

## Characterization of particles behaviour in combined sewers

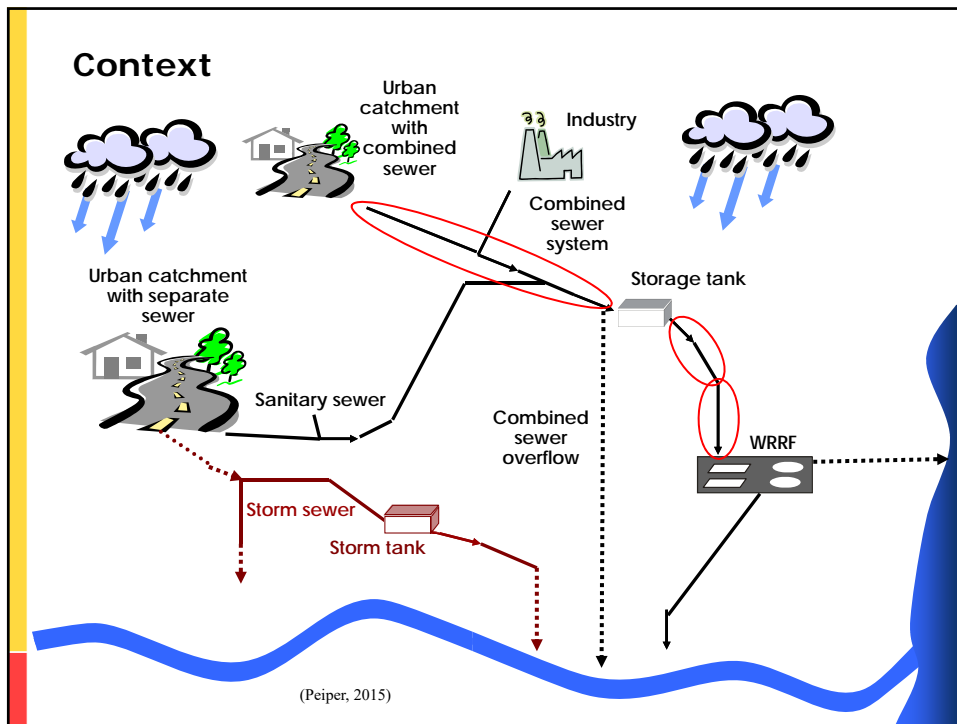
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### Plan

- Context
- Objectives
- Case study
- Material and methodology
- Results and discussion
- Conclusion



## Problem statement

Transport of particulate pollutants in the combined sewer : the most important process of water quality dynamics

Complexity of the description of the transport of particulate pollutants

- ✓Heterogeneity of pollutants in the sewer system
- ✓Difficulty in observing particles physical properties: Particles settling velocity distribution
- ✓Lack of representative data

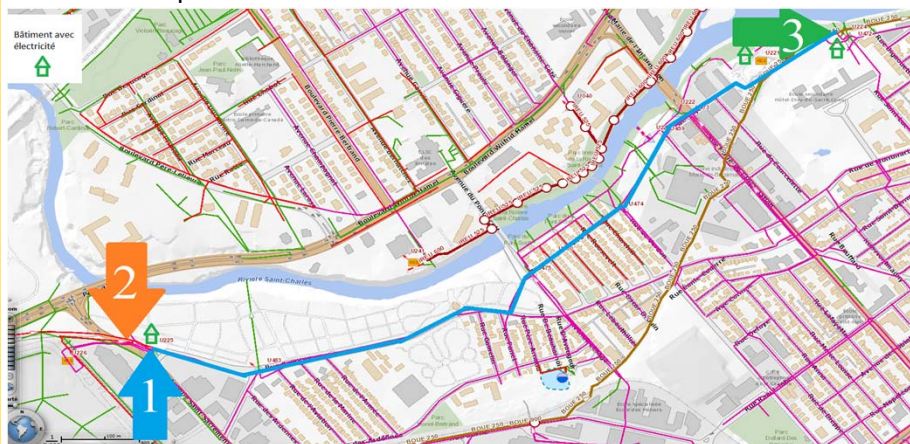
## Objectives

1. Characterization of the hydraulic behavior of the system
2. Characterization of particulate pollutants and their sedimentation
3. Understanding of the flow/sedimentation/resuspension interaction as a function of particles settling velocity distribution

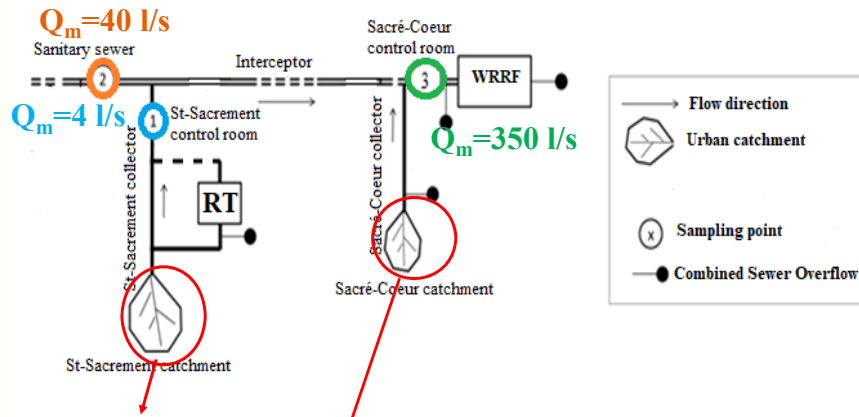
## Case study

### • Quebec city

Interceptor section 1.8 km



## Case study



| Characteristics    |                    | Land use      |     |
|--------------------|--------------------|---------------|-----|
| Surface            | 3.4km <sup>2</sup> | Institutional | 12% |
| Imperviousness     | 65%                | Residential   | 46% |
| Concentration time | 25min              | Commercial    | 10% |
| Population         | 23000              | Industrial    | 20% |
|                    |                    | Green space   | 12% |

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## Methodology

- Dry weather

Particles behaviour in dry weather: sanitary water

- Wet weather

Particles behaviour

During the first flush

During the dilution phase

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## Methodology

- Dry weather
  - ✓ 05am-09am: sample every 10 minutes
  - ✓ 11am-14pm: sample every 08 minutes
  - ✓ 06pm-10pm: sample every 10 minutes
  - ➡ TSS , ViCAs ( test for settling velocity in sewerage)
- Wet weather

Once the flow increases in St-Sacramento control room:

  - ✓ Sample of 17L every 20 minutes: ViCAs
  - ✓ Sample of 100 ml every 2 minutes: TSS

## Material



Cooled autosampler  
Sigma SD 900: including  
24 bottles of 1 L

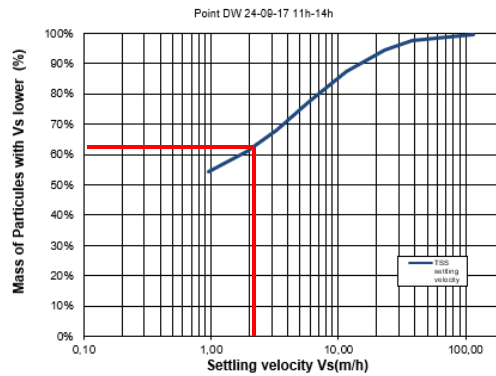
## Material



Settling column of 2m:  
ViCAs: **V**itesse de **C**hute en  
**A**ssainissement

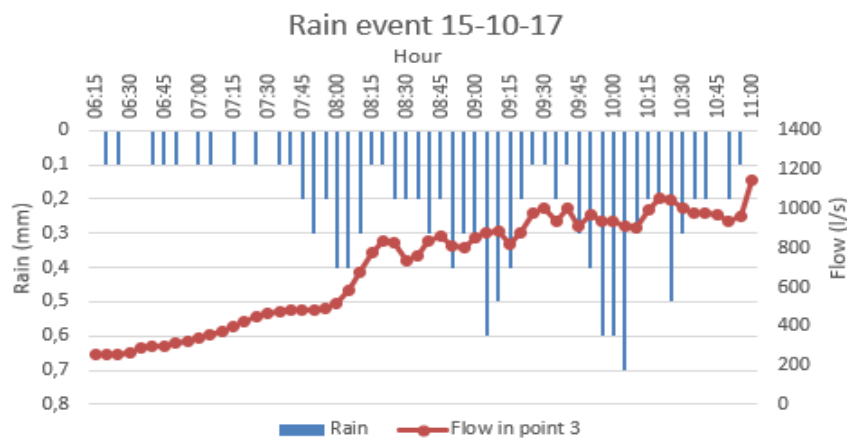
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The settled particles are recovered at the bottom of the column after 1; 3; 5; 10; 20; 35; 60 and 120 min.



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## Results and discussion



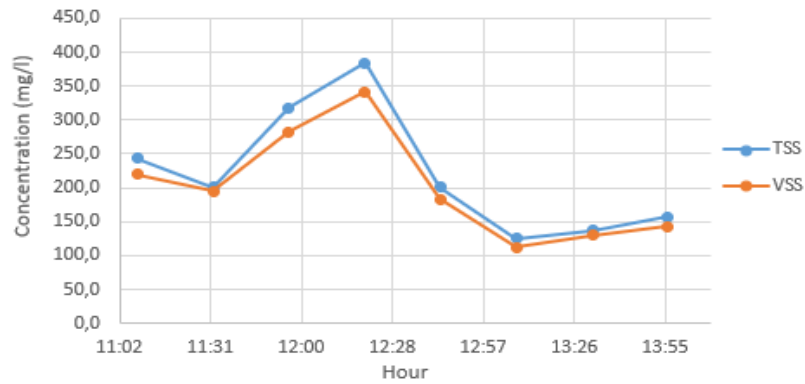
- Antecedent dry weather: 131h
- Rain: 12,2mm
- Maximal intensity: 8,4mm/h

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## Results and discussions

St-Sacrement combined sewer DW 05-07-17



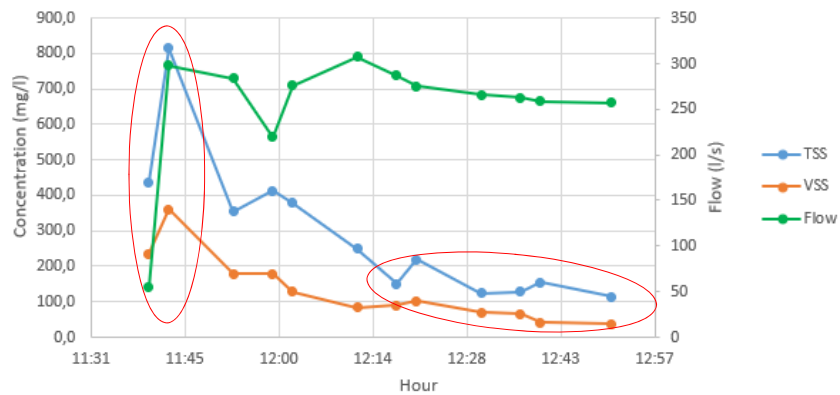
- Mean TSS=220 mg/l
- In dry weather, the fraction of organic matter is very important (90%)

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## Results and discussions

Point 1 WW 11-07-17

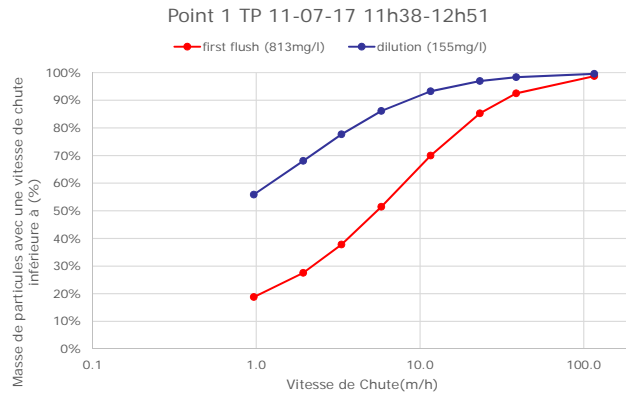


- TSS increases with increasing flow
- VSS is 45% of TSS

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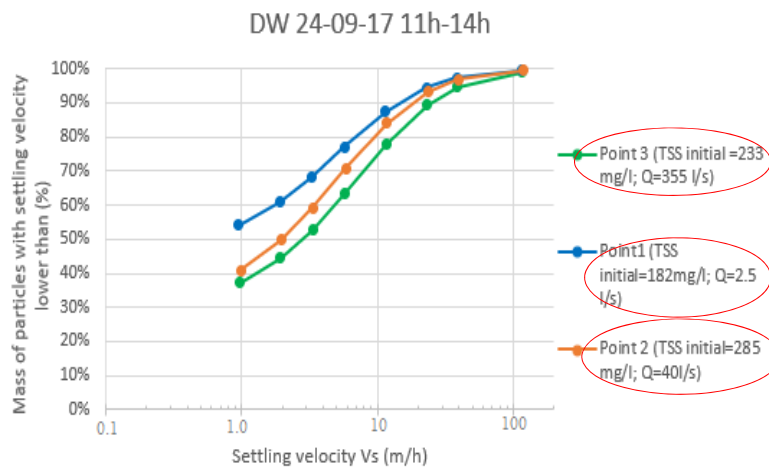
## Results and discussions



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## Results and discussions



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## Conclusion

- During wet weather, TSS increases with flow
- VSS fractions are less important in wet weather
- More inorganic matter , is introduced in the combined sewer by the stormwater, and settled particles during dry weather are resuspended at the higher flow rate
- At high flow rates, the particles settle faster

## Acknowledgement

