Rockland County’s Water Resources
-Selected Findings from the USGS Study-

Paul M. Heisig, Hydrologist
New York USGS Water Science Center
Troy, NY
Water Sources
Rockland County, NY

- Lake DeForest Reservoir
- Alluvial Aquifers
  Ramapo and Mahwah Valleys
- Bedrock Aquifer
  Newark Basin
- Sedimentary rock
- Letchworth Reservoirs
  (since 2006)

▲ Streamflow gage site
2005 Water Use
Rockland County
12.9 Billion Gallons

Water Use

Residential 62.8 percent
Commercial, industrial, governmental, and institutional 10.2 percent
Summertime increase in residential, and commercial, industrial, governmental, and institutional use 18 percent
Industrial cooling water 5.6 percent
Golf courses 3.1 percent
Nurseries, orchards, farms 0.3 percent

2005 Water Use
Rockland County
12.9 Billion Gallons

Water Use

Residential 62.8 percent
Commercial, industrial, governmental, and institutional 10.2 percent
Summertime increase in residential, and commercial, industrial, governmental, and institutional use 18 percent
Industrial cooling water 5.6 percent
Golf courses 3.1 percent
Nurseries, orchards, farms 0.3 percent
Water-Resource Concerns in Rockland County (2004)

- Is Pumpage from the **Bedrock Aquifer** Sustainable?
- What are the shape and size of Wellfield Capture zones?
- How much Recharge does the Aquifer Receive?
- What are effects of:
  - Impervious Surfaces
  - Sanitary Sewering
- Additional Sources of Water?
Evapotranspiration (ET)

Precipitation

Recharge

Storm Runoff

Lake, Stream, or Wetland

Aquifer

Stream Baseflow (GW Discharge)
Evapotranspiration (ET)
The Bedrock Aquifer

1. Physical Framework / Water-bearing properties

2. Hydrology – use groundwater-level data and framework to delineate:
   - Groundwater flow-system
   - Production Well Capture Zones
Sedimentary Bedrock of the Newark Basin Aquifer
Surface of Water-Bearing Fracture (saturated)

Fracture Surface (unsaturated)

Recharge

Regional GW Flow Direction

Water-Bearing Fractures
Spring 2007
Ground Water Levels, Bedrock Framework, GW Divides, GW Flow
Production Well Capture Zones
(250 ft below bedrock surface)

From Numerical GW Flow Model

Groundwater flow model results from R. Yager, USGS
Aspects of Aquifer Health

• Aquifer Responses to Groundwater Withdrawals
• Streamflow
• Recharge
  – Natural Variability
  – Effects of Impervious Surfaces
• Sanitary Sewering – Water Loss from Aquifer
Water levels decrease or increase with respect to pumping rate, but there is no long-term groundwater-level decline.
Seasonality of Bedrock Aquifer Withdrawals

Graph showing withdrawal rate over time for 2005, with peaks in June and September.
Seasonal Groundwater-Level Changes

Groundwater Level Elevation, in feet

Pumping Rate, in Gallons per Minute

Observation Well and Pumping Wellfield are 0.7 miles apart.
If pumped continuously, about 1/3 of UWNY Supply wells would reach the bottom of airline prior to the end of the growing season.

Most wells are not pumped continuously, so this is a worst-case assumption. However, it also assumes constant drawdown rates, which is a best-case assumption:

- Drawdown rates can increase as water-bearing fractures become dewatered.
- Air entrainment may reduce pumping rates prior to water levels nearing the pump.
Areas of Dry Streams over the Aquifer, Sept. 2005 (brown shaded areas)
Factors that Affect Recharge Totals:

• Precipitation Amount
• Overburden Thickness
• Wetland / Surface Water Area
• Impervious Surface Area
How much of recharge to the bedrock aquifer is pumped out for water supply? (2006 data)

Estimates from watersheds with streamflow gages:

- Mahwah River 12%
- Saddle River 24%
- Pascack Brook 21%
Impervious Surface Effects
Stormflow Hydrographs and Impervious Surfaces

Est. Annual incr. in Storm Runoff with % impervious surface:
- Pascack Br. ~400 Mgal.
- Saddle R. ~150 Mgal.
- Mahwah R. ~20 Mgal.

Effects -- Loss of Recharge (less base flow), Streambed Erosion, Turbidity, and Temperature Fluctuations
Sanitary Sewer System
Sewer Mains are a Subsurface Drainage Network, Much Like Streams

Total Outflow to Hudson River was 14.1 Billion Gallons in 2005
Potential Sources of Water-

Summer season sources

• Sedimentary Bedrock Aquifer
• Ambrey Pond Reservoir
• Stormwater Retention / Use
• Stony Brook Watershed (Ramapo River)

High volume, year-round sources

• Desalinization of Hudson River Water
• Indirect Use of Recycled Water
  (Example, with possible increased use of Lake Deforest)

A purely hydrologic perspective

Each with its own set of issues and caveats
Recycled water – indirect re-use

(hypothetical example)
Conclusions

• Long-term, progressive declines in groundwater levels across the aquifer are not indicated by available data or by computer modeling with historic pumpage data.

• Of Greatest Concern are Seasonal Groundwater-Level Declines at Supply Wells caused by increased Water Use During Prolonged Dry, Hot Spring and Summer Periods.
Summary and Conclusions (continued)

• Sustainability of **Current** Water Resources in Rockland County is Largely Dependent on:
  
  (1) the ability to curtail water-use during during summer peak-demand periods, and
  
  (2) to avoid loss of supply from groundwater contamination

• Recharge in Rockland County is Significantly Higher than Previous Estimates, but is Highly Variable in Space and Time.
Summary and Conclusions (continued)

- Impervious Surfaces Increase Storm Runoff in Pascack Br. by nearly 400 Mgal./yr and Probably Decrease Recharge by about 200 Mgal./yr.

- The Sanitary Sewer System behaves like a River - it transports wastewater, but also receives Stormwater Inflows and Infiltration of Groundwater.

- Potential Additional Water Sources:
  1. Additional pumpage from Bedrock Aquifer
  2. Ambrey Pond
  3. Retention/Use of Stormwater
  4. Augmentation of Ramapo River flow from the Stony Brook Watershed.
  5. Desalinization of Hudson River Water
  6. Indirect Reuse of Recycled Water