipronil sulfide, filtered, µg/L	<.013	<.013	<.013	<.012	<.013	<.013	<.013	<.013
62168	Fipronil sulfone, filtered, µg/L	<.024	<.024	<.024	<.024	<.024	<.024	<.024	<.024
62166	Fipronil, filtered, µg/L	<.016	<.018	<.016	<.018	<.016	<.018	<.016	<.018
04095	Fonofos, filtered, µg/L	<.003	<.004	<.003	<.005	<.003	<.004	<.003	<.004
39341	Lindane, filtered, µg/L	<.004	<.004	<.004	<.004	<.004	<.004	<.004	<.004
82666	Linuron, filtered, µg/L	<.035	<.060	<.035	<.060	<.035	<.060	<.035	<.060
39532	Malathion, filtered, µg/L	<.027	<.016	<.027	<.016	<.027	<.016	<.027	<.016

Table 2-12. Concentrations of pesticides in groundwater samples collected in St. Lawrence River Basin, New York, 2005 and 2010.—Continued

[NWIS, National Water Information System; µg/L, micrograms per liter, <, less than; E, estimated concentration. **Bold** value indicates detected concentration]

U.S. Geological Survey NWIS parameter code	Constituent	Well F543		Well F573		Well ST378		Well ST950	
		2005	2010	2005	2010	2005	2010	2005	2010
82667	Methyl parathion, filtered, µg/L	<0.015	<0.008	<0.015	<0.008	<0.015	<0.008	<0.015	<0.008
39415	Metolachlor, filtered, µg/L	<.006	<.014	<.006	<.014	<.006	<.014	<.006	<.014
82630	Metribuzin, filtered, µg/L	<.006	<.012	<.006	<.012	<.006	<.012	<.006	<.012
82671	Molinate, filtered, µg/L	<.003	<.003	<.003	<.004	<.003	<.003	<.003	<.003
82684	Napropamide, filtered, µg/L	<.007	<.008	<.007	<.008	<.007	<.008	<.007	<.008
34653	*p,p'*-DDE, filtered, µg/L	<.003	<.002	<.003	<.002	<.003	<.002	<.003	<.002
39542	Parathion, filtered, µg/L	<.010	<.020	<.010	<.020	<.010	<.020	<.010	<.020
82669	Pebulate, filtered, µg/L	<.004	<.016	<.004	<.016	<.004	<.016	<.004	<.016
82683	Pendimethalin, filtered, µg/L	<.022	<.012	<.022	<.012	<.022	<.012	<.022	<.012
82664	Phorate, filtered, µg/L	<.011	<.020	<.011	<.020	<.011	<.020	<.011	<.020
04037	Prometon, filtered, µg/L	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
82676	Propyzamide, filtered, µg/L	<.004	<.004	<.004	<.004	<.004	<.004	<.004	<.004
04024	Propachlor, filtered, µg/L	<.025	<.006	<.025	<.006	<.025	<.006	<.025	<.006
82679	Propanil, filtered, µg/L	<.011	<.010	<.011	<.010	<.011	<.010	<.011	<.010
82685	Propargite, filtered, µg/L	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
04035	Simazine, filtered, µg/L	<.005	<.006	<.005	<.006	<.005	<.006	<.005	<.006
82670	Tebuthiuron, filtered, µg/L	<.02	<.03	<.02	<.03	<.02	<.03	<.02	<.03
82665	Terbacil, filtered, µg/L	<.034	<.024	<.034	<.024	<.034	<.024	<.034	<.024
82675	Terbufos, filtered, µg/L	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
82681	Thiobencarb, filtered, µg/L	<.010	<.016	<.010	<.016	<.010	<.016	<.010	<.016
82678	Triallate, filtered, µg/L	<.006	<.006	<.006	<.005	<.006	<.006	<.006	<.006
82661	Trifluralin, filtered, µg/L	<.009	<.018	<.009	<.018	<.009	<.018	<.009	<.018

Table 2-13. Concentrations of volatile organic compounds in groundwater samples collected in the St. Lawrence River Basin, New York, 2005 and 2010.

[NWIS, National Water Information System; µg/L, micrograms per liter, <, less than. **Bold** value indicates detected concentration]

U.S. Geological Survey NWIS parameter code	Constituent	Well F543		Well F573		Well ST378		Well ST950	
		2005	2010	2005	2010	2005	2010	2005	2010
34506	1,1,1-Trichloroethane, unfiltered, µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
77652	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113), unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
34496	1,1-Dichloroethane, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
34501	1,1-Dichloroethene, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
34536	1,2-Dichlorobenzene, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
32103	1,2-Dichloroethane, unfiltered, µg/L	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2
34541	1,2-Dichloropropane, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
34566	1,3-Dichlorobenzene, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
34571	1,4-Dichlorobenzene, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
34030	Benzene, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
32101	Bromodichloromethane, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
32104	Tribromomethane, unfiltered, µg/L	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2
34301	Chlorobenzene, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
77093	*cis*-1,2-Dichloroethene, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
32105	Dibromochloromethane, unfiltered, µg/L	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2
34668	Dichlorodifluoromethane, unfiltered, µg/L	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2
34423	Dichloromethane, unfiltered, µg/L	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2
81576	Diethyl ether, unfiltered, µg/L	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2
81577	Diisopropyl ether, unfiltered, µg/L	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2
34371	Ethylbenzene, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
50005	Methyl *tert*-pentyl ether, unfiltered, µg/L	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2
85795	*m*- + *p*-Xylene, unfiltered, µg/L	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2
77135	*o*-Xylene, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
77128	Styrene, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
50004	*tert*-Butyl ethyl ether, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
78032	Methyl *tert*-butyl ether (MTBE), unfiltered, µg/L	<.2	<.2	<.2	<.2	**.3**	<.2	<.2	<.2
34475	Tetrachloroethene, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
32102	Tetrachloromethane, unfiltered, µg/L	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2
34010	Toluene, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
34546	*trans*-1,2-Dichloroethene, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
39180	Trichloroethene, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
34488	Trichlorofluoromethane (CFC-11), unfiltered, µg/L	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2
32106	Trichloromethane, unfiltered, µg/L	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
39175	Vinyl chloride, unfiltered, µg/L	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2

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