

**Flushing consolidated sewer sediments:
Characterization of settled flushwater
returned to the sewer systems**

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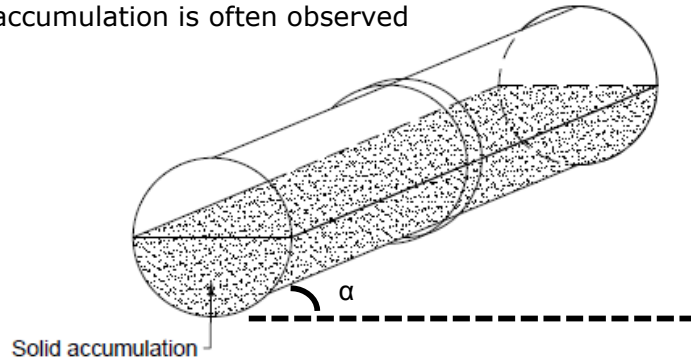


CONTENTS

- Introduction
- Objectives
- Methodology
 - Characterization of the particles load
 - Particle settling velocity
 - Particle size distribution
- Results
 - Laboratory test
 - Study comparison
- Conclusions and recommendations

INTRODUCTION

- Conception criteria are costly to achieve
 - Insufisent slope (α)
 - Insufisent velocity to resuspend consolidated solids
- Solid accumulation is often observed



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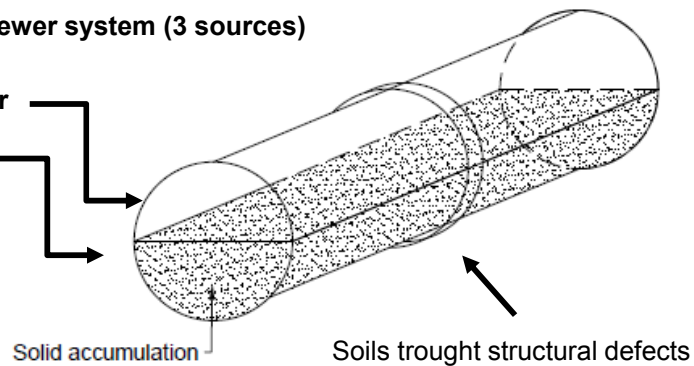
INTRODUCTION

- Source of solids differ depending of sewer system site

Combined sewer system (3 sources)

Pluvial water

Wastewater



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INTRODUCTION

- The sewer system must be cleaned



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INTRODUCTION



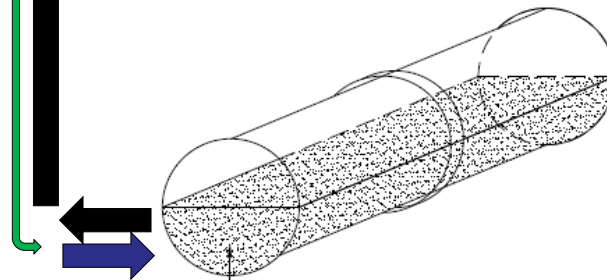
Water tanker



Vacuum truck

Step 3:

- **Settled flushwater** is release to sewer



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INTRODUCTION



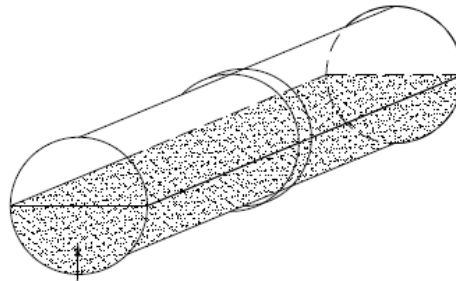
Water tanker



Vacuum truck

Step 3:

- **Settled flushwater** is release to sewer



Solid accumulation

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PROBLEM STATEMENTS

- Flushwater characteristics are unknown
- Environmental impact is not well defined



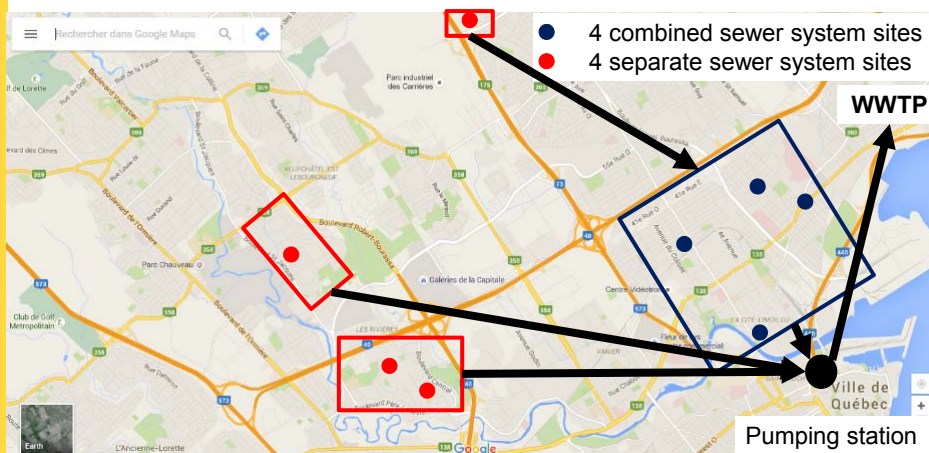
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OBJECTIVES

- Characterize the flushwater that is returned to the sewer system after a short settling period
- Compare the flushwater characteristics between combined and separate sewer systems
- Evaluate the flushwater potential impact on combined and separate sewer systems

CASE STUDIES



METHODS



- Discharge period (8–10 minutes)
 - 1 L sample at every minute
 - 10 L sample during the discharge



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METHODS

- Characterization of the particles load
 - Filtration of the 1L samples (triplicate)
 - Total Suspended Solids (TSS)
 - Volatile Suspended Solids (VSS)
 - Inorganic Total Suspended Solids (iTSS)



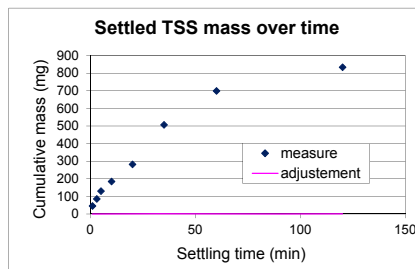
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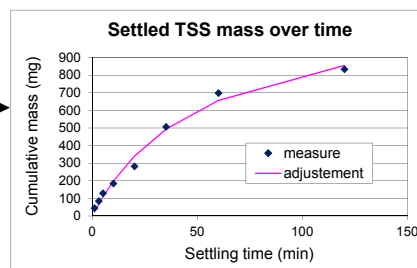
METHODS

- Particle settling velocity distribution (PSVD)
- **ViCAs (*Vitesses de Chute en Assainissement*)**
 - *Settling velocities in wastewater*
- Simple and fast PSVD measurement in wastewater

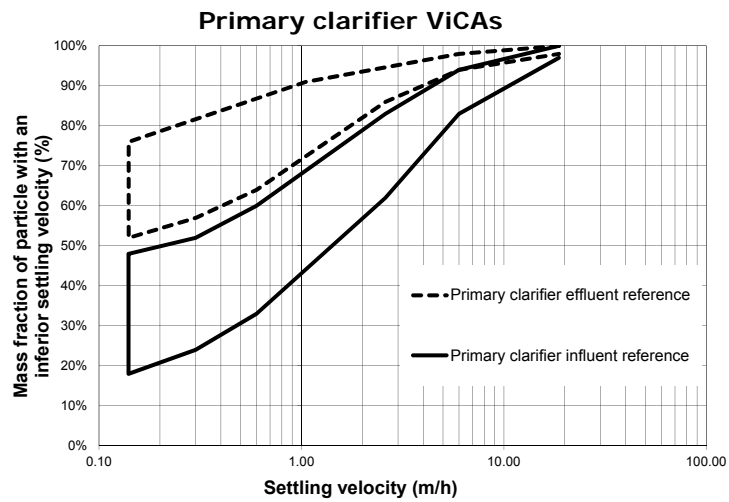
METHODS



Numerical
treatment



METHODS

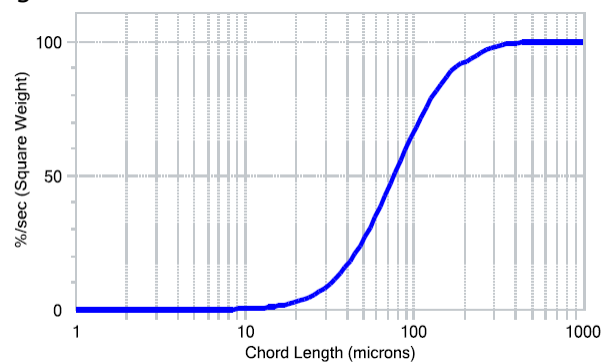


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METHODS

- Particle size distribution (PSD)
- Focused beam reflectance measurement (FBRM)
- Light reflectance measurement



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(Heath *et al.*, 2002)

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RESULTS

- No significant difference between the sewer systems
- iTSS ratio is higher than a typical residential wastewater

# site	Separate sewer systems			
	TSS (mg/L)	VSS (mg/L)	iTSS (mg/L)	iTSS (%)
5	470	235	235	50
6	660	290	370	56
7 (AM)	370	110	260	71
7 (PM)	1250	410	840	67
8	360	210	150	43
Average	470	210	260	55

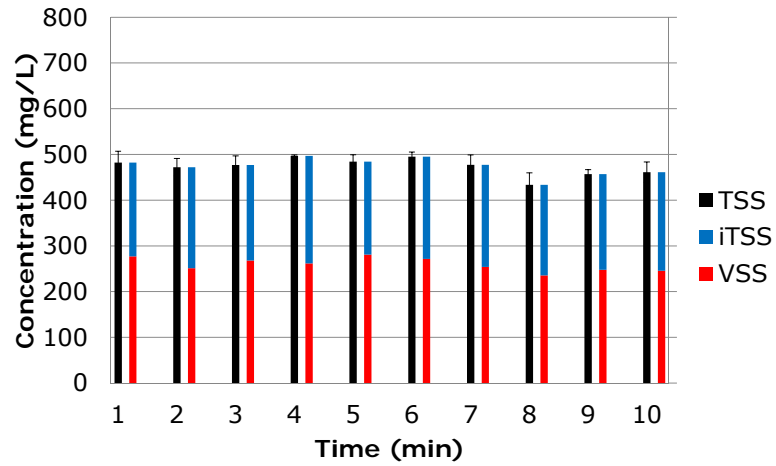
RESULTS

- No significant difference between the sewer systems
- iTSS ratio is higher than a typical residential wastewater

# site	Combined sewer systems			
	TSS (mg/L)	VSS (mg/L)	iTSS (mg/L)	iTSS (%)
1	620	200	420	67
2	480	260	220	45
3 (AM)	12 000	1490	10 510	88
3 (PM)	400	90	310	78
4	610	320	290	48
Average	530	220	310	58

RESULTS

Flushwater concentration over time

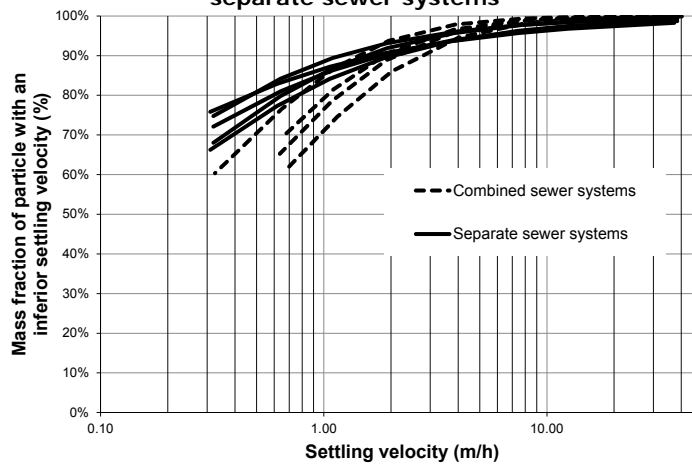


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RESULTS

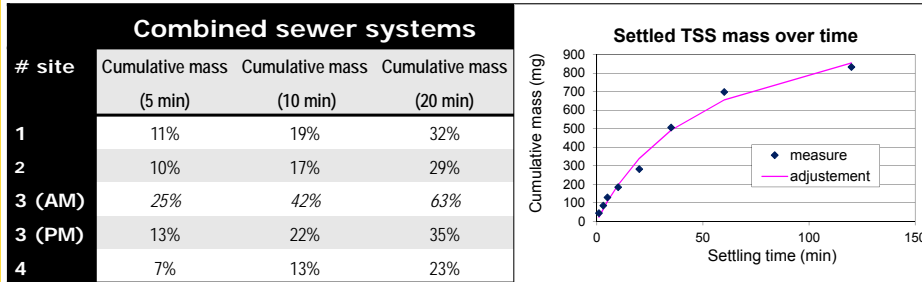
Settling velocity distribution of combined and separate sewer systems



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RESULTS



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RESULTS

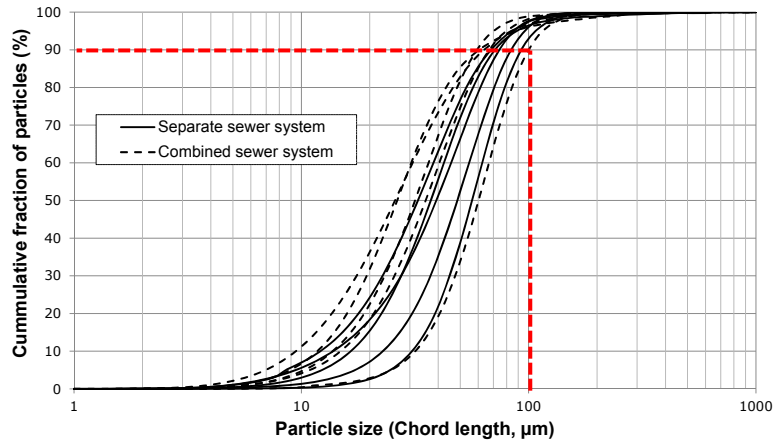
# site	Combined sewer systems			Separate sewer systems		
	Cumulative mass (5 min)	Cumulative mass (10 min)	Cumulative mass (20 min)	Cumulative mass (5 min)	Cumulative mass (10 min)	Cumulative mass (20 min)
1	11%	19%	32%	9%	14%	20%
2	10%	17%	29%	8%	13%	21%
3 (AM)	25%	42%	63%	7%	11%	17%
3 (PM)	13%	22%	35%	9%	13%	18%
4	7%	13%	23%	10%	16%	23%

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RESULTS

Particle size distribution of combined and separate sewer systems

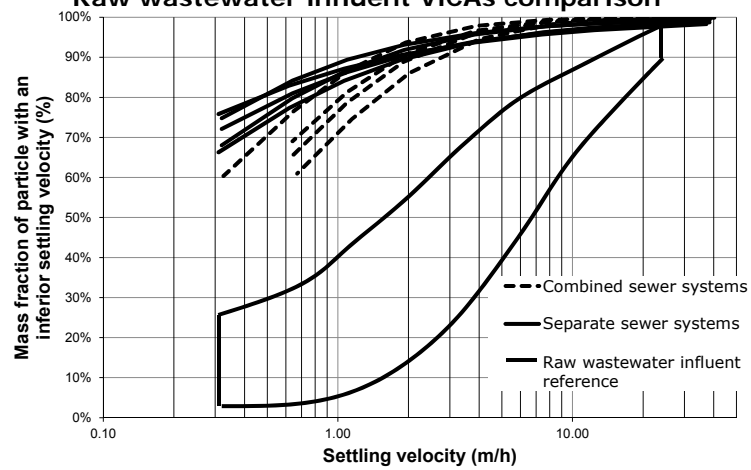


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RESULTS

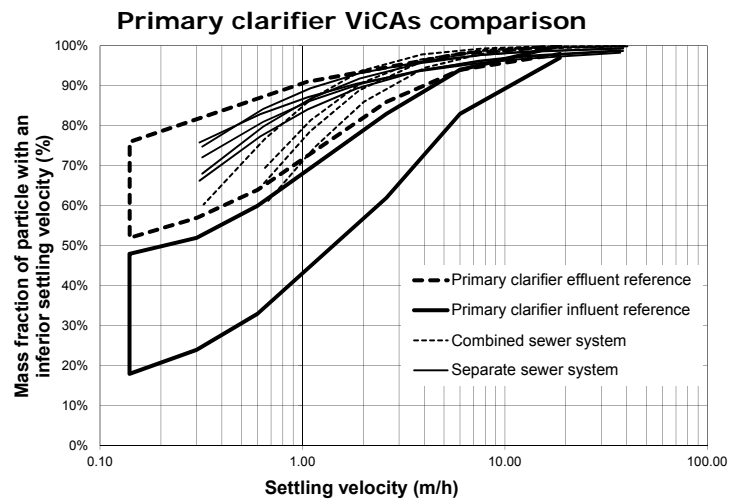
Raw wastewater influent ViCAs comparison



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RESULTS



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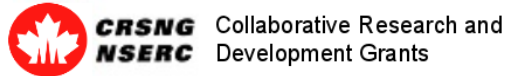
CONCLUSIONS AND RECOMMENDATIONS

- In the settled flushwater, higher concentrations of slow-settling TSS were observed compared to typical wastewater.
- The settled flushwater would not have an impact on both sewer systems due to the small particles size and slow-settling TSS.
- Increasing the settling time in the truck would not improve the quality of the flushwater due to the slow particle settling velocity distribution.

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Questions?

