

Mobile Monitoring for Site Evaluation in Vancouver, WA

NW-AIRQUEST Annual Meeting

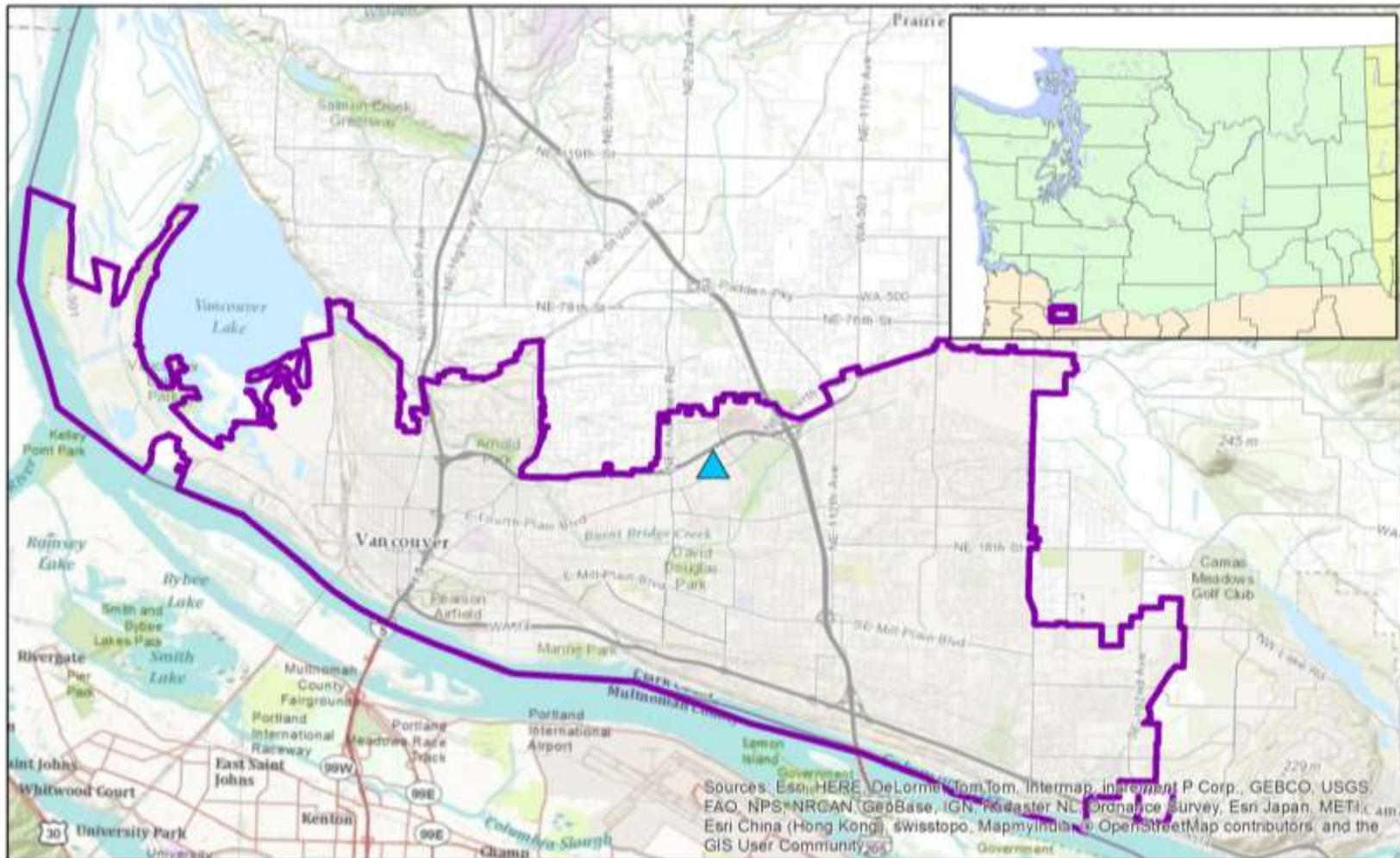
Jill Schulte

June 20, 2014



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Vancouver Overview



-  Vancouver Plaza Dr. Site
-  Vancouver City Limits



0 1 2 4 6 Miles

Vancouver Monitoring Site

- Neighborhood-scale PM_{2.5} monitoring
- Thermo Scientific™ 1405F
 - Tapered Element Oscillating Microbalance (TEOM)™
 - Federal Equivalent Method (FEM)
- Installed at 4th Plain Rd. site October 2011
- Moved ~200m northwest to Vancouver Plaza Dr. in August 2013

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Vancouver Sites Map



▼ Vancouver Plaza Dr. site (current)

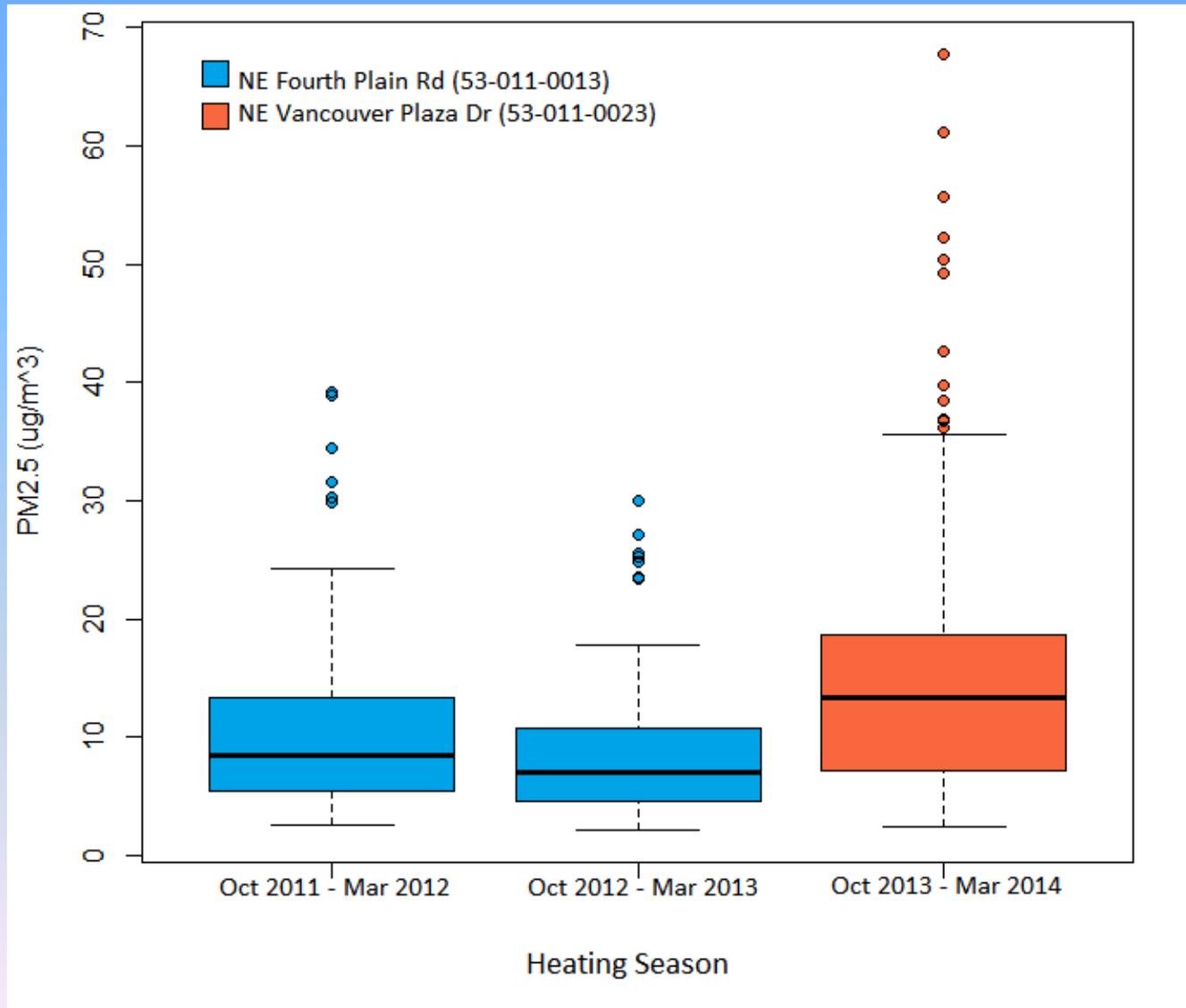
▼ 4th Plain Rd. site (past)

Source: Esri, DigitalGlobe, GeoEye, I-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

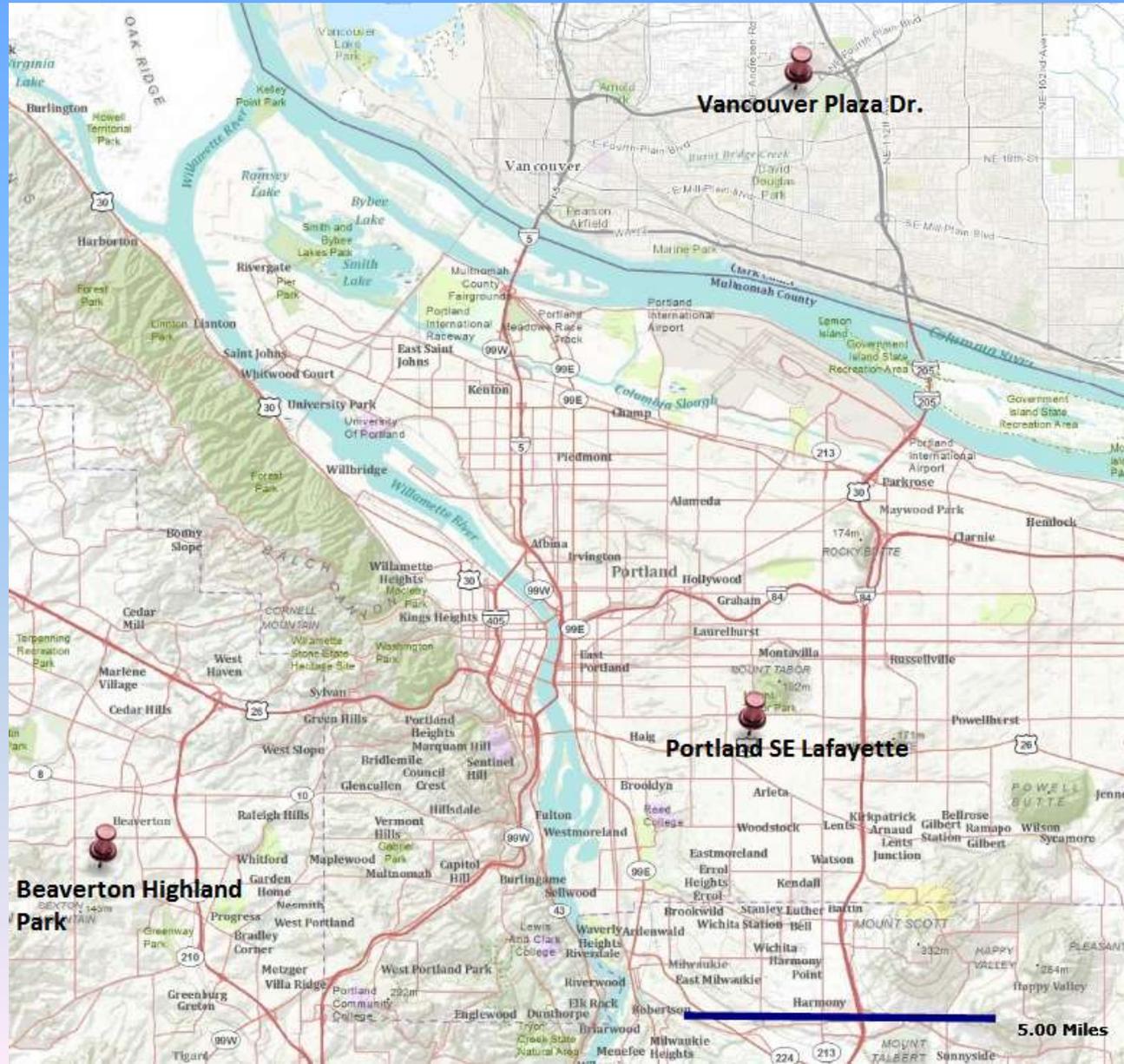


0 50 100 200 Meters

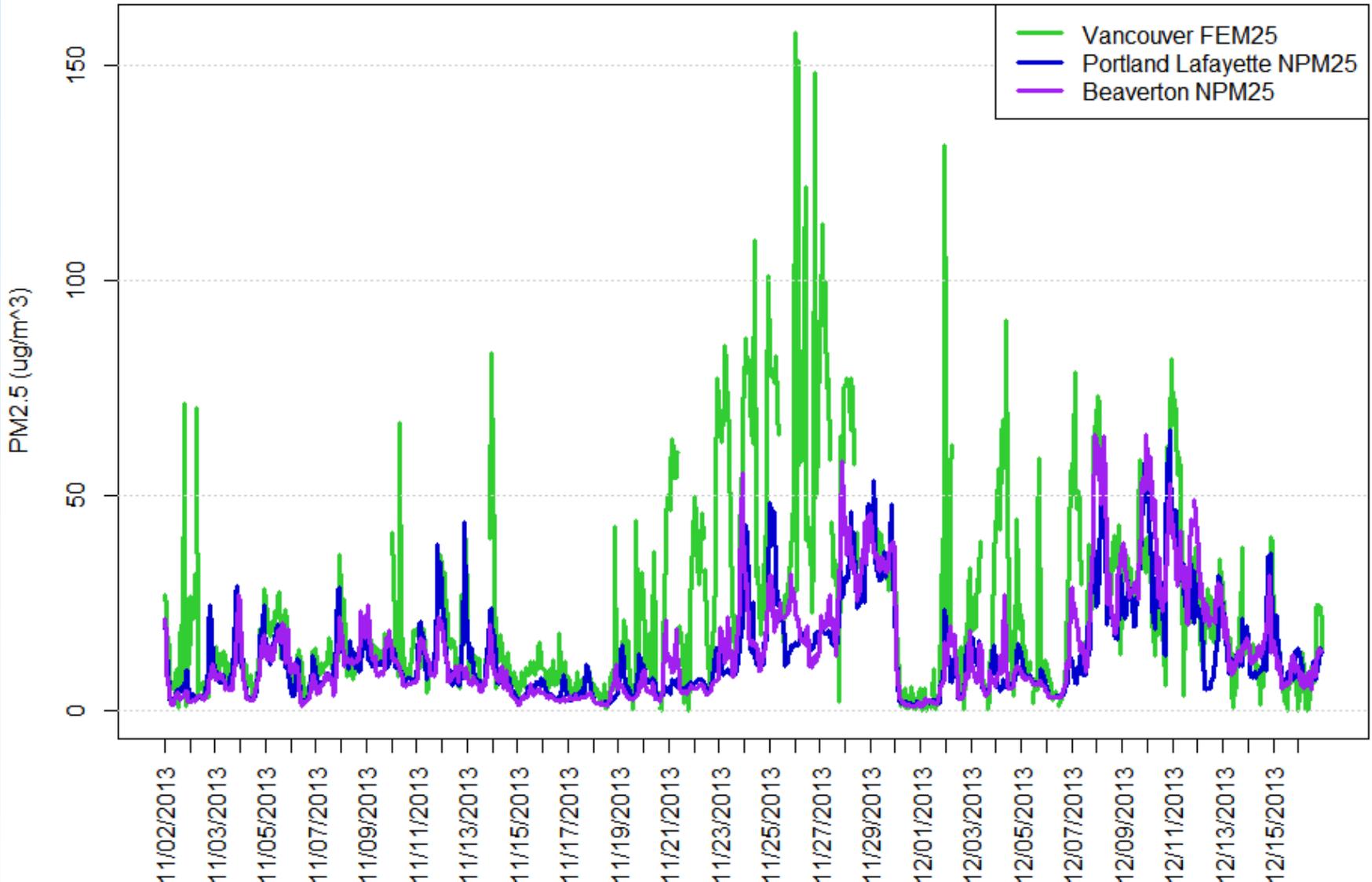
Winter PM_{2.5} by Heating Season and Location



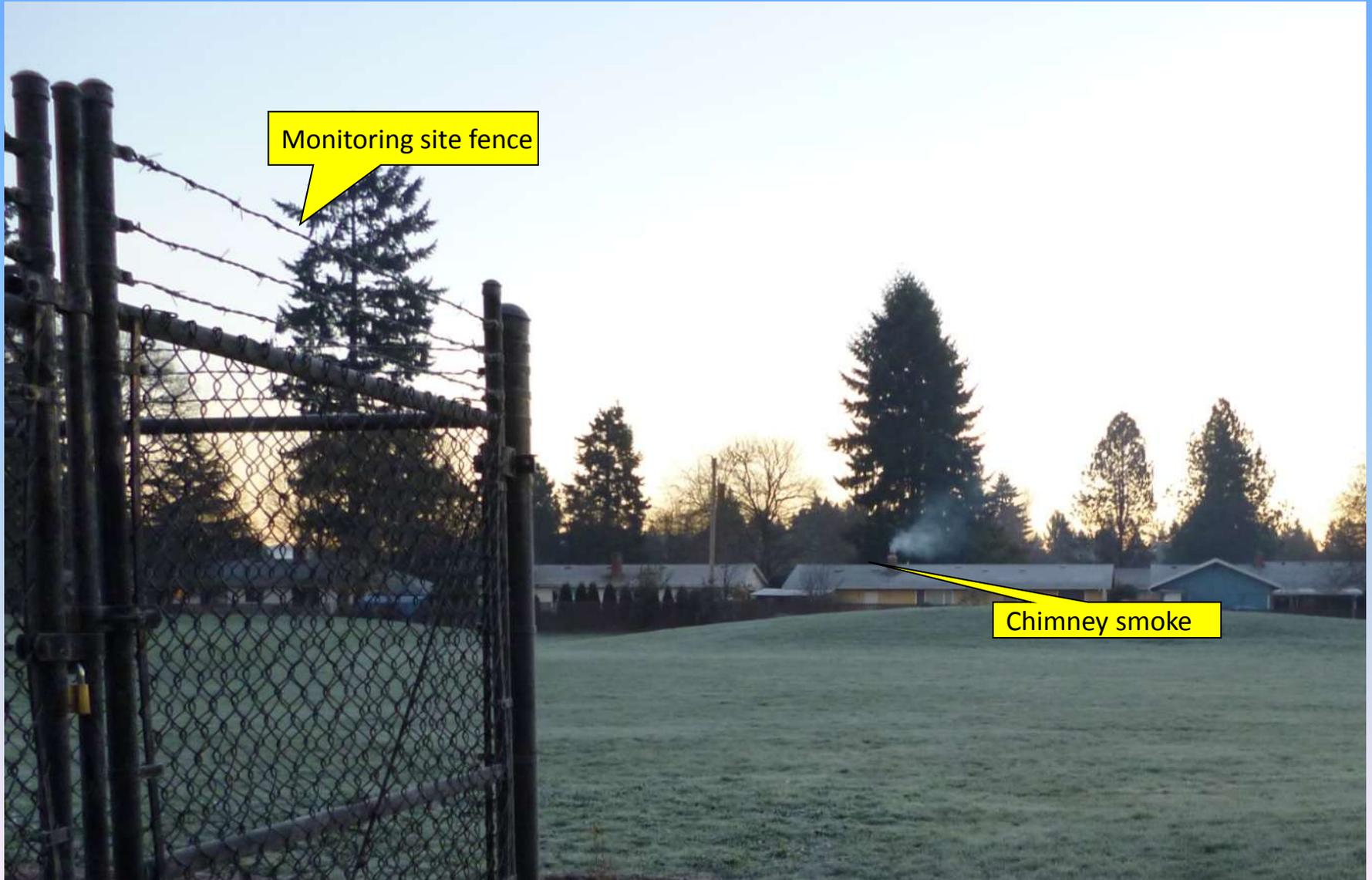
Nearby Monitoring Sites



Vancouver/Portland/Beaverton PM_{2.5} Comparison



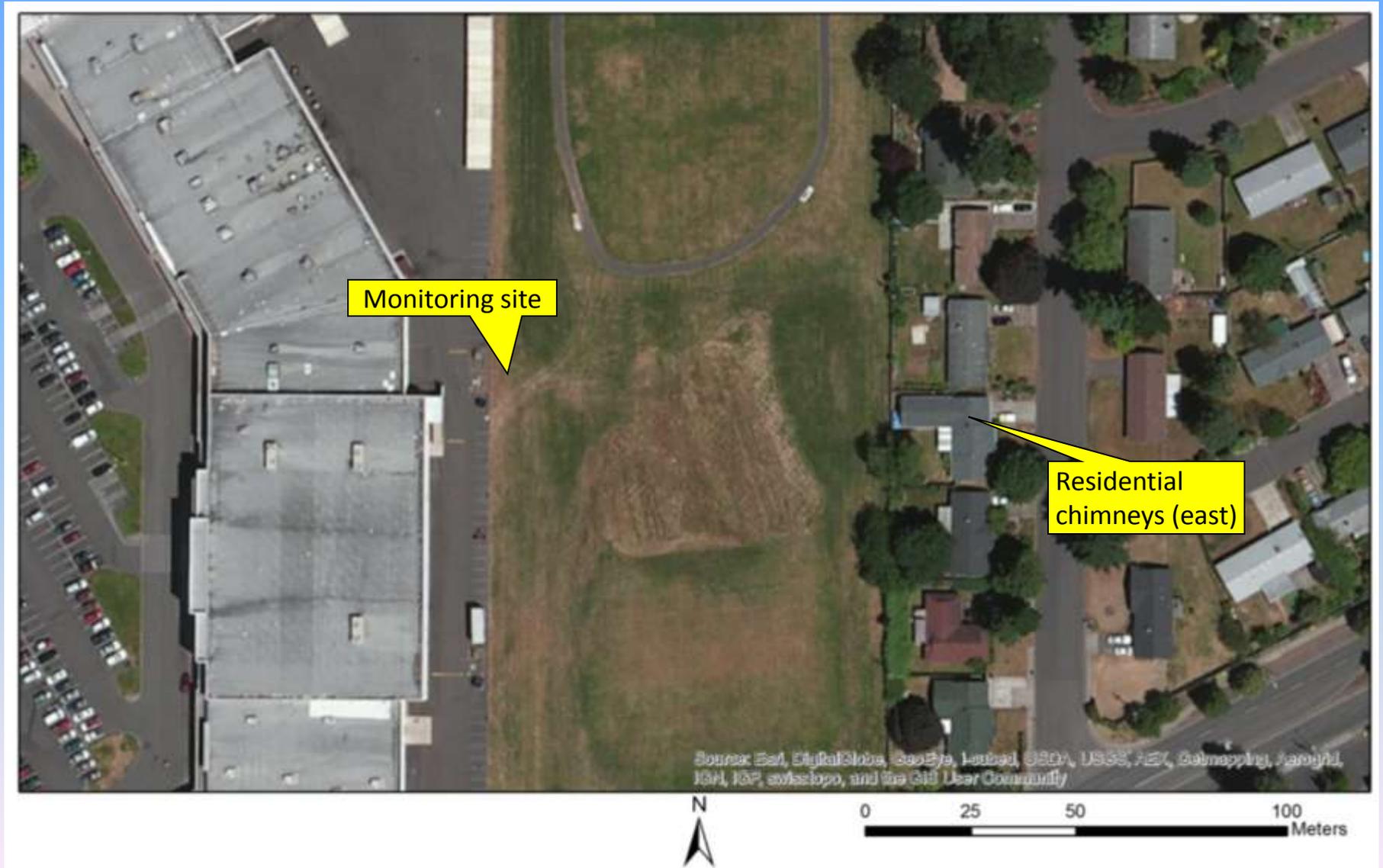
Nearby Source Impacts



Monitoring site fence

Chimney smoke

Nearby Source Impacts



What do you do when you have neither time nor money?

- Study needs:
 - Immediate results
 - Only equipment on hand
 - Wide spatial coverage
 - Minimal temporal variation

...all it takes is a nephelometer, a GPS, two adventurous night-owls, a funnel, and a pair of pantyhose.



Mobile Nephelometer Platform



Mobile Nephelometer Platform



Mobile Nephelometer Platform



Mobile Nephelometer Platform



Methods

- Radiance Research M903 nephelometer
 - Calibrated in lab before and after use
- Funnel out rear window
- “Slow” data mode at $2.5 \sigma_{sp}$ values per second
- RS232 connection to Hyperterminal
- Garmin eTrex GPS at 1 point per second
- 3 runs in late evening and early morning

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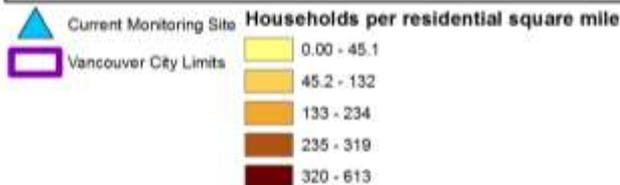
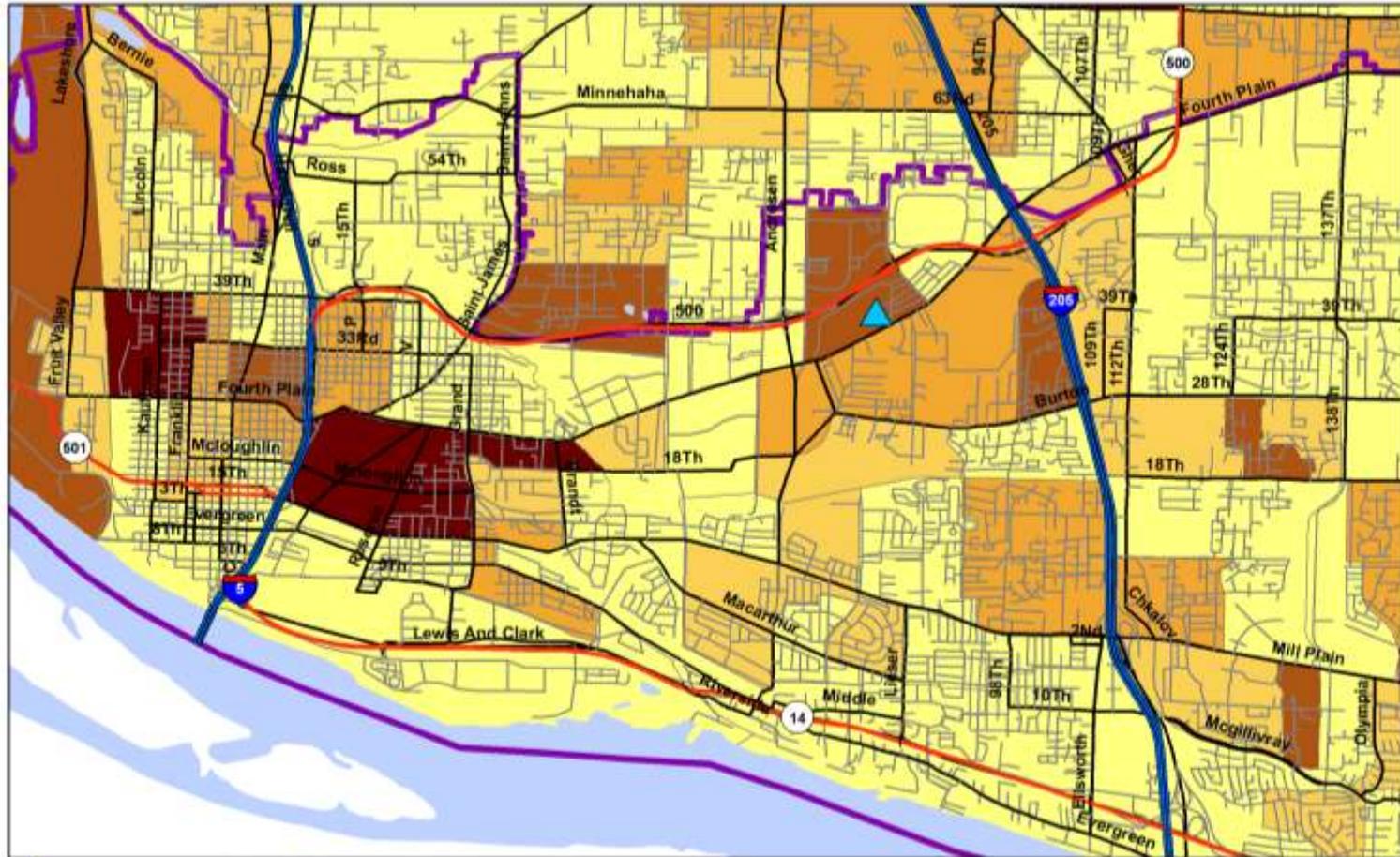
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Route Priorities

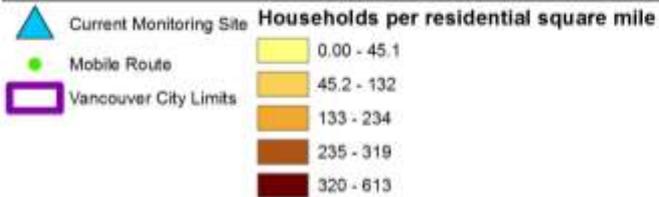
- ~35 miles (1.5 hours)
- Focus on residential areas with moderate-to-high density of primary wood heating
- Include monitoring site and surrounding neighborhood
- Identify impacts of elevation and distance from Columbia River



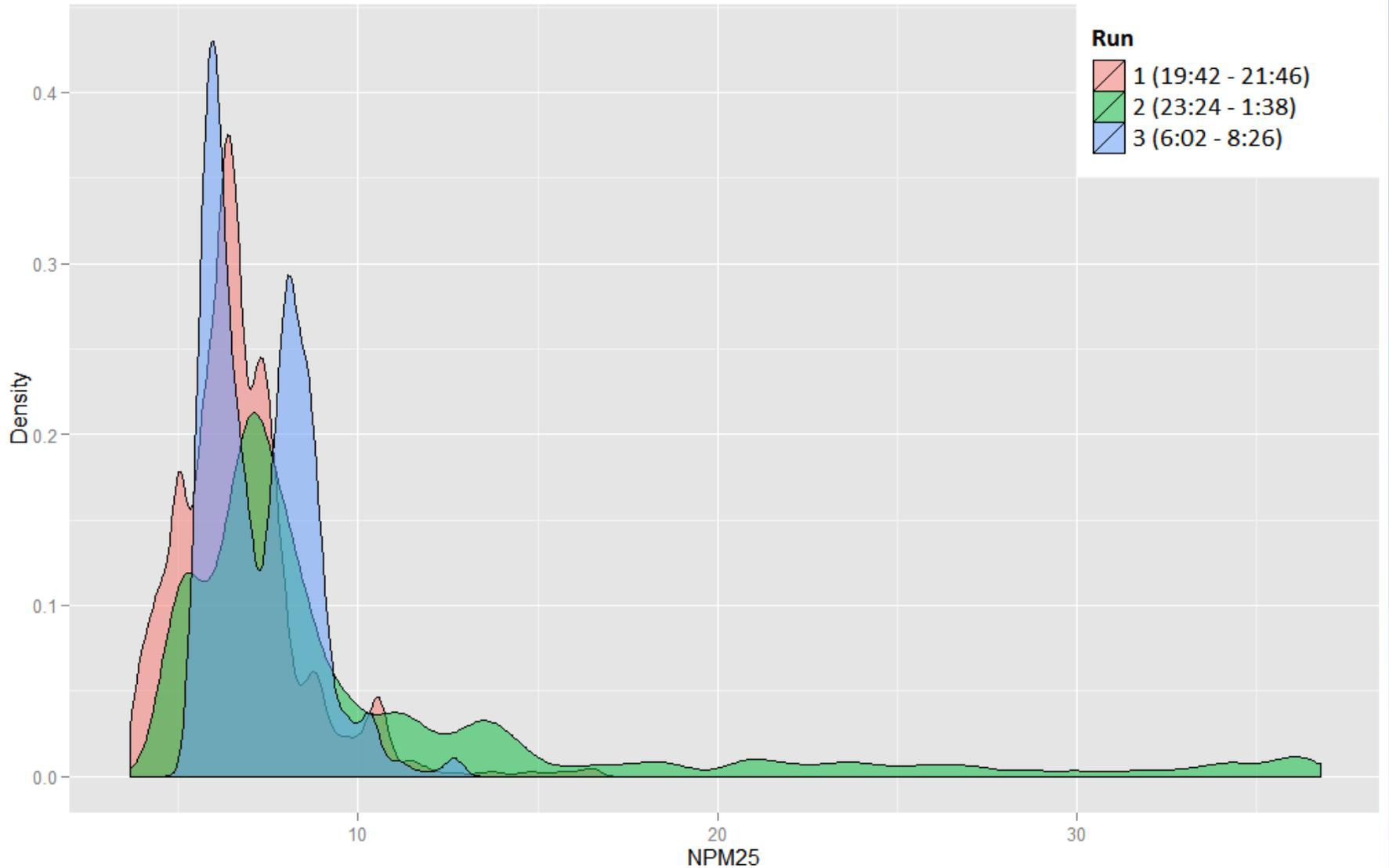
Density of Primary Wood Heating (ACS 2005-2009)



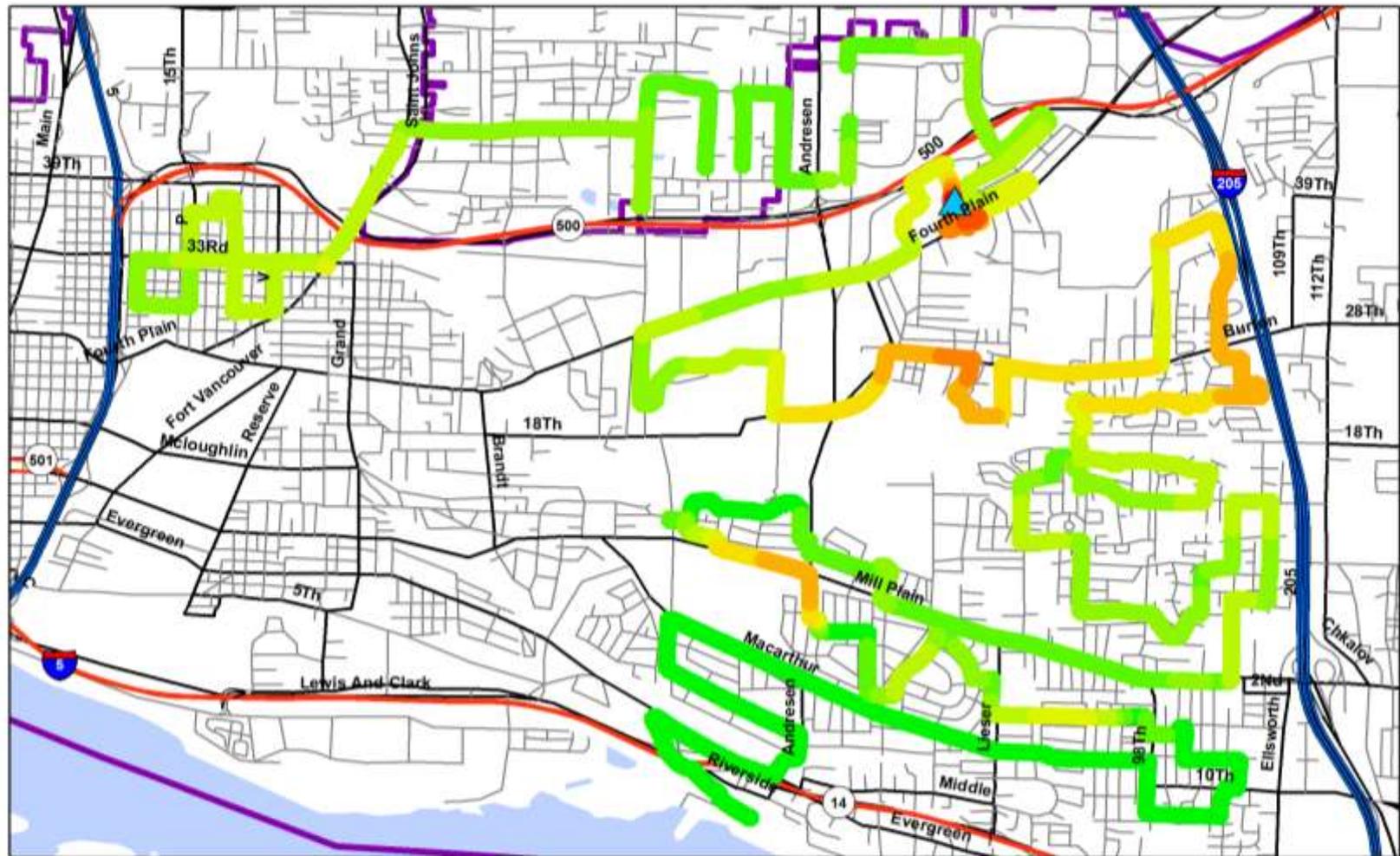
Mobile Monitoring Route



Distribution of PM_{2.5} Results



Run 2 Results (23:24 – 1:38)

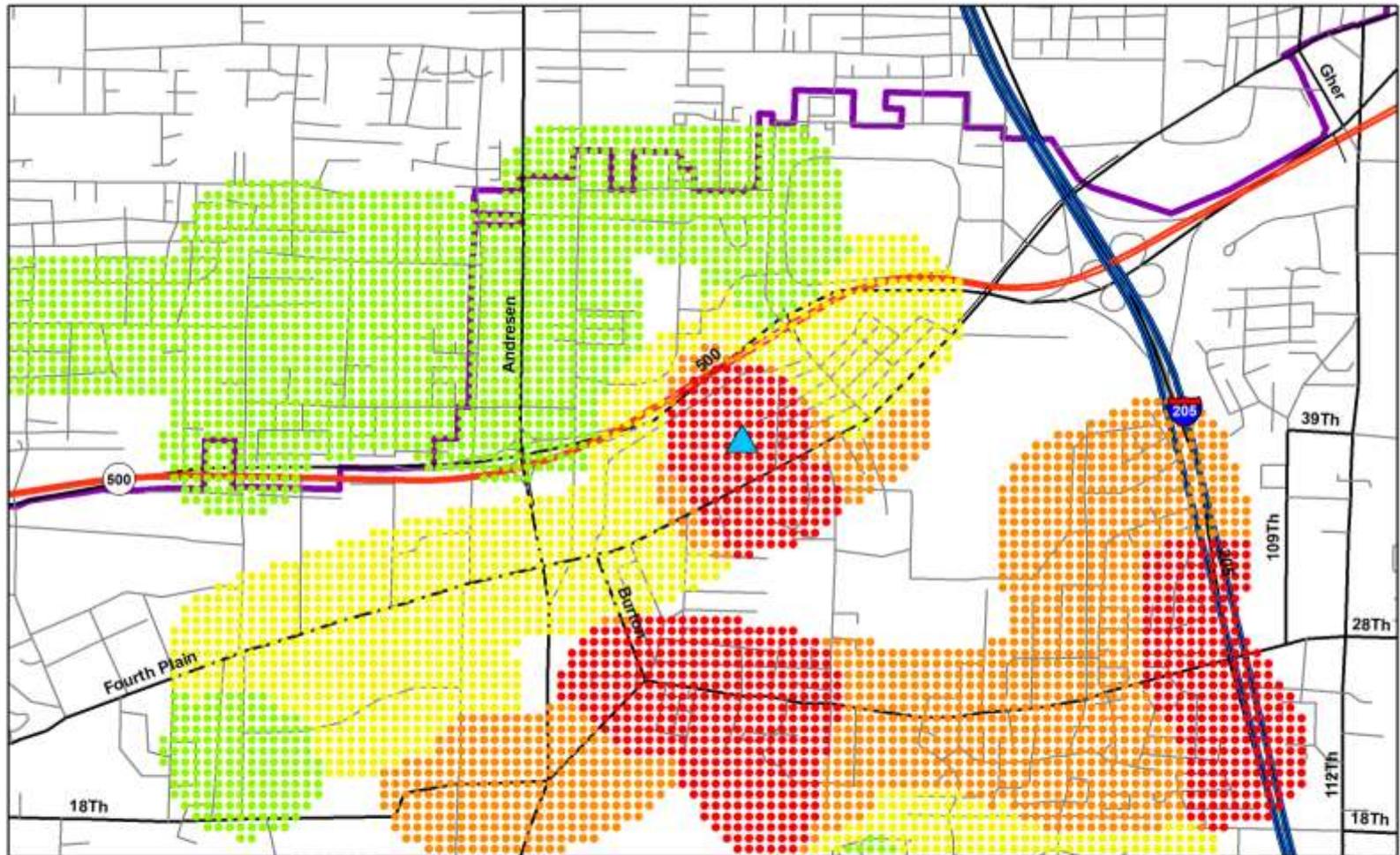


6/11/2014

Analysis Method

- Grid of evenly-spaced points 50m apart
- By run:
 - Geometric mean $\log-\sigma_{sp}$ within 300m of each point
 - $\log-\sigma_{sp} \rightarrow PM_{2.5}$ using Vancouver correlation
- Arithmetic mean $PM_{2.5}$ across 3 runs
- Ordinary kriging

50m Grid Map (Run 2 Results)



Vancouver Plaza Dr. Site



Vancouver City Limits

Run 2 PM2.5 (ug/m³)

- 4.64 - 6.46
- 6.47 - 9.21
- 9.22 - 12.5
- 12.6 - 16.8
- 16.9 - 24.2

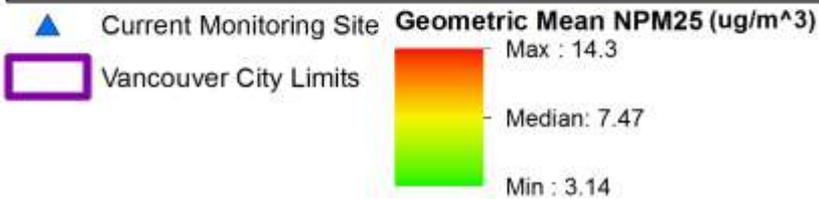
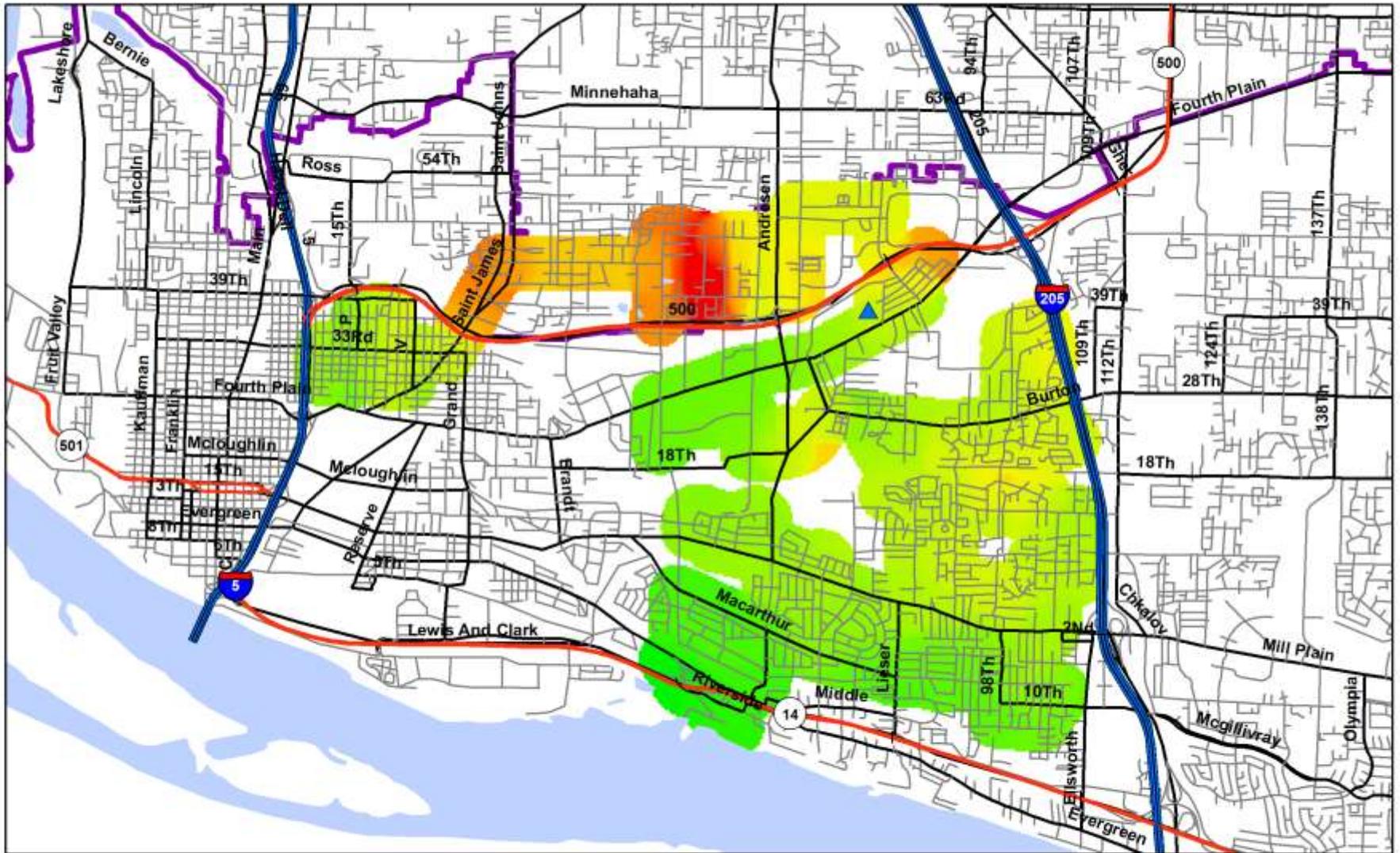


0 0.25 0.5 1 Miles

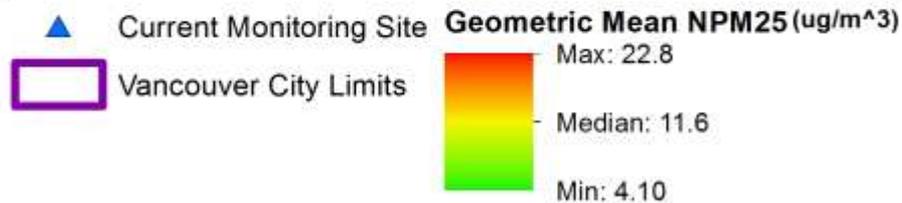
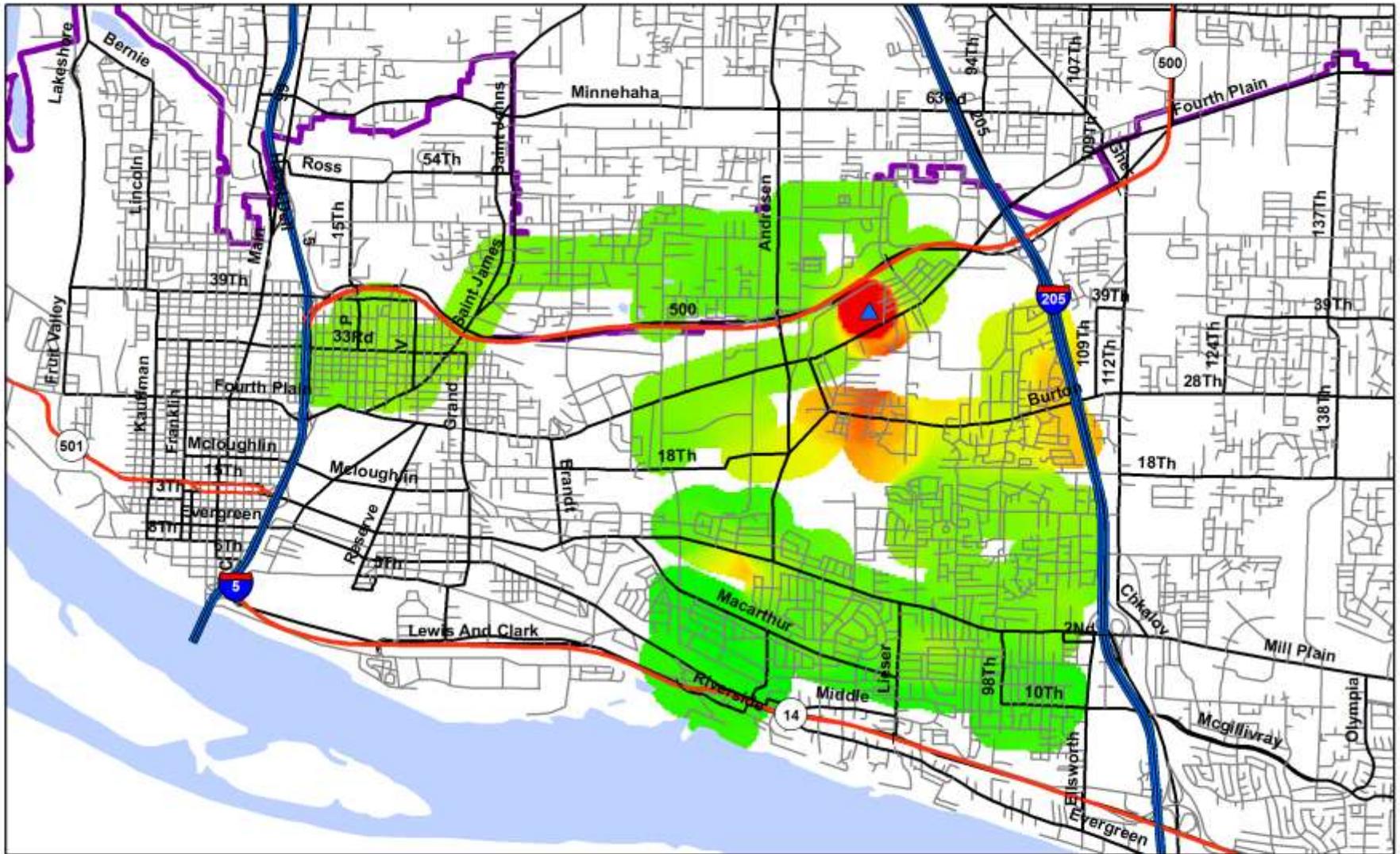
6/11/2014

Vancouver Mobile Monitoring Results, 1/21/14

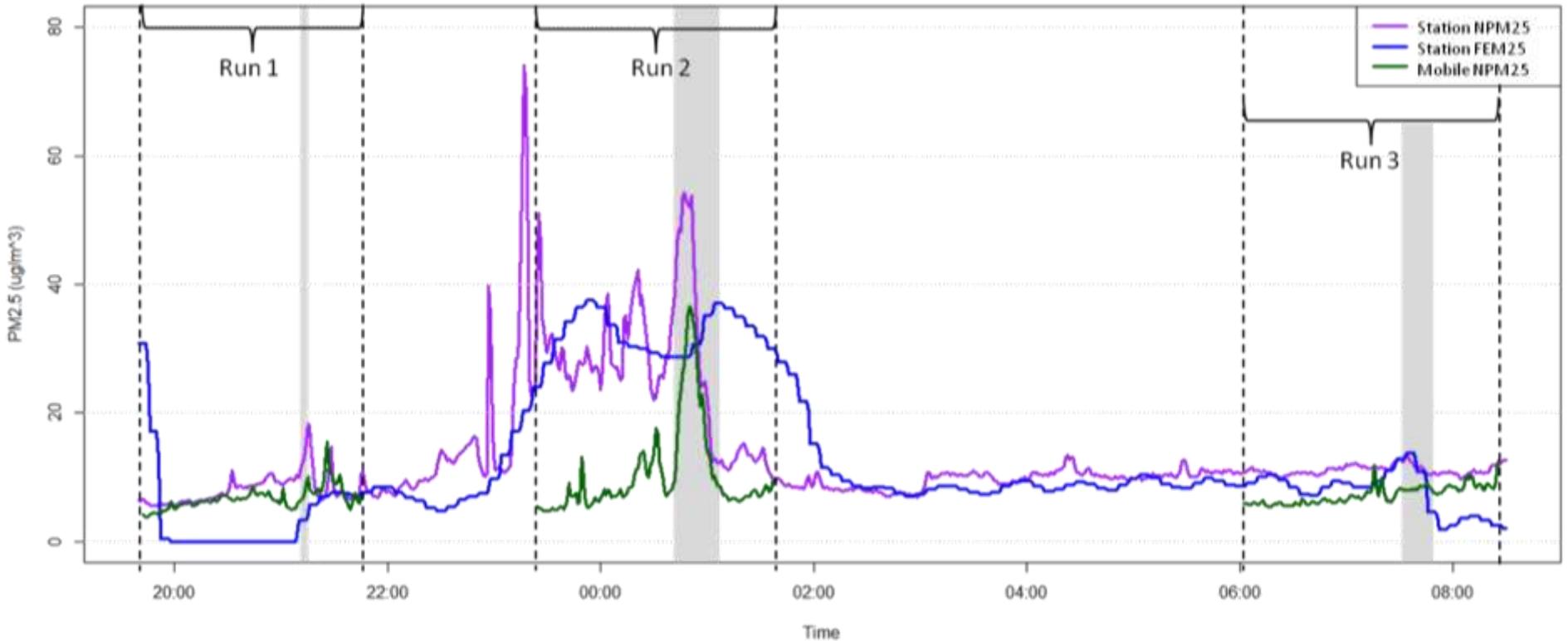
Run 1 (19:42-21:46)



Vancouver Mobile Monitoring Results, 1/21-1/22/2014
Run 2 (23:24 - 01:38)



Mobile/Stationary Monitor Comparison



Indicates mobile monitor < 300m from station

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Recommendations

- Longer stagnation period
- More and shorter runs
- Maximize right turns
- Drive the route before sampling
- Maintain a constant speed



Next Steps

- Screened 4 alternate sites
 - 2 meet neighborhood-scale siting criteria
- Deploy E-samplers at 2 sites by late summer
- Move to new site by Dec. 31, 2014

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Questions?

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October 13, 2009



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