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Urban Runoff Characteristics in Tehran, Iran

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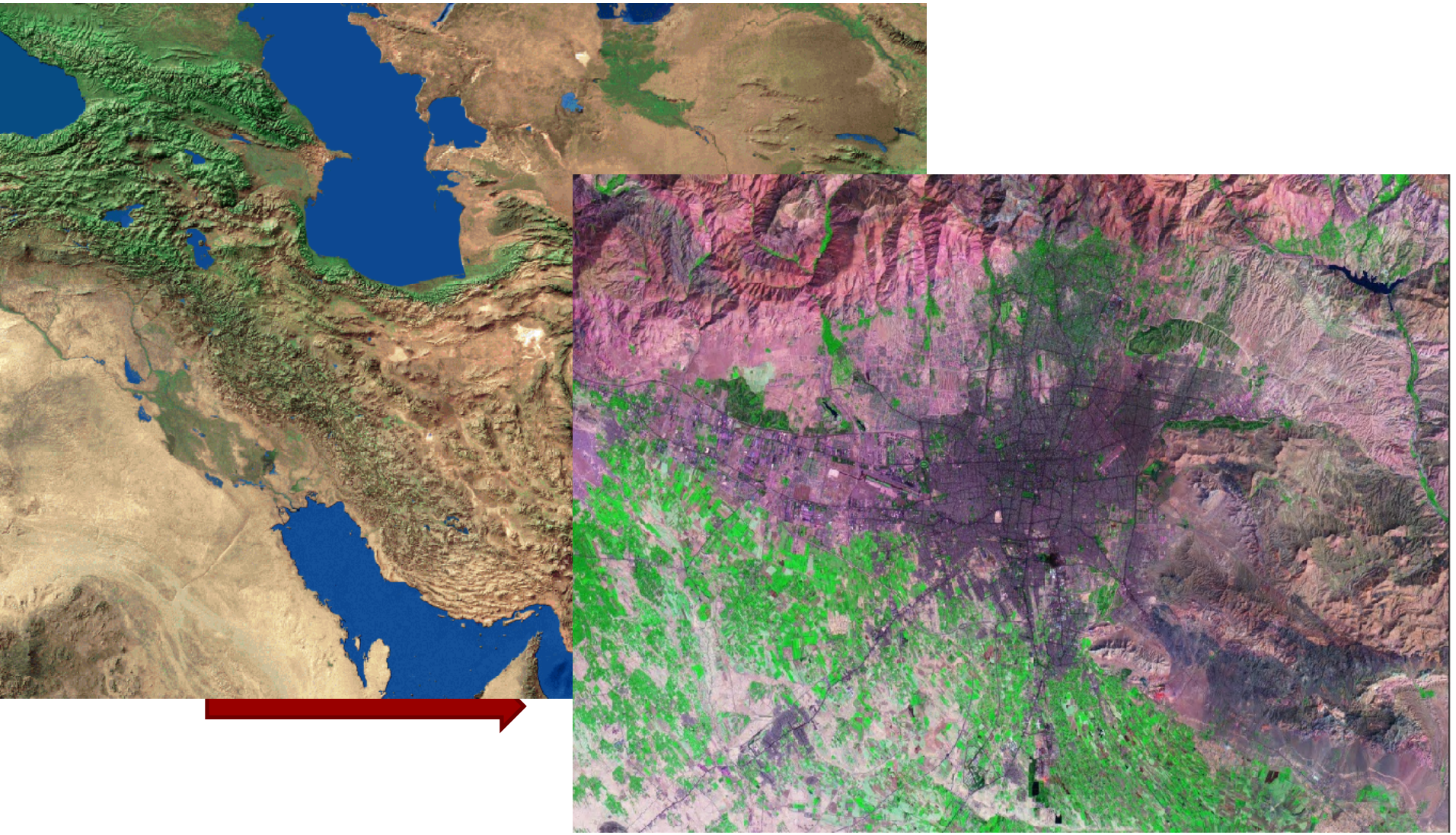
Outline

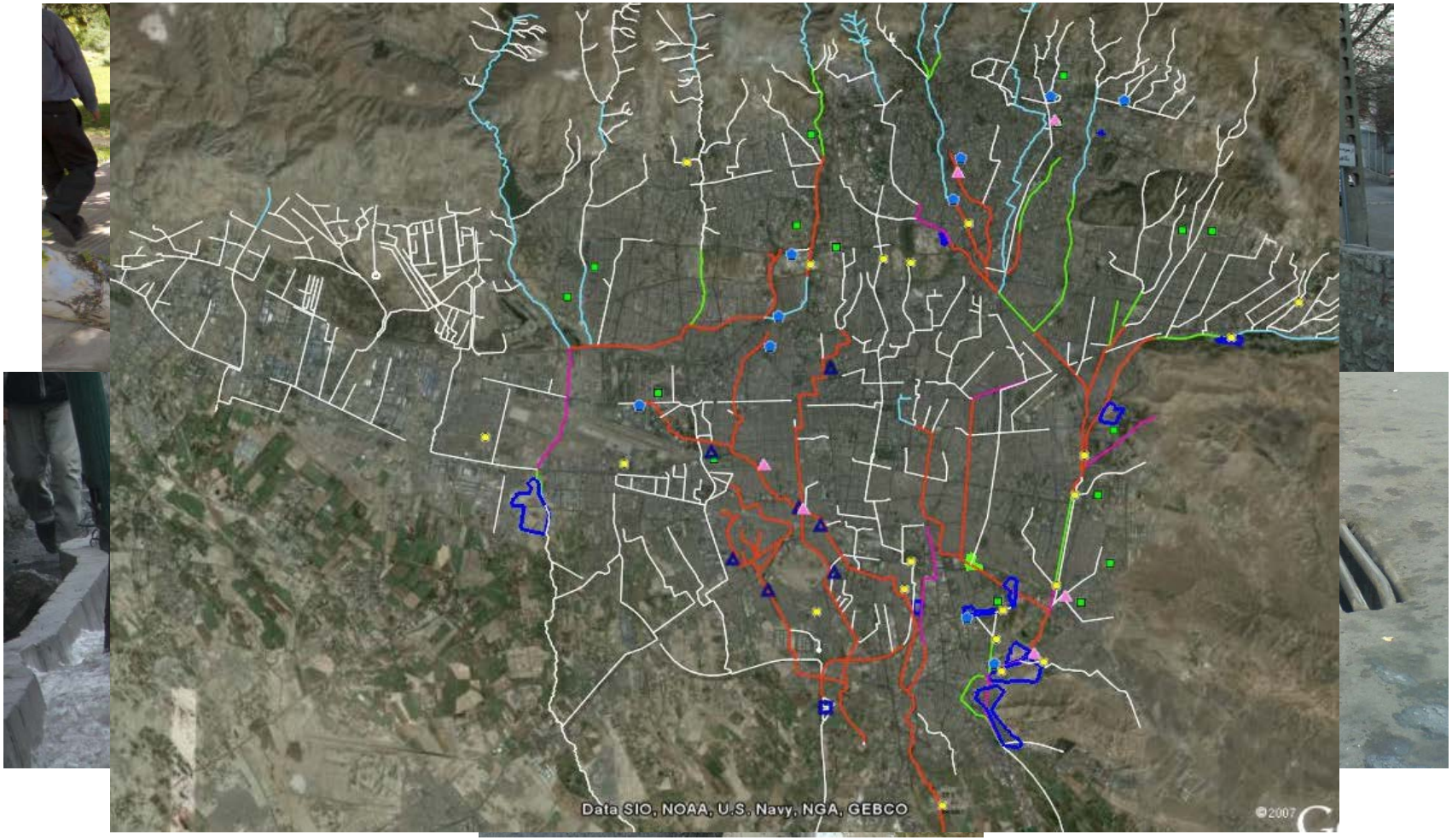
- Background
- Methodology
- Results
- Conclusion

Background



Stormwater Collection in Tehran

- Various methods of stormwater collection



Major urban cities monitoring data

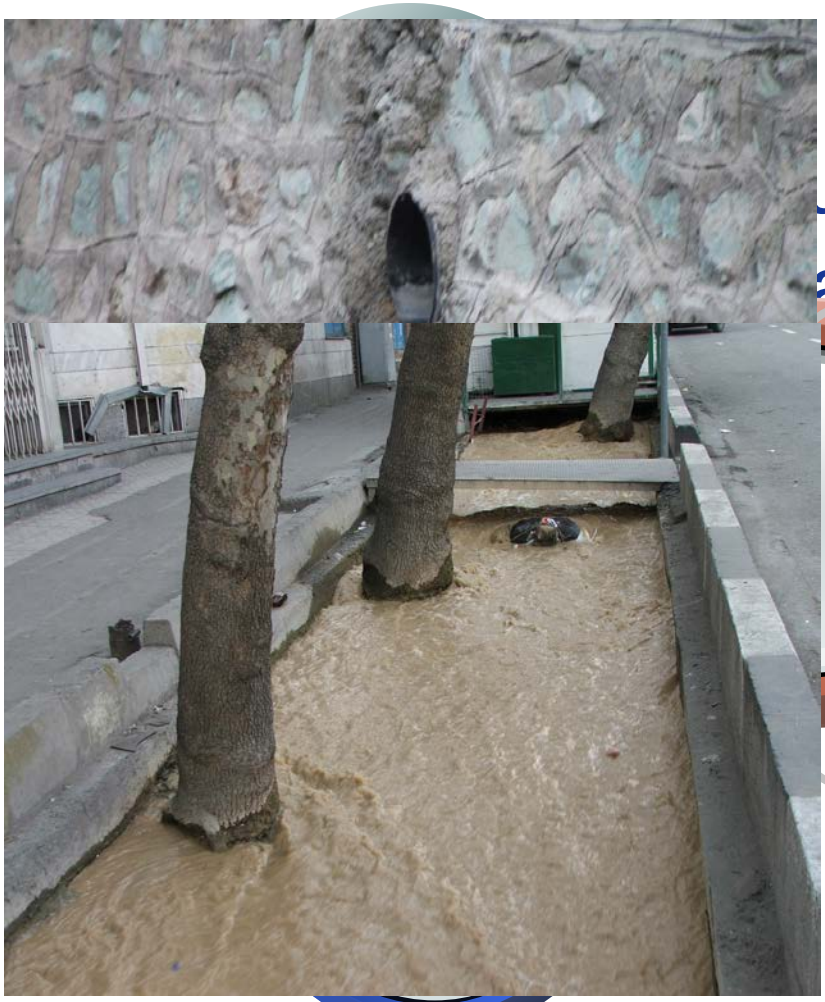
Monitoring data limitation in Tehran

City	Year	AAR (mm)	Land use	TSS (mg/L)	TP (mg/L)	TN (mg/L)
Moderate climate						
Austin	1993-95	825	Highway	19-129	0.1-0.33	0.37-1.07**
Minneapolis	1981-88	719	Highway	118	0.56	2.39
Los Angeles	1999-2002	510	Freeway	68	0.9	1.7*
Arid/semiarid climate						
Riyadh	1984-92	95	Parking lot/ Street	276-1458	0.33-0.37	4.12-4.38*
Tehran	2001	240-500	Highway	820-1179	-	-
Esfahan	1999-2001	118	Residential/ Commercial	230-3177	0.27	1.2-22.4
Calgary	2006-07	320	Residential	20-342	-	-

* TKN, ** $N\text{-}NO_3$

Previous urban pollution study in Tehran

- Studies by Khakriz Ab Co. (1997)



urban runoff management

and Poiry (2010)

uality of urban streams

ity of stormwater

Declinality in Quality

BMP techniques

Illicit discharge to urban streams

urban stormwater runoff

Methodology: Pollution Sources

- Runoff and stream sample collection from each source

Urban Stream

Galvanized roof

Storm channel

Asphalt street

Rusted roof

Methodology: Sampling and Chemical Analysis

- Up to 10 samples collected (depending on rain duration)
- Each 500 mL subsample was analyzed for TSS, TP, PO_4^-, NH_4-N, NO_3-N, Zn, Cu, Pb.
- Volume/flow -based techniques were used for flow measurement.
-

Results: Particulate Pollutants

- EMC- particulate pollutants

Impervious surface	Date	Q_{avg} (L/s)	TSS (mg/L)	TP (mg/L)
Urban stream (A1)	3 Nov 2009	306.7	-	4.96
Rusted roof (B3)	26 Feb 2010	0.2	80	-
Galvanized roof (C3)	26 Feb 2010	0.1	109	0.20
Asphalt street (D1)	26 Feb 2010	0.6	182	1.23
Asphalt street (D2)	8 Apr 2010	0.5	392	1.85
Mosaic roof (E1)	24 Apr 2010	0.04	449	1.74
Urban stream (A2)	2 May 2010	168.5	398	5.02
Storm channel (F1)	13 Dec 2010	2.8	1720	5.38
Mean		**76**	**593**	**4.6**
Median		**0.34**	**392**	**2.4**

Results: Dissolved Pollutants

- EMC- dissolved pollutants

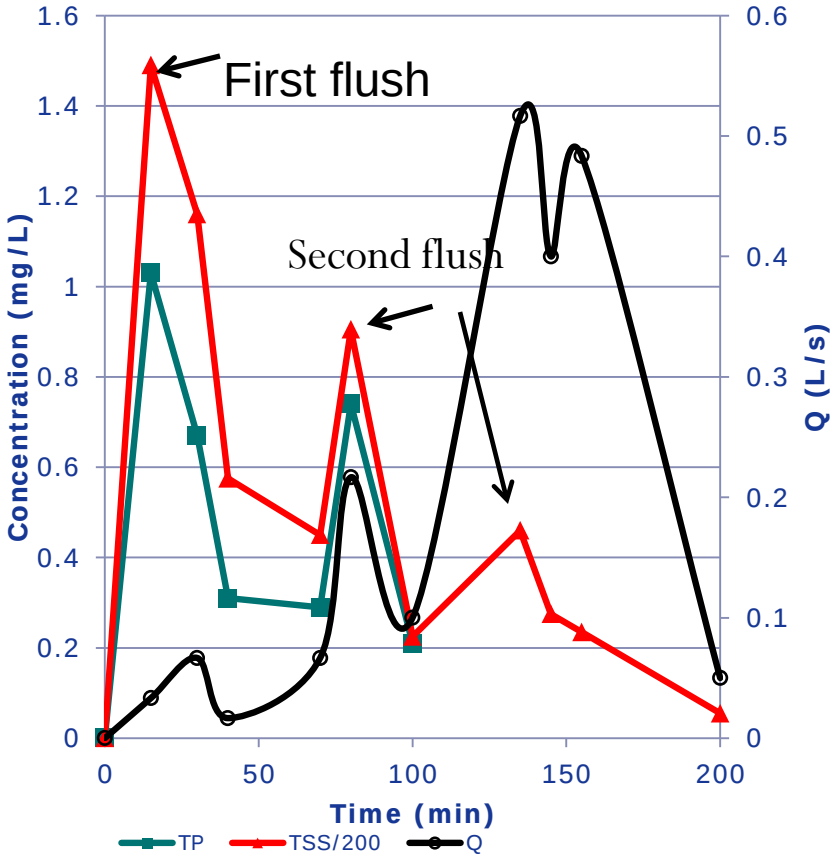
Impervious surface	Date	PO_4 (mg/L)	NO_3-N (mg/L)	NH_4-N (mg/L)	Zn (µg/L)	Cu (µg/L)	Pb (µg/L)
Urban stream (A1)	3 Nov 2009	2.30	4.89	4.25	-	-	-
Rusted roof (B3)	26 Feb 2010	0.11	0.57	0.77	765	-	-
Galvanize roof (C3)	26 Feb 2010	0.11	0.45	0.56	431	5	5
Asphalt street (D1)	26 Feb 2010	0.10	1.47	0.88	-	6	6
Asphalt street (D2)	8 Apr 2010	0.06	2.71	1.28	837	14	71
Mosaic roof (E1)	24 Apr 2010	0.18	2.05	0.77	-	-	-
Urban stream (A2)	2 May 2010	1.15	1.49	3.44	41	22	5
Storm channel (F1)	13 Dec 2010	0.36	19.89	2.50	60	28	-
Mean		**0.69**	**3.19**	**2.23**	**600**	**11**	**43**
Median		**0.14**	**1.49**	**1.28**	**431**	**6**	**7**

Results: Event Mean Concentration

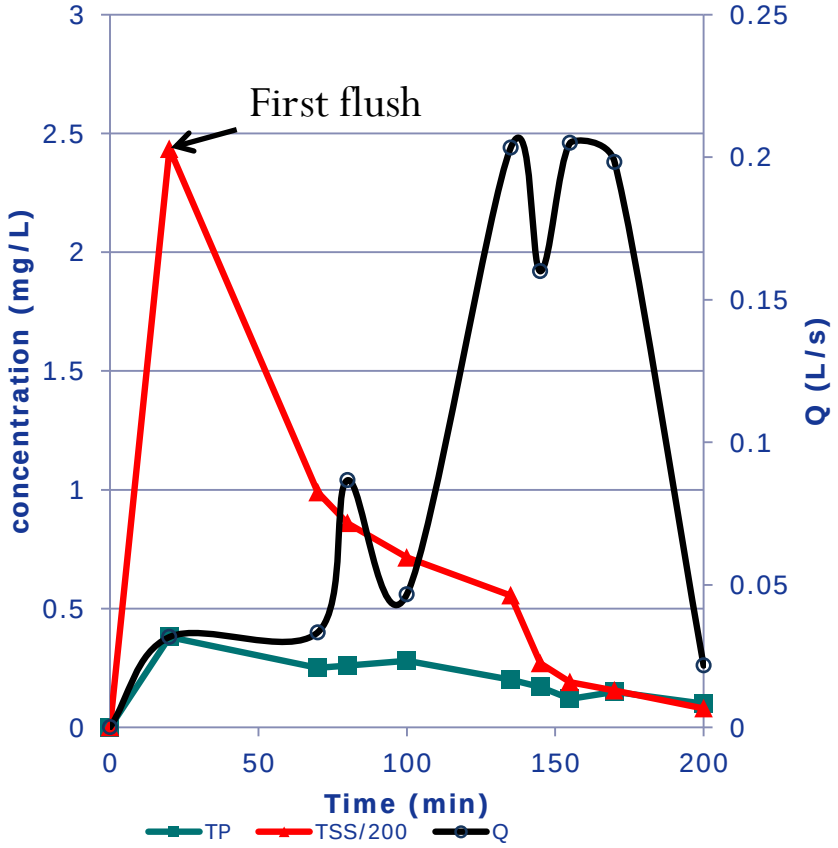
- Event Mean Concentration (EMC)
  - Average TSS EMC is 15 times of allowable limit (40 mg/L) in Iran.
  - Average TP EMC is very close to allowable limit (5 mg/L) in Iran.
  - The average NO_3-N plus NH_4-N EMCs is almost half of NO_3-N discharge limit to drinking waters (10 mg/L).
  - Heavy metals, especially Pb and Zn, must be considered.

Results: Concentration First Flush (CFF) Effect

Particulate pollutants, rusted roof

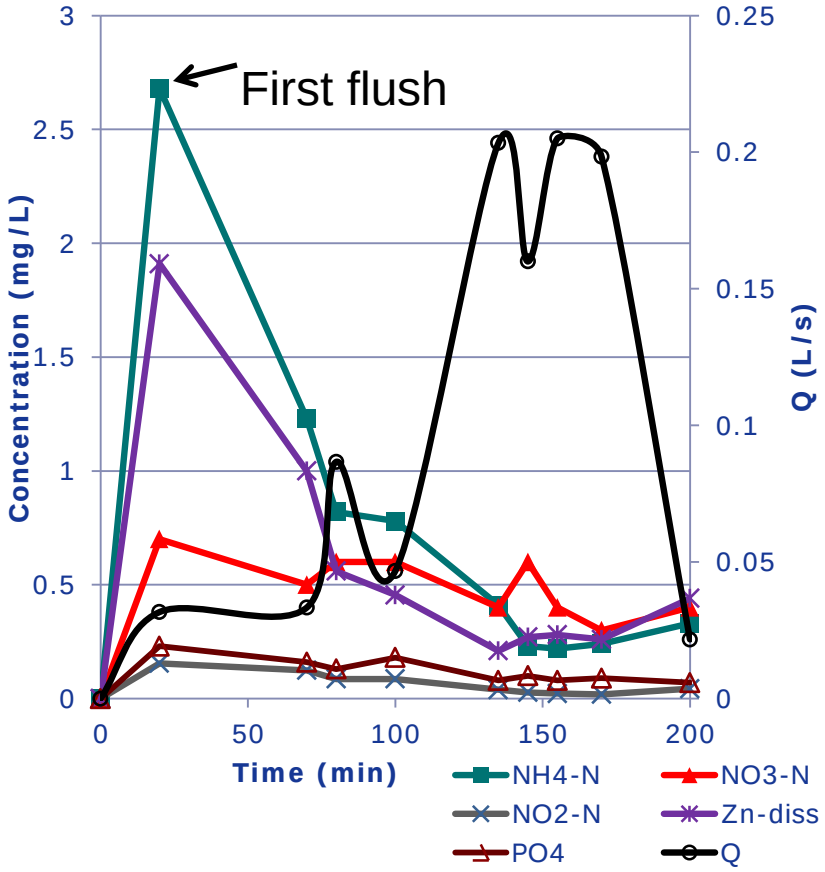


Particulate pollutants, galvanized roof

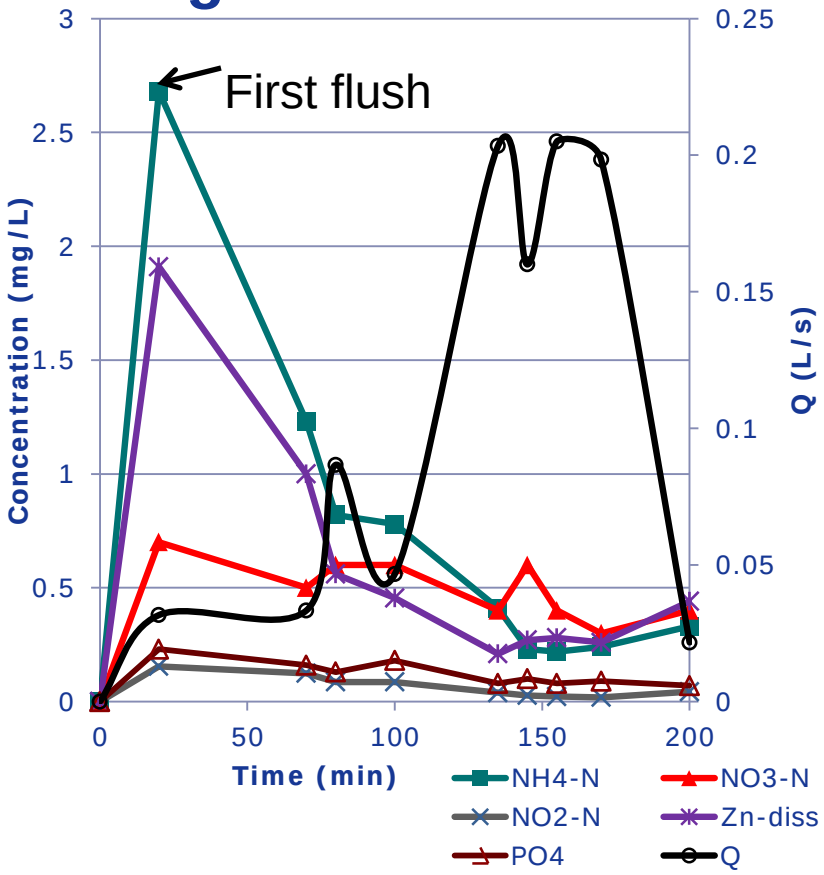


CFF Effect (continue)

Dissolved pollutants, rusted roof

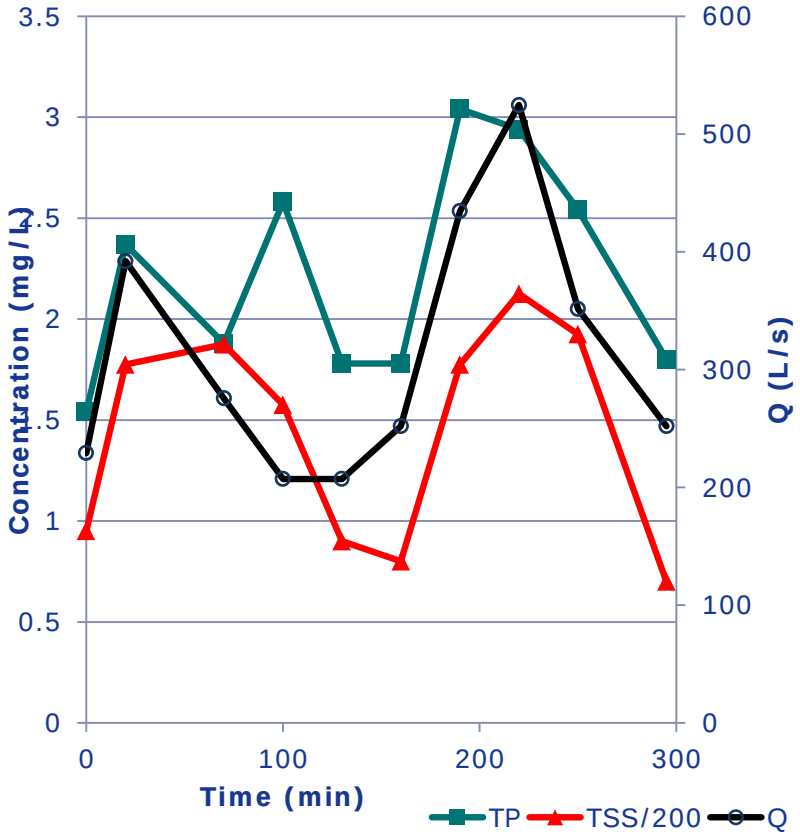


Dissolved pollutants, galvanized roof

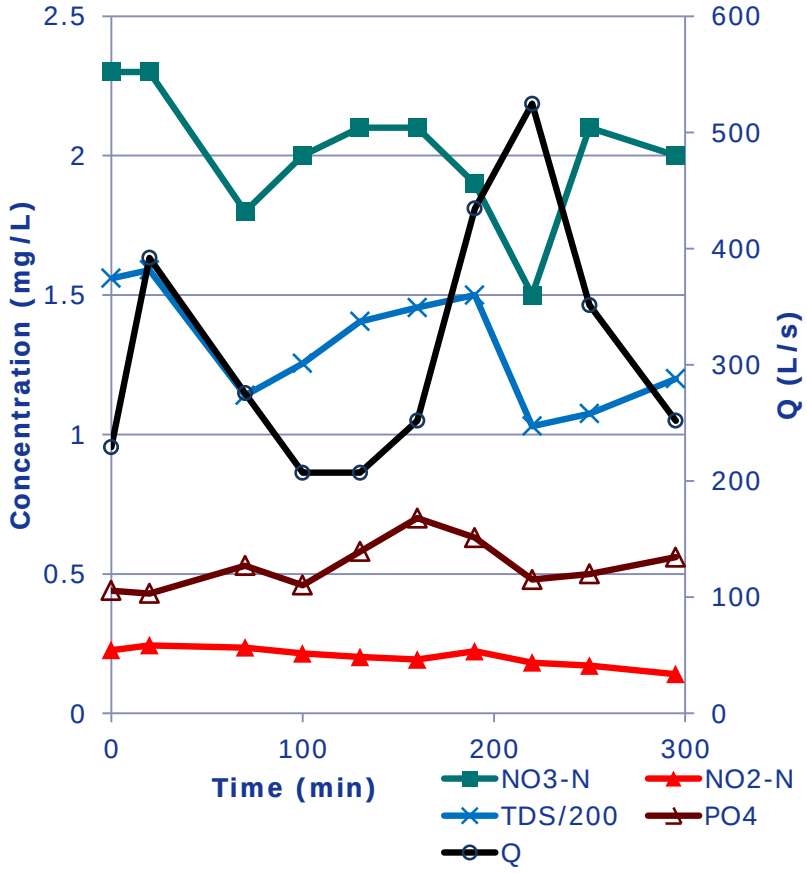


CFF Effect (continue)

Particulate pollutants, urban stream

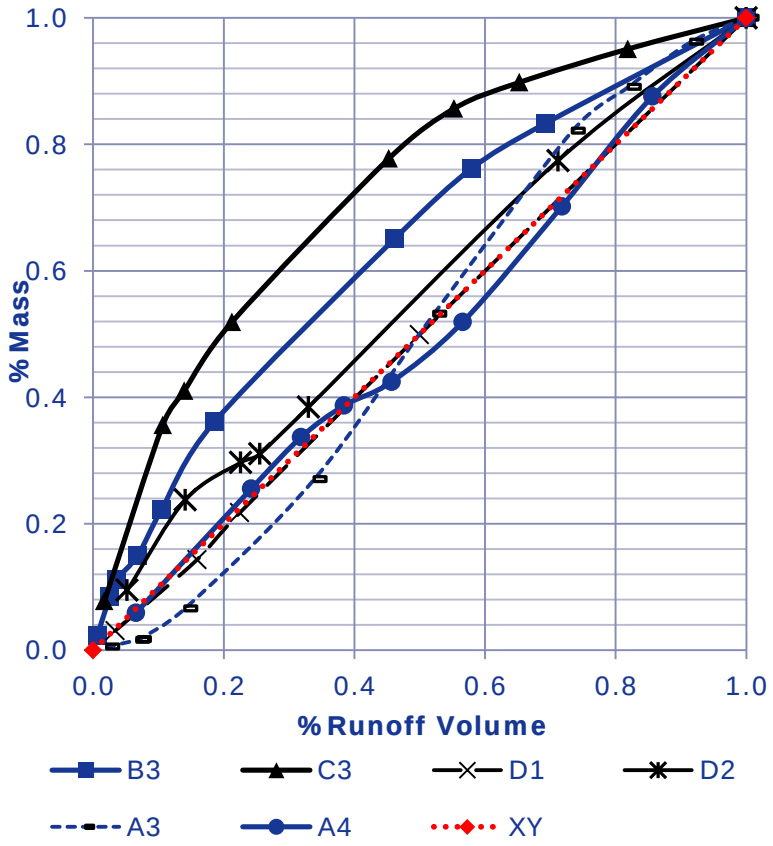


Dissolved pollutants, urban stream

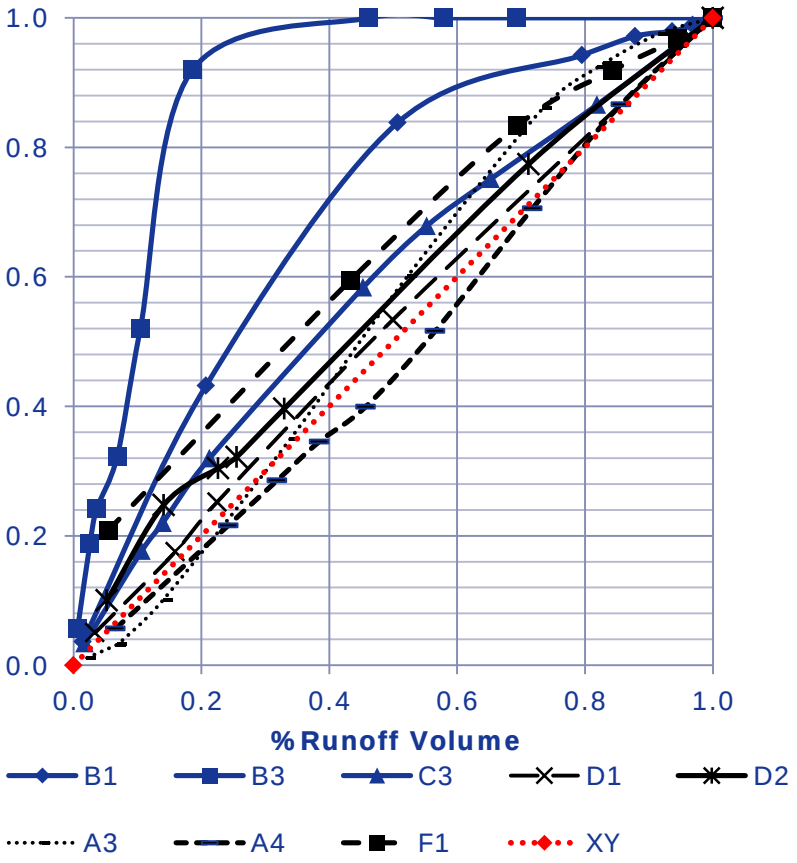


Results: Mass First Flush (MFF) Effect

MFF for TSS

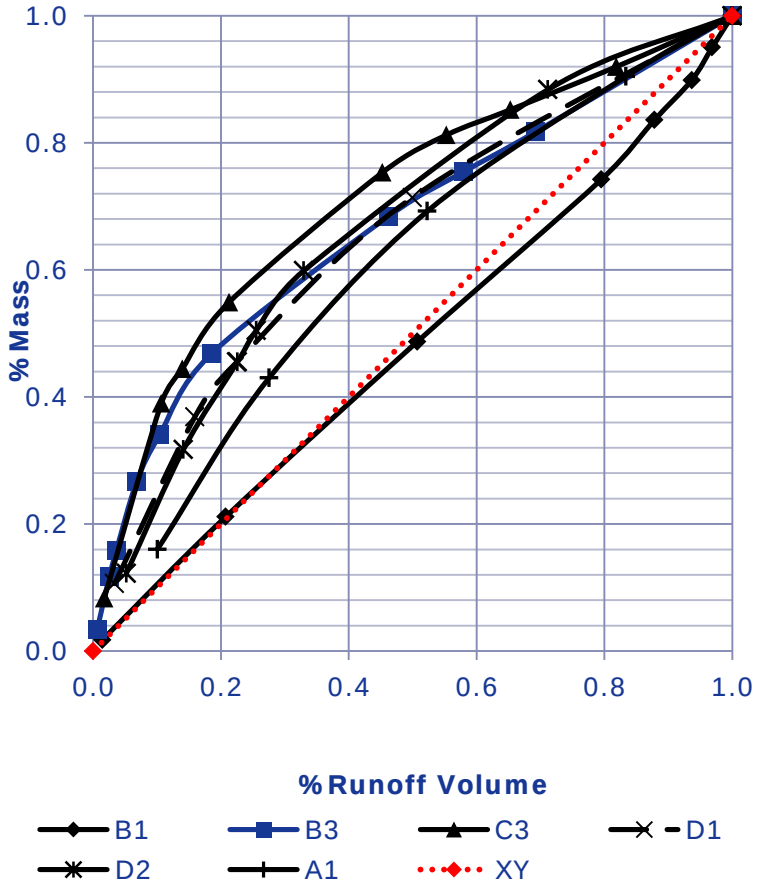


MFF for TP

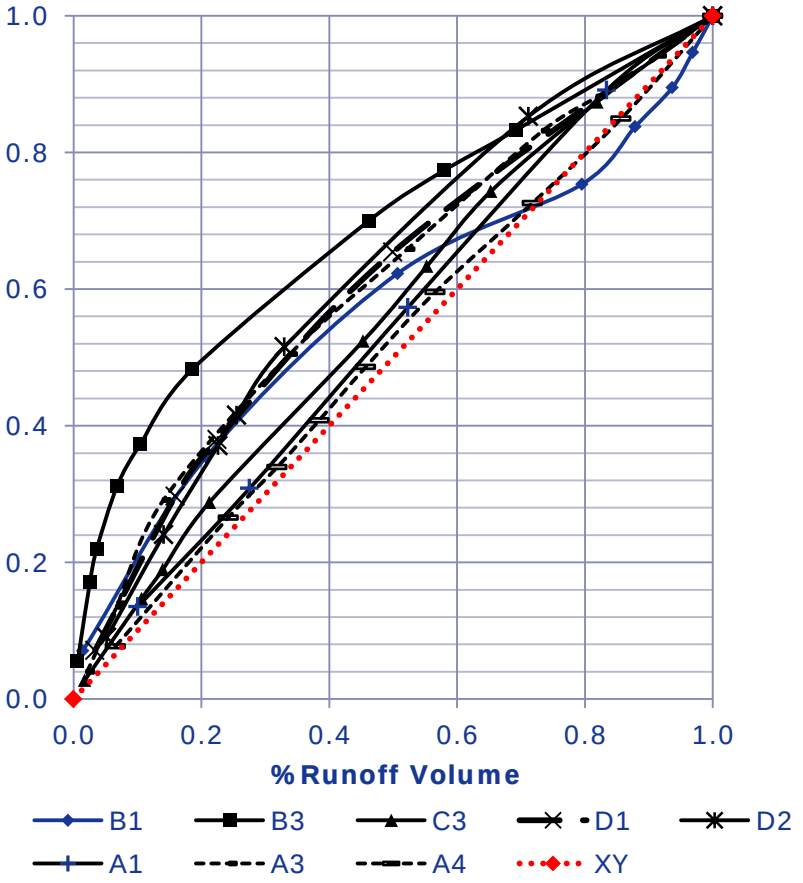


MFF Effect (Continue)

MFF for NH_4-N



MFF for NO_3-N



Conclusion

- On average the EMC of TSS, TP and most heavy metals exceed standard discharge limit to receiving waters in Iran.
- Concentration first flush was observed in dissolved and particulate pollutants. Second flush can be observed depending on presence and availability of TSS.
- Stronger and more frequent mass first flush was observed for dissolved pollutants from small impervious areas.

Conclusion (continued)

- In streams, first flush is lagging behind because of higher time of concentration.
- The findings of our study stressed that source control should be viewed as a viable option of pollutions management discharged into urban runoff and streams.
- The information gathered as part of this study could be used as a basis for future monitoring and stormwater management program in Tehran.

Thank for your attention!

Presenter: Somayeh Ghazvinizadeh