

BEDLOAD TRANSPORT IN URBANIZED STREAMS WITH AND WITHOUT STORMWATER MANAGEMENT

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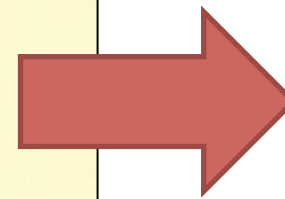
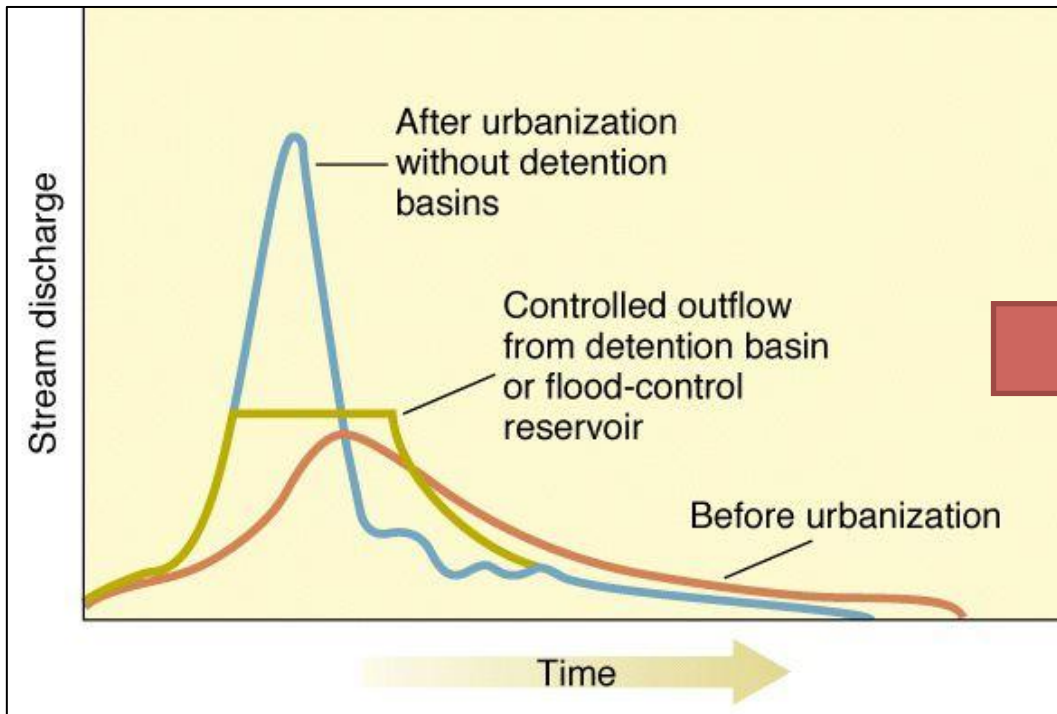


civil AND
environmental
ENGINEERING



**NSERC
CRSNG**

INTRODUCTION



**Sediment
(bedload)
transport?**

INTRODUCTION

- River restoration projects do not explicitly design for sediment transport: focus is on sediment *stability* rather than sediment *mobility*.
- This approach becomes a problem when designing with ecological needs in mind.
- Ultimately leads to project failure.



...but in natural systems sediment moves...

INTRODUCTION

Why don't we design for bedload transport?

- Lack of understanding of how urbanization, SWM and restoration projects affect bedload transport.
- Lack of data on bedload transport in urban settings.

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Project Objectives

- Monitor bedload transport in streams in the Greater Toronto Area (GTA) with varying SWM and restoration projects.
- Understand the effect of these SWM and restoration projects on bedload transport and stream stability.

STUDY SITES

Morningside Creek

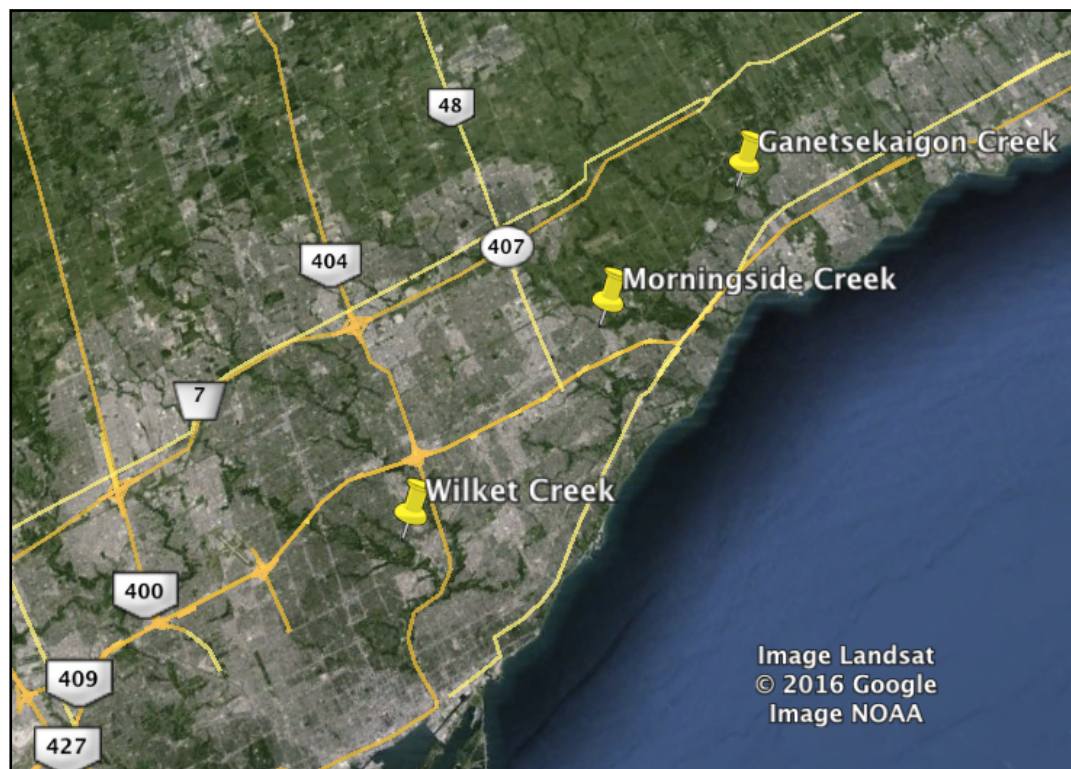
- Urbanized (suburbs)
- SWM ponds
- 1 study reach
- 3 flow gauges

Wilket Creek

- Heavily urbanized
- Minimal SWM
- 2 study reaches: restored and non-restored
- 5 flow gauges

Ganatsikaigon Creek (Ganny)

- Undeveloped: abandoned farmland and forest
- Plans for development in watershed
- 2 study reaches
- 5 flow gauges



Urban



Non-Urban



Urban Restored



Urban Non-Restored



Urban with SWM



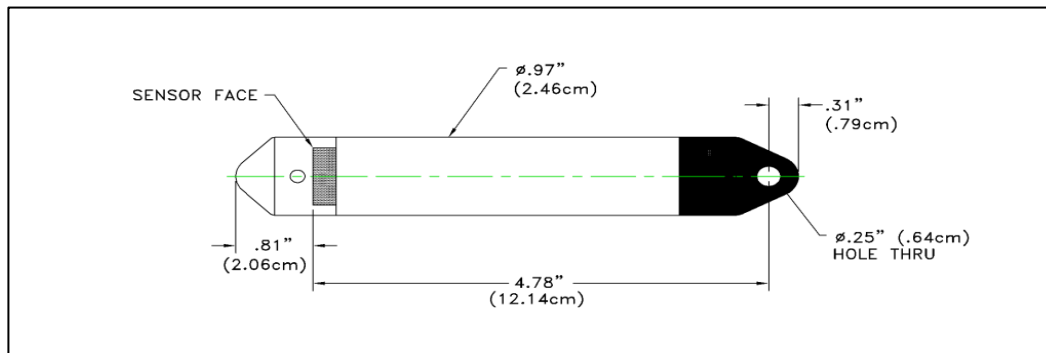
Urban without SWM



METHODS

HYDROLOGY

- 2-minute interval stage measurements during field season.
- 5-7 minute interval stage measurements during winter season.
- 5-minute interval precipitation data from TRCA from 12 nearby precipitation stations.



METHODS

USING TRACERS TO MEASURE SEDIMENT TRANSPORT

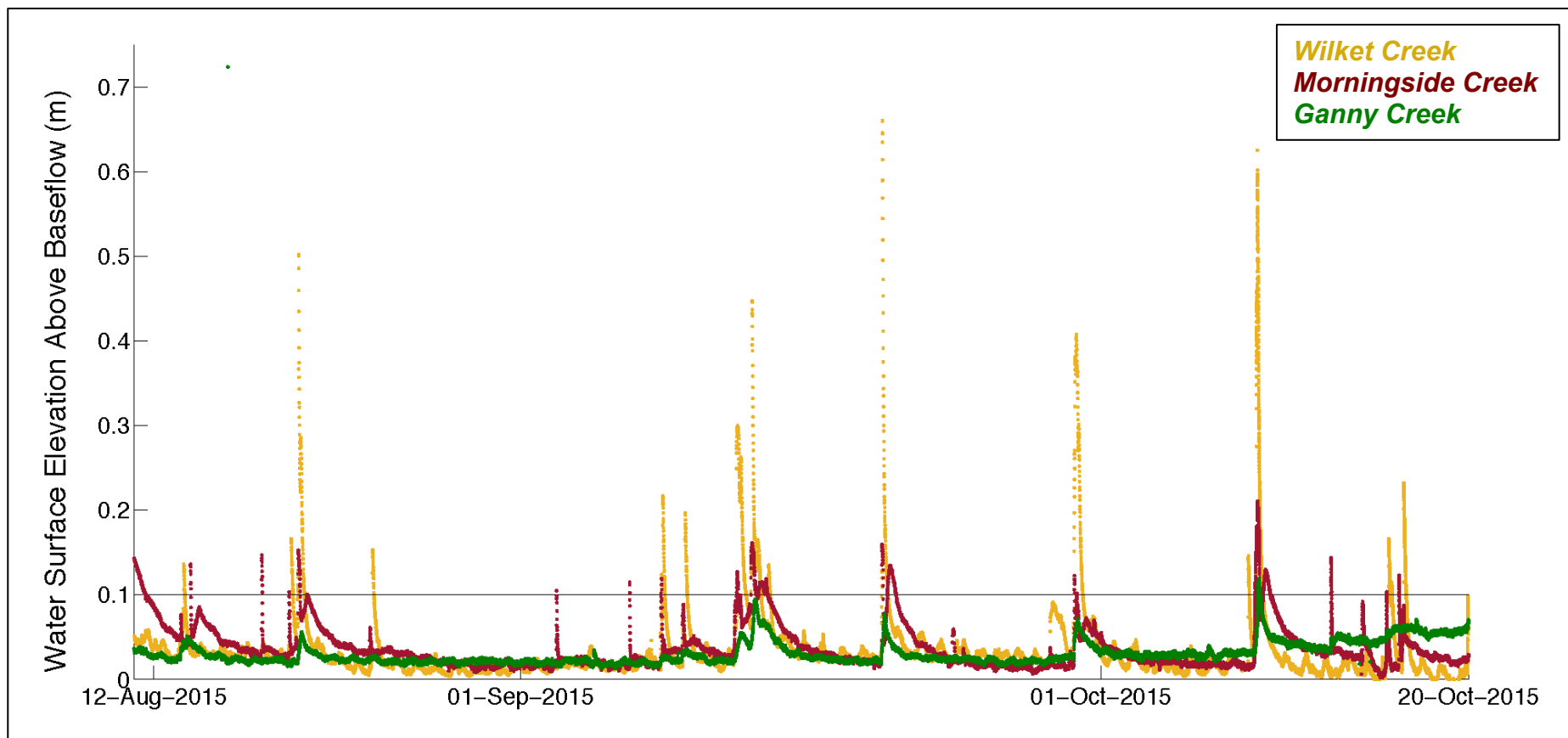
- 300 RFID tagged stones per site with size distribution matching reach.
- Seeded in riffles.
- Recovery rates 85 – 100 %



RESULTS

FALL FLOODS

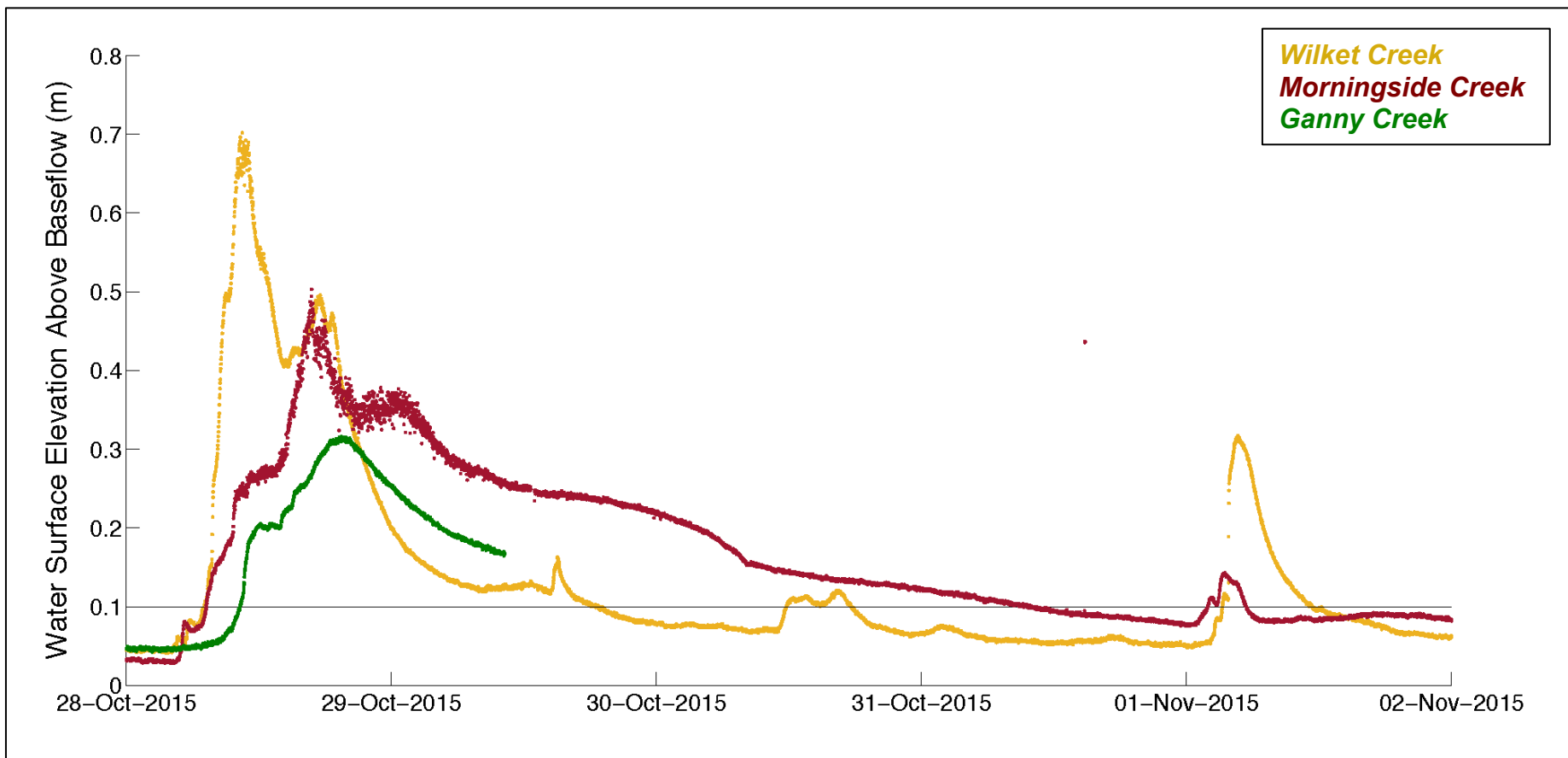
1) 12-Aug to 20-Oct 2015: Multiple short floods with high peaks.



RESULTS

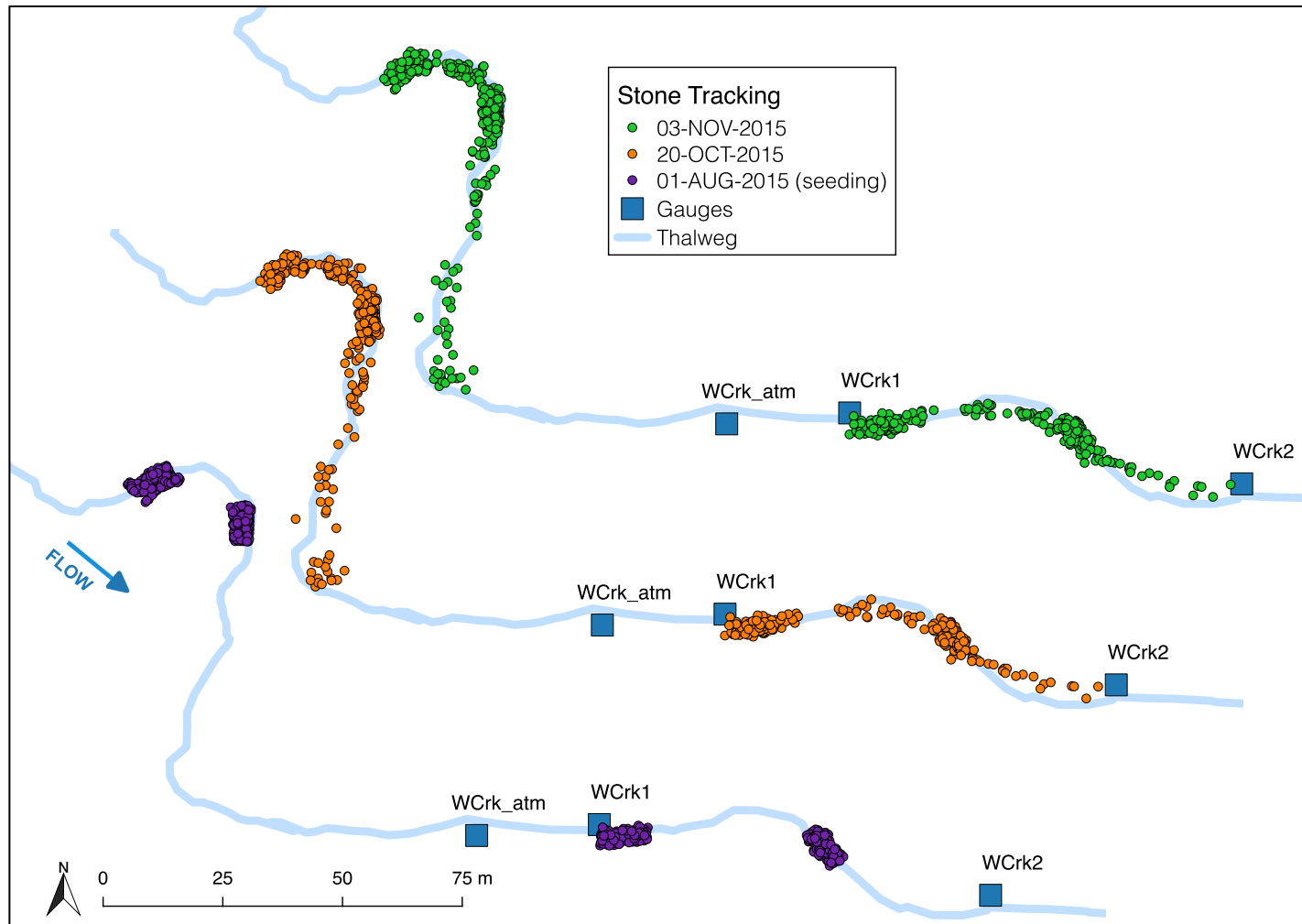
FALL FLOODS

2) 28-OCT to 02-NOV: One long and high magnitude flood.



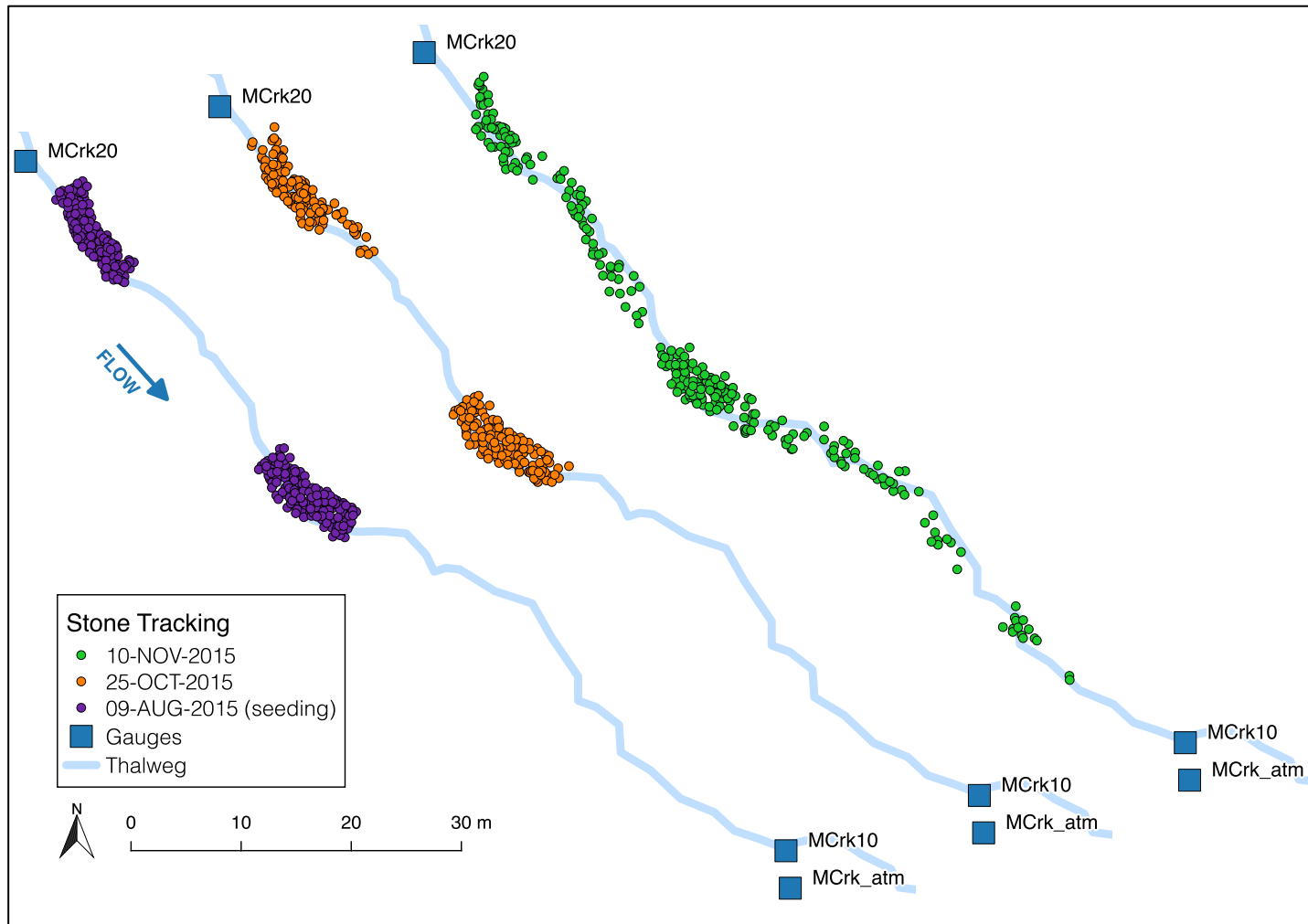
RESULTS

FALL FLOODS – WILKET CREEK



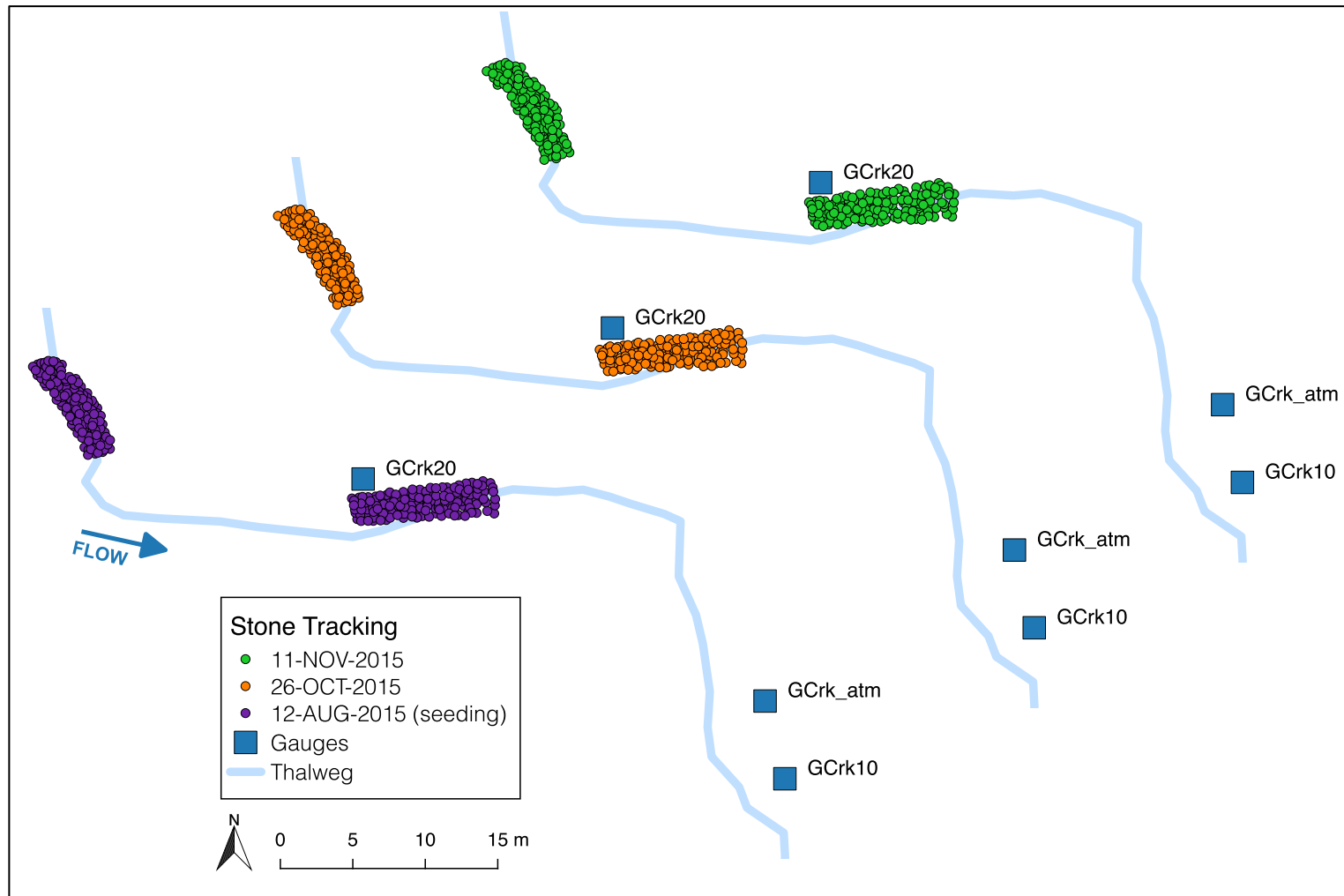
RESULTS

FALL FLOODS – MORNINGSIDE CREEK



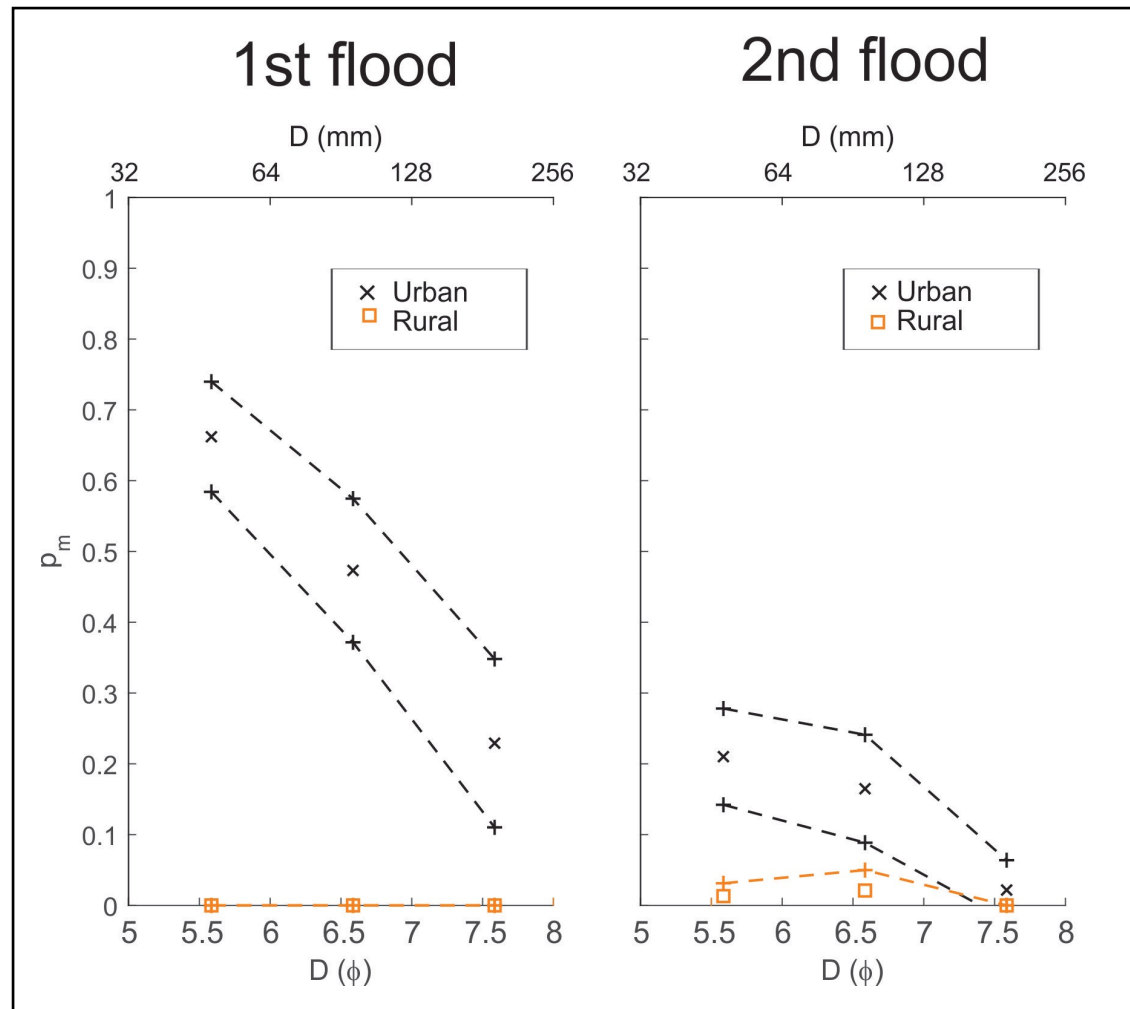
RESULTS

FALL FLOODS – GANNY CREEK



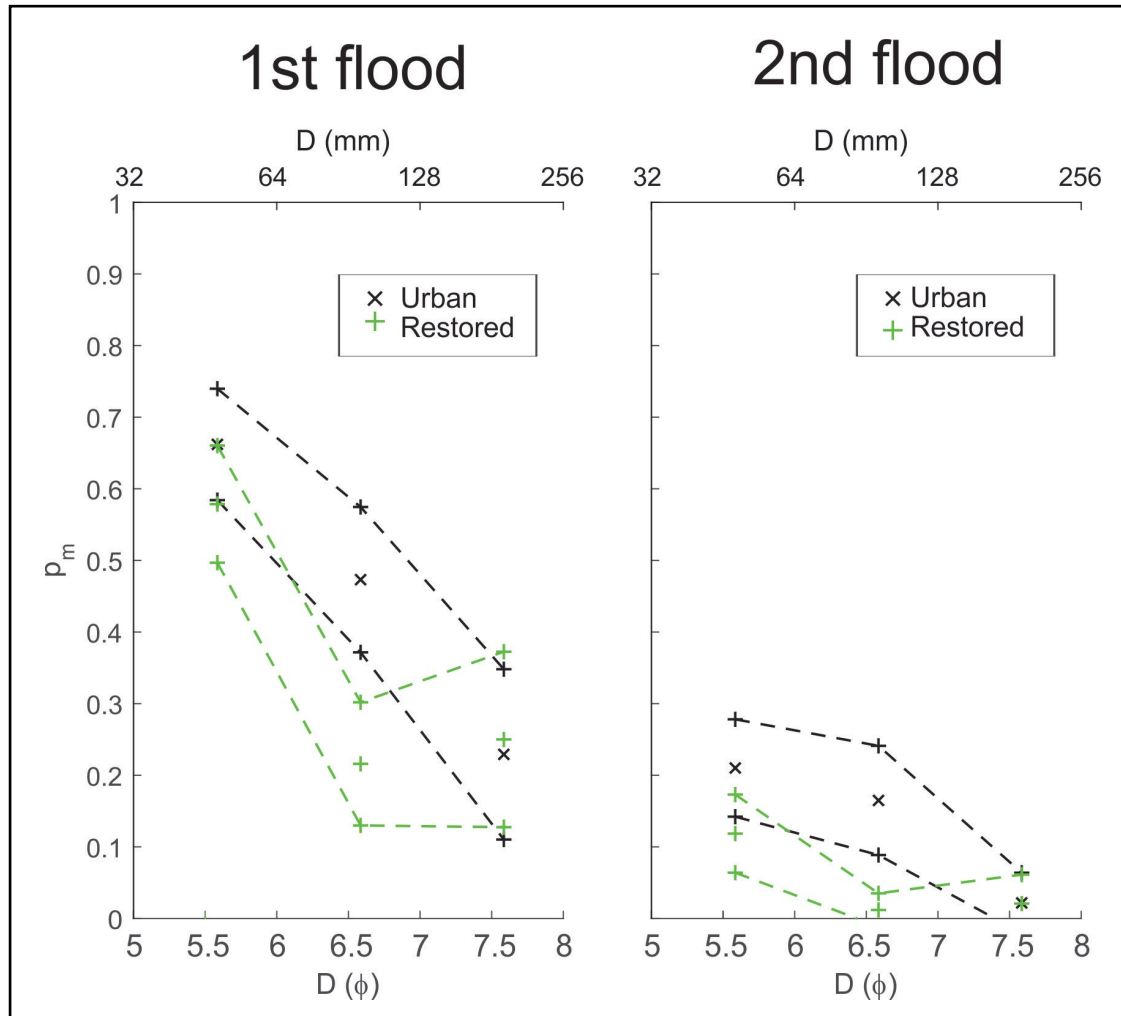
Urban

Non-Urban



Urban Restored

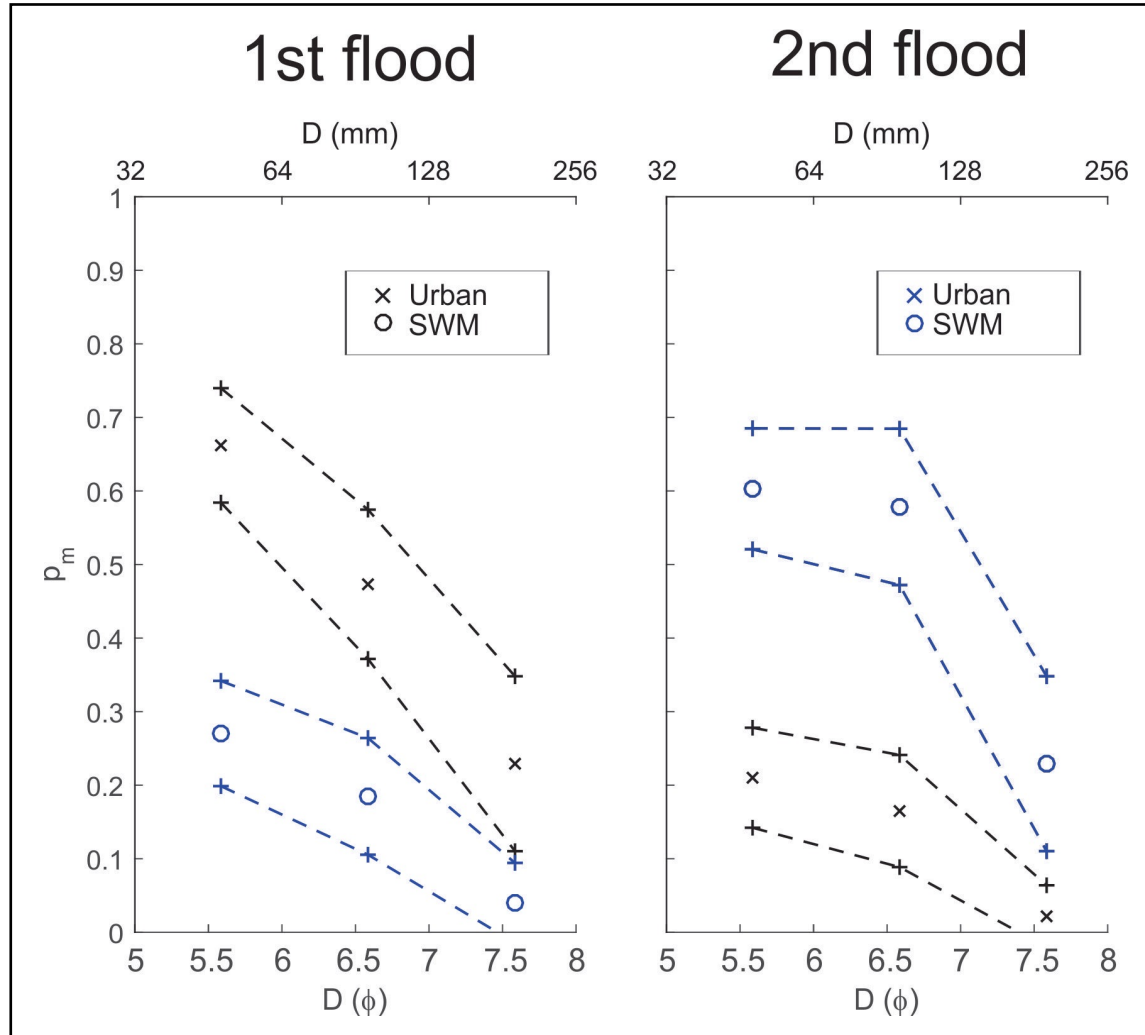
Urban Non-Restored



Urban with SWM

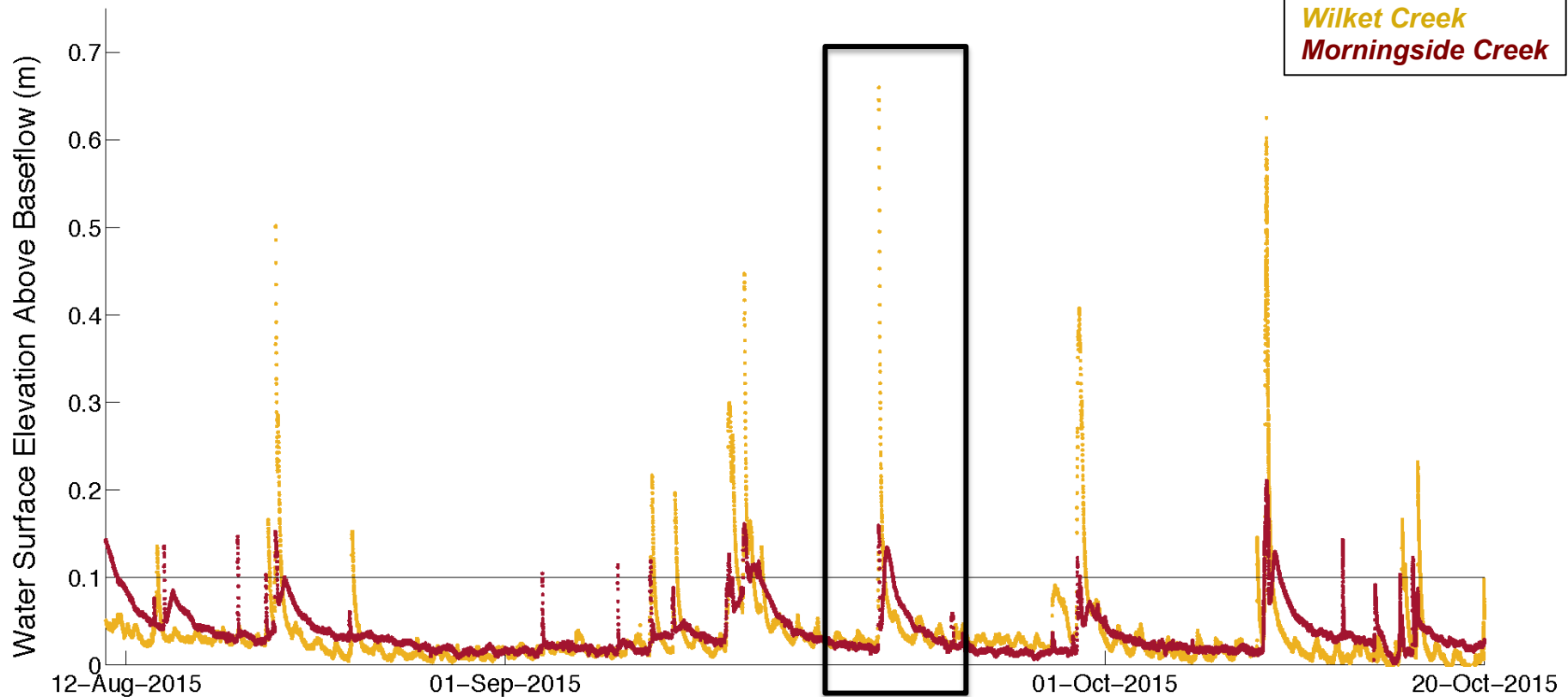


Urban without SWM



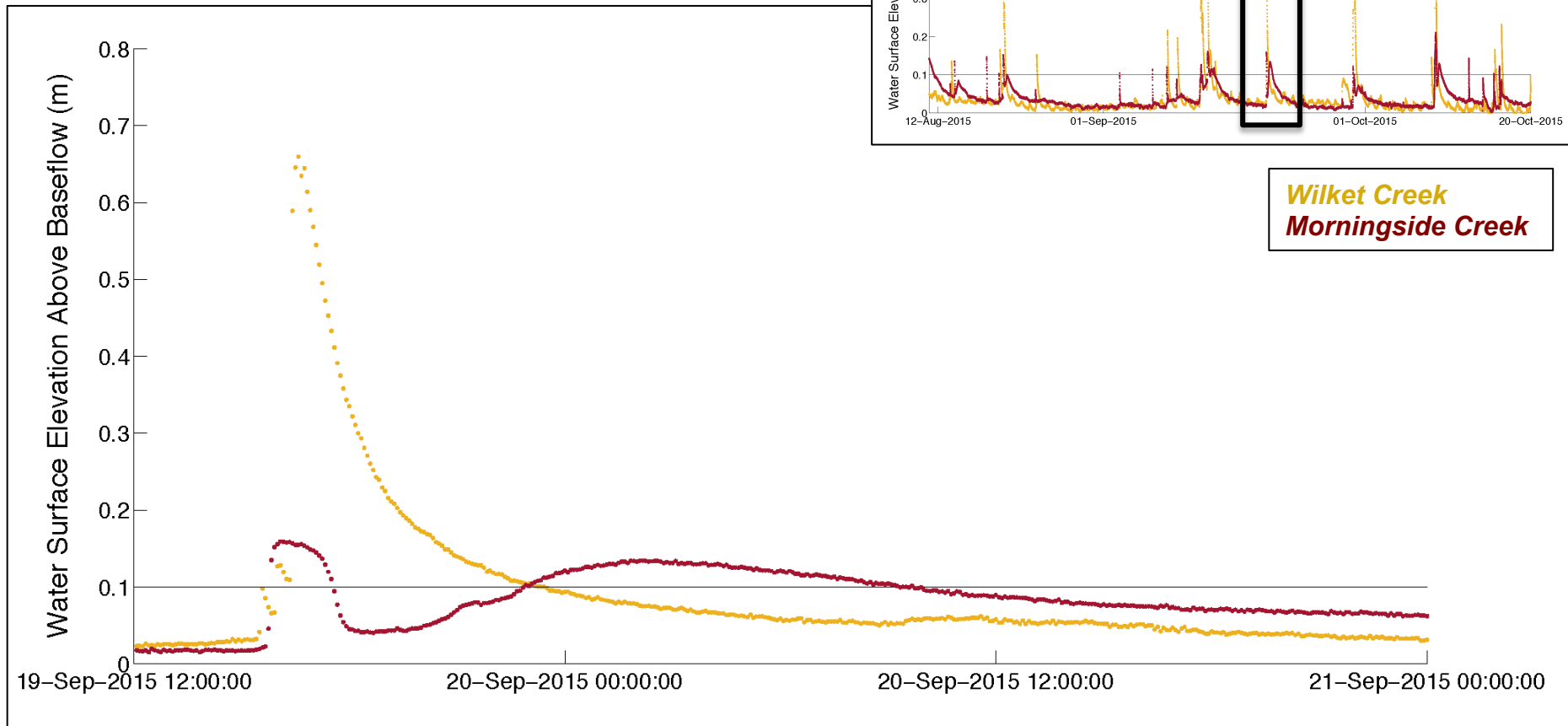
DISCUSSION

FIRST PERIOD HYDROGRAPHS



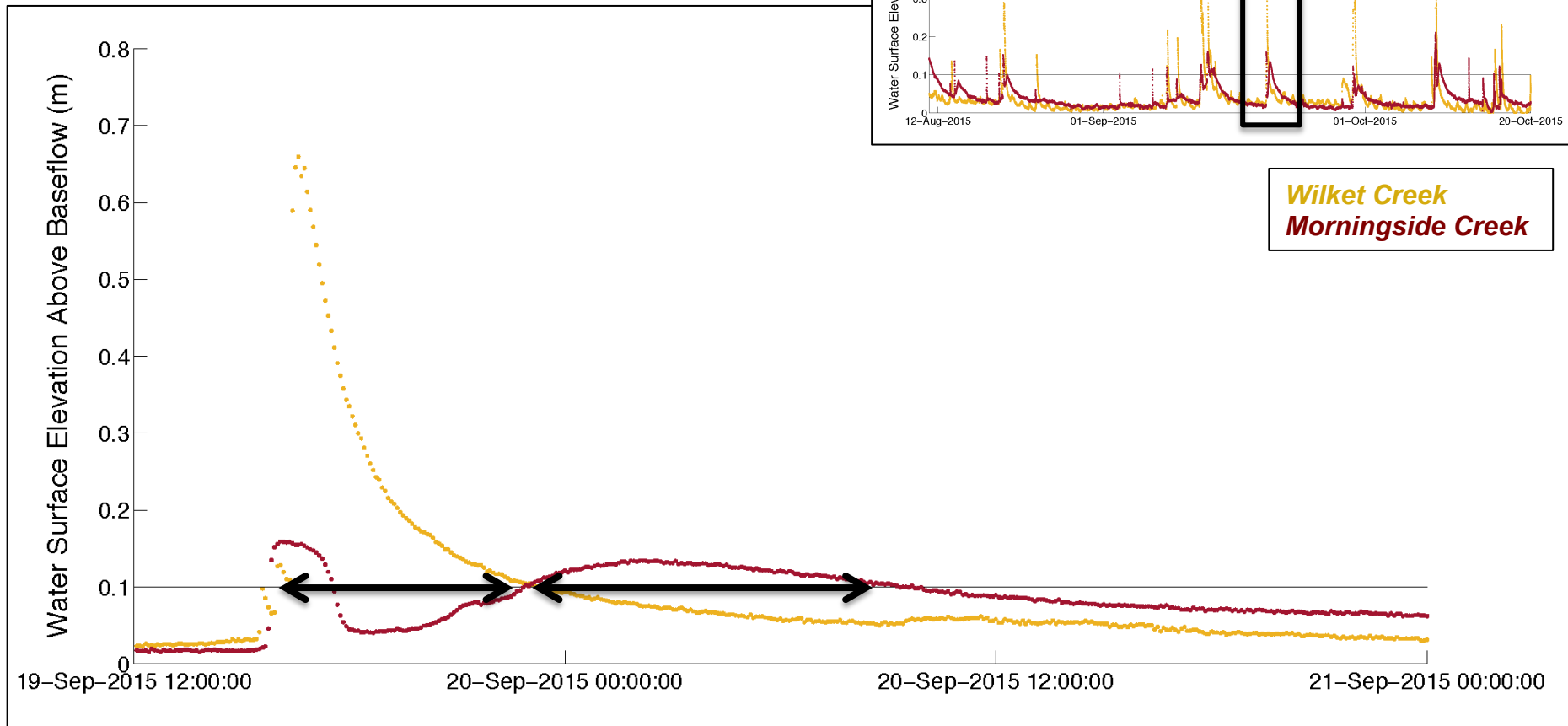
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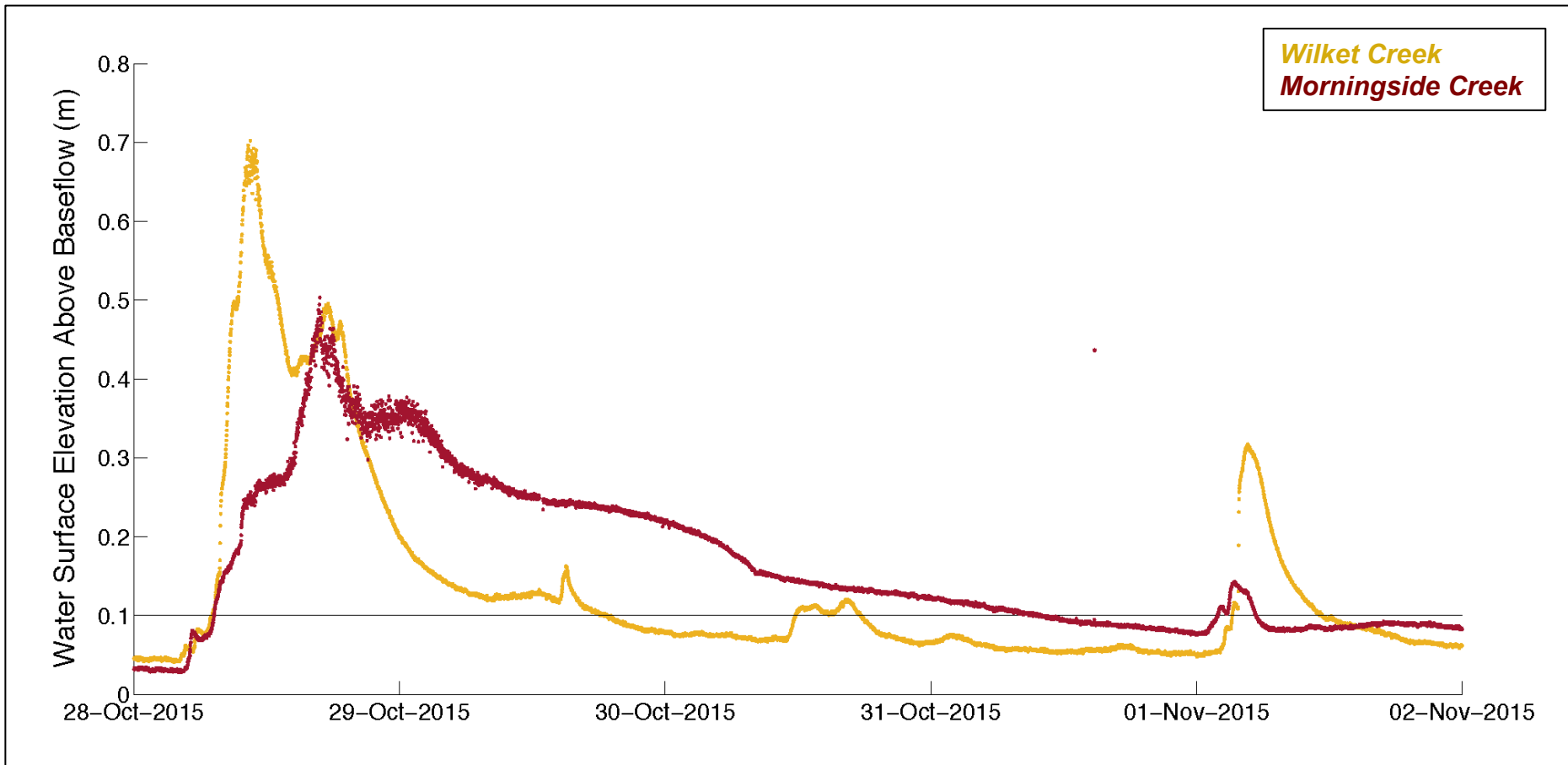
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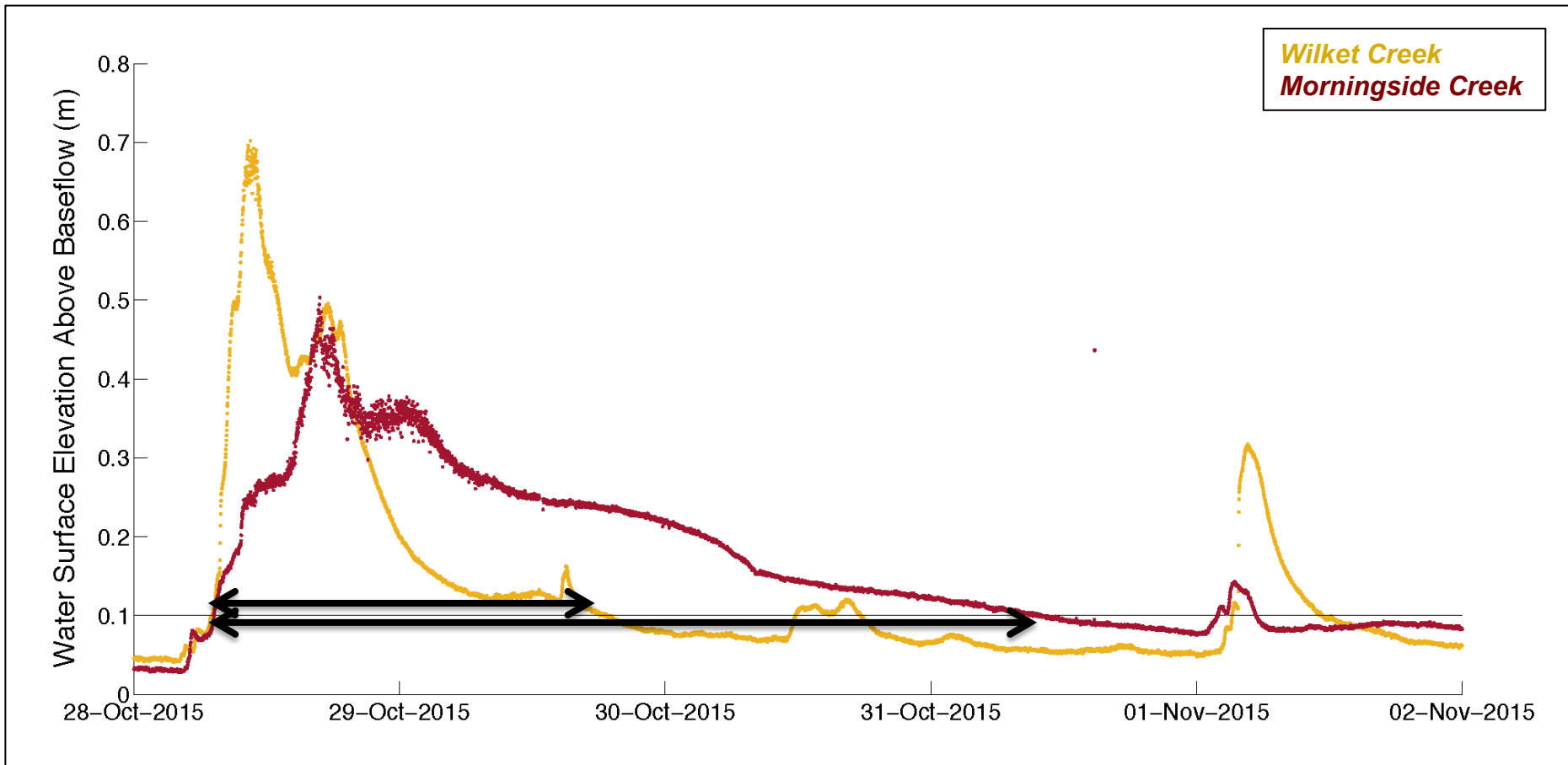
DISCUSSION

SECOND PERIOD HYDROGRAPHS



DISCUSSION

SECOND PERIOD HYDROGRAPHS





CONCLUSIONS

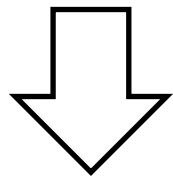
As expected, differences in bedload transport between:

- Urban and non-urban streams,
- Restored and non-restored streams, and
- Between streams with and without SWM

CONCLUSIONS

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- Restored and non-restored streams, and
- ***Between streams with and without SWM***



HYPOTHESIS: Duration of transport events matters

- ***Multiple short-duration*** events more significant for bedload transport in urban stream ***without SWM***
- ***Single long-duration*** event more significant for bedload transport in urban stream ***with SWM***

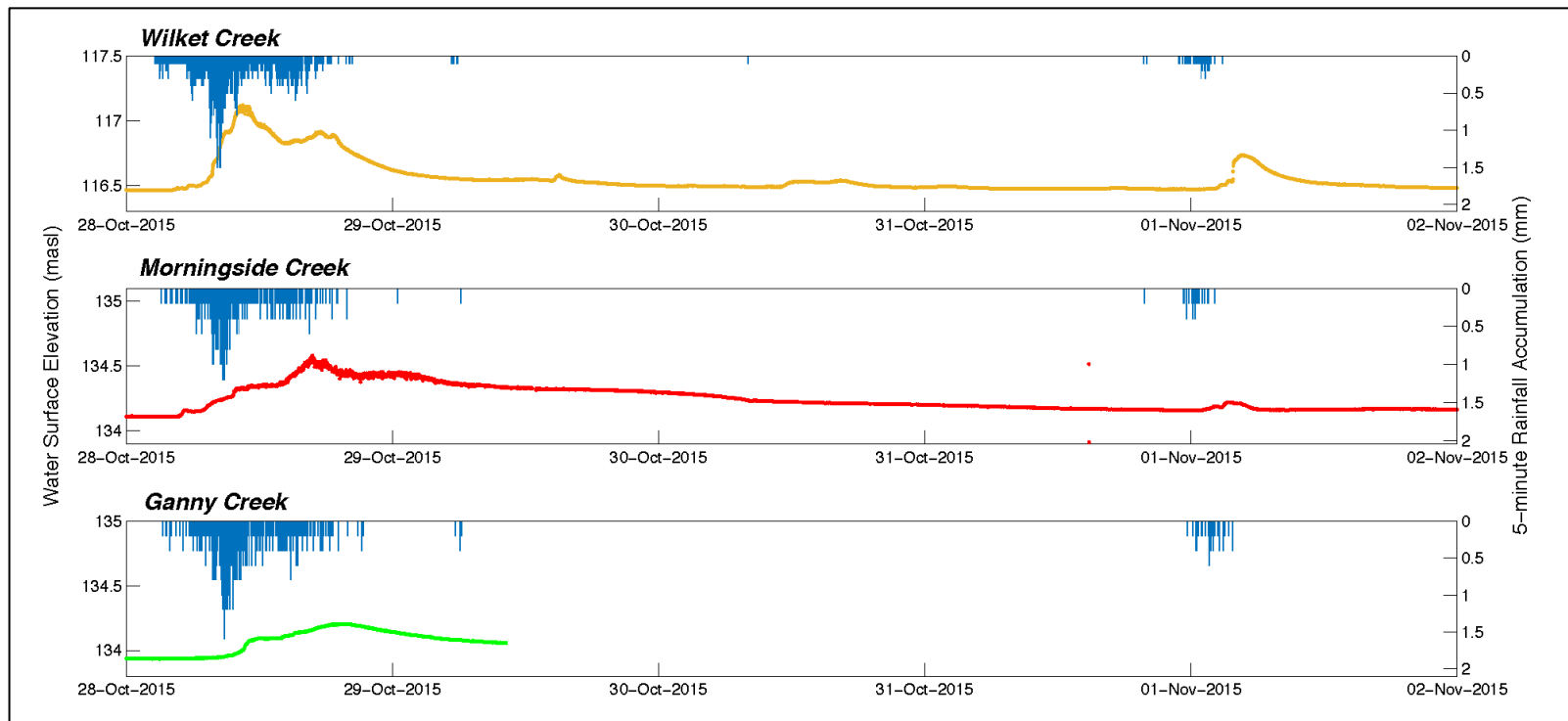


FUTURE WORK

- Continue monitoring bedload transport.
- Quantify hydrographs through various cumulative metrics and relate to transport observed.

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- Link to precipitation data.





THANK YOU