

Lead Poisoning Risk in the City of Hartford: A GIS Analysis

Katie E. Perham, MPH

GIS Consultant

ESRI Health GIS Conference

September 21, 2009

Overview

- Background on health effects of lead in children
- Hartford Health & Human Services (HHS) Lead Program
 - High Tech Lead Tracking Project
- Approach for lead poisoning risk analysis
- Results

Children and Lead

- Lead found in and around homes built prior to 1978
 - Paint chips, dust, soil
- Can result in:
 - Brain damage
 - Nervous system damage
 - Behavior and learning problems
 - Slowed growth
 - Hearing damage

HHS Lead Program

Blood Lead Level $\mu\text{g}/\text{dl}$	Action
10–19	Child has lead in blood. Case management begins.
≥ 20	Child is lead poisoned. Epidemiological investigation, inspections, tracking

- CDC Stellar Database – where data is tracked

High Tech Lead Tracking project

- EPA 2-year grant (Oct 07-Sept 09) specific to use of GIS for prevention of lead poisoning
- Collect and analyze information on lead hazard inspections
- Identify properties with lead hazards and properties which have been remediated
- Guide remediation efforts and allow for real-time analysis of neighborhood “hot spots”
- Direct outreach and education efforts to parents and property owners, referring them to funding sources for property abatement.

Research Question

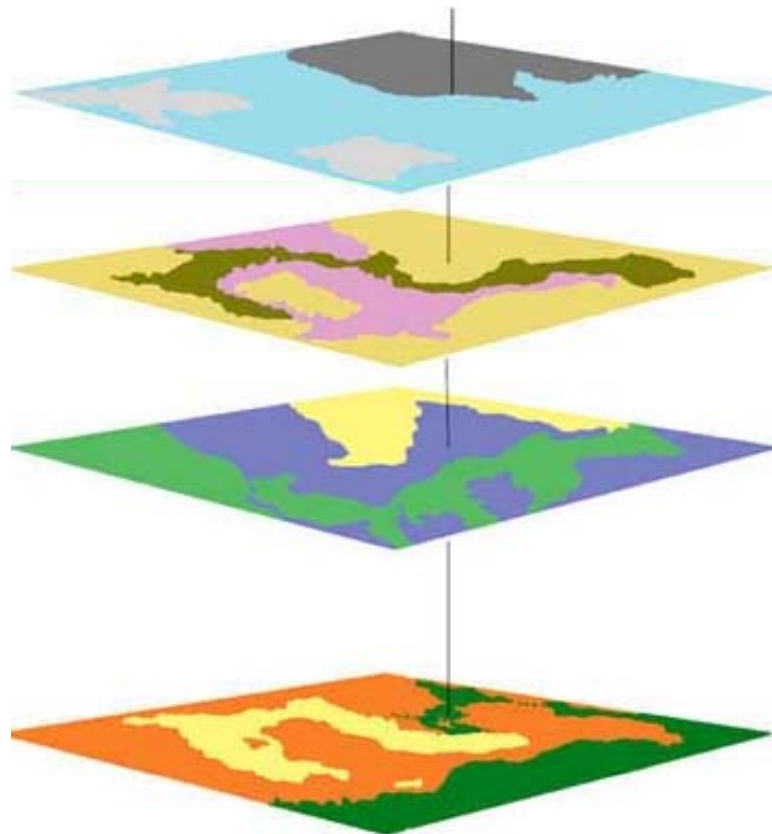
- Where are the highest risk areas for lead poisoning in Hartford?

Data Sources

Risk Factor	Source
Age of Housing (Year Built)	Tax Assessor
Locations of children with elevated blood lead levels (1993-2007)	HHS Stellar Database
Household Income	US Census
Percentage of children under age 5	US Census
Building type: residential 2 or 3 BR apts or houses	Tax Assessor
Buildings with soil samples with lead levels \geq 400 ppm	HHS Stellar Database

Project Approach – Weighted Overlay Analysis

- Combine all GIS layers to calculate a ‘risk score’ per building



Project Approach – Weighted Overlay Analysis

Steps:

1. Assign weight to each data source
2. Assign risk values based on our understanding of risk
3. Run layers through weighted overlay tool
4. Map the results

Weighting

- Previous understanding of risk
- Experience and insight into area of study
- Relative influence of each layer on risk
- Alternative (weighted sum analysis) assumes all six layers are equally influential on risk

Step 1: Assign weight to each data source

Risk Factor	Weight
Age of Housing (Year Built)	35%
Locations of children with elevated blood lead levels	20%
Household Income	15%
Percentage of children under age 5	15%
Building type: residential 2 or 3 BR apts or houses	10%
Buildings with soil samples with lead levels ≥ 400 ppm	5%

Step 2: Assign rank values to data based on our understanding of risk

Layer	Values	Assigned Risk Value	Risk
Age of Housing	Pre-1950	3	Highest
	1950-1977	2	
	1978-2007	1	
Children with EBLL (Stellar Results)	≥ 20 $\mu\text{g}/\text{dl}$	6	Highest
	15-19	5	
	10-14	4	
	5-9	3	
	>0-4	2	
	zero	1	

Step 2: Assign rank values to data based on our understanding of risk

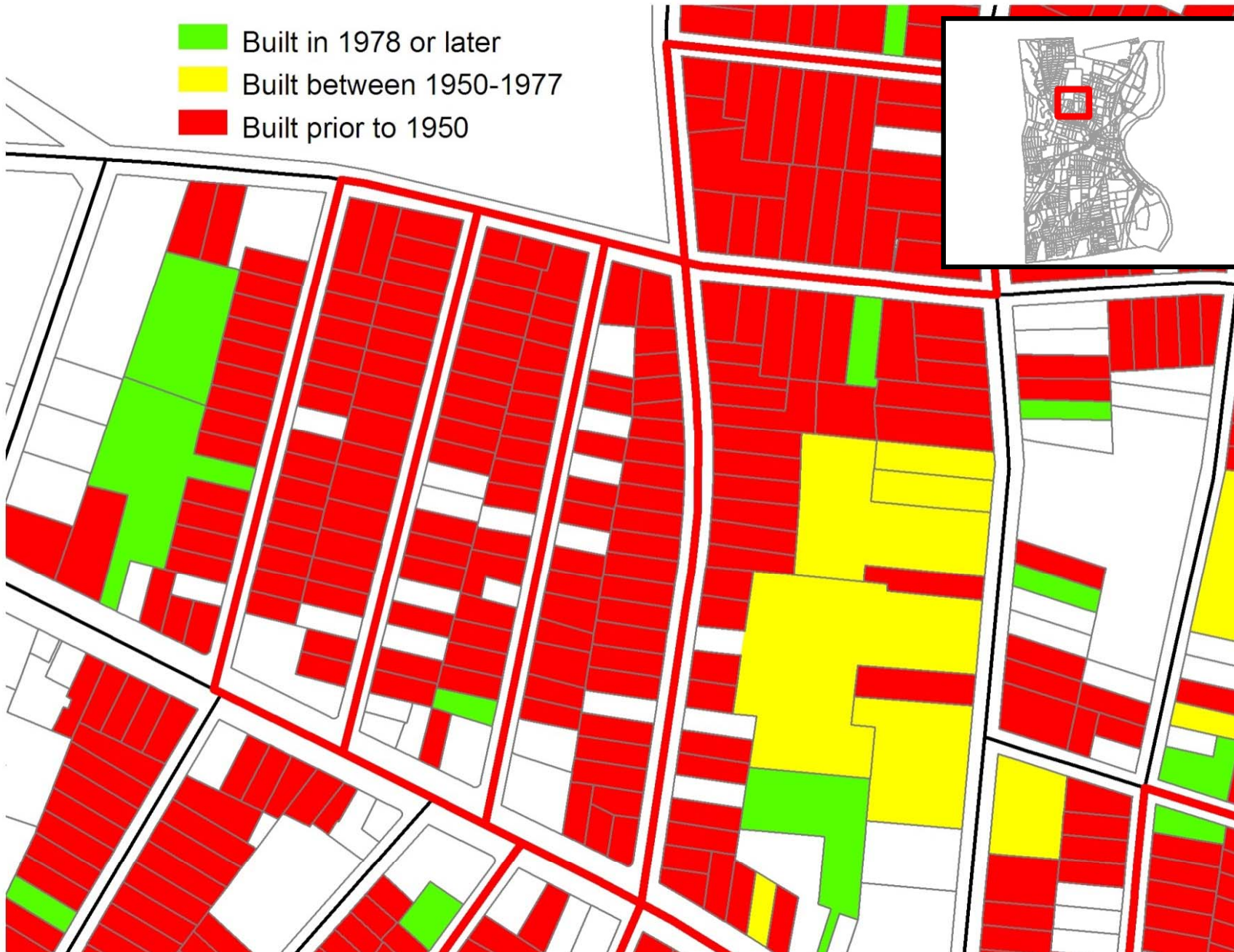
Layer	Values	Assigned Risk Value	Risk
Household Income	< 10K	8	Highest
	10-15K	7	
	15-19K	6	
	20-25K	5	
	25-29K	4	
	30-40	3	
	40-50	2	
	50+	1	
Percentage of Children < age 5	> 10%	3	Highest
	1-10%	2	
	<1%	1	

Step 2: Assign rank values to data based on our understanding of risk




Layer	Values	Assigned Risk Value	Risk
Soil samples	≥ 400 ppm	3	Highest
	300-400 ppm	2	
	< 300	1	
Number of Bedrooms	2+ bedrooms	2	Highest
	<2 bedrooms	1	

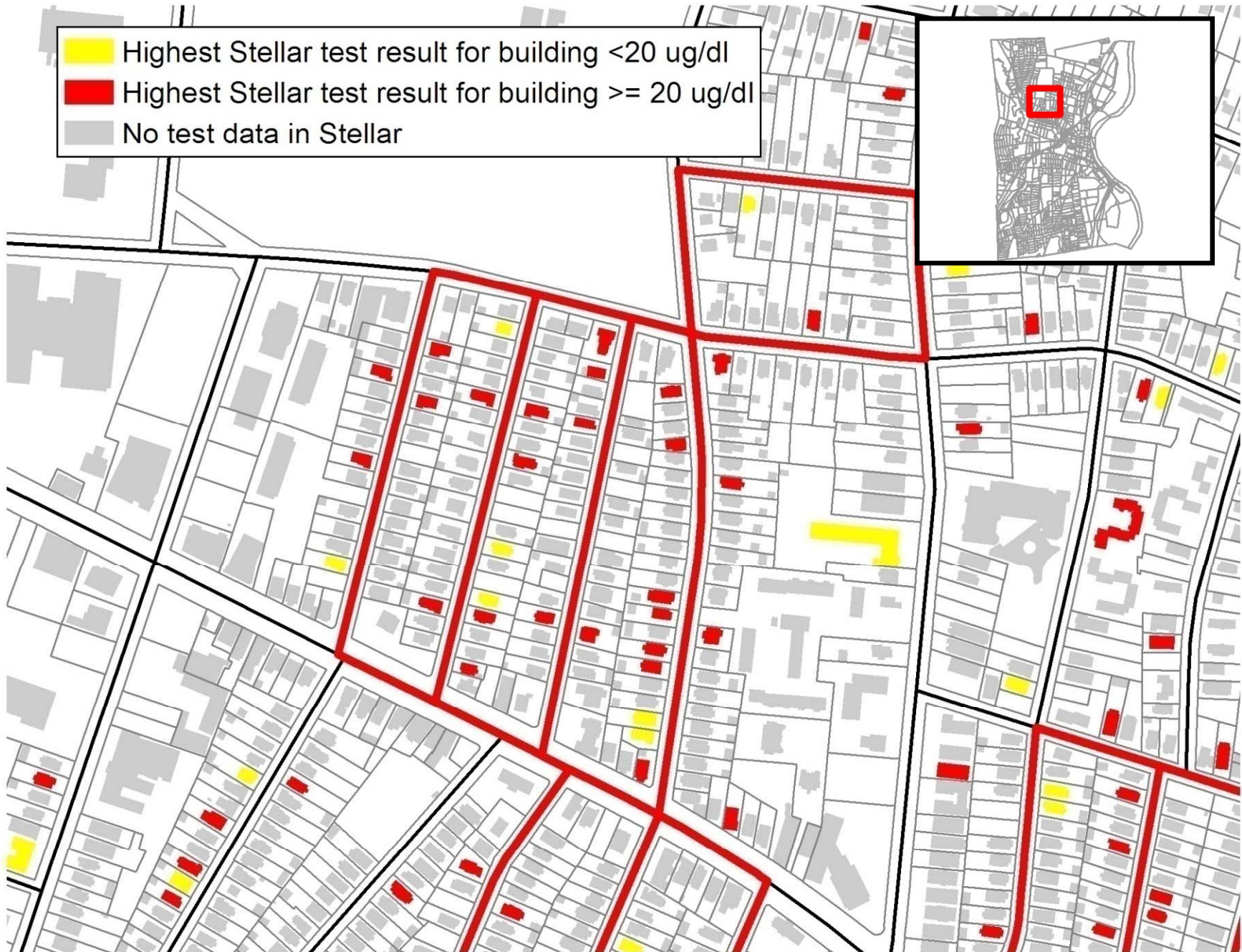
Age of Housing

- Built in 1978 or later
- Built between 1950-1977
- Built prior to 1950

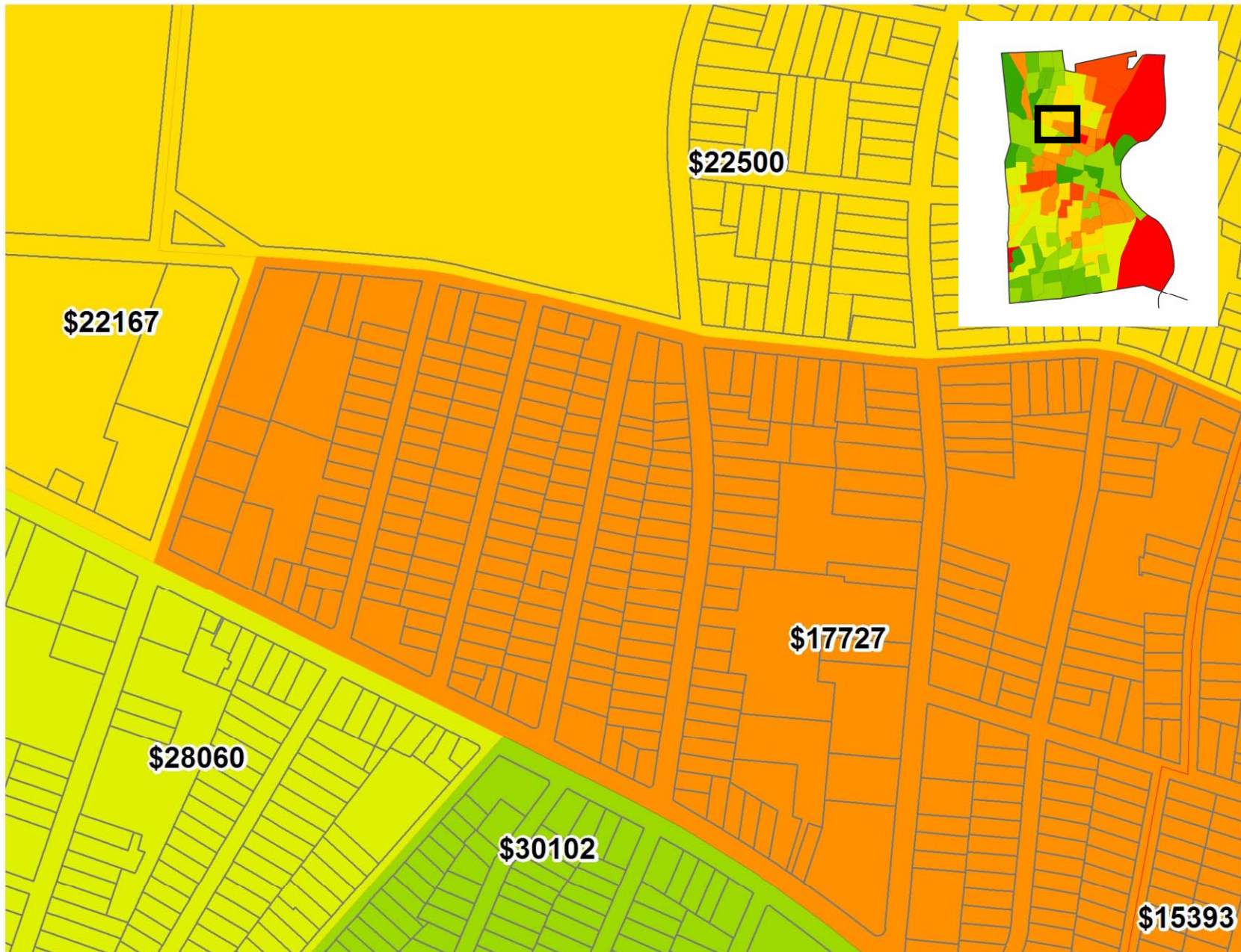


Stellar Lab Samples

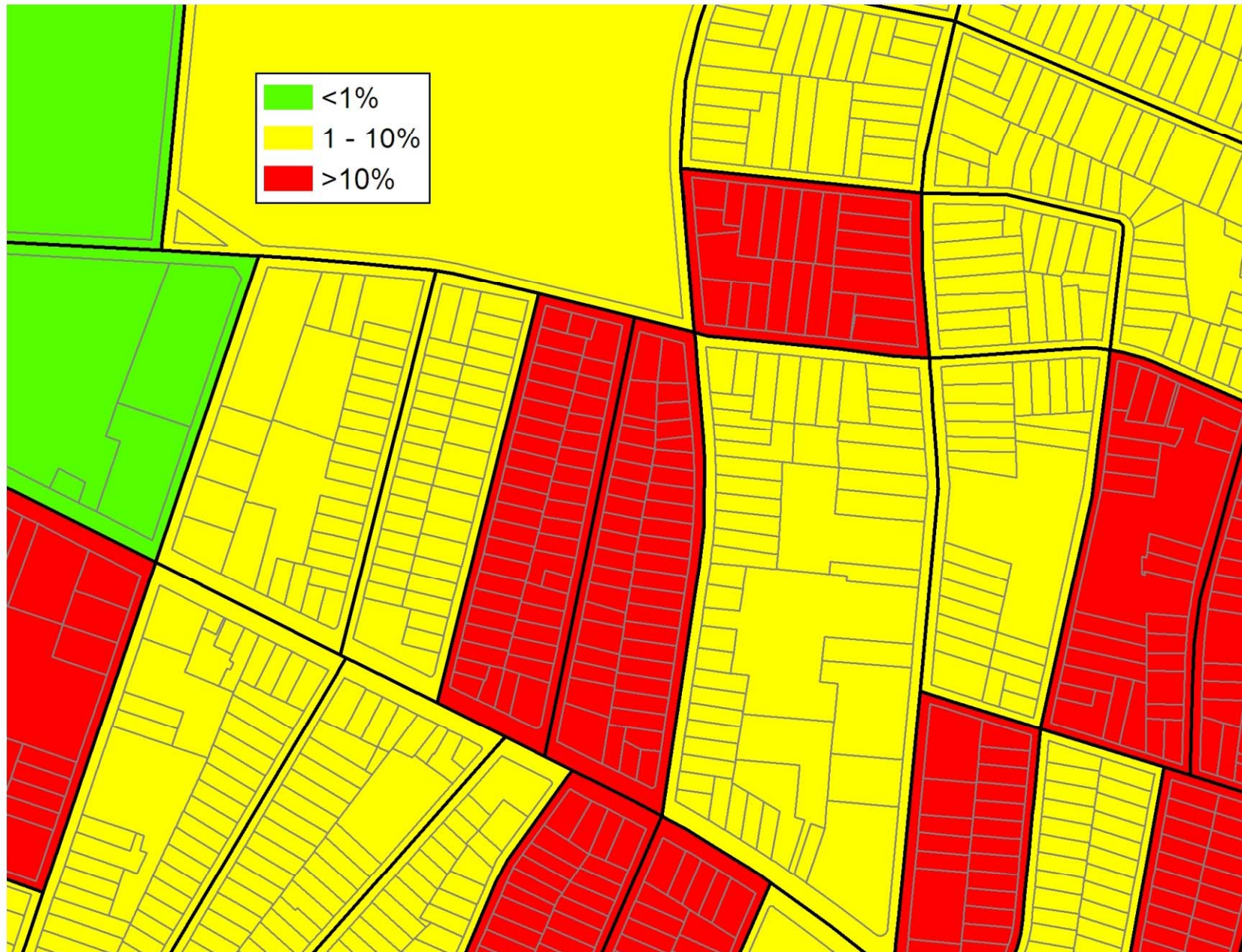
-  Highest Stellar test result for building <math>< 20 \text{ ug/dl}</math>
-  Highest Stellar test result for building $\geq 20 \text{ ug/dl}$
-  No test data in Stellar



Median Household Income



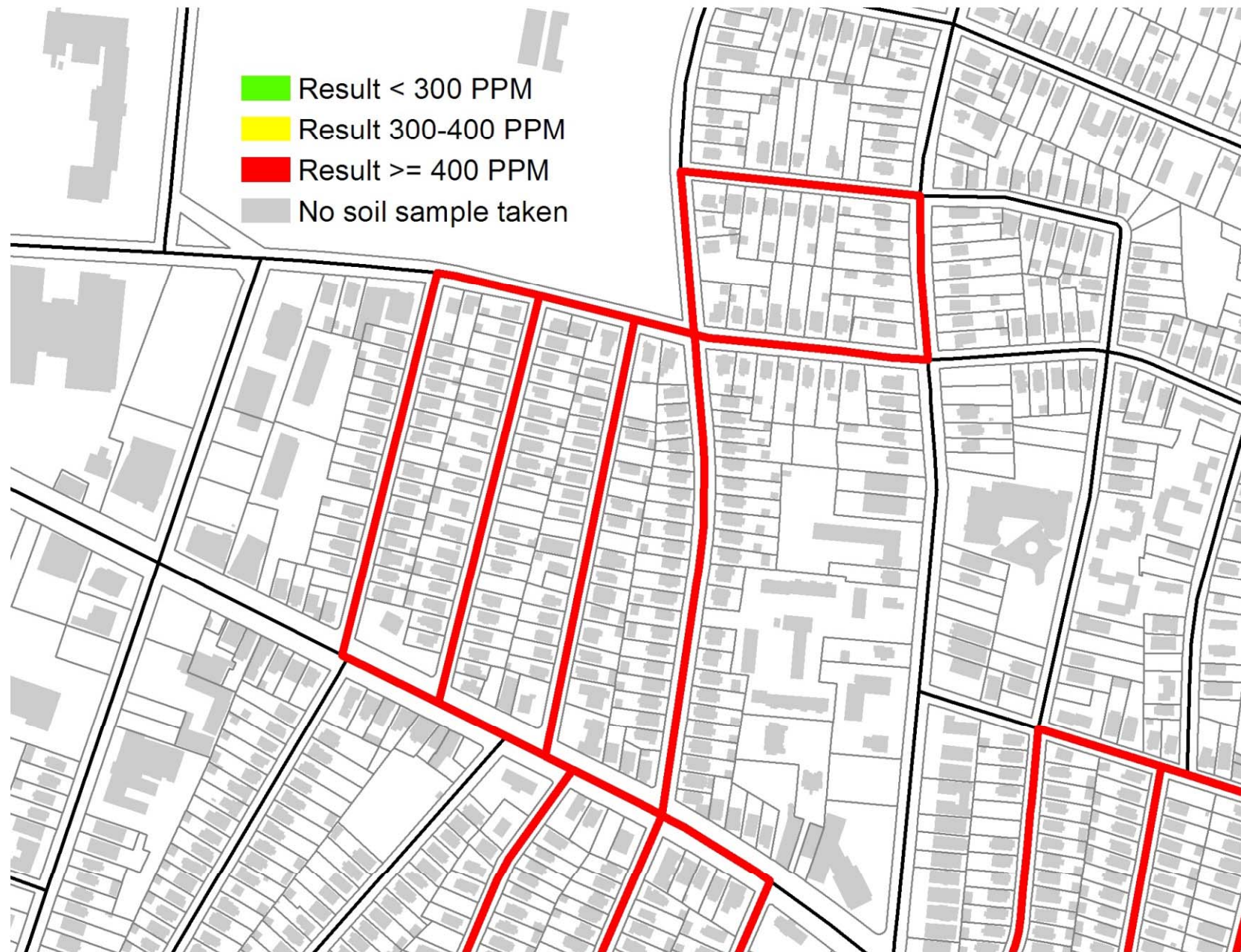
Percentage of Children Under Age 5



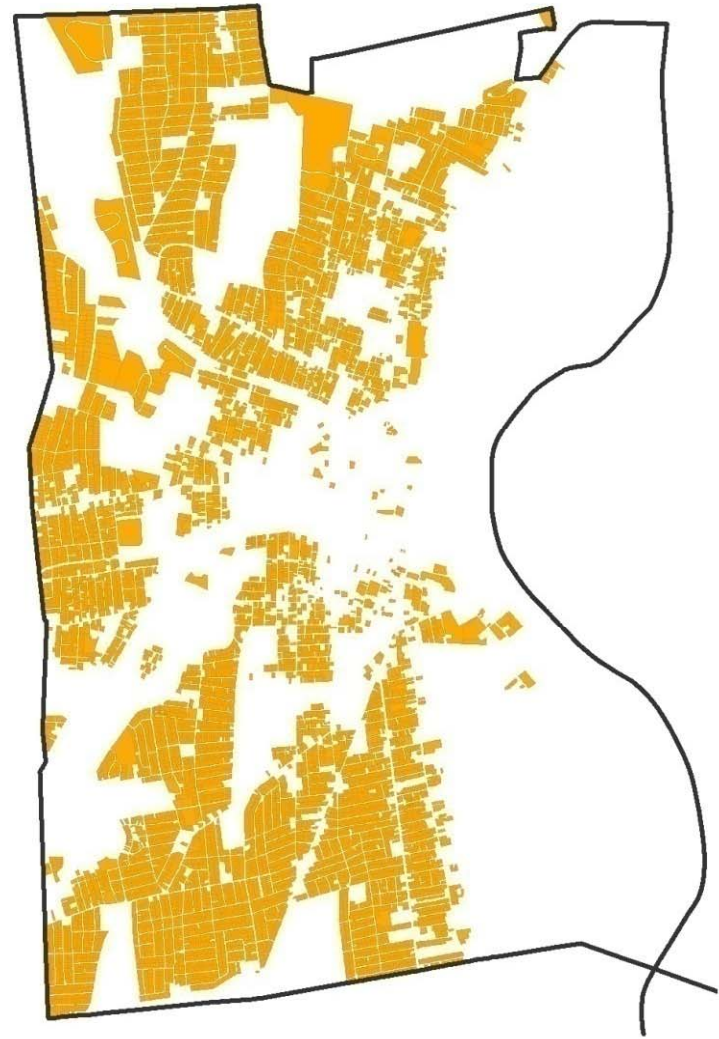
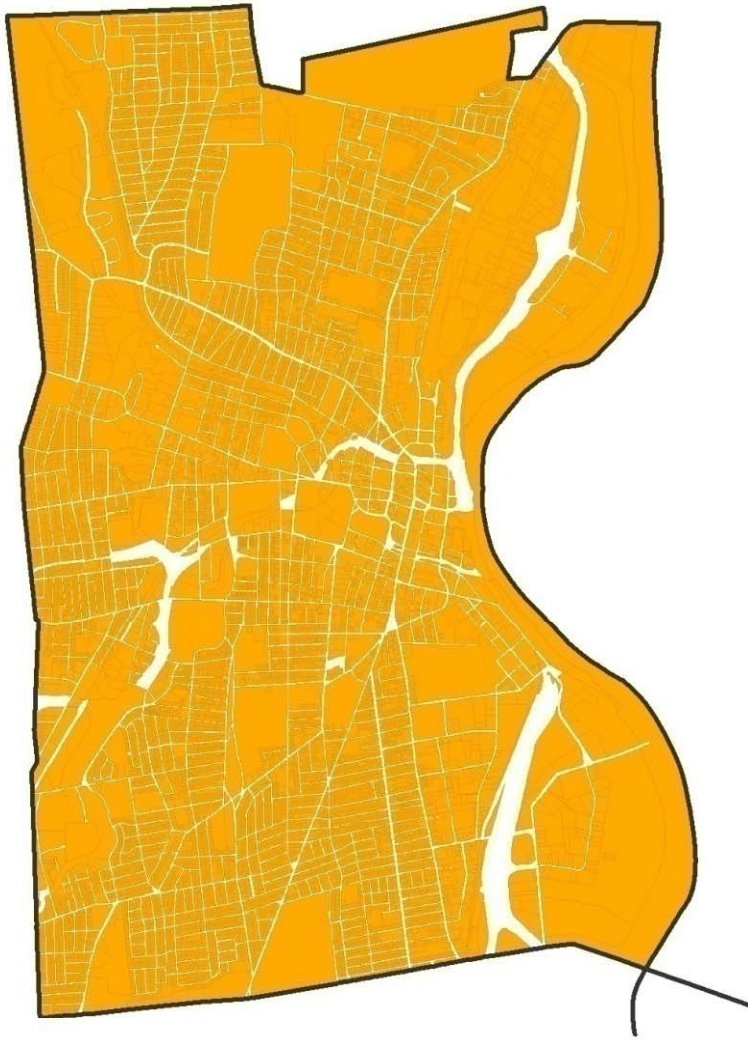
Number of Bedrooms



Soil Samples

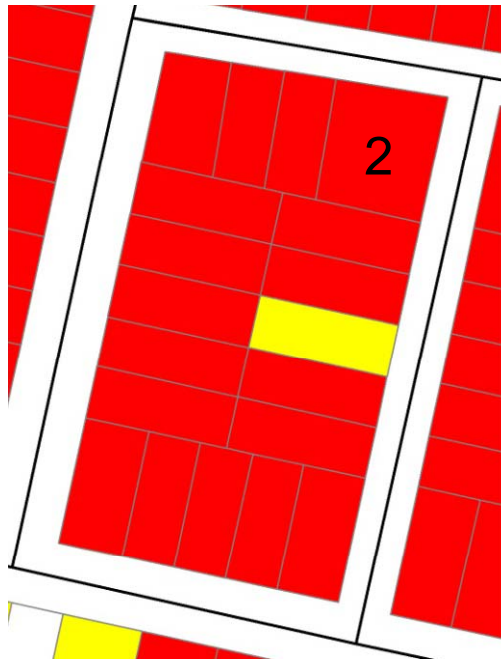


Remove out non-residential properties



Step 3: Run weighted overlay tool

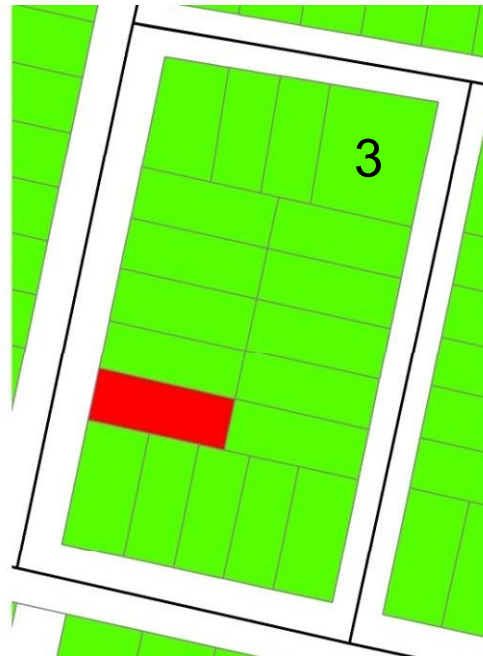
Age of Housing



75% influence

$$(2 \times 0.75) \\ 1.5$$

Percent Children <5

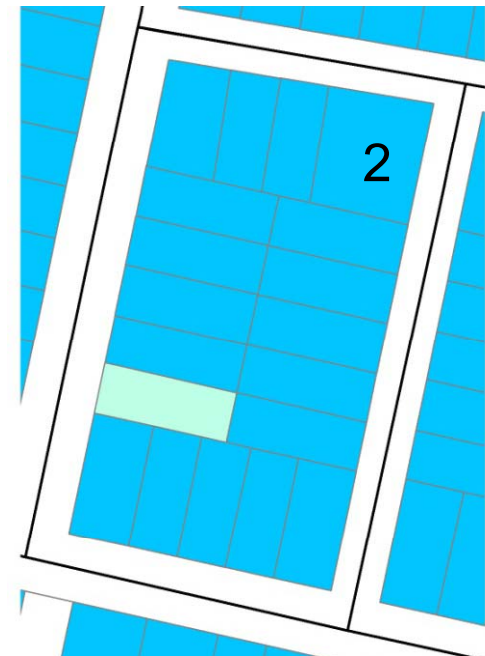


25% influence

$$(3 \times 0.25) \\ 0.75$$

Rounded to closest integer

Output layer



+

=

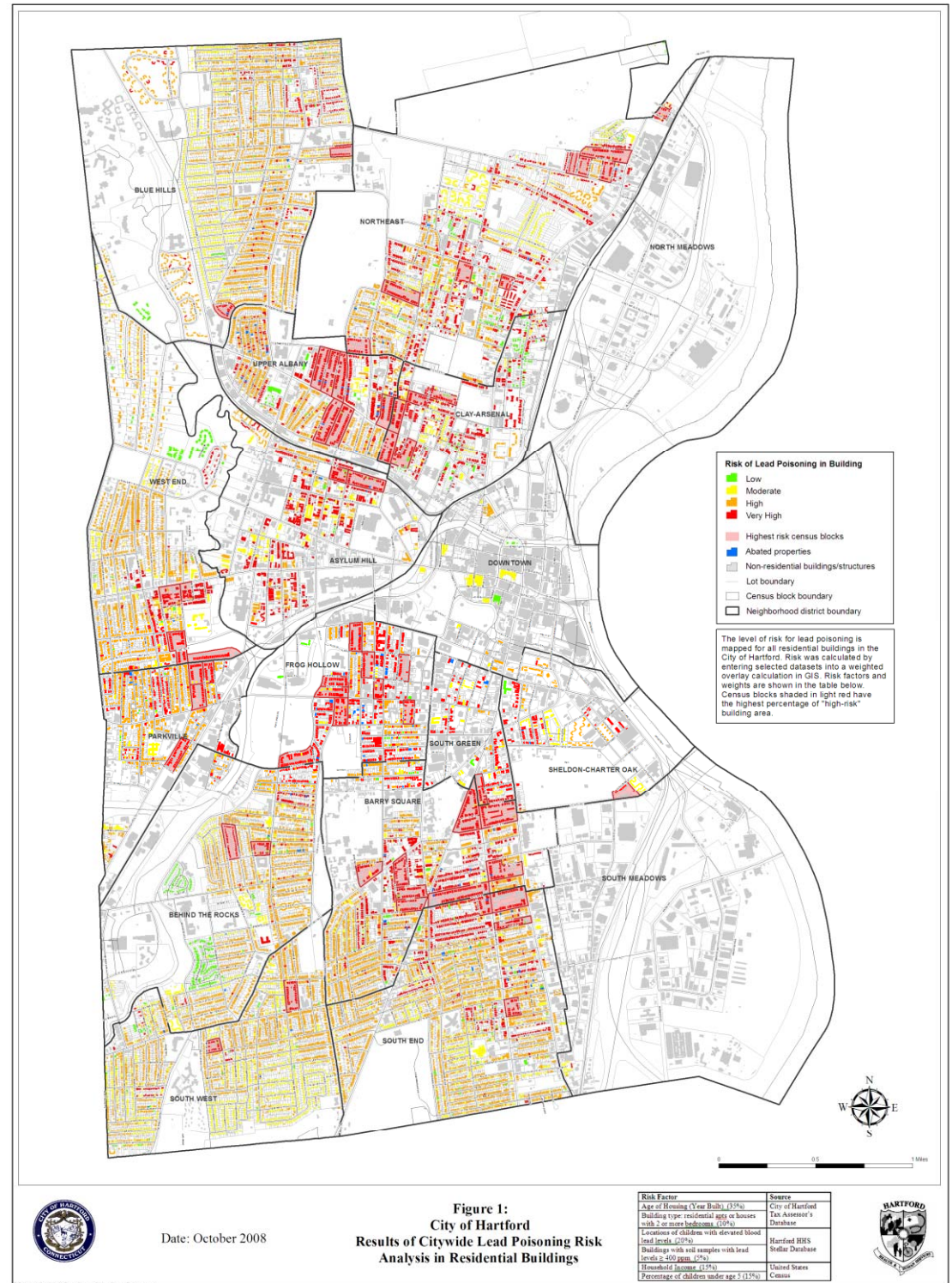
+

=

2.25

2.0

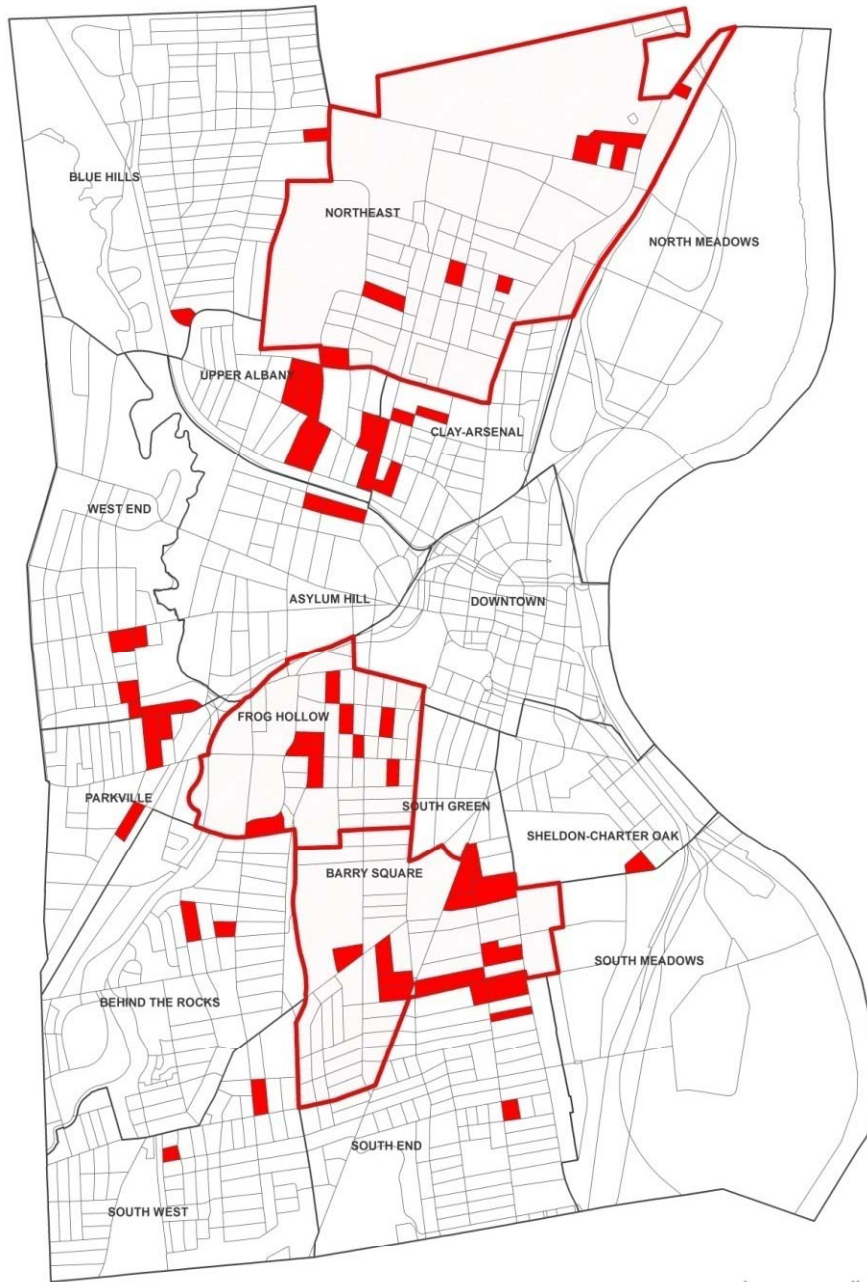
Step 4: Map the results





Results

- Buildings: 28% of residential buildings in Hartford have a very high-risk for lead poisoning
- Census blocks: 61 (out of 997) in Hartford have 90% or greater very high-risk building area
- Neighborhoods: Highest risk are Barry Square, Frog Hollow and the Northeast



Date: October 2008

**Highest Risk Neighborhoods and Census Blocks
Lead Poisoning Risk Analysis
City of Hartford**

Risk Factor	Source
Age of Housing (Year Built) (33%)	City of Hartford
Building type: residential app in houses with 2 or more bedrooms (10%)	Tax Assessor's Database
Locations of children with elevated blood lead levels (25%)	Hartford HHS
Buildings with soil samples with lead levels ≥ 400 ppm (6%)	Soil Database
Household Income (13%)	United States Census
Percentage of children under age 5 (15%)	



Conclusions

- Based on results, outreach strategies have been designed to educate residents and property owners to improve housing conditions
- Grant applications submitted
- GIS layers developed will be used going forward in the future stages of the High Tech Lead Tracking Project, e.g. mobile field applications

Questions and Comments

Contact Info:

Katie E. Perham, MPH
PerhamGIS@me.com