Effects of Urban Stormwater Infrastructure on Dissolved Nutrient Export and Runoff from Semi-Arid Urban Catchments

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Research Questions

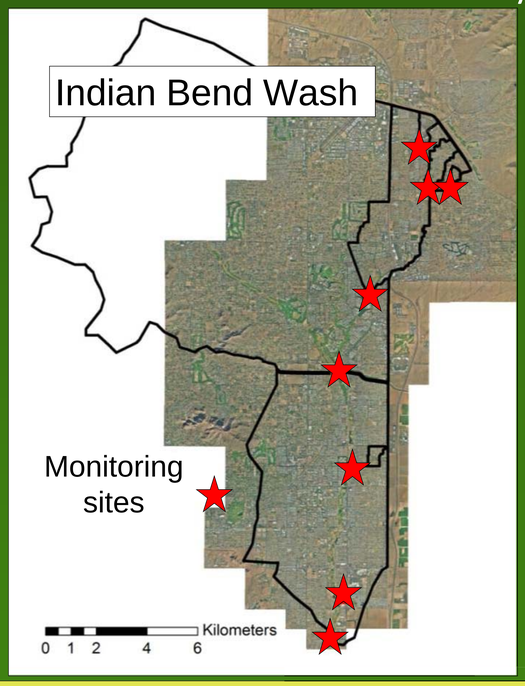
How does drainage infrastructure affect the export of water and nutrients from urban watersheds?

1. Total loads for a storm season
2. Distribution of nutrient export across storms
3. Distribution of nutrient export within storms

Study Design

11 nested urban catchments

- Vary stormwater infrastructure and scale
- Control land use: med density residential

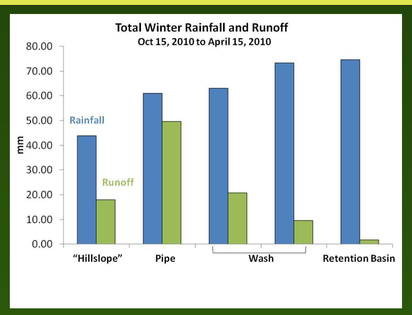


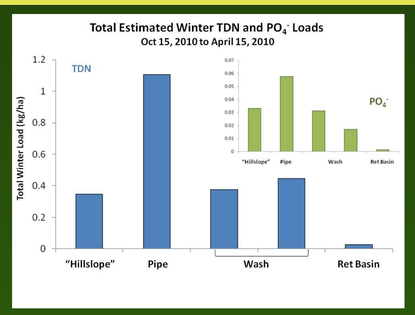
Methods

Ephemeral storm flow – all events

- Automated ISCO samplers
- Discharge and precipitation
- All major cations & anions
- Focus here: dissolved TN and PO_4^{3-}

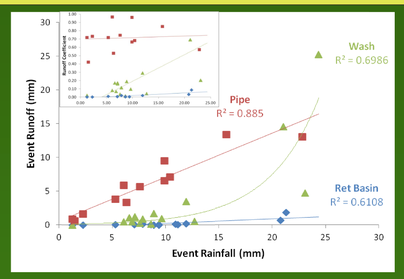
Q1. Seasonal Patterns

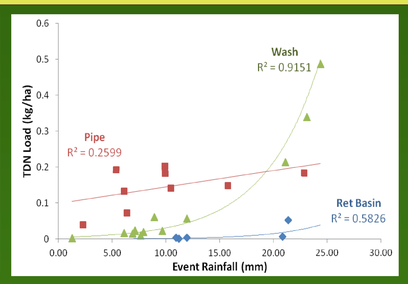




- Total Seasonal TDN export from watersheds is correlated with seasonal discharge
- Retentive infrastructure exports less water and nutrients.

Q2. Patterns Across Storms





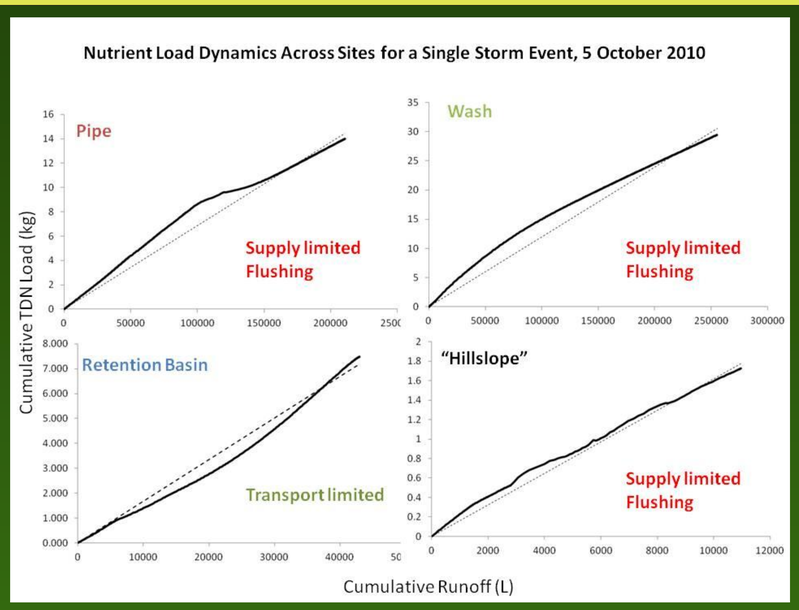
Hydrology

- Strong rainfall-runoff relationship all sites
- Nonlinear for wash and ret basin (↑RC with rainfall)

Nutrient Export

- Ret structures: nonlinear, rainfall strong predictor
- Pipes: linear, rainfall weak predictor

Q3. Patterns Within Storms



Within a storm, between-site variation in nutrient export behavior

- Supply-limited "flushing" – classic urban response
- Transport-limited – indicates export determined by ability of water to move materials through watershed

Within a site, between-storm variation in nutrient export behavior (data not shown)

- behavior not consistent within sites, may be related to storm characteristics (rainfall volume, rainfall intensity)

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Conclusions

- Retentive infrastructure decreases average and seasonal loads, while increasing variability between storms (load and behavior)
- Implications for modeling runoff/nutrient export, risk assessment and climate change vulnerability