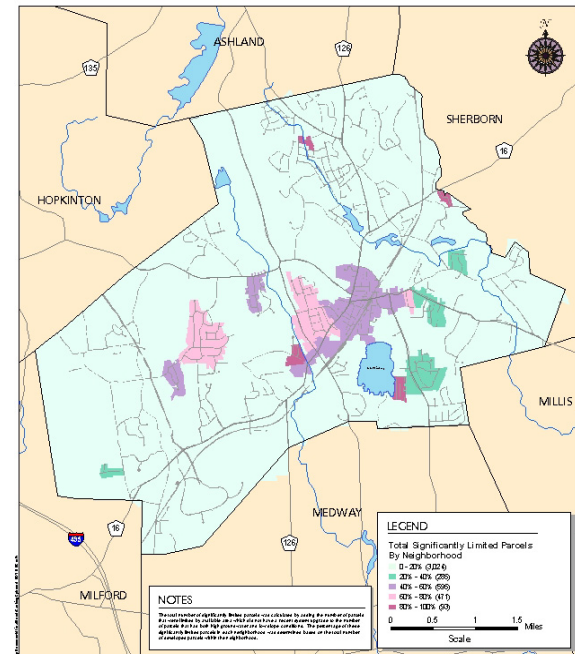
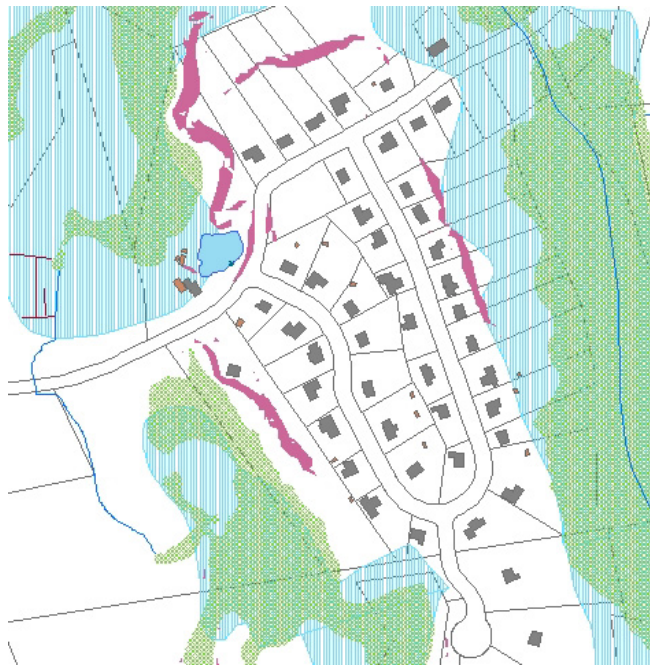


Developing Tools to Assess Community On-Site Wastewater Management

Presented to Vermont GIS Expo 2002

Presented by Michael Winchell



4/11/2002

The Need For a GIS-Focused Approach

- Three consultants in past ten years
- Over \$ 4 million in fees
- Results: A \$45 million solution to town wastewater disposal needs
- Town rejected this solution
- New approach
 - GIS-based analysis
 - Data focused: Quantity and quality

Outline for a Community-Wide Wastewater Disposal Analysis

- Conduct an analysis of every lot containing a system
 - Assess lot area limitations
 - Assess other limiting factors
- Identify neighborhoods requiring alternative disposal methods
 - Group lots into neighborhoods
 - Rank neighborhoods according to alternative disposal need

Spatial Elements of an On-Site Wastewater Disposal Analysis

- Area availability
 - Setbacks from manmade features: buildings, property lines, drainage ditches, wells
 - Setbacks from natural features: streams, ponds, wetland, vernal pools, high slope region, rock outcrops
- Required treatment area
 - Soil characteristics
 - System size requirements
- Aesthetic considerations
 - Groundwater conditions
 - Lot contours

Assessment of Available Lot Area

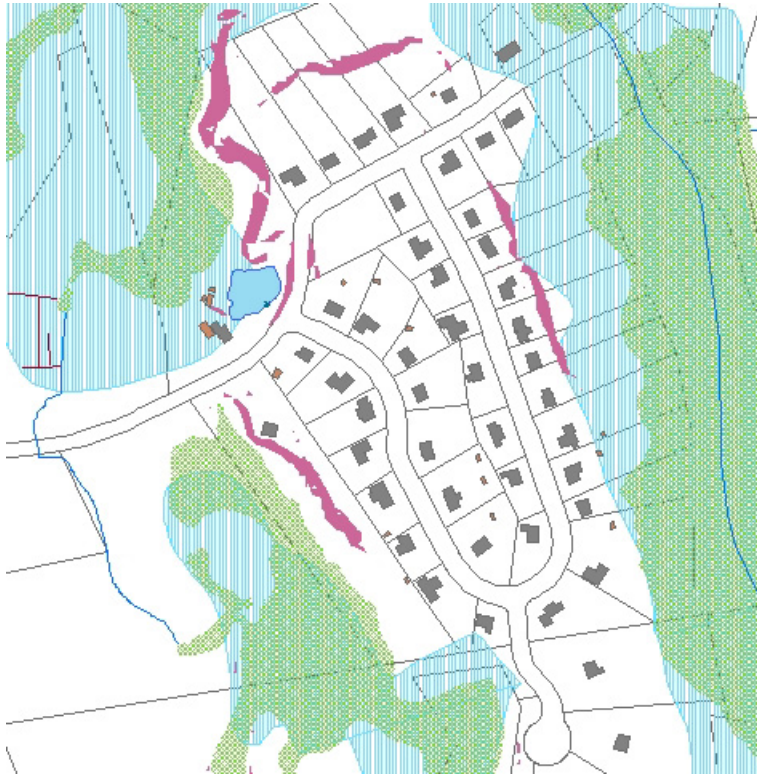
■ Data

- Town photogrammetry, 1:6,000 scale: building footprints, streams, water bodies, wetlands, rock outcrops, drainage ditches
- Town parcel map: scanned and digitized hard copy maps, rectified to photogrammetry (road edge layer)
- MassGIS, 1:24,000 scale: vernal pools, wells, 100-year floodplain

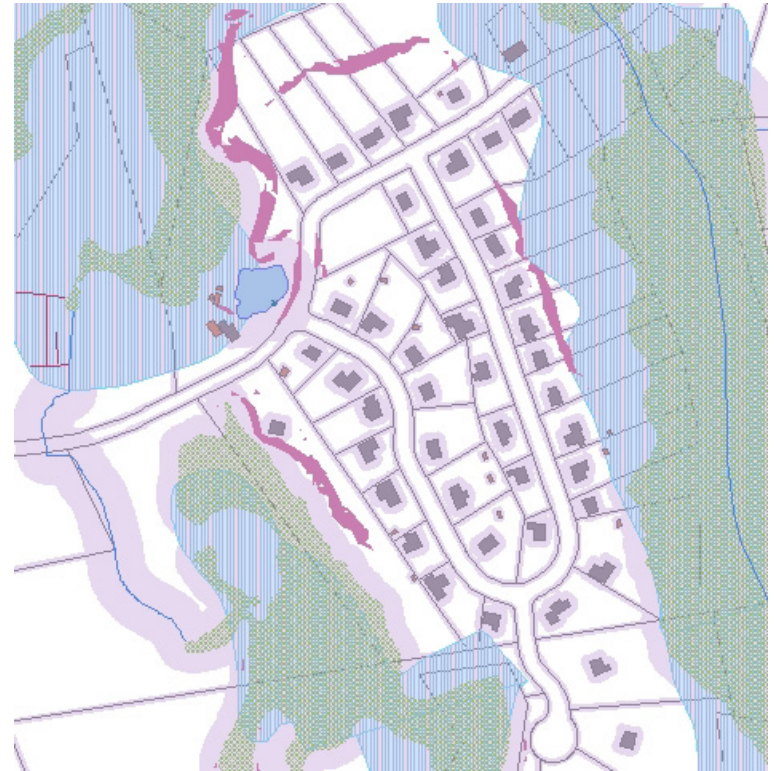
■ Process

- Determine setback distances for each feature class
- Buffer features
- Union buffers with parcels
- Determine available lot area

Available Area Analysis

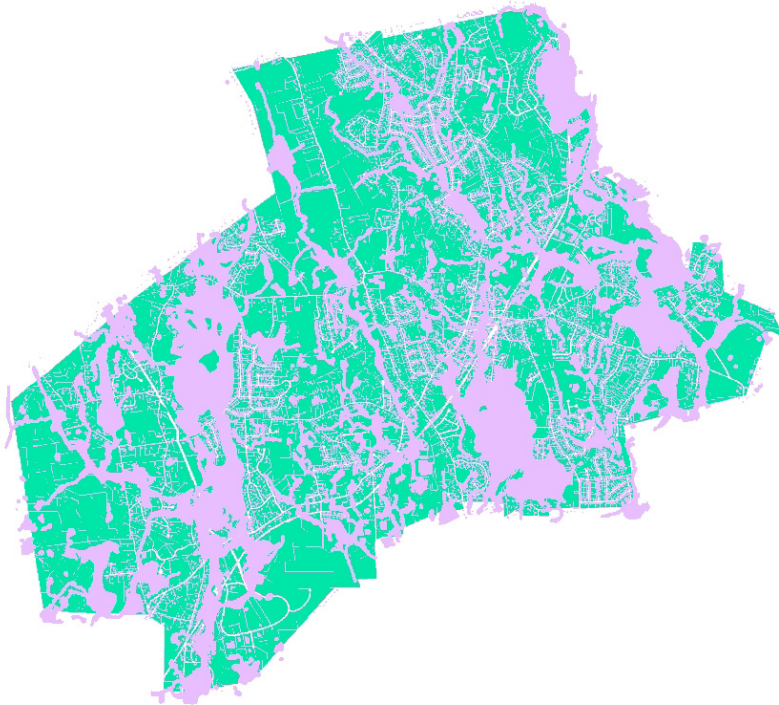


Features requiring setbacks were identified

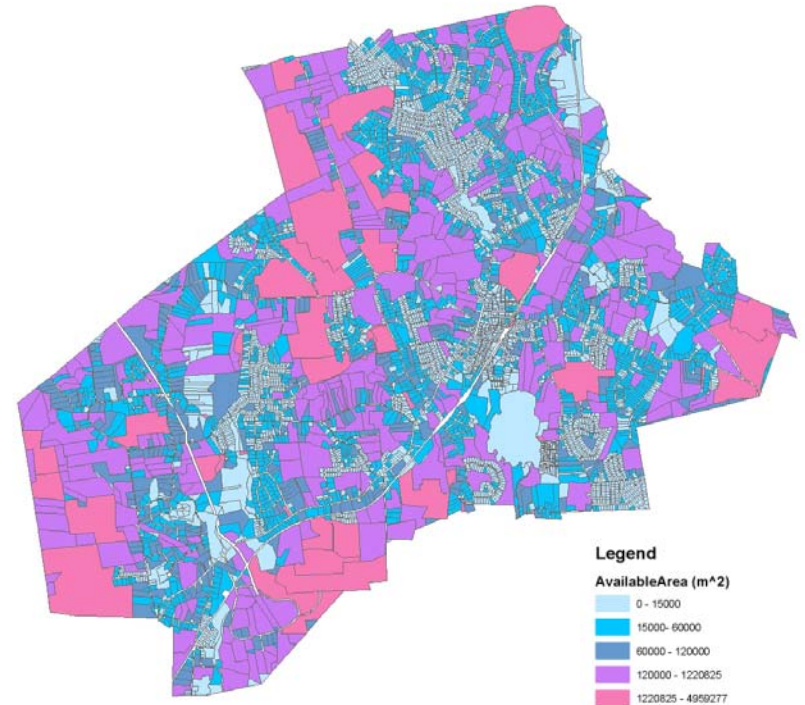


Features were buffered based on required setback distance

Available Area Analysis



**Areas suitable for
system development
assessed town-wide**

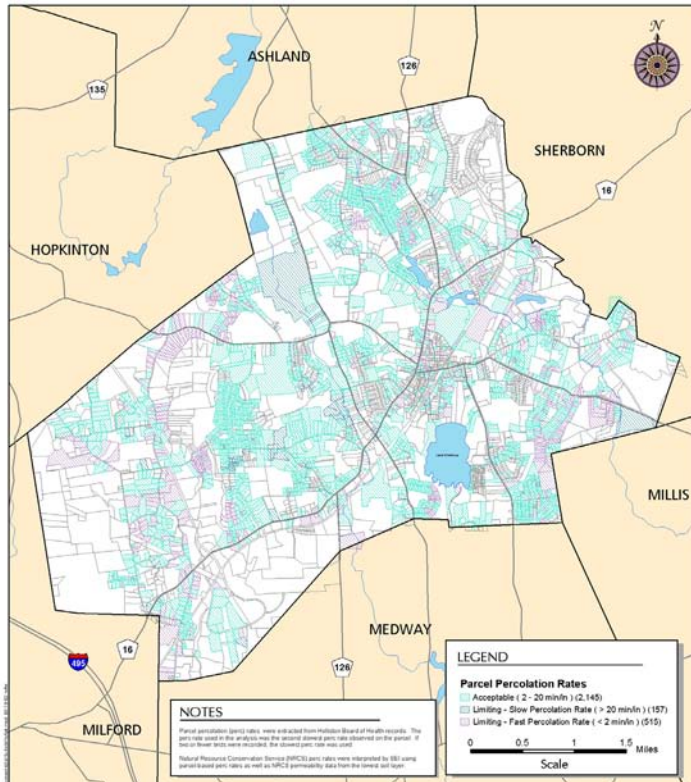


**Total available area
calculated for each parcel**

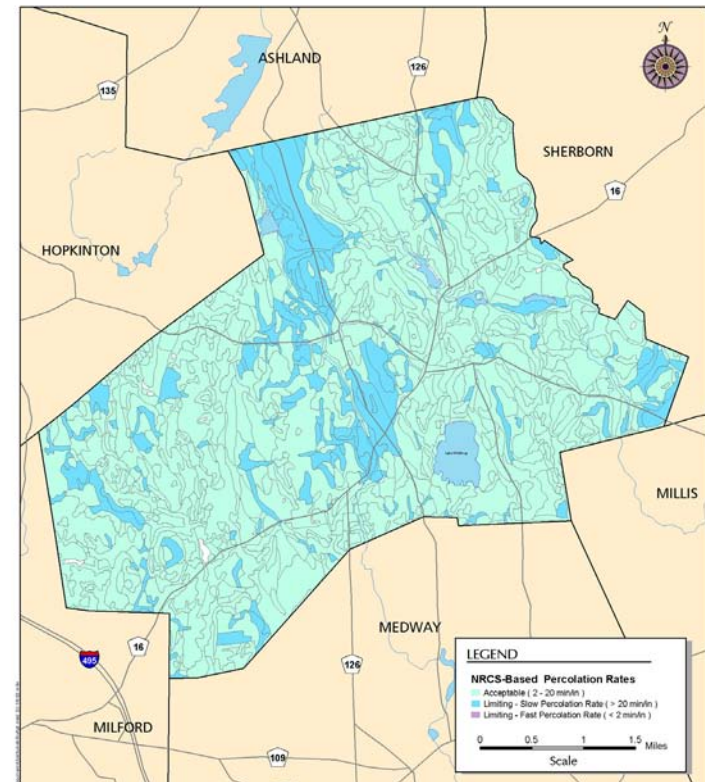
Assessment of Required Treatment Area

- Data
 - Town Board of Health data: soil properties, system characteristics
 - NRCS soils data: Preliminary SSURGO data for soils characteristics
- Process
 - Determine soil properties of each parcel for available land
 - Calculate required system size from soil properties and system properties

Required Treatment Area Analysis

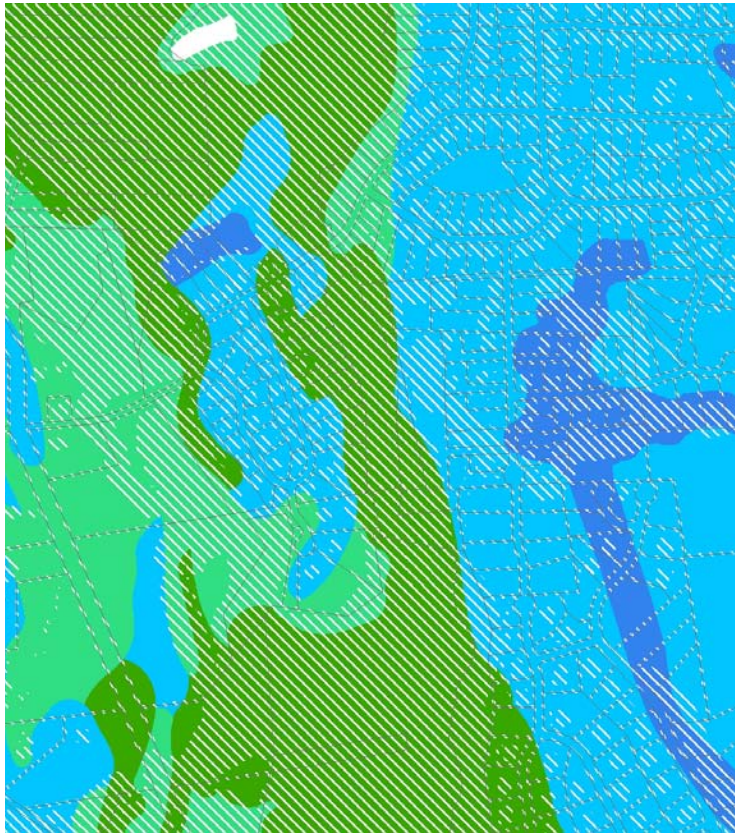


Parcels with Board of Health percolation data identified

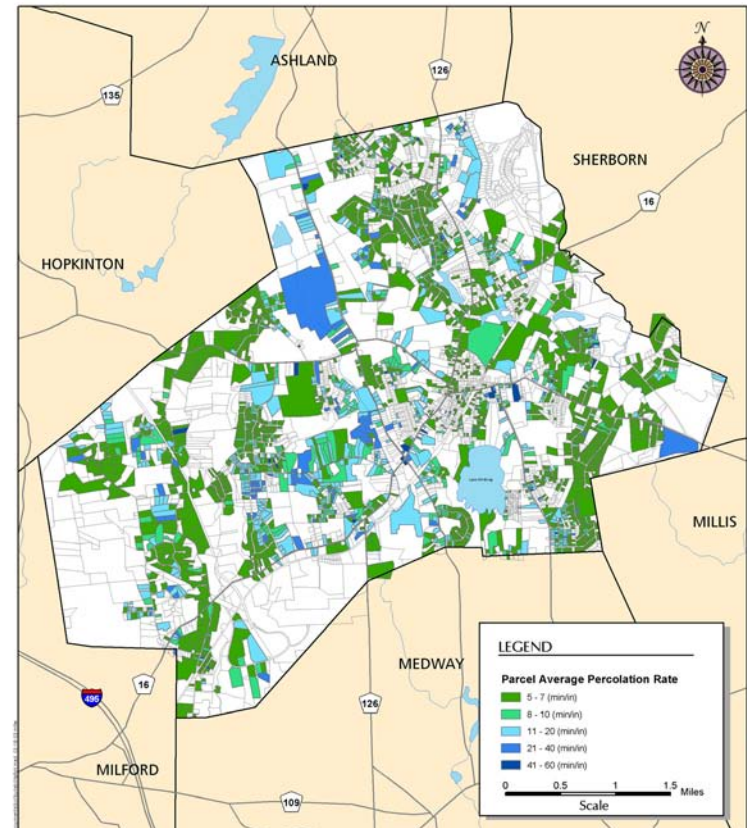


Percolation data inferred for NRCS soil units

Required Treatment Area Analysis



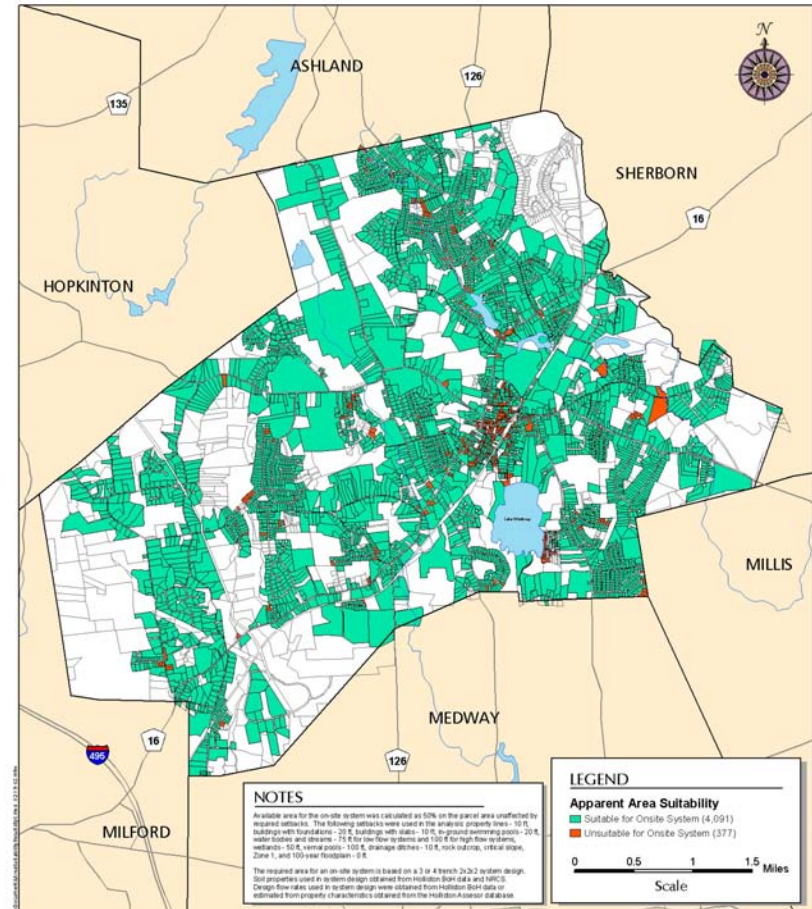
Soil properties based on weighted average over un-buffered area



Town-wide parcel percolation rate

Lots With Insufficient Area Identified

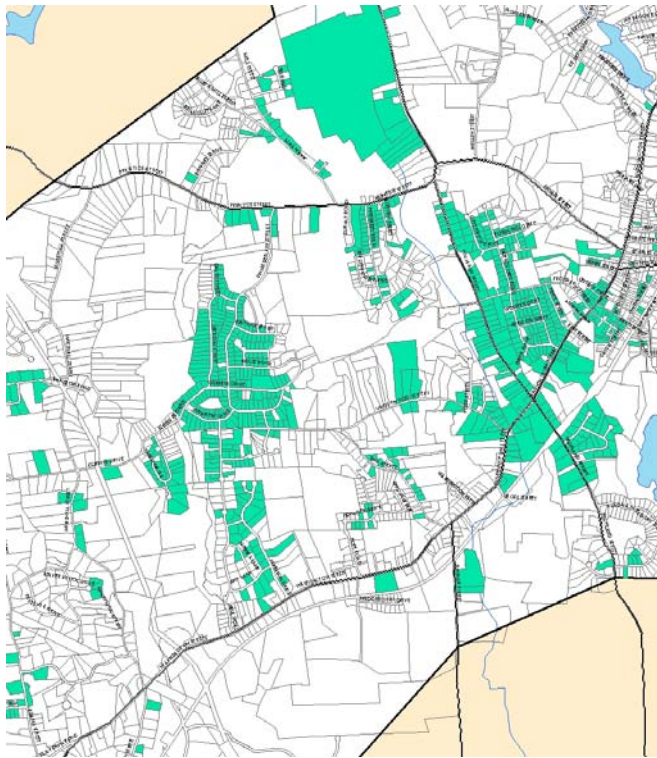
- Required land area calculated from soil properties and system capacity
- Required land area compared to available land area



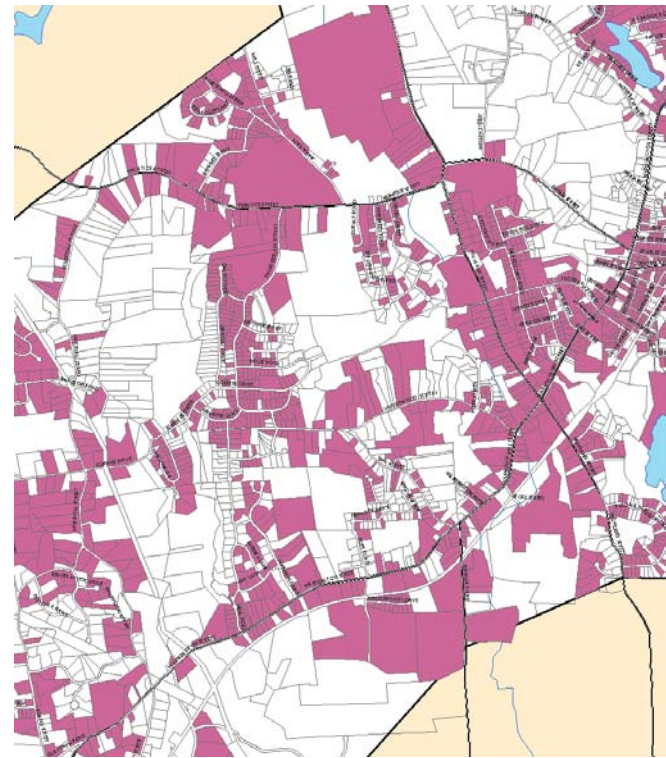
Assessment of Aesthetic Factors

- Data
 - Town Board of Health data: groundwater depth, system characteristics
 - Slope Data: derived from photogrammetry-based 2 ft contours
- Process
 - Identify high groundwater parcels
 - Identify low slope parcels
 - Identify older systems
 - Predict where mound systems required

Aesthetic Factors GIS Analysis

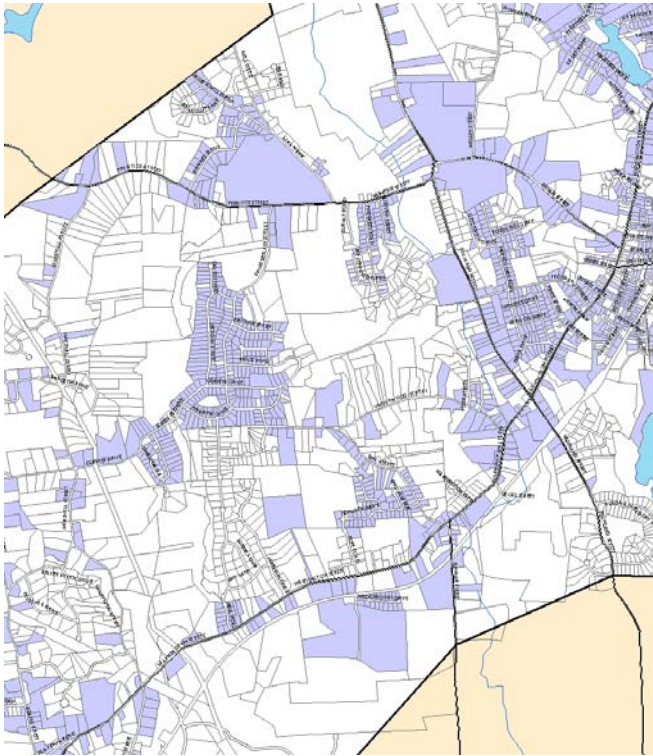


Properties with high groundwater identified

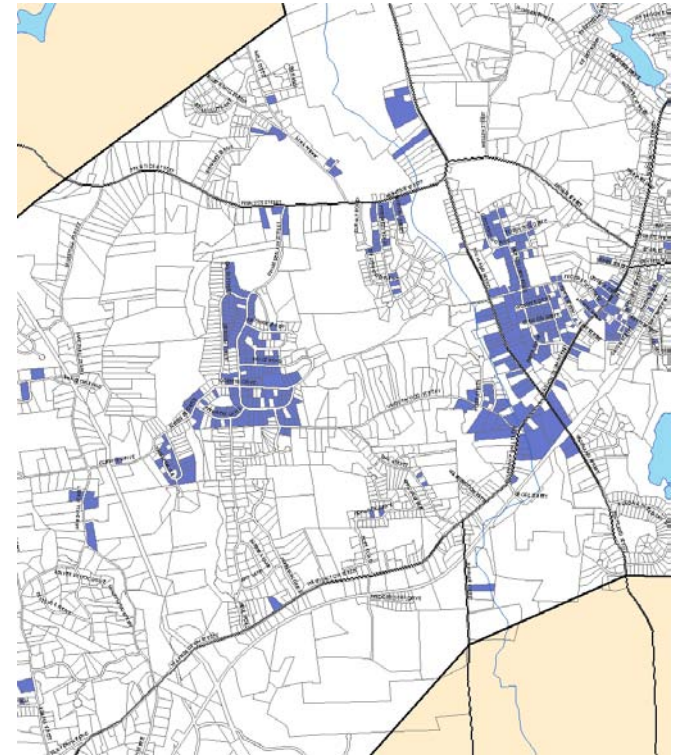


Properties with low average slopes identified

Aesthetic Factors GIS Analysis



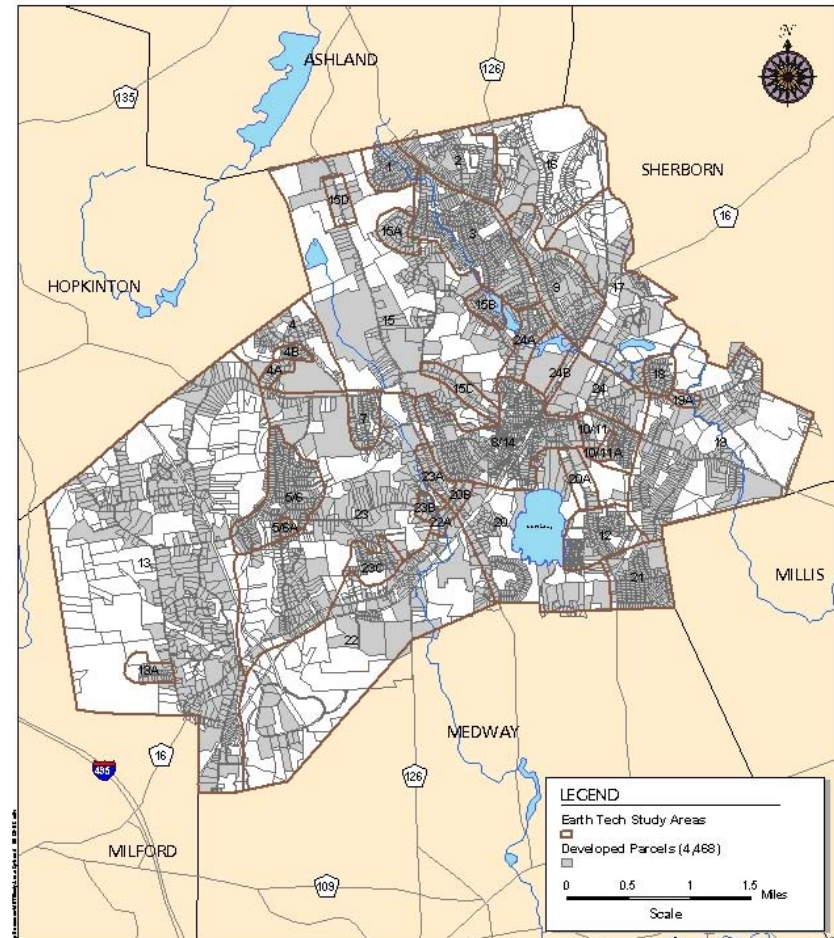
Properties with older systems identified



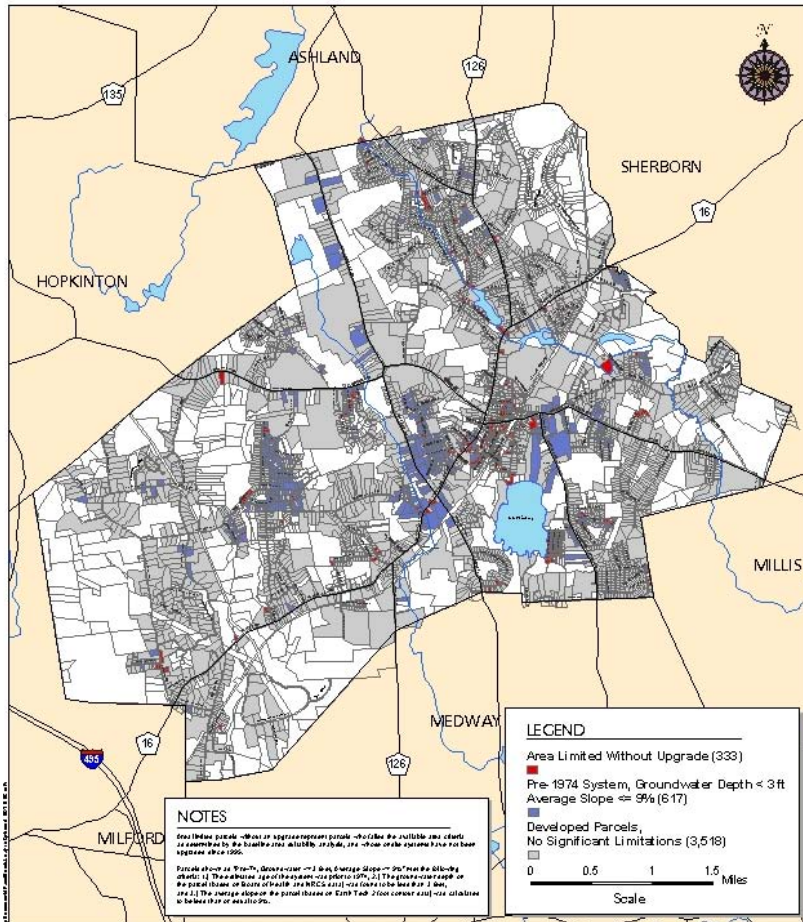
Intersection of high groundwater, low slope, and older system

Development of Neighborhoods

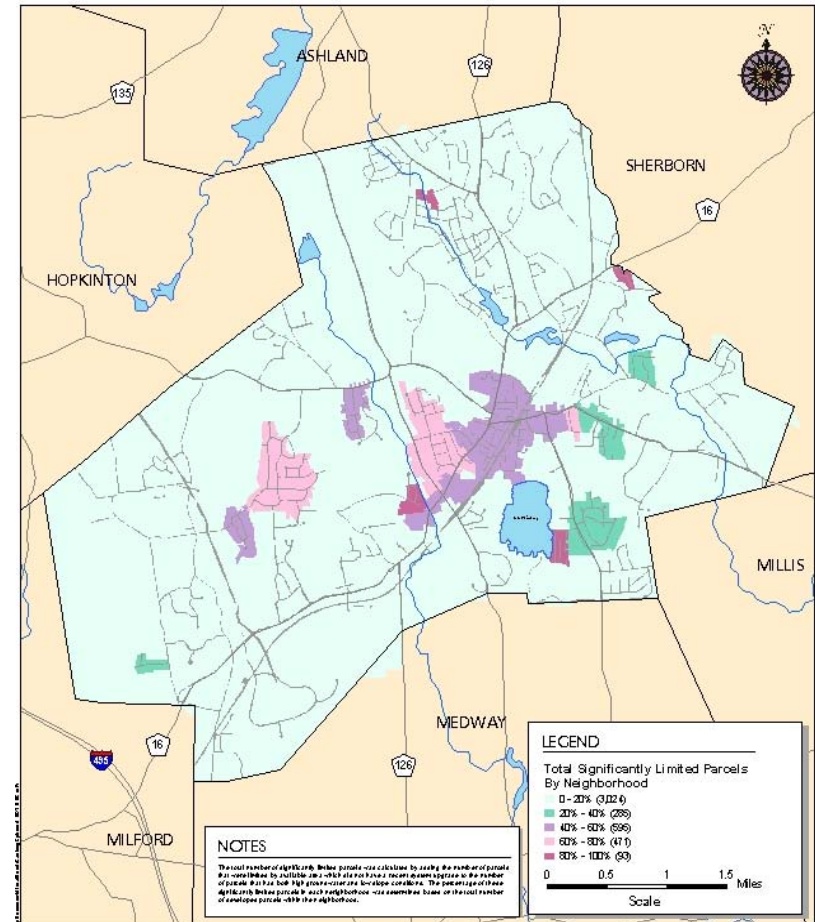
- GIS analysis focused thus far on local analysis
- Planning purposes required a regional analysis



Classification of Neighborhoods Into Needs Areas



Parcel Needs Results



Neighborhood Needs Results

Project Conclusions

- A highly detailed lot-based wastewater disposal analysis was performed
- Regional conclusions were drawn for purpose of town planning
- Recommendations made for regions of town requiring alternative solutions
- Town received a complete GIS database at conclusion project
- GIS database suitable for both government/planning tasks, as well as future engineering analyses

GIS Lessons Learned

- An ArcGIS geodatabase and external MS Access databases served as the analysis environment
- ArcGIS 8.1 environment not well suited to complex database queries
- Linkage between ArcGIS and external Access database could stand to be cleaner
- Data quality concerns were of highest importance
- A detailed GIS analysis to solve any problem is only as strong as the underlying data