Green/Duwamish River Watershed



Pollutant Loading Assessment

Technical Advisory Committee Meeting
April 6, 2016

DEPARTMENT OF ECOLOGY
State of Washington

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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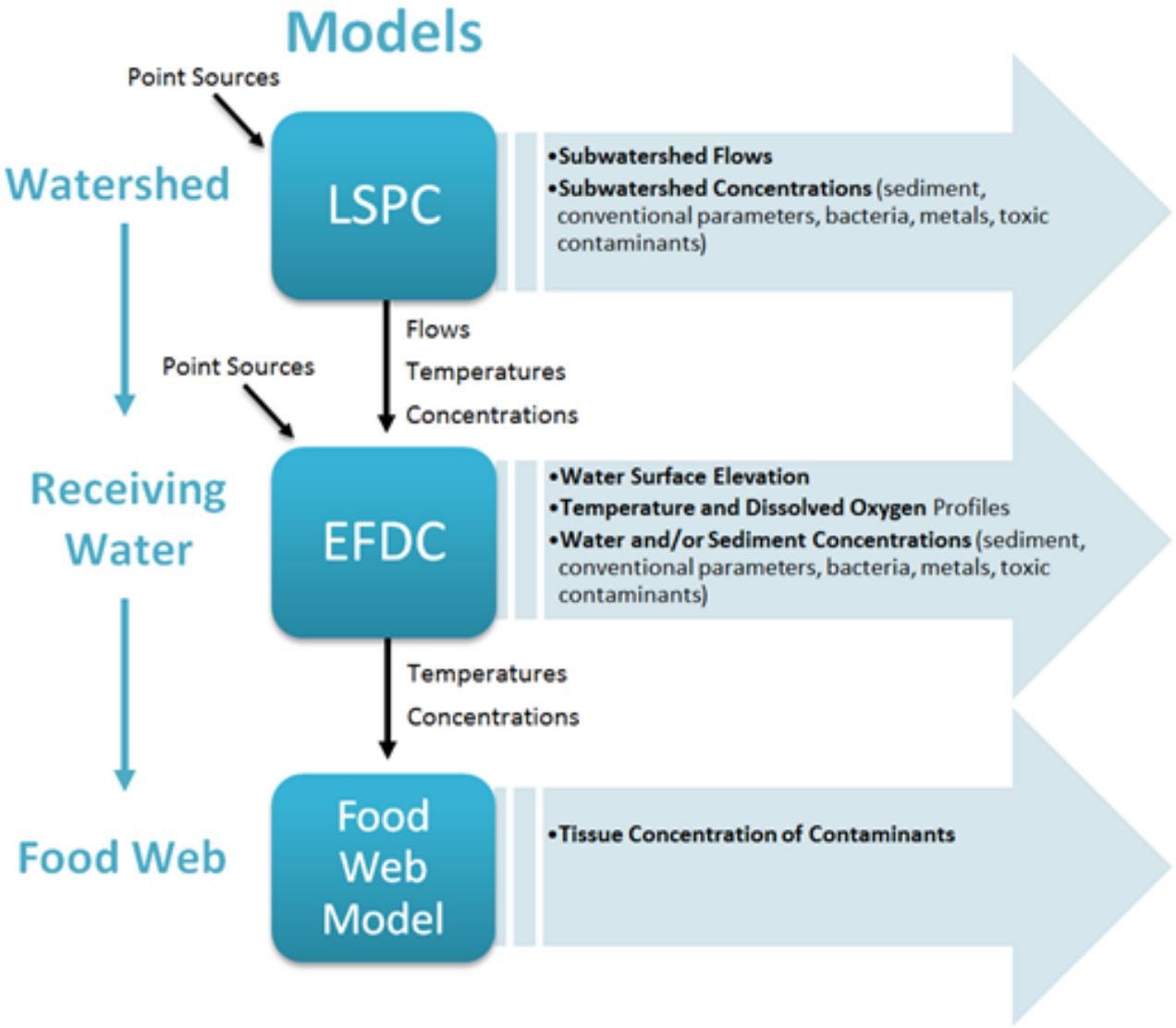
Model selection

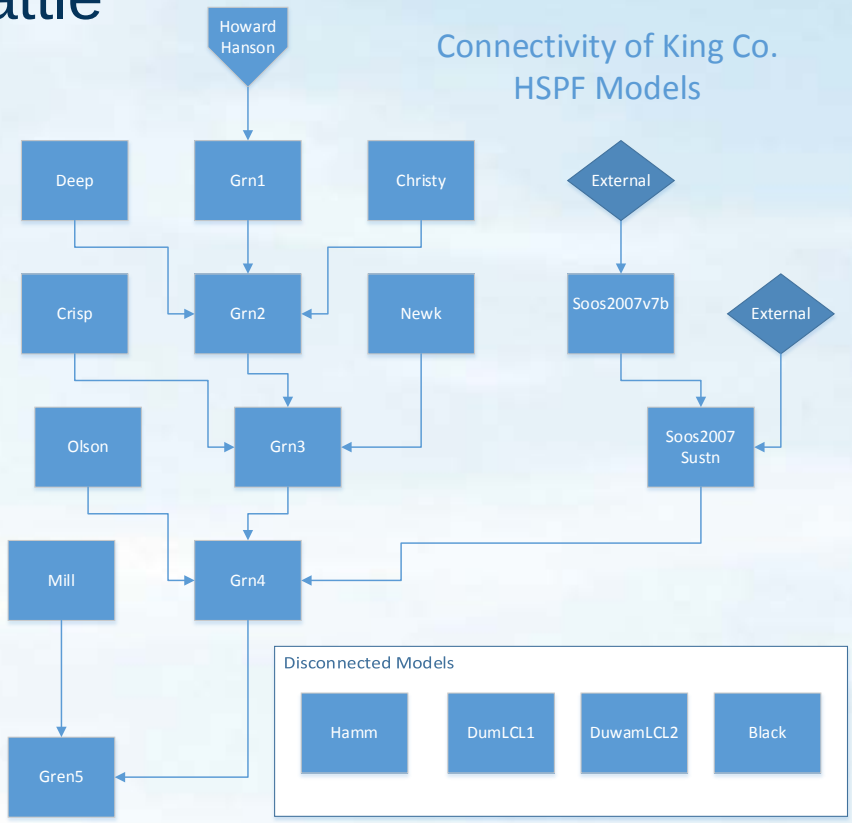


LSPC Watershed Model

- Previous TAC meeting (July 6, 2015) went through the characteristics and proposed application of the LSPC model in detail.
  - *We won't repeat that material here…*
  - Focus here on decisions and refinements made in conjunction with QAPP
  - Example of first phases of calibration process
- Phased approach – First phase addresses flow and sediment calibration
  - may be further refinements (and additional data) for toxics calibration

Refinements to Existing HSPF Models

- Combine 17 linked HSPF model to one LSPC model
- Extend model area to cover direct drainage to LDW within City of Seattle



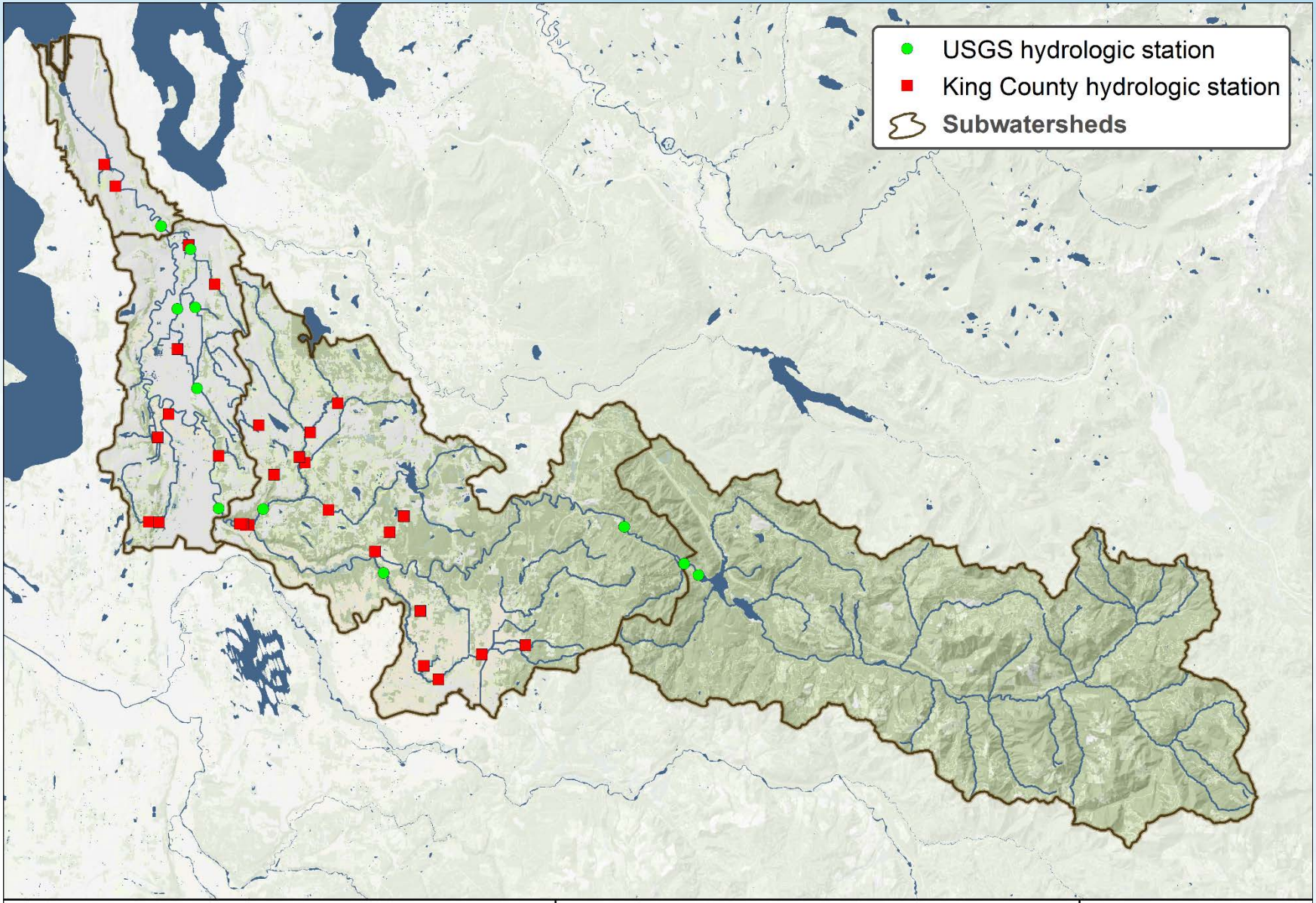
Model Boundaries and Time Period

- Work with existing (2007) land use classes
- Treat Howard Hanson Dam as boundary condition
  - Do not model upstream watershed
  - Use gaged flows
  - Use fixed (seasonal?) assumptions for water quality
  - Check flow, temperature and water quality performance based on downstream monitoring at Tukwila
- Time Period:
  - Extend end from 2009 to *at least* 2016
  - Hydrologic Calibration
  - Model calibration period for hydrology: 1996-2016

Calibration

- Flow
  - Continuously measured and simulated
  - Multiple volumetric error statistics
  - Nash-Sutcliffe coefficient of model fit efficiency
- Water Quality
  - Sparse, point-in-time measurements
  - Report annual and seasonal relative error statistics for sediment calibration
  - For toxics – calibration subject to change through updates to QAPP as additional data are collected

Hydrologic Calibration



Duwamish and Green River Watersheds
Flow Gage Locations

Map produced by H. Nicholas, 02-29-2016
NAD_1983_HARN_StatePlane_Washington_South_FIPS_4602_Feet

N

0 3 6 12 Kilometers

0 3 6 12 Miles

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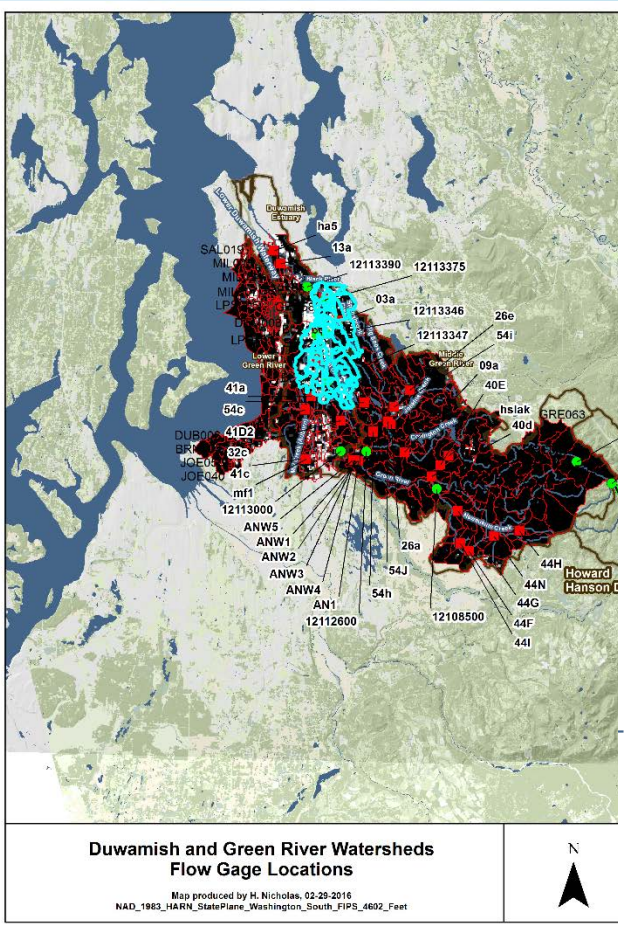
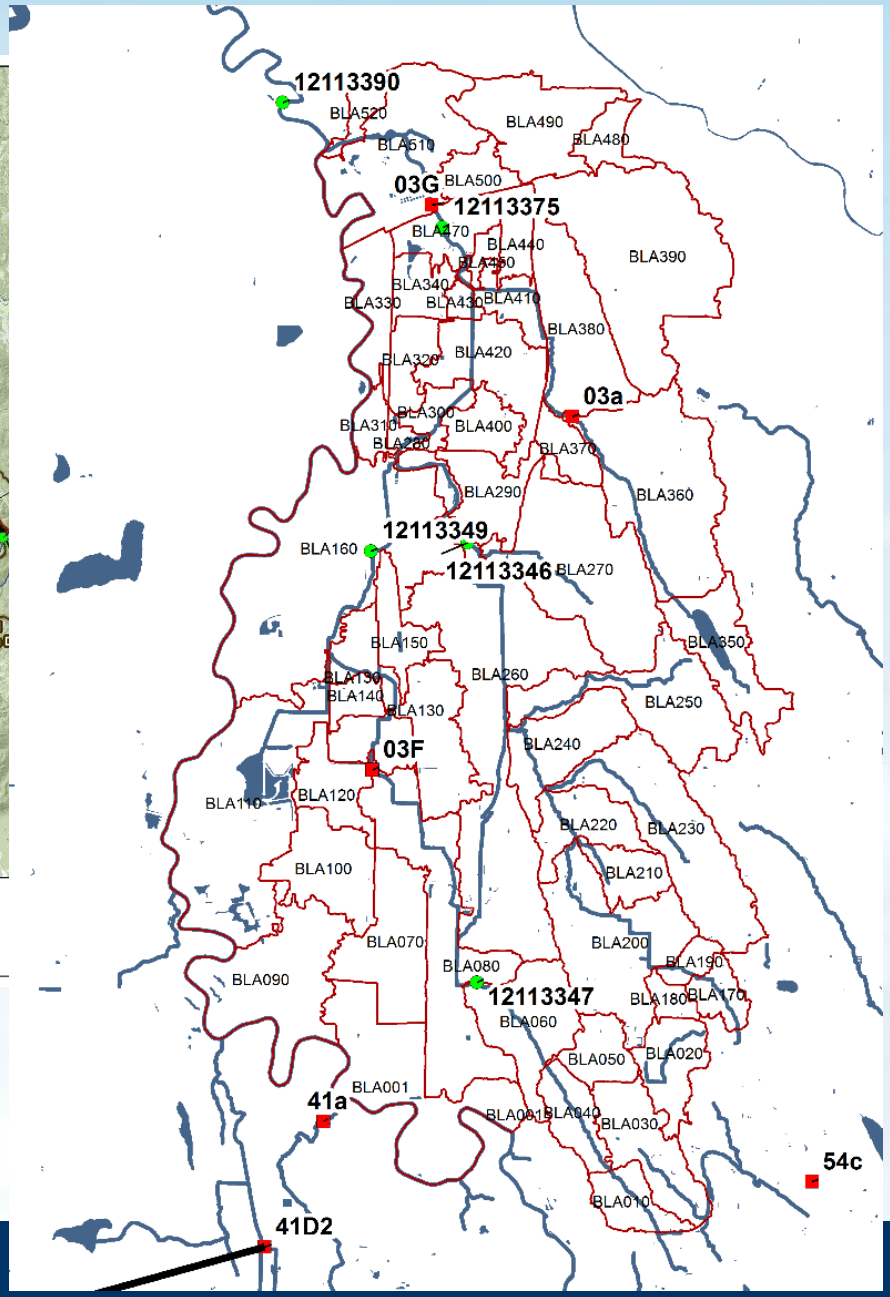
Sediment Transport Calibration

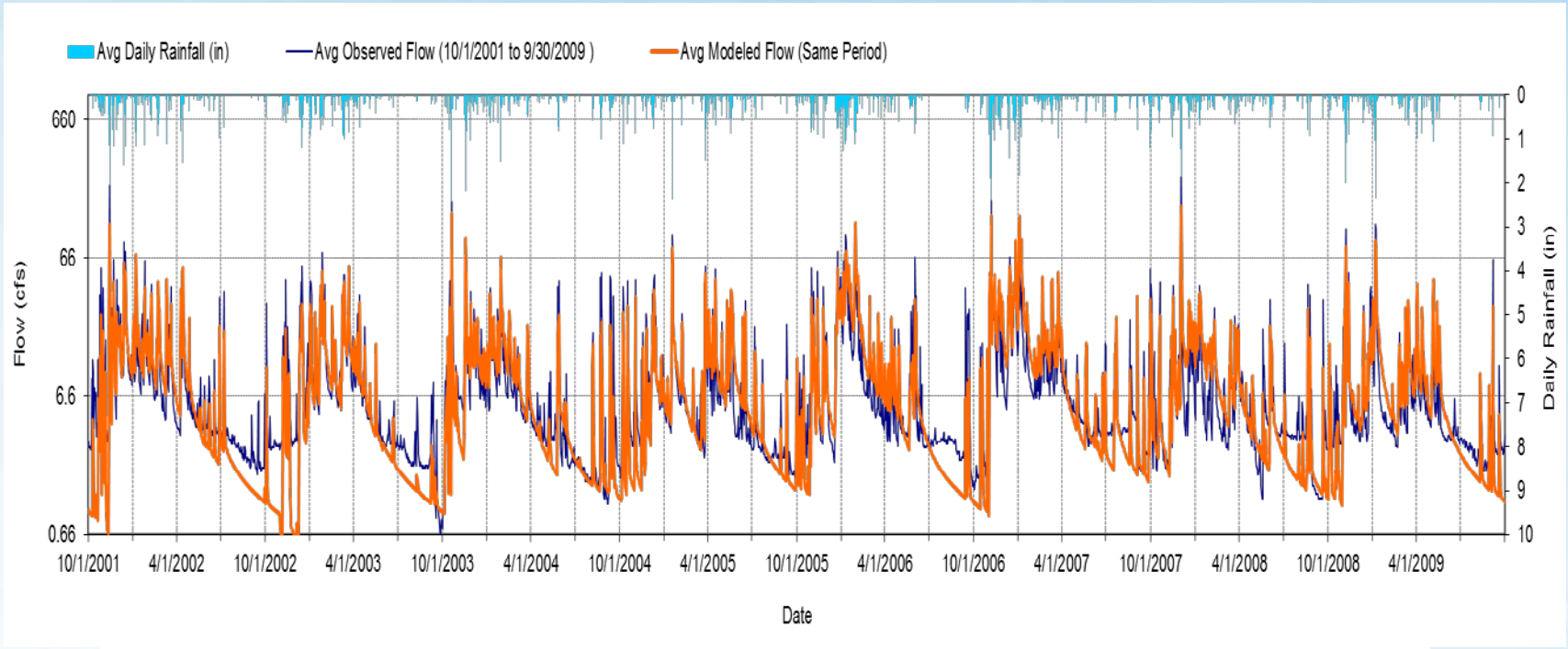
- Existing hydrology calibration is reasonable
  - Will extend calibration and identify potential improvements
- Sediment transport:
  - Limited suspended sediment data
  - Depends on channel scour and deposition processes
- Strategy
  - Use all available data to improve hydraulic simulation of shear stress and scour/deposition
  - Use 1996-2016/7 data as available for calibration
    - Use all data
    - Spatial corroboration by fitting to multiple monitoring points

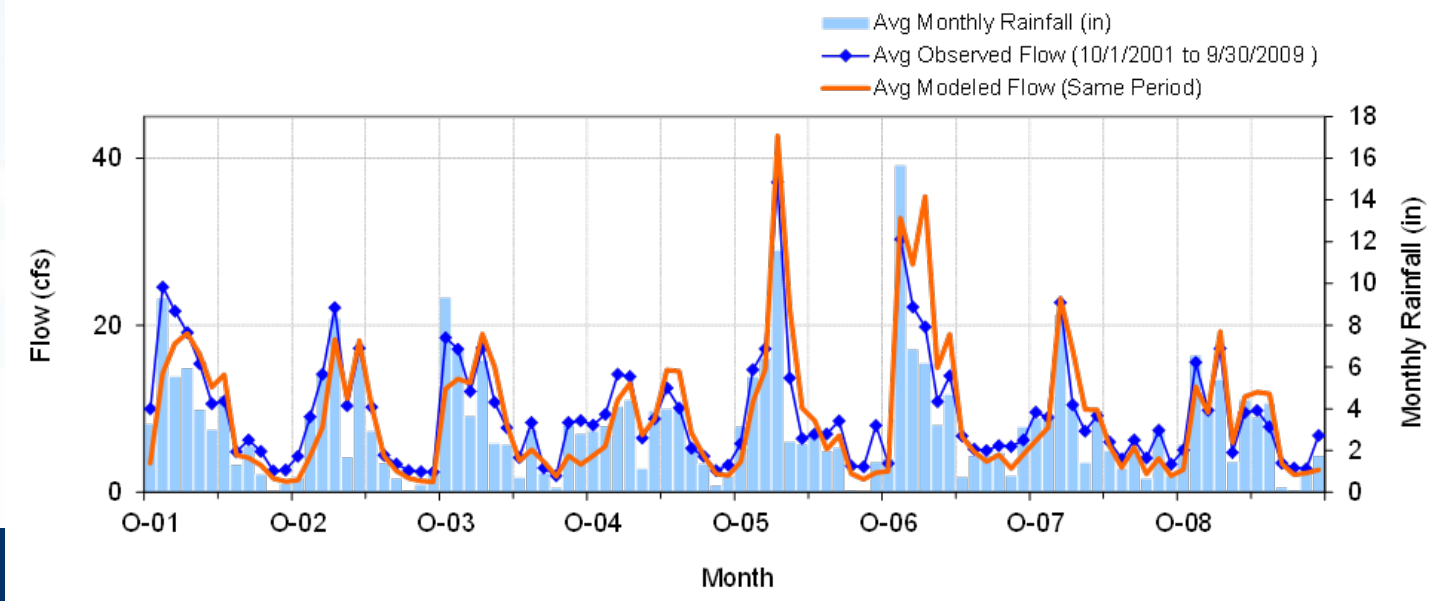
Example: Black River / Springbrook Creek Model





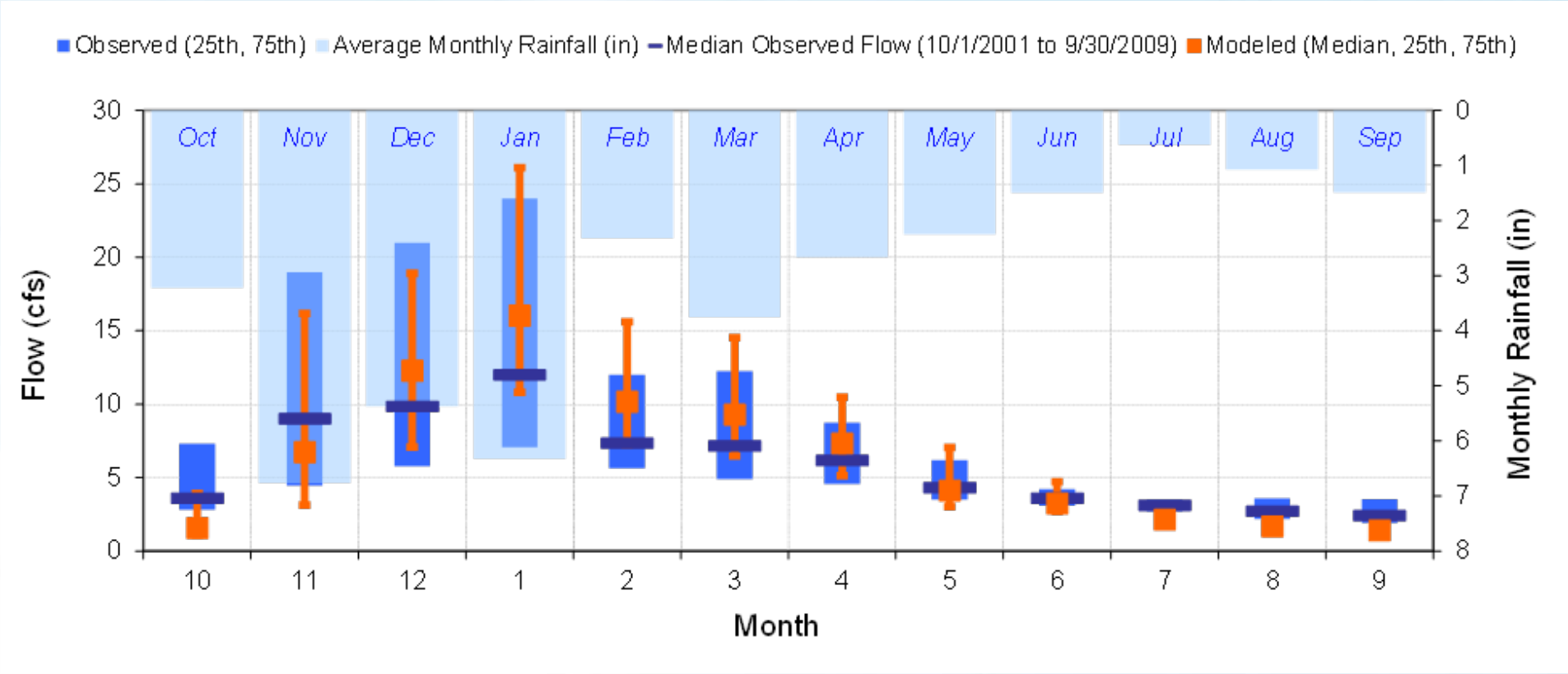
Gage 12113346: Springbrook Creek nr Orilla





Gage 12113346: Springbrook Creek nr Orilla

- Over-predicts in Winter-Spring; under in Summer-Fall…

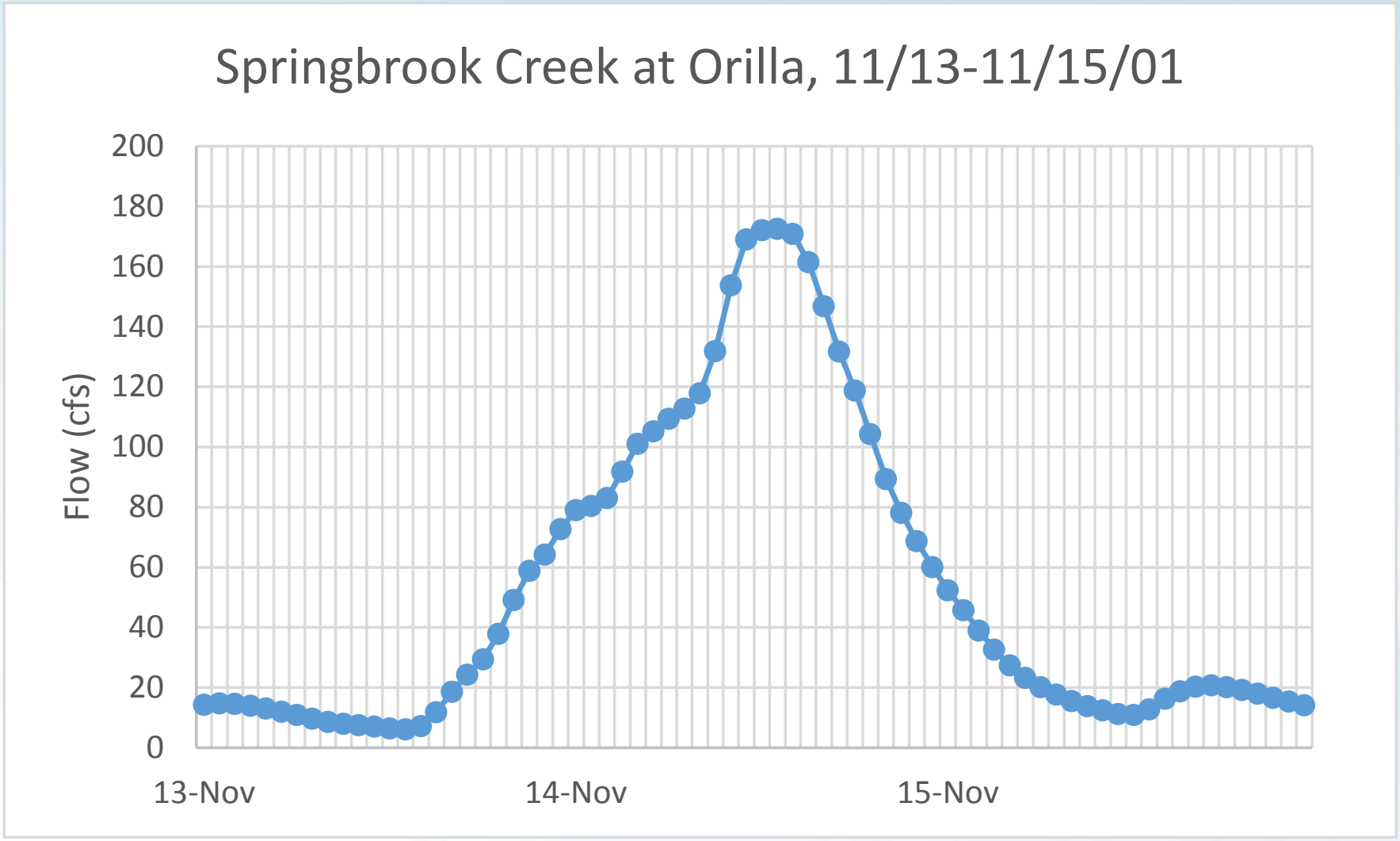


Error Stats : Springbrook Creek nr Orilla

HSPF Simulated Flow		Observed Flow Gage	
REACH OUTFLOW FROM DSN 262		12113346 Springbrook Creek near Orilla	
8-Year Analysis Period: 10/1/2001 - 9/30/2009		Manually Entered Data	
Flow volumes are (inches/year) for upstream drainage area		Drainage Area (sq-mi): 8.44	
Total Simulated In-stream Flow:	**14.65**	Total Observed In-stream Flow:	**15.34**
Total of simulated highest 10% flows:	**5.99**	Total of Observed highest 10% flows:	**6.62**
Total of Simulated lowest 50% flows:	**1.94**	Total of Observed Lowest 50% flows:	**2.51**
Simulated Summer Flow Volume (months 7-9):	**1.05**	Observed Summer Flow Volume (7-9):	**1.78**
Simulated Fall Flow Volume (months 10-12):	**4.44**	Observed Fall Flow Volume (10-12):	**5.54**
Simulated Winter Flow Volume (months 1-3):	**6.40**	Observed Winter Flow Volume (1-3):	**5.35**
Simulated Spring Flow Volume (months 4-6):	**2.76**	Observed Spring Flow Volume (4-6):	**2.68**
Total Simulated Storm Volume:	**4.24**	Total Observed Storm Volume:	**5.56**
Simulated Summer Storm Volume (7-9):	**0.28**	Observed Summer Storm Volume (7-9):	**0.60**

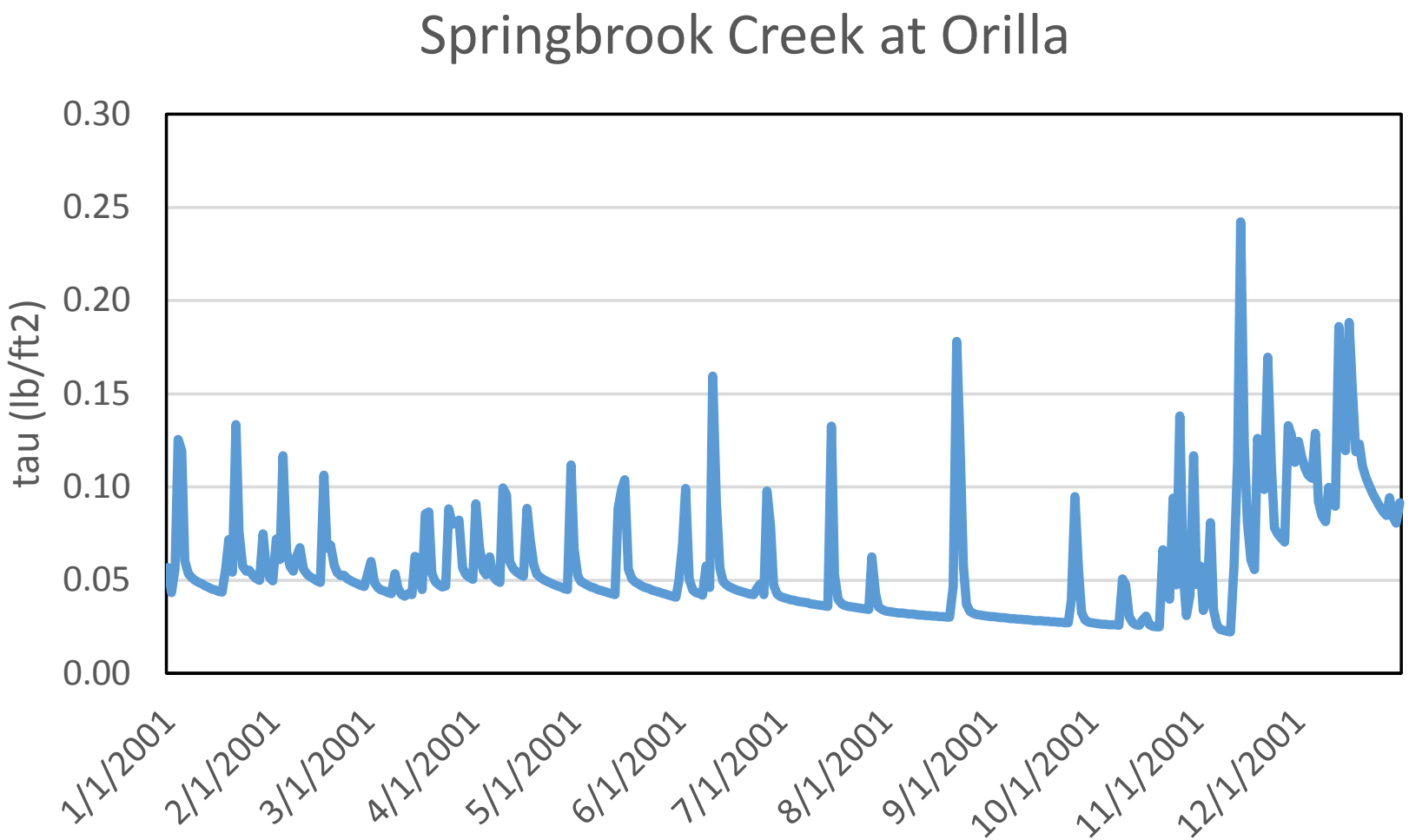
Errors (Simulated-Observed)	*Error Statistics*	*Recommended Criteria*
Error in total volume:	-4.51	10
Error in 50% lowest flows:	**-22.68**	**10**
Error in 10% highest flows:	-9.53	15
Seasonal volume error - Summer:	**-41.04**	**30**
Seasonal volume error - Fall:	-19.87	30
Seasonal volume error - Winter:	19.64	30
Seasonal volume error - Spring:	3.32	30
Error in storm volumes:	**-23.65**	**20**
Error in summer storm volumes:	**-53.06**	**50**
Nash-Sutcliffe Coefficient of Efficiency, E:	0.785	Model accuracy increases toward 1.0
Baseline adjusted coefficient (Garrick), E':	0.570	
Monthly NSE	0.724	

Sub-daily Hydraulic Analysis – simulated hourly or 15 minute flows

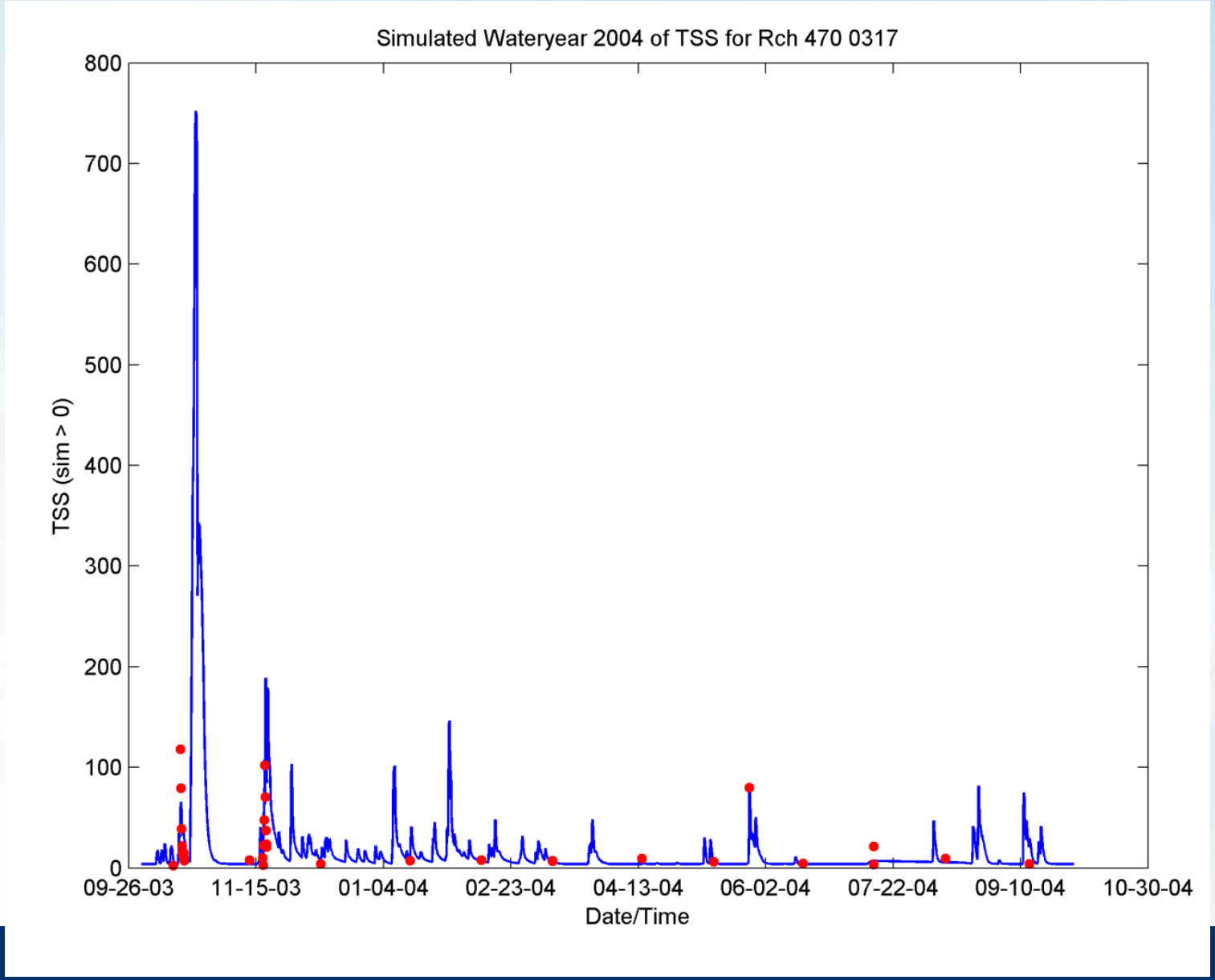


Simulated Shear Stress

- Controls channel scour/deposition of cohesive sediment



Black R. : Suspended sediment calibration



Watershed Model – Next steps

- Starting now, we will assemble information:
  - Spatial data
  - Flow and suspended sediment calibration time series
  - Meteorological data
  - Additional hydraulic information
- After QAPP finalization
  - Convert existing model structure to LSPC
  - Extend boundary inputs to new time period
  - Hydrodynamic re-calibration
  - Sediment Transport re-calibration
- And then…
  - Toxics data assembly and calibration

Questions and Discussion
(It's always sunny in Seattle!)