NEW YORK STATE OF OPPORTUNITY. | Department of Environmental Conservation

Chapter 2

Description of Proposed Action

Final

Supplemental Generic Environmental Impact Statement

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Chapter 2 – Description of Proposed Action

FIGURES

TABLES

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Chapter 2 DESCRIPTION OF PROPOSED ACTION

The proposed action is the Department's issuance of permits to drill, deepen, plug back or convert wells for horizontal drilling and high-volume hydraulic fracturing in the Marcellus Shale and other low-permeability natural gas reservoirs. Wells where high-volume hydraulic fracturing is used may be drilled vertically, directionally or horizontally. The proposed action, however, does not include horizontal drilling where high-volume hydraulic fracturing is not employed. Such drilling is covered under the GEIS.

Hydraulic fracturing is a well stimulation technique which consists of pumping an engineered fluid system and a proppant such as sand down the wellbore under high pressure to create fractures in the hydrocarbon-bearing rock. The fractures serve as pathways for hydrocarbons to move to the wellbore for production. High-volume hydraulic fracturing, using 300,000 gallons of water or more per well, is also referred to as "slick water fracturing." An individual well treatment may consist of multiple stages (multi-stage fracturing). Further information on high-volume hydraulic fracturing, including the composition of the fluid system, is provided in Chapter 5.

Multiple wells may be drilled from a common location (multi-well pad, or multi-well site). The Department may receive applications to drill approximately 1,700 – 2,500 horizontal and vertical wells for development of the Marcellus Shale by high-volume hydraulic fracturing during a "peak development" year. An average year may see 1,600 or more applications. Development of the Marcellus Shale in New York may occur over a 30-year period.[9] More information about these activity estimates and the factors which could affect them is presented in Chapter 5.

This SGEIS is focused on topics not addressed by the 1992 GEIS, with emphasis on potential impacts associated with the large volumes of water required to hydraulically fracture horizontal shale wells using the slick water fracturing technique and the disturbance associated with multi-well sites. An additional aspect of this SGEIS is to consider measures that will be incorporated into revisions or additions to the Department's regulations concerning high-volume hydraulic fracturing.

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[9] ALL Consulting, 2010, pp. 7 - 9.

2.1 Purpose

As stated in the 1992 GEIS, a generic environmental impact statement is used to evaluate the environmental effects of a program having wide application and is required for direct programmatic actions undertaken by a state agency. The SGEIS will address new activities or new potential impacts not addressed by the 1992 GEIS and will set forth practices and mitigation designed to reduce environmental impacts to the maximum extent practicable. The SGEIS and its findings will be used to satisfy SEQR for the issuance of permits to drill, deepen, plug back or convert wells for horizontal drilling and high-volume hydraulic fracturing. The SGEIS will also be used to satisfy SEQR for the enactment of revisions or additions to the Department's regulations relating to high-volume hydraulic fracturing.

2.2 Project Location

The 1992 GEIS is applicable to onshore oil and gas well drilling statewide. Sedimentary rock formations which may someday be developed by horizontal drilling and hydraulic fracturing exist from the Vermont/Massachusetts border up to the St. Lawrence/Lake Champlain region, west along Lake Ontario to Lake Erie and across the Southern Tier and Finger Lakes regions. Drilling will not occur on State-owned lands in the Adirondack and Catskill Forest Preserves because of the State Constitution's requirement that Forest Preserve lands be kept forever wild and not be leased or sold. Drilling will not occur on State reforestation areas and wildlife management areas that are located in the Forest Preserve because the State Constitution prohibits those areas from being leased or sold. Surface disturbance associated with high-volume hydraulic fracturing would not be allowed on State-owned lands administered by DEC outside of the Forest Preserve, including but not limited to State Forests and State Wildlife Management Areas, because high-volume hydraulic fracturing would be inconsistent with the purposes for which those lands were acquired. Current OPRHP policy would impose a similar restriction on State Parks. In addition, the subsurface geology of the Adirondacks, NYC and Long Island and other factors render drilling for hydrocarbons in those areas unlikely.

The prospective region for the extraction of natural gas from Marcellus and Utica Shales has been roughly described as an area extending from Chautauqua County eastward to Greene, Ulster and Sullivan Counties, and from the Pennsylvania border north to the approximate location of the east-west portion of the New York State Thruway between Schenectady and Auburn. The maps in Chapter 4 depict the prospective area.

2.3 Environmental Setting

Environmental resources discussed in the 1992 GEIS with respect to potential impacts from oil and gas development include: waterways/water bodies; drinking water supplies; public lands; coastal areas; wetlands; floodplains; soils; agricultural lands; intensive timber production areas; significant habitats; areas of historical, architectural, archeological and cultural significance; clean air and visual resources.[10] Further information is provided below regarding specific aspects of the environmental setting for Marcellus and Utica Shale development and high-volume hydraulic fracturing that were determined during Scoping to require attention in the SGEIS.

2.3.1 Water Use Classifications[11]

Water use classifications are assigned to surface waters and groundwaters throughout New York. Surface water and groundwater sources are classified by the best use that is or could be made of the source. The preservation of these uses is a regulatory requirement in New York. Classifications of surface waters and groundwaters in New York are identified and assigned in 6 NYCRR Part 701.

In general, the discharge of sewage, industrial waste, or other wastes must not cause impairment of the best usages of the receiving water as specified by the water classifications at the location of discharge and at other locations that may be affected by such discharge. In addition, for higher quality waters, the Department may impose discharge restrictions (described below) in order to protect public health, or the quality of distinguished value or sensitive waters.

A table of water use classifications, usages and restrictions follows.

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[10] NYSDEC, 1992, GEIS Chapter 6 provides a broad background of these environmental resources, including the then-existing legislative protections, other than SEQRA, guarding these resources from potential impacts. Chapters 8, 9, 10, 11, 12, 13, 14 and 15 of the GEIS contain more detailed analyses of the specific environmental impacts of development on these resources, as well as the mitigation measures required to prevent these impacts.

[11] URS, 2009, p. 4-2.

Table 2.1 - New York Water Use Classifications

Water Use Class	Water Type	Best Usages and Suitability	Notes
N	Fresh Surface	1, 2	
AA-Special	Fresh Surface	3, 4, 5, 6	Note a
A-Special	Fresh Surface	3, 4, 5, 6	Note b
AA	Fresh Surface	3, 4, 5, 6	Note c
A	Fresh Surface	3, 4, 5, 6	Note d
B	Fresh Surface	4, 5, 6	
C	Fresh Surface	5, 6, 7	
D	Fresh Surface	5, 7, 8	
SA	Saline Surface	4, 5, 6, 9	
SB	Saline Surface	4, 5, 6,	
SC	Saline Surface	5, 6, 7	
I	Saline Surface	5, 6, 10	
SD	Saline Surface	5, 8	
GA	Fresh Groundwater	11	
GSA	Saline Groundwater	12	Note e
GSB	Saline Groundwater	13	Note f
Other – T/TS	Fresh Surface	Trout/Trout Spawning	
Other – Discharge Restriction Category	All Types	N/A	See descriptions below

Best Usage/Suitability Categories [Column 3 of Table 2.1 above]

1. Best usage for enjoyment of water in its natural condition and, where compatible, as a source of water for drinking or culinary purposes, bathing, fishing, fish propagation, and recreation;

2. Suitable for shellfish and wildlife propagation and survival, and fish survival;

3. Best usage as source of water supply for drinking, culinary or food processing purposes;

4. Best usage for primary and secondary contact recreation;

5. Best usage for fishing;

6. Suitable for fish, shellfish, and wildlife propagation and survival;

7. Suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes;

8. Suitable for fish, shellfish, and wildlife survival (not propagation);

9. Best usage for shellfishing for market purposes;

10. Best usage for secondary, but not primary, contact recreation;

11. Best usage for potable water supply;

12. Best usage for source of potable mineral waters, or conversion to fresh potable waters, or as raw material for the manufacture of sodium chloride or its derivatives or similar products; and

13. Best usage is as receiving water for disposal of wastes (may not be assigned to any groundwaters of the State, unless the Commissioner finds that adjacent and tributary groundwaters and the best usages thereof will not be impaired by such classification).

<u>Notes</u> [Column 4 of Table 2.1 above]

a. These waters shall contain no floating solids, settleable solids, oil, sludge deposits, toxic wastes, deleterious substances, colored or other wastes or heated liquids attributable to sewage, industrial wastes or other wastes; there shall be no discharge or disposal of sewage, industrial wastes or other wastes into these waters; these waters shall contain no phosphorus and nitrogen in amounts that will result in growths of algae, weeds and slimes that will impair the waters for their best usages; there shall be no alteration to flow that will impair the waters for their best usages; there shall be no increase in turbidity that will cause a substantial visible contrast to natural conditions;

b. This classification may be given to those international boundary waters that, if subjected to approved treatment, equal to coagulation, sedimentation, filtration and disinfection with additional treatment, if necessary, to reduce naturally present impurities, meet or will meet NYSDOH drinking water standards and are or will be considered safe and satisfactory for drinking water purposes;

c. This classification may be given to those waters that if subjected to pre-approved disinfection treatment, with additional treatment if necessary to remove naturally present impurities, meet or will meet NYSDOH drinking water standards and are or will be considered safe and satisfactory for drinking water purposes;

d. This classification may be given to those waters that, if subjected to approved treatment equal to coagulation, sedimentation, filtration and disinfection, with additional treatment if necessary to reduce naturally present impurities, meet or will meet NYSDOH drinking water standards and are or will be considered safe and satisfactory for drinking water purposes;

e. Class GSA waters are saline groundwaters. The best usages of these waters are as a source of potable mineral waters, or conversion to fresh potable waters, or as raw material for the manufacture of sodium chloride or its derivatives or similar products; and

f. Class GSB waters are saline groundwaters that have a chloride concentration in excess of 1,000 milligrams per liter (mg/L) or a total dissolved solids (TDS) concentration in excess of 2,000 mg/L; this classification shall not be assigned to any groundwaters of the State, unless the Department finds that adjacent and tributary groundwaters and the best usages thereof will not be impaired by such classification.

<u>Discharge Restriction Categories</u> [Last Row of Table 2.1 above]

Based on a number of relevant factors and local conditions, per 6 NYCRR §701.20, discharge restriction categories may be assigned to: (1) waters of particular public health concern; (2) significant recreational or ecological waters where the quality of the water is critical to maintaining the value for which the waters are distinguished; and (3) other sensitive waters where the Department has determined that existing standards are not adequate to maintain water quality.

1. Per 6 NYCRR §701.22, new discharges may be permitted for waters where discharge restriction categories are assigned when such discharges result from environmental remediation projects, from projects correcting environmental or public health

emergencies, or when such discharges result in a reduction of pollutants for the designated waters. In all cases, best usages and standards will be maintained;

2. Per 6 NYCRR §701.23, except for storm water discharges, no new discharges shall be permitted and no increase in any existing discharges shall be permitted; and

3. Per 6 NYCRR §701.24, specified substances shall not be permitted in new discharges, and no increase in the release of specified substances shall be permitted for any existing discharges. Storm water discharges are an exception to these restrictions. The substance will be specified at the time the waters are designated.

2.3.2 Water Quality Standards

Generally speaking, groundwater and surface water classifications and quality standards in New York are established by the United States Environmental Protection Agency (USEPA) and the Department. The NYC Department of Environmental Protection (NYCDEP) defers to the New York State Department of Health (NYSDOH) for water classifications and quality standards. The most recent NYC Drinking Water Quality Report can be found at http://www.nyc.gov/html/dep/pdf/wsstate10.pdf. The Susquehanna River Basin Commission (SRBC) has not established independent classifications and quality standards. However, one of SRBC's roles is to recommend modifications to state water quality standards to improve consistency among the states. The Delaware River Basin Commission (DRBC) has established independent classifications and water quality standards throughout the Delaware River Basin, including those portions within New York. The relevant and applicable water quality standards and classifications include the following:

- 6 NYCRR Part 703, Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations;[12]
- USEPA Drinking Water Contaminants;[13]
- 18 CFR Part 410, DRBC Administrative Manual Part III Water Quality Regulations;[14]

[12] http://www.dec.ny.gov/regs/4590.html.

[13] http://www.epa.gov/safewater/contaminants/index.html.

- 10 NYCRR Part 5, Subpart 5-1 Public Water Systems; [15] and
- NYCDEP Drinking Water Supply and Quality Report.[16]

2.3.3 Drinking Water[17]

The protection of drinking water sources and supplies is extremely important for the maintenance of public health, and the protection of this water use type is paramount. Chemical or biological substances that are inadvertently released into surface water or groundwater sources that are designated for drinking water use can adversely impact or disqualify such usage if there are constituents that conflict with applicable standards for drinking water. These standards are discussed below.

2.3.3.1 Federal

The Safe Drinking Water Act (SDWA), passed in 1974 and amended in 1986 and 1996, gives USEPA the authority to set drinking water standards. There are two categories of drinking water standards: primary and secondary. Primary standards are legally enforceable and apply to public water supply systems. The secondary standards are non-enforceable guidelines that are recommended as standards for drinking water. Public water supply systems are not required to comply with secondary standards unless a state chooses to adopt them as enforceable standards. New York has elected to enforce both as Maximum Contaminant Levels (MCLs) and does not make the distinction.

The primary standards are designed to protect drinking water quality by limiting the levels of specific contaminants that can adversely affect public health and are known or anticipated to occur in drinking water. The determinations of which contaminants to regulate are based on peer-reviewed science research and an evaluation of the following factors:

- Occurrence in the environment and in public water supply systems at levels of concern;

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[14] http://www.state.nj.us/drbc/regs/WQRegs_071608.pdf

[15] http://www.health.state.ny.us/environmental/water/drinking/part5/subpart5.htm

[16] http://www.nyc.gov/html/dep/html/drinking_water/wsstate.shtml.

[17] URS, 2009, pp. 4-5:4-16.

- Human exposure and risks of adverse health effects in the general population and sensitive subpopulations;
- Analytical methods of detection;
- Technical feasibility; and
- Impacts of regulation on water systems, the economy and public health.

After reviewing health effects studies and considering the risk to sensitive subpopulations, EPA sets a non-enforceable Maximum Contaminant Level Goal (MCLG) for each contaminant as a public health goal. This is the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, and which allows an adequate margin of safety. MCLGs only consider public health and may not be achievable given the limits of detection and best available treatment technologies. The SDWA prescribes limits in terms of MCLs or Treatment Techniques (TTs), which are achievable at a reasonable cost, to serve as the primary drinking water standards. A contaminant generally is classified as microbial in nature or as a carcinogenic/non-carcinogenic chemical.

Secondary contaminants may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. The numerical secondary standards are designed to control these effects to a level desirable to consumers.

Table 2.2 and Table 2.3 list contaminants regulated by federal primary and secondary drinking water standards.

Table 2.2 - Primary Drinking Water Standards

Microorganisms

Contaminant	MCLG (mg/L)	MCL or TT (mg/L)
Cryptosporidium	0	TT
Giardia Lamblia	0	TT
Heterotrophic plate count	n/a	TT
Legionella	0	TT
Total Coliform (including fecal coliform and E. coli)	0	5%
Turbidity	n/a	TT
Viruses (enteric)	0	TT

MCLG: Maximum contaminant level goal
MCL: Maximum contaminant level
TT: Treatment technology

Disinfection Byproducts

Contaminant	MCLG (mg/L)	MCL or TT (mg/L)
Bromate	0	0.01
Chlorite	0.8	1
Haloacetic acids (HAA5)	n/a	0.06
Total Trihalomethanes (TTHMs)	n/a	0.08

Disinfectants

Contaminant	MRDLG (mg/L)	MRDL (mg/L)
Chloramines (as Cl_2)	4.0	4.0
Chlorine (as Cl_2)	4.0	4.0
Chlorine dioxide (as ClO_2)	0.8	0.8

MRDL: Maximum Residual Disinfectant Level
MRDLG: Maximum Residual Disinfectant Level Goal

Inorganic Chemicals

Contaminant	CAS number	MCLG (mg/L)	MCL or TT (mg/L)
Antimony	07440-36-0	0.006	0.006
Arsenic	07440-38-2	0	0.01 as of 01/23/06
Asbestos (fiber >10 micrometers)	01332-21-5	7 million fibers per liter	7 MFL
Barium	07440-39-3	2	2
Beryllium	07440-41-7	0.004	0.004
Cadmium	07440-43-9	0.005	0.005
Chromium (total)	07440-47-3	0.1	0.1
Copper	07440-50-8	1.3	TT; Action Level=1.3
Cyanide (as free cyanide)	00057-12-5	0.2	0.2
Fluoride	16984-48-8	4	4

Inorganic Chemicals

Contaminant	CAS number	MCLG (mg/L)	MCL or TT (mg/L)
Lead	07439-92-1	0	TT; Action Level=0.015
Mercury (inorganic)	07439-97-6	0.002	0.002
Nitrate (measured as Nitrogen)		10	10
Nitrite (measured as Nitrogen)		1	1
Selenium	07782-49-2	0.05	0.05
Thallium	07440-28-0	0.0005	0.002

Organic Chemicals

Contaminant	CAS number	MCLG (mg/L)	MCL or TT (mg/L)
Acrylamide	00079-06-1	0	TT
Alachlor	15972-60-8	0	0.002
Atrazine	01912-24-9	0.003	0.003
Benzene	00071-43-2	0	0.005
Benzo(a)pyrene (PAHs)	00050-32-8	0	0.0002
Carbofuran	01563-66-2	0.04	0.04
Carbon tetrachloride	00056-23-5	0	0.005
Chlordane	00057-74-9	0	0.002
Chlorobenzene	00108-907	0.1	0.1
2,4-Dichloro-phenoxyacetic acid (2,4-D)	00094-75-7	0.07	0.07
Dalapon	00075-99-0	0.2	0.2
1,2-Dibromo-3-chloropropane (DBCP)	00096-12-8	0	0.0002
o-Dichlorobenzene	00095-50-1	0.6	0.6
p-Dichlorobenzene	00106-46-7	0.075	0.075
1,2-Dichloroethane	00107-06-2	0	0.005
1,1-Dichloroethylene	00075-35-4	0.007	0.007
cis-1,2-Dichloroethylene	00156-59-2	0.07	0.07
trans-1,2-Dichloroethylene	00156-60-5	0.1	0.1
Dichloromethane	00074-87-3	0	0.005
1,2-Dichloropropane	00078-87-5	0	0.005
Di(2-ethylhexyl) adipate	00103-23-1	0.4	0.4
Di(2-ethylhexyl) phthalate	00117-81-7	0	0.006
Dinoseb	00088-85-7	0.007	0.007
Dioxin (2,3,7,8-TCDD)	01746-01-6	0	0.00000003
Diquat		0.02	0.02
Endothall	00145-73-3	0.1	0.1
Endrin	00072-20-8	0.002	0.002
Epichlorohydrin		0	TT
Ethylbenzene	00100-41-4	0.7	0.7
Ethylene dibromide	00106-93-4	0	0.00005
Glyphosate	01071-83-6	0.7	0.7
Heptachlor	00076-44-8	0	0.0004

Organic Chemicals

Contaminant	CAS number	MCLG (mg/L)	MCL or TT (mg/L)
Heptachlor epoxide	01024-57-3	0	0.0002
Hexachlorobenzene	00118-74-1	0	0.001
Hexachlorocyclopentadiene	00077-47-4	0.05	0.05
Lindane	00058-89-9	0.0002	0.0002
Methoxychlor	00072-43-5	0.04	0.04
Oxamyl (Vydate)	23135-22-0	0.2	0.2
Polychlorinated biphenyls (PCBs)		0	0.0005
Pentachlorophenol	00087-86-5	0	0.001
Picloram	01918-02-1	0.5	0.5
Simazine	00122-34-9	0.004	0.004
Styrene	00100-42-5	0.1	0.1
Tetrachloroethylene	00127-18-4	0	0.005
Toluene	00108-88-3	1	1
Toxaphene	08001-35-2	0	0.003
2,4,5-TP (Silvex)	00093-72-1	0.05	0.05
1,2,4-Trichlorobenzene	00120-82-1	0.07	0.07
1,1,1-Trichloroethane	00071-55-6	0.2	0.2
1,1,2-Trichloroethane	00079-00-5	0.003	0.005
Trichloroethylene	00079-01-6	0	0.005
Vinyl chloride	00075-01-4	0	0.002
Xylenes (total)		10	10

Radionuclides

Contaminant	MCLG (mg/L)	MCL or TT (mg/L)
Alpha particles	none ------------ zero	15 picocuries per Liter (pCi/L)
Beta particles and photon emitters	none ------------ zero	4 millirems per year
Radium 226 and Radium 228 (combined)	none ------------ zero	5 pCi/L
Uranium	zero	30 ug/L

Table 2.3 - Secondary Drinking Water Standards

Contaminant	CAS number	Standard
Aluminum	07439-90-5	0.05 to 0.2 mg/L
Chloride		250 mg/L
Color		15 (color units)
Copper	07440-50-8	1.0 mg/L
Corrosivity		Non-corrosive
Fluoride	16984-48-8	2.0 mg/L
Foaming Agents (surfactants)		0.5 mg/L
Iron	07439-89-6	0.3 mg/L
Manganese	07439-96-5	0.05 mg/L
Odor		3 threshold odor number
pH		6.5-8.5
Silver	07440-22-4	0.10 mg/L
Sulfate	14808-79-8	250 mg/L
Total Dissolved Solids		500 mg/L
Zinc	07440-66-6	5 mg/L

New York State is a primacy state and has assumed responsibility for the implementation of the drinking water protection program.

2.3.3.2 New York State

Authorization to use water for a public drinking water system is subject to Article 15, Title 15 of the ECL administered by the Department, while the design and operation of a public drinking water system and quality of drinking water is regulated under the State Sanitary Code 10 NYCRR, Subpart 5-1 administered by NYSDOH.[18]

Anyone planning to operate or operating a public water supply system must obtain a Water Supply Permit from the Department before undertaking any of the regulated activities.

Contact with the Department and submission of a Water Supply Permit application will automatically involve NYSDOH, which has a regulatory role in water quality and other sanitary aspects of a project relating to human health. Through the State Sanitary Code (Chapter 1 of 10 NYCRR), NYSDOH oversees the suitability of water for human consumption. Section 5-1.30 of

[18] 6 NYCRR 601 – http://www.dec.ny.gov/regs/4445.html.

10 NYCRR[19] prescribes the required minimum treatment for public water systems, which depends on the source water type and quality. To assure the safety of drinking water in New York, NYSDOH, in cooperation with its partners, the county health departments, regulates the operation, design and quality of public water supplies; assures water sources are adequately protected, and sets standards for constructing individual water supplies.

NYSDOH standards, established in regulations found at Section 5-1.51 of 10 NYCRR and accompanying Tables in Section 1.52, meet or exceed national drinking water standards. These standards address national primary standards, secondary standards and other contaminants, including those not listed in federal standards such as principal organic contaminants with specific chemical compound classification and unspecified organic contaminants.

2.3.4 Public Water Systems

Public water systems in New York range in size from that of NYC, the largest engineered water system in the nation, serving more than nine million people, to those run by municipal governments or privately-owned water supply companies serving municipalities of varying size and type, schools with their own water supply, and small retail outlets in rural areas serving customers water from their own wells. Privately owned, residential wells supplying water to individual households do not require a water supply permit. In total, there are nearly 10,000 public water systems in New York State. A majority of the systems (approximately 8,460) rely on groundwater aquifers, although a majority of the State's population is served by surface water sources. Public water systems include community water systems (CWS) and non-community water systems (NCWS). NCWSs include non-transient non-community (NTNC) and transient non-community (TNC) water systems. NYSDOH regulations contain the definitions listed in Table 2.4.

[19] 10 NYCRR 5-1.30 – http://www.health.state.ny.us/nysdoh/phforum/nycrr10.htm.

Table 2.4 - Public Water System Definition[20]

Public water system means a community, non-community or non-transient non-community water system which provides water to the public for human consumption through pipes or other constructed conveyances, if such system has at least five service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. Such term includes: a. collection, treatment, storage and distribution facilities under control of the supplier of water of such system and used with such system; and b. collection or pretreatment storage facilities not under such control which are used with such system. **Community water system (CWS)** means a public water system which serves at least five service connections used by year-round residents or regularly serves at least 25 year-round residents. **Noncommunity water system (NCWS)** means a public water system that is not a community water system. **Non-transient noncommunity water system (NTNC)** means a public water system that is not a community water system but is a subset of a noncommunity water system that regularly serves at least 25 of the same people, four hours or more per day, for four or more days per week, for 26 or more weeks per year. **Transient noncommunity water system (TNC)** means a noncommunity water system that does not regularly serve at least 25 of the same people over six months per year.

2.3.4.1 Primary and Principal Aquifers

About one quarter of New Yorkers rely on groundwater as a source of potable water. In order to enhance regulatory protection in areas where groundwater resources are most productive and most vulnerable, the NYSDOH, in 1981, identified 18 Primary Water Supply Aquifers (also referred to simply as Primary Aquifers) across the State. These are defined in the Division of Water (DOW) Technical and Operational Guidance Series (TOGS) 2.1.3[21] as "highly productive aquifers presently utilized as sources of water supply by major municipal water supply systems."

Many Principal Aquifers have also been identified and are defined in the DOW TOGS as "highly productive, but which are not intensively used as sources of water supply by major municipal systems at the present time." Principal Aquifers are those known to be highly productive aquifers or where the geology suggests abundant potential supply, but are not presently being heavily used for public water supply. The 21 Primary and the many Principal Aquifers greater than one square mile in area within New York State (excluding Long Island) are shown on

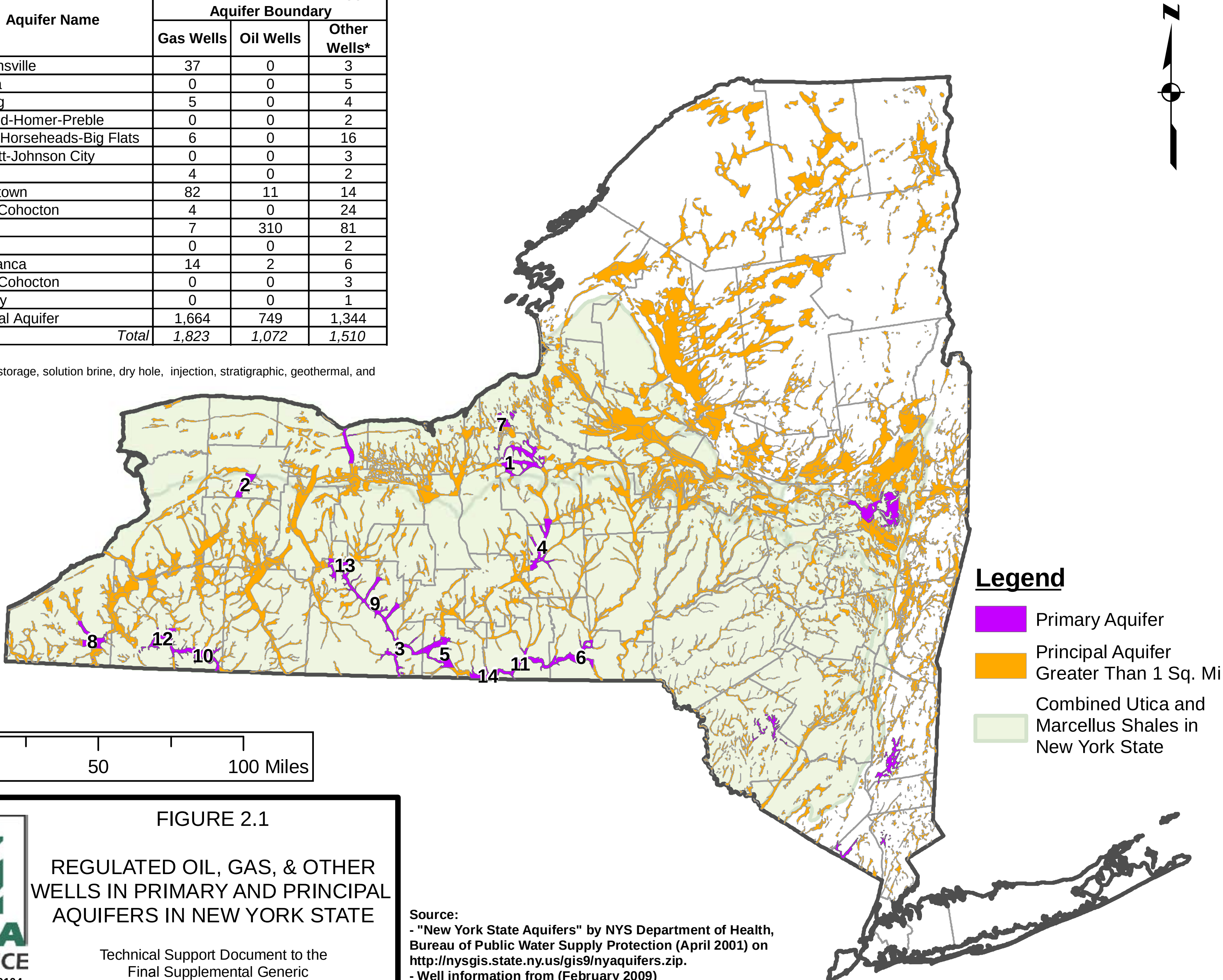
[20] 10 NYCRR, Part 5, Subpart 5-1 Public Water Systems (Current as of: October 1, 2007); SUBPART 5-1; PUBLIC WATER SYSTEMS; 5-1.1 Definitions. (Effective Date: May 26, 2004).

[21] http://www.dec.ny.gov/docs/water_pdf/togs213.pdf.

Map No.	Aquifer Name	Number of Wells Within Mapped Aquifer Boundary		
		Gas Wells	Oil Wells	Other Wells*
1	Baldwinsville	37	0	3
2	Batavia	0	0	5
3	Corning	5	0	4
4	Cortland-Homer-Preble	0	0	2
5	Elmira-Horseheads-Big Flats	6	0	16
6	Endicott-Johnson City	0	0	3
7	Fulton	4	0	2
8	Jamestown	82	11	14
9	Lower Cohocton	4	0	24
10	Olean	7	310	81
11	Owego	0	0	2
12	Salamanca	14	2	6
13	Upper Cohocton	0	0	3
14	Waverly	0	0	1
	Principal Aquifer	1,664	749	1,344
	Total	*1,823*	*1,072*	*1,510*

Notes:

* - Other wells include storage, solution brine, dry hole, injection, stratigraphic, geothermal, and not listed well types.



ALPHA GEOSCIENCE

Alpha Project No. 09104

FIGURE 2.1

REGULATED OIL, GAS, & OTHER WELLS IN PRIMARY AND PRINCIPAL AQUIFERS IN NEW YORK STATE

Technical Support Document to the Final Supplemental Generic Environmental Impact Statement

Source:
- "New York State Aquifers" by NYS Department of Health, Bureau of Public Water Supply Protection (April 2001) on http://nysgis.state.ny.us/gis9/nyaquifers.zip.
- Well information from (February 2009) http://www.dec.ny.gov/energy/1603.html

Figure 2.1. The remaining portion of the State is underlain by smaller aquifers or low-yielding groundwater sources that typically are suitable only for small community and non-community public water systems or individual household supplies.[22]

2.3.4.2 Public Water Supply Wells

NYSDOH estimates that over two million New Yorkers outside of Long Island are served by public groundwater supplies.[23] Most public water systems with groundwater sources pump and treat groundwater from wells. Public groundwater supply wells are governed by Subpart 5-1 of the State Sanitary Code under 10 NYCRR.[24]

2.3.5 Private Water Wells and Domestic-Supply Springs

There are potentially tens to hundreds of thousands of private water supply wells in the State. To ensure that private water wells provide adequate quantities of water fit for consumption and intended uses, they need to be located and constructed to maintain long-term water yield and reduce the risk of contamination. Improperly constructed water wells can allow for easy transport of contaminants to the well and pose a significant health risk to users. New, replacement or renovated private wells are required to be in compliance with the New York State Residential Code, NYSDOH Appendix 5-B "Standards for Water Wells,"[25] installed by a certified Department-registered water well contractor and have groundwater as the water source. However, many private water wells installed before these requirements took effect are still in use. The 1992 GEIS describes how improperly constructed private water wells are susceptible to pollution from many sources, and proposes a 150-foot setback to protect vulnerable private wells.[26]

NYSDOH includes springs – along with well points, dug wells and shore wells – as susceptible sources that are vulnerable to contamination from pathogens, spills and the effects of drought.[27]

[22] Alpha, 2009, p. 3-2.

[23] http://www.health.state.ny.us/environmental/water/drinking/facts_figures.htm.

[24] http://www.health.state.ny.us/environmental/water/drinking/part5/subpart5.htm.

[25] http://www.health.state.ny.us/environmental/water/drinking/part5/appendix5b.htm.

[26] NYSDEC, 1992, GEIS, p. 8-22.

[27] http://www.health.state.ny.us/environmental/water/drinking/part5/append5b/fs5_susceptible_water_sources.htm.

Use of these sources for drinking water is discouraged and should be considered only as a last resort with proper protective measures. With respect to springs, NYSDOH specifically states:

> Springs occur where an aquifer discharges naturally at or near the ground surface, and are broadly classified as either rock or earth springs. It is often difficult to determine the true source of a spring (that is, whether it truly has the natural protection against contamination that a groundwater aquifer typically has.) Even if the source is a good aquifer, it is difficult to develop a collection device (e.g., "spring box") that reliably protects against entry of contaminants under all weather conditions. (The term "spring box" varies, and, depending on its construction, would be equivalent to, and treated the same, as either a spring, well point or shore well.) Increased yield and turbidity during rain events are indications of the source being under the direct influence of surface water.[28]

Because of their vulnerability, and because in addition to their use as drinking water supplies they also supply water to wetlands, streams and ponds, the 1992 GEIS proposes a 150-foot setback.[29]

For oil and gas regulatory purposes, potable fresh water is defined as water containing less than 250 ppm of sodium chloride or 1,000 ppm TDS[30] and salt water is defined as containing more than 250 ppm sodium chloride or 1,000 ppm TDS.[31] Groundwater from sources below approximately 850 feet in New York typically is too saline for use as a potable water supply; however, there are isolated wells deeper than 850 feet that produce potable water and wells less than 850 feet that produce salt water. A depth of 850 feet to the base of potable water is commonly used as a practical generalization for the maximum depth of potable water; however, a variety of conditions affect water quality, and the maximum depth of potable water in an area should be determined based on the best available data.[32]

2.3.6 History of Drilling and Hydraulic Fracturing in Water Supply Areas

A tabulated summary of the regulated oil, gas, and other wells located within the boundaries of the Primary and Principal Aquifers in the State is provided on Figure 2.1. There are 482 oil and gas wells located within the boundaries of 14 Primary Aquifers and 2,413 oil and gas wells

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[28] NYSDOH - http://www.health.ny.gov/environmental/water/drinking/part5/append5b/docs/fs5_susceptible_water_sources.pdf.

[29] NYSDEC, 1992, GEIS, p. 8-16.

[30] 6 NYCRR Part 550.3(ai).

[31] 6 NYCRR Part 550.3(at).

[32] Alpha, 2009, p. 3-3.

located within the boundaries of Principal Aquifers. Another 1,510 storage, solution brine, injection, stratigraphic, geothermal, and other deep wells are located within the boundaries of the mapped aquifers. The remaining regulated oil and gas wells likely penetrate a horizon of potable freshwater that can be used by residents or communities as a drinking water source. These freshwater horizons include unconsolidated deposits and bedrock units.[33]

Chapter 4, on Geology, includes a generalized cross-section (Figure 4.3) across the Southern Tier of New York State which illustrates the depth and thickness of rock formations including the prospective shale formations.

No documented instances of groundwater contamination from previous horizontal drilling or hydraulic fracturing projects in New York are recorded in the Department's well files or records of complaint investigations. No documented incidents of groundwater contamination in public water supply systems could be recalled by the NYSDOH central office and Rochester district office (NYSDOH, 2009a; NYSDOH, 2009b). References have been made to some reports of private well contamination in Chautauqua County in the 1980s that may be attributed to oil and gas drilling (Chautauqua County Department of Health, 2009; NYSDOH, 2009a; NYSDOH, 2009b; Sierra Club, undated). The reported Chautauqua County incidents, the majority of which occurred in the 1980s and which pre-date the current casing and cementing practices and fresh water aquifer supplementary permit conditions, could not be substantiated because pre-drilling water quality testing was not conducted, improper tests were run which yielded inconclusive results and/or the incidents of alleged well contamination were not officially confirmed.[34]

An operator caused turbidity (February 2007) in nearby water wells when it continued to pump compressed air for many hours through the drill string in an attempt to free a stuck drill bit at a well in the Town of Brookfield, Madison County. The compressed air migrated through natural fractures in the shallow bedrock because the well had not yet been drilled to the permitted surface casing seat depth. This non-routine incident was reported to the Department and staff were dispatched to investigate the problem. The Department shut down drilling operations and ordered the well plugged when it became apparent that continued drilling at the wellsite would cause

[33] Alpha, 2009, p. 3-3.

[34] Alpha, 2009, p. 3-3.

turbidity to increase above what had already been experienced. The operator immediately provided drinking water to the affected residents and subsequently installed water treatment systems in several residences. Over a period of several months the turbidity abated and water wells returned to normal. Operators that use standard drilling practices and employ good oversight in compliance with their permits would not typically cause the excessive turbidity event seen at the Brookfield wells. The Department has no records of similar turbidity caused by well drilling as occurred at this Madison County well. Geoffrey Snyder, Director Environmental Health Madison County Health Department, stated in a May 2009 email correspondence regarding the Brookfield well accident that, "Overall we find things have pretty much been resolved and the water quality back to normal if not better than pre-incident conditions."

2.3.7 Regulated Drainage Basins

New York State is divided into 17 watersheds, or drainage basins, which are the basis for various management, monitoring, and assessment activities.[35] A watershed is an area of land that drains into a body of water, such as a river, lake, reservoir, estuary, sea or ocean. The watershed includes the network of rivers, streams and lakes that convey the water and the land surfaces from which water runs off into those water bodies. Since all of New York State's land area is incorporated into watersheds, all oil and gas drilling that has occurred since 1821 has occurred within watersheds, specifically, in 13 of the State's 17 watersheds. Watersheds are separated from adjacent watersheds by high points, such as mountains, hills and ridges. Groundwater flow within watersheds may not be controlled by the same topographic features as surface water flow.

The river basins described below are subject to additional jurisdiction by existing regulatory bodies with respect to certain specific activities related to high-volume hydraulic fracturing.

The delineations of the Susquehanna and Delaware River Basins in New York are shown on Figure 2.2.

[35] See map at http://www.dec.ny.gov/lands/26561.html.

2.3.7.1 Delaware River Basin

Including Delaware Bay, the Delaware River Basin comprises 13,539 square miles in four states (New York, Pennsylvania, Delaware and New Jersey). Approximately 18.5 % of the surface area of the basin, or 2,362 square miles, lies within portions of Broome, Chenango, Delaware, Schoharie, Greene, Ulster, Sullivan and Orange Counties in New York. This acreage overlaps with NYC's West of Hudson Watershed; the Basin supplies about half of NYC's drinking water and 100% of Philadelphia's supply.

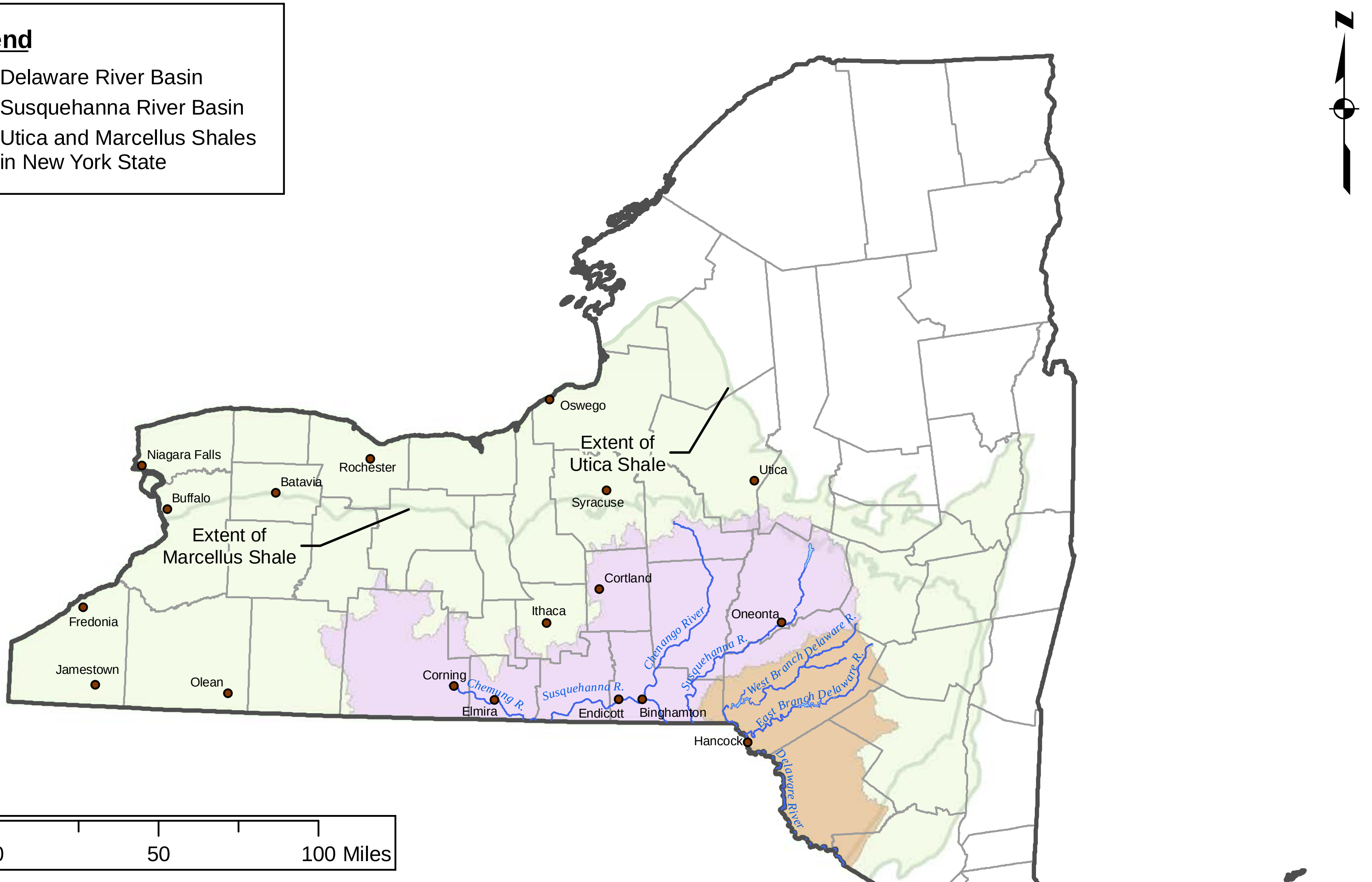
The DRBC was established by a compact among the federal government, New York, New Jersey, Pennsylvania and Delaware to coordinate water resource management activities and the review of projects affecting water resources in the basin. New York is represented on the DRBC by a designee of New York State's Governor, and the Department has the opportunity to provide input on projects requiring DRBC action.

DRBC has identified its areas of concern with respect to natural gas drilling as reduction of flow in streams or aquifers, discharge or release of pollutants into ground water or surface water, and treatment and disposal of hydraulic fracturing fluid. DRBC staff will also review drill site characteristics, fracturing fluid composition and disposal strategy prior to recommending approval of shale gas development projects in the Delaware River Basin.[36]

2.3.7.2 Susquehanna River Basin

The Susquehanna River Basin comprises 27,510 square miles in three states (New York, Pennsylvania and Maryland) and drains into the Chesapeake Bay. Approximately 24 % of the basin, or 6,602 square miles, lies within portions of Allegany, Livingston, Steuben, Yates, Ontario, Schuyler, Chemung, Tompkins, Tioga, Cortland, Onondaga, Madison, Chenango, Broome, Delaware, Schoharie, Otsego, Herkimer and Oneida Counties in New York.

[36] http://www.state.nj.us/drbc/naturalgas.htm



ALPHA GEOSCIENCE

Alpha Project No. 09104

FIGURE 2.2

MAJOR TRIBUTARIES IN THE SUSQUEHANNA & DELAWARE RIVER BASINS IN NEW YORK STATE

Technical Support Document to the Final Supplemental Generic Environmental Impact Statement

Sources:
- Delaware River Basin Commission Geographic Information System http://www.state.nj.us/drbc/gis.htm.
- Susquehanna River Basin Commision Map and Data Atlas http://www.srbc.net/atlas/whatgis.asp

The SRBC was established by a compact among the federal government, New York, Pennsylvania and Maryland to coordinate water resource management activities and review of projects affecting water resources in the Basin. New York is represented on the SRBC by a designee of the Department's Commissioner, and the Department has the opportunity to provide input on projects requiring SRBC action.

The Susquehanna River is the largest tributary to the Chesapeake Bay, with average annual flow to the Bay of over 20 billion gallons per day (gpd). Based upon existing consumptive use approvals plus estimates of other uses below the regulatory threshold requiring approval, SRBC estimates current maximum use potential in the Basin to be 882.5 million gpd. Projected maximum consumptive use in the Basin for gas drilling, calculated by SRBC based on twice the drilling rate in the Barnett Shale play in Texas, is about 28 million gpd as an annual average.[37]

2.3.7.3 Great Lakes-St. Lawrence River Basin

In New York, the Great Lakes-St. Lawrence River Basin is the watershed of the Great Lakes and St. Lawrence River, upstream from Trois Rivieres, Quebec, and includes all or parts of 34 counties, including the Lake Champlain and Finger Lakes sub-watersheds. Approximately 80 percent of New York's fresh surface water, over 700 miles of shoreline, and almost 50% of New York's lands are contained in the drainage basins of Lake Ontario, Lake Erie, and the St. Lawrence River. Jurisdictional authorities in the Great Lakes-St. Lawrence River Basin, in addition to the Department, include the Great Lakes Commission, the Great Lakes Fishery Commission, the International Joint Commission, the Great Lakes-St. Lawrence River Water Resources Compact Council, and the Great Lakes-St. Lawrence Sustainable Water Resources Regional Body.

2.3.8 Water Resources Replenishment[38]

The ability of surface water and groundwater systems to support withdrawals for various purposes, including natural gas development, is based primarily on replenishment (recharge). The Northeast region typically receives ample precipitation that replenishes surface water (runoff and groundwater discharge) and groundwater (infiltration).

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[37] http://www.srbc.net/programs/projreviewmarcellustier3.htm.

[38] Alpha, 2009, p. 3-26.

The amount of water available to replenish groundwater and surface water depends on several factors and varies seasonally. A "water balance" is a common, accepted method used to describe when the conditions allow groundwater and surface water replenishment and to evaluate the amount of withdrawal that can be sustained. The primary factors included in a water balance are precipitation, temperature, vegetation, evaporation, transpiration, soil type, and slope.

Groundwater recharge (replenishment) occurs when the amount of precipitation exceeds the losses due to evapotranspiration (evaporation and transpiration by plants) and water retained by soil moisture. Typically, losses due to evapotranspiration are large in the growing season and consequently, less groundwater recharge occurs during this time. Groundwater also is recharged by losses from streams, lakes, and rivers, either naturally (in influent stream conditions) or induced by pumping. The amount of groundwater available from a well and the associated aquifer is typically determined by performing a pumping test to determine the safe yield, which is the amount of groundwater that can be withdrawn for an extended period without depleting the aquifer. Non-continuous withdrawal provides opportunities for water resources to recover during periods of non-pumping.

Surface water replenishment occurs directly from precipitation, from surface runoff, and by groundwater discharge to surface water bodies. Surface runoff occurs when the amount of precipitation exceeds infiltration and evapotranspiration rates. Surface water runoff typically is greater during the non-growing season when there is little or no evapotranspiration, or where soil permeability is relatively low.

Short-term variations in precipitation may result in droughts and floods which affect the amount of water available for groundwater and surface water replenishment. Droughts of significant duration reduce the amount of surface water and groundwater available for withdrawal. Periods of drought may result in reduced stream flow, lowered lake levels, and reduced groundwater levels until normal precipitation patterns return.

Floods may occur from short or long periods of above-normal precipitation and rapid snow melt. Flooding results in increased flow in streams and rivers and may increase levels in lakes and reservoirs. Periods of above-normal precipitation that may cause flooding also may result in increased groundwater levels and greater availability of groundwater. The duration of floods typically is relatively short compared to periods of drought.

The SRBC and DRBC have established evaluation processes and mitigation measures to ensure adequate replenishment of water resources. The evaluation processes for proposed withdrawals address recharge potential and low-flow conditions. Examples of the mitigation measures utilized by the SRBC include:

- Replacement – release of storage or use of a temporary source;
- Discontinue – specific to low-flow periods;
- Conservation releases;
- Payments; and
- Alternatives – proposed by applicant.

Operational conditions and mitigation requirements establish passby criteria and withdrawal limits during low-flow conditions. A passby flow is a prescribed quantity of flow that must be allowed to pass an intake when withdrawal is occurring. Passby requirements also specify low-flow conditions during which no water can be withdrawn.

2.3.9 Floodplains

Floodplains are low-lying lands next to rivers and streams. When left in a natural state, floodplain systems store and dissipate floods without adverse impacts on humans, buildings, roads or other infrastructure. Floodplains can be viewed as a type of natural infrastructure that can provide a safety zone between people and the damaging waters of a flood. Changes to the landscape outside of floodplain boundaries, like urbanization and other increases in the area of impervious surfaces in a watershed, may increase the size of floodplains. Floodplain information is found on Flood Insurance Rate Maps (FIRMs) produced by the Federal Emergency Management Agency (FEMA). These maps are organized on either a county, town, city or village basis and are available through the FEMA Map Service Center.[39] They may also be viewed at local government facilities, the Department, and county and regional planning offices.

A floodplain development permit issued by a local government (town, city or village) must be obtained before commencing any floodplain development activity. This permit must comply with a local floodplain development law (often named Flood Damage Prevention Laws), designed to ensure that development will not incur flood damages or cause additional off-site flood damages. These local laws, which qualify communities for participation in the National Flood Insurance Program (NFIP), require that any development in mapped, flood hazard areas be built to certain standards, identified in the NFIP regulations (44 CFR 60.3) and the Building Code of New York State and the Residential Code of New York State. Floodplain development is defined to mean any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures (including gas and liquid storage tanks), mining, dredging, filling, paving, excavation or drilling operations, or storage of equipment or materials. Virtually all communities in New York with identified flood hazard areas participate in the NFIP.

The area that would be inundated by a 100-year flood (also thought of as an area that has a one percent or greater chance of experiencing a flood in any single year) is designated as a Special Flood Hazard Area. The 100-year flood is also known as the *base flood*, and the elevation that the base flood reaches is known as the base flood elevation (BFE). The BFE is the basic standard for floodplain development, used to determine the required elevation of the lowest floor of any new or substantially improved structure. For streams where detailed hydraulic studies have identified the BFE, the 100-year floodplain has been divided into two zones, the floodway and the floodway fringe. The floodway is that area that must be kept open to convey flood waters downstream. The floodway fringe is that area that can be developed in accordance with FEMA standards as adopted in local law. The floodway is shown either on the community's FIRM or on a separate “Flood Boundary and Floodway” map or maps published before about 1988. Flood Damage Prevention Laws differentiate between more hazardous floodways and other areas inundated by flood water. In particular for floodways, no encroachment can be permitted unless

[39] http://msc.fema.gov.

there is an engineering analysis that proves that the proposed development does not increase the BFE by any measurable amount at any location.

Each participating community in the State has a designated floodplain administrator. This is usually the building inspector or code enforcement official. If development is being considered for a flood hazard area, then the local floodplain administrator reviews the development to ensure that construction standards have been met before issuing a floodplain development permit.

2.3.9.1 Analysis of Recent Flood Events[40]

The Susquehanna and Delaware River Basins in New York are vulnerable to frequent, localized flash floods every year. These flash floods usually affect the small tributaries and can occur with little advance warning. Larger floods in some of the main stem reaches of these same river-basins also have been occurring more frequently. For example, the Delaware River in Delaware and Sullivan Counties experienced major flooding along the main stem and in its tributaries during more than one event from September 2004 through June 2006 (Schopp and Firda, 2008). Significant flooding also occurred along the Susquehanna River during this same time period.

The increased frequency and magnitude of flooding has raised a concern for unconventional gas drilling in the floodplains of these rivers and tributaries, and the recent flooding has identified concerns regarding the reliability of the existing FEMA FIRMs that depict areas that are prone to flooding with a defined probability or recurrence interval. The concern focused on the Susquehanna and Delaware Rivers and associated tributaries in Steuben, Chemung, Tioga, Broome, Chenango, Otsego, Delaware and Sullivan Counties, New York.

2.3.9.2 Flood Zone Mapping[41]

Flood zones are geographic areas that FEMA has defined according to varying levels of flood risk. These zones are depicted on a community's FIRM. Each zone reflects the severity or type of flooding in the area and the level of detailed analysis used to evaluate the flood zone.

[40] Alpha, 2009, p. 3-30.

[41] Alpha, 2009, p. 3-30.

Appendix 1 Alpha's Table 3.4 – FIRM Maps summarizes the availability of FIRMs for New York State as of July 23, 2009 (FEMA, 2009a). FIRMs are available for all communities in Broome, Delaware, and Sullivan Counties. The effective date of each FIRM is included in Appendix 1. As shown, many of the communities in New York use FIRMs with effective dates prior to the recent flood events. Natural and anthropogenic changes in stream morphology (e.g., channelization) and land use/land cover (e.g., deforestation due to fires or development) can affect the frequency and extent of flooding. For these reasons, FIRMs are updated periodically to reflect current information. Updating FIRMs and incorporation of recent flood data can take two to three years (FEMA, 2009b).

While the FIRMs are legal documents that depict flood-prone areas, the most up-to-date information on extent of recent flooding is most likely found at local or county-wide planning or emergency response departments (DRBC, 2009). Many of the areas within the Delaware and Susquehanna River Basins that were affected by the recent flooding of 2004 and 2006 lie outside the flood zones noted on the FIRMs (SRBC, 2009; DRBC, 2009; Delaware County 2009). Flood damage that occurs outside the flood zones often is related to inadequate maintenance or sizing of storm drain systems and is unrelated to streams. Mapping the areas affected by recent flooding in the Susquehanna River Basin currently is underway and is scheduled to be published in late 2012 (SRBC, 2011). Updated FIRMs are being prepared for communities in Delaware County affected by recent flooding and are expected to be released in late 2012 (Delaware County, 2011).

According to the DOW, preliminary county-wide FIRMs have been completed and adopted by Sullivan County. County-wide FIRMs for Broome and Delaware Counties are scheduled to be completed in late 2012.

2.3.9.3 Seasonal Analysis[42]

The historic and recent flooding events do not show a seasonal trend. Flooding in Delaware County, which resulted in Presidential declarations of disaster and emergency between 1996 and 2006, occurred during the following months: January 1996, November 1996, July 1998, August 2003, October 2004, August 2004 and April 2005 (Tetra Tech, 2005). The Delaware River and many of its tributaries in Delaware and Sullivan Counties experienced major flooding that caused

[42] Alpha, 2009, p. 3-31.

extensive damage from September 2004 to June 2006 (Schopp and Firda, 2008). These data show that flooding is not limited to any particular season and may occur at any time during the year.

2.3.10 Freshwater Wetlands

Freshwater wetlands are lands and submerged lands, commonly called marshes, swamps, sloughs, bogs, and flats, supporting aquatic or semi-aquatic vegetation. These ecological areas are valuable resources, necessary for flood control, surface and groundwater protection, wildlife habitat, open space, and water resources. Freshwater wetlands also provide opportunities for recreation, education and research, and aesthetic appreciation. Adjacent areas may share some of these values and, in addition, provide a valuable buffer for the wetlands.

The Department has classified regulated freshwater wetlands according to their respective functions, values and benefits. Wetlands may be Class I, II, III or IV. Class I wetlands are the most valuable and are subject to the most stringent standards.

The Freshwater Wetlands Act (FWA), Article 24 of the ECL, provides the Department and the Adirondack Park Agency (APA) with the authority to regulate freshwater wetlands in the State. The NYS Legislature passed the Freshwater Wetlands Act in 1975 in response to uncontrolled losses of wetlands and problems resulting from those losses, such as increased flooding. The FWA protects wetlands larger than 12.4 acres (5 hectares) in size, and certain smaller wetlands of unusual local importance. In the Adirondack Park, the APA regulates wetlands, including wetlands above one acre in size, or smaller wetlands if they have free interchange of flow with any surface water. The law requires the Department and APA to map those wetlands that are protected by the FWA. In addition, the law requires the Department and APA to classify wetlands. Inside the Adirondack Park, wetlands are classified according to their vegetation cover type. Outside the Park, the Department classifies wetlands according to 6 NYCRR Part 664, Wetlands Mapping and Classification.[43] Around every regulated wetland is a regulated adjacent area of 100 feet, which serves as a buffer area for the wetland.

FWA's main provisions seek to regulate those uses that would have an adverse impact on wetlands, such as filling or draining. Other activities are specifically exempt from regulation,

[43] 6 NYCRR 664 - http://www.dec.ny.gov/regs/4612.html.

such as cutting firewood, continuing ongoing activities, certain agricultural activities, and most recreational activities like hunting and fishing. In order to obtain an FWA permit, a project must meet the permit standards in 6 NYCRR Part 663, Freshwater Wetlands Permit Requirement Regulations.[44] Intended to prevent despoliation and destruction of freshwater wetlands, these regulations were designed to:

- preserve, protect, and enhance the present and potential values of wetlands;
- protect the public health and welfare; and
- be consistent with the reasonable economic and social development of the State.

2.3.11 Socioeconomic Conditions[45]

The Marcellus and Utica Shales are the most prominent shale formations in New York State. The prospective region for the extraction of natural gas from these formations generally extends from Chautauqua County eastward to Greene, Ulster, and Sullivan Counties, and from the Pennsylvania border north to the approximate location of the east-west portion of the New York State Thruway, between Schenectady and Auburn (Figure 2.3). This region covers all or parts of 30 counties. Fourteen counties are entirely within the area underlain by the Marcellus and Utica Shales, and 16 counties are partially within the area.

Due to the broad extent of the prospective region for the extraction of natural gas from the Marcellus and Utica Shales, the socioeconomic analysis in the SGEIS focuses on representative regional and local areas of New York State where natural gas extraction may occur, and also provides a statewide analysis. The three regions were selected to evaluate differences between areas with a high, moderate and low production potential; areas that have experienced gas development in the past and areas that have not experienced gas development in the past; and differences in land use patterns. The three representative regions and the respective counties within the region are:

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[44] 6 NYCRR 663 - http://www.dec.ny.gov/regs/4613.html.

[45] Subsection 2.4.11, in its entirety, was provided by Ecology and Environment Engineering, P.C., August 2011 and was adapted by the Department.

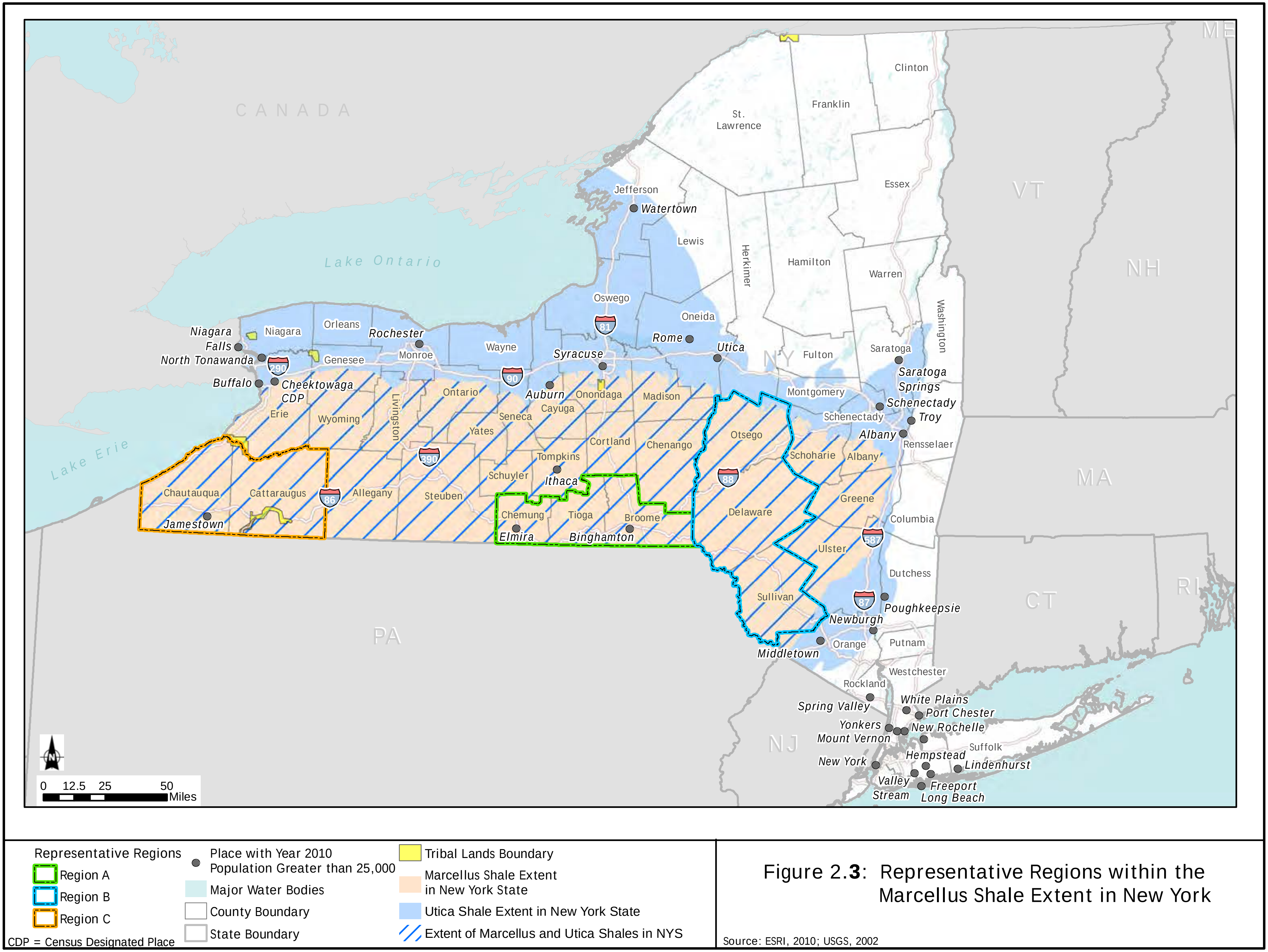

Figure 2.3: Representative Regions within the Marcellus Shale Extent in New York

Source: ESRI, 2010; USGS, 2002

- Region A: Broome County, Chemung County, and Tioga County (Figure 2.4a);
- Region B: Delaware County, Otsego County, and Sullivan County (Figure 2.4b); and
- Region C: Cattaraugus County and Chautauqua County (Figure 2.4c);

Region A is defined as a high-potential production area. Wells in Broome, Chemung, and Tioga Counties are expected to yield some of the highest production of shale gas, based on the geology, thermal maturity of the organic matter, and other geochemical factors of the Marcellus and Utica Shale formations. Due to the proximity to active gas drilling in these counties, and neighboring counties in Pennsylvania, the associated infrastructure (pipelines) has already been developed. With the associated infrastructure in place, developers are expected to begin development of wells in this area if development in New York State is approved. Region A encompasses urban/suburban land uses associated with the larger cities of Binghamton and Elmira, as well as rural settings. In addition, conventional natural gas development has occurred in this area.

Region B is defined as an average-potential production area. High-volume hydraulic-fracturing is expected to occur in portions of Delaware, Otsego, and Sullivan Counties, but the production of shale gas is not anticipated to reach the levels expected in Region A. Region B is largely rural and encompasses part of the Catskill Mountains. Development in this region would be limited by the exclusion of drilling from the New York City watershed and state-owned lands (e.g., the Forest Preserve) in the Catskill Mountains. To date, only exploratory natural gas well development has occurred in this region.

Region C is defined as a low-potential production area. Although Chautauqua and Cattaraugus Counties are within the footprints of both the Utica and Marcellus Shales, they are outside of the fairways for both shales; thus, horizontal wells in this region would not be expected to yield enough gas to be economically feasible. However, thousands of vertical gas wells exist in conventional formations, and additional vertical wells would likely be constructed. If the price of gas increases or drilling technology advances, gas production in the Utica or other formations in this region may become more feasible. Region C is largely rural, and conventional natural gas development has been occurring in this area for many years.