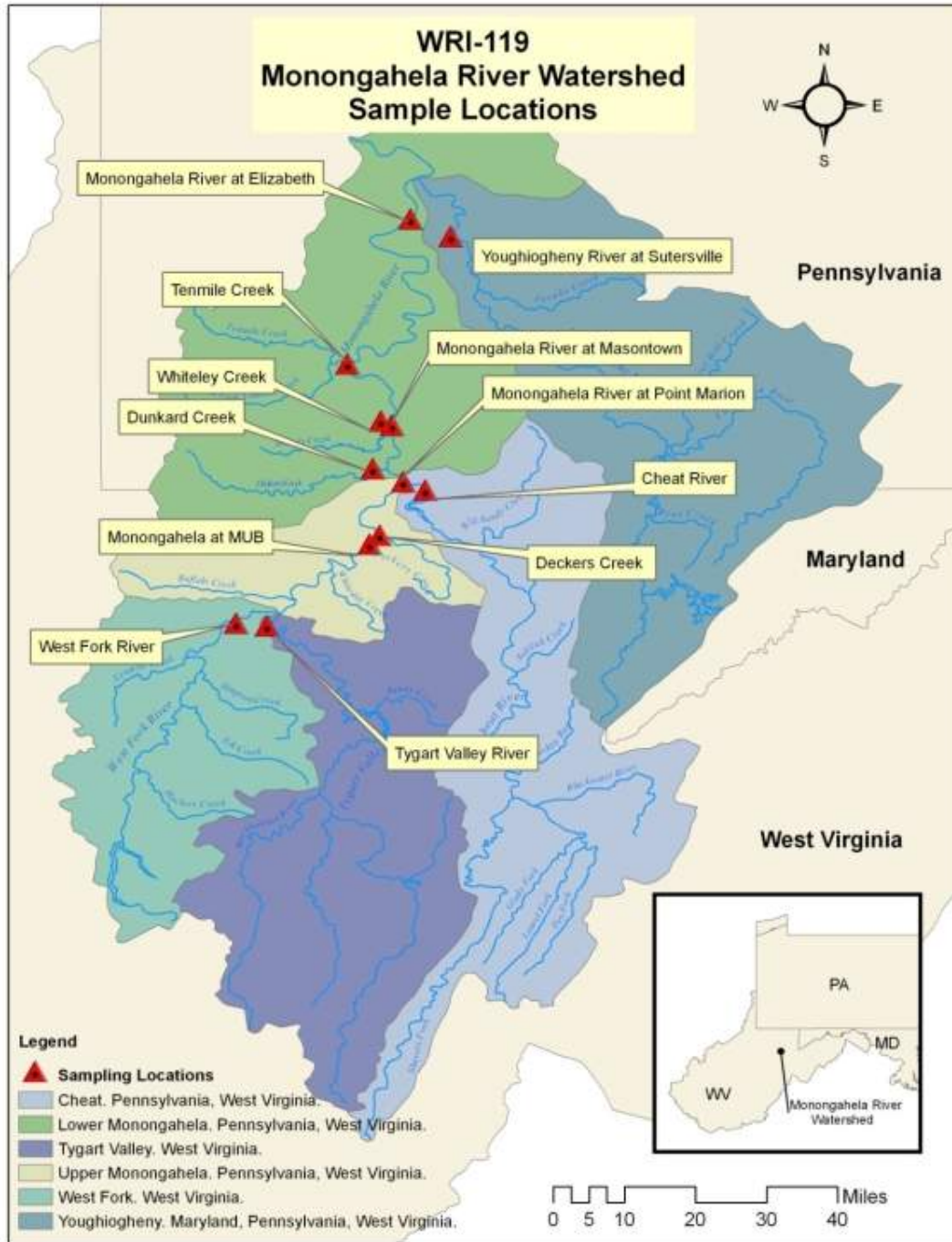
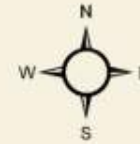


Upper Monongahela River Water Quality Project
Project WRI 119

July to September 09 Results

Paul Ziemkiewicz

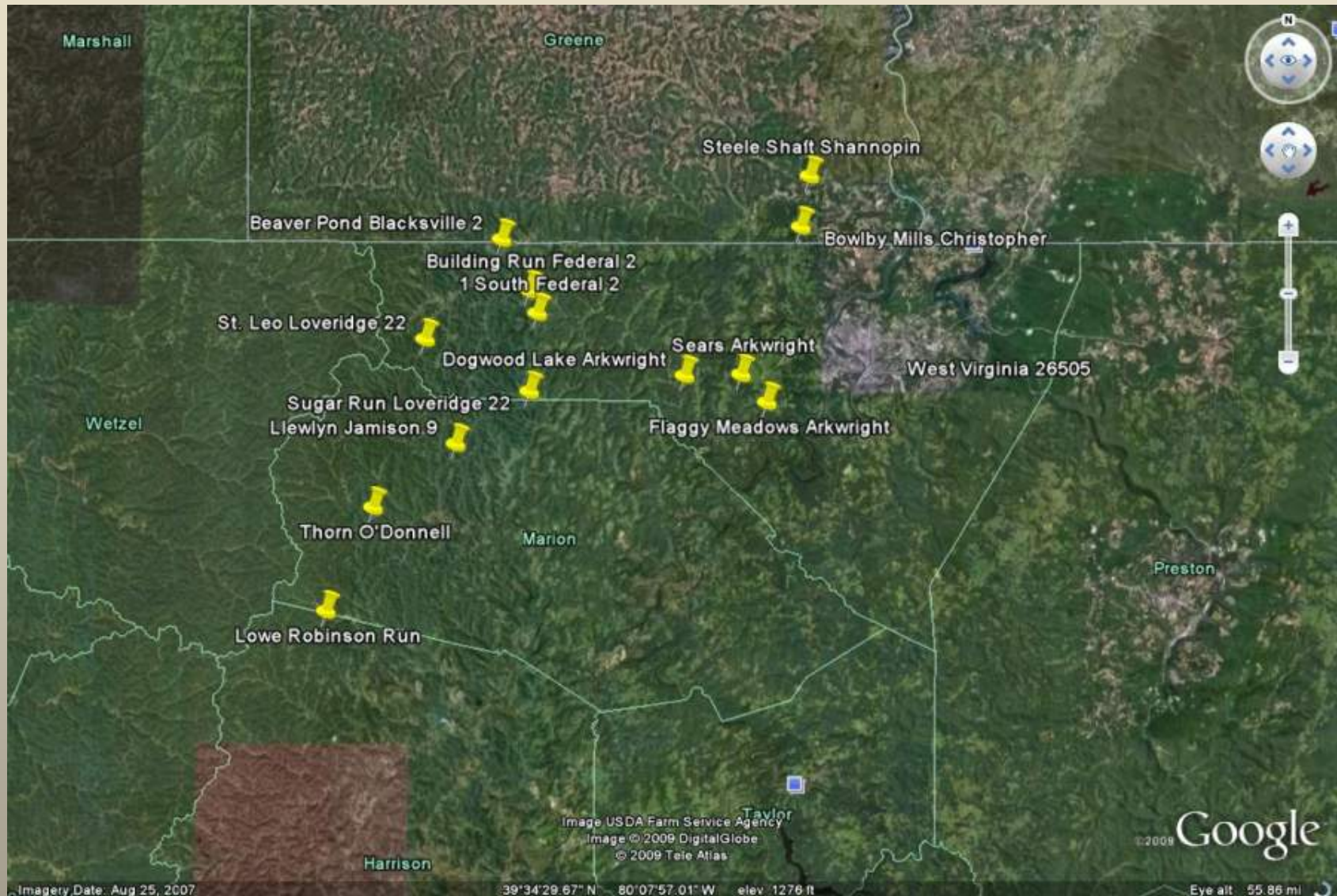
WRI-119 Monongahela River Watershed Sample Locations



Legend

- ▲ Sampling Locations
- Cheat. Pennsylvania, West Virginia.
- Lower Monongahela. Pennsylvania, West Virginia.
- Tygart Valley. West Virginia.
- Upper Monongahela. Pennsylvania, West Virginia.
- West Fork. West Virginia.
- Youghiogheny. Maryland, Pennsylvania, West Virginia.

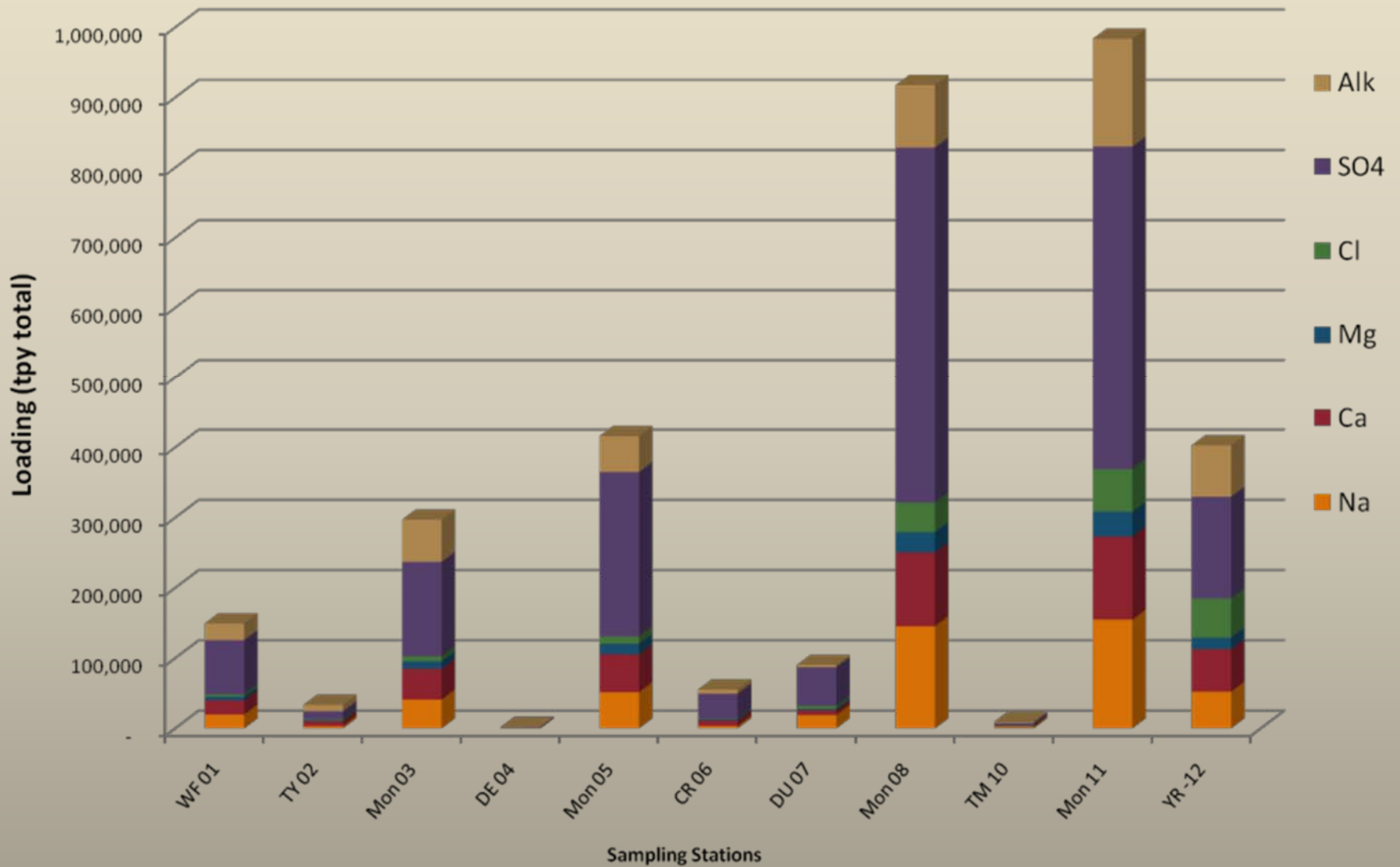
Major AMD treatment Plants



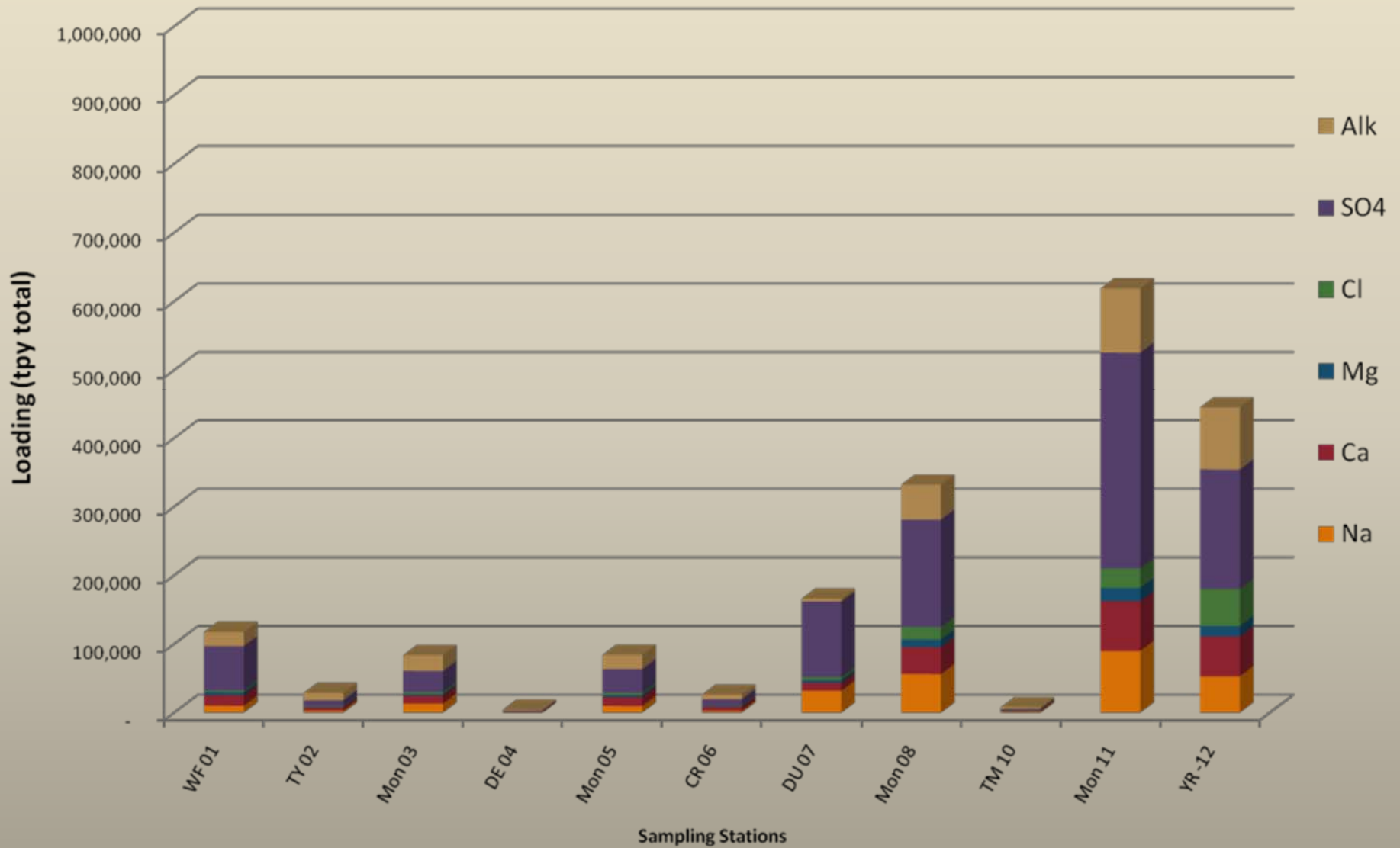
Sampling Sites:

- WF 01 West Fork River DS Worthington, WV
- TY 02 Tygart Valley River, Coalfax, WV
- Mon 03 Monongahela River at MUB
- DE 04 Deckers Creek in Morgantown
- Mon 05 Monongahela River at Point Marion, PA
- CR 06 Cheat River at tailrace of dam
- DU 07 Dunkard Creek Shannopin Gage
- Mon 08 Monongahela River at Masontown
- WH 09 Whiteley Creek
- TM 10 Tenmile Creek near Route 88
- Mon 11 Monongahela River, Elizabeth PA
- YR 12 Youghiogheny River near Sutersville, PA

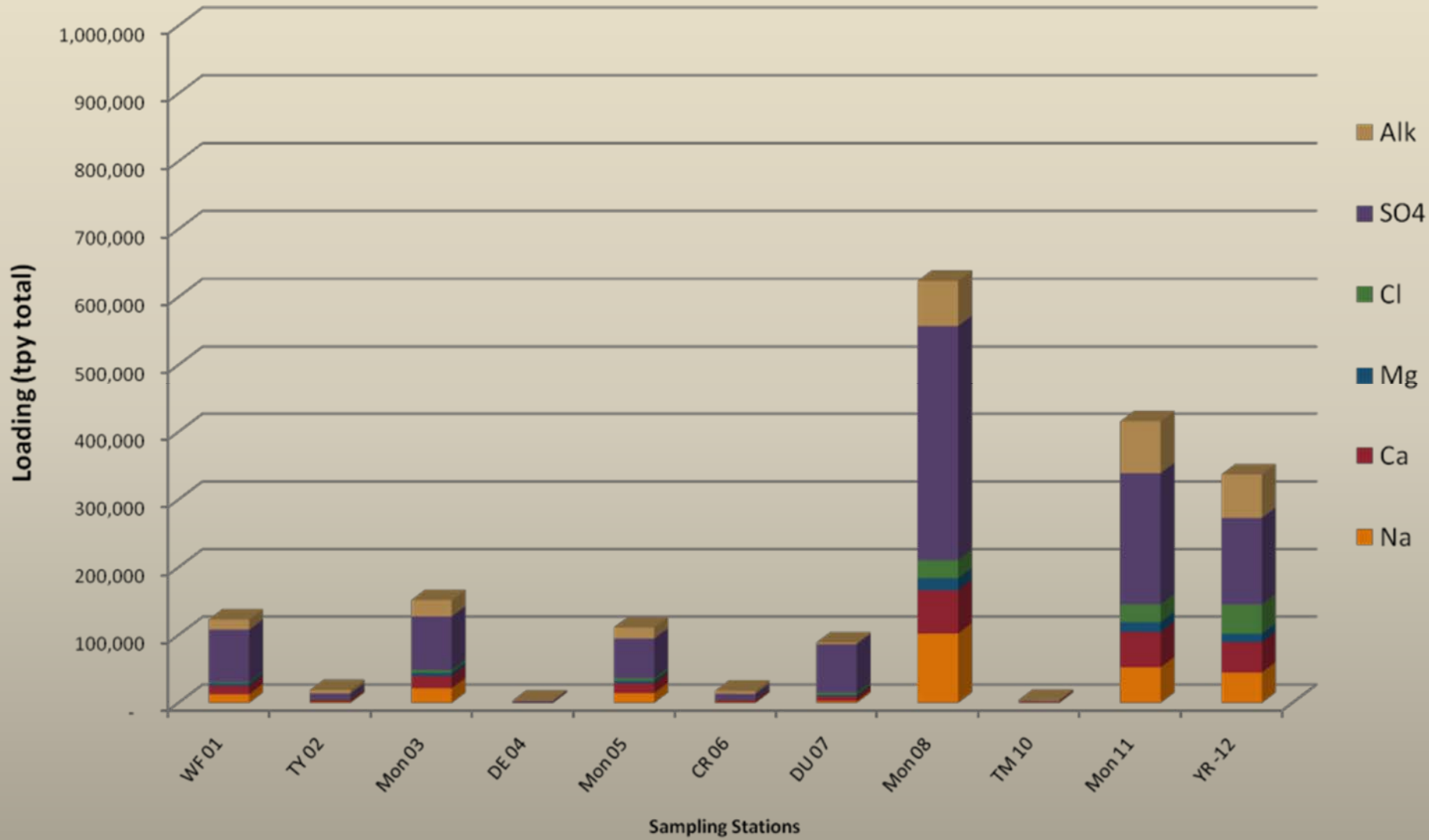
Monongahela River TDS Loading 28 July 2009



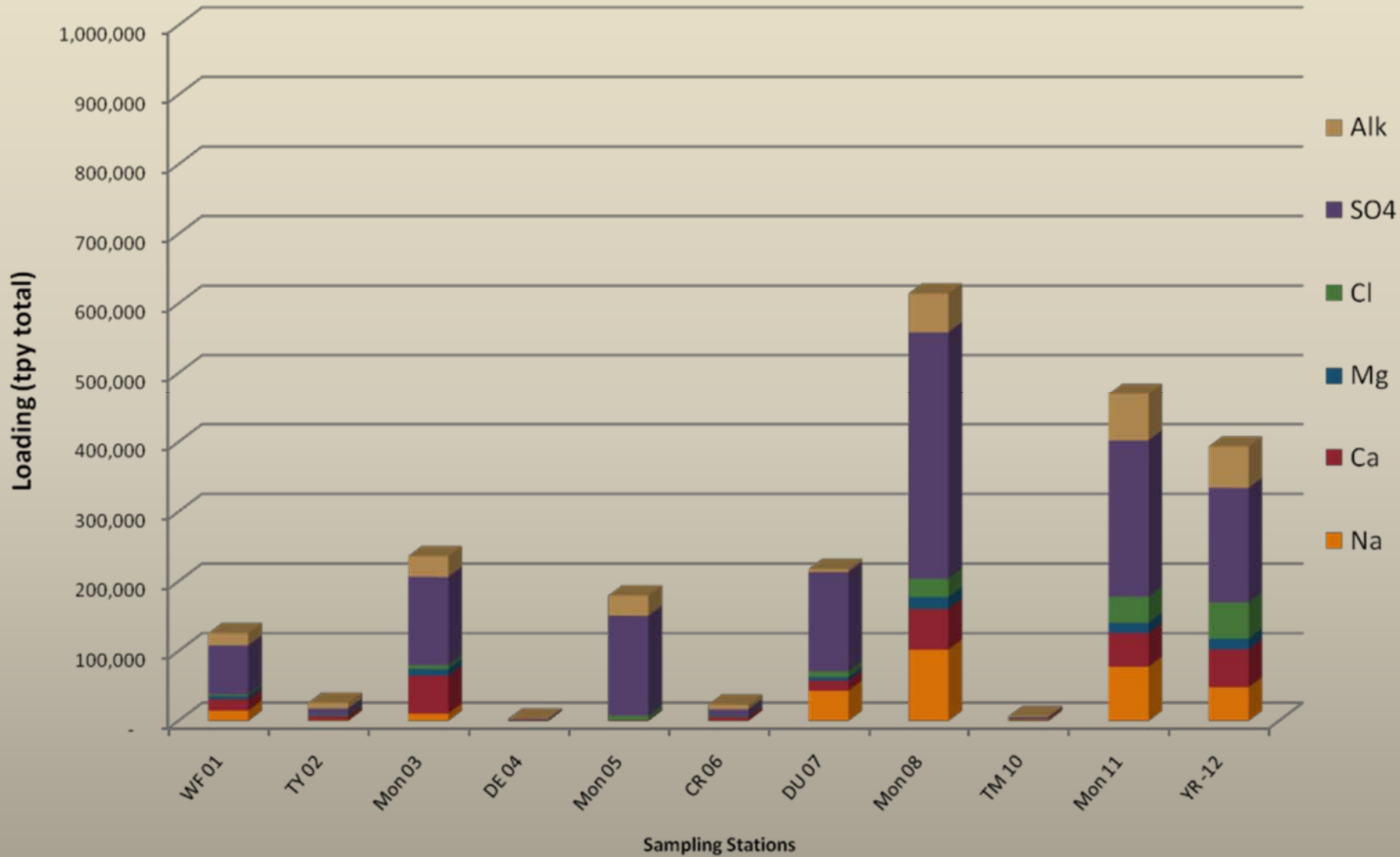
Monongahela River TDS Loading 11 August 2009



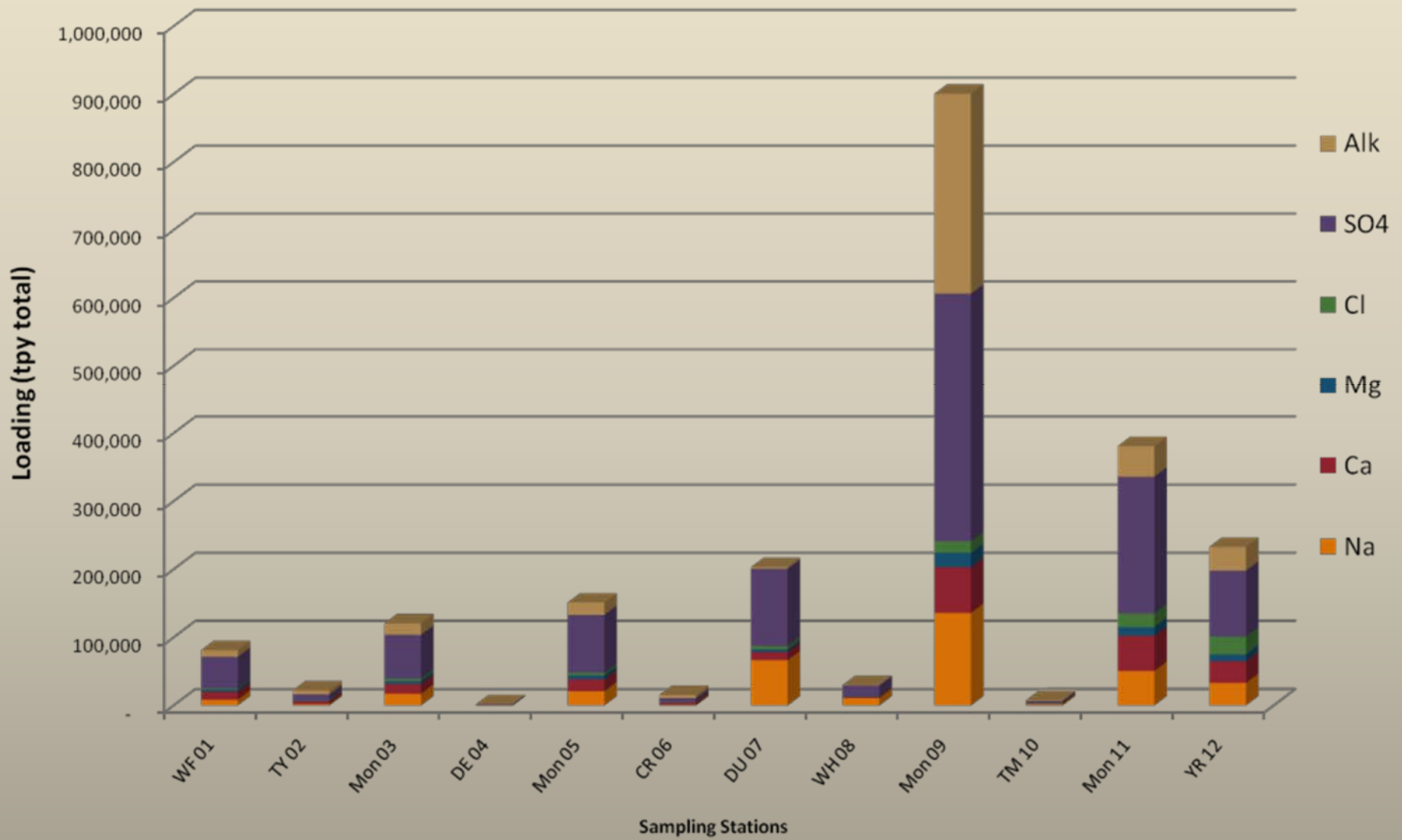
Monongahela River TDS Loading 25 August 2009



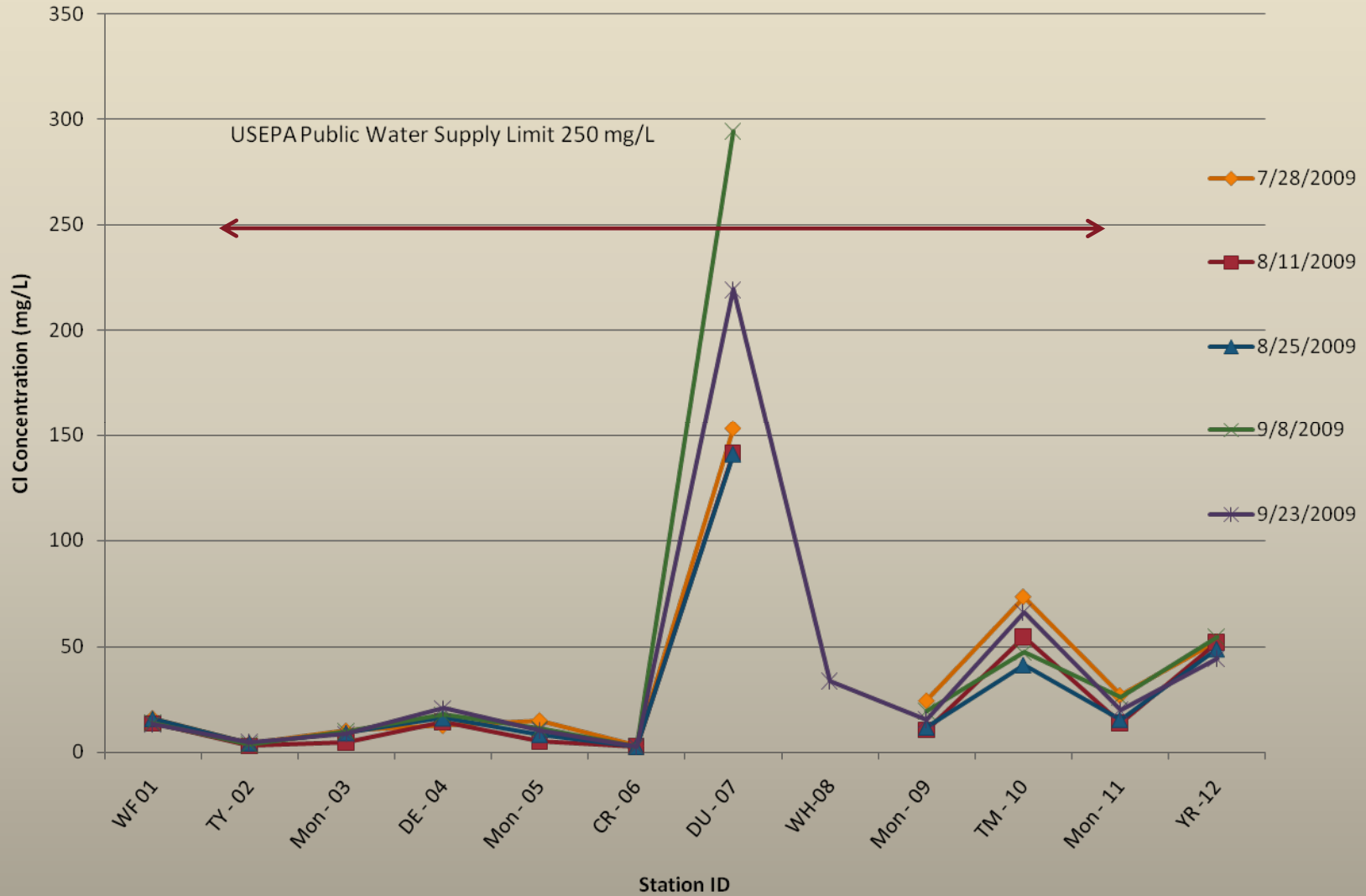
Monongahela River TDS Loading 8 September 2009



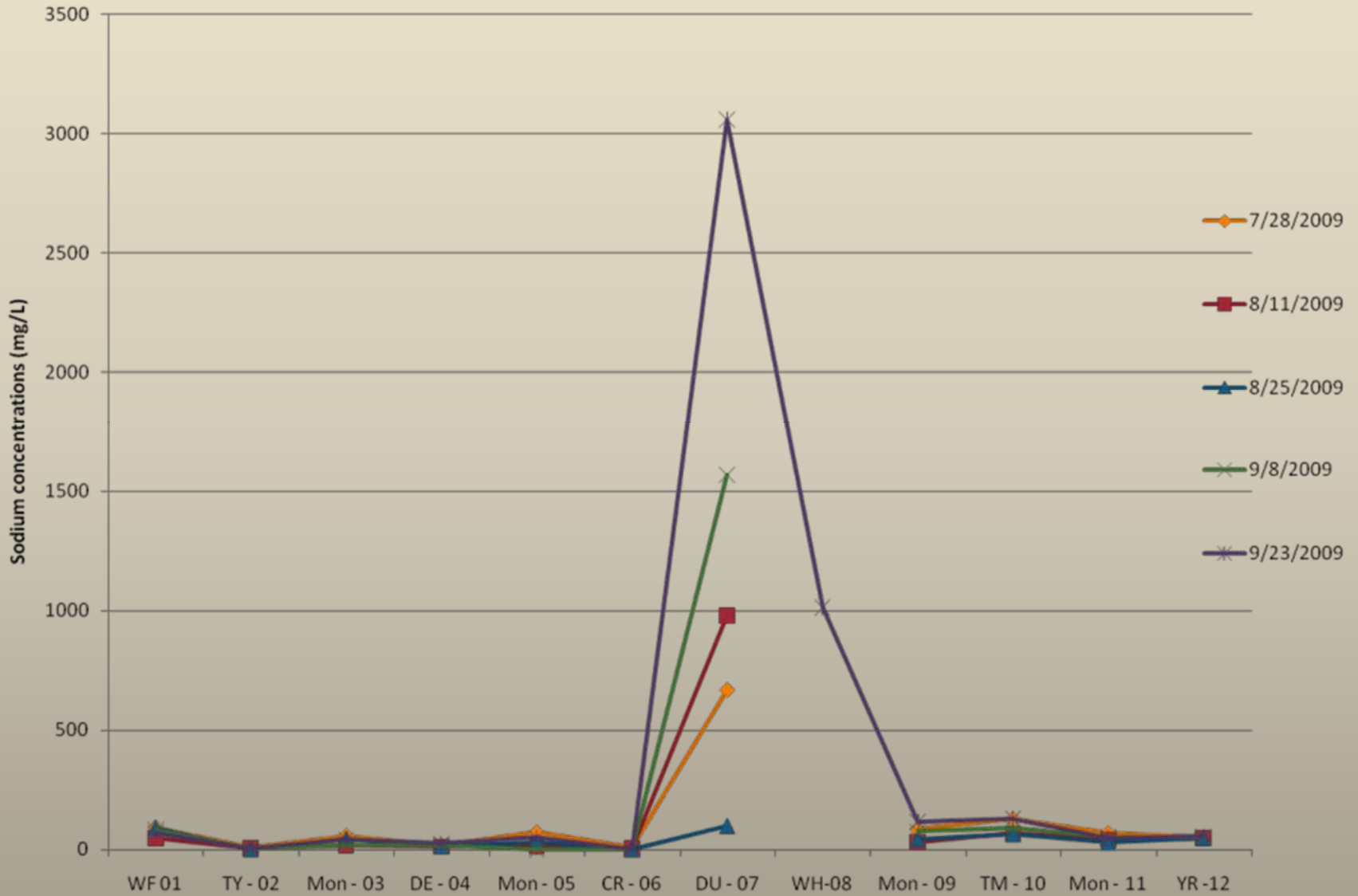
Monongahela River TDS Loading 22 September 2009



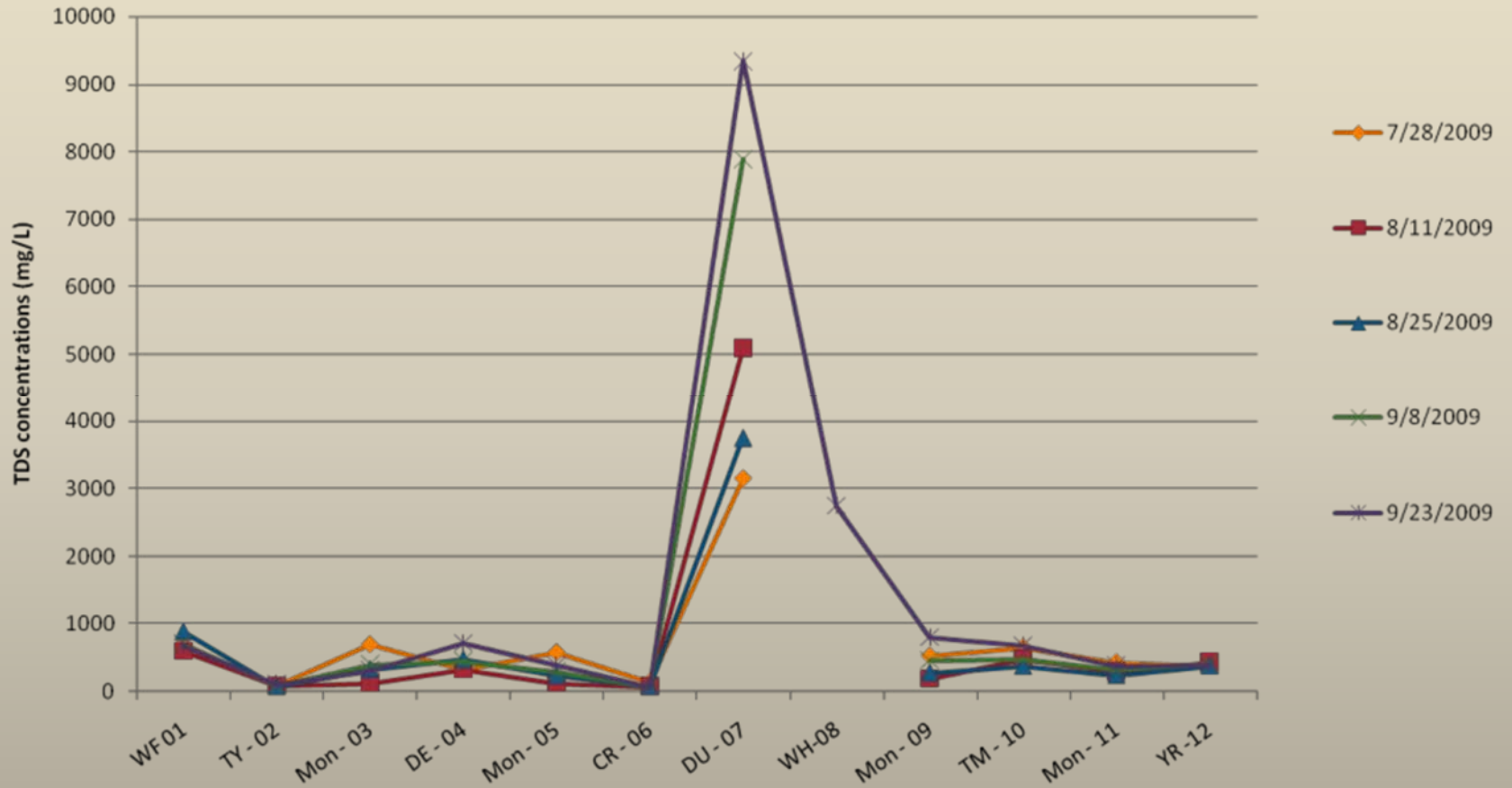
Total Chloride



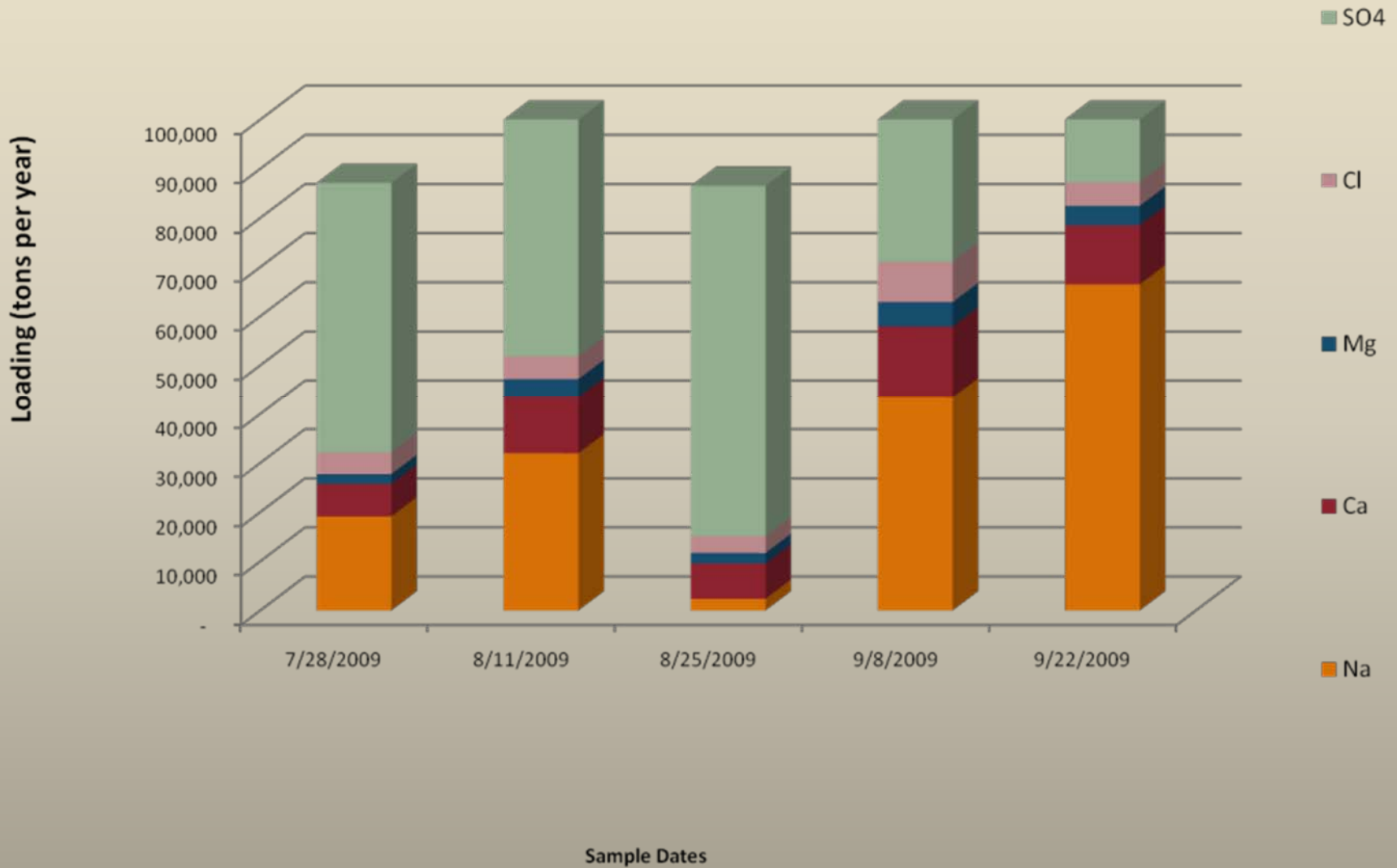
Total Sodium



Total Dissolved Solids



Dunkard Creek Loading (tpy)



TDS in The Monongahela River

	Relative Loadings		
	1 frac job		
	6 million gal *	1 UG mine	
flow	5.7	2,000	gpm
TDS	250,000	8,500	mg/L
TDS	3,139	37,400	tpy
ratio Frac/mine	12	1	
# units	120	10	
TDS	376,712	374,000	tpy

* assume ½ of injected water remains in formation

Distribution of TDS in Dunkard Ck-2008

average 2008	TDS mg/L	Flow (cfs)	TDS (tpy)	
US Steel Shaft	371	361.7	123,285	56%
Steele Shaft	9178	10.0	89,417	40%
AML discharges	1525	7.0	12,085	5%
Mouth of Dunkard *	1078	378.7	221,736	101%

Distribution of TDS in Dunkard Ck-2008

	TDS mg/L	Flow (cfs)	TDS (tpy)	
<u>high flow 2008</u>			<u>12-May-08</u>	
US Steel Shaft	324	758.5	243,766	77%
Steele Shaft	8439	13.6	113,467	36%
AML discharges	2177	4.9	8,060	3%
Mouth of Dunkard	413	777.0	316,280	115%
<u>medium flow 2008</u>			<u>17-Jan-08</u>	
US Steel Shaft	352	251.6	88,659	46%
Steele Shaft	9765	10.4	100,566	52%
AML discharges	1807	4.0	7,959	4%
Mouth of Dunkard	742	266.0	194,530	101%
<u>low flow 2008</u>			<u>17-Nov-08</u>	
US Steel Shaft	436	83.9	37,430	20%
Steele Shaft	9330	5.9	54,217	28%
AML discharges	1438	3.2	7,857	4%
Mouth of Dunkard	2080	93.0	190,654	52%

TDS in The Monongahela River

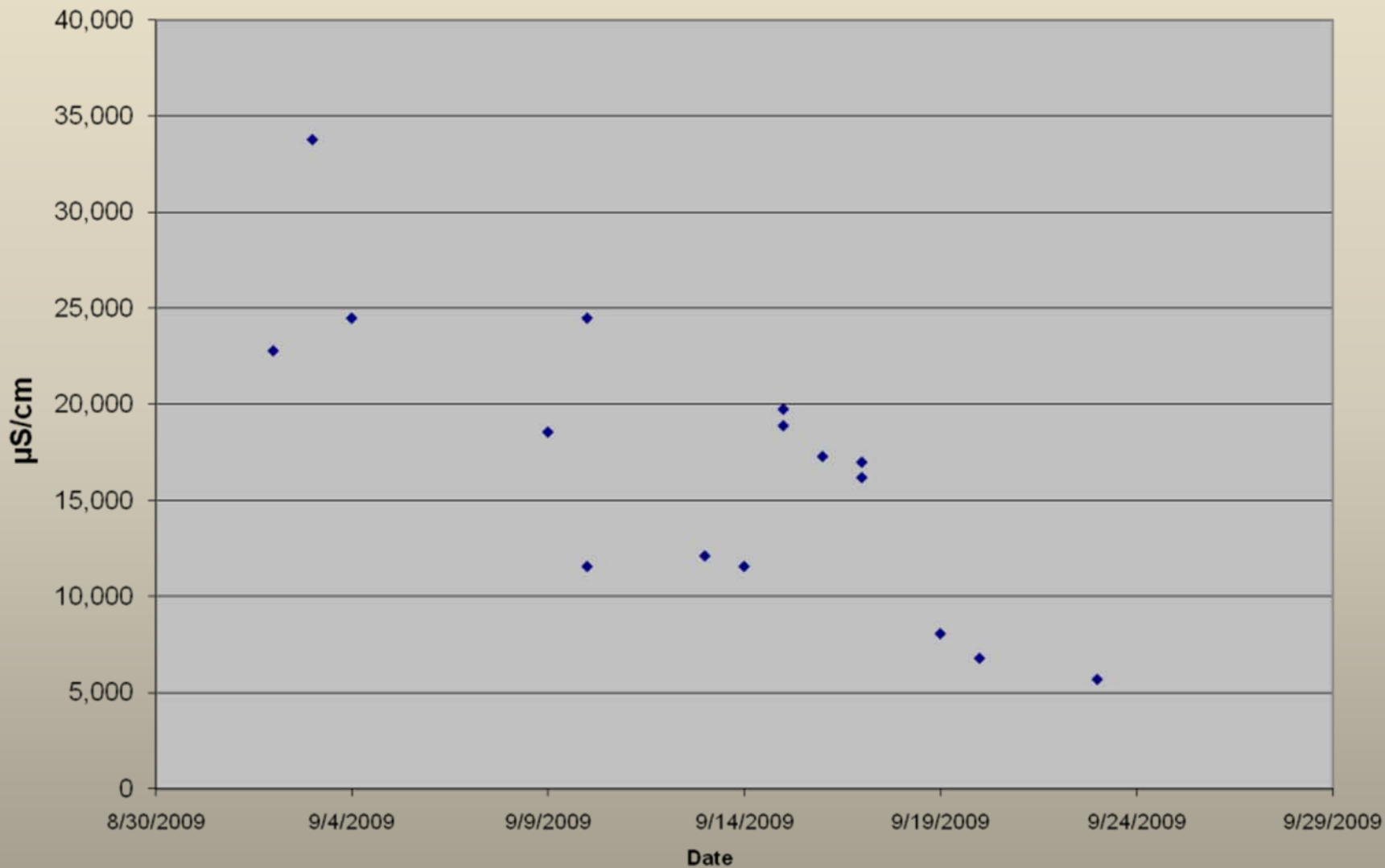
Assimilative Capacity

Today	Pt Marion	Elizabeth	
flow	1,305	2,210	cfs
TDS	357	500	mg/L
TDS	459,176	1,089,088	tpy
difference		629,912	tpy

Drought	Pt Marion	Elizabeth	
flow	400	500	cfs
TDS	500	500	mg/L
TDS	197,120	246,400	tpy
difference		49,280	tpy

High Flow	Pt Marion	Elizabeth	
flow	12,000	18,000	cfs
TDS	500	500	mg/L
TDS	5,913,600	8,870,400	tpy
difference		2,956,800	tpy

EC in WV Fk Dunkard Ck. Downstream of Outfall 005



Questions?

Monongahela River Monitoring Program

Paul Ziemkiewicz, PhD

Director

West Virginia Water Research Institute

West Virginia University