Chloride Impacts

Douglas J. Feldman, P.E.
Principal Engineer, Office of Water Resources, Suffolk County Department of Health Services

2017

Chloride Contamination of Potable Supply Wells
In Nassau and Suffolk Counties, Long Island, New York

Douglas J. Feldman, P.E., Principal Engineer
Office of Water Resources, Suffolk County Department of Health Services

Acknowledgements
Appreciation is extended to Andrew Rapiejko, Associate Hydrogeologist of the Suffolk County Department of Health Services (SCDHS), and Joseph DeFranco, Director of the Bureau of Environmental Protection of the Nassau County Department of Health (NCDOH), for providing a summary of analytical results and other relevant information that was used as part of this project.

Abstract
This report includes a summary of chloride concentrations identified in potable supply wells operating within Nassau and Suffolk Counties during 2014, together with an assessment of potential sources of chloride contamination within the vicinity of affected public supply wells. Water quality data was assembled from existing public supply wells in both Nassau and Suffolk Counties for all three principal aquifers. The range of results and their distribution within each county are displayed in Table 1 and Table 2 of this report.

The data collected from potable supply wells during this period shows that mean chloride concentrations are significantly below the drinking water and groundwater standard of 250 ppm; however, wells located near shoreline areas appear to be susceptible to chlorides via saltwater intrusion and upconing. For example, the public supply wells that exceeded the drinking water and groundwater standard in Suffolk County were located within proximity to shoreline areas. In addition, the analytical results indicate that chloride concentrations in wells screened in the Glacial Aquifer are greater than chloride concentrations identified in deeper wells screened within the Magothy and Lloyd Aquifers, suggesting that various land uses and activities may be having a greater impact upon the shallower

wells (e.g., road salting; institutional, commercial, and residential developments; the operation of salt storage facilities; etc.).

Introduction

The potential impact of chlorides upon Long Island aquifers and water resources is an ongoing concern, as the groundwater has been designated by the United States Environmental Protection Agency (USEPA) as a sole source water supply. Chlorides can impact the Long Island groundwater and drinking water supply primarily through: salt water intrusion via lateral intrusion and upconing when operating supply wells in proximity to surface waters, road salting, and runoff from improperly stored road salt and deicing compounds. Other sources of chlorides include effluent from sewage disposal systems, leachate from municipal landfills, and infiltration of storm water from recharge and drainage basins. Impacts of chlorides from lateral intrusion and upconing are particularly relevant with respect to areas on the North and South Forks of Suffolk County, Shelter Island, and various coastal regions along the south shore of Long Island. In addition, several supply wells within areas of the Brookhaven and Islip Towns also have been affected with chlorides. In Nassau County, several public supply wells located in Great Neck, Manhasset Neck, and Bayville were shut down due to saltwater intrusion and overpumping. It should be noted that removal or treatment of excessive chloride contamination from drinking water supplies is typically not an option because of the difficulty and expense involved. For purposes of this report, drinking water wells that exhibit chloride concentrations exceeding 100 parts per million (ppm) are considered impacted or affected with chlorides.

Methods

A query of the SCDHS database was performed to compile the chloride results of samples collected from potable supply wells during 2014 as part of the department's public water supply surveillance monitoring program and private well sampling program. All samples were analyzed by the SCDHS Public and Environmental Health Laboratory in accordance with USEPA's Method 300. Water quality results for wells operating in Nassau County were collected and analyzed by public water suppliers in Nassau County and compiled by the NCDOH. Screening values for chlorides were compiled for ranges up to 50 ppm; between 50 and 100 ppm; from 100 to 250 ppm, and greater than 250 ppm. In addition, salt storage facilities located within the groundwater contributing areas of public supply wells operating within Suffolk County were identified to help with assessing possible sources of chloride contamination. A compilation of historical water quality results performed by the SCDHS from 1998 and through most of 2015 was also utilized to help identify chloride concentrations at public supply wells exhibiting concentrations that exceeded 100 ppm.

Discussion

Public supply wells serve both community water supply and non-community public water supply systems. Pursuant to the New York State Sanitary Code, public community water supply systems serve at least five service connections used by year round residents or regularly serve at least 25 year-round residents. Non-community public water supply systems regularly serve at least 25 people a minimum of 60 days of the year. In general, supply wells serving community public water systems are much deeper than wells serving non-community systems and private wells. In addition, private wells typically serve single family residences and are not regulated as public water systems.

Chloride Results from Public and Private Wells within Suffolk County

During 2014, the SCDHS collected a total of 1458 samples for chloride analyses from public and private drinking water supply wells operating within Suffolk County as part of the department's routine surveillance monitoring programs (this total includes 1099 samples from public wells and 359 samples from private wells). Test results show that 401 public supply wells (81%) screened within the Glacial Aquifer exhibited chloride concentrations below 50 ppm; 67 wells (14%) exhibited concentrations between 51 and 100 ppm; 19 wells (4%) exhibited chloride concentrations between 101 and 250 ppm; and 8 wells (1%) exceeded the New York State Department of Health's (NYSDOH) drinking water standard and the New York State Department of Environmental Conservation's (NYSDEC) groundwater standard of 250 ppm (this includes one community supply well and seven non-community supply wells). The mean concentration was 41 ppm. Analysis of public supply wells screened within the Magothy Aquifer shows that 372 wells (97%) exhibited chloride concentrations below 50 ppm; 9 wells (2.5%) exhibited chloride concentrations between 51 and 100 ppm; only one well showed chlorides between 101 and 250 ppm, and none exceeded 250 ppm. The mean concentration was 12 ppm. Chloride concentrations identified in all five wells screened in the Lloyd Aquifer were below 50 ppm, with a mean

concentration of 8 ppm, while chloride concentrations in all three wells screened in the Raritan Formation were also below 50 ppm, with a mean value of 11 ppm. Samples collected from private wells within Suffolk County during 2014, showed that 210 wells (82%) exhibited chloride concentrations below 50 ppm; 26 wells (10%) exhibited chloride concentrations between 51 and 100 ppm; 16 wells (6%) exhibited concentrations between 101 and 250 ppm, and 5 wells exceeded the drinking water and groundwater standards of 250 ppm. It should be noted that these results represent a small percentage of the estimated 45,000 private wells in Suffolk County.

The eight public supply wells that exceeded the drinking water standard noted above are located within the townships of Shelter Island, Southold, and East Hampton and include one community supply well and seven non-community wells. The affected public water systems either: removed the impacted wells from service, provided the appropriate treatment devices, or connected to a community water supply system. All of the private well owners were notified accordingly of their results by the SCDHS. Table 1 provides a summary of chloride concentrations identified in public and private supply wells sampled by the SCDHS during 2014. Figures 1, 2, and 3 illustrate the chloride detections identified in public community supply wells, non-community supply wells, and private wells operating within Suffolk County during 2014, respectively.

Chloride Results from Public Wells within Nassau County

Water quality results compiled by the NCDOH from 305 public supply wells during 2014 as part of their regulatory programs showed the following results: 4 wells (44%) screened within Glacial Aquifer exhibited chloride concentrations below 50 ppm, and 5 of wells (56%) exhibited chloride concentrations between 51 and 100 ppm. The mean chloride concentration was 46 ppm. Public supply wells screened within the Magothy Aquifer showed that 248 wells (95%) had chloride concentrations below 50 ppm, and 14 wells (5%) had concentrations between 51 and 100 ppm. The mean concentration was 21 ppm. Public supply wells screened within the Lloyd Aquifer showed that 31 wells (94%) had concentrations of below 50 ppm while 2 wells exhibited chloride concentrations between 51 and 100 ppm. The mean chloride concentration was 12 ppm. In addition, only one supply well screen within the Port Washington Magothy Aquifer exhibited a mean chloride concentration of 50 ppm. Table 2 includes a summary of the results, and Figure 4 shows the chloride concentrations from public supply wells operating within Nassau County during 2014.

Evaluation of Source Water Assessment Areas of Public Supply Wells Affected with Chlorides

To help evaluate potential sources of chloride contamination in public drinking supplies, supply wells with chloride concentrations greater than 100 ppm were evaluated in greater detail. Fifteen public supply wells in Suffolk County exhibited chloride concentrations exceeding 100 ppm (Table 3). Of these 15 wells, the groundwater contributing areas of 12 wells have been modeled by Camp, Dresser, and McKee (CDM) as part of the Suffolk County Comprehensive Water Resources Management Plan. A review of this information, as well as identifying potential sources of chlorides in the vicinity of the other three wells that exceeded 100 ppm indicates that five of the wells are located near roadways that are possibly influenced by road salting; five wells are located in proximity to a saltwater body such as the Long Island Sound; three wells are located in proximity to both salt storage facilities and roadways; and two wells are in the vicinity of both a saltwater body and roadways (Table 4). This review indicates that there are multiple potential sources of chloride contamination at public supply wells with elevated chlorides.

As noted above, Table 4 provides a summary of potential sources of chloride contamination that exists within the vicinity of public supply wells where concentrations exceeded 100 ppm. Table 5 provides a list of public supply wells where salt storage facilities were identified within the groundwater contributing areas together with the respective trends in chloride concentrations.

In addition, a review of available information shows that approximately 29 road salt storage facilities are located within the groundwater contributing areas serving 33 public supply wells in Suffolk County. A compilation of water quality results obtained from these wells between 1998 through most of 2015 suggests that, overall, chloride concentrations generally increased in 12 of the 33 wells sampled during this period; however, chloride concentrations generally remained the same in 18 wells and decreased in 3 of the wells. Table 4 provides a list of public supply wells where salt storage facilities were identified within the source water contributing areas together with supporting data.

To help identify and monitor the freshwater-saltwater interface near shoreline areas at select locations within Suffolk County, the SCDHS is in the process of installing monitoring wells near shoreline areas of the Southwest Sewer District; within the North and South Forks, and at locations within Shelter Island. These monitoring wells will be utilized to measure the concentration and trend in chloride concentrations, and to monitor the freshwater-saltwater interface through the use of geophysical logging equipment and measuring other chemical parameters. Additional monitoring wells at other locations may be installed and monitored depending upon available resources.

Summary and Conclusions

Based upon the compilation and evaluation of the water quality results and other available information noted above, the following summary and general conclusions can be offered:

- Public supply wells operating within Suffolk County during 2014 revealed that 81% of the wells screened in the Glacial Aquifer exhibited chloride concentrations below 50 ppm; 14% of the wells exhibited chloride levels between 51 and 100 ppm; 4% exhibited chlorides concentrations between 101 and 250 ppm, and only 1% of the wells tested exceeded the drinking water and groundwater standard of 250 ppm. The mean concentration was 41 ppm. Public supply wells screened within the Magothy Aquifer revealed that 97% of the wells exhibited chloride concentrations below 50 ppm; 2.5% of wells exhibited chloride levels between 51 and 100 ppm, less than 1% of the wells tested showed chloride concentrations between 100 and 250 ppm, and none exceeded 250 ppm. The mean chloride concentration was 12 ppm. All of the wells screened within the Lloyd Aquifer and Raritan Formation were significantly below 250 ppm, with mean values of 8 ppm and 11 ppm, respectively.

- Samples collected and analyzed by the SCDHS from private wells during 2014 revealed that 82% exhibited chloride concentrations below 50 ppm; 10% of the wells had chloride concentrations between 51 and 100 ppm; 6% of the wells sampled exhibited chloride concentrations between 101 and 250 ppm, and less than 2% of the wells tested exceeded 250 ppm. Also, a review the data suggests that chloride concentrations exceeding the drinking water standard in the eight public supply wells sampled in during 2014 was likely caused by saltwater intrusion and storm surges, as these wells operated in proximity to surface waters. However, other sources of chlorides, such as road salting may have also contributed to the chloride levels identified in these wells.

- Water quality results compiled by the NCDOH from 305 public supply wells during 2014 showed the following results: 4 wells (44%) screened within Glacial Aquifer exhibited chloride concentrations below 50 ppm, and 5 of wells (56%) exhibited chloride concentrations between 51 and 100 ppm. The mean chloride concentration was 46 ppm. Public supply wells screened within the Magothy Aquifer showed that 248 wells (95%) had chloride concentrations below 50 ppm, and 14 wells (5%) had concentrations between 51 and 100 ppm. The mean concentration was 21 ppm. Public supply wells screened within the Lloyd Aquifer showed that 31 wells (94%) had concentrations of below 50 ppm, while 2 wells exhibited chloride concentrations between 51 and 100 ppm. The mean chloride concentration was 12 ppm. In addition, only one supply well screen within the Port Washington Magothy Aquifer exhibited a mean chloride concentration of 50 ppm.

- The data collected from potable supply wells during 2014 shows that mean chloride concentrations are significantly below the drinking water and groundwater standard of 250 ppm; however, wells located near shoreline areas can be susceptible to chlorides via saltwater intrusion and upconing. In addition, the analytical results indicate that chloride concentrations in wells screened in the Glacial Aquifer are greater than chloride concentrations identified in deeper wells screened within the Magothy and Lloyd Aquifers, suggesting that various land uses and activities may be having a greater impact upon the shallower wells (e.g., from road salting, developed properties, salt storage facilities, etc.).

- A review of available information by the SCDHS shows that 29 salt storage facilities are located within the groundwater contributing areas of 33 public supply wells operating within Suffolk County. An evaluation of the water quality results obtained from these wells between 1998 and most of 2015 suggests that overall, chloride concentrations generally increased in 12 of the 33 wells sampled during this period; however, concentrations generally remained the same in 18 wells and decreased in 3 wells.

- It should be noted that the report includes test results from 2014 and represents only a limited data set. Supply wells that may have had chloride impacts that were taken out of service were not included in this

report.

- An evaluation of the source water assessment areas serving 15 public supply wells operating within Suffolk County exhibiting chlorides exceeding 100 ppm, indicates that five of the wells are located near roadways; five wells are located in proximity to a saltwater body such as the Long Island Sound; three wells are located in proximity to salt storage facilities and roadways; and two wells are in the vicinity of both a saltwater body and roadways (Table 4). This information suggests that a variety of sources and activities could be contributing to the increase in chloride concentrations identified in some of the affected wells.

Recommendations and Suggestions

- The information in this report should be shared with municipalities and other entities that are responsible for maintaining roadways so that alternative deicing compounds and practices may be considered.

- Water suppliers may want to continue to investigate ways to further optimize pumping operations for wells located near shoreline areas to help minimize upconing of chlorides.

- Efforts to monitor the freshwater-saltwater interface near shoreline areas should be continued. As noted above, the SCDHS is in the process of installing monitoring wells at various locations as part of an effort to help monitor the freshwater-saltwater interface at select locations in Suffolk County, as resources allow.

- To help protect our groundwater and surface water resources from chlorides, facilities stockpiling and utilizing road salt and deicers should ensure that the requirements in the *Chapter 5 of the New York State Department of Transportation's (NYSDOT) Highway Maintenance Guidelines,* dated April, 2006, as well as the items noted the *NYSDOT's Environmental Handbook for Transportation Operations,* dated June 1991, are consistently being met. In addition, facilities should meet the requirements of Article 12 of the Suffolk County Sanitary Code and Article XI of Nassau County Public Health Ordinance.

- Municipalities should consider coordinating their efforts with water suppliers and the appropriate regulatory agencies when planning new salt storage facilities and/or recharge and drainage structures as these relate to the location of drinking water wells. Source water assessments could be utilized for these purposes to help with optimizing the locations of these facilities with respect to drinking water supplies.

- Public water systems may want to continue to investigate and possibly identify specific sources of chlorides in supply wells with elevated chloride concentrations, such evaluating specific chemical parameters including chloride to bromide rations. This work has already been performed by the Suffolk County Water Authority and the United States Geological Survey at several public supply wells.

References

Pano, S.V., K.C. Hackley, H.H. Hwang, et al, 2003, Source Identification of Sodium and Chloride Contamination in Natural Waters, preliminary results, Illinois State Geological Survey.

Field, R., E.J. Struzeski, Jr., H.E. Masters and A.N. Tafuri, 1973. Water Pollution and Associated Effects from Street Salting, USEPA research report, EPA-R2-73-257.

Panno, S.V., K.C. Hackley, and S.E. Greenberg, 2000, An Exploration of Techniques for Determining the Origin of Sodium and Chloride in Groundwater Feeding South Elgin , Unpublished report to Kane County, Illinois, 23 pp.

USEPA, September 1985. Seminar Publication - Protection of Public Water Supplies from Groundwater Contamination, Center for Environmental Research Information, Cincinnati, Ohio, pp 107-137.

Responsible Purchasing Network, December 2013, Green Purchasing Best Practices: Deicers, Prepared for the: Washington State Department of Enterprise Services (DES).

NYSDOT, April 2006 (Revised January 2012), Office of Transportation Maintenance, Highway Maintenance Guidelines: Chapter 5 - Snow and Ice Control.

Special Report 235, Transportation Research Board, 1991, Highway Deicing, Comparing Salt and Calcium Magnesium Acetate, National Research Council.

The Salt Institute, 2013, Salt Storage Handbook - Practical Recommendations for Storing and Handling Deicing Salt.

USEPA, August 2010, Source Water Protection Practices Bulletin: Managing Highway Deicing to Prevent Contamination of Drinking Water.

Stumm, F. Hydrogeological and Extent of Salt Water Intrusion of the Lloyd Aquifer in Northern Nassau County, New York, USGS.

Brown, C. and M.P. Scorca. Effects of Road Salting on Storm Water and Groundwater Quality at the East Meadow Headwaters Area, Nassau County, Long Island New York, USGS.

United States Department of Transportation, Federal Highway Administration, May 11, 2009, Clear Roads at Less Cost: A New Technology is Helping to Keep Roads Clear During Winter Storms and Cutting the Cost of Winter Maintenance.

Stackelberg, P.E., 1995, Relation Between Land Use and Quality of Shallow, Intermediate, and Deep Groundwater in Nassau and Suffolk Counties, Long Island, New York.

Figure 1

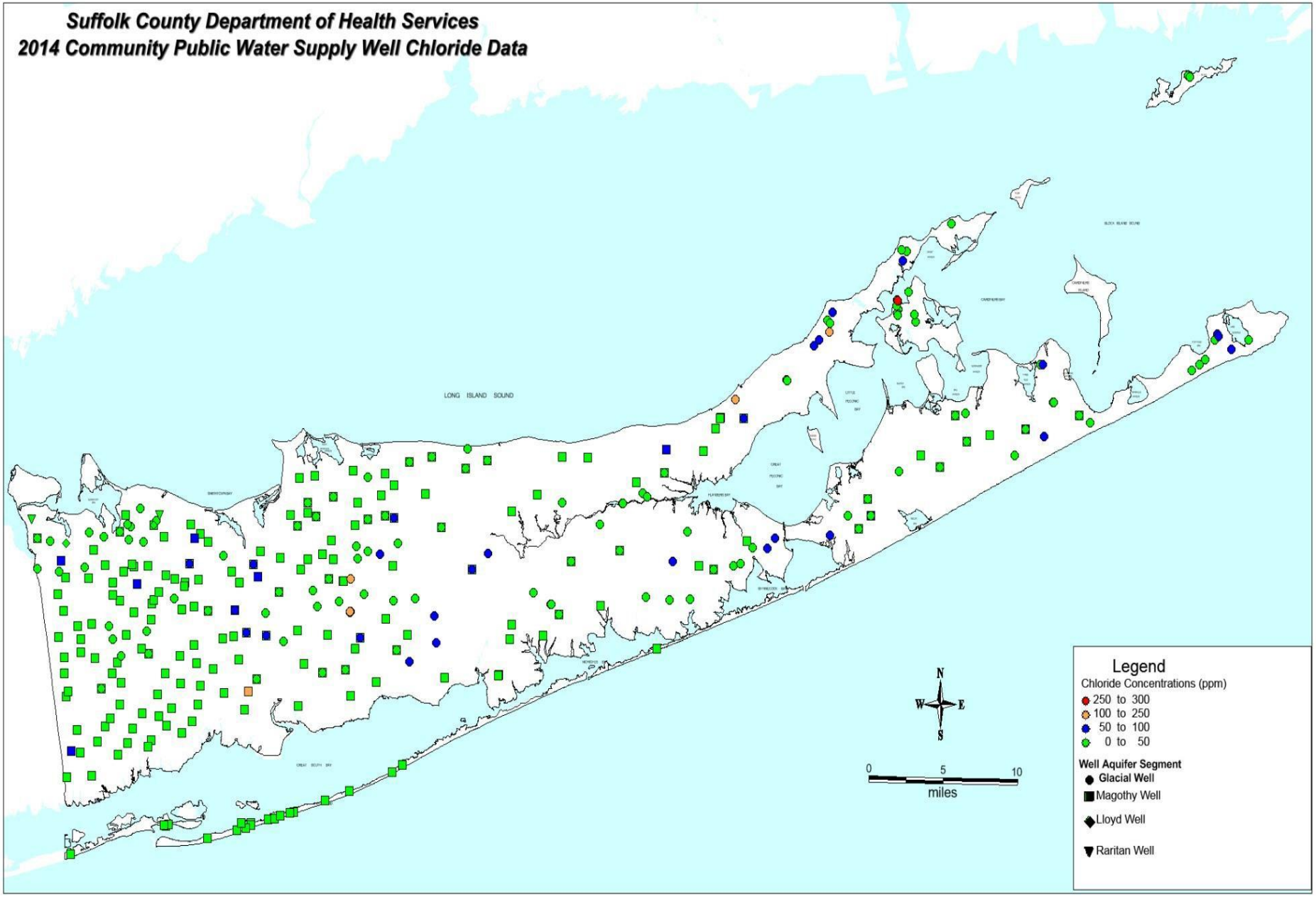
Suffolk County Department of Health Services
2014 Community Public Water Supply Well Chloride Data
LONG ISLAND SOUND
Legend
Chloride Concentrations (ppm)
250 to 300
100 to 250
50 to 100
0 to 50
Well Aquifer Segment
Glacial Well
Magothy Well
Lloyd Well
Raritan Well
N
W
E
S
0
5
10
miles

Figure 2

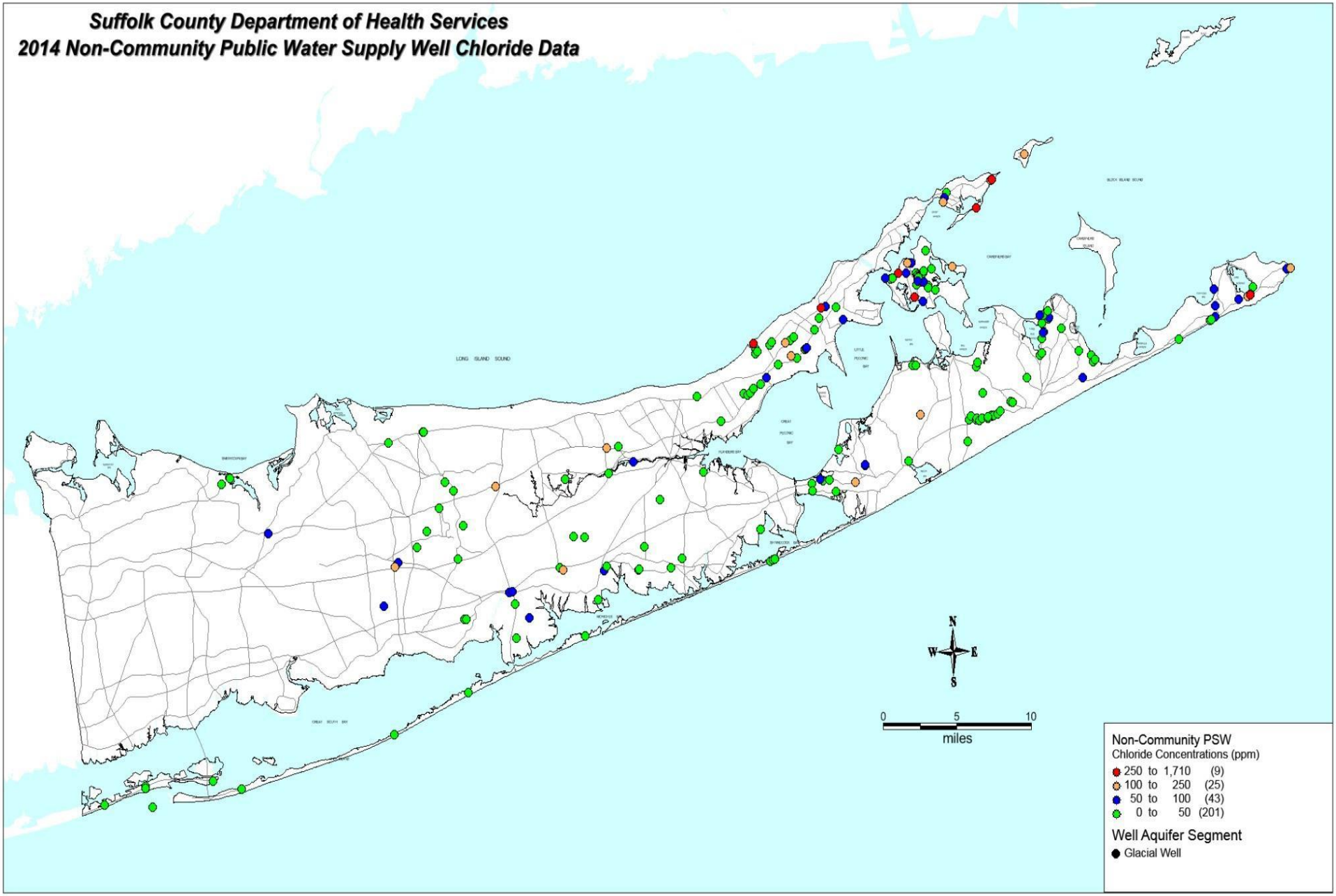
Suffolk County Department of Health Services
2014 Non-Community Public Water Supply Well Chloride Data
LONG ISLAND SOUND
N
W
E
S
0
5
10
miles
Non-Community PSW
Chloride Concentrations (ppm)
250 to 1,710 (9)
100 to 250 (25)
50 to 100 (43)
0 to 50 (201)
Well Aquifer Segment
Glacial Well

Figure 3

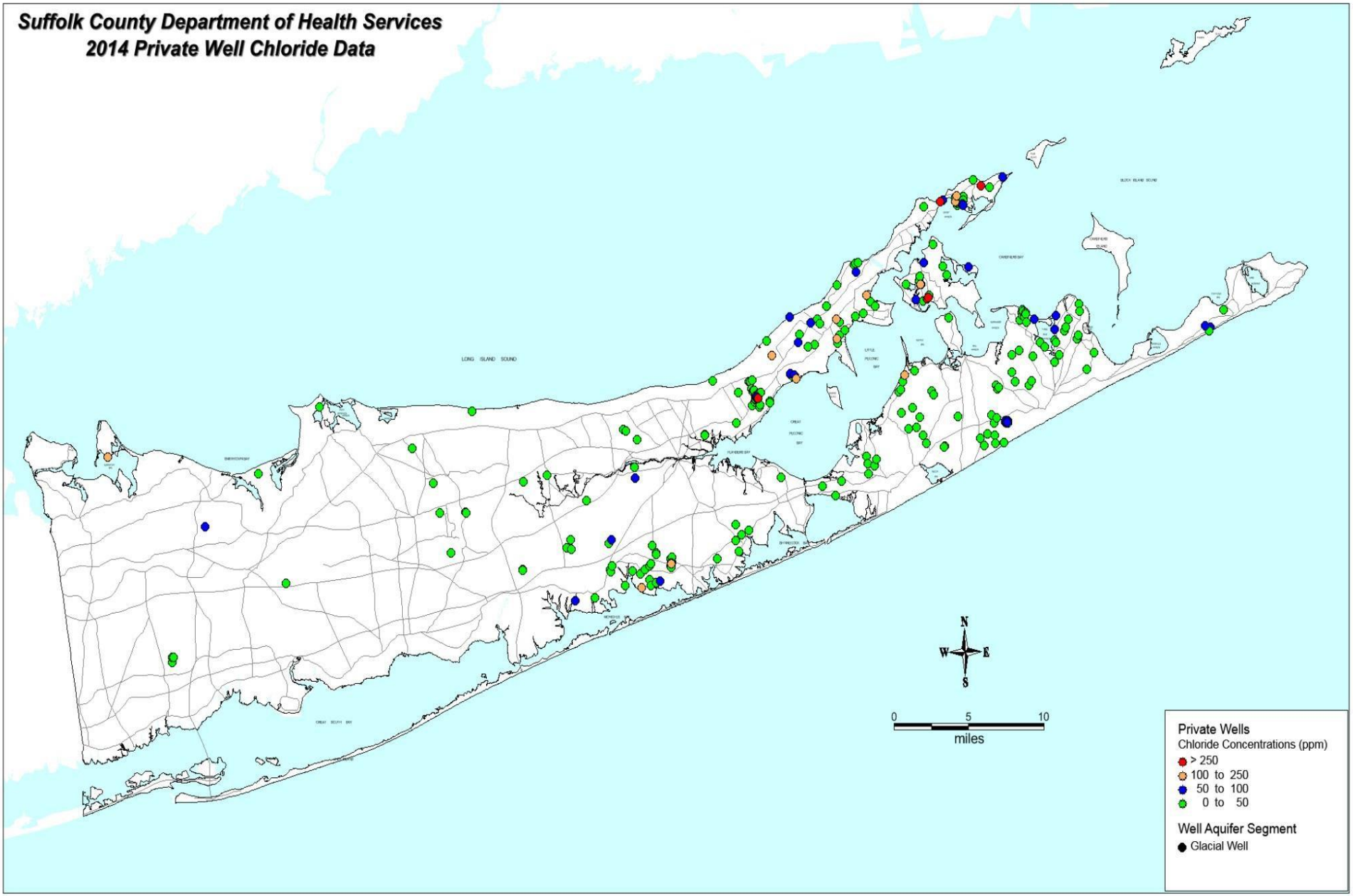
Suffolk County Department of Health Services
2014 Private Well Chloride Data
LONG ISLAND SOUND
N
W
E
S
0
5
10
miles
Private Wells
Chloride Concentrations (ppm)
> 250
100 to 250
50 to 100
0 to 50
Well Aquifer Segment
Glacial Well

Figure 4

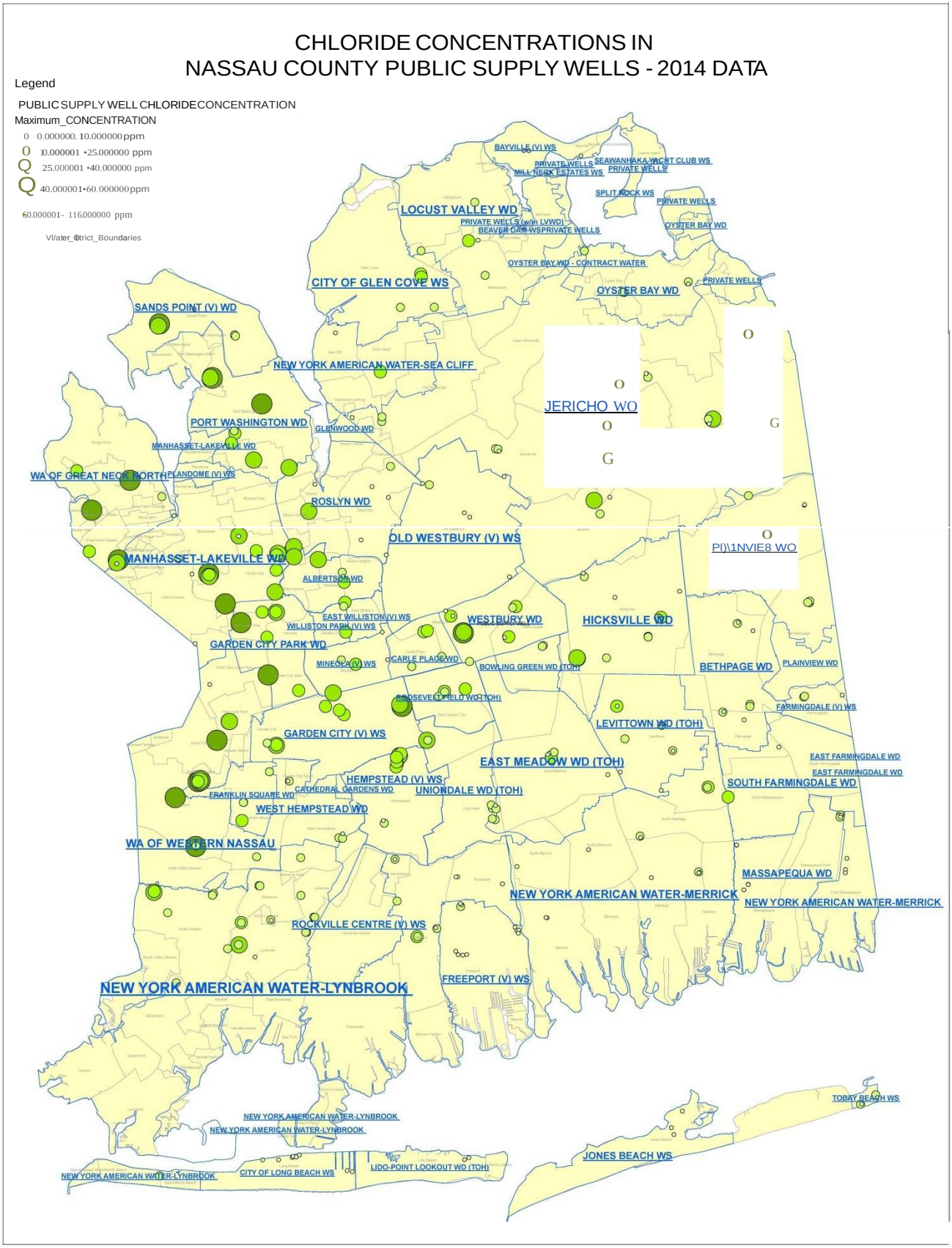
CHLORIDE CONCENTRATIONS IN
NASSAU COUNTY PUBLIC SUPPLY WELLS - 2014 DATA
Legend
PUBLIC SUPPLY WELL CHLORIDE CONCENTRATION
Maximum_CONCENTRATION
0 0.000000. 10.000000 ppm
10.000001 - 25.000000 ppm
25.000001 - 40.000000 ppm
40.000001 - 60.000000 ppm
60.000001 - 116.000000 ppm
Water_District_Boundaries
BAYVILLE (V) WS
PRIVATE WELLS
SEAWANHAKA YACHT CLUB WS
MILL NECK ESTATES WS
PRIVATE WELLS
SPLIT ROCK WS
PRIVATE WELLS
LOCUST VALLEY WD
PRIVATE WELLS (w/in LVWD)
BEAVER DAM WS
PRIVATE WELLS
OYSTER BAY WD
OYSTER BAY WD - CONTRACT WATER
CITY OF GLEN COVE WS
OYSTER BAY WD
PRIVATE WELLS
SANDS POINT (V) WD
NEW YORK AMERICAN WATER-SEA CLIFF
JERICHO WD
PORT WASHINGTON WD
GLENWOOD WD
MANHASSET-LAKEVILLE WD
WA OF GREAT NECK NORTH
PLANDOME (V) WS
ROSLYN WD
OLD WESTBURY (V) WS
PLAINVIEW WD
MANHASSET-LAKEVILLE WD
ALBERTSON WD
EAST WILLISTON (V) WS
WILLISTON PARK (V) WS
WESTBURY WD
HICKSVILLE WD
GARDEN CITY PARK WD
MINEOLA (V) WS
CARLE PLACE WD
BOWLING GREEN WD (TOH)
BETHPAGE WD
PLAINVIEW WD
ROOSEVELT FIELD WD (TOH)
FARMINGDALE (V) WS
LEVITTOWN WD (TOH)
GARDEN CITY (V) WS
EAST MEADOW WD (TOH)
EAST FARMINGDALE WD
EAST FARMINGDALE WD
HEMPSTEAD (V) WS
CATHEDRAL GARDENS WD
UNIONDALE WD (TOH)
SOUTH FARMINGDALE WD
FRANKLIN SQUARE WD
WEST HEMPSTEAD WD
WA OF WESTERN NASSAU
MASSAPEQUA WD
NEW YORK AMERICAN WATER-MERRICK
NEW YORK AMERICAN WATER-MERRICK
ROCKVILLE CENTRE (V) WS
FREEPORT (V) WS
NEW YORK AMERICAN WATER-LYNBROOK
TOBAY BEACH WS
NEW YORK AMERICAN WATER-LYNBROOK
NEW YORK AMERICAN WATER-LYNBROOK
JONES BEACH WS
NEW YORK AMERICAN WATER-LYNBROOK
CITY OF LONG BEACH WS
LIDO-POINT LOOKOUT WD (TOH)

Table 1
Summary of Chloride Concentrations:
Supply Wells in Suffolk County Operating During 2014

Suffolk County Public Supply Wells - Glacial Aquifer		
Number of Wells	Range of Chloride Concentrations	Percentage of Wells
401	0 - 50 ppm	81%
67	51 - 100 ppm	14%
19	101 - 250 ppm	4%
8	Exceeding 250 ppm	1%
Total = 495	Mean Concentration = 41 ppm	
Suffolk County Public Supply Wells - Magothy Aquifer		
Number of Wells	Range of Chloride Concentrations	Percentage of Wells
372	0 - 50 ppm	97%
9	51 - 100 ppm	2.5%
1	101 and 250 ppm	< 1%
Total = 383	Mean Concentration = 12 ppm	
Suffolk County Public Supply Wells - Lloyd Aquifer		
Number of Wells	Range of Chloride Concentrations	Percentage of Wells
5	0 - 50 ppm	100%
Total = 5	Mean Concentration = 8 ppm	
Suffolk County Public Supply Wells - Raritan Formation		
Number of Wells	Range of Chloride Concentrations	Percentage of Wells
3	0 - 50 ppm	100%
Total = 3	Mean Concentration = 11 ppm	
Suffolk County Private Wells - Glacial Aquifer		
Number of Wells	Range of Chloride Concentrations	Percentage of Wells
210	0 - 50 ppm	82%
26	51 - 100 ppm	10%
16	101 - 250 ppm	6%
5	Exceeding 250 ppm	2%
Total = 257	Mean Concentration = 41 ppm	

Table 2
Summary of Chloride Concentrations:
Supply Wells in Nassau County Operating During 2014

Nassau County Public Supply Wells - Glacial Aquifer		
Number of Wells	Range of Chloride Concentrations	Percentage of Wells
4	0 - 50 ppm	44%
5	51 - 100 ppm	56%
0	101 - 250 ppm	0%
Total = 9	Mean Concentration = 46 ppm	
Nassau County Public Supply Wells - Magothy Aquifer		
Number of Wells	Range of Chloride Concentrations	Percentage of Wells
248	0 - 50 ppm	95%
14	51 - 100 ppm	5%
0	101 - 250 ppm	0%
Total = 33	Mean Concentration = 21 ppm	
Nassau County Public Supply Wells - Lloyd Aquifer		
Number of Wells	Range of Chloride Concentrations	Percentage of Wells
31	0 - 50 ppm	94%
2	51 - 100 ppm	6%
0	101 - 250 ppm	0%
Total = 33	Mean Concentration = 12 ppm	
Nassau County Public Supply Wells - Port Washington Magothy Aquifer		
1	0 - 50 ppm	%100
Total = 1	Mean Concentration = 50 ppm	

Table 3
Concentration History:
Public Community Supply Wells in Suffolk County
Exhibiting Concentrations Exceeding 100 mg/L

S-Number	Date of 1st Sample	Date of Last Sample	Number of Samples	Min. Conc.	Max Conc.	Mean Conc.	1st Sample Conc.	Last Sample Conc.	Change in Conc.
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
S-00177	10/19/1998	10/14/2015	18	14	111	52	30	86	56
S-103522	12/15/1998	11/17/2015	19	29	134	89	29	91	62
S-121811	5/16/2005	2/3/2010	6	33	104	57	104	66	-38
S-124659	7/31/2007	9/9/2015	9	47	147	89	47	147	100
S-124789	10/29/2008	6/2/2015	6	171	198	181	172	198	26
S-126076	9/9/2008	8/21/2014	6	111	201	155	111	192	81
S-126912	8/12/2008	9/23/2015	8	17	296	112	17	197	180
S-129199	8/22/2011	7/14/2015	6	171	277	213	277	171	-106
S-130317	8/2/2011	5/18/2015	5	6	209	74	6	209	203
S-131612	6/27/2013	6/23/2015	3	67	137	99	67	137	70
S-29492	7/16/1998	7/1/2015	19	32	131	66	36	80	44
S-32552	7/16/1998	6/2/2015	20	60	196	121	81	171	90
S-33775	1/27/1999	6/3/2015	17	85	131	114	100	107	7
S-54473	9/29/1999	6/2/2015	18	38	128	69	38	128	90
S-66366	11/5/1998	6/18/2015	19	94	152	115	95	108	13

Table 4
Potential Sources of Chloride Contamination within Source Water Assessment Areas or Within the Vicinity of Public Supply Wells in Suffolk County Exhibiting Chloride Concentrations Exceeding 100 ppm

S-Number	Location	Groundwater Contributing Area Available	Potential Sources within Source Water Assessment Area or Within Vicinity of Supply Well
S-00177	Shelter Island	Yes	Well is located within 800 feet of Dering harbor
S-103522	Southold	Yes	Well is located within 0.68 miles of the Long Island Sound; adjacent to County Road 48
S-121811	East Hampton Montauk	Yes	Well is adjacent to Montauk Hwy. and is situated near agricultural areas
S-124659	East Hampton	No	Well is located within 0.5 miles of the Atlantic Ocean and Lake Montauk
S-124789 S-32552 S-54473	Brookhaven Selden	Yes	Wells are located within the vicinity of a salt storage facility and are adjacent to Nicolls Road. Institutional and residential properties are also within the sources water assessment areas
S-126076	Southold	Yes	Well is located within 0.40 miles of the Long Island Sound
S-126912	Shelter Island Heights	No	Well is adjacent to Dering Harbor
S-129199	Islip Terrace	Yes	Well is located several hundred feet away from Southern State Parkway. A salt storage facility is also located over a mile away and is situated outside of the source water assessment area to the well.
S-130317	Riverhead	Yes	Well is adjacent to Northville Turnpike and is situated about 1.5 miles from the Long Island Sound.
S-131612	Southold	No	Well is located about 0.5 miles from the Long Island Sound
S-29492	Brookhaven Medford	Yes	Well is located in the vicinity of Portion Road and Morris Avenue. Residential and commercial properties exist within the source water assessment area.
S-33775	Southold	Yes	Well is located within one mile of the Long Island Sound, and is within the vicinity of Old North Road
S-66366	Huntington	Yes	Well is adjacent to Oakwood Road. Various residential, commercial, and industrial properties exist within the source water assessment area.

Table 5
Chloride Concentration History - Public Community Supply Wells in Suffolk County
With Salt Storage Areas Located Within Source Water Assessment Areas

S-Number	Date of 1st Sample	Ending Date	Number of Samples	Min. Conc. mg/L	Max. Conc. mg/L	Mean Conc. mg/L	1st Sample Conc. mg/L	Last Sample Conc. mg/L	Change in Conc. mg/L
S-111777	4/3/2000	5/18/2015	17	3	6	4.9	5	5	0
S-113006	8/23/1999	1/22/2015	19	3	7	4.6	7	5	-2
S-113387	7/19/2001	6/23/2015	17	10	19	13	15	19	4
*S-117742	5/21/2003	6/23/2015	12	9	32	15	11	32	21
*S-118818	10/16/2003	8/25/2015	13	27	62	43	28	62	34
*S-120190	3/22/2005	2/4/2015	11	5	17	13	5	17	12
*S-124003	5/16/2006	10/6/2015	10	23	59	43	38	59	21
S-124088	11/28/2005	5/18/2015	11	17	23	20	18	22	4
S-125133	11/19/2007	6/23/2015	9	11	16	14	12	16	4
S-125797	7/8/2009	4/21/2015	7	7	9	7.7	8	8	0
S-17576	10/19/2004	10/20/2015	9	5	8	6.7	6	8	2
S-17577	10/19/2004	3/17/2010	4	6	9	7	6	7	1
*S-20318	6/30/1998	5/13/2015	18	15	28	21	17	28	11
S-22640	11/9/1998	5/12/2015	19	7	23.7	16	15	8	-7
S-24851	7/11/2001	8/18/2014	14	23	27	25	25	27	2
S-32412	6/30/1998	5/13/2015	18	3	5	4.1	3	5	2
*S-32552	7/16/1998	6/2/2015	20	38	196	119	81	171	90
S-33820	8/2/1999	7/29/2015	17	21	30	26	28	29	1
*S-36976	2/2/1999	10/13/2015	17	15	34	22	15	34	19
S-38784	4/19/1999	5/26/2015	18	7	10	8	8	9	1
S-39709	6/24/1998	3/3/2015	18	2	5	3.5	3	4	1
*S-42761	9/15/1999	6/25/2015	19	9	38	20	15	38	23
S-51673	5/25/1999	3/31/2015	17	2	4	3	3	4	1
*S-54473	9/29/1999	6/2/2015	19	38	128	70	38	128	90
S-66496	3/22/1999	6/25/2015	19	3	6	4.2	4	5	1
S-66685	9/1/1998	5/18/2015	19	15	29	21	20	24	4
*S-67925	12/3/1998	10/6/2015	20	12	28	17	15	28	13
S-71533	4/7/2008	7/1/2015	12	9	11	10	9	11	2
S-93701	7/7/1999	6/16/2015	15	8	43	16	9	16	7
S-96673	6/17/1999	10/20/2015	18	5	12	7.6	8	10	2
S-99130	9/8/1999	6/25/2015	18	3	6	4.6	5	4	-1
*X-00041	10/25/1999	5/11/2015	17	6	29	16	6	29	23
*X-00050	10/25/1999	9/29/2015	13	13	89	44	13	89	76