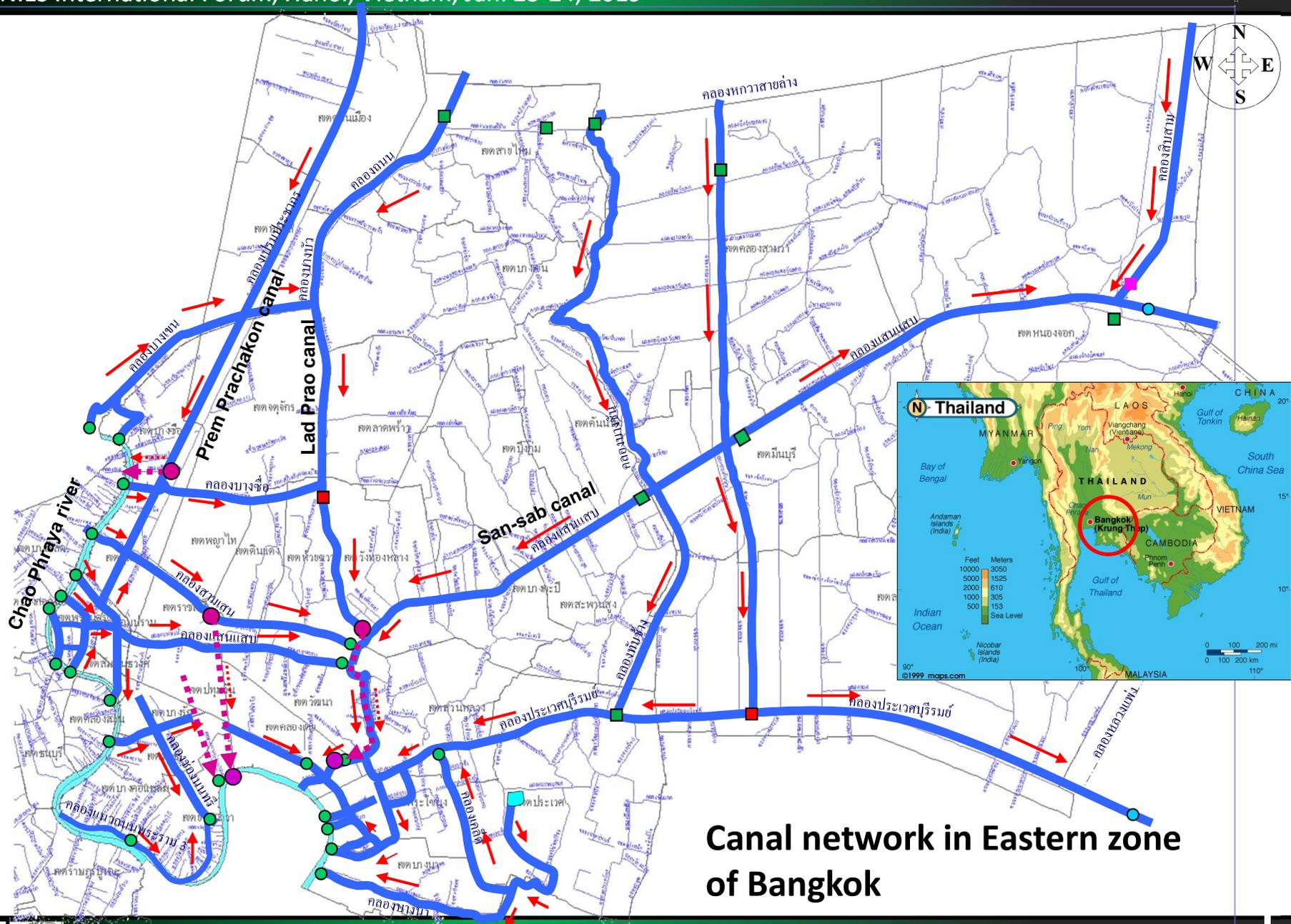


# **Solid Waste Characterization in Bangkok Canals and Its Impact to Drainage Function of Combined Sewer System**

**presented by**

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KASETSART University (KU)**





Canal network in Eastern zone of Bangkok

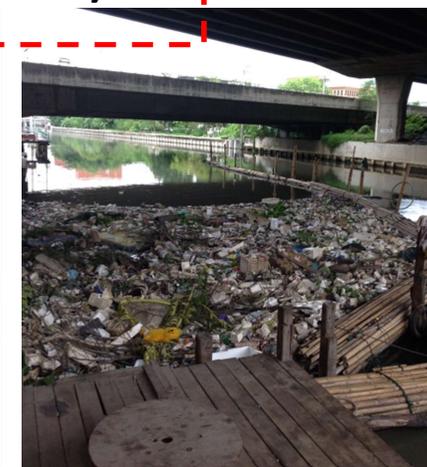
## Lad Prao canal



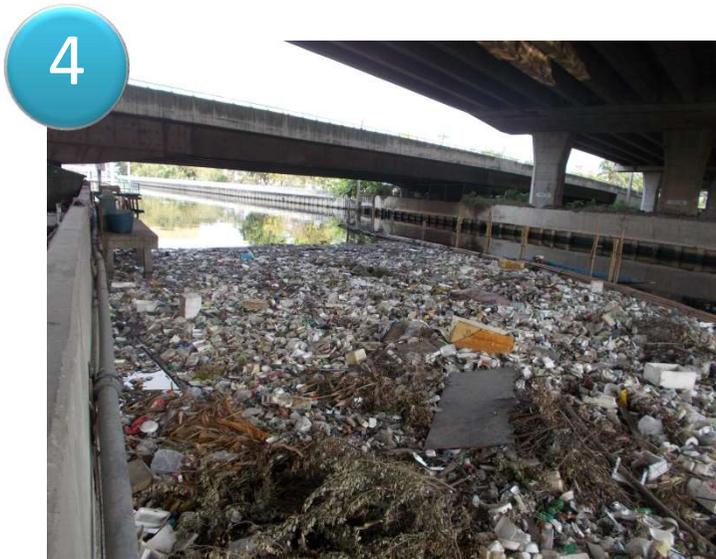
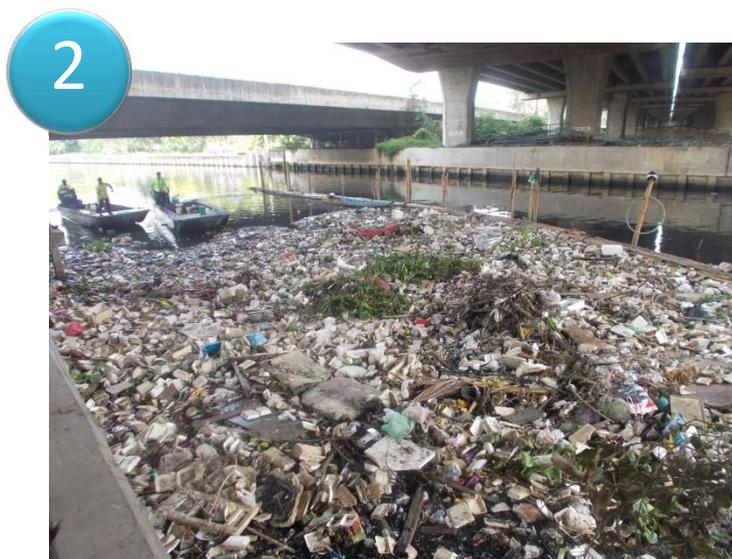
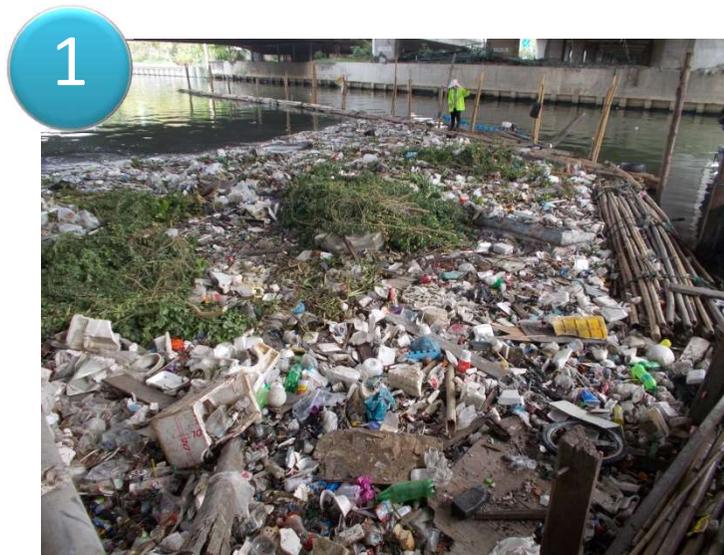
## Waste collecting station (klong Lum-Pie)



## Waste collecting station (Rama IX)



## Waste composition analysis 4 times (2 @ dry season, 2 @ rainy season)



## Prem Prachakon canal

Waste composition analysis 1 time (@ dry season)



Waste collecting station  
(Wat Thawa Sunthon)



# Waste sampling and analysis

1. Sampling of 1-2 m<sup>3</sup> of solid wastes collected from the waste storage area
2. Using quartering method to reduce the sample size to about 100 L
3. Determine waste composition (% wet wt.), bulk density and moisture content



## Waste composition analysis

The waste was classified into 16 components

- |                        |                      |                            |
|------------------------|----------------------|----------------------------|
| 1) Wood (timber)       | 7) Shell and bone    | 13) Metal and aluminum     |
| 2) Wood (trim)         | 8) Textile           | 14) Rubber                 |
| 3) Plastic (bottle)    | 9) napkin and diaper | 15) Plant (water hyacinth) |
| 4) Plastic (packaging) | 10) Paper            | 16) Plant (natural plants) |
| 5) Plastic (material)  | 11) Glass            |                            |
| 6) Food waste          | 12) Foam             |                            |

Bulk density of the mixed wastes was determined.



Timber



Trim



Foam



Paper



Glass



Plastic (packaging)



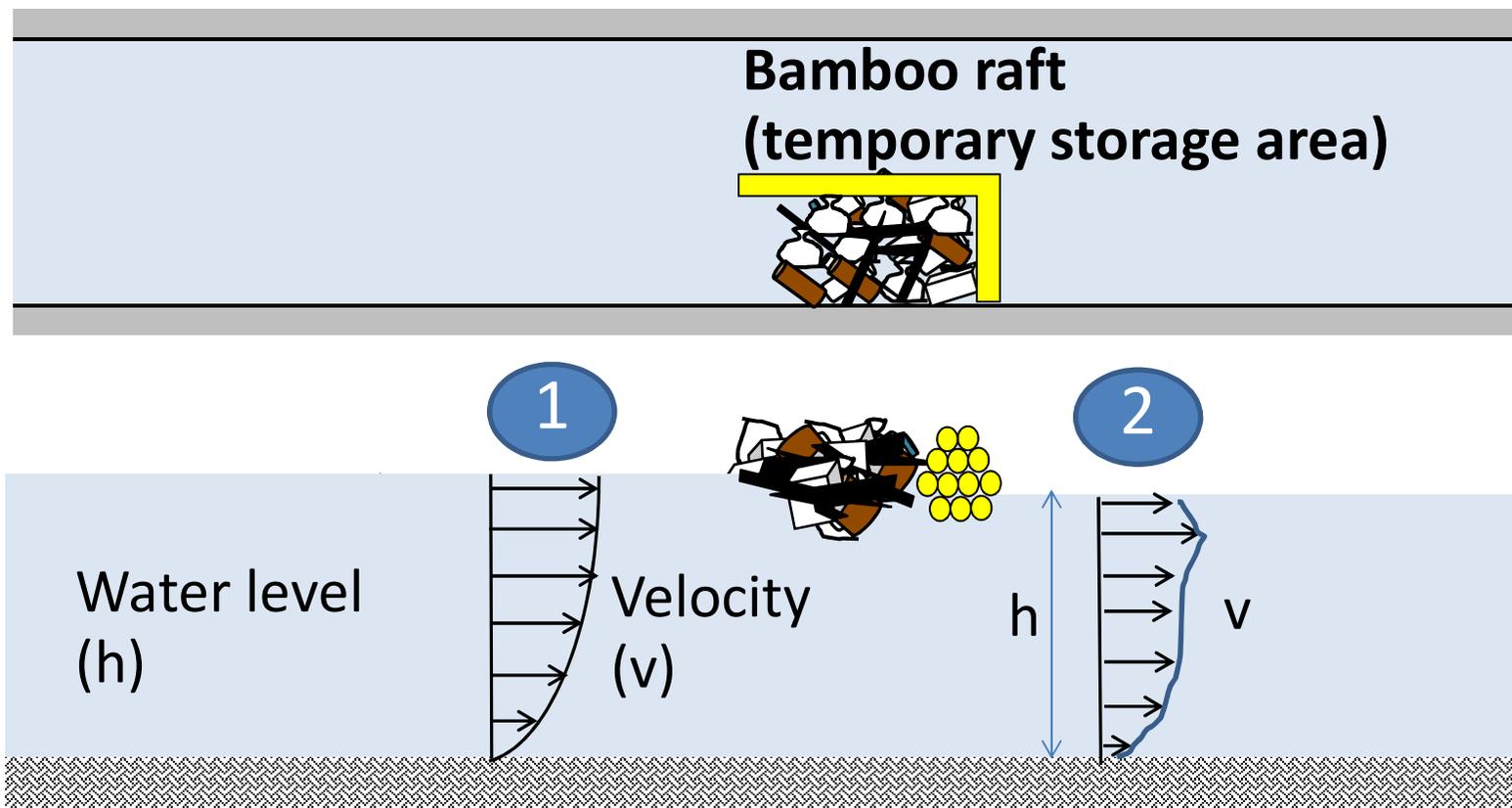
Water hyacinth

Summary

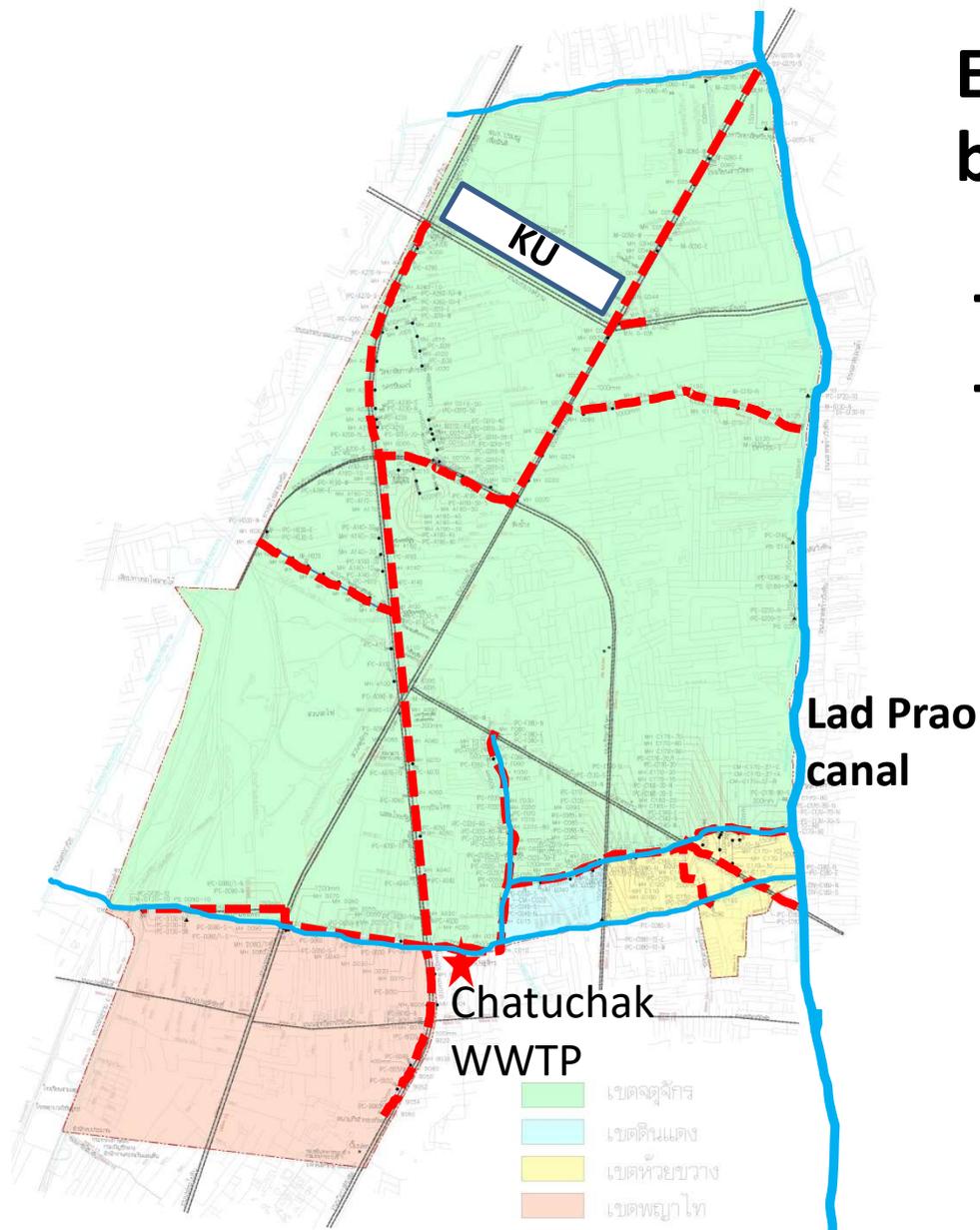
No.	Type of waste	Dry (% by weight)	Rainy (% by weight)	Moisture Content (%)
1	Wood (timber from household)	34.3	21.4	50
2	Wood (trim)	13.6	22.5	64
3	Plastic (bottle)	1.0	2.6	15
4	Plastic (packaging)	12.8	11.8	76
5	Plastic (material)	3.3	4.3	13
6	Food waste	6.6	9.7	77
7	Shell and bone	0.3	0.8	-
8	Textile	2.2	1.3	68
9	Sanitary napkin and Diaper	2.2	1.6	88
10	Paper	1.3	1.7	29
11	Glass	3.4	6.3	< 1
12	Foam	1.9	6.1	46
13	Metal and Aluminum	0.4	0.6	6
14	Rubber	1.7	3.4	37
15	Plant (water hyacinth)	4.1	0.8	-
16	Plant (natural plants)	10.9	5.1	93
<b>Bulk density (kg/m<sup>3</sup>)</b>		<b>242</b>	<b>266</b>	



# Determination of solid waste blockage on the reduction of drainage capacity in Bangkok

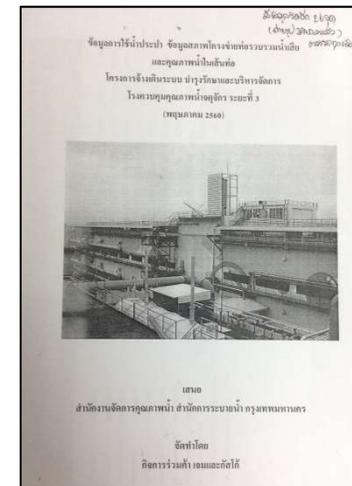


## Effect of solid waste blockage in the canal



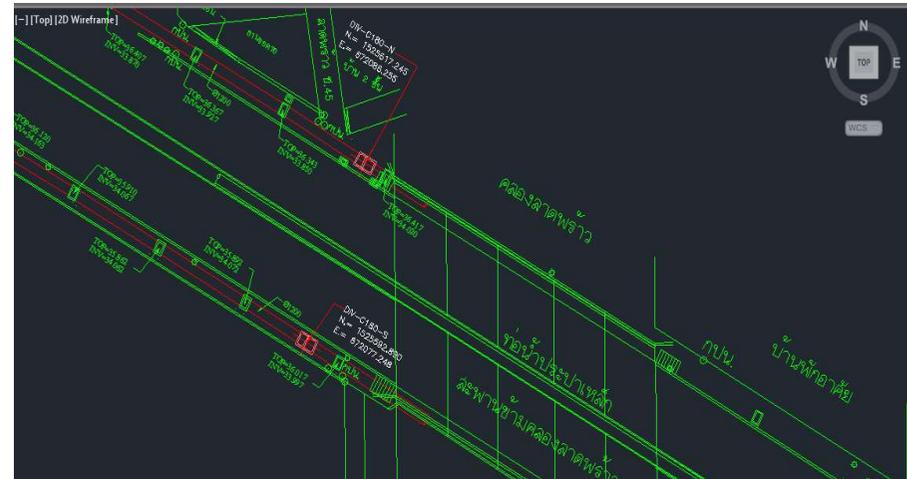
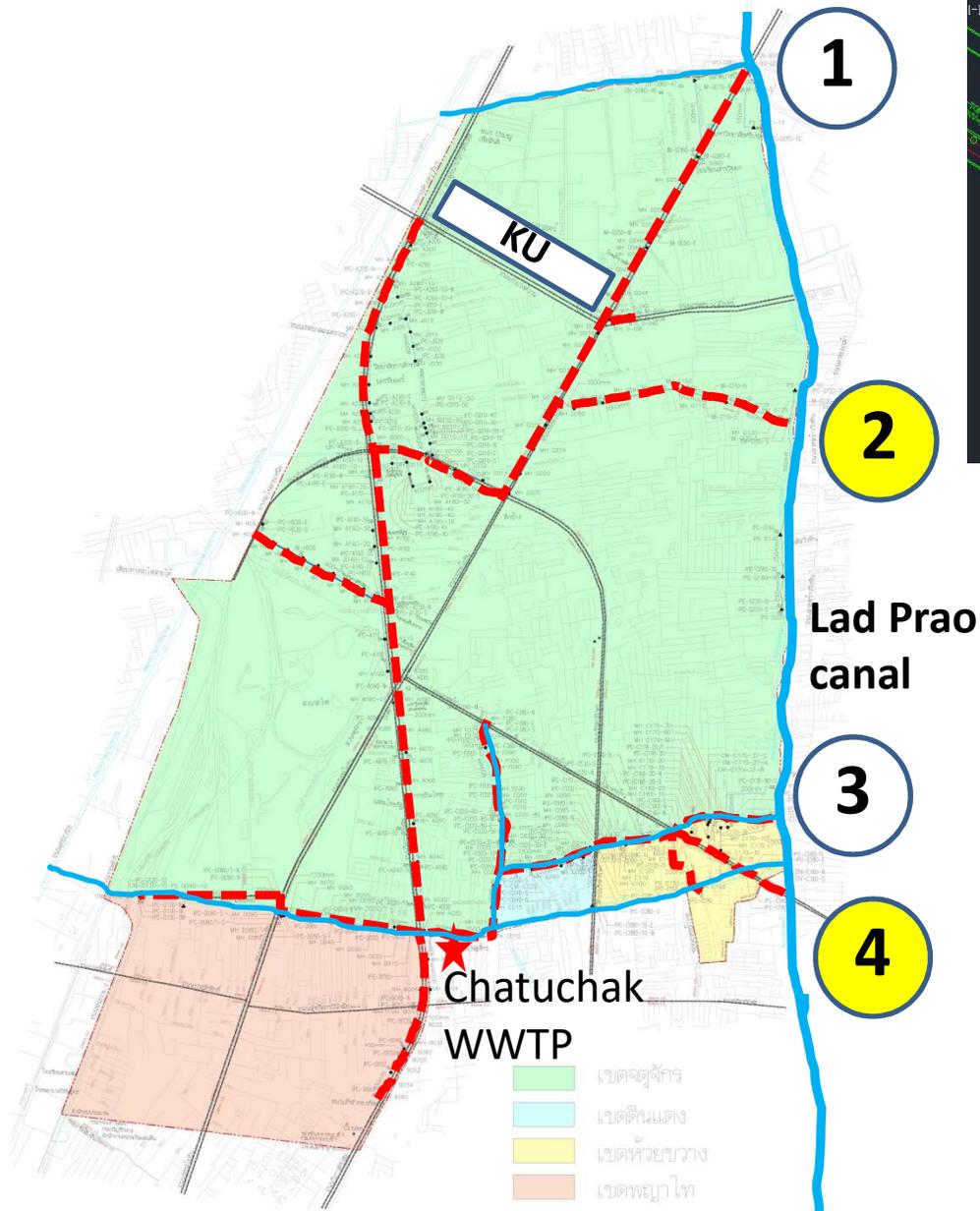
## Effect of solid waste blockage in Lad Prao canal

- temporary flooding
- back flow of canal water into combined sewer



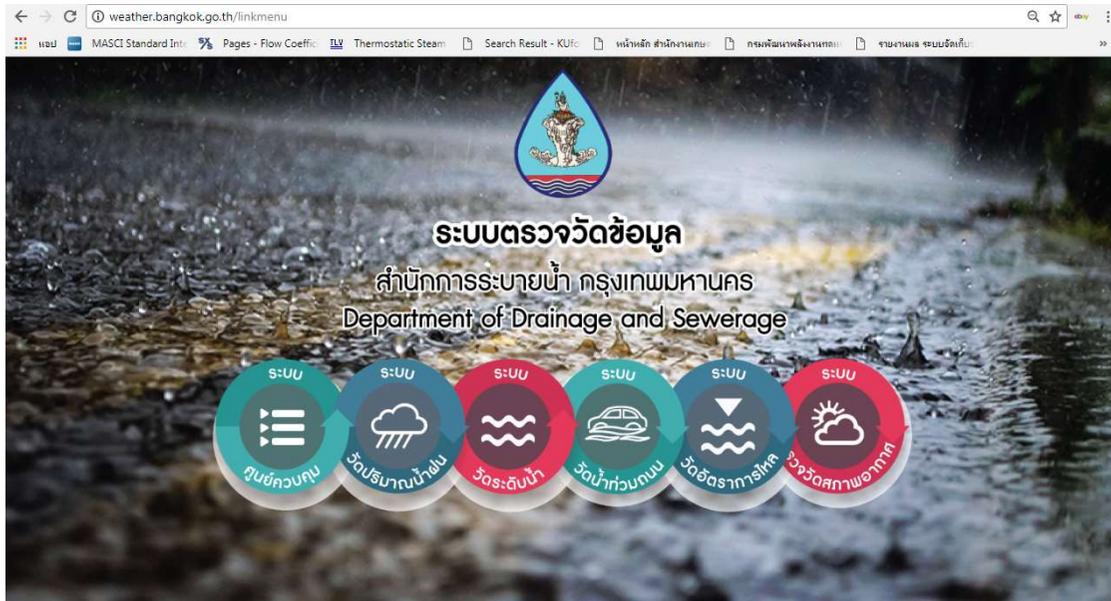
Chatuchak Wastewater Treatment Plant report (data of wastewater collection system)

--- Intercepting sewer canal



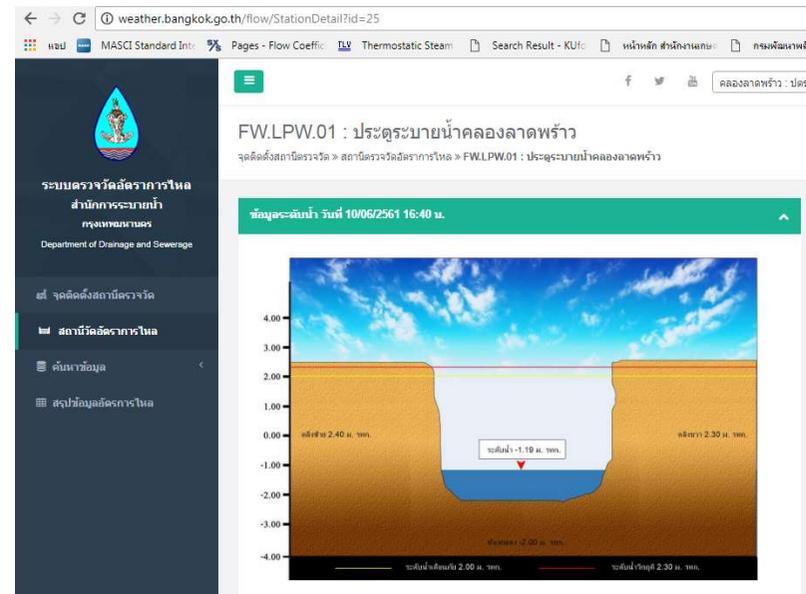
### Elevation of Outfall

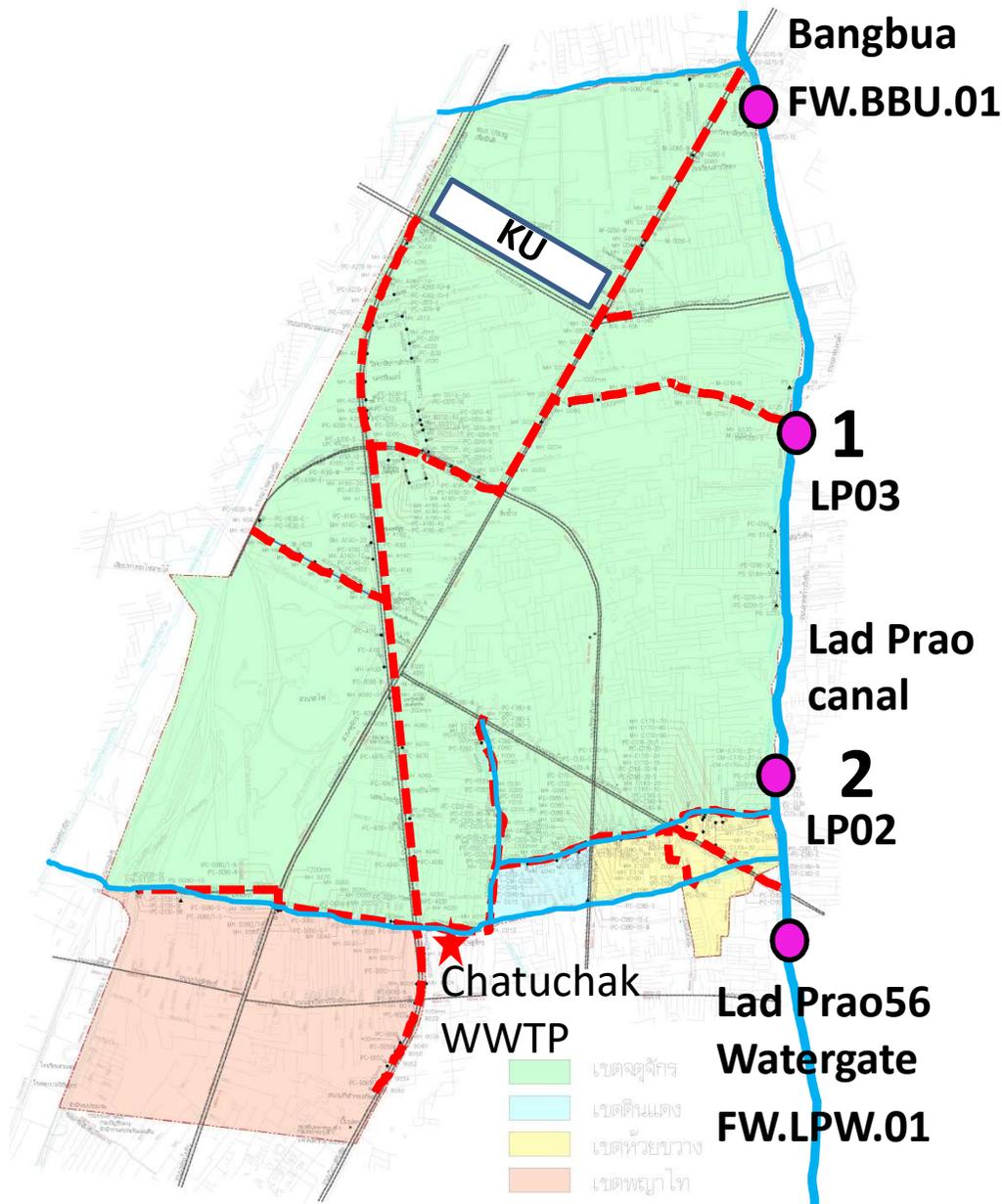
Location	TOP (MSL)	INV (MSL)
1	2.34	-1.01
	1.20	-0.93
2	1.39	-1.73
	1.61	-1.82
3	1.80	-0.54
4	1.38	-0.93
	0.99	-1.03



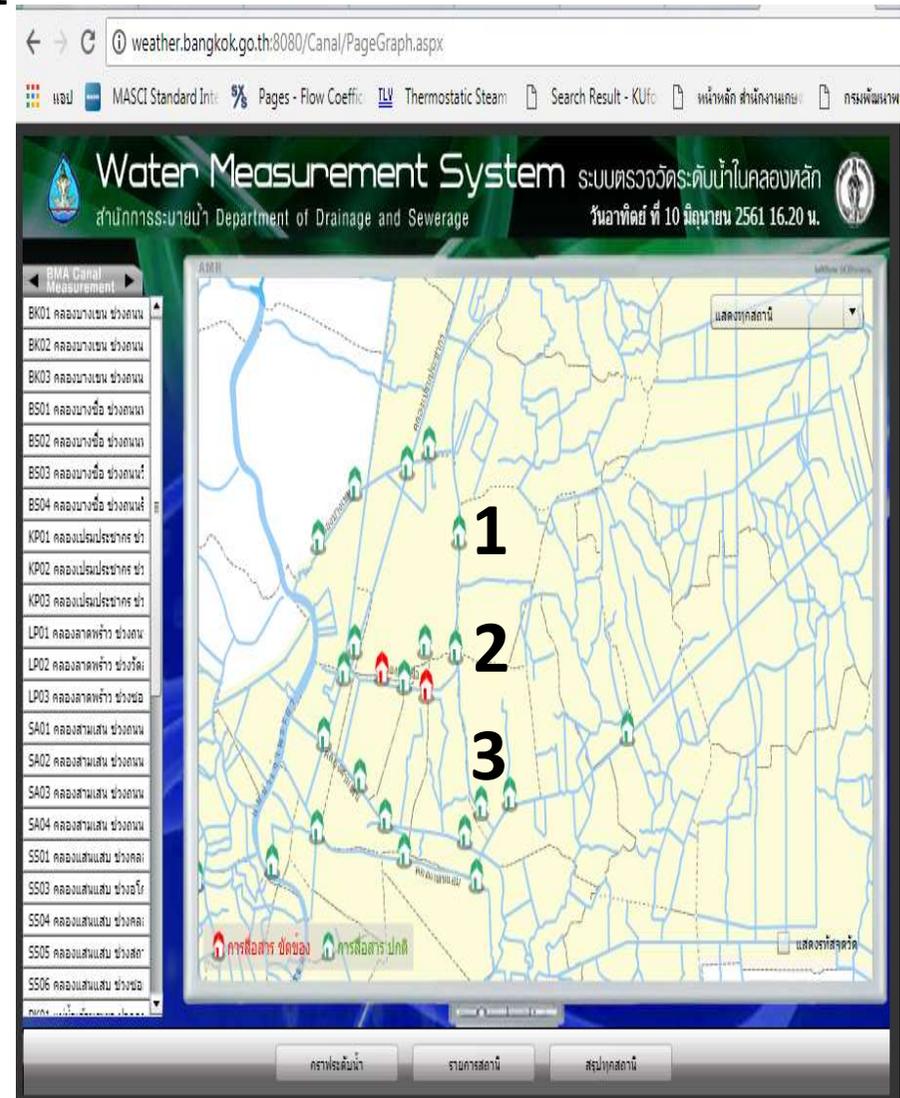
## Water Measurement system by DDS

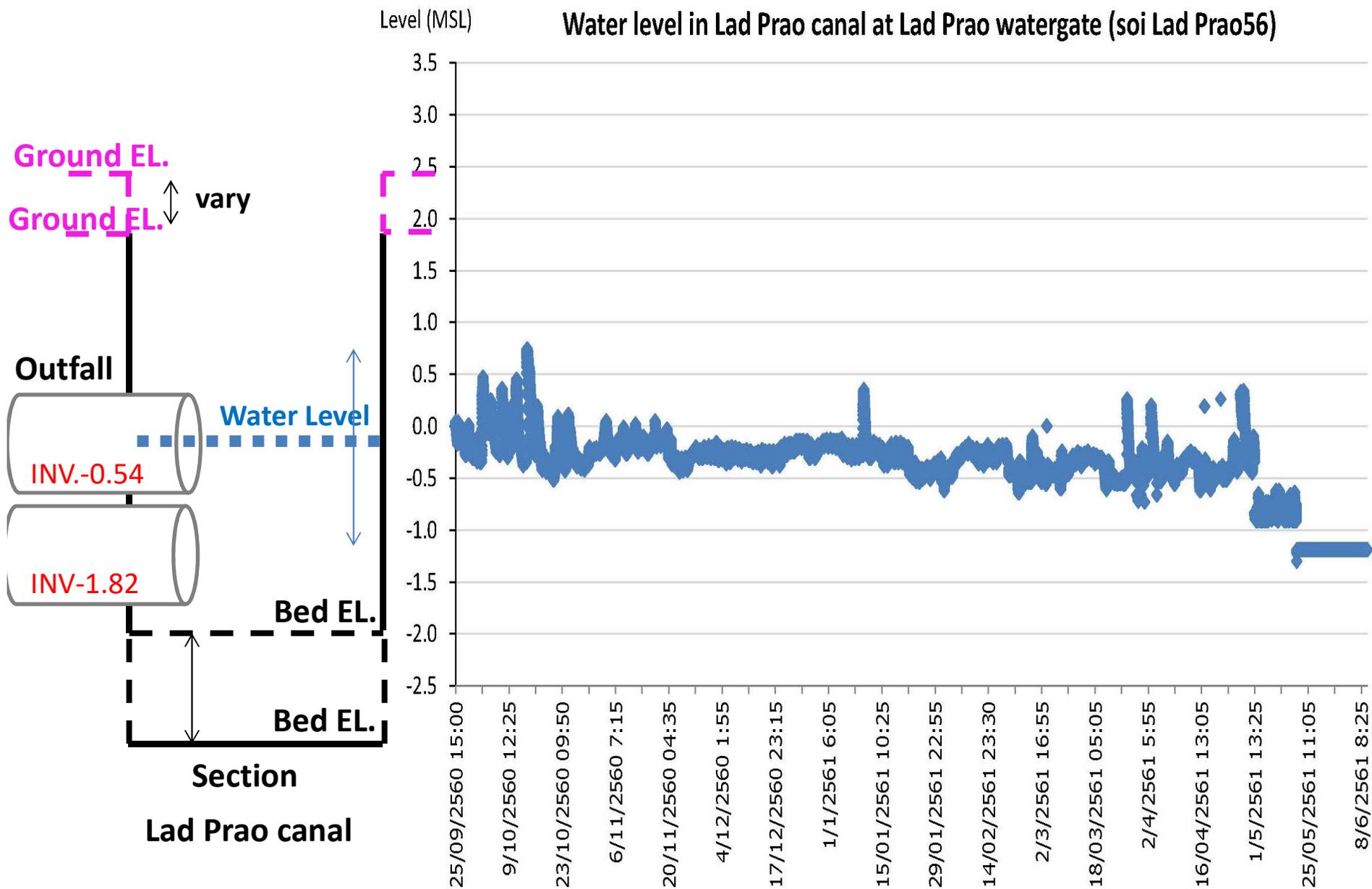
- Water level
- Flow rate



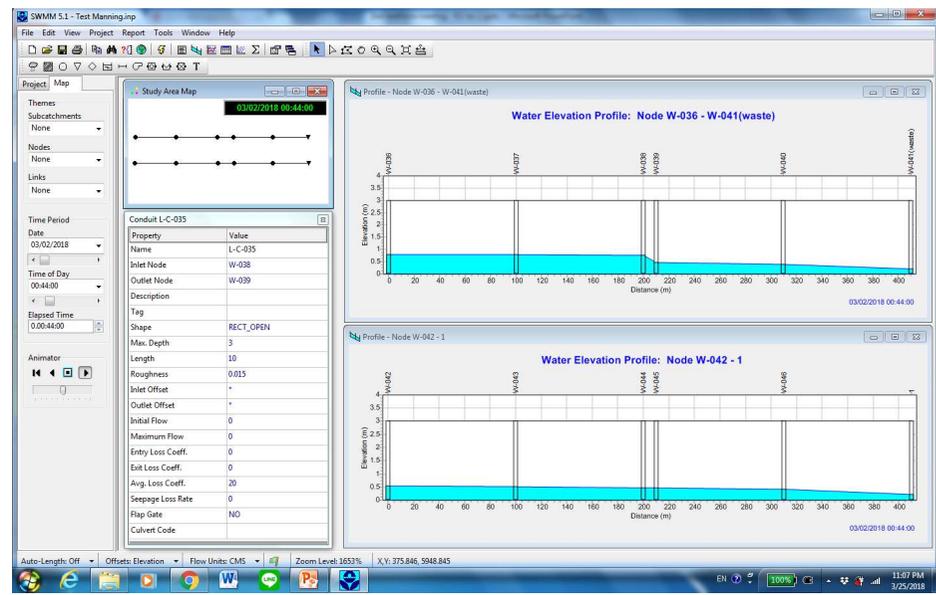
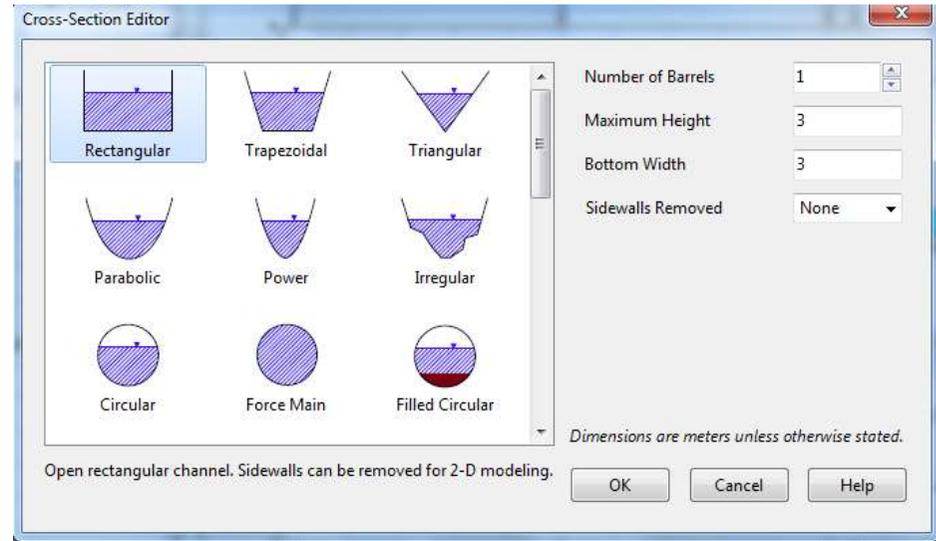
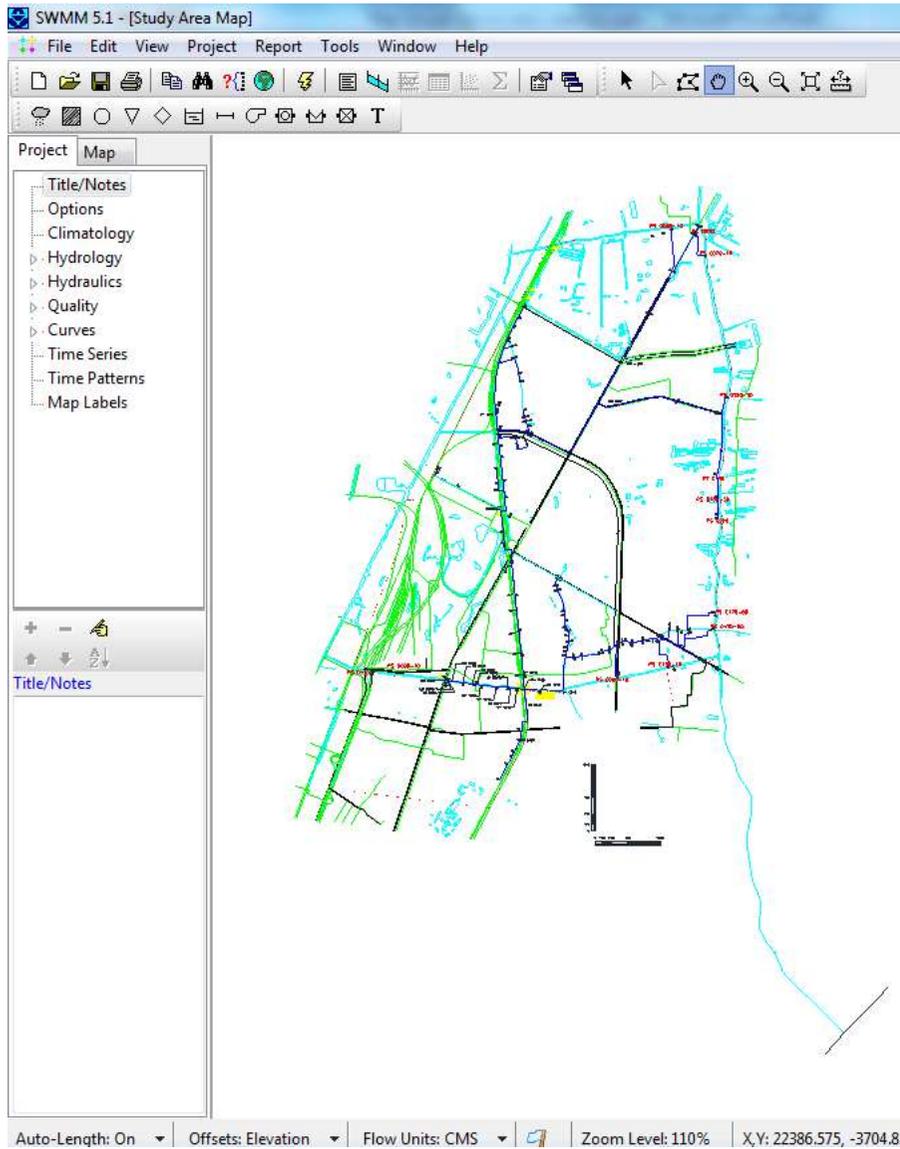


# Measuring Station



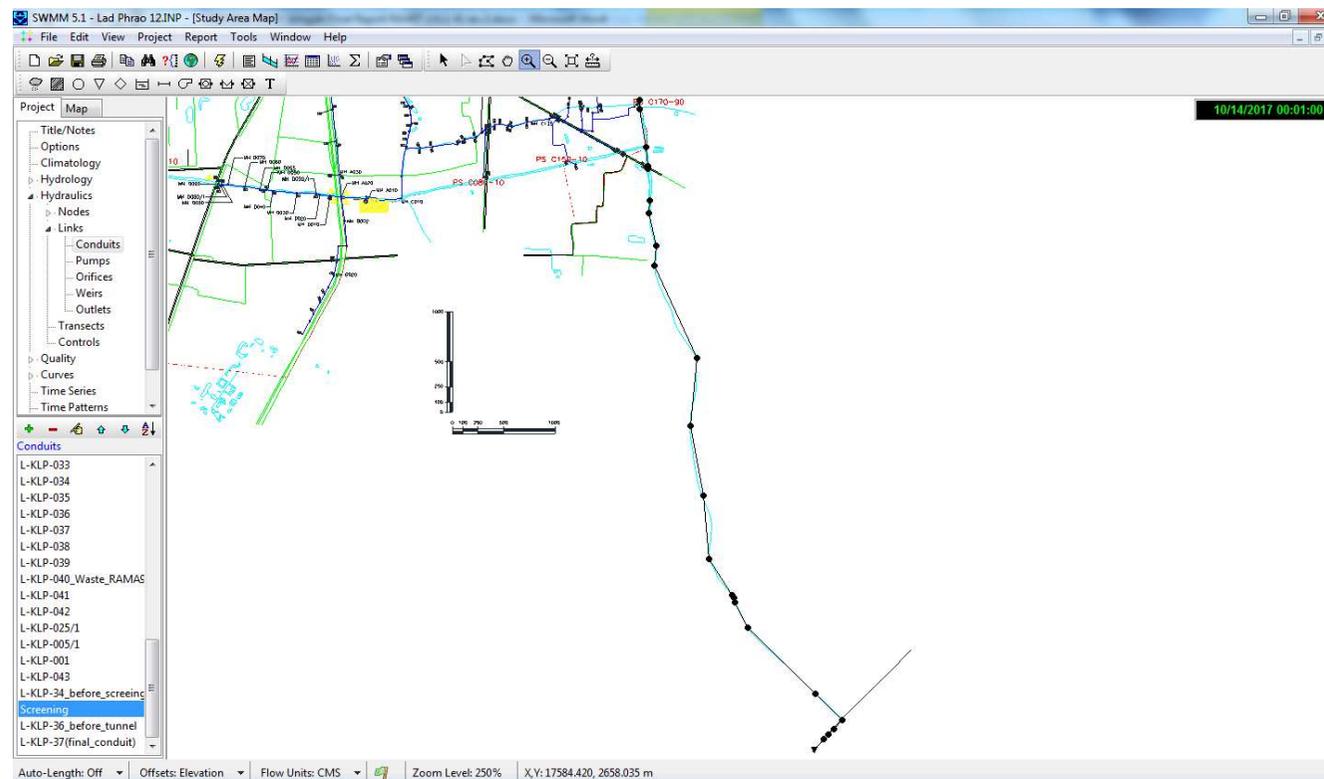


# Model by SWMM (Storm Water Management Model)



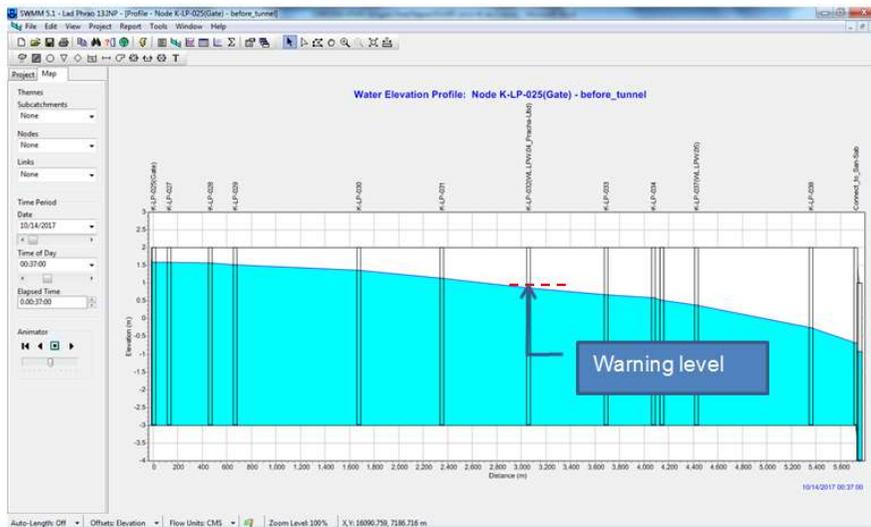
## Drainage model at Lad Prao canal

- SWMM model was applied to simulate the drainage condition in Lad Prao canal.
- The model starting at a drainage control gate upstream to San-Sab tunnel with total distance of 6.1 km.
- A rainfall event with 60 mm/h intensity of 1 hour duration was simulated under blockage condition of 0% (no blockage) and 50%.



## Model with Lad Prao canal

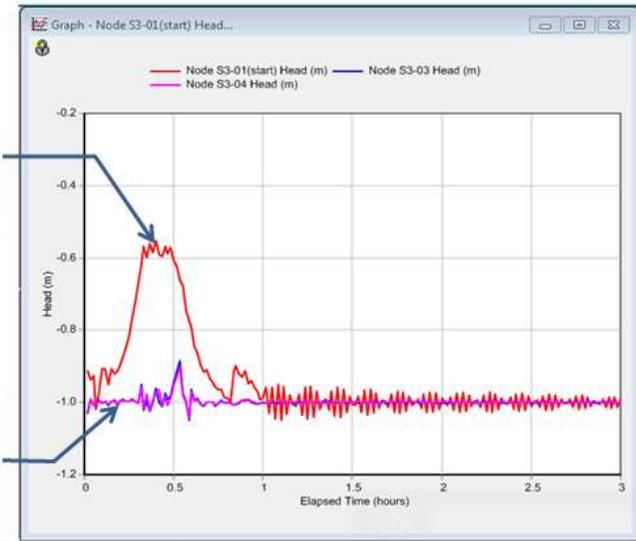
- The determination of water elevation shows that 50% blockage at the trash rack of San-Sab canal cause the water rising to the warning level at PraCha-Utid level station.
- The blockage does not affect the drainage capacity directly but the rising of water level cause temporary flooding.



No blockage

Water elevation at start node (red line)

Water elevation at the entrance trash rack (blue line) and the exit of trash rack (pink line)

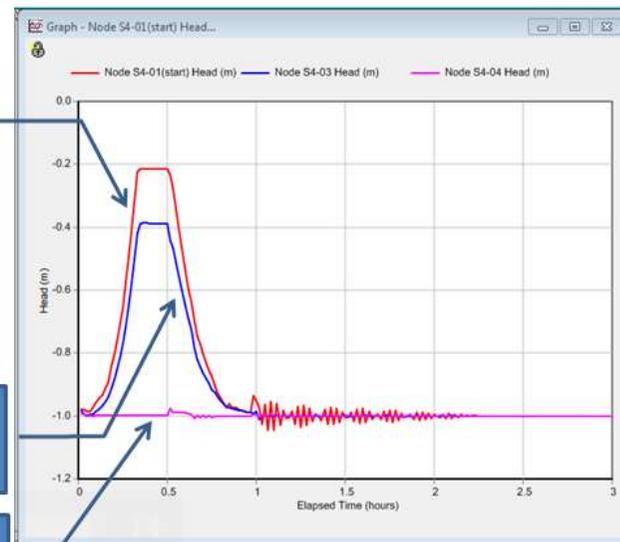


50% blockage

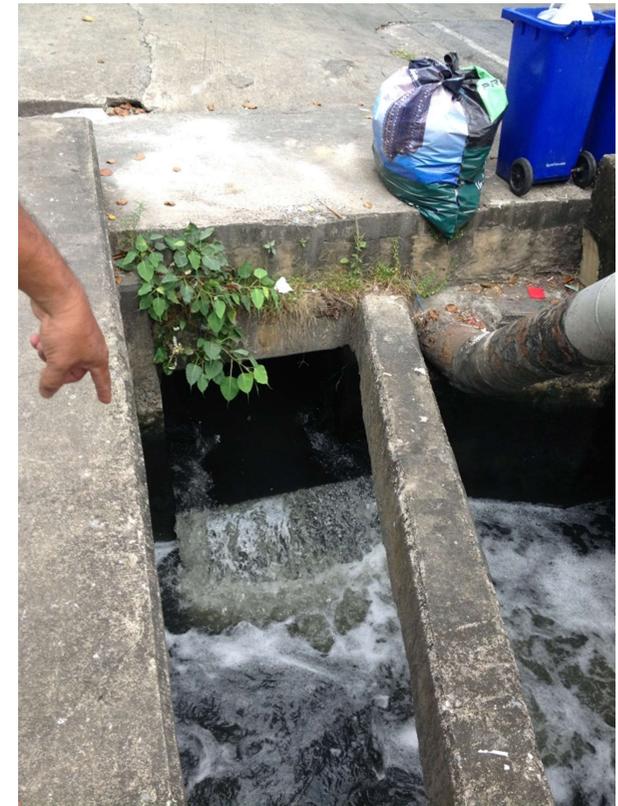
Water elevation at start node (red line)

Water elevation at the entrance trash rack (blue line)

Water elevation at the exit of trash rack (pink line)



## Evidence of back flow of canal water into combined sewer



## Conclusion

- Significant amount of human and natural wastes was collected from major canals in Bangkok
- The waste composition varied among canal location with different human activities along side them. Wood components (timber & trim) have largest weight fraction among the collected wastes but plastic materials and foam were found in largest volume.
- The effect of waste blockage on reduction of drainage capacity in combined sewer was confirmed through simulation of the drainage system.
- The waste blockage at 50% of flow area cause temporary flooding and intrusion of canal water into the sewerage system by rising the water level upstream of the blocking location above the storm water outfall of the sewage treatment plant.

## Acknowledgement

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Kind support and cooperation from **Department of Drainage and Sewerage, Bangkok Metropolitan Administration** is highly appreciated.



**THANK YOU**  
**for your attention**

