

# Public Health Issues Related to Gas Well Drilling in Broome County

Presented by the Broome County Health Department  
Division of Environmental Health Services



# Gas Well Drilling

- Gas well drilling has been conducted in New York State since 1821.
- First gas well in Broome County dates to 1880.
- Several rock units have been targeted.
- New drilling techniques have generated greater interest in the Marcellus Formation.

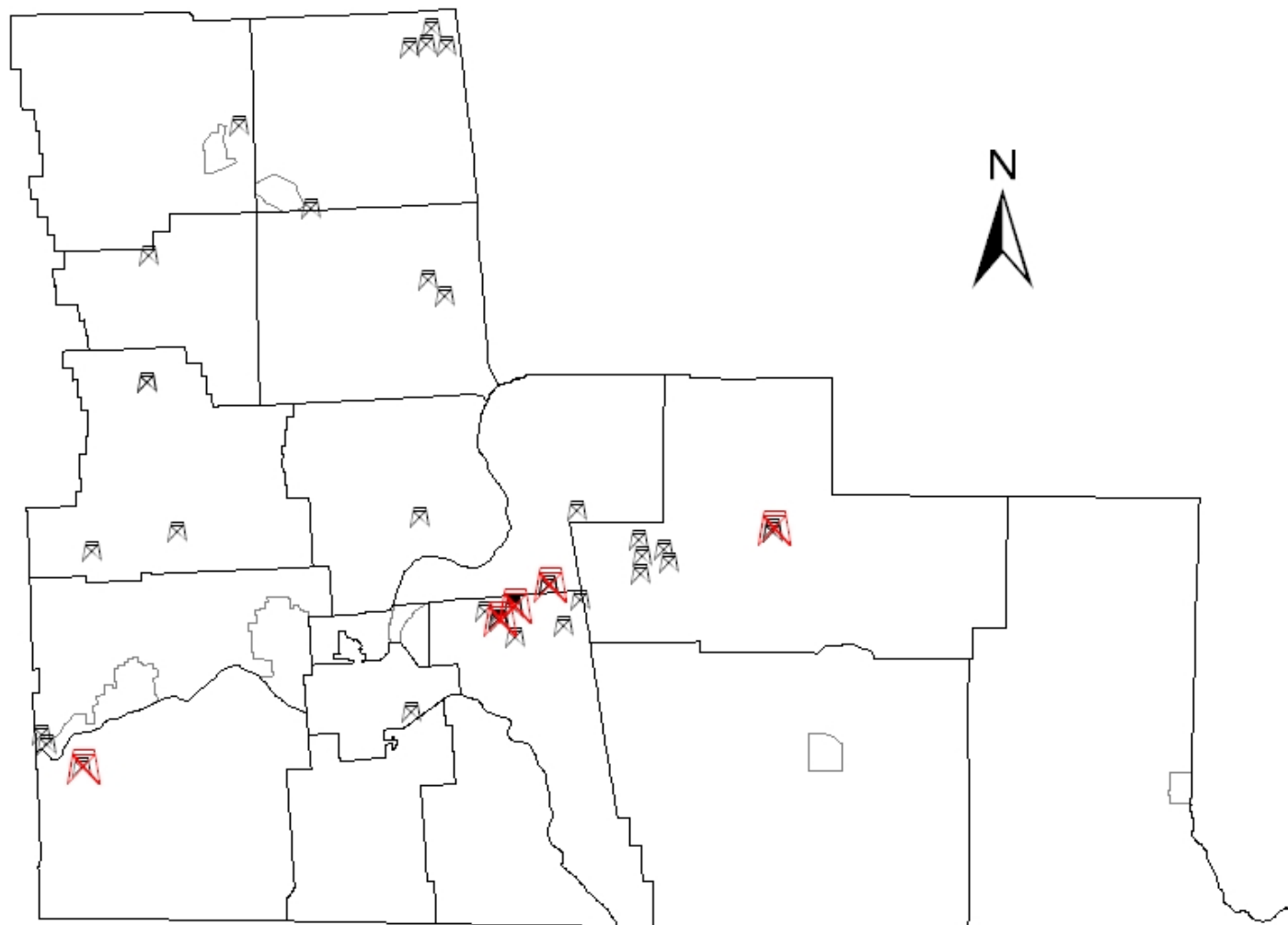


# Gas Well Drilling

- 42 permits have been issued in Broome County.
- 6 permits have been for directional or horizontal drilling (Black River Formation).
- 13 permits have been issued since 2003 – two for vertical wells in the Marcellus Formation.



# Gas Wells in Broome County



# Marcellus Shale

- Black shale formed by sediments deposited in oxygen-starved deep sea valley approximately 390 million years ago.
- Lack of oxygen preserved organic material resulting in ~11% organic content.
- Rock units above and below trap the gas produced by the thermal/pressure conversion of organic material.

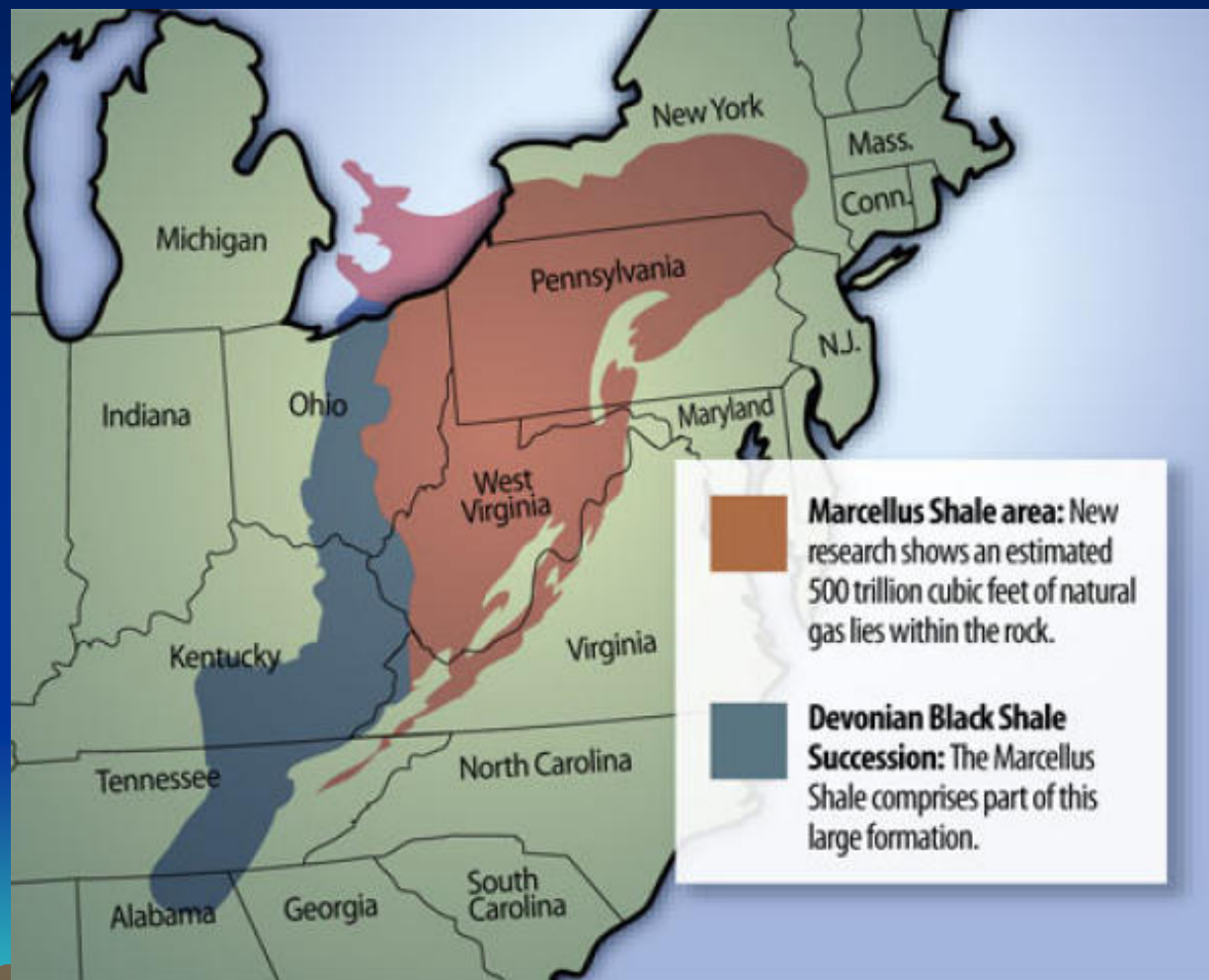


# Marcellus Shale

- Marcellus shale approximately 3000 to 4000 feet below ground level in Broome County.
- Some estimates are 500 trillion cubic feet of natural gas in entire formation with 50 trillion cubic feet of recoverable gas (about 2 years of U.S. consumption) worth one trillion dollars.



# Marcellus Shale Extent



# Marcellus Shale Profile

System	Western Pennsylvania	Northwestern New York	
Middle Devonian	Harrell Shale	Genesee Fm.	
	Tully Limestone	Tully Limestone	
	Mahantango Formation	Moscow Shale	Hamilton Group
		Ludlowville Shale	
		Skaneateles Shale	
	Marcellus Shale	Marcellus Shale Tioga ✓ bentonite	
Selinsgrove Limestone	Onondaga Limestone		
Lower Dev.	Needmore Shale	Bois Blanc Fm.	



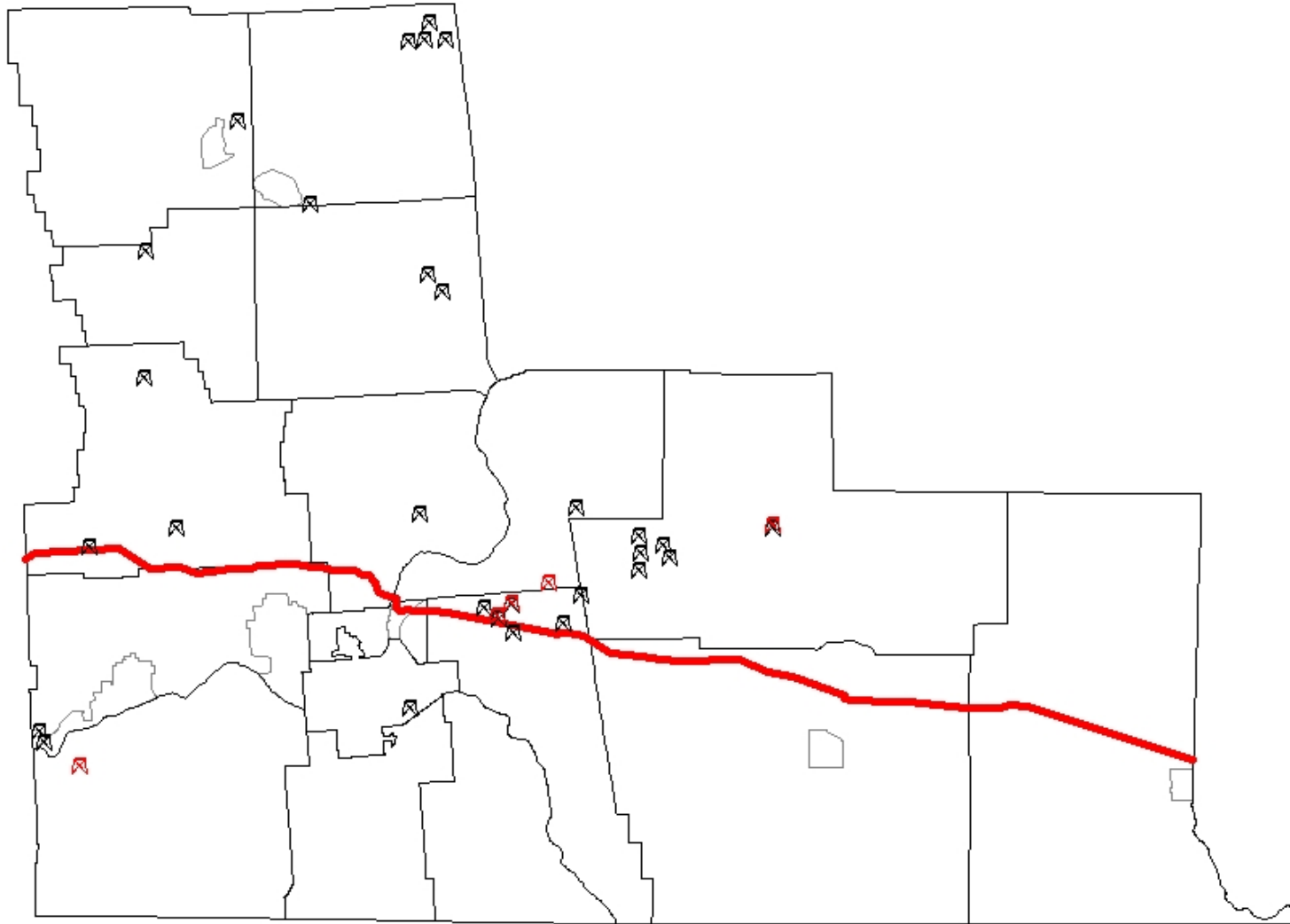


# Why the Interest in the Marcellus Shale Now?

- Recent enhancements to gas well development technology, specifically horizontal drilling and hydraulic fracturing.
- The proximity of high natural gas demand markets in New York, New Jersey and New England.
- The construction of the Millennium Pipeline through the Southern Tier.



# Millennium Pipeline in Broome County



# What Is Horizontal Drilling?

- A "horizontal well" is first drilled down vertically to a depth above the target gas-bearing rock formation.
- Special tools are then used to curve the well so that the hole is drilled horizontally within the gas-bearing rock for up to several thousand feet.
- Except for special tools used underground, horizontal drilling is performed using the same equipment and technology as vertical drilling, with the same protocols in place for aquifer protection, fluid containment and waste handling.



# Benefits of Horizontal Drilling

- Maximum contact with the gas-bearing rock formation, so that more gas can be produced from a single well.
- Multiple horizontal wells can be drilled laterally from the same surface location, so that less of the ground surface is disturbed compared to using vertical wells to produce the same amount of gas.

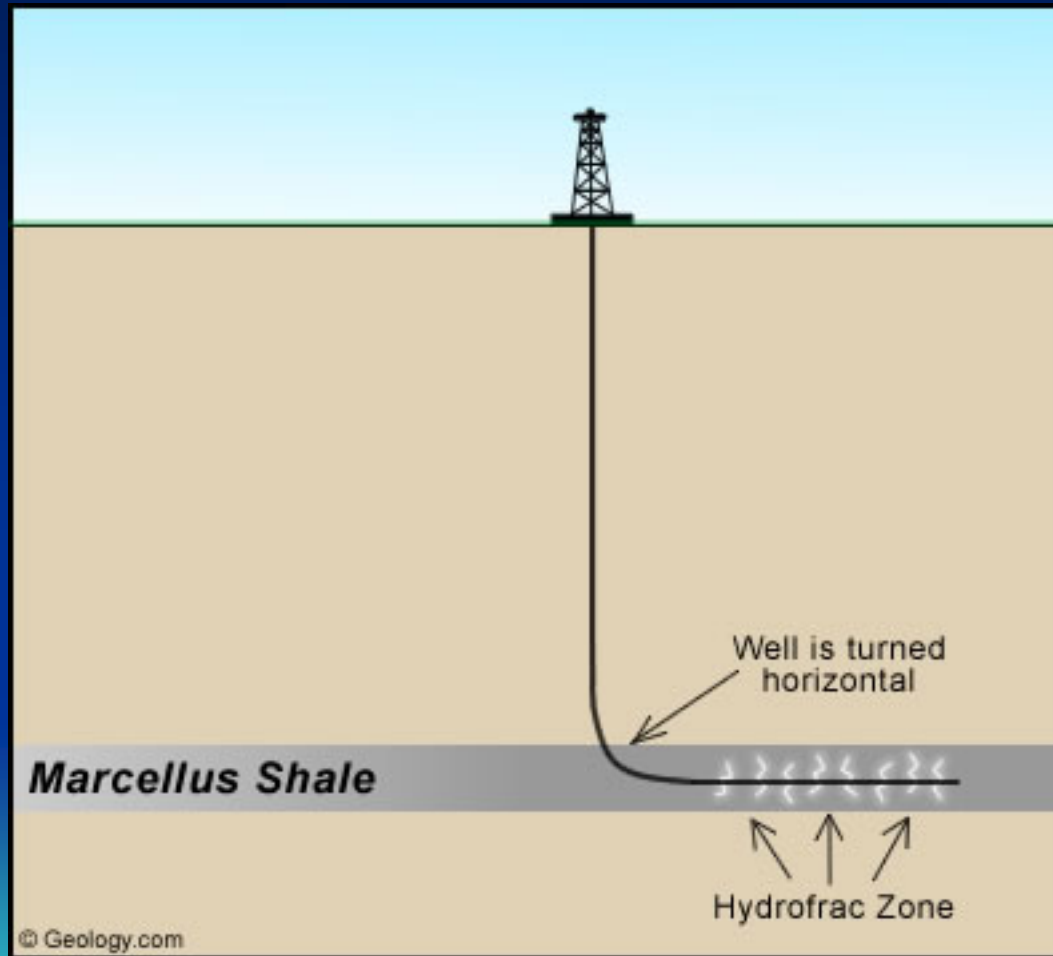


# What is Hydraulic Fracturing?

- Consists of pumping a fluid and a propping material such as sand down the well under high pressure to create fractures in the gas-bearing rock.
- The propping material (usually referred to as a "proppant") holds the fractures open, allowing more gas to flow into the well than would naturally.
- NYSDEC has no record of contamination despite use of this technique for 50+ years.



# Typical Marcellus Shale Gas Well



# Who Regulates Gas Well Drilling?

- NYSDEC Division of Mineral Resources Bureau of Oil and Gas Regulation issues the permits, inspects gas well operations and enforces the regulations.
- Regulations are promulgated by Environmental Conservation Law Article 23 which gives NYSDEC sole oversight of gas well drilling.



# ECL Article 23

- Provides that the DEC's Oil, Gas and Solution Mining Law supersedes all local laws except for local jurisdiction over roads and the right to collect real property taxes.
- It also provides for supercedure over local laws enacted to impose fees on gas well drilling.





# Regulations

- Rules and Regulations for Oil, Gas and Solution Mining - 6 NYCRR Parts 550 – 559.
- State Environmental Quality Review Act (SEQRA).
- Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program (GEIS).



# Generic Environmental Impact Statement

- Finalized in 1992.
- Assesses the environmental impacts of separate actions having common or generic impacts.
- Sets parameters and conditions that are applicable statewide for SEQRA review of gas well permitting.
- When conditions are met, SEQRA is satisfied and a Negative or Positive Determination is not required.



# Generic Environmental Impact Statement Conditions

- Well Spacing
  - For shale formations, formerly 40 acres +/- 10% with 660 foot setback.
  - In 2008, shale formation spacing increased to 640 acres +/- 10% with 330 foot setback. Entire unit must be drilled.
  - Compulsory Integration



# Generic Environmental Impact Statement Conditions

- Siting of Oil and Gas Wells – the DEC must review, among other items, if a gas well and access road are:
  - Within 2,640 feet of a municipal water well
  - Over a Primary or Principal Aquifer
  - In an Agricultural District
  - Within a drinking water watershed
- Any of these conditions trigger further review by the NYSDEC.

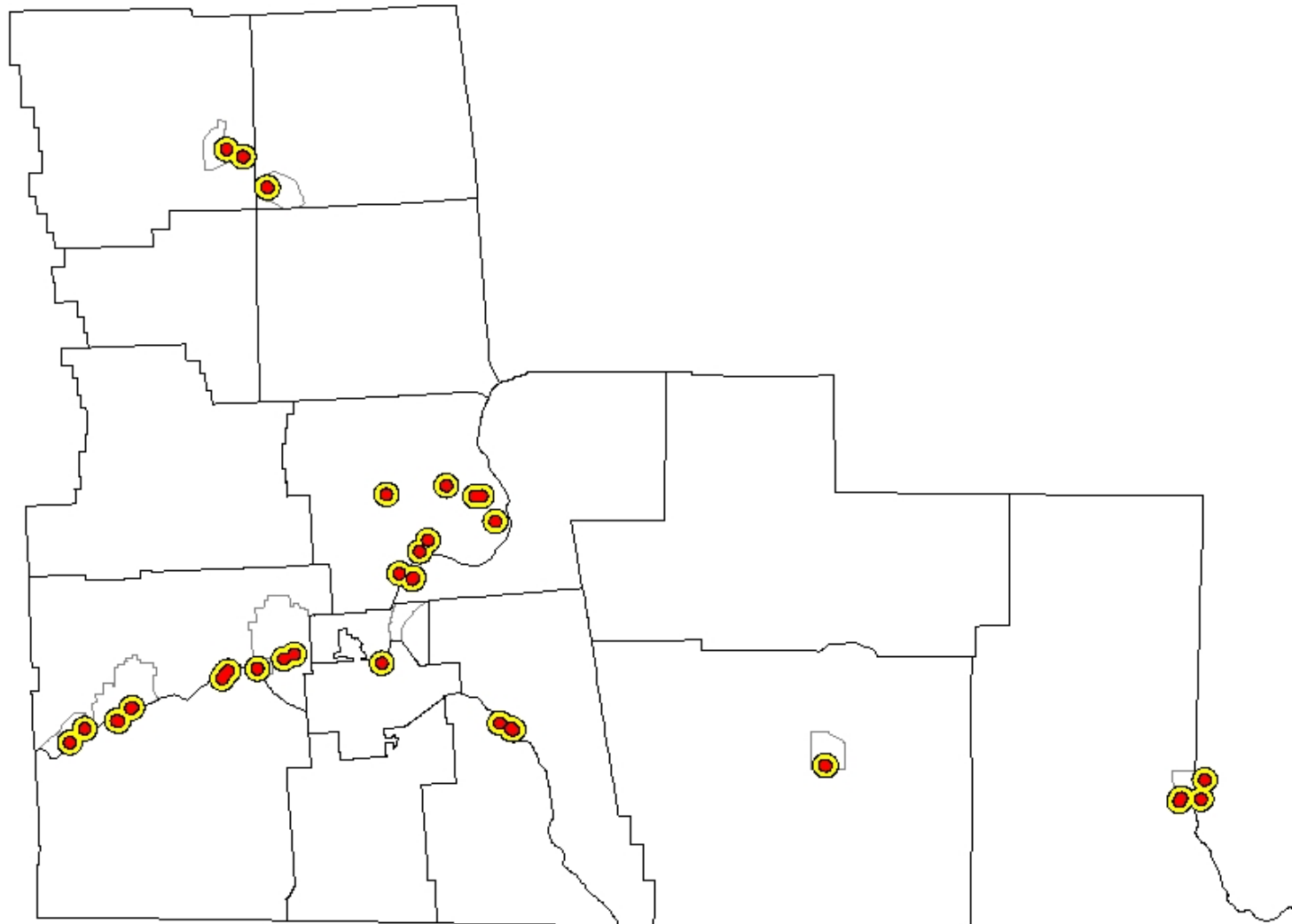


# Water Quality

- Surface Water – a gas well cannot be sited closer than 50 feet to a surface water body.
- Municipal Water Wells
  - A gas well sited greater than 2000 feet from a municipal water well – no action required.
  - A gas well sited between 1000 and 2000 feet from a municipal water well – SEQRA Type 1 action – may require a Site Specific EIS
  - A gas well sited within 1000 feet of a municipal water well – Site Specific EIS required.



# Municipal Water Wells and Buffer Zones in Broome County



# Water Quality

- Aquifers
  - An aquifer is an underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt or clay) from which ground water can be usefully extracted using a water well or spring.
  - Three types of designated aquifers in Broome County
    - Primary
    - Principal
    - Sole Source



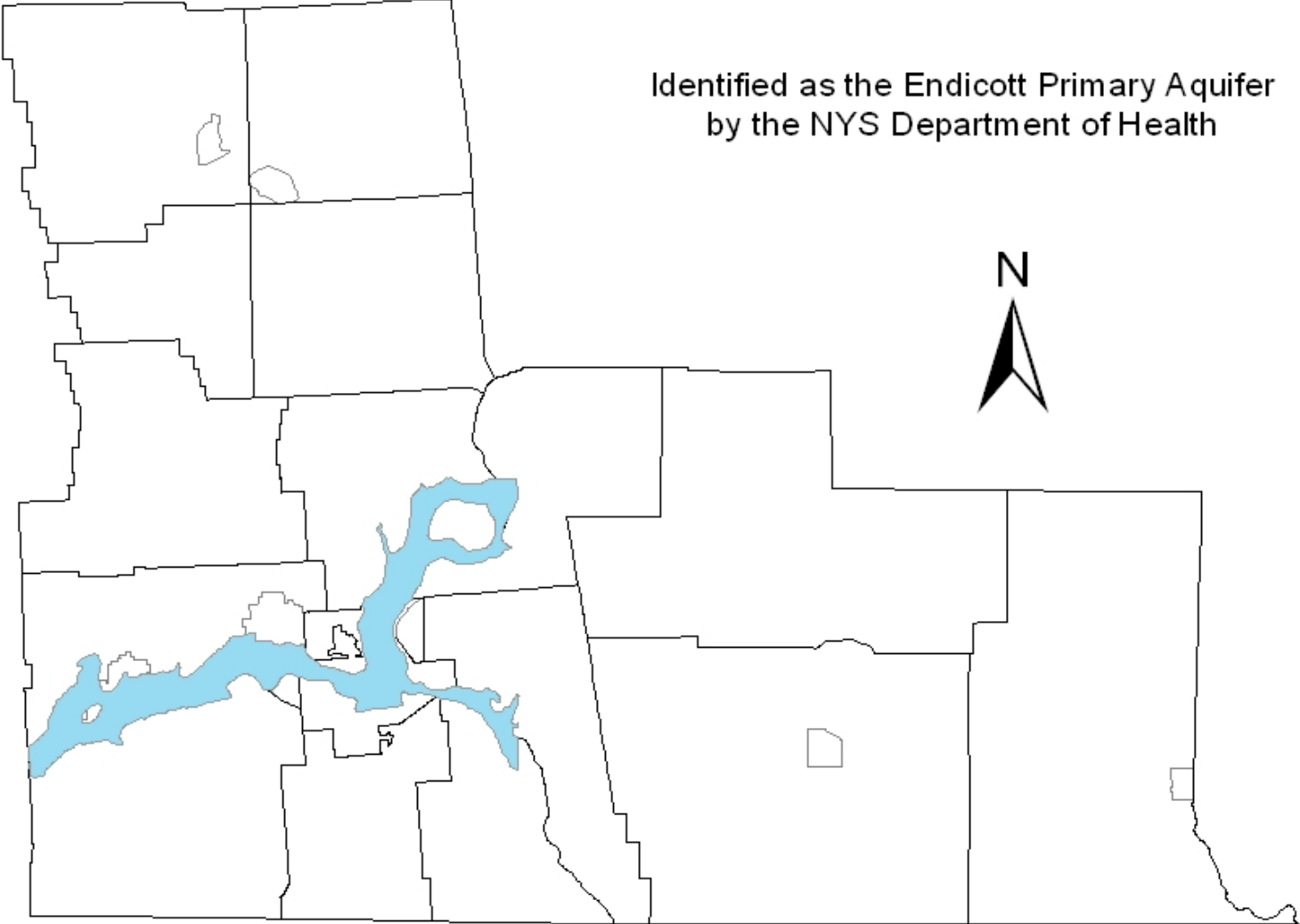
# Primary Aquifers

- Eighteen Primary water supply aquifers were identified by the New York State Department of Health in 1980 across New York State.
- Primary aquifers are defined as highly productive aquifers presently utilized by major municipal water systems.
- The Primary aquifer in Broome County is identified as the Endicott Primary Aquifer.





# Primary Aquifer in Broome County

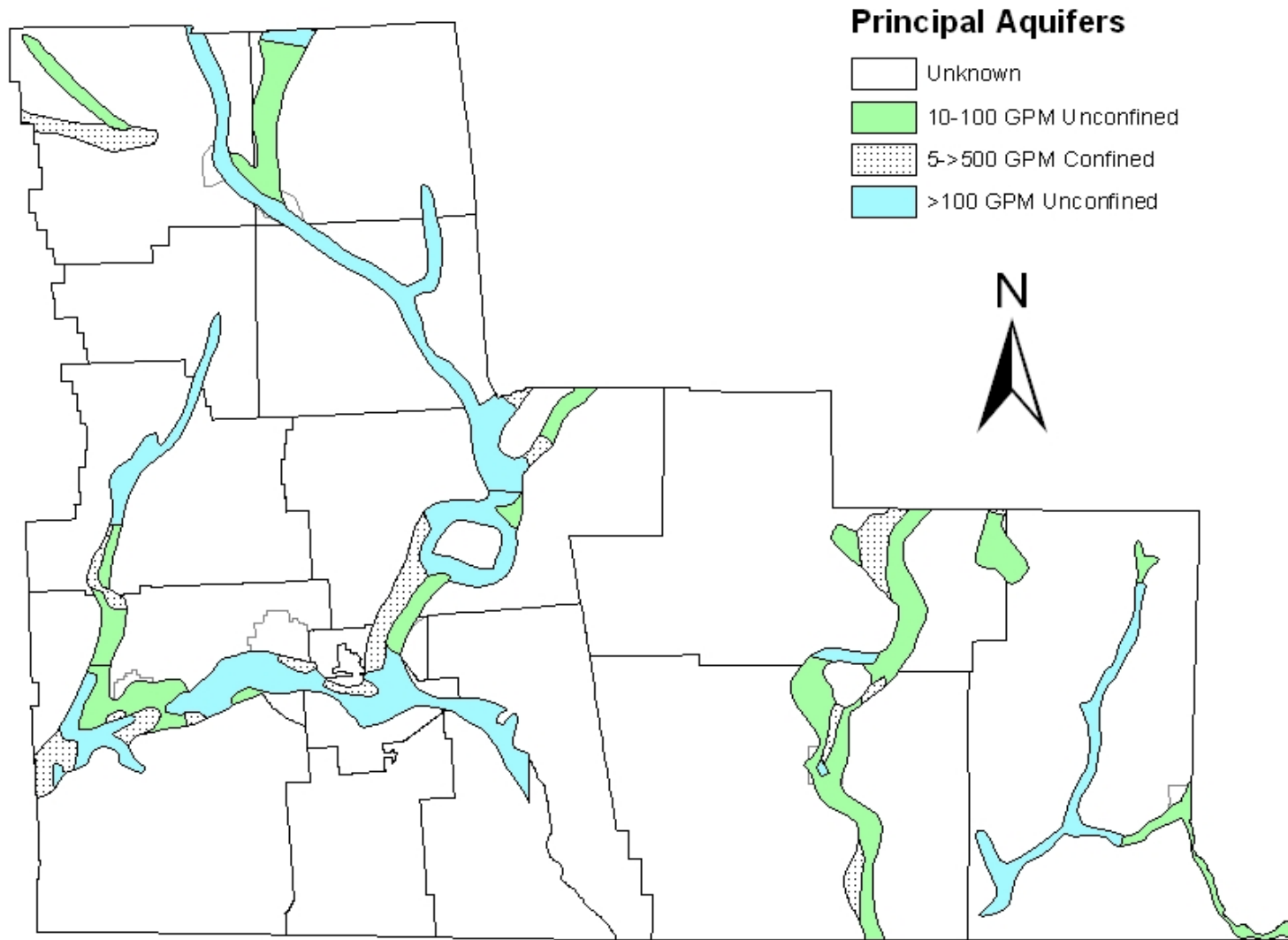


# Principal Aquifers

- Aquifers known to be highly productive or whose geology suggests abundant water but which are not intensively used as major municipal sources at the present time.



# Principal Aquifers in Broome County

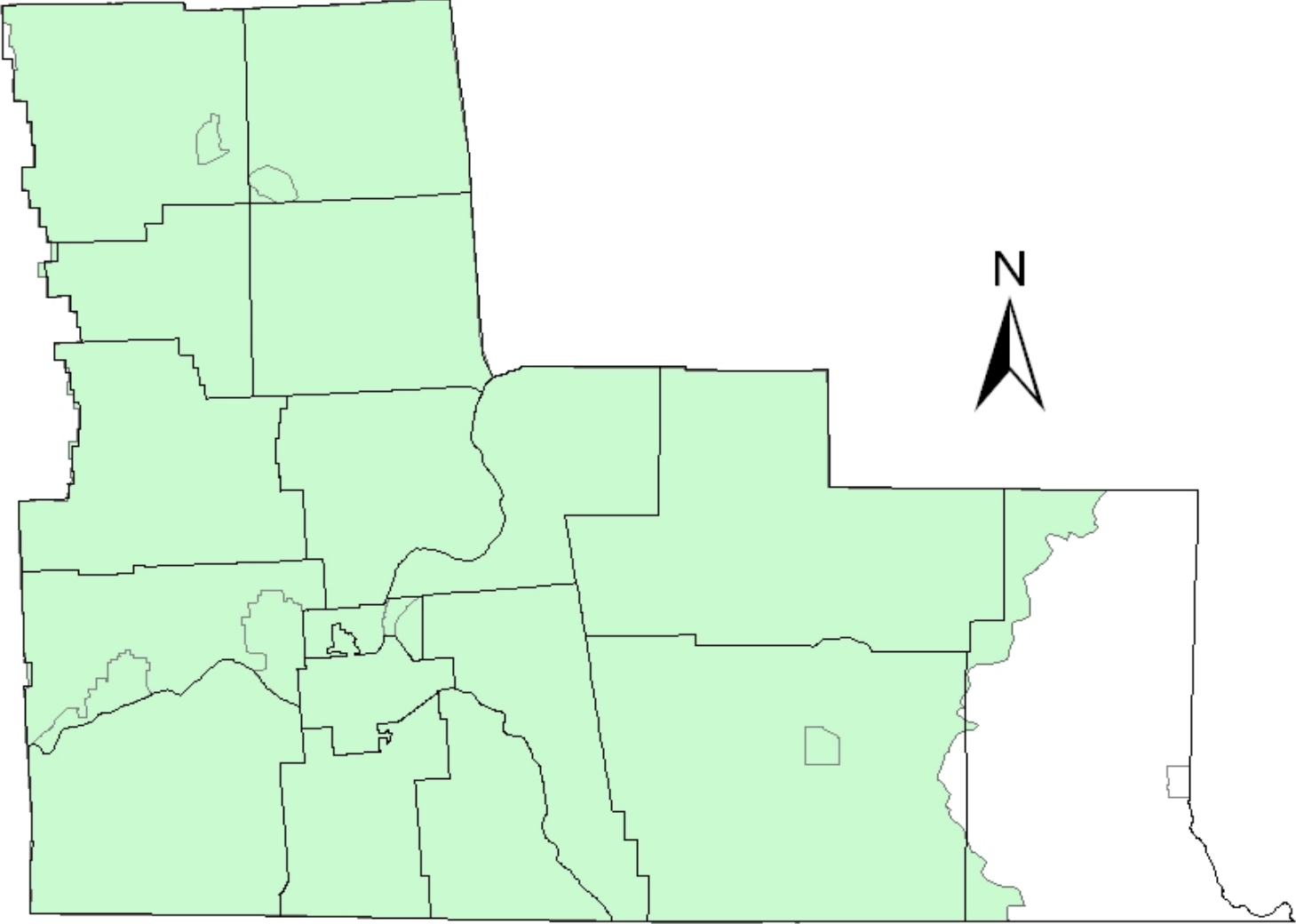


# Sole Source Aquifers

- Designated by the USEPA as an aquifer which supplies at least 50% of the drinking water consumed in the area overlying the aquifer.
- Identified in Broome County in 1985 as the Clinton Street Ballpark Sole Source Aquifer.
- Designation impacts only federally funded projects in aquifer area.



# Sole Source Aquifer in Broome County



# Primary and Principal Aquifer Protection

- Gas well siting above a primary or principal aquifer triggers special permit conditions to enhance protection of the aquifer.
- These permit conditions called Fresh Water Aquifer Supplementary Permit Conditions involve casing and grouting enhancement, increased casing length and other conditions.

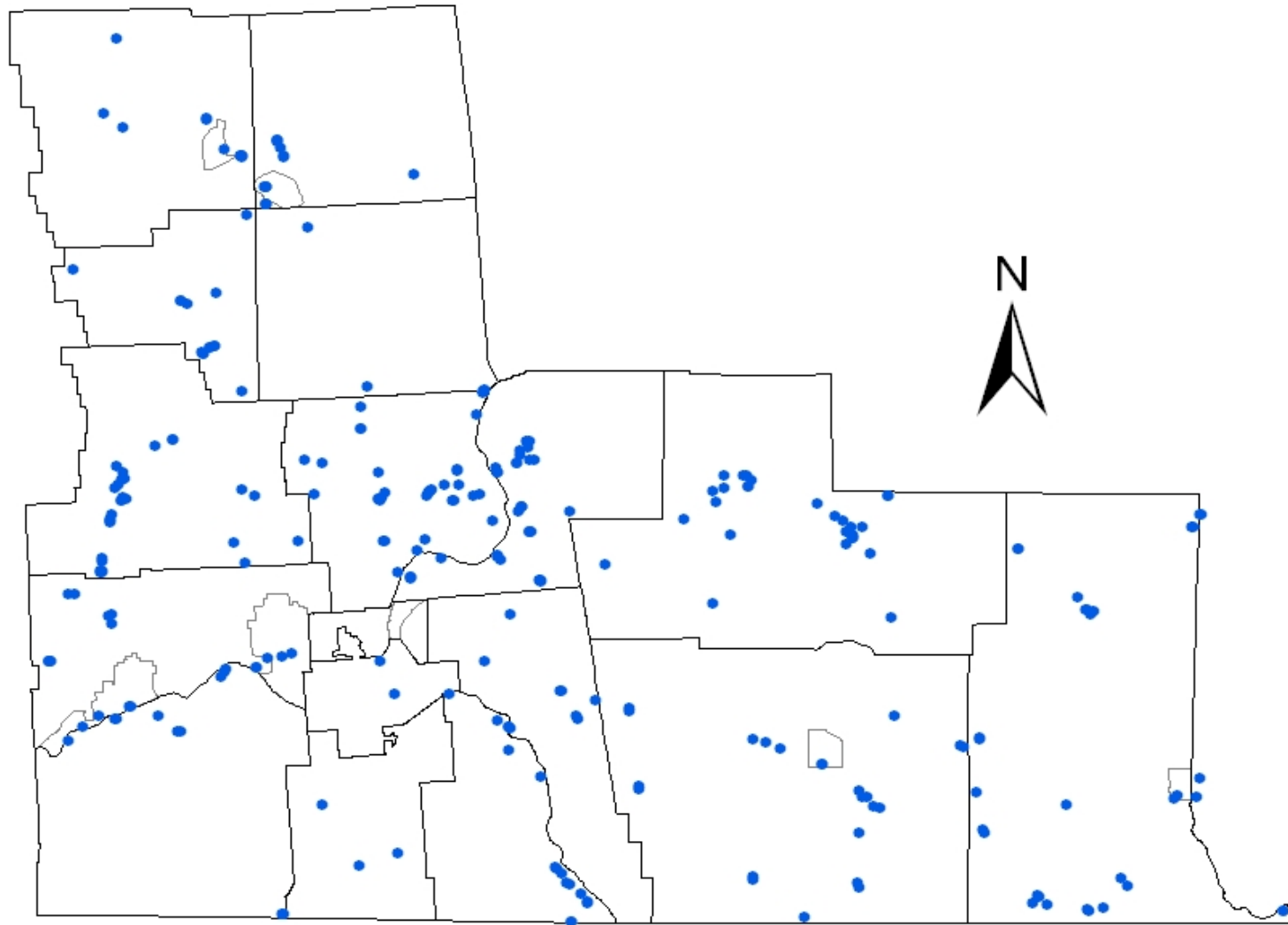


# Other Public (Community and Noncommunity) Water Supply Wells

- Public water supplies (PWS) are water systems that serve at least 25 people at least 60 days per year.
- There are approximately 300 PWS wells regulated by the Broome County Health Department.
- GEIS states public water supplies will be given “closer review” during the permitting process.



# Public Water Supply Wells in Broome County



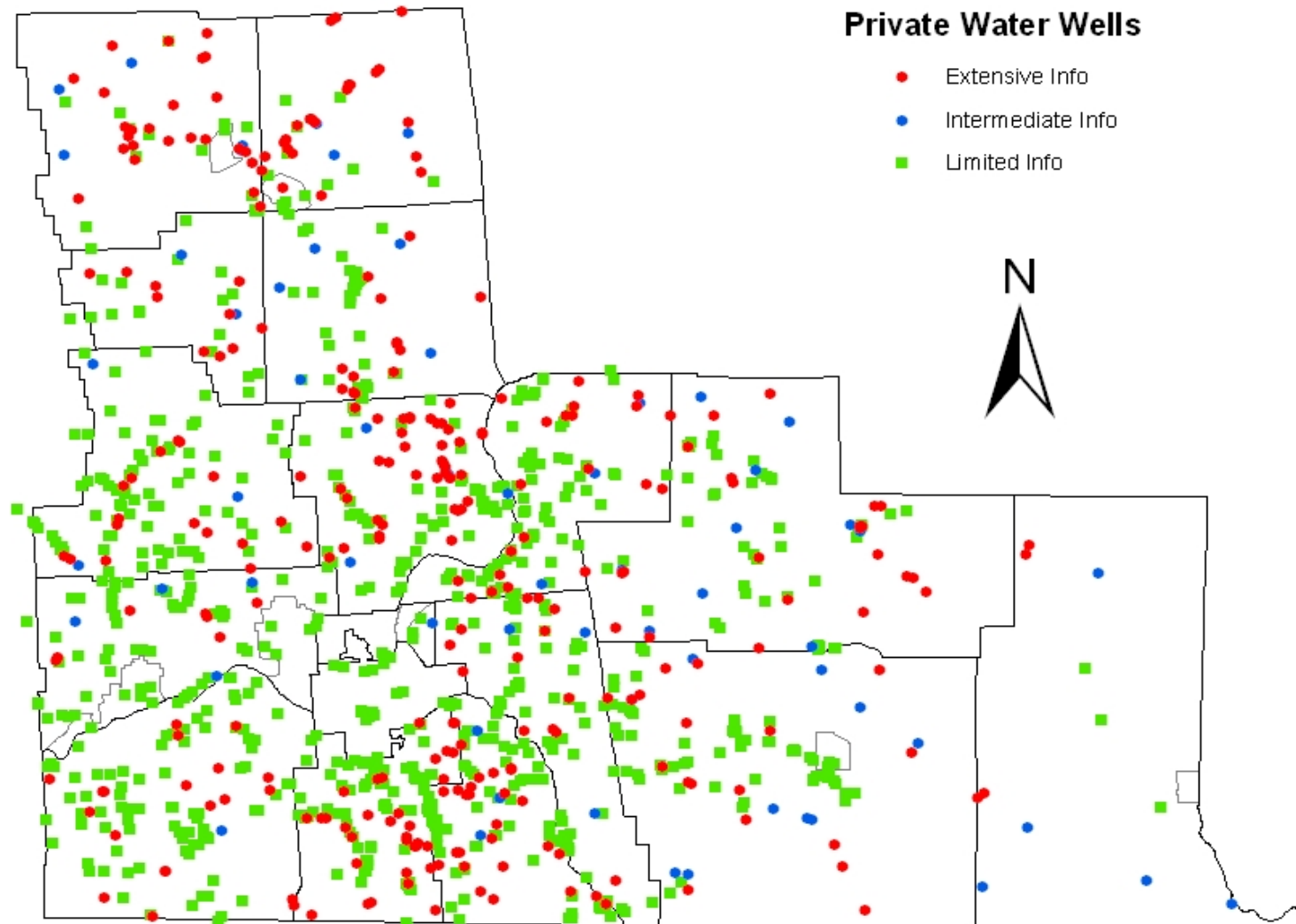


# Private Water Supply Wells

- Wells that supply water to rural residences and farms.
- There are approximately 19,000 private water supply wells in Broome County.
- These wells are not regulated by the Broome County Health Department.
- GEIS recommends a 150 foot gas well setback from a private water well.



# Select Private Water Supply Wells in Broome County

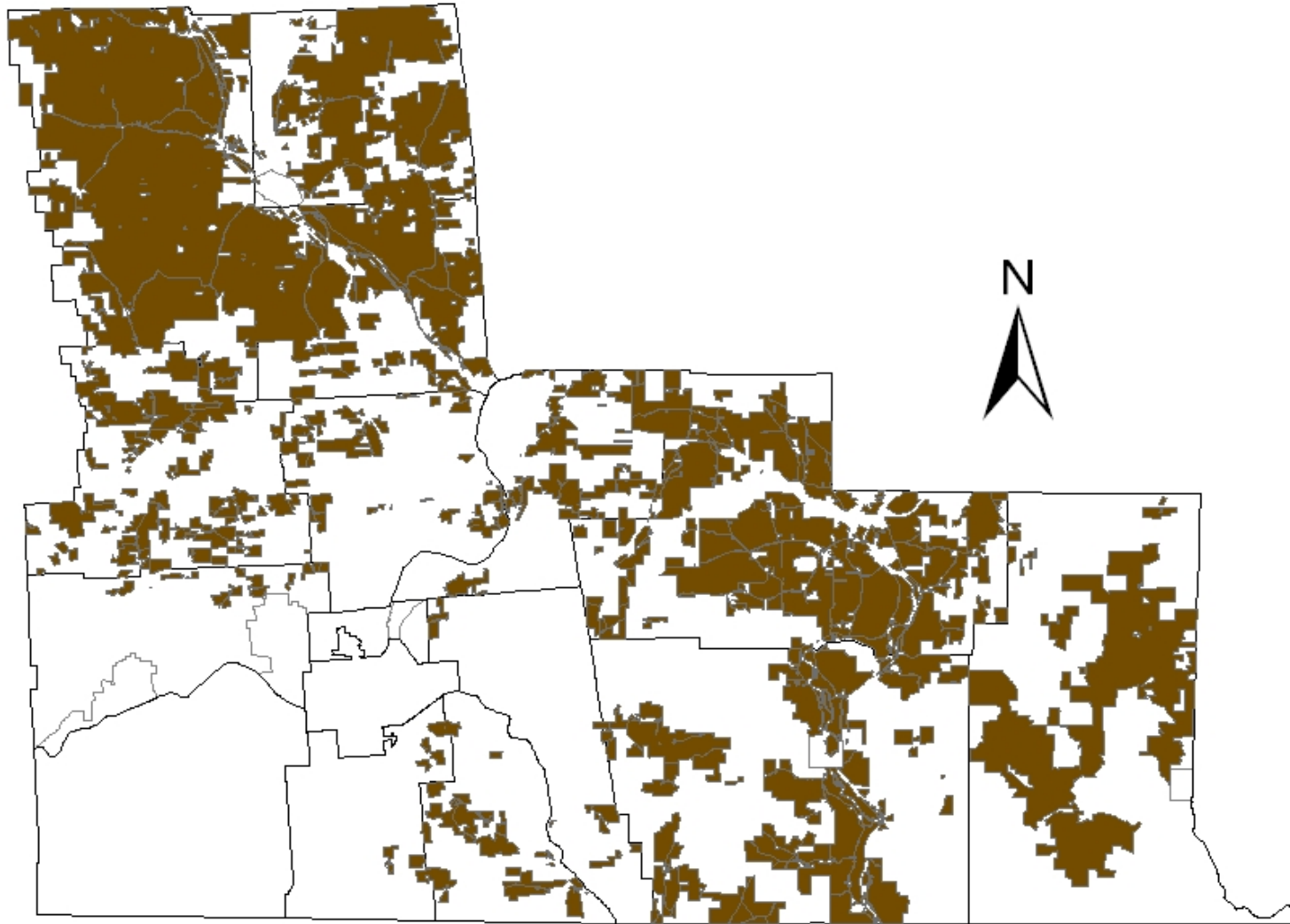


# Agricultural Districts

- Gas development activities in designated Agricultural Districts that disturb more than 2.5 acres are Type 1 Actions under SEQRA and may require a Site Specific EIS.



# Agricultural Districts in Broome County



# Generic Environmental Impact Statement Conditions

- Drilling Phase Protections
  - Casing and Grouting Considerations
    - Conductor Casing
    - Surface Casing
    - Production Casing



# Conductor Casing

- 20 to 40 feet of steel casing set at the upper portion of the borehole to keep surficial sediments out of the borehole.
- Usually cemented – in Primary/Principal aquifer areas a calculated 50% excess grout is required.



# Surface Casing

- Also called fresh water string
- Provides anchor for well control equipment; prevents water from water zones from flooding borehole; and, protects freshwater zones.
- Usually 300 to 500 feet in length.
  - Must be at least 75 feet into rock and 75 feet below deepest fresh water zone.
  - Must be at least 100 feet into rock and 100 feet below deepest fresh water zone in Primary/Principal aquifer areas.



# Surface Casing (continued)

- Grouted with Portland cement to surface. In Primary/Principal aquifer areas a calculated 50% excess grout is required.





# Production Casing

- Casing that is drilled into the production formation either vertically or horizontally to collect the gas and transport it to the surface.
- Grouted to ground surface.

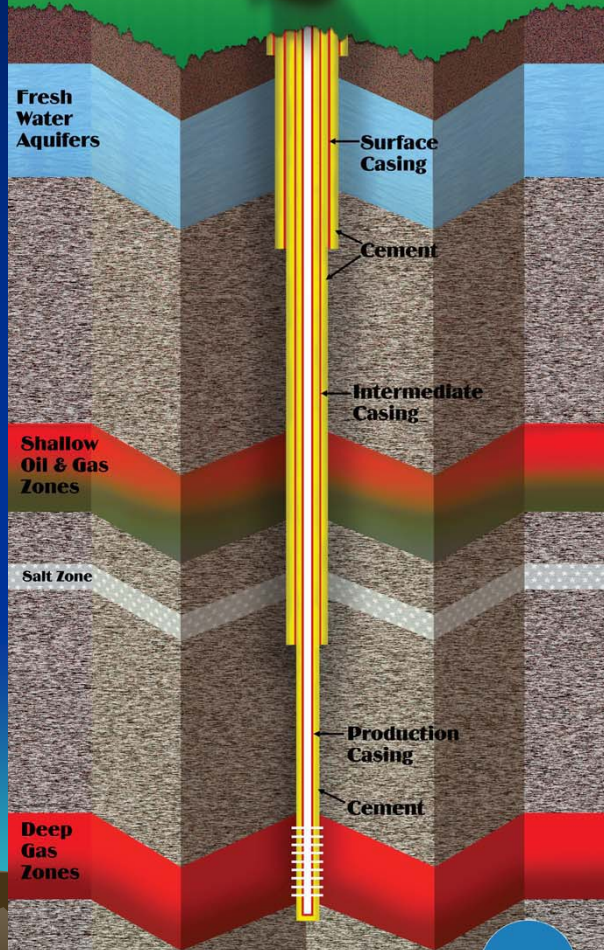


# Groundwater Protection

## Well Casing and Cementing Program

The Division of Mineral Resources' well casing and cementing regulations provide for the protection of the State's fresh water aquifers

Regulations require that wells be constructed and operated to prevent the movement of oil, gas or water from one zone to another



New York State Department of Environmental Conservation



# Problems Observed When Setting Casing

- Temporary increased turbidity observed in nearby water wells.
- Temporary increased salinity observed in nearby water wells.
- No known instances of groundwater contamination have occurred from previous horizontal drilling or hydraulic fracturing projects in New York State.



# Other Environmental Protections

- Open pits are usually used at drilling sites for only fresh water.
- Tanks are usually used for fracture fluid return and production brines.
- Pits and tanks must be properly lined and sized to fully contain fluids generated at the well site.
- Fluids must be removed within 7 days after drilling cessation.
- Wastes must be transported from site by a transporter with an approved 6 NYCRR Part 364 permit.



# What's In Fracturing Fluids

- Mostly water (95% in “slick water”).
- Lubricant such as detergent or other surfactants (soaps) or ethylene glycol.
- Proppants such as sand to hold fractures open.
- Other substances such as biocides and anti-rust agents.
- NYSDEC will obtain information on the chemical makeup of fracturing fluids.



# What Happens to the Fluid

- Recovered hydraulic fracturing fluid may be handled in the following ways:
  - Injection wells (Regulated by the USEPA under a UIC permit and NYSDEC under a SPDES permit).
  - Municipal sewage treatment facility (After determination that fluid can be effectively treated).
  - Out-of-state industrial treatment plant.
  - Reused/recycled.



# Supplemental GEIS

- Draft Supplemental Generic Environmental Impact Statement (dSGEIS) released by NYSDEC in September 2009
- Comments on dSGEIS from interested parties back to the NYSDEC by December 31, 2009.



# Supplemental GEIS

- Primarily three factors:
  - Water volume
    - 80,000 gallons for conventional well.
    - A million to millions of gallons for horizontal shale wells utilizing multistage fracturing.
  - Drilling locations
    - Drilling may occur in more sensitive environmental locations.
  - Multi-well pads
    - Up to 16 horizontal wells at a single pad resulting in longer duration activities at one site (possibly up to three years) and possibly more space required for equipment and facilities.





# SGEIS Enhancements

- Private water well testing
  - Schedule
  - Parameters
  - Complaint handling
- Pre-Frac Checklist and Certification Form for Surface and Production Casings
  - Attestation of construction per permit
  - List depths of fresh water, brine, oil or gas or lost circulation zones encountered
  - How lost circ zones were addressed



# SGEIS Enhancements

- Hydrofracturing Procedures
  - Well testing
  - Proper pit construction, liner specs and secondary containment measures
  - Pressure control equipment and procedures
  - Notification of DEC prior to grouting casing
  - Cement to surface and cement bond logs
  - Pressure testing prior to fracking



# SGEIS Enhancements

- Surface impoundments and tanks
  - No impoundments within Primary/Principal Aquifers or 100 year flood plains
  - Must be constructed and operated using Part 360-6 Liquid Storage requirements (double liners – upper synthetic and lower composite with leak detection, monitoring wells)
  - Tanks must have secondary containment and overflow protection



# SGEIS Enhancements

- Setbacks
  - No changes to 2,000 foot threshold to municipal wells (there are no WRR or Appendix 5-B or 5-D setbacks greater than 2,000 feet)



# What were concerns in dSGEIS?

- Oversight and regulatory coordination
  - NYSDEC inspectors
  - Unfunded mandates for local governments
  - Involvement and notification of local governments
  - Vague language (“weasel words”)
- Ground Water Monitoring
  - Inadequate aquifer protection
  - Monitoring wells
  - Testing frequency
  - Complaint-based program
  - Person-hours at LHUs for complaint follow-up
  - Communication and data management



# What were concerns in dSGEIS?

- NORM (Naturally Occurring Radioactive Material)
  - Not enough data to address it appropriately in SGEIS
- Open pits and centralized impoundments
- Flowback and fluid disposal
- Setbacks
- Water withdrawals
- Cumulative Environmental Impacts



# Other Environmental Protections

- Gas well drillers required to get permit from Susquehanna River Basin Commission or Delaware River Basin Commission for water withdrawals from basins.
- Source Water Protection Laws
  - Not likely to have significant effect on gas well drilling since they cover areas close to municipal water wells (less than 1,000 feet – Source Zone 1).



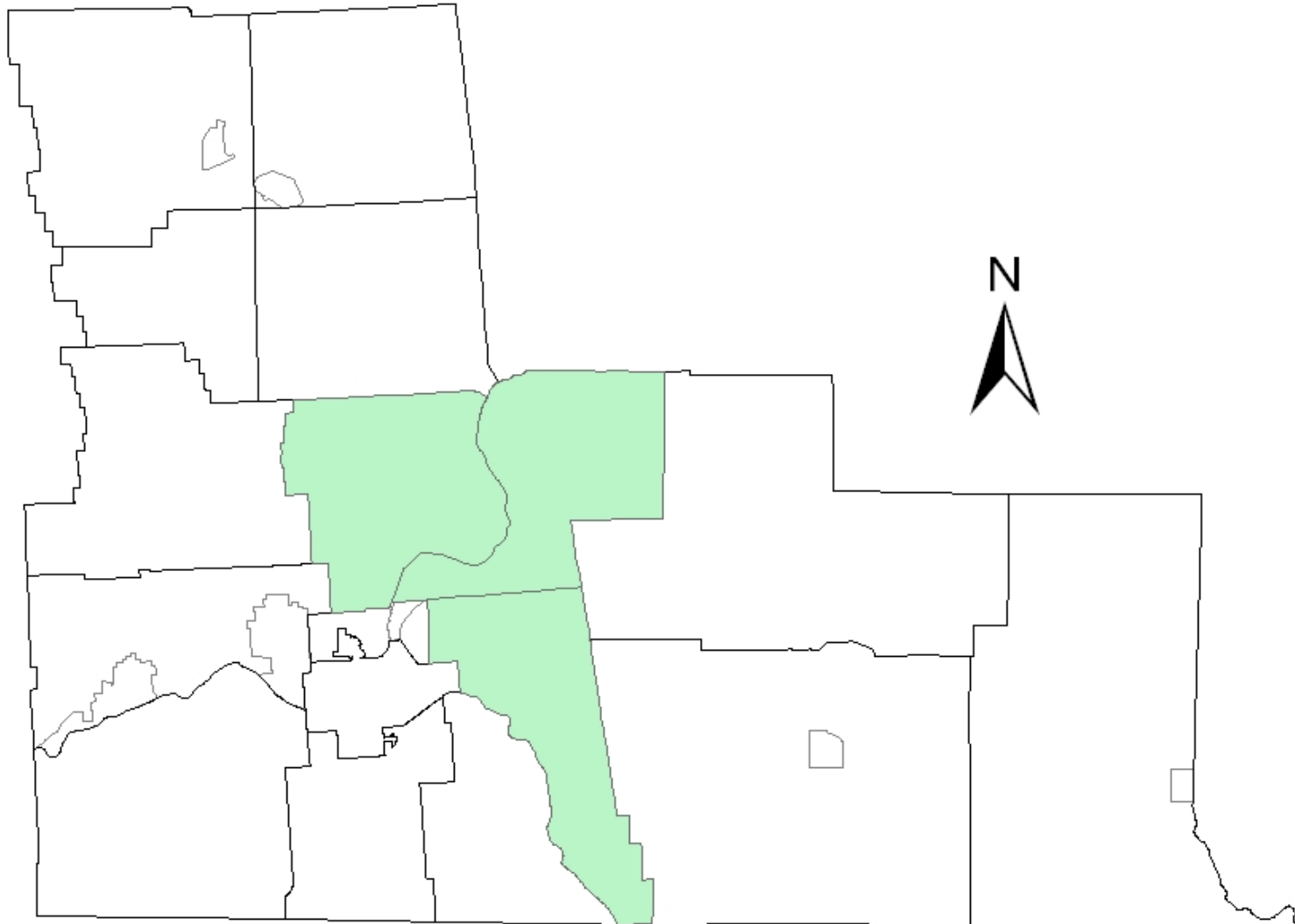
# Source Water Protection Laws

- NYSDOH Rules and Regulations
  - Defined as local watershed rules codified in 10 NYCRR Part 102.
  - Establishes definitions of contaminant sources and allowable distances to wells of potential contaminants (i.e. privies, cesspools, cemeteries, waste sites).
  - 3 towns – Chenango, Fenton and Kirkwood.
- Local Ordinances
  - Passed by municipalities as local zoning laws.
  - 7 towns





# Towns With Watershed Rules and Regulations



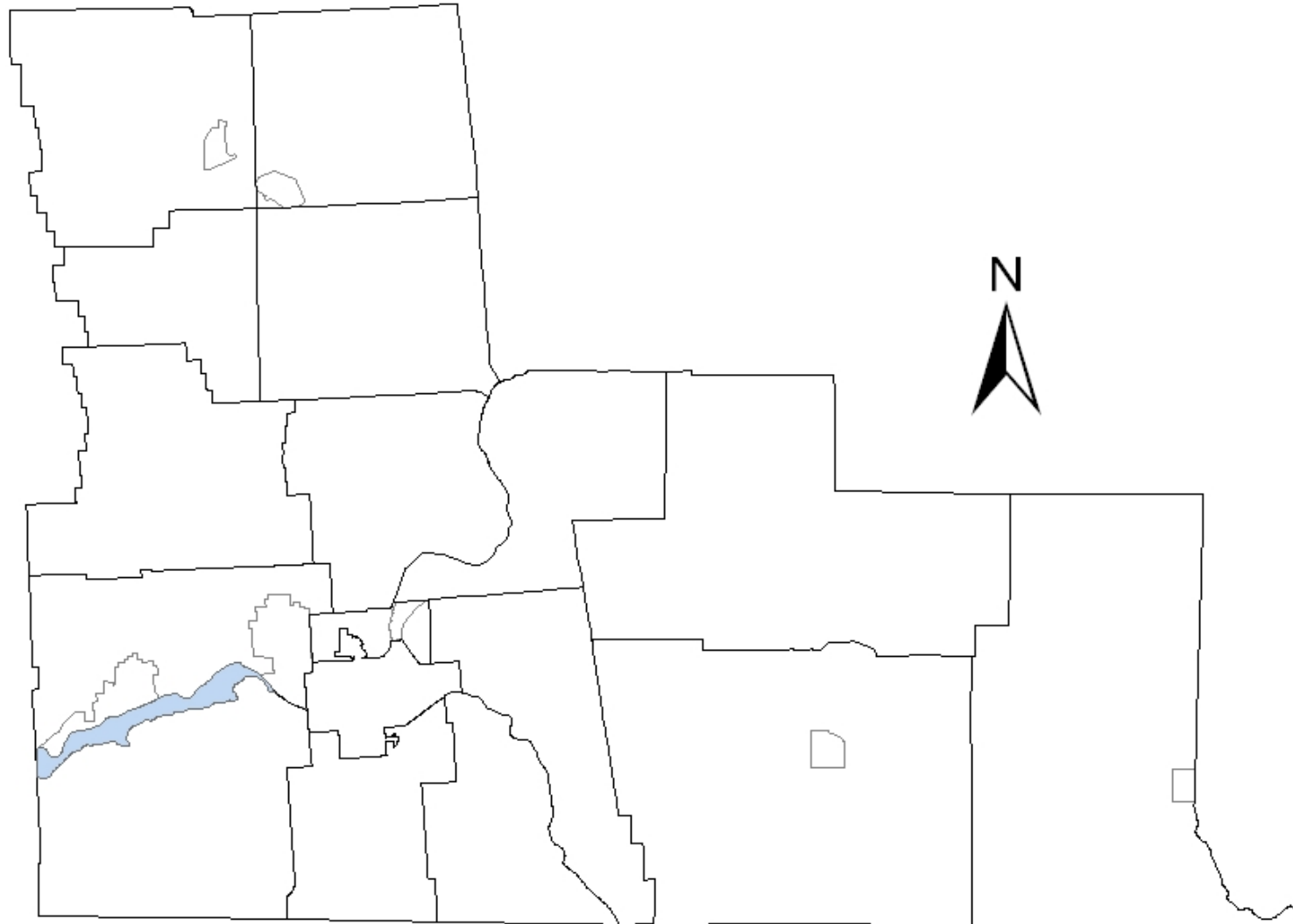


# Source Water Protection Laws (continued)

- Critical Environmental Area
  - Local zoning law developed under NYSDEC rules.
  - Applies in Vestal, only.



# Vestal Critical Environmental Area



# Broome County Public Health Responsibilities

- NYSDEC Division of Mineral Resources Bureau of Oil & Gas Regulations has responsibility of overseeing drilling sites and enforcing all regulations concerning gas drilling and production.
- Broome County Health Department will provide assistance and advice to our regulated facilities and public water supplies to ensure the water provided to the public continues to meet water quality standards.



# Broome County Public Health Responsibilities

- Broome County Health Department will provide advice to individual non-public water well users by:
  - Providing a list of water sample parameters individuals can use when sampling for background conditions.
  - Providing information to homeowners that ensures maximum setback distances of gas well sites from water well locations.
  - Possibly providing complaint-driven sanitary surveys of private wells.



# Additional Broome County Public Health Responsibilities

- Develop a procedure to refer residents with complaints (i.e. noise, light, dust) to the appropriate NYSDEC personnel.
- Reviewed and commented on the Draft Supplemental GEIS.
- Review any Site Specific Environmental Impacts Statements and review any EAFs developed under a SEQRA Type 1 positive determination near regulated facilities.
- Hopefully work with NYSDEC to identify any critical environmental situations or concerns before they become public health problems.



# Questions?

