### Number of Wells Within Mapped Aquifer Boundary

<table>
<thead>
<tr>
<th>Map No.</th>
<th>Aquifer Name</th>
<th>Gas Wells</th>
<th>Oil Wells</th>
<th>Other Wells*</th>
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<td>Cortland-Homer-Preble</td>
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<td>Endicott-Johnson City</td>
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<td>7</td>
<td>Fulton</td>
<td>4</td>
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<td>Jamestown</td>
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<td>11</td>
<td>14</td>
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<td>9</td>
<td>Lower Cohocton</td>
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<td>10</td>
<td>Olean</td>
<td>7</td>
<td>310</td>
<td>81</td>
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<td>11</td>
<td>Owego</td>
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<td>12</td>
<td>Salamanca</td>
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<td>6</td>
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<td>13</td>
<td>Upper Cohocton</td>
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<td>3</td>
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<td>14</td>
<td>Waverly</td>
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<td><strong>1,664</strong></td>
<td><strong>749</strong></td>
<td><strong>1,344</strong></td>
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</table>

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

---

**FIGURE 3-1**

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

Map Document: (Z:\projects\2009\09100-09120\09104 - Gas Well Permitting GeIS\figures\GIS\Aquifers.mxd)

Source:
- Well information from (February 2009) http://www.dec.ny.gov/energy/1603.html
FIGURE 3-2
WATER WITHDRAWALS IN THE UNITED STATES

Source: USGS, 2009
http://ga.water.usgs.gov/edu/wupt.html

Technical Support Document
Draft Supplemental Generic Environmental Impact Statement
Maximum Approved Daily Consumptive Use (in mgd)


Technical Support Document to the Draft Supplemental Generic Environmental Impact Statement
Total Water Withdrawals (ground and surface) from the Delaware River Basin: 8,736 mgd

Major Exports from the Delaware River Basin: 736 mgd

Consumptive Use in the Delaware River Basin: 324 mgd

Source: DRBC

FIGURE 3-4
DAILY WATER WITHDRAWALS, EXPORTS, AND CONSUMPTIVE USES IN THE DELAWARE RIVER BASIN

Technical Support Document
Draft Supplemental Generic Environmental Impact Statement
FIGURE 3-5

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

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

Legend
- Delaware River Basin
- Susquehanna River Basin
- Utica and Marcellus Shales in New York State
Figure 4-1

Source: NYCDEP, 2009; New York City 2008 Drinking Water Supply and Quality Report
This map of the City indicates the general areas where water can be supplied by the Catskill/Delaware, Croton, and Groundwater Systems.
FIGURE 5-1
GAS SHALE DISTRIBUTION IN THE APPALACHIAN BASIN OF THE EASTERN UNITED STATES


Legend
- Marcellus & Utica shales
- Marcellus shale
- Utica shale
- Appalachian Basin Province

Map Document: (Z:\projects\2009\09100-09120\09104 - Gas Well Permitting GIS\Figures\GIS\Appalachian_Basin.mxd)
8/10/2009 -- 2:47:01 PM
<table>
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<th>PERIOD</th>
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<th>UNIT</th>
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<th>THICKNESS (feet)</th>
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<td>Knapp</td>
<td>Ss, cgl</td>
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<td></td>
<td>Conewango</td>
<td>Riceville</td>
<td>Sh, ss, cgl</td>
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<td>Gneiss, marble, quartzite</td>
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</table>
FIGURE 5-4
EXTENT OF UTICA SHALE IN NEW YORK STATE

Source:
- Nyahay et al. (2007).
- Fisher et al. (1970).

Legend

- Utica Shale Outcrop*
- Extent of the Utica Shale in New York

* - Outcrop extent includes Utica and Canajoharie shales (Fisher et al, 1970)
FIGURE 5-5
DEPTH TO BASE OF UTICA SHALE
IN NEW YORK STATE

Legend
- Depth to Base of Utica Shale
- Utica Shale Outcrop
- Extent of the Utica Shale in New York

Notes:
- Top of the Trenton limestone approximates the base of the Utica shale (New York State Museum - Reservoir Characterization Group, 2009).
FIGURE 5-6
THICKNESS OF HIGH-ORGANIC UTICA SHALE IN NEW YORK STATE

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Note:
- Contours show the combined thickness of the high organic carbon interval (>1% TOC) lower Indian Castle, Dolgeville, Flat Creek members (New York State Museum - Reservoir Characterization Group, 2009).

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FIGURE 5-7

UTICA SHALE FAIRWAY
IN NEW YORK STATE

Legend
- Utica Shale Outcrop
- Utica Shale Fairway
- Extent of the Utica Shale in New York

Source: - modified from Nyahay et al. (2007)

Map Document: Z:\projects\2009\09100-09120\09104 - Gas Well Permitting GIS\Figures\GIS\Utica_Fairway.mxd
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FIGURE 5-8
DEPTH AND EXTENT OF MARCELLUS SHALE IN NEW YORK STATE

Source:
- New York State Museum - Reservoir Characterization Group (Leone, 2009).

Legend
- Depth to the Top of the Marcellus Shale
- Marcellus Shale and Hamilton Group Outcrop
- Extent of the Marcellus Shale in New York

Map Document: (Z:\proj t \2009\09100-09120\09104 - Gas Well Permitting GIS\Figures\GIS\Marcellus_Extent.mxd)
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FIGURE 5-9
MARCELLUS SHALE THICKNESS
IN NEW YORK STATE

Notes:
- Source: New York State Museum - Reservoir Characterization Group (Leone, 2009)
- Organic-rich Marcellus includes Union Springs and Oatka Creek Members and lateral equivalents.
FIGURE 5-10
TOTAL ORGANIC CARBON OF MARCELLUS SHALE IN NEW YORK STATE

Source: Modified from New York State Museum - Reservoir Characterization Group (Leone, 2009).
FIGURE 5-11

MARCELLUS SHALE
THERMAL MATURITY

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Environmental Impact Statement

Source:
- Modified from Smith & Leone (2009).

Legend

- Extent of the Marcellus Shale in New York

Vitrinite Reflection (%Ro)

- Less than 0.6
- 0.6 to 1.5
- 1.5 to 3.0
- Greater than 3.0

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FIGURE 5-12
MARCELLUS SHALE FAIRWAY IN NEW YORK STATE

Source:
- New York State Museum - Reservoir Characterization Group
- Nyahay et al. (2007)

Legend
- Marcellus Shale and Hamilton Group Outcrop
- Marcellus Shale Fairway
- Extent of the Marcellus Shale in New York

Map Document: Z:\projects\2009\09100-09120\09104 - Gas Well Permitting GIS\Figures\GIS\Marcellus_Fairway.mxd
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FIGURE 5-13
MARCELLUS SHALE GAS WELLS IN NEW YORK STATE

Source:
- New York State Dept. of Environmental Conservation, Division of Mineral Resources Oil, Gas, and Other Regulated Wells Database (July 9, 2009)
- New York State Museum - Reservoir Characterization Group
- Nyahay et al. (2007)

Legend
Wells Completed in the Marcellus Shale*
- Gas Well
- Gas Well Plugged
- Dry Hole
- Other
- Other Plugged
- Marcellus Shale Fairway
- Extent of the Marcellus Shale in New York

Note:
- Includes wells reportedly completed in or producing from the Marcellus, Hamilton, or Devonian Shale.

Map Document: (Z:\jtt\2009\09100-09120\09104 - Gas Well Permitting GIS\Figures\GIS\Marcellus_Wells.mxd)
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Legend

- Geologic Fault
- Combined Utica and Marcellus Shales
- in New York State

FIGURE 7-1
MAPPED GEOLOGIC FAULTS
IN NEW YORK STATE

Note:
- Geologic fault features shown were compiled by Isachsen and McKendree (1977) and exclude brittle structures identified as drillholes, topographic, and tonal linear features.
FIGURE 7-2

NEW YORK STATE SEISMIC HAZARD MAP

Notes:
- Map shows peak acceleration (%g) with 2% probability of exceedence in 50 years.
FIGURE 7-3
SEISMIC EVENTS IN NEW YORK STATE (1970 to 2009)

Notes:
- Lamont-Doherty Cooperative Seismographic Network, 2009
(http://almaty.ldeo.columbia.edu/s080/data.search.html)

Legend
Recorded Seismic Events
Magnitude (Richter Scale)
- Less than 3.0
  Minor - not felt
- 3.0 to 3.9
  Minor - often felt, no damage
- 4.0 to 4.9
  Minor - shaking observed
- 5.0 to 5.3
  Moderate - Some damage

Combined Utica and Marcellus Shales in New York State

Extent of Utica shale
Extent of Marcellus shale