Sources, Patterns and Mechanisms of Storm Water Pollutant Loading from Watersheds and Land Uses of the Greater Los Angeles Area

Liesl Tiefenthaler

Southern California Coastal Water Research Partnership

www.sccwrp.org

Ag Waiver Workshop
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Background

- SCCWRP's ongoing storm water research program
  - Characterization
  - Modeling
- Numerous partners and funders
- Results of first 6 years of sampling and analysis
  - Greater Los Angeles area

Today's Presentation

- Key questions
- Study Approach
- Results
- Key conclusions
- Next steps

Challenges of Storm Water Management

- Difficult to understand and predict all the factors that influence storm water.
  - Highly variable
  - Many sources
  - Many influencing factors

Routine Compliance Monitoring Does Not Address These Issues

- Effective management requires tools to increase our understanding
  - Monitoring
  - Source characterization and identification
  - **Model development**
  - BMP siting and design

Study Objectives

- Identify sources of key constituents
- Develop insight into mechanisms
  - Seasonal patterns
  - Within storm patterns
  - Factors that control variability

Data Collection

- Intensive sampling of representative land use sites
- Samples collected approximately hourly over the duration of the storm
  - Continuous flow and precipitation
  - Discrete analysis of each water quality sample
  - TSS, bacteria, metals, organics
- Data used to construct “pollutographs”

Land Use Sites

High Density Residential
- Mixed
- With pets

Low Density Residential
- Sewered
- Unsewered

Commercial
- With homeless
- Without homeless
- Restaurant
- Shopping mall

Industrial
- Mixed
- Food industry
- Junk yard
- Metal plating
- Oil extraction

Agriculture
- Mixed
- Nursery

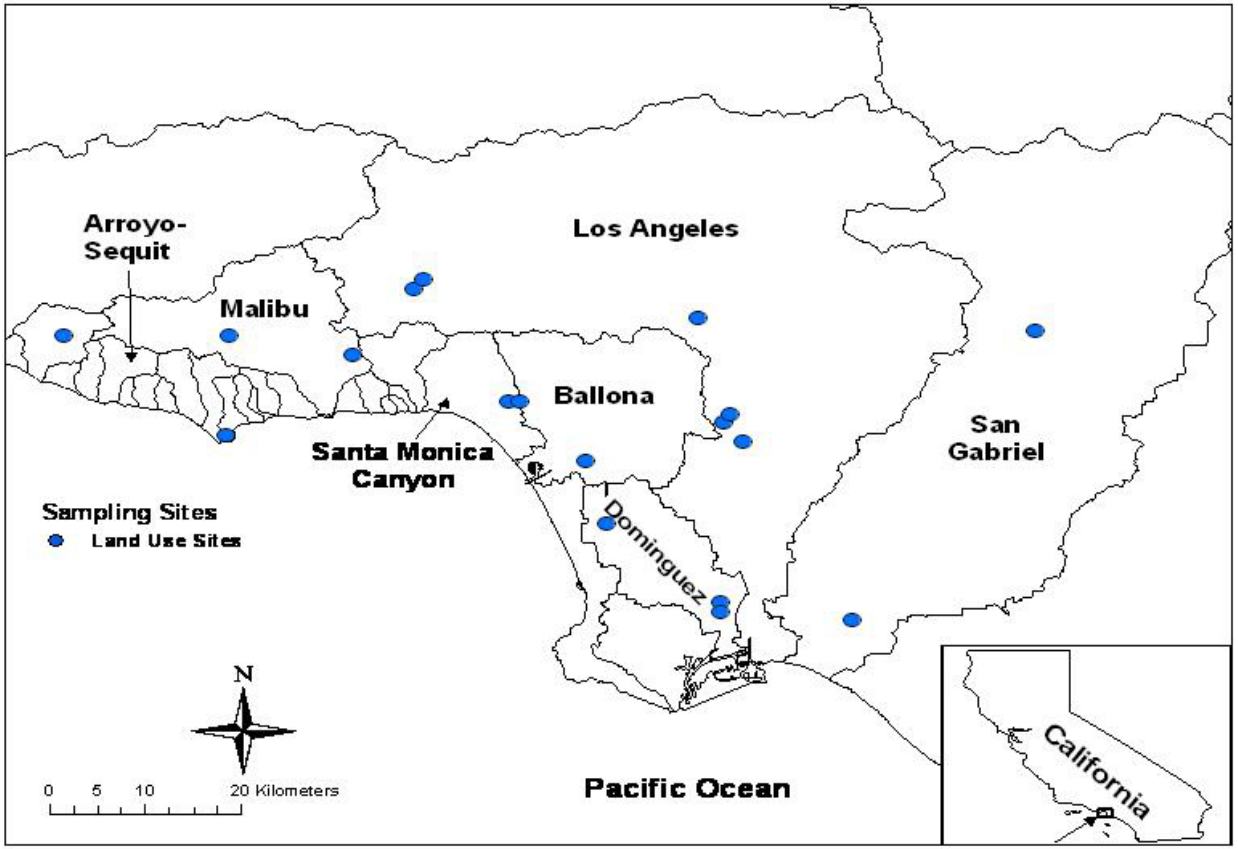
Recreational
- Horse stables

Transportation
- Rail yard

Open
- General
- Recreational
- Rural residential

Sampling Locations and Summary

- 2000 – 2005
- 20 discrete storms
- 33 land use site events
- 0.1 – 10 cm rain events
- 1 – 142 antecedent dry days



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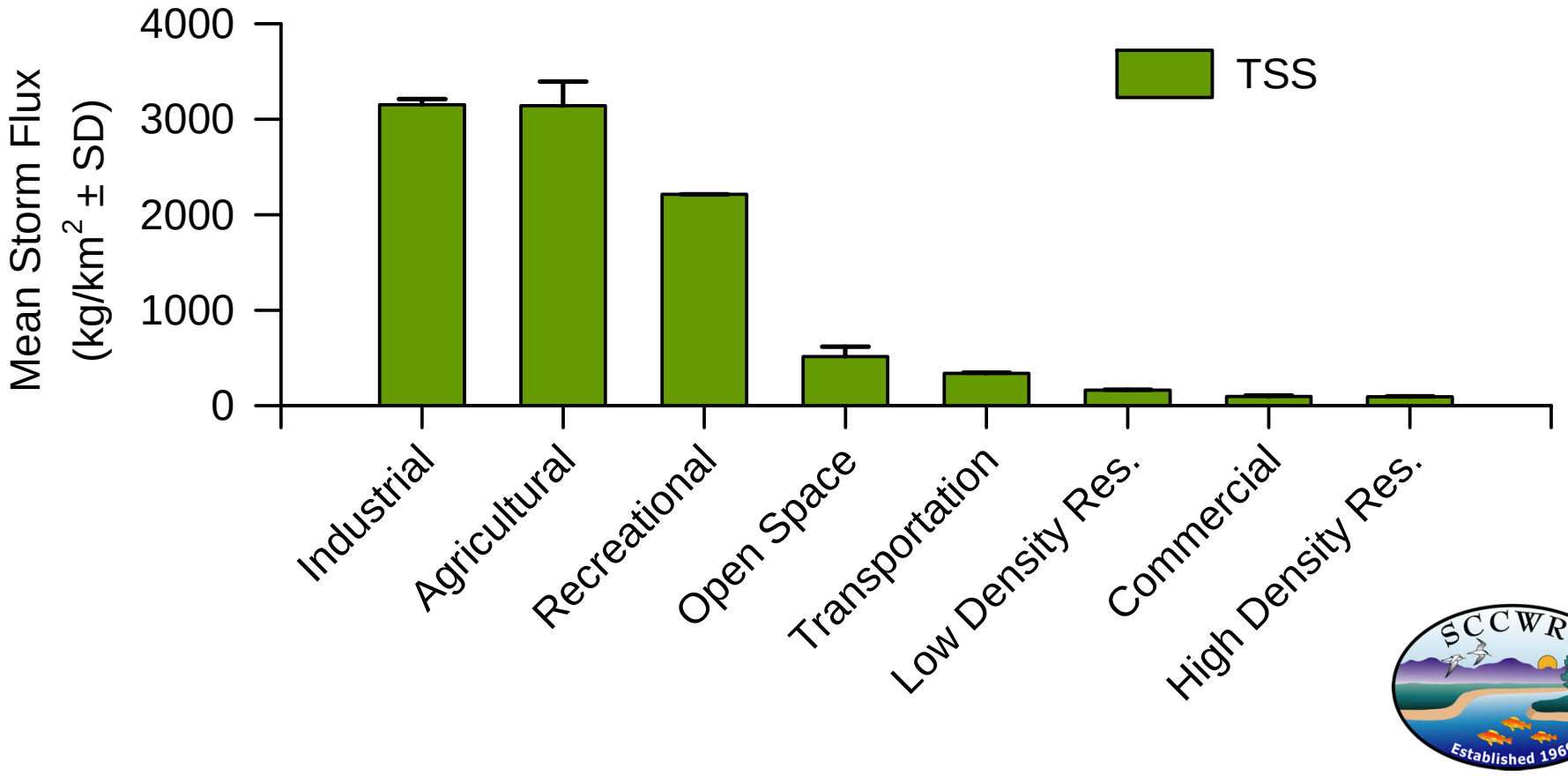
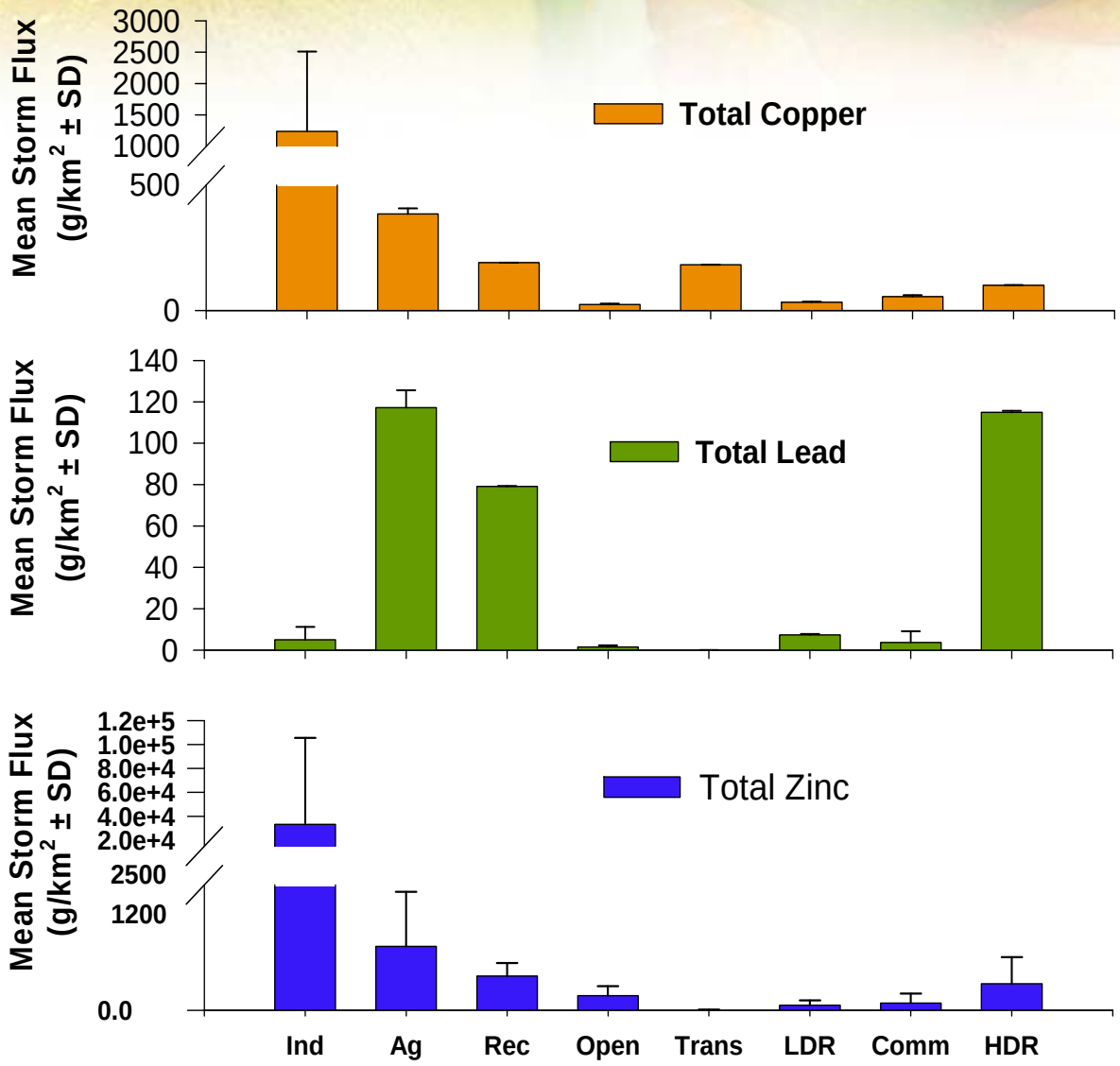
Concentrations By Land Use

Land Use Sites	*TSS (mg/L)*	*Copper (ug/L)*	*E. Coli (MPN/100mL)*
High Density Residential	77.4	26	8.20E+03
Low Density Residential	105	29.9	3.00E+04
Commercial	49.6	38.1	1.10E+04
Industrial	92.2	**70.3**	3.80E+03
Agricultural	112	32.6	4.00E+04
Recreational	**530**	38	5.30E+05
Open Space	134	7.6	5.40E+03

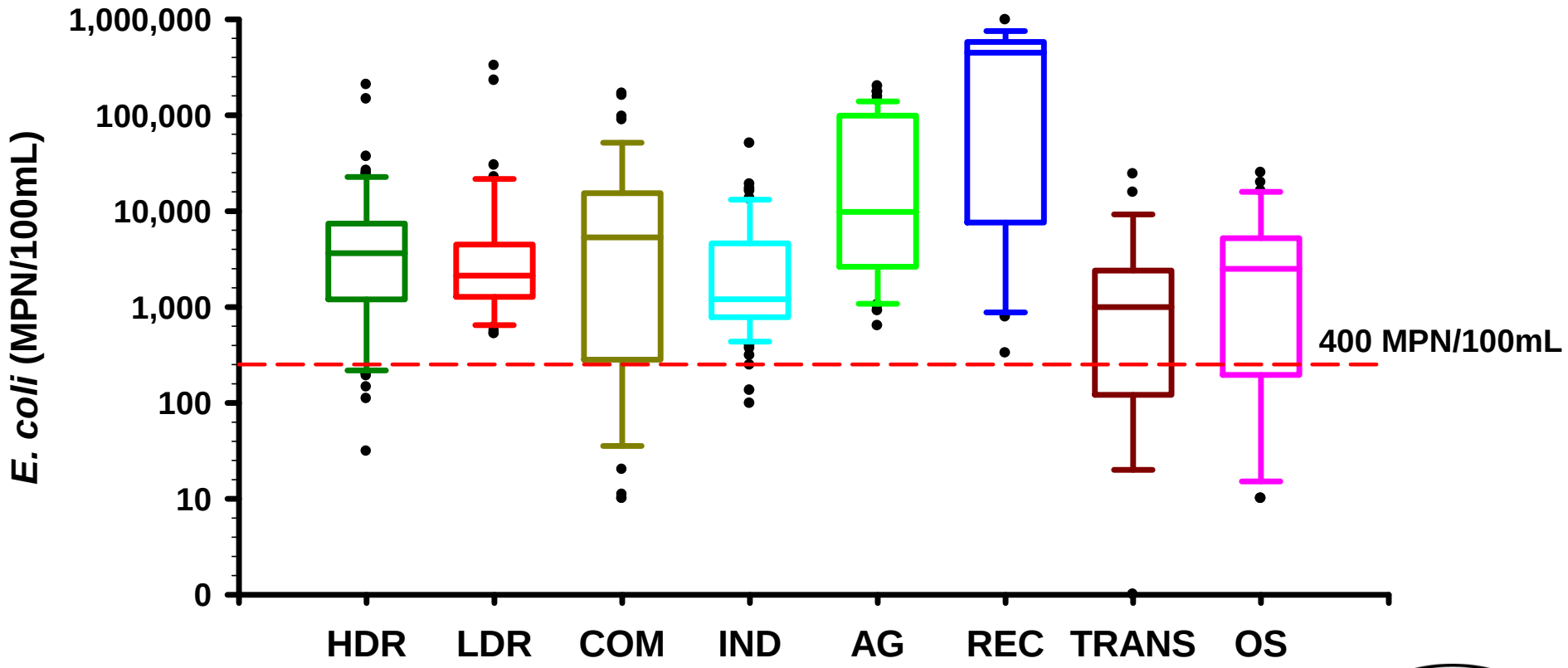
TSS Flux Varies By Land Use



Metals Flux Varies By Land Use

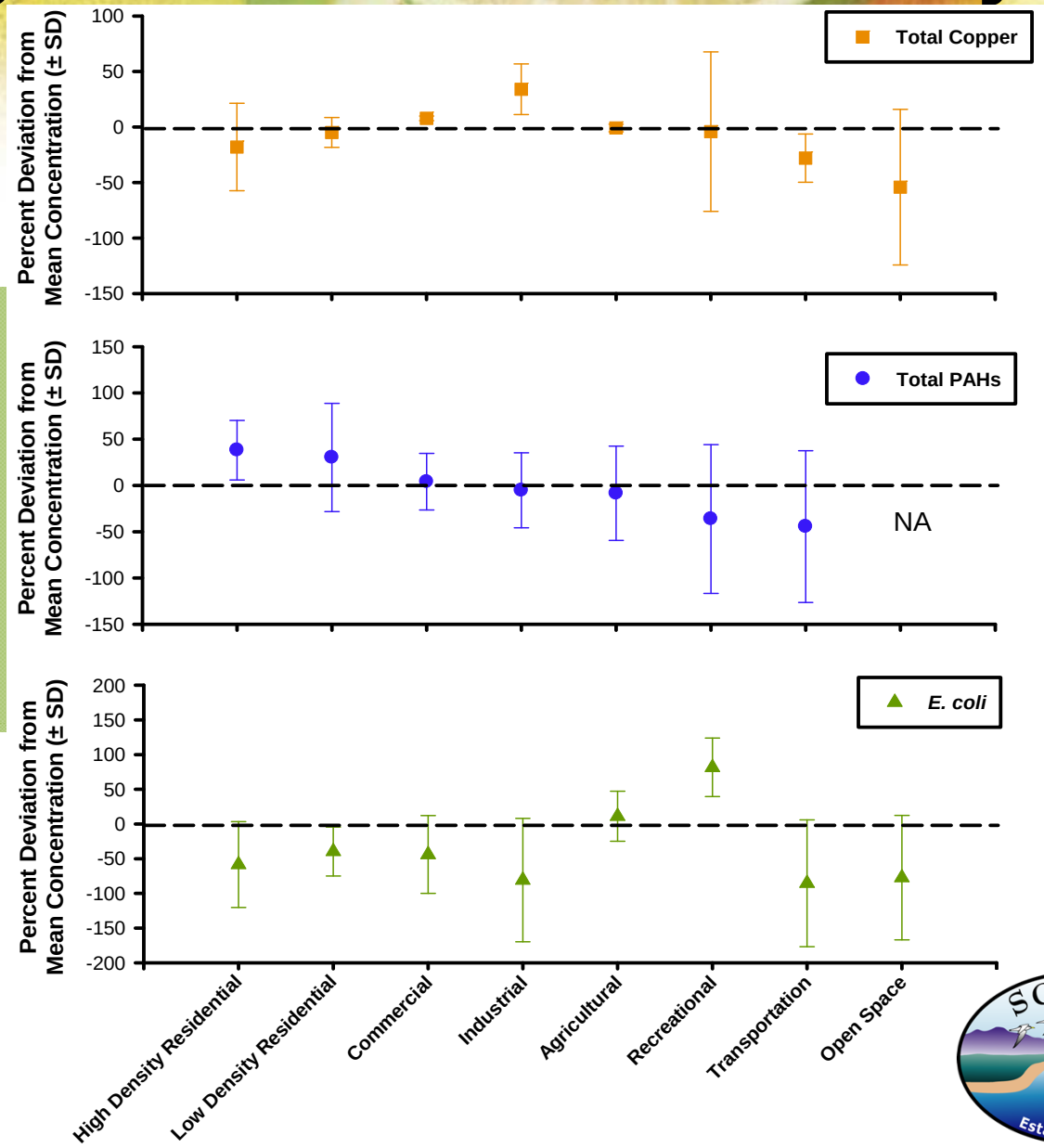


Bacteria Sources Vary By Land Use



Sampling Locations and Summary

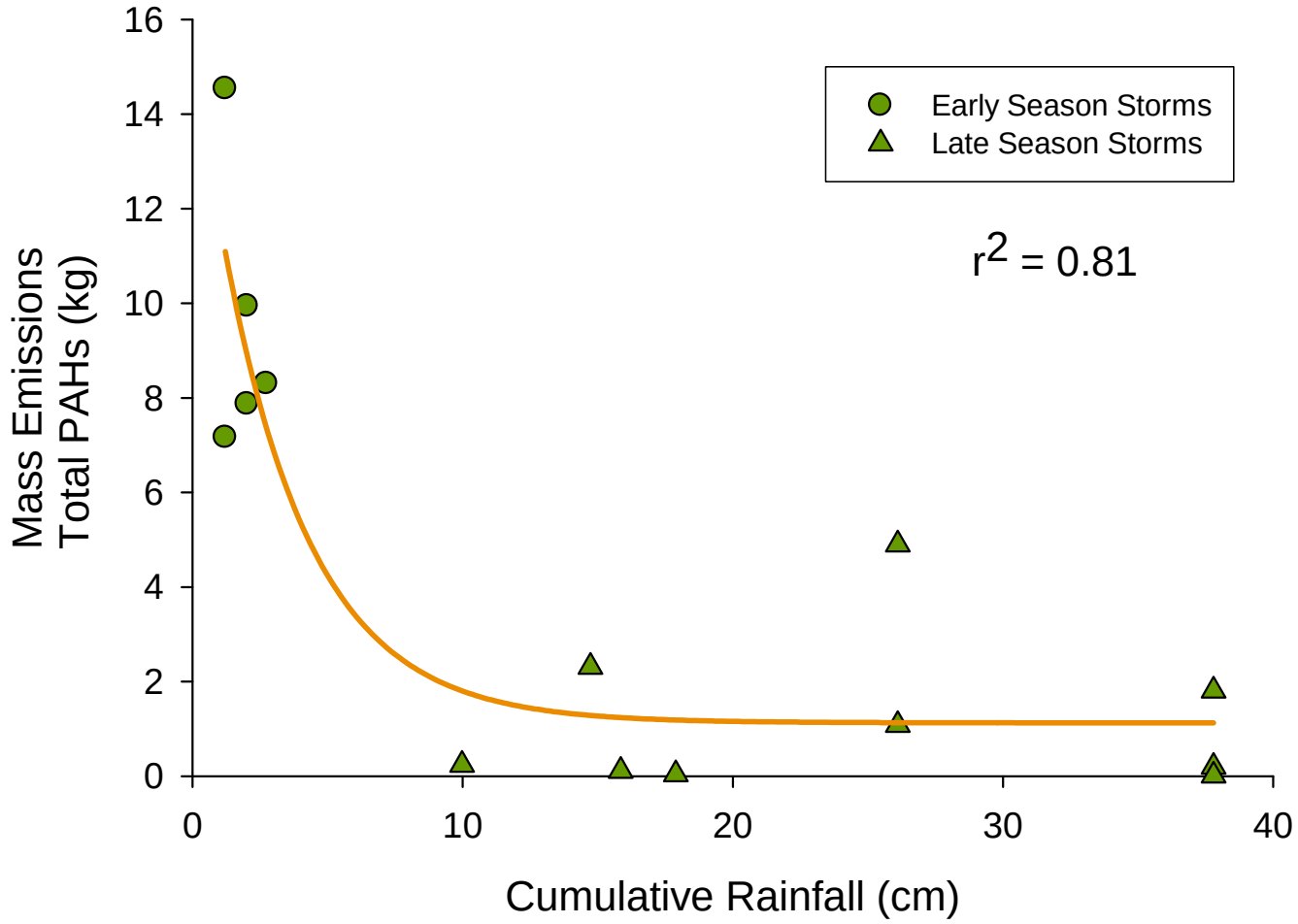
- Patterns are subtle
- Need deeper investigation
  - components of land use



Mechanisms That Influence Loading Patterns

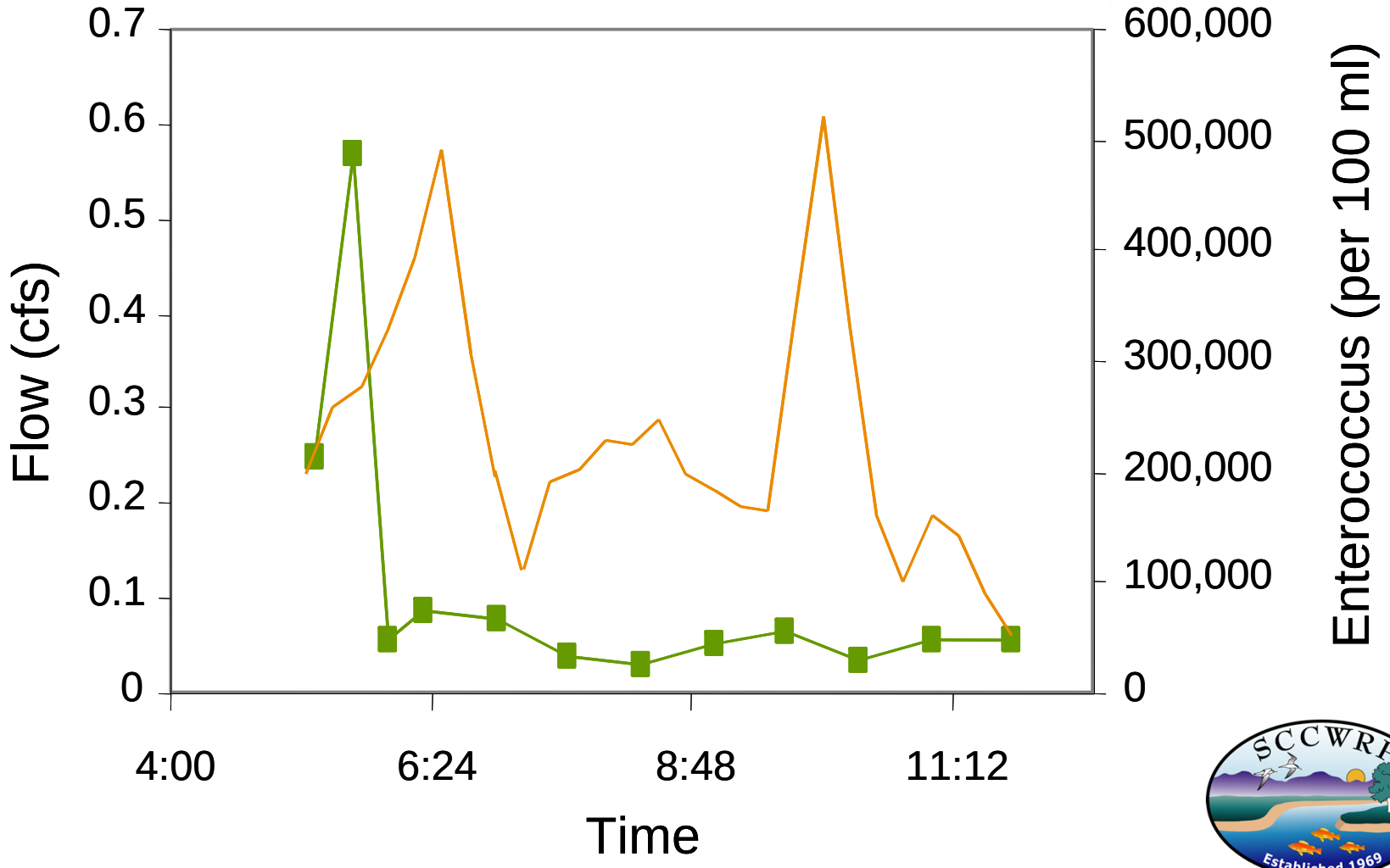
- Between seasons
  - Rainfall
- Within seasons
  - Rainfall
  - Antecedent Conditions
- Within storms
  - Timing within storm hydrograph

What is the Effect of Antecedant Dry Period?



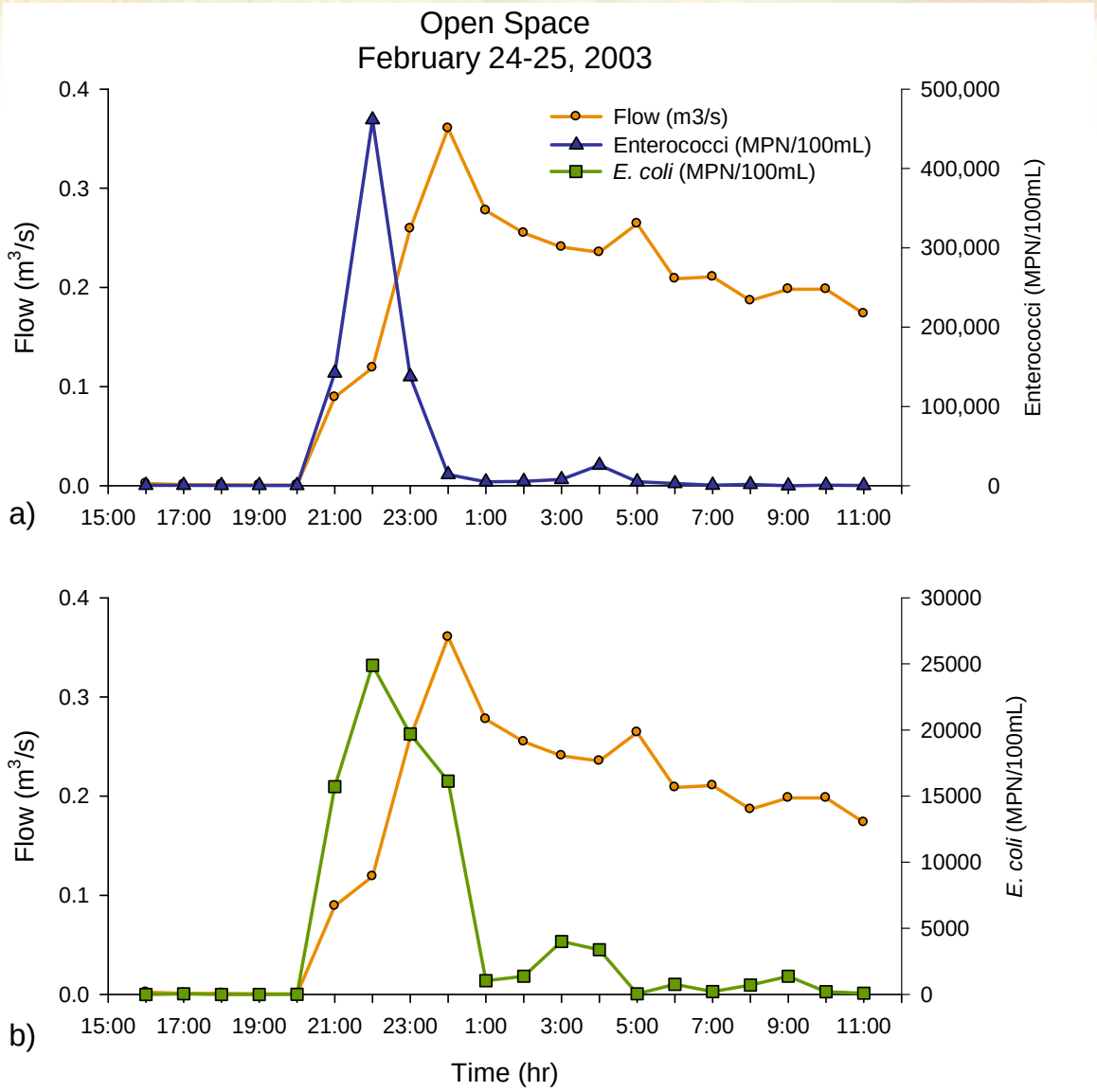
Intra-Storm Variability

Industrial Land Use Site

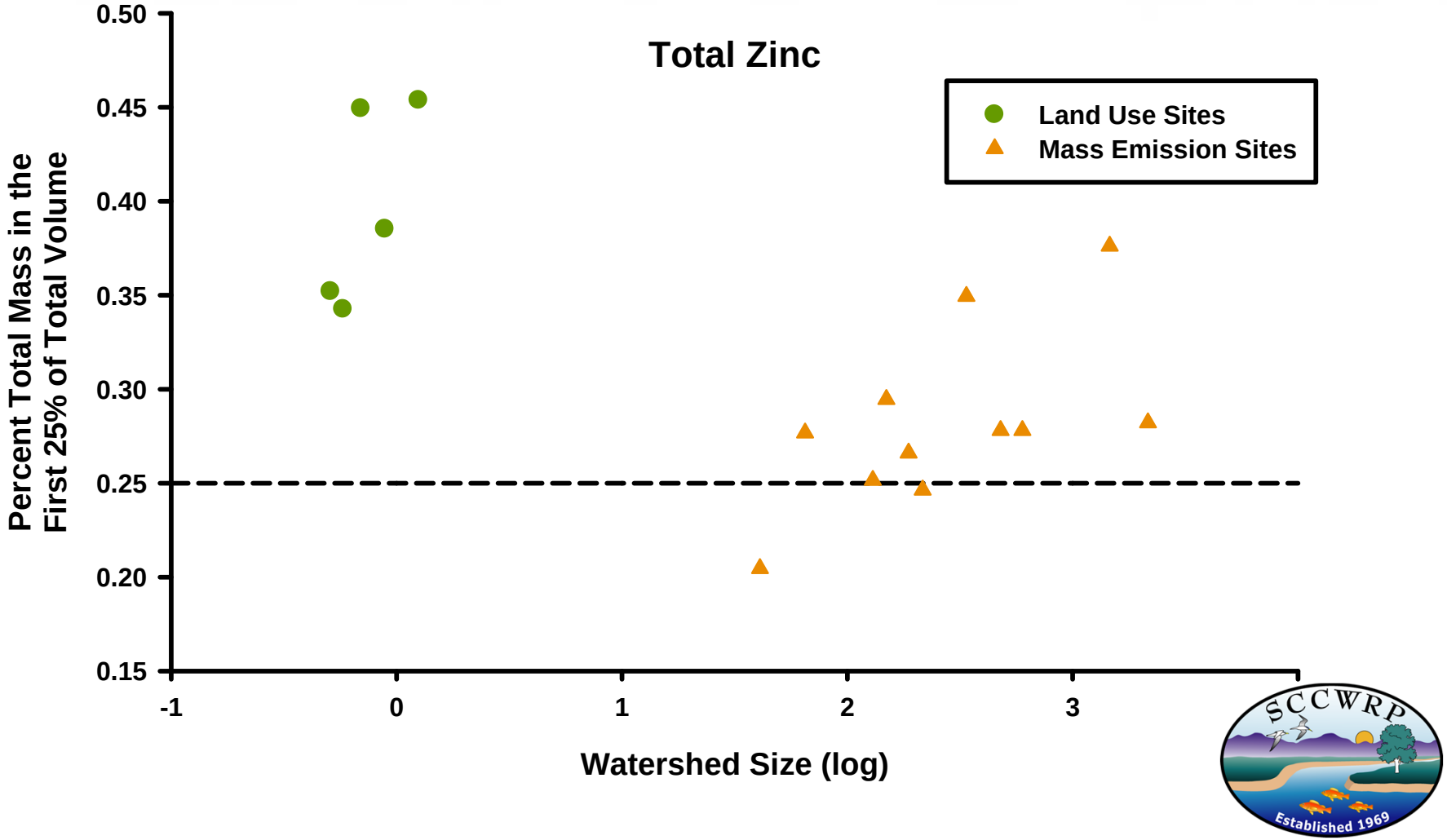


Intra-Storm Variability

Open Space Land Use Site



First Flush as a Function of Catchment Size



Key Conclusions

- Predominant sources vary by constituent
  - Metals vary by land use, high at industrial
  - Bacteria mainly recreational and agricultural
  - *Patterns are subtle – need more investigation*
- Storm water runoff and loading varies at multiple spatial and temporal scales
  - Models must account for this variability
- Intra-annual variability is driven more by antecedent dry period than by rainfall
- Accurate estimates of concentration must account for intra-storm variability in concentration
  - Sampling must capture early portion of storm

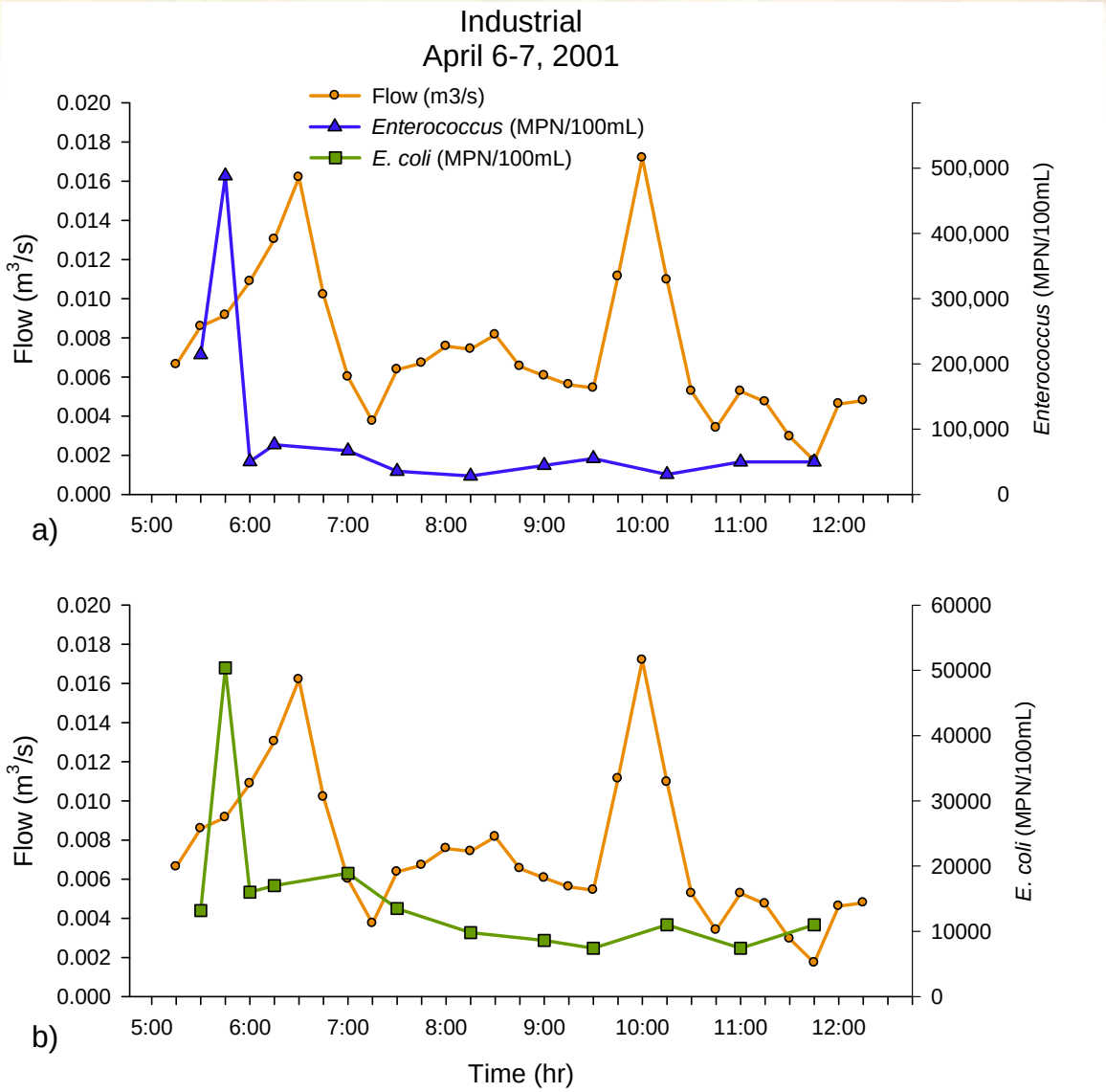
Next Steps

- Additional Investigation of Sources
  - Components of land use
  - Transferability (other watersheds/regions)
- Coordinated Nutrient Monitoring
  - To adequately characterize nutrient and biological conditions
  - To develop nutrient water quality criteria
  - Data comparability
- BMP Design, and Modeling

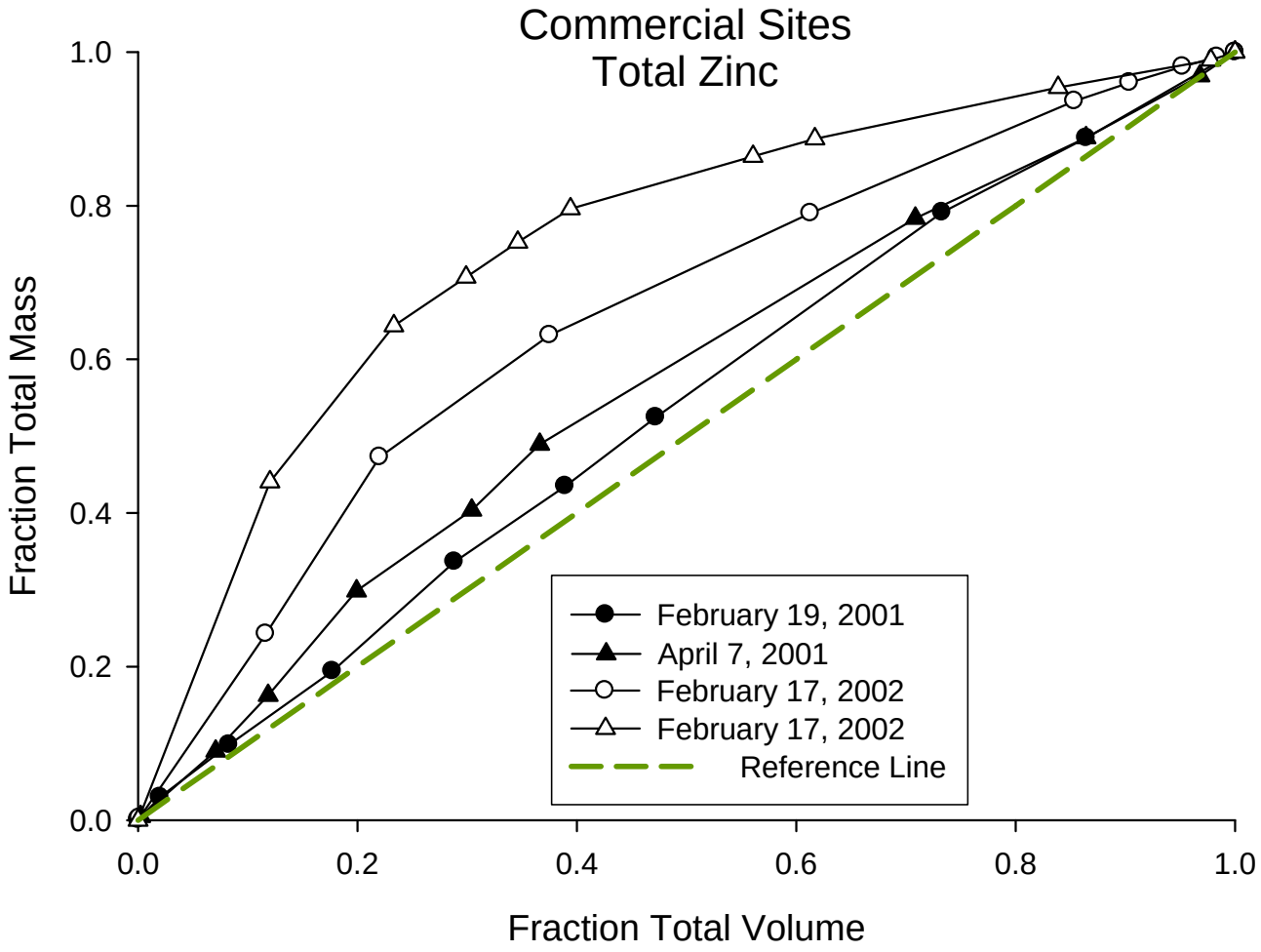

Questions???

Intra-Storm Variability

Industrial Land Use Site

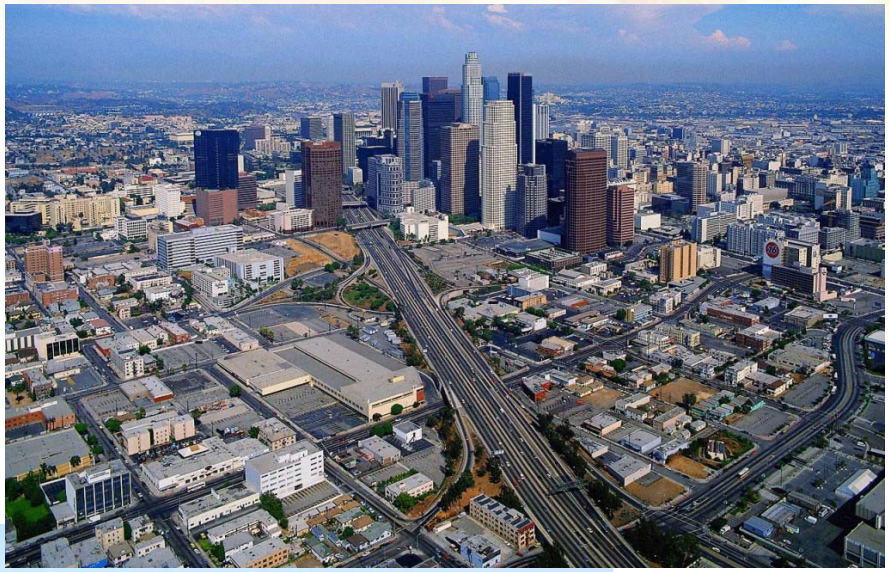


First Flush


Commercial Sites
Total Zinc
Fraction Total Mass
Fraction Total Volume
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
February 19, 2001
April 7, 2001
February 17, 2002
February 17, 2002
Reference Line

Potential Sources

- Anthropogenic
  - Land uses
  - Mobile sources
  - Aerial deposition



- Natural
  - Background

Bacteria Sources Vary By Land Use