

Groundwater Recharge Rates, Septic Density Recommendations & Impervious Impacts on Recharge

All Part of the Watershed

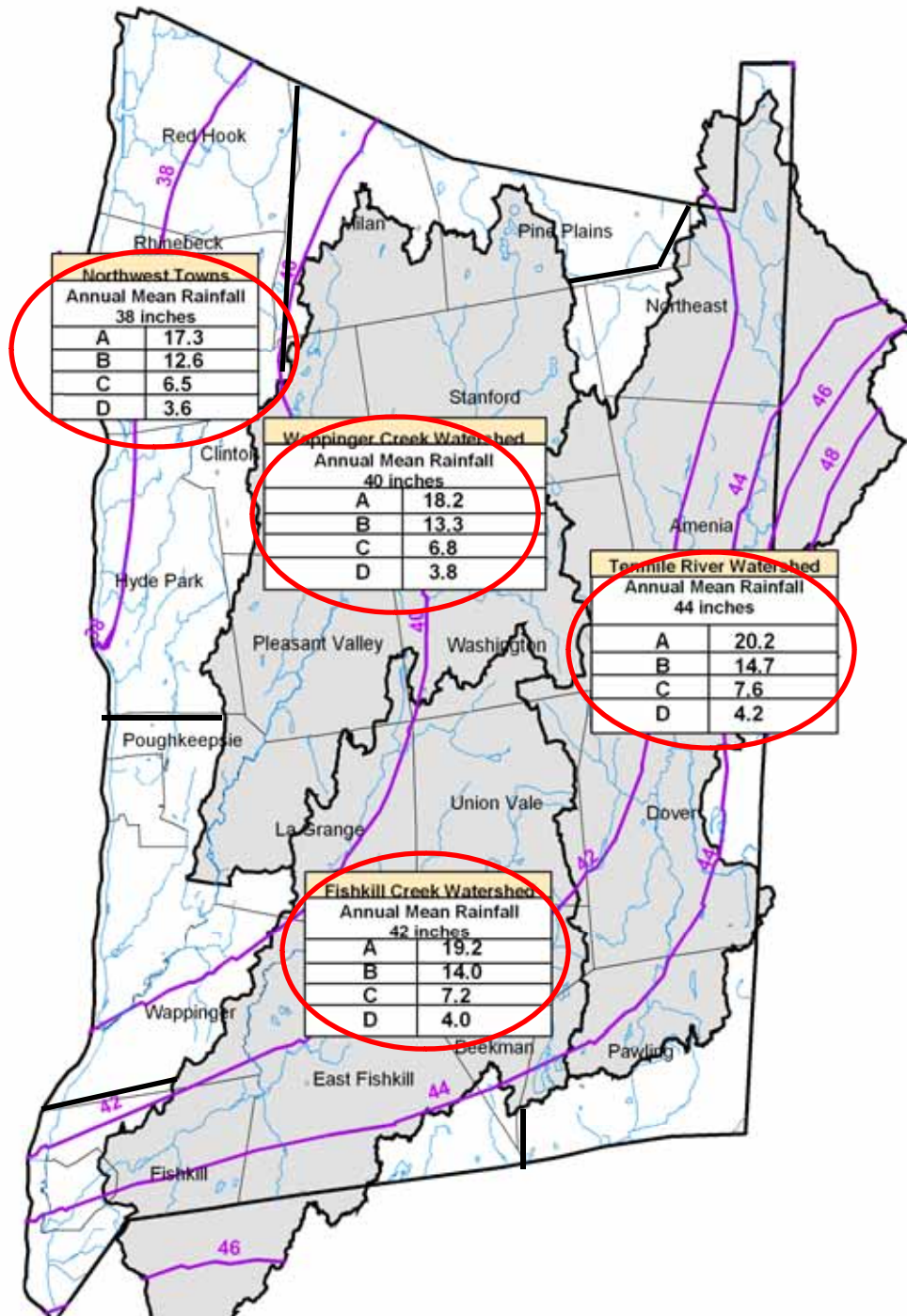
State of the Hudson River Watershed
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The Chazen Companies

September 29, 2009

DC Research on Aquifer Recharge, Sustainable Septic System Densities, Land Use Impacts on Aquifer Recharge

- **Aquifer Recharge Rate Study:** Critical to water supply budgets, ecological budgets and baseflow evaluations.
- **Application:** Sustainable septic system densities protective of public health & eco-resources.
- **Land Use Impacts on GW Recharge:** Impervious thresholds leading to aquifer recharge losses.



Annual Inches of Aquifer Recharge

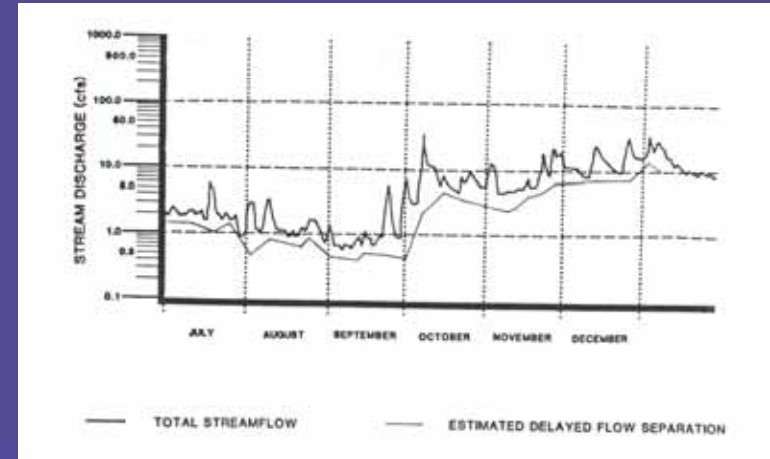
Reference equivalents:

18.2 inch/yr = 1,354 gpd/acre
 13.3 inch/yr = 989 gpd/acre
 6.8 inch/yr = 506 gpd/acre
 3.8 inch/yr = 283 gpd/acre

Study can be extrapolated throughout the Hudson River Watershed by Mean Precip zones.

Identification of Aquifer Recharge Rates

- * Aquifer recharge were matched to mean aquifer discharge (baseflow) in Dutchess County streams. Used Posten baseflow separation method.
- * Stream records reflected precipitation isopleths across the County from 38 to 44+ inches/year.
- * Draft recharge rates were first constrained by literature values and then calibrated to stream, soil type and precipitation data. Rates resolved to within 0.2 inches/year.



Aquifer Recharge Summary @ 38 to 44” annual precipitation:

A soils

17.3 to 20.2 inch/year

B soils

12.6 to 14.7 inch/year

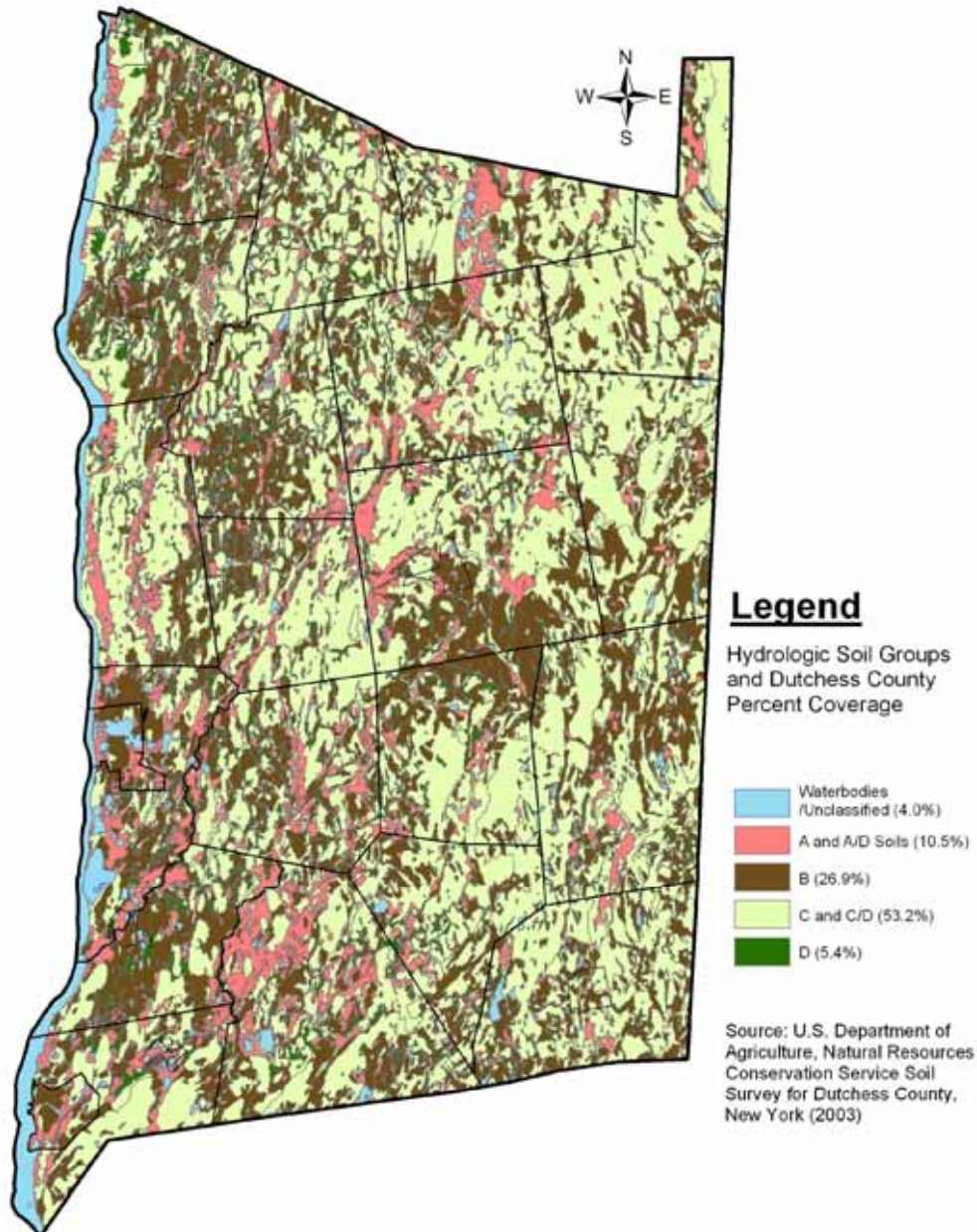
C soils

6.5 to 7.6 inch/year

D soils

3.6 to 4.2 inch/year

(Interflow: an
additional ~35%)



Recharge Data are Useful for

- * Site or regional water balance studies
- * Impact development analyses
(along with impervious cover consideration)
- * Streamflow studies
(along with interflow adding ~35%).

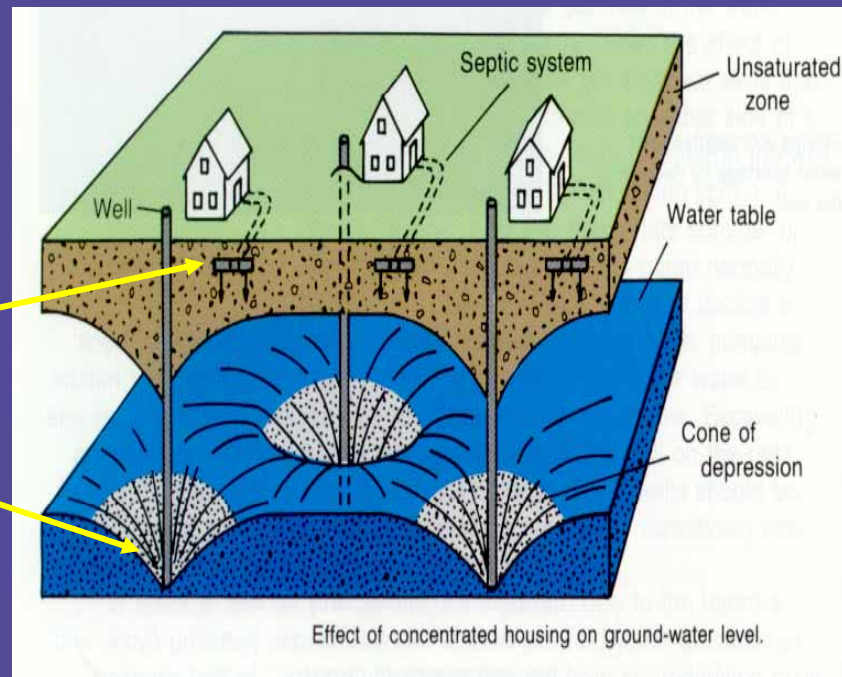
Example: a 40 acre site in an area with 40 inches/precip per year with 25% HSG B and 75% HSG C would convey:

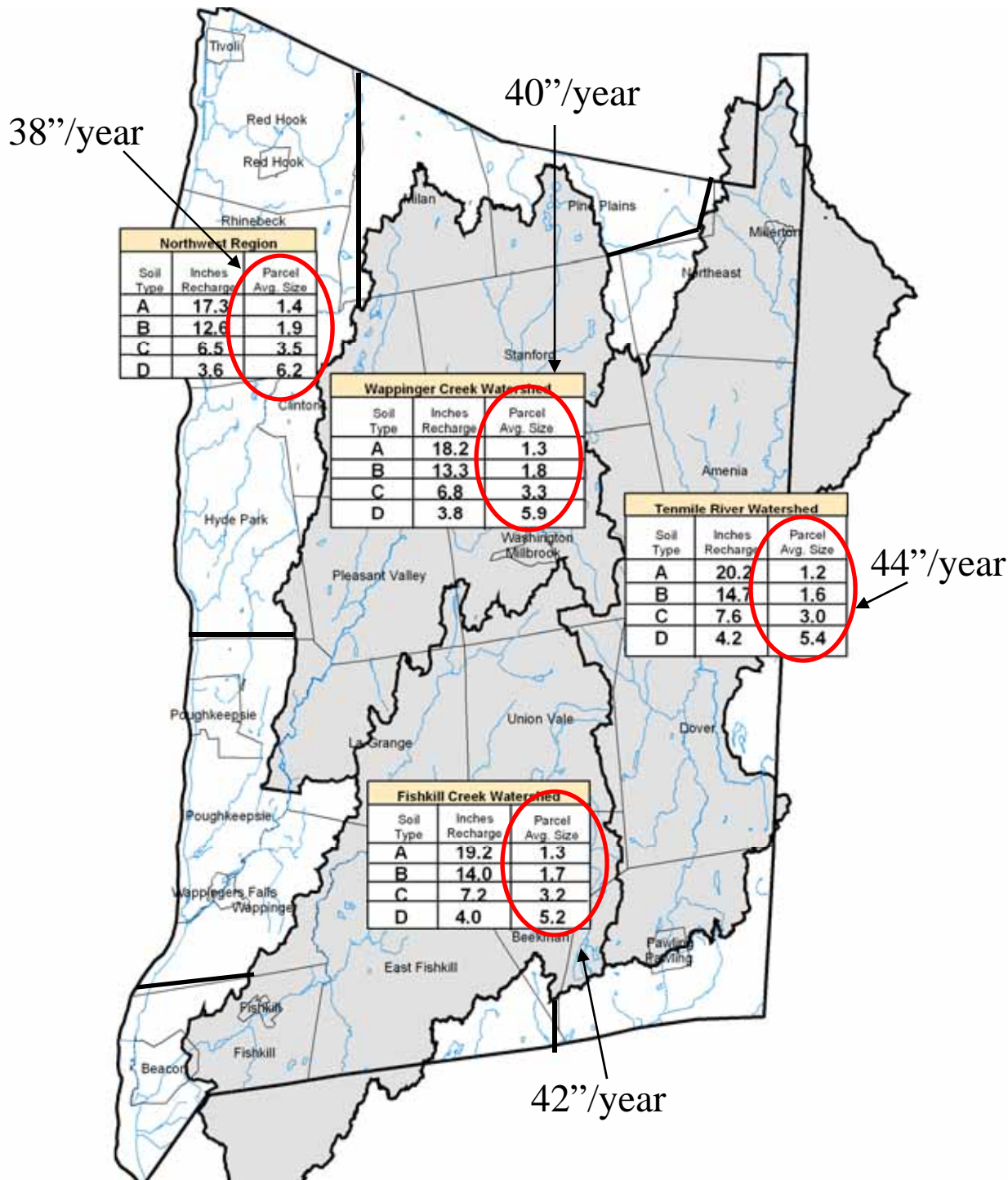
$$\begin{array}{l} \text{unit adjustment factor} \\ 10 \text{ acres at } 13.3 \text{ inch/year} \times 74.4 = 9,895 \text{ gpd} \\ 30 \text{ acres at } 6.8 \text{ inch/year} \times 74.4 = \underline{15,178 \text{ gpd}} \\ \hline 25,073 \text{ gpd (17.4 gpm)} \end{array}$$

Well and Septic Density Analysis

- Density recommendations for areas using domestic wells & traditional septic systems.
- A tool for community analysis.
- Nitrate GW model for persistent contaminants.

Recharge Dilutes
Wastewater
Recharge
Supports Wells





Minimum Average Recommended Parcel Sizes for areas with domestic wells and septic systems, based on different precipitation zones

Results can be applied throughout the Hudson River Watershed by Mean Precip zones.

Septic Density Calculations

Recharge dilutes wastewater and supports wells.

High recharge allows close wells and septics.

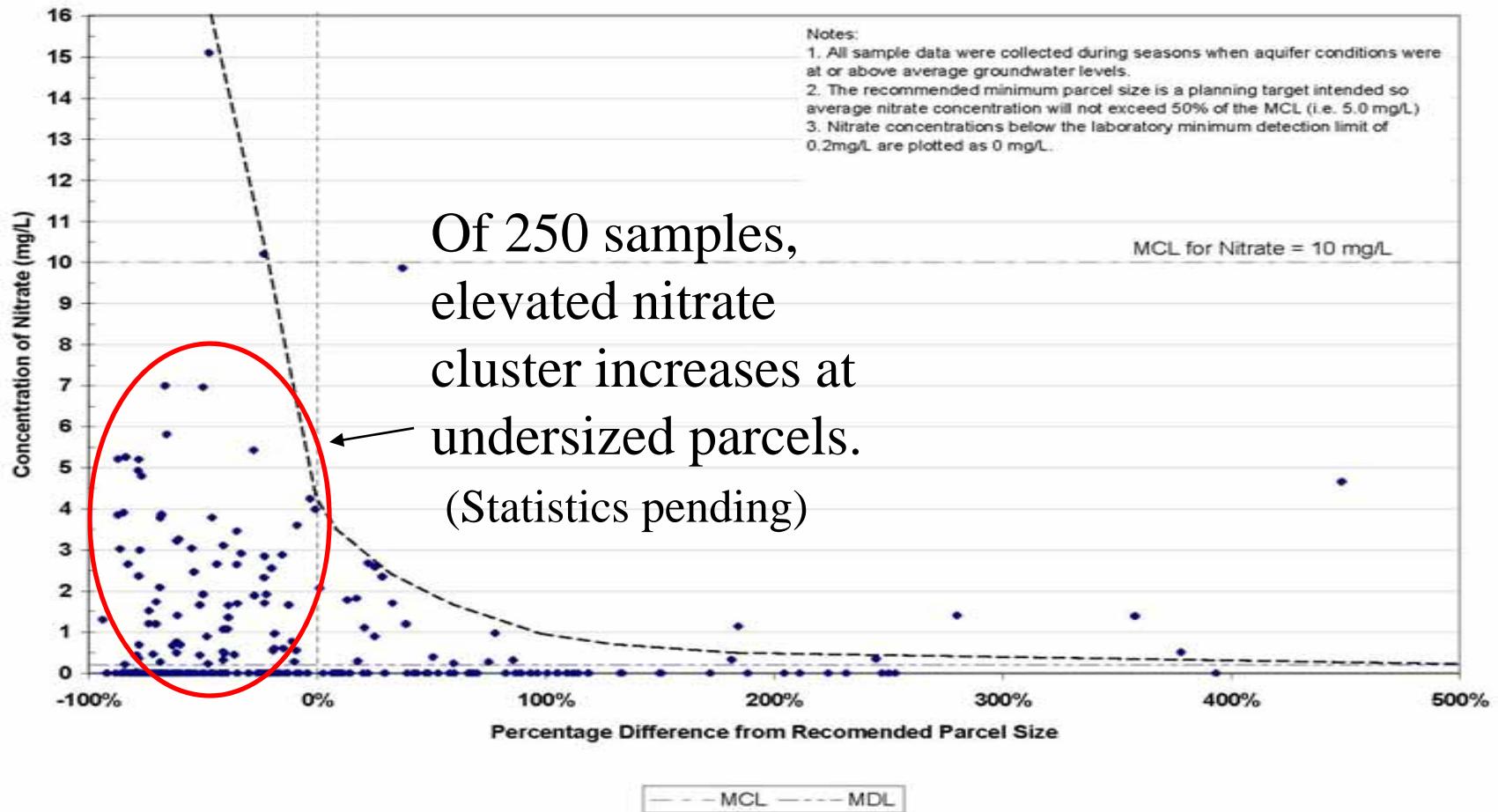
Low recharge warrants more separation.

- Use new Aquifer Recharge rates. (R)
- Wastewater nitrate target of ½ drinking standard (Cq)
- Adjust for occupancy levels. (H) (Default is 2.6 per household)
- Allowance for drained impervious roofs & driveways.
(Isc) (default Isc is 0.1 acres per parcel)
- Assumes 10 lbs annual nitrogen release per capita (M)

$$A = \text{Isc} + (4.4186)HM/CqR$$

Sampling Data and the Model

Figure 1: Nitrate Concentrations found in Well Water Throughout Dutchess County Compared to Percentage Difference Between Recommended Parcel Size and Actual Parcel Size.



Septic Minimum Density Data are Useful for

- * Regional planning & zoning
- * Determining central service needs
- * Project & watershed sustainability

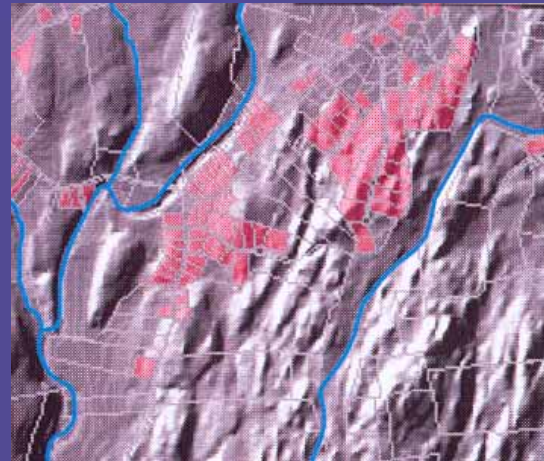
Example 1: the 40 acre site with 25% HSG B and 75% HSG C will sustain

10 acres with 1.8 acre/system = 5.6

30 acres with 3.3 acre/system = 9.9

15 homes

Example 2: Inventory where water & sewer may be needed in unserviced areas



Land Use and Aquifer Recharge

Storms aside...

- Measurable Precipitation: 125 days/year
- 53 days/year with precip over $\frac{1}{4}$ inch
- Of the 53 days over $\frac{1}{4}$ inch:
 - median precip is 0.5 inches
 - average precip is 0.71 inches
- Only 15 days/year exceed $\frac{3}{4}$ inch of precip and only 7 days/year exceed 1.25 inches.

The POINT: Most Rainfall is Modest

Source: CIES data, Millbrook NY, 1996 to 2006 record

Land Use Impacts on Aquifer Recharge

Next Points:

- TR-55 identifies negligible runoff increases for events up to 0.8 inches except “commercial” and “industrial” LUNR classes with >30 percent impervious.
- NJ Geologic Survey has found that 80% of total annual recharge occurs during precipitation events <1.25 inches.

The POINT: Little aquifer recharge is lost until large areas with connected impervious surfaces exceed +30%.

This explains: why drought stream flow reductions are not being observed in watersheds in spite of land use changes.

(This threshold differs from 10-20% imperv that accelerates stormwater damage.)

Resources

Available free

- Aquifer Recharge Study and Septic Density Study
 - Model Aquifer Protection Ordinance

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Also available free from Dutchess County website

www.co.dutchess.ny.us

then County Government

then Departments

then Water & Wastewater Authority

to find report listed on left column