

Targeted Loading Studies

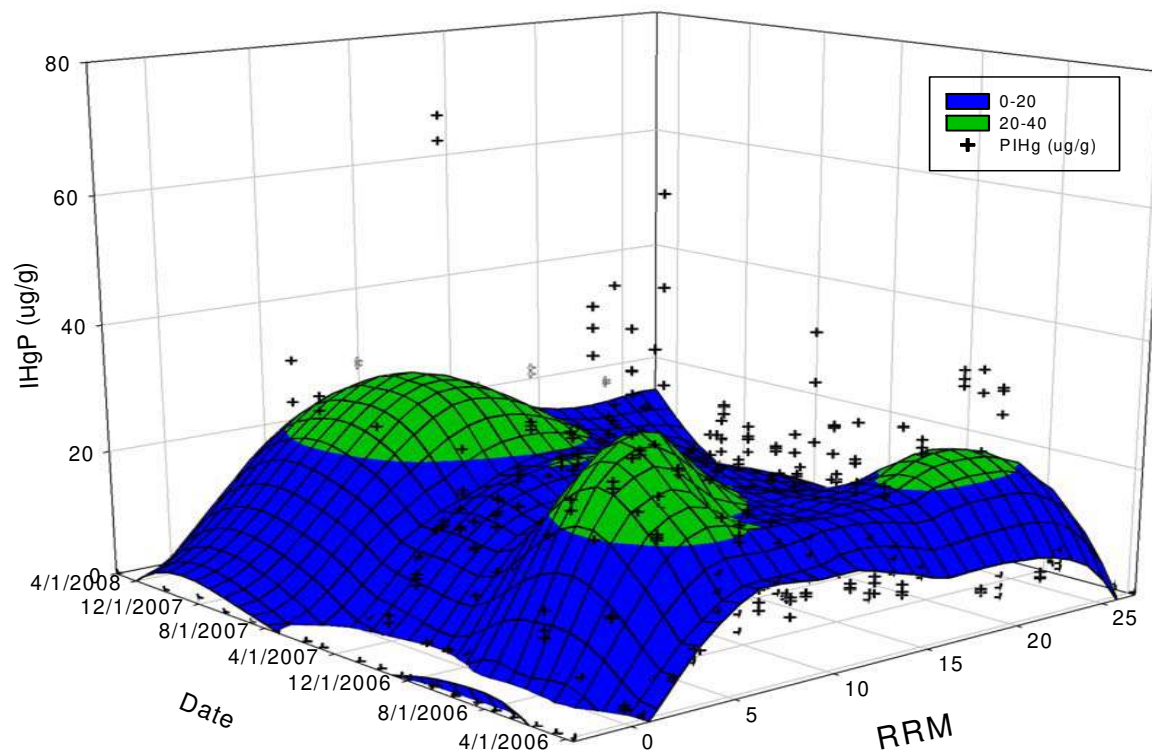


Target Study Area (RRM 0-10)

- ❑ Baseline data confirm Hg loading
- ❑ Highest Hg & MeHg concentrations in sediment and soil
- ❑ Geomorphology data indicate:
 - Lower river gradient
 - Greater floodplain area
 - Higher % of eroding banks
 - Greater in-channel storage of fine-grained sediments
- ❑ Closest proximity to historic release point

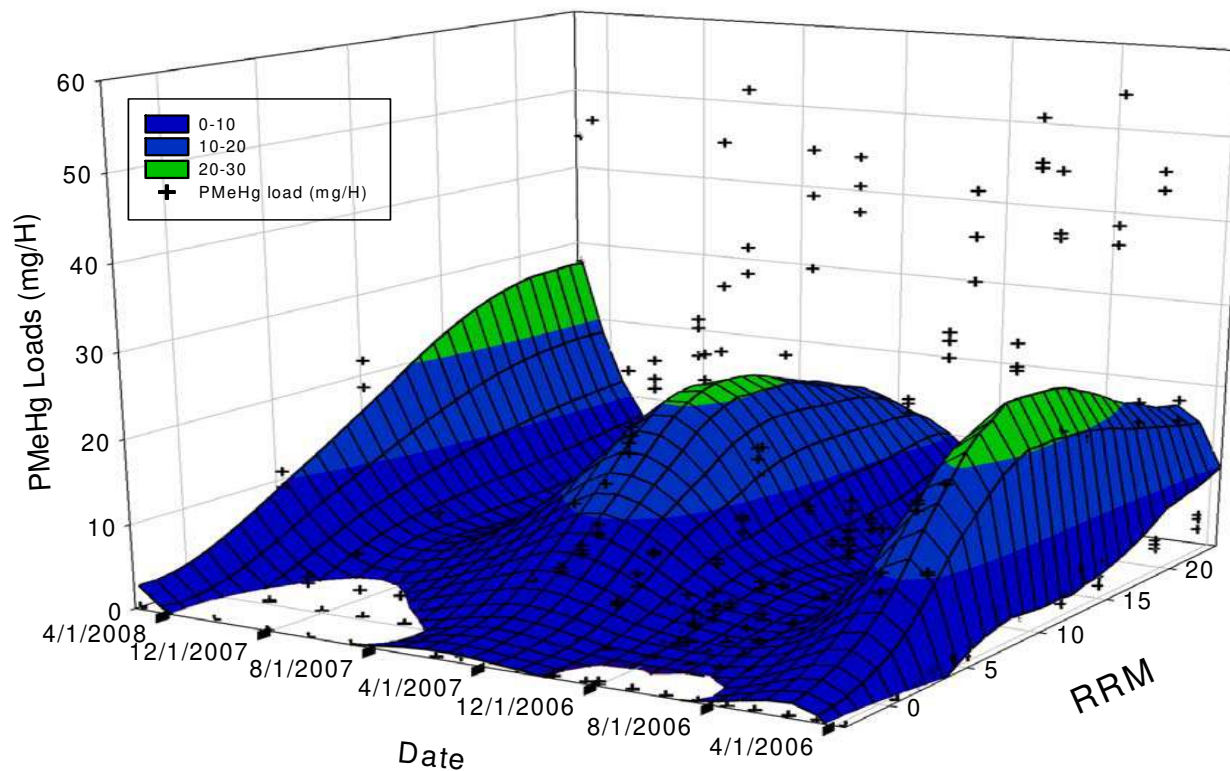
Background Data from Baseline Sampling

Inorganic Mercury on Particles (IHgP)
Time Series Baseline Data
South River 2006-2008



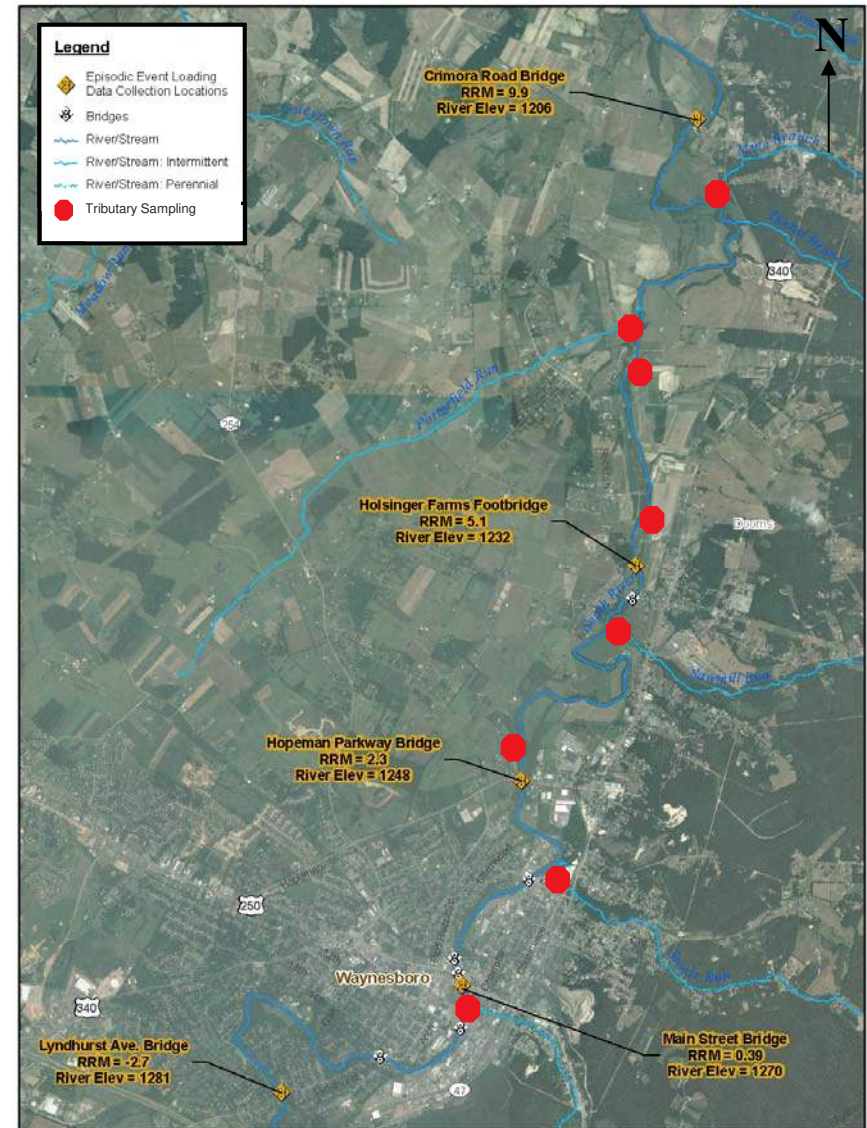
Background Data from Baseline Sampling

Unfiltered Methylmercury Total Loads (PMeHg)
Time Series Baseline Data
South River 2006-2008



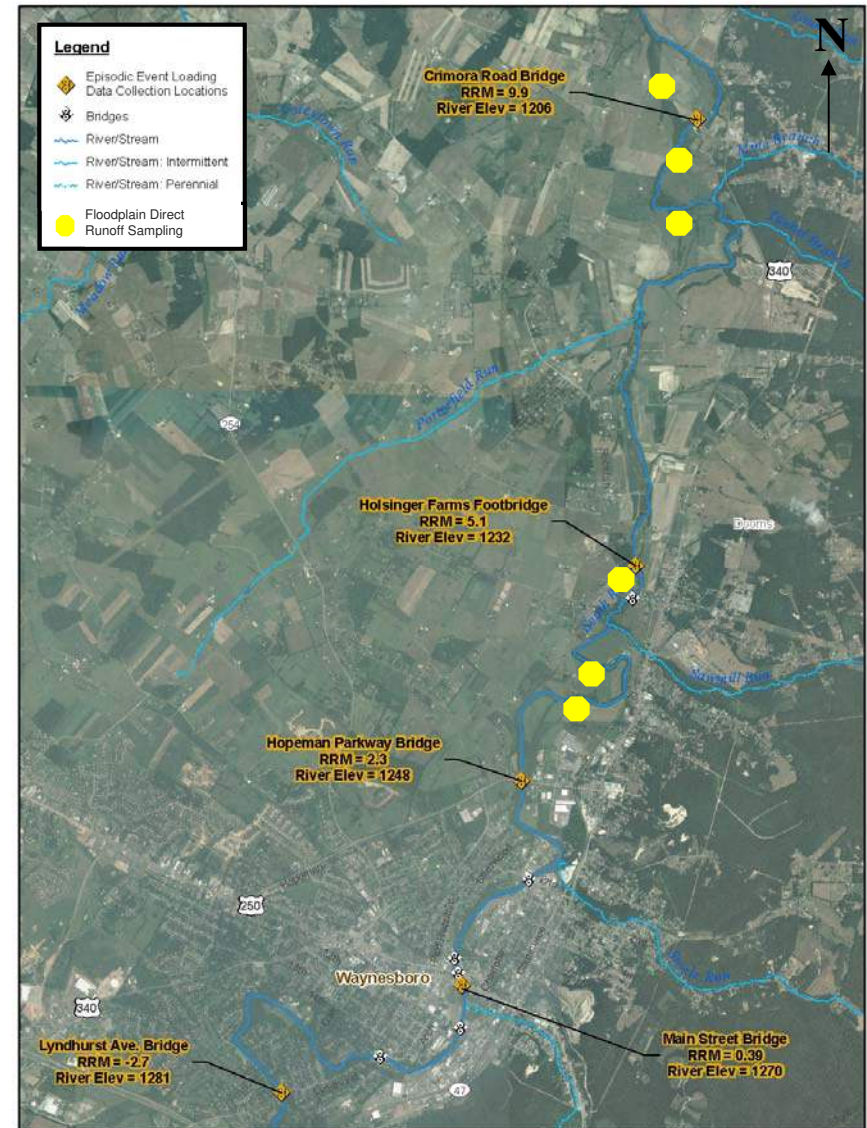
Tributary Selection

- ❑ Evaluated total & floodplain drainage areas under various storm inundation frequencies
- ❑ Identified 14 tributaries with drainage areas $>0.5 \text{ km}^2$
- ❑ Selected 8 tributaries for study based on size of overall and/or floodplain drainage areas:
 - 87% of total tributary drainage area
 - 93% of total tributary 100-yr floodplain drainage area



Floodplain Drainage Feature Selection

- Reviewed aerial photos to identify prominent floodplain drainage features; field verification identified drainage channels from floodplain to river
- Selected six drainage features typically inundated during high flow conditions



Passive Storm Water Sampling

- ❑ Set passive storm water samplers at selected locations in tributaries, floodplain drainage features and mill race channels:
 - Tributary samplers set at bridge and confluence locations
- ❑ Logged stream stage continuously using co-located Solinst Leveloggers



www.solinst.com

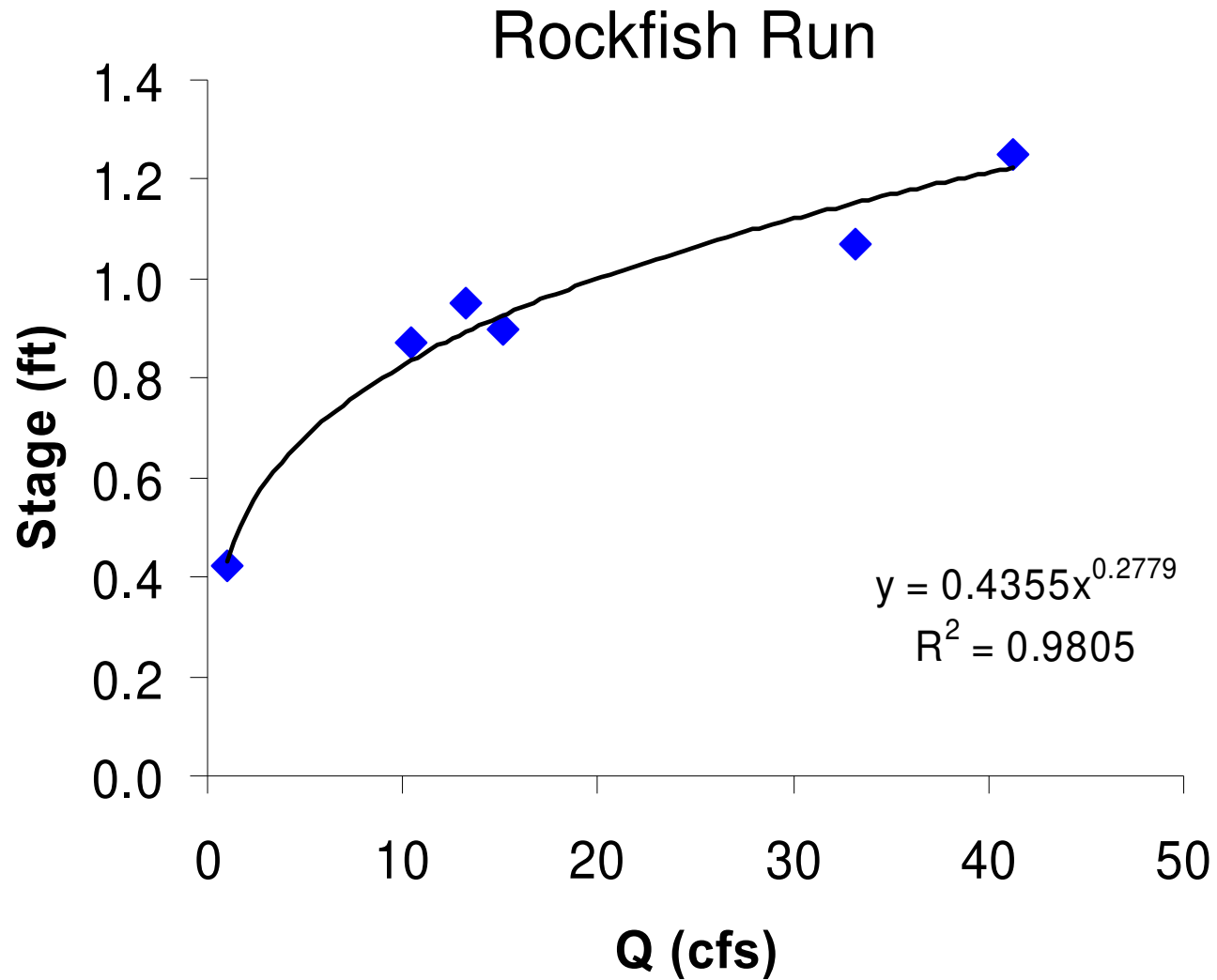
Stage-Discharge Curve Development

- ❑ Measured discharge using Sontek FlowTracker (ADV) and accepted USGS methodology at passive sampler locations over various flow regimes
- ❑ Developed stage-discharge curves for tributaries at bridge locations, and floodplain and mill race channels

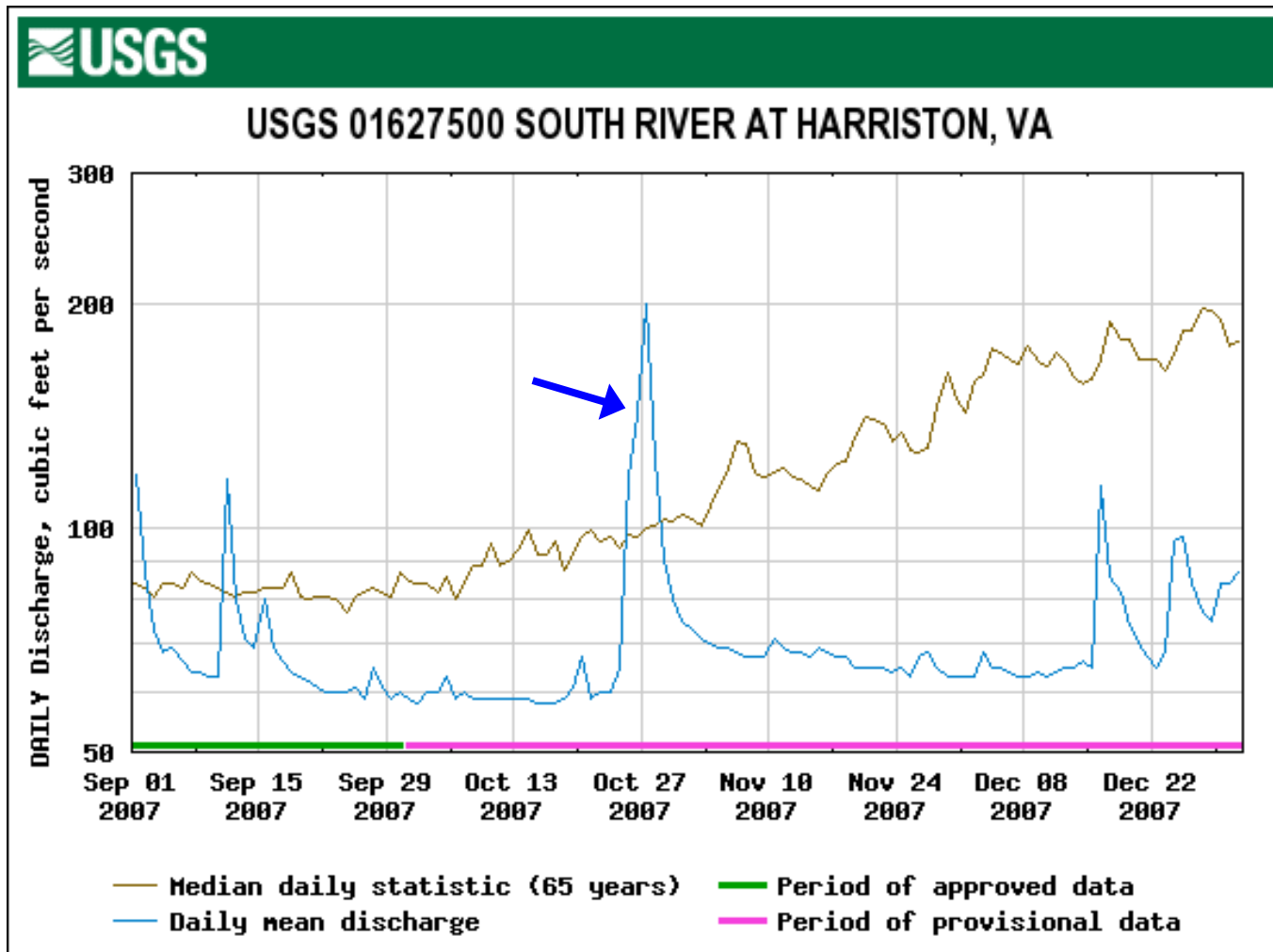


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Example Stage-Discharge Curve

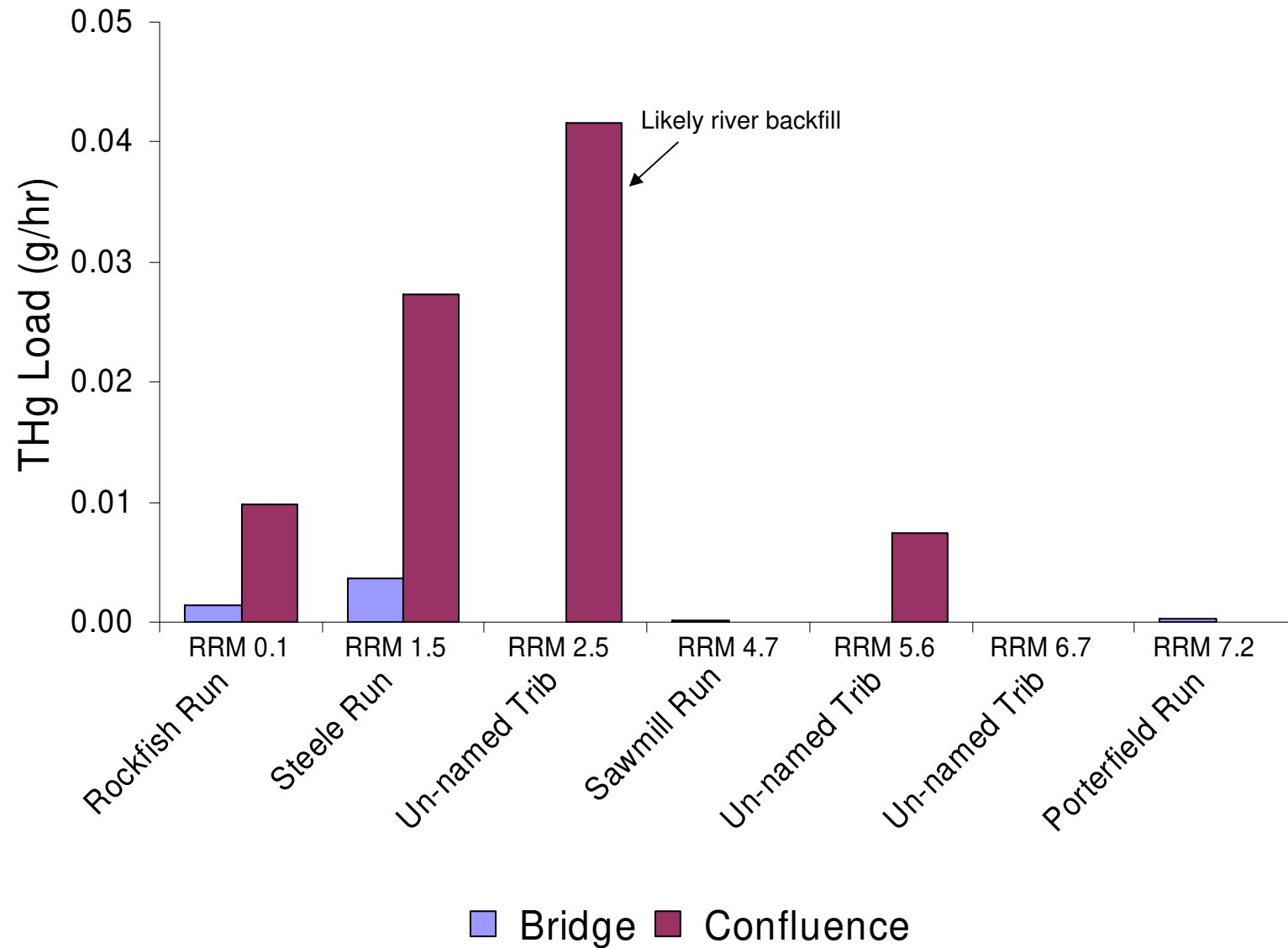


October 2007 Storm Event

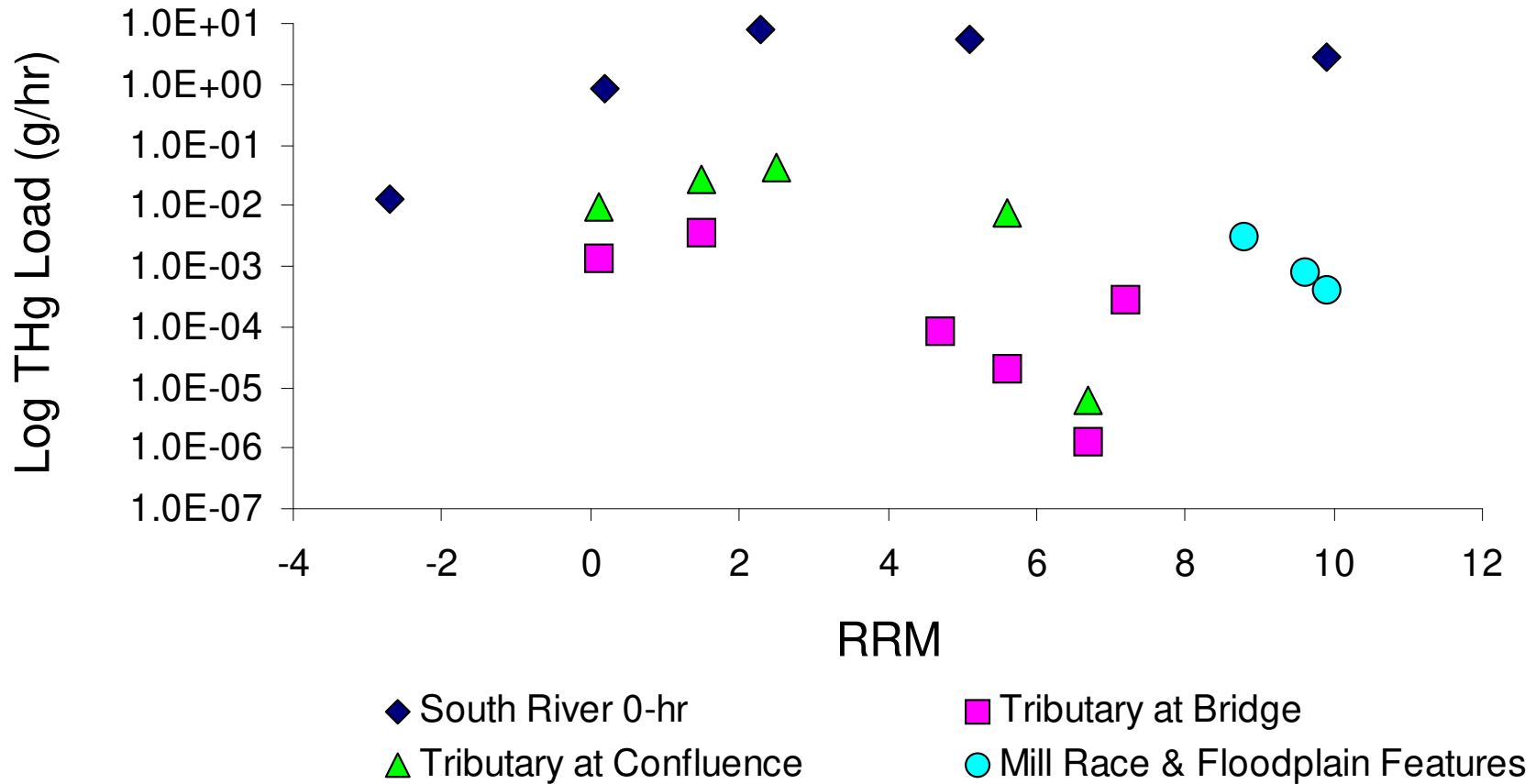


<http://waterdata.usgs.gov/va/nwis/dv?>

Instantaneous THg Loading Estimates



Instantaneous THg Loading Estimates



Integrated Rising Limb THg Loading Estimates

Tributary Confluence	RRM	Reach Specific Discharge Contribution to River	Instantaneous THg Load Contribution to River	Reach Specific THg Load Contribution to River	
				0-hr	3-hr
Rockfish Run	0.1	7.0%	1.13%	1.14%	4.16%
Steele Run	1.5	3.3%	0.34%	0.39%	1.79%
Un-named Trib at RRM 2.5	2.5	2.9%	0.77%	**	0.61%
Sawmill Run	4.7	dry	dry	dry	dry
Un-named Trib at RRM 5.6	5.6	0.2%	0.26%	**	0.10%
Un-named Trib at RRM 6.7	6.7	0.0%	0.00%	0.00%	0.00%
Porterfield Run	7.2	*	*	*	*
Floodplain Feature at RRM 8.8	8.8	0.1%	0.11%	**	0.04%
Floodplain Feature at RRM 9.6	9.6	0.1%	0.03%	**	0.01%
Mill Race at RRM 9.9	9.9	0.0%	0.00%	**	0.01%

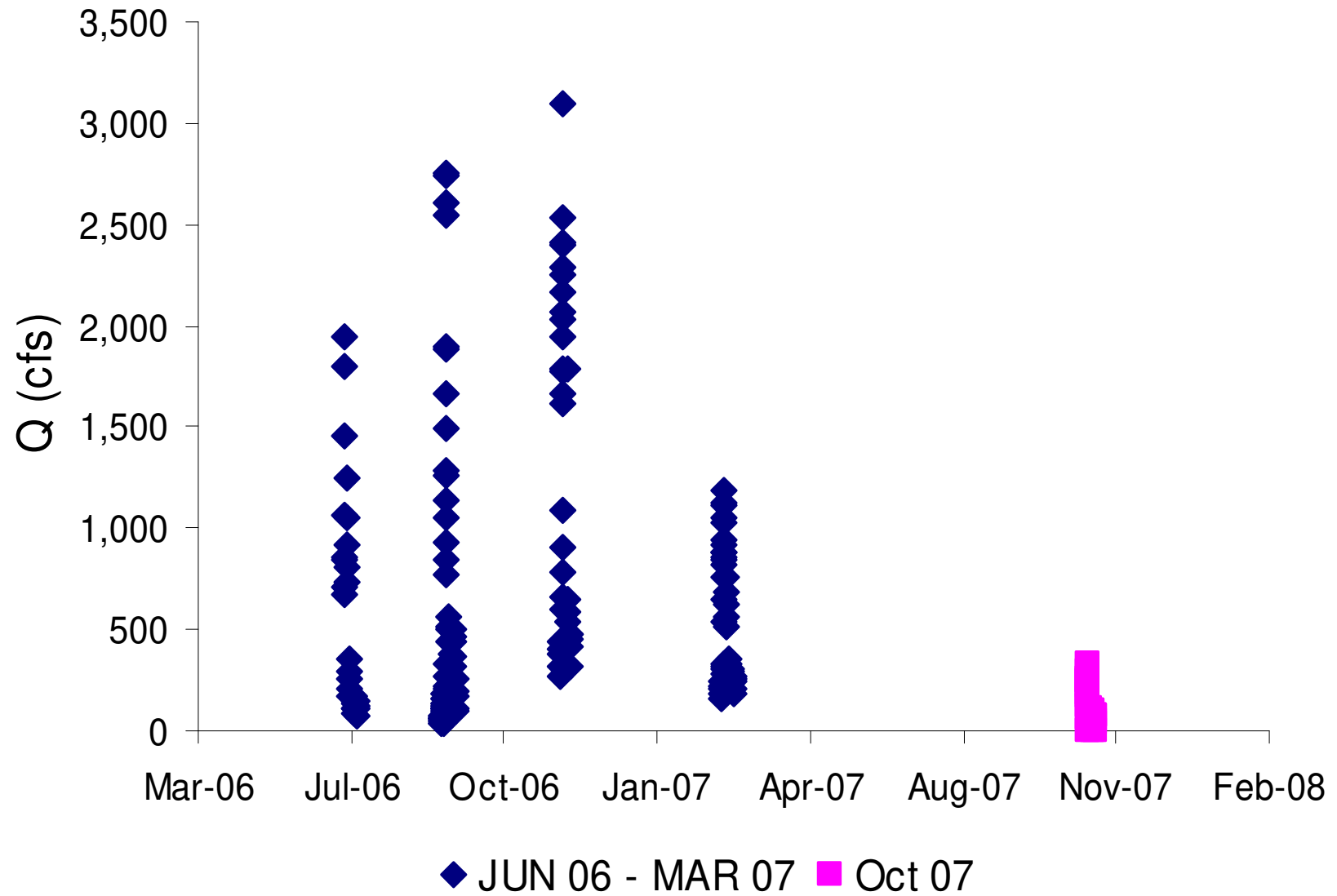
Notes:

*Passive sampler installed at confluence in 2008

**Reach specific contribution was negative

Reach specific discharge and THg load contributions estimated using nearest downstream sampling location on main stem of South River

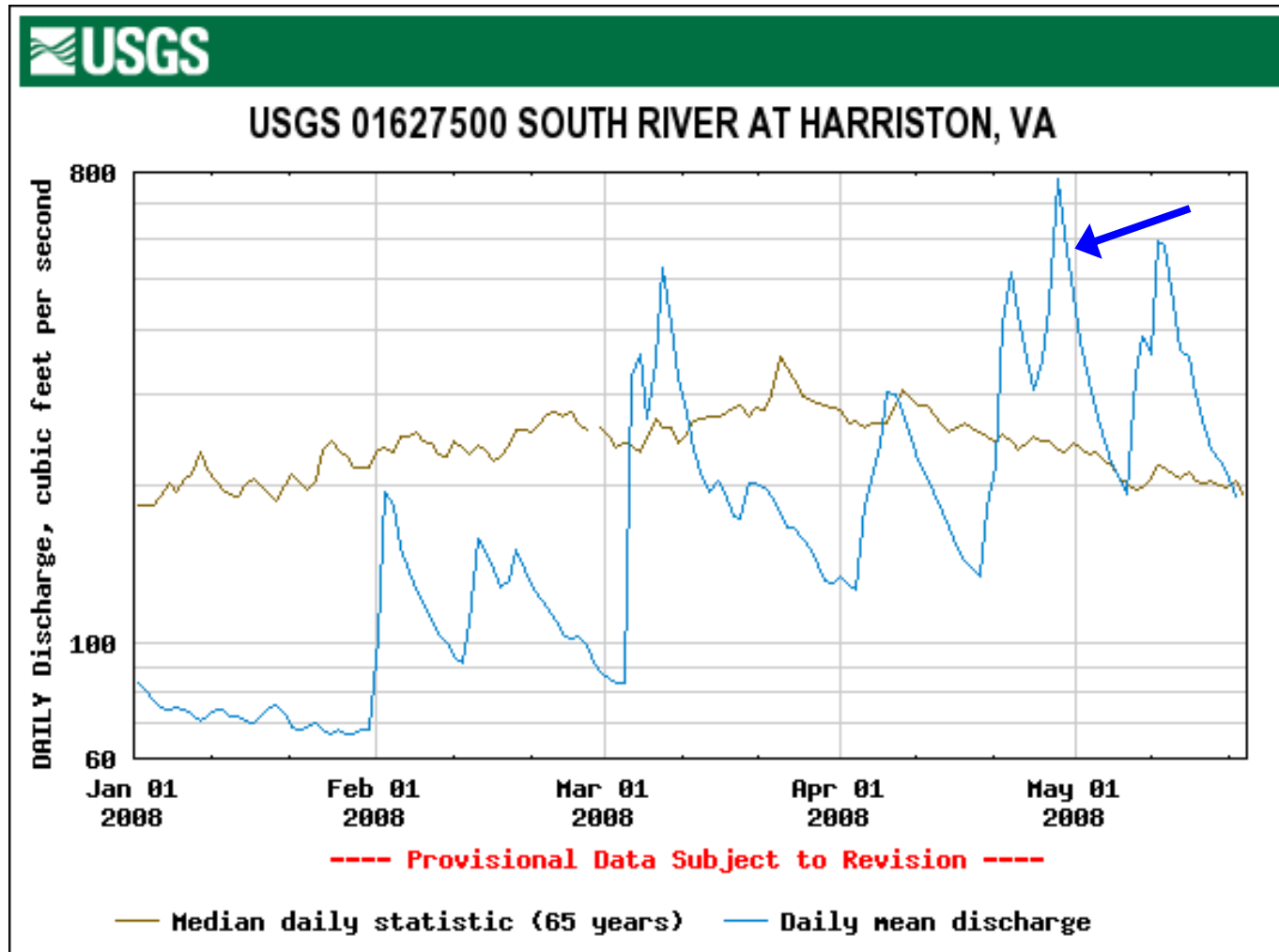
South River Discharge



Data Findings

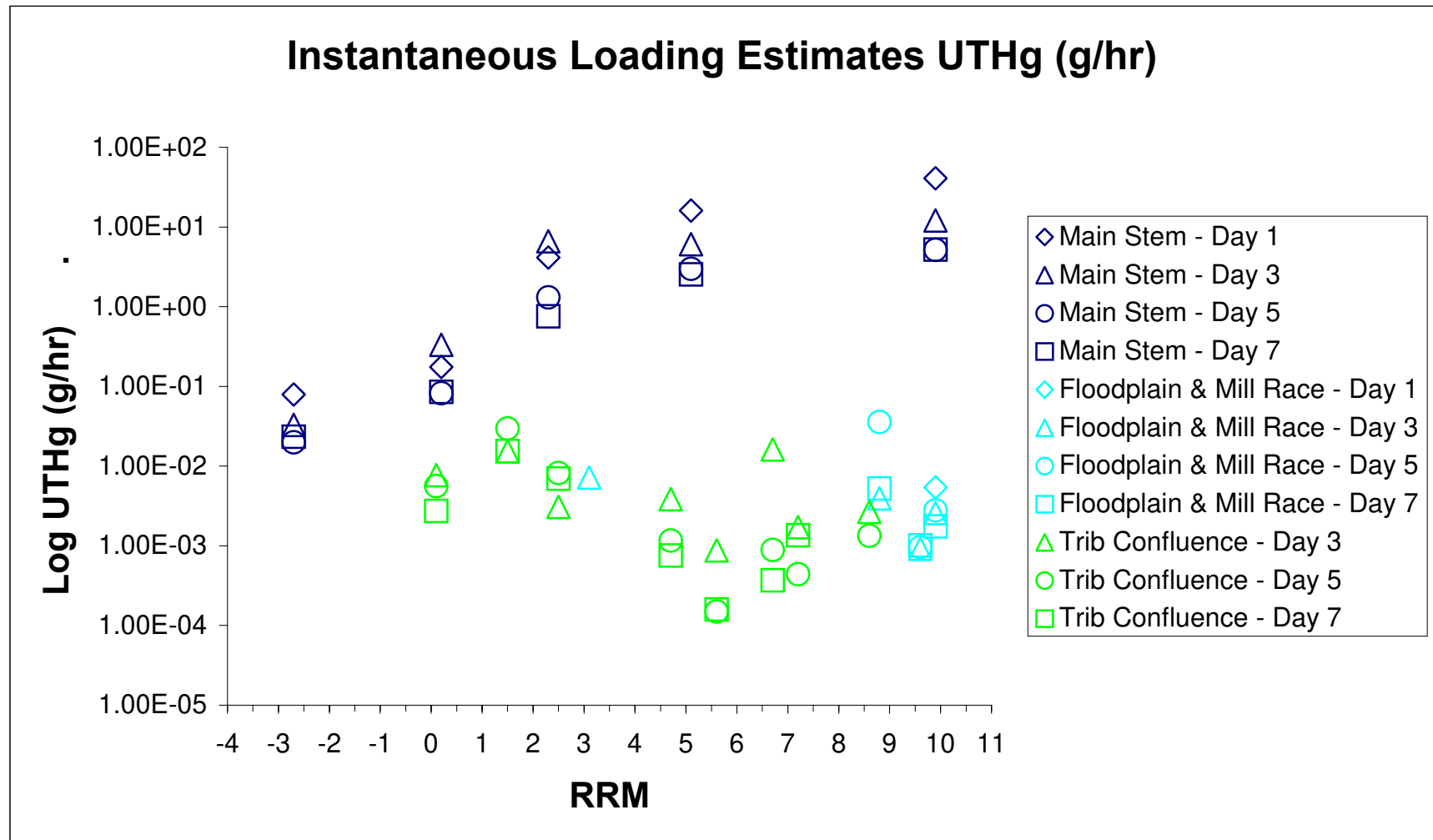
- ❑ October storm sampling provided THg loading estimates for first flush conditions in tributaries following prolonged dry period; though flow conditions were lower than prior storm sampling events
- ❑ Measurable difference between THg loading estimates between bridge and confluence locations on tributaries
- ❑ Tributaries and floodplain features accounted for minor percentage of THg loading to the South River

April/May 2008 Storm Event

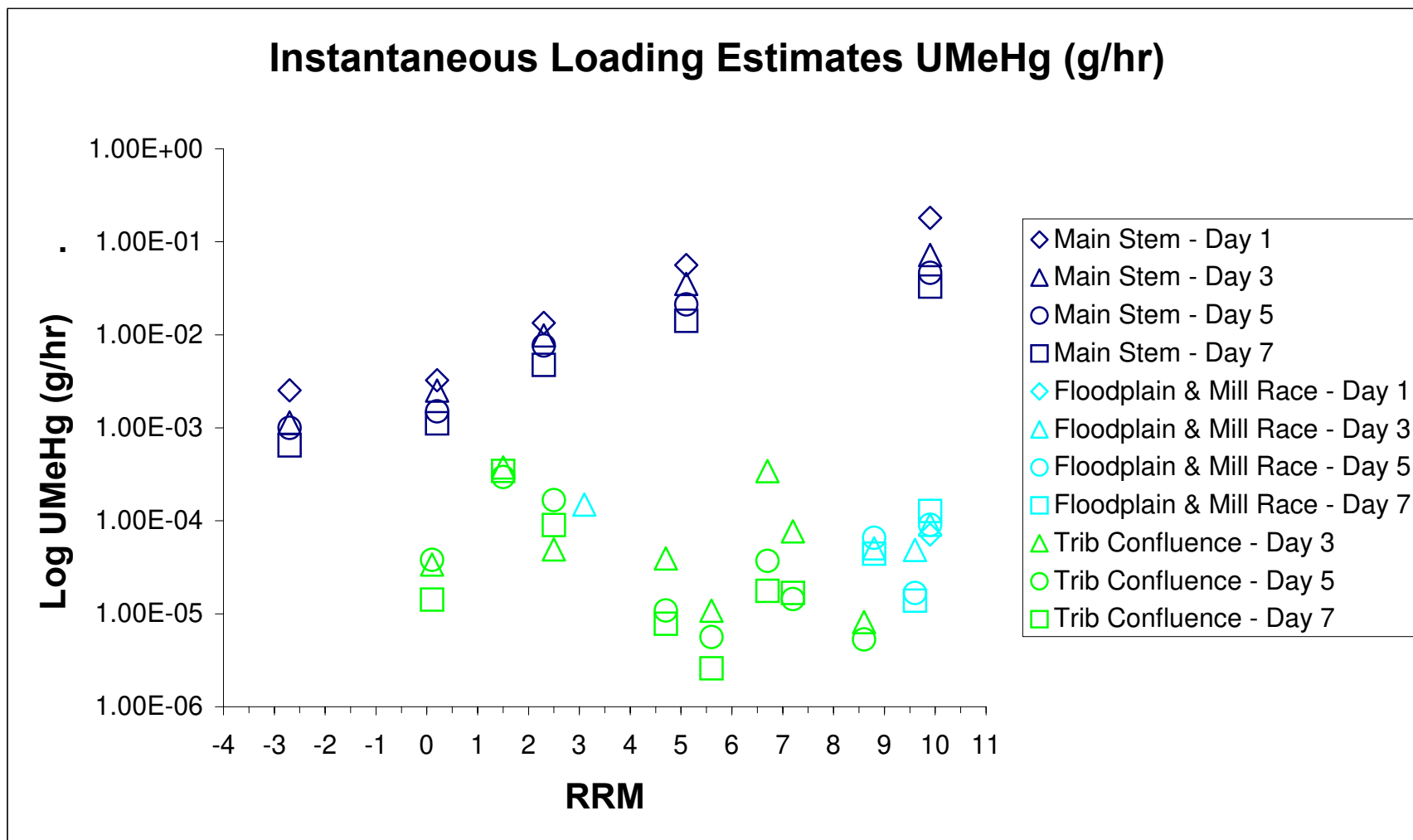


<http://waterdata.usgs.gov/va/nwis/dv?>

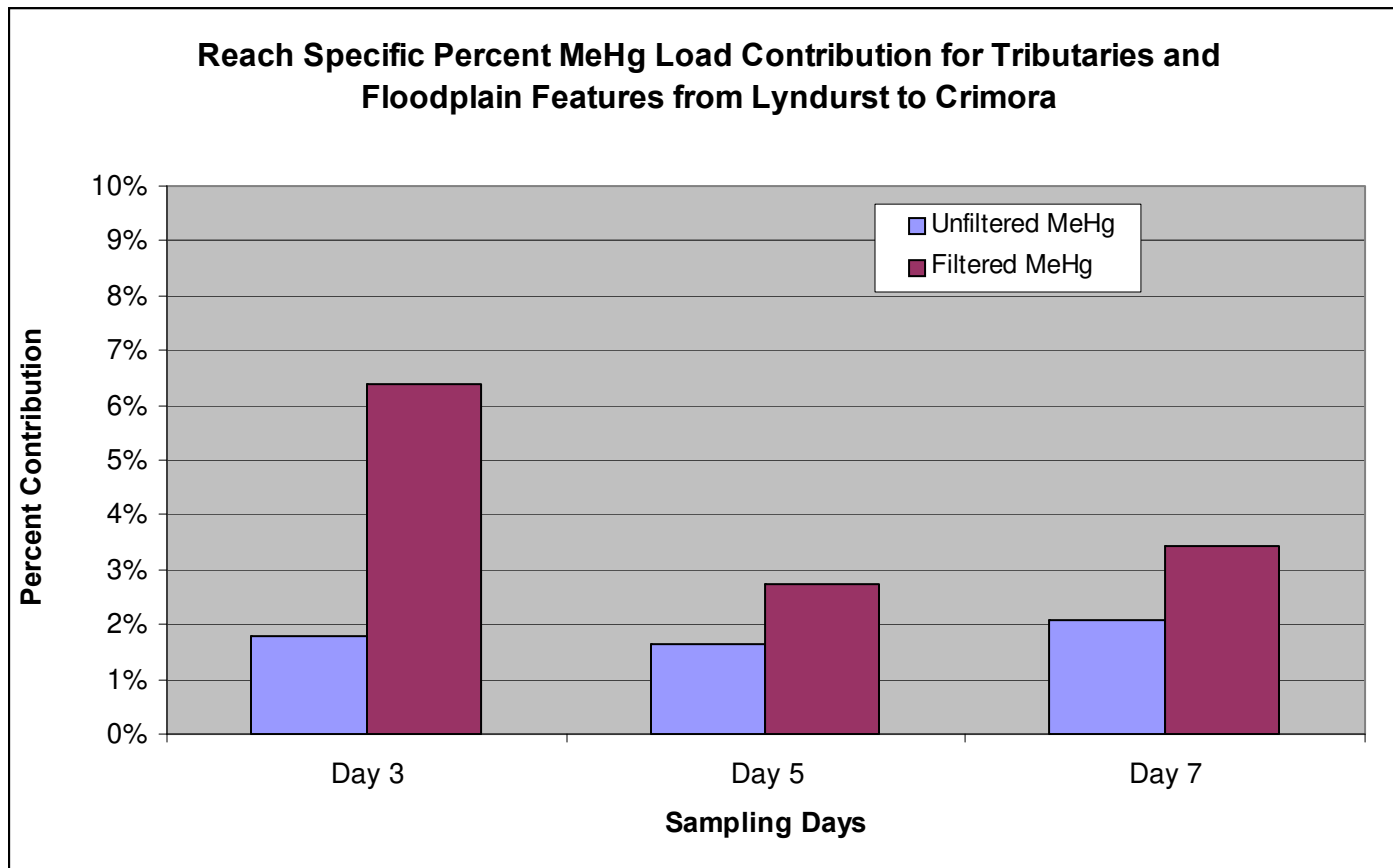
Tributary Loading – May 2008



Tributary Loading – May 2008



Tributary Loading – May 2008



Data Findings

- ❑ April/May falling limb storm sampling provided MeHg and THg loading estimates for post-storm conditions in tributaries/floodplain
- ❑ Sampling integrated with flux chambers and baseline surface water and sediment sampling
- ❑ Tributaries and floodplain features accounted for minor percentage of total MeHg and THg loads to the South River

Conclusions

- ❑ Tributaries contribute MeHg and THg loads to South River generally at several orders of magnitude below mainstem loads
- ❑ Among tributaries and floodplain features, Steele Run generally shows the highest loading rates; data is consistent with floodplain soils findings for oxbow area
- ❑ Overall, tributaries and floodplain features accounted for minor percentage of total MeHg loads to the South River suggesting this pathway is of secondary importance for input of MeHg

Additional Slides

Target Tributaries

RRM Confluence	River Channel Entry Side	Common Name	Total Drainage Area (KM ²)	Tributary Drainage Area in Floodplain (KM ²)			
				100-yr	5-yr	2-yr	0.3-yr
0.1 to 0.2	East	Rockfish Run	14.5	0.148	0.057	0.003	0.0014
1.5 to 1.6	East	Steele Run	12.7	0.199	0.115	0.021	0.0021
2.5 to 2.6	West		7.6	0.063	0.034	0.017	0.0048
3.7 to 3.8	East		1.7	0.006	0.002	0.0007	0.0004
4.5 to 4.6	West		2.5	0.002	0.001	0.0007	0.0004
4.7 to 4.8	East	Sawmill Run	26.1	0.067	0.011	0.002	0.0004
5.6 to 5.7	East		4.7	0.129	0.039	0.026	0.014
6.0 to 6.1	East		4.1	0.057	0.004	0.0008	0.0003
6.7 to 6.8	East		4.6	0.164	0.106	0.029	0.011
7.2 to 7.3	West	Porterfield Run	15.0	0.178	0.079	0.015	0.0093
7.9 to 8.0	East		0.9	0.009	0.007	0.005	0.0028
8.1 to 8.2	East		0.5	0.004	0.001	0.0006	0.0004
8.4 to 8.5	East	Tunnel Branch	4.1	0.006	0.001	0.0004	0.0001
8.6 to 8.7	East	Mine Branch	10.8	0.009	0.0005	0.0002	0.0001

Notes:

Shaded tributaries selected for targeted loading study

River channel entry side as facing down-river

Total drainage area and floodplain drainage area inundated for modeled storm events are listed

KM² - square kilometers

RRM - relative river mile

Target Floodplain Drainage Features

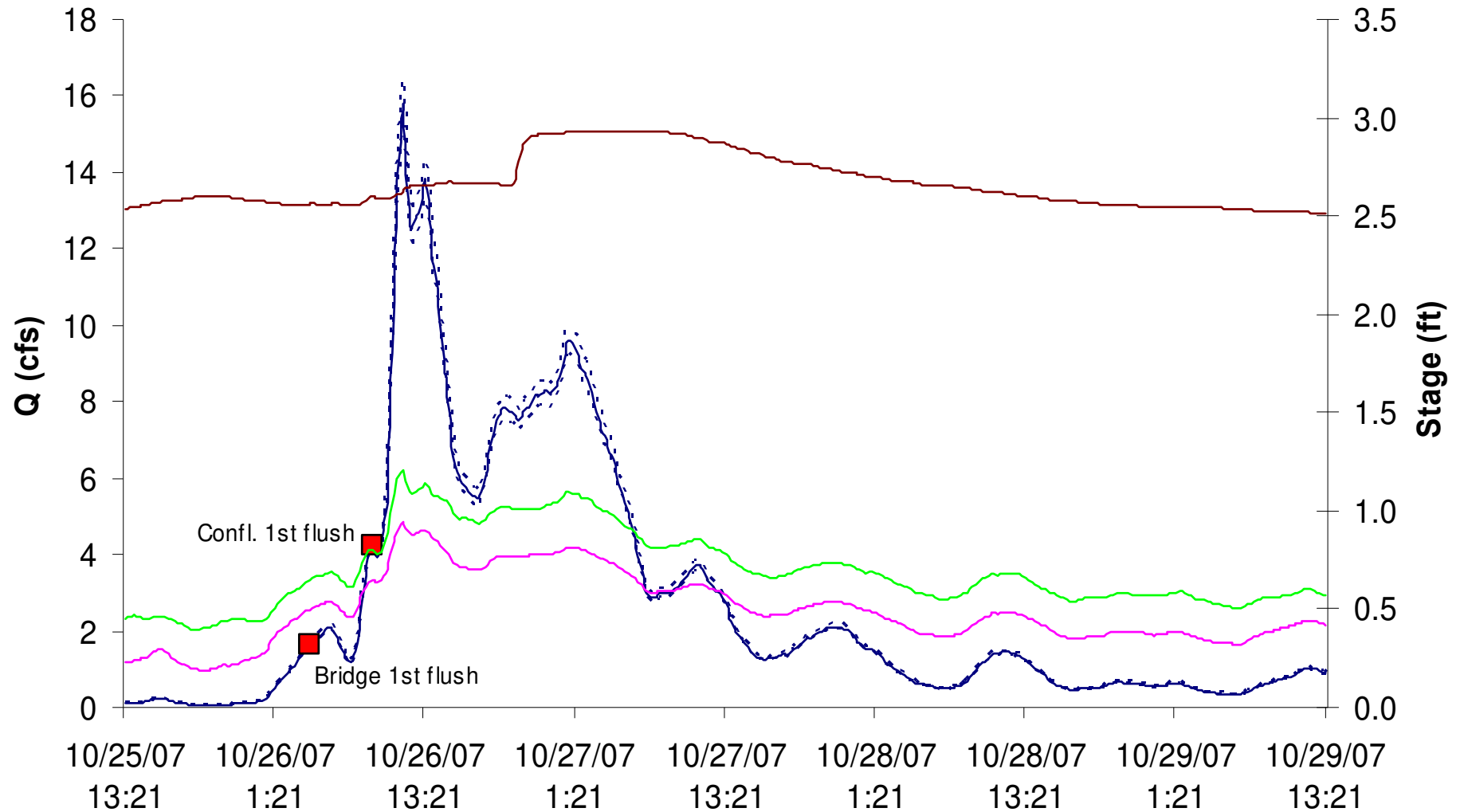


RRM 2.5 to 4.5



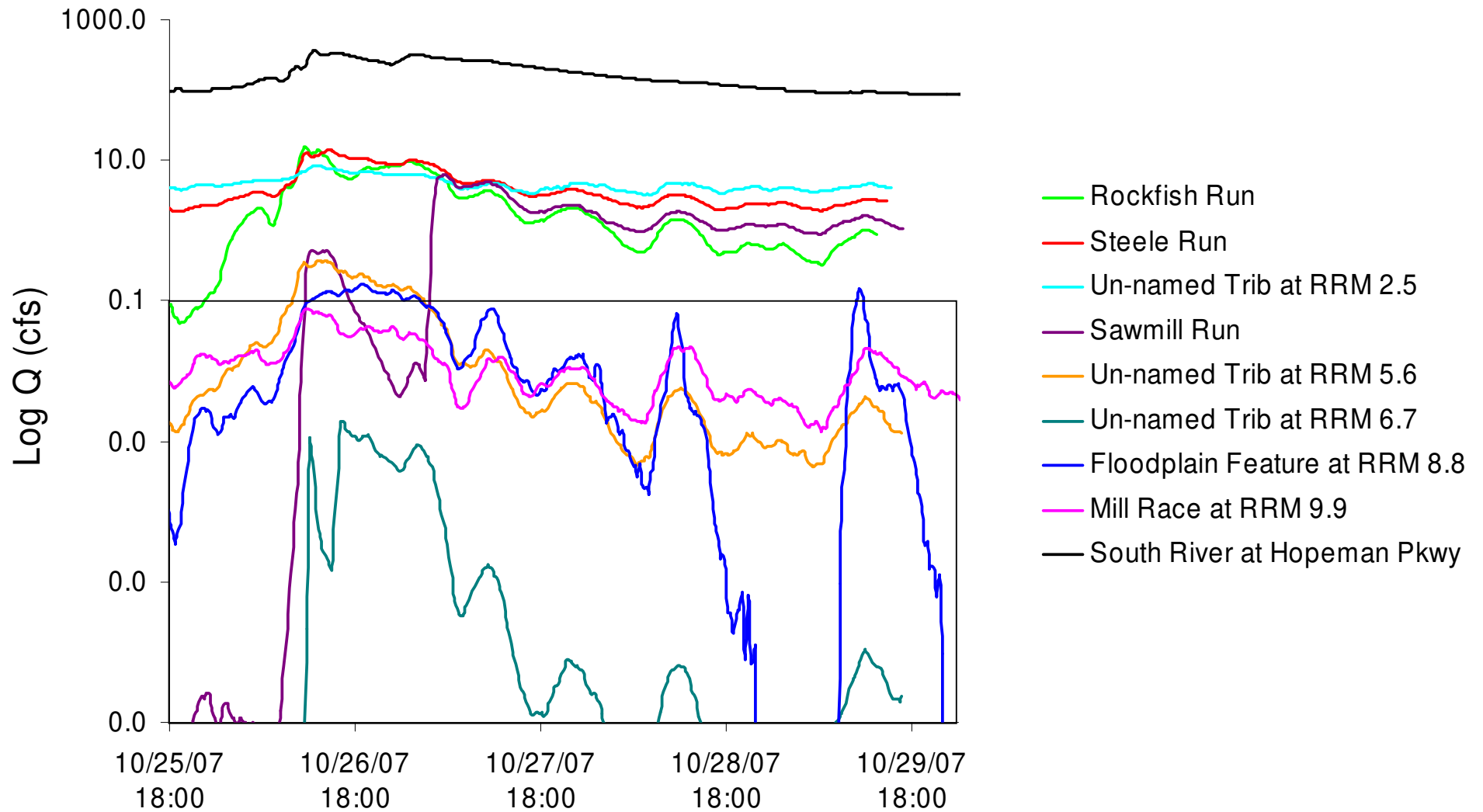
RRM 7.5 to 10

Rockfish Run



— Predicted Q at Bridge — Stage at Bridge — Stage at Confluence — SR Stage at Lyndhurst

Discharge Comparison



Fall Limb Sampling – Day 3

Loading Percent Contribution

River Feature Confluence	RRM	Day	Discharge Contribution to River	Instantaneous THg Contribution to River	Reach Specific THg Contribution to River	Instantaneous MeHg Contribution to River	Reach Specific MeHg Contribution to River
Rockfish Run	0.1	3	2.3%	2.3%	2.6%	1.3%	2.5%
Steele Run	1.5	3	2.0%	0.2%	0.2%	3.8%	5.1%
Unnamed Tributary	2.5	3	1.9%	0.1%	*	0.1%	0.2%
Drainage Feature	3.1	3	0.1%	0.1%	*	0.4%	0.6%
Sawmill Run	4.7	3	11.2%	0.1%	*	0.1%	0.2%
Unnamed Tributary	5.6	3	0.0%	0.0%	0.0%	0.0%	0.0%
Unnamed Tributary	6.7	3	2.5%	0.1%	0.3%	0.5%	0.9%
Porterfield Run	7.2	3	1.5%	0.0%	0.0%	0.1%	0.2%
Mine Branch	8.6	3	2.3%	0.0%	0.0%	0.0%	0.0%
Drainage Feature	8.8	3	0.1%	0.0%	0.1%	0.1%	0.1%
Drainage Feature	9.6	3	0.1%	0.0%	0.0%	0.1%	0.1%
Mill Race	9.9	3	0.1%	0.0%	0.0%	0.1%	0.2%

Fall Limb Sampling – Day 5

Loading Percent Contribution

River Feature Confluence	RRM	Day	Discharge Contribution to River	Instantaneous THg Contribution to River	Reach Specific THg Contribution to River	Instantaneous MeHg Contribution to River	Reach Specific MeHg Contribution to River
Rockfish Run	0.1	5	2.3%	6.9%	9.1%	2.6%	7.6%
Steele Run	1.5	5	2.2%	2.3%	2.4%	3.9%	4.8%
Unnamed Tributary	2.5	5	2.8%	0.3%	0.5%	0.8%	1.2%
Sawmill Run	4.7	5	5.0%	0.0%	0.1%	0.1%	0.1%
Unnamed Tributary	5.6	5	0.0%	0.0%	0.0%	0.0%	0.0%
Unnamed Tributary	6.7	5	0.3%	0.0%	0.0%	0.1%	0.1%
Porterfield Run	7.2	5	0.3%	0.0%	0.0%	0.0%	0.1%
Mine Branch	8.6	5	2.3%	0.0%	0.1%	0.0%	0.0%
Drainage Feature	8.8	5	0.1%	0.7%	1.6%	0.1%	0.3%
Drainage Feature	9.6	5	0.1%	0.0%	0.0%	0.0%	0.1%
Mill Race	9.9	5	0.1%	0.1%	0.1%	0.2%	0.4%

Fall Limb Sampling – Day 7

Loading Percent Contribution

River Feature Confluence	RRM	Day	Discharge Contribution to River	Instantaneous THg Contribution to River	Reach Specific THg Contribution to River	Instantaneous MeHg Contribution to River	Reach Specific MeHg Contribution to River
Rockfish Run	0.1	7	1.4%	3.2%	4.4%	1.3%	3.0%
Steele Run	1.5	7	1.8%	2.0%	2.3%	7.2%	9.4%
Unnamed Tributary	2.5	7	4.0%	0.3%	0.4%	0.6%	1.0%
Sawmill Run	4.7	7	4.4%	0.0%	0.0%	0.1%	0.1%
Unnamed Tributary	5.6	7	0.0%	0.0%	0.0%	0.0%	0.0%
Unnamed Tributary	6.7	7	0.2%	0.0%	0.0%	0.1%	0.1%
Porterfield Run	7.2	7	0.4%	0.0%	0.1%	0.1%	0.1%
Drainage Feature	8.8	7	0.1%	0.1%	0.2%	0.1%	0.2%
Drainage Feature	9.6	7	0.1%	0.0%	0.0%	0.0%	0.1%
Mill Race	9.9	7	0.2%	0.0%	0.1%	0.4%	0.7%

Tributary Loading – May 2008

