

Hughes River TMDL Calibrations

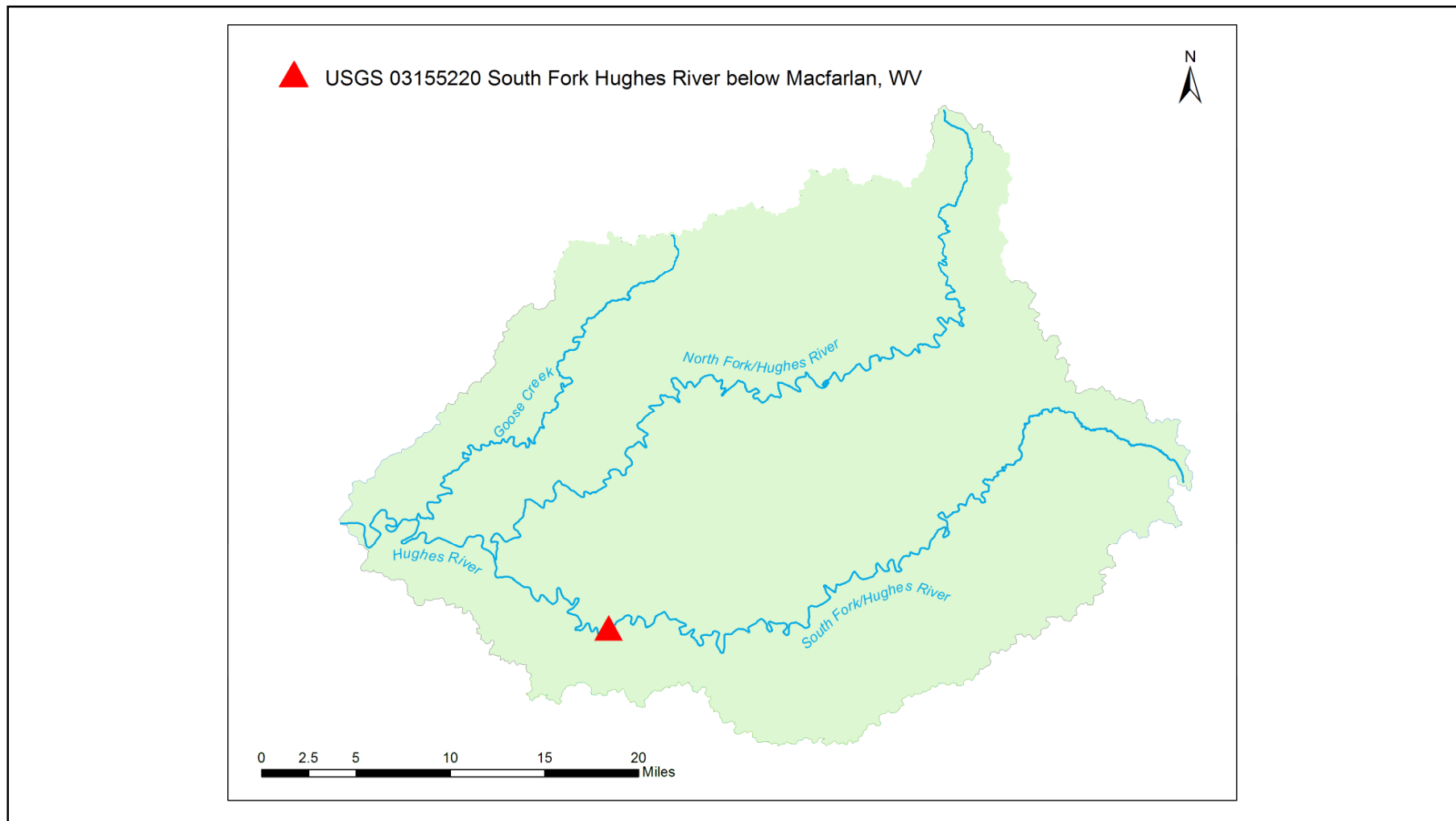
Hydrology Calibration

Fecal Coliform Water Quality Calibration

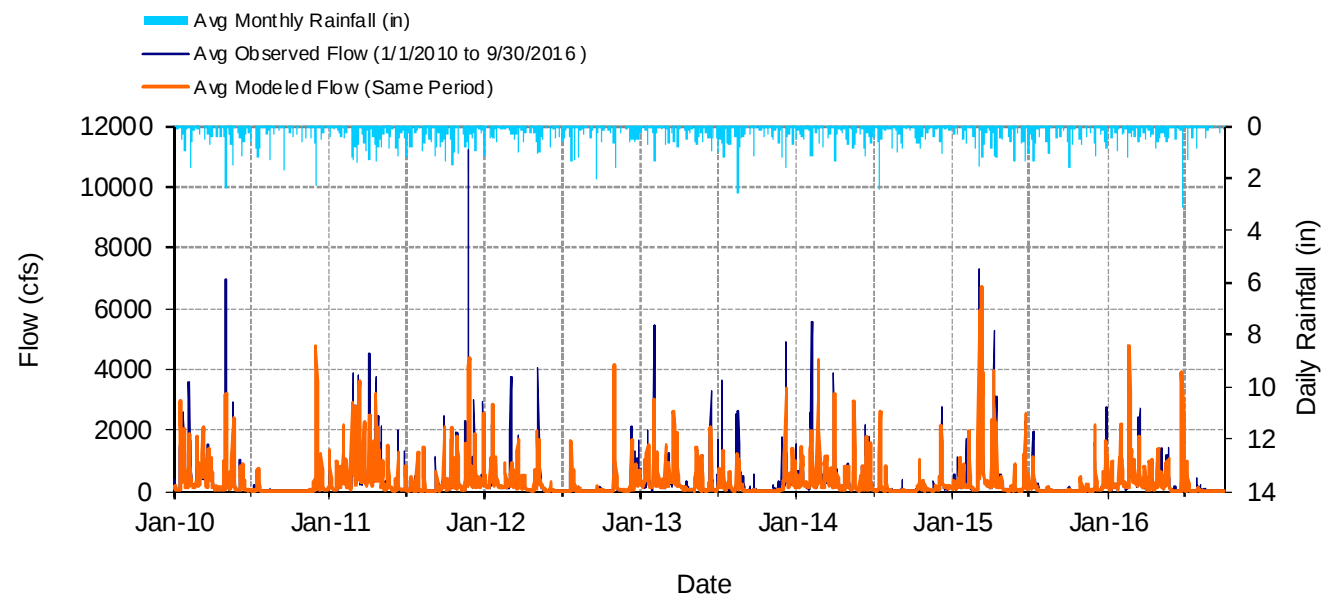
Iron Water Quality Calibration

Hydrology Calibration

Group D3 TMDL
Hughes River
Draft Model Hydrology Calibration
January 12, 2017

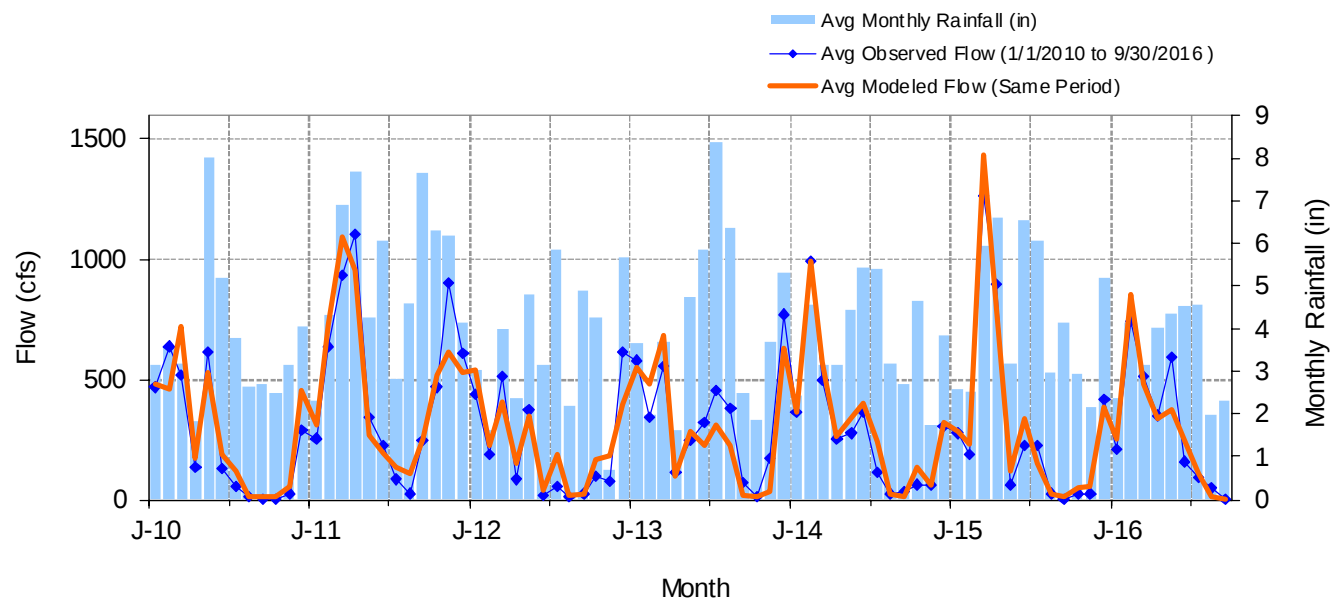


Mean Daily Flow

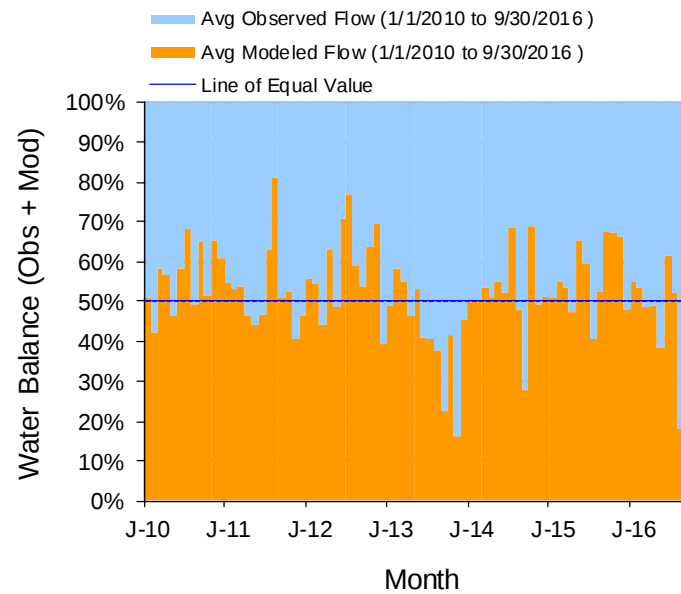
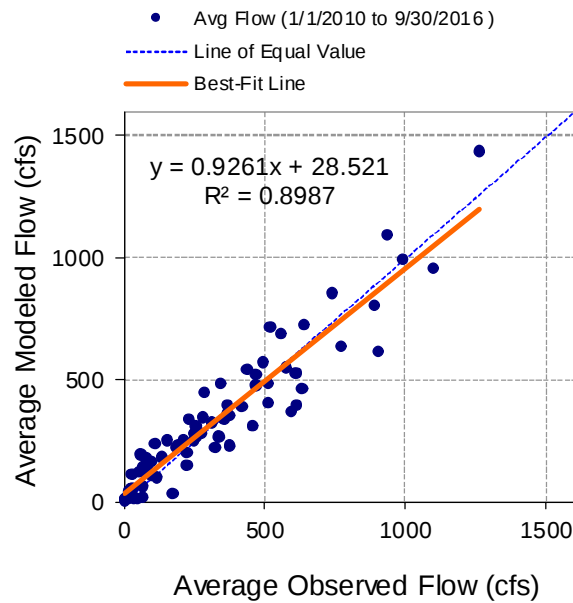


Model Outlet 216 vs. USGS 03155220 South Fork Hughes River Below Macfarlan, WV

Mean Monthly Flow

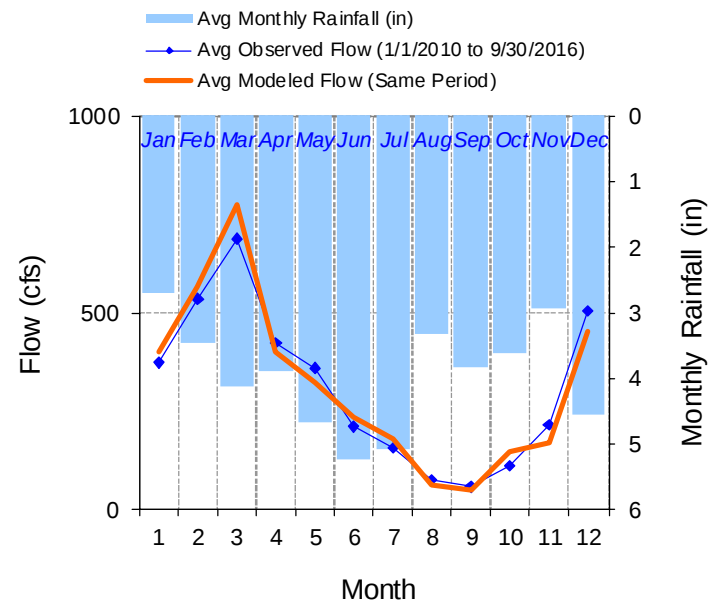
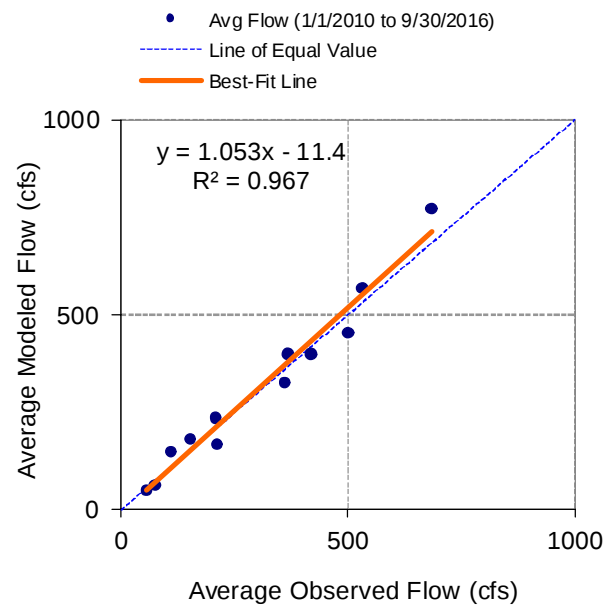


Monthly Regression and Temporal Variation



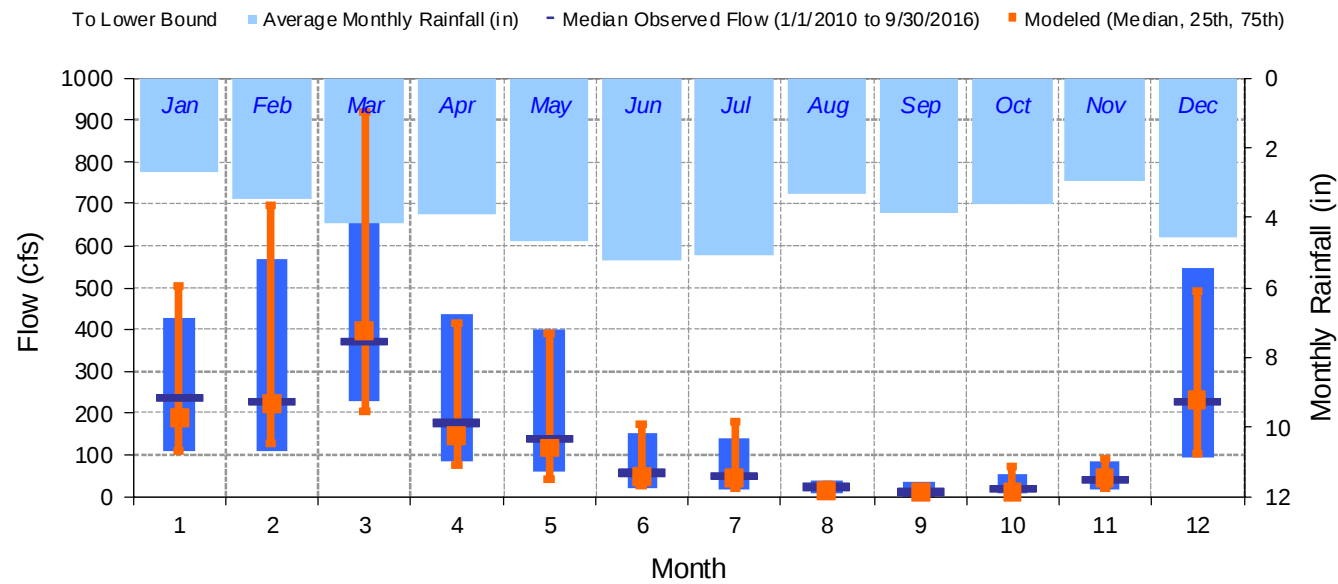
Model Outlet 216 vs. USGS 03155220 South Fork Hughes River Below Macfarlan, WV

Seasonal Regression and Temporal Aggregate



Model Outlet 216 vs. USGS 03155220 South Fork Hughes River Below Macfarlan, WV

Seasonal Medians and Ranges

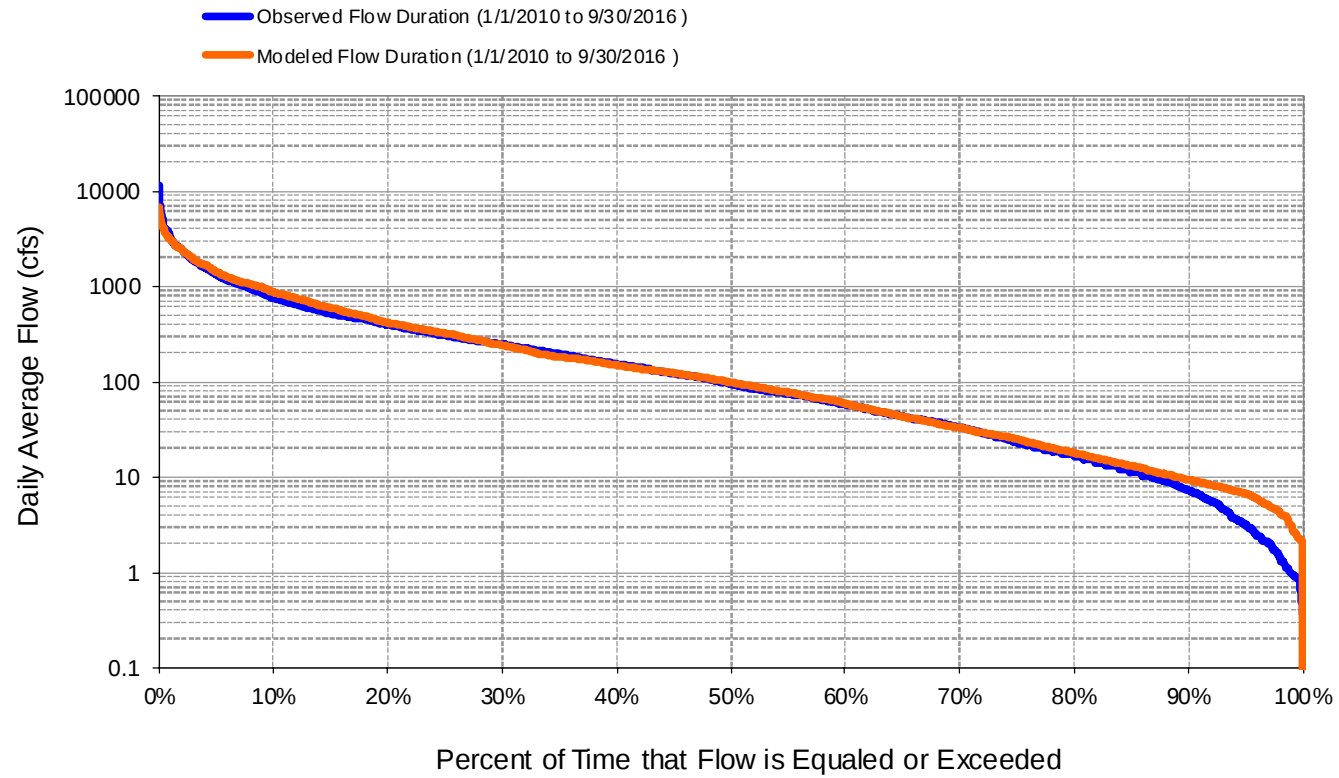


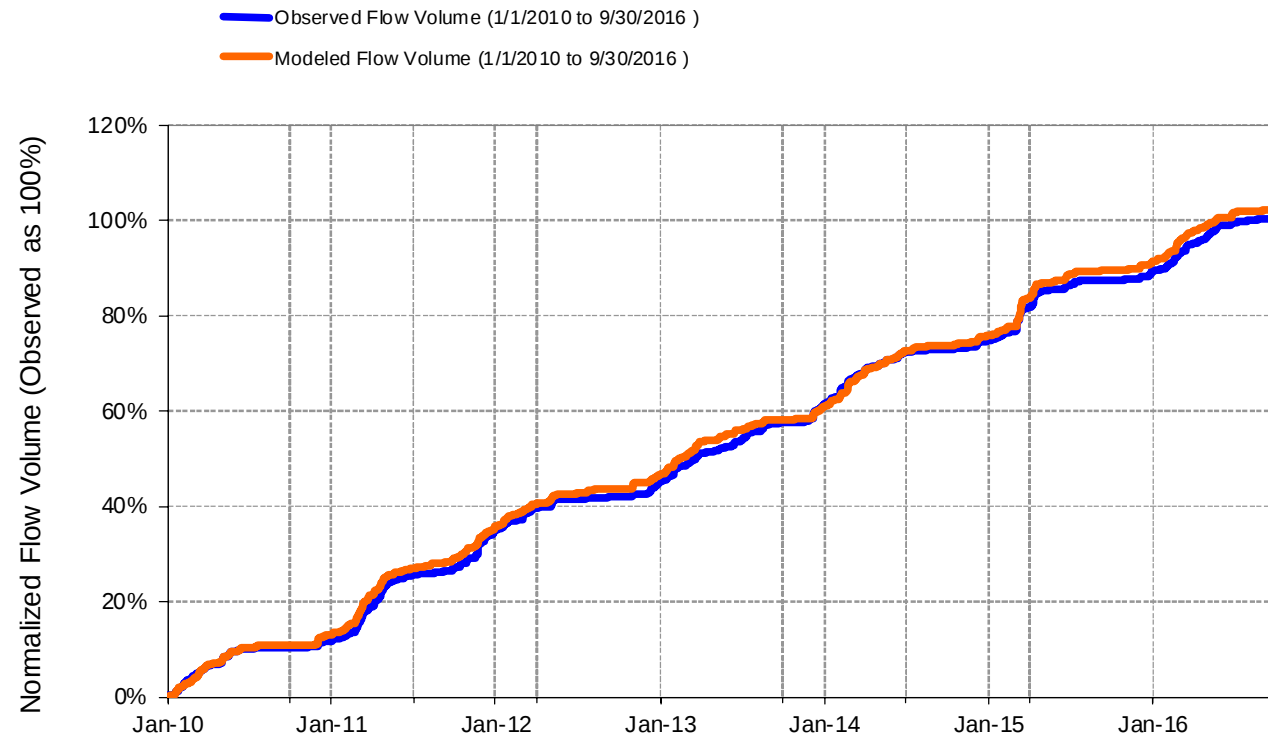
Model Outlet 216 vs. USGS 03155220 South Fork Hughes River Below Macfarlan, WV

Seasonal Summary

MONTH	OBSERVED FLOW (CFS)				MODELED FLOW (CFS)			
	MEAN	MEDIAN	25TH	75TH	MEAN	MEDIAN	25TH	75TH
Jan	369.97	230.00	109.00	427.00	397.22	188.92	109.77	503.36
Feb	532.04	222.00	109.00	566.75	566.82	222.82	126.29	694.86
Mar	684.79	365.00	227.00	657.00	770.44	395.54	203.56	919.79
Apr	420.40	172.00	84.00	435.50	396.82	146.21	77.93	416.04
May	359.48	134.00	58.00	398.00	323.10	116.81	43.42	387.98
Jun	207.21	52.00	21.25	150.75	232.78	48.88	25.94	172.77
Jul	154.21	44.00	16.00	139.00	178.99	44.13	19.66	177.08
Aug	75.56	18.00	7.50	40.00	61.62	15.18	9.74	28.21
Sep	54.89	6.20	2.10	33.75	47.78	9.59	5.18	20.10
Oct	112.20	13.50	6.63	56.00	148.39	11.49	7.31	70.00
Nov	212.99	38.00	18.00	86.00	167.14	44.52	20.87	88.99
Dec	501.70	220.50	91.25	547.50	452.85	233.05	100.28	493.27

Model Outlet 216 vs. USGS 03155220 South Fork Hughes River Below Macfarlan, WV





LSPC Simulated Flow		Observed Flow Gage	
REACH OUTFLOW FROM SUBBASIN 216 6.75-Year Analysis Period: 1/1/2010 - 9/30/2016 Flow volumes are (inches/year) for upstream drainage area		USGS 03155220 SOUTH FORK HUGHES RIVER BELOW MACFARLAN, WV Hydrologic Unit Code: 5030203 Latitude: 39.07896905 Longitude: -81.2123373 Drainage Area (sq-m): 229	
Total Simulated In-stream Flow:	18.58	Total Observed In-stream Flow:	18.24
Total of simulated highest 10% flows:	10.38	Total of Observed highest 10% flows:	10.49
Total of Simulated lowest 50% flows:	0.97	Total of Observed Lowest 50% flows:	0.93
Simulated Summer Flow Volume (months 7-9):	1.50	Observed Summer Flow Volume (7-9):	1.48
Simulated Fall Flow Volume (months 10-12):	3.41	Observed Fall Flow Volume (10-12):	3.67
Simulated Winter Flow Volume (months 1-3):	8.80	Observed Winter Flow Volume (1-3):	8.04
Simulated Spring Flow Volume (months 4-6):	4.87	Observed Spring Flow Volume (4-6):	5.05
Total Simulated Storm Volume:	11.25	Total Observed Storm Volume:	10.84
Simulated Summer Storm Volume (7-9):	1.03	Observed Summer Storm Volume (7-9):	1.01
<i>Errors (Simulated-Observed)</i>	<i>Error Statistics</i>	<i>Recommended Criteria</i>	<i>last run</i>
Error in total volume:	1.87	10	
Error in 50% lowest flows:	4.66	10	
Error in 10% highest flows:	-1.09	15	
Seasonal volume error - Summer:	1.40	30	
Seasonal volume error - Fall:	-6.96	30	
Seasonal volume error - Winter:	9.39	30	
Seasonal volume error - Spring:	-3.56	30	
Error in storm volumes:	3.77	20	
Error in summer storm volumes:	2.14	50	
Nash-Sutcliffe Coefficient of Efficiency, E:	0.431	Model accuracy increases as E or E' approaches 1.0	
Baseline adjusted coefficient (Garrick), E':	0.446		

Fecal Coliform Water Quality Calibration

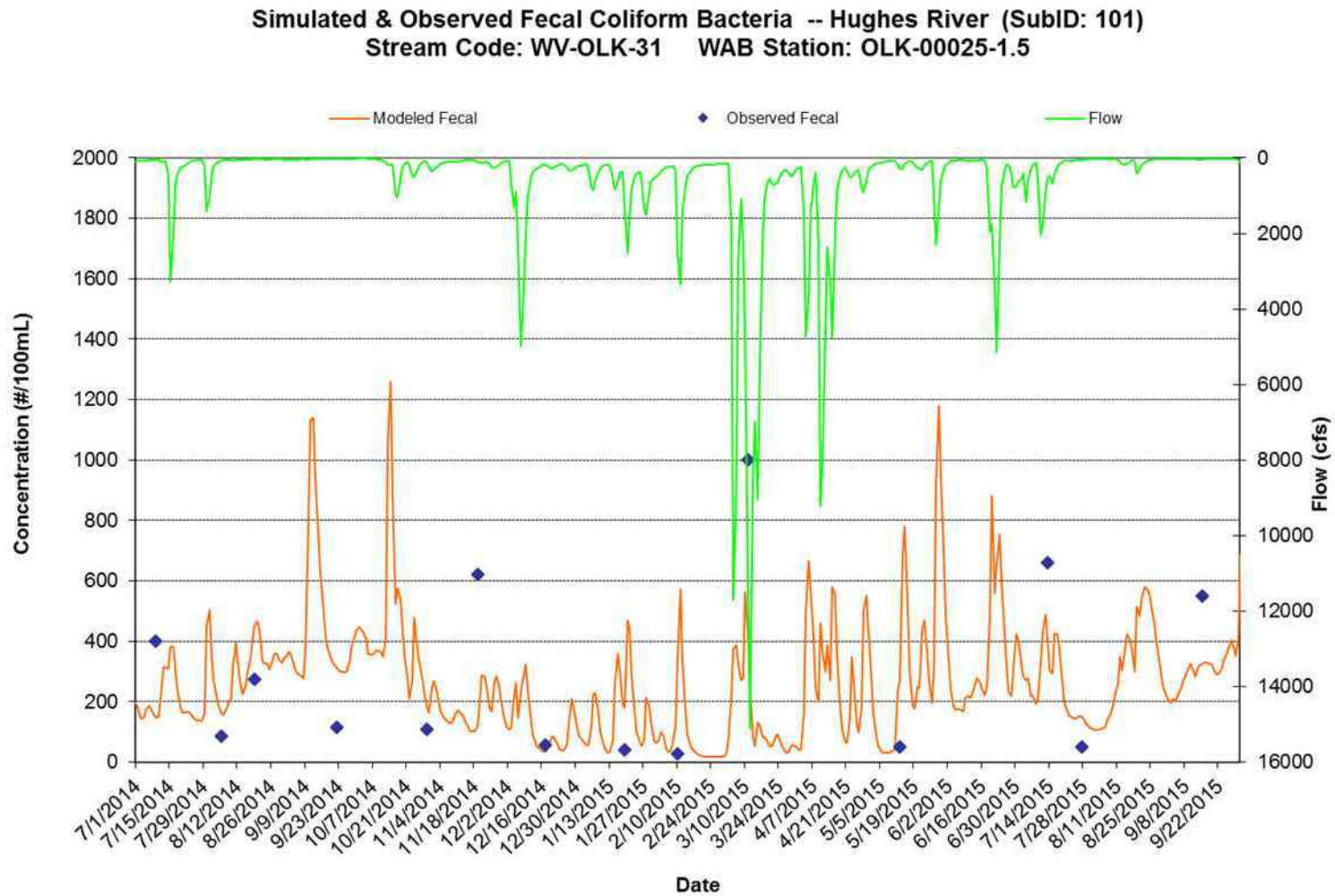
Group D3
Hughes River

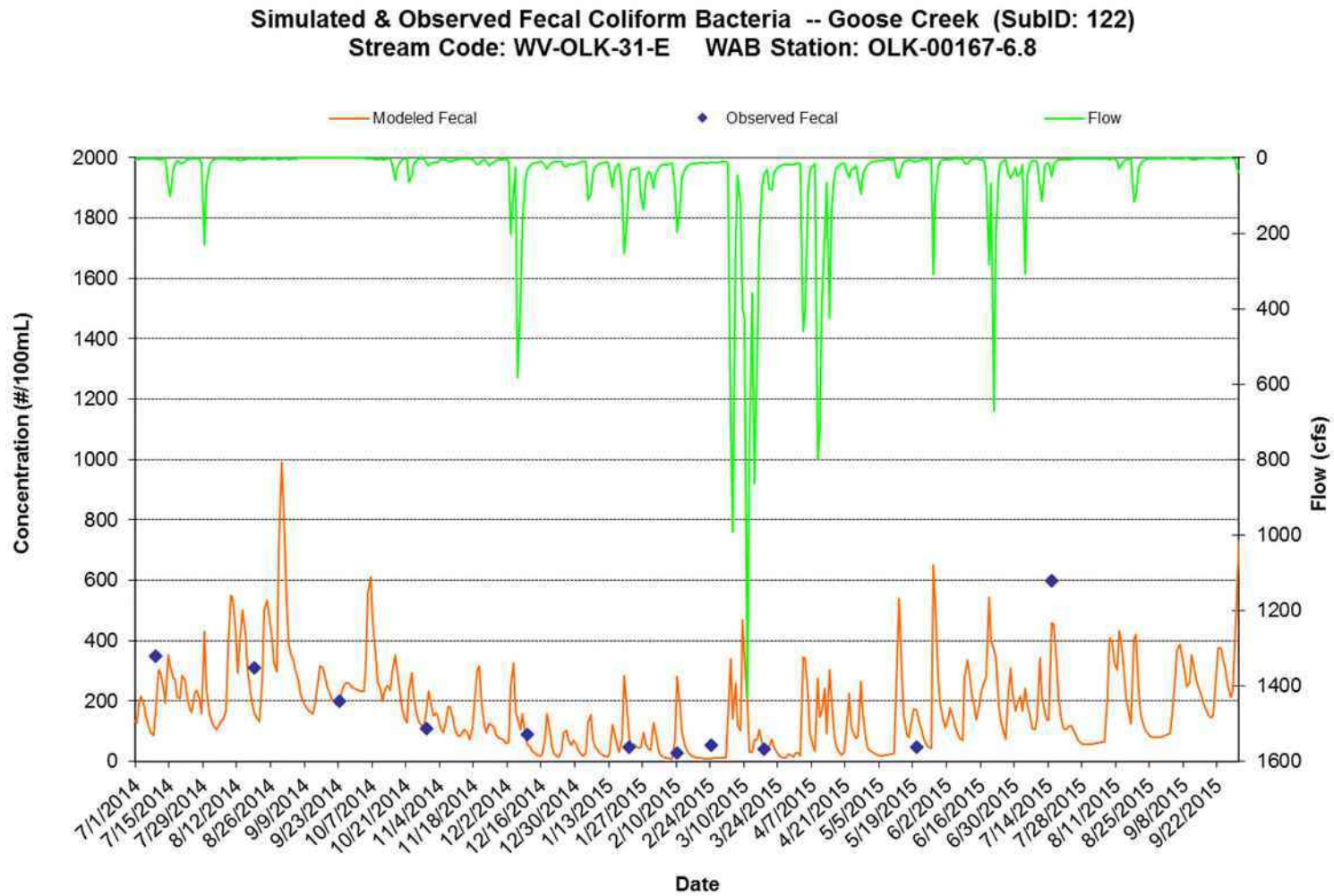
Fecal Coliform Water Quality Calibration Plots
March 21, 2017

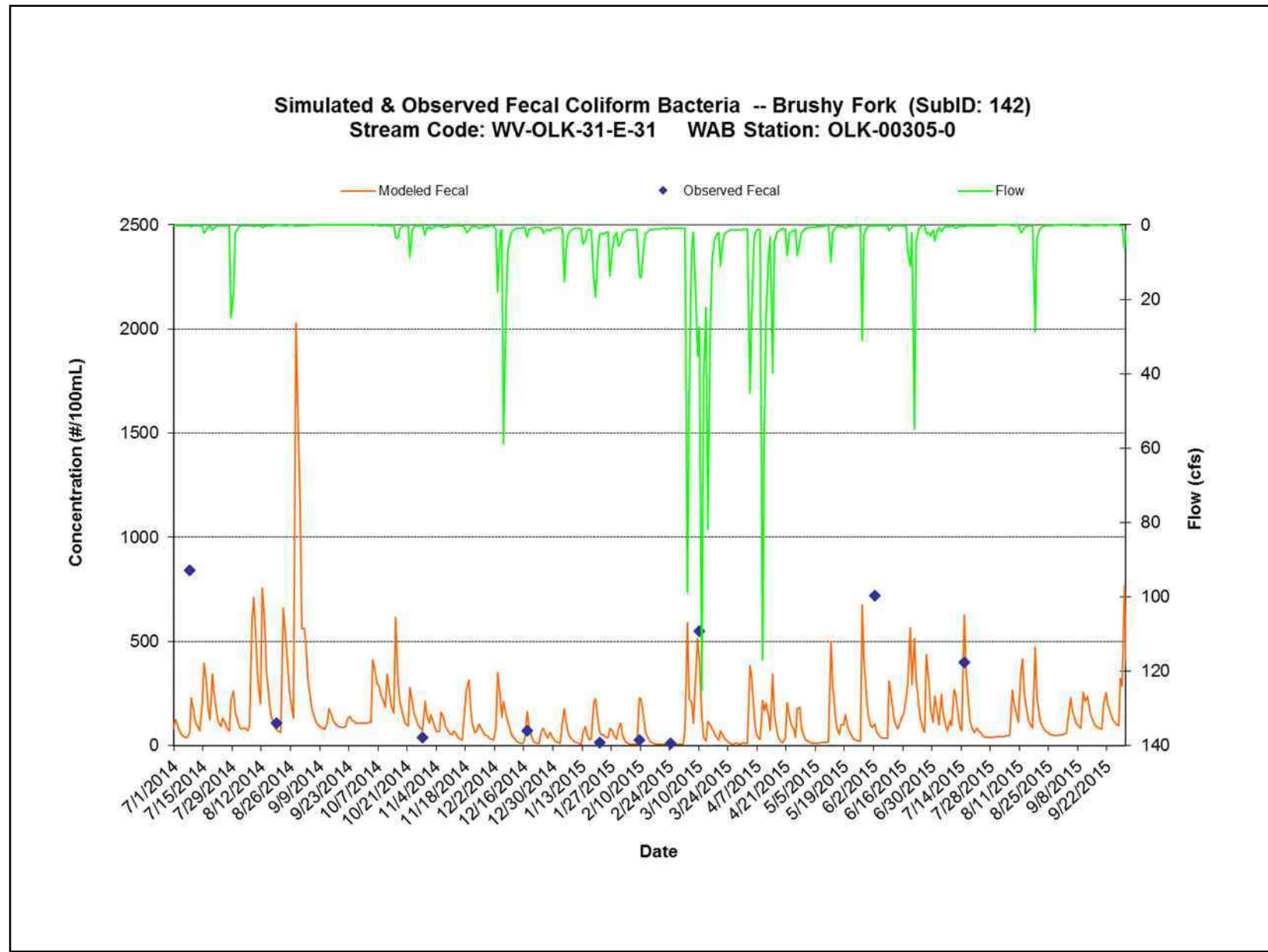
The TMDL model was run under baseline conditions with nonpoint sources, NPDES permitted point sources, and failing septics represented at 100% of loading rates.

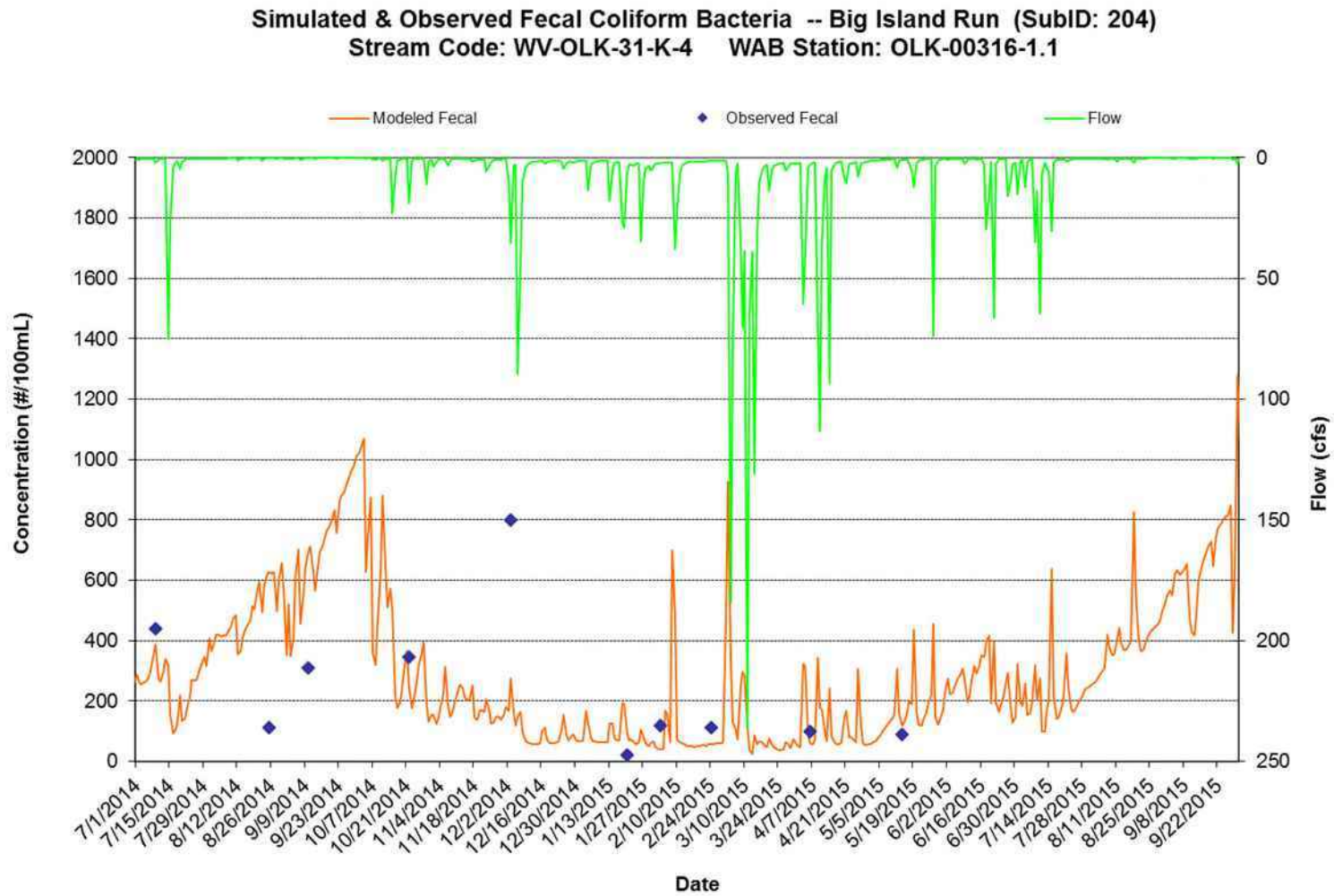
Watershed Characteristics for Calibration Plot Streams

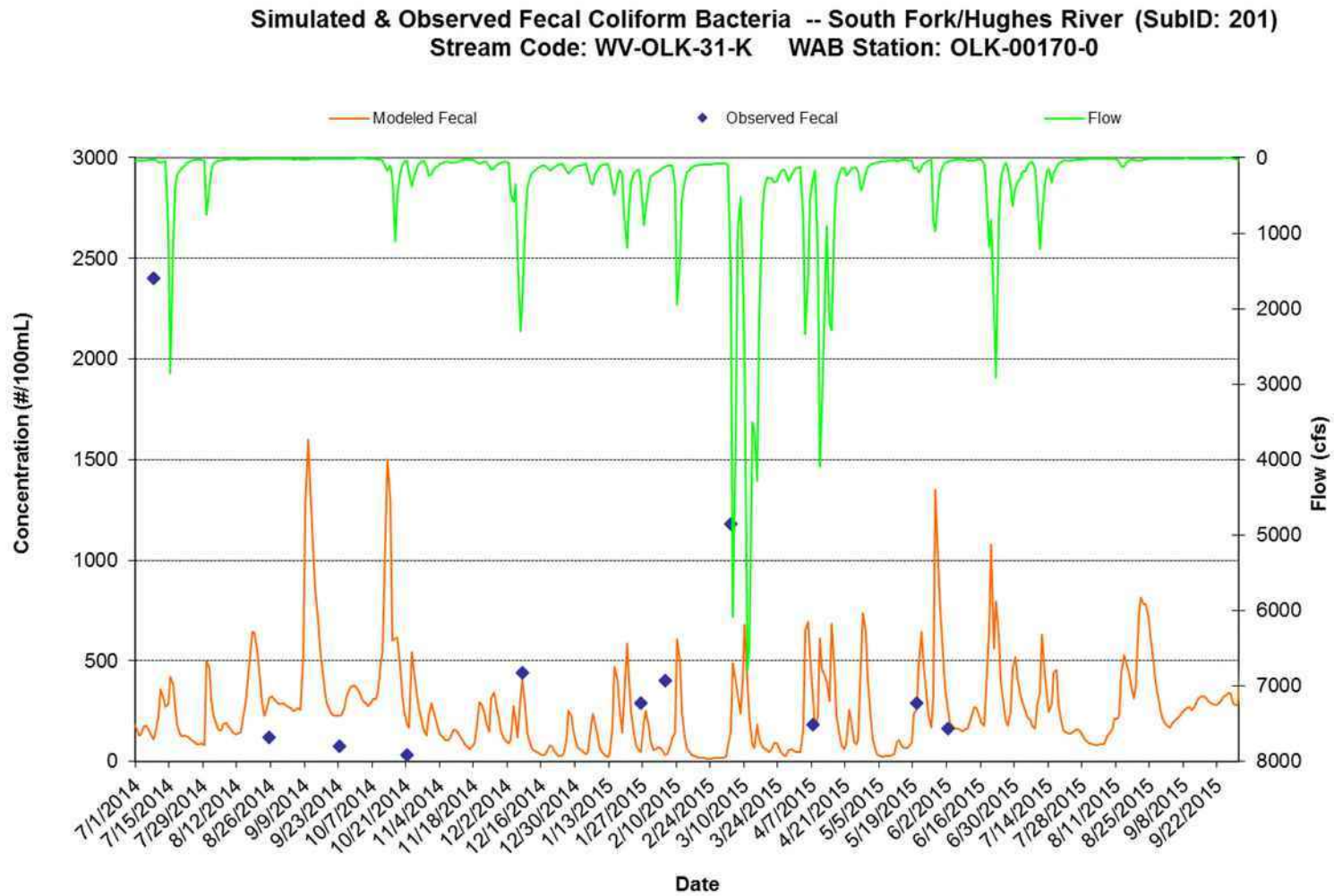
SUBID	Stream Name	Stream Size	Point Sources	Nonpoint Sources
101	Hughes River	Very Large	POTW, package plant, HAUs	Failing septic, pasture, residential
122	Goose Creek	Large	Package plant, HAUs	Failing septic, pasture, residential
142	Brushy Fork	Small		Failing septic, pasture, residential
201	South Fork/Hughes River	Large	Package plant, HAUs	Failing septic, pasture, residential
204	Big Island Run	Small		Failing septic dominant, residential
213	Louthers Run	Small		Failing septic, residential
274	Cedar Run	Small	None	Background only
325	Jesse Cain Run	Small		Failing septic, pasture, residential
331	Slab Creek	Large		Failing septic, pasture, residential
361	Turtle Run	Small		Failing septic, pasture, residential
363	Middle Fork/South Fork/Hughes River	Medium		Failing septic, pasture, residential
371	Upper Run	Small		Failing septic, pasture, residential
392	South Fork/Hughes River	Medium		Failing septic, pasture, residential
400	Sheep Run	Small	None	Failing septic, residential
501	North Fork/Hughes River	Large	Package plant, HAUs	Failing septic, pasture, residential
521	Devilhole Creek	Small		Failing septic, residential
557	Bonds Creek	Medium		Failing septic, pasture, residential
578	Whiskey Run	Small		Failing septic, residential
601	Back Run	Small		Pasture dominant, failing septic, residential
624	North Fork/Hughes River	Large		Failing septic, pasture, residential
645	Leason Run	Small		Pasture dominant, failing septic, residential
657	North Fork/Hughes River	Medium		Pasture dominant, failing septic, residential
666	Haddox Run	Small		Pasture dominant, failing septic, residential

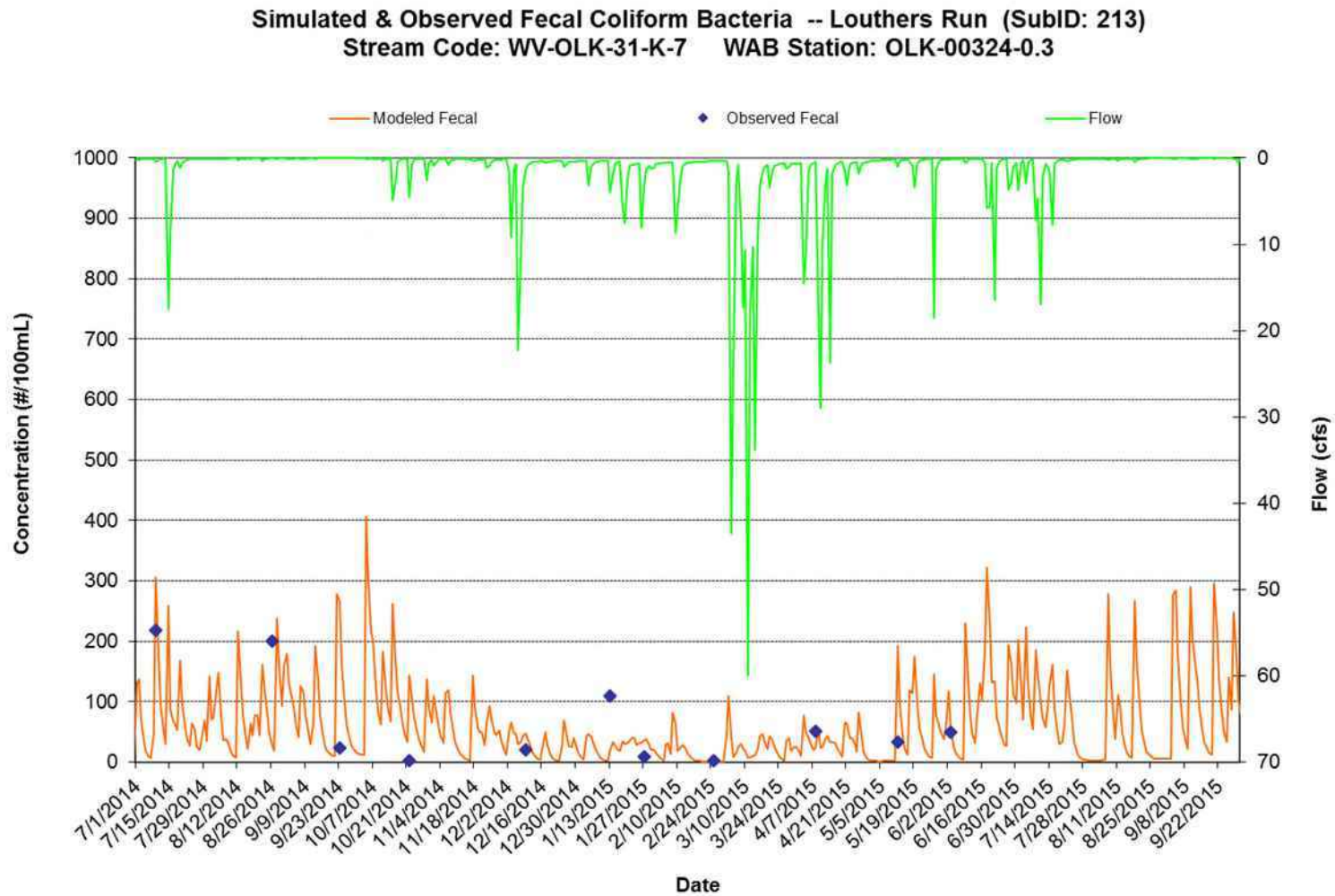


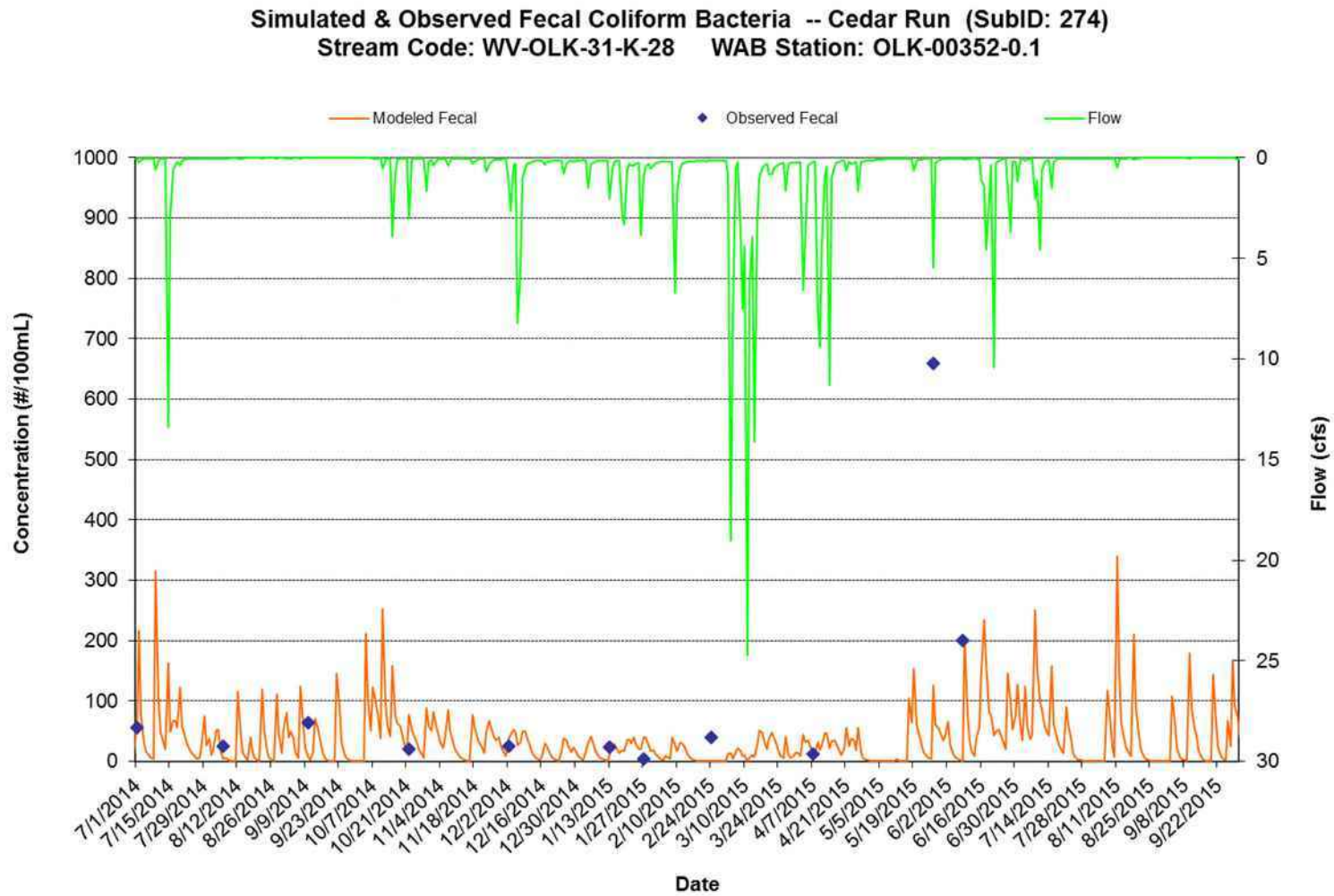


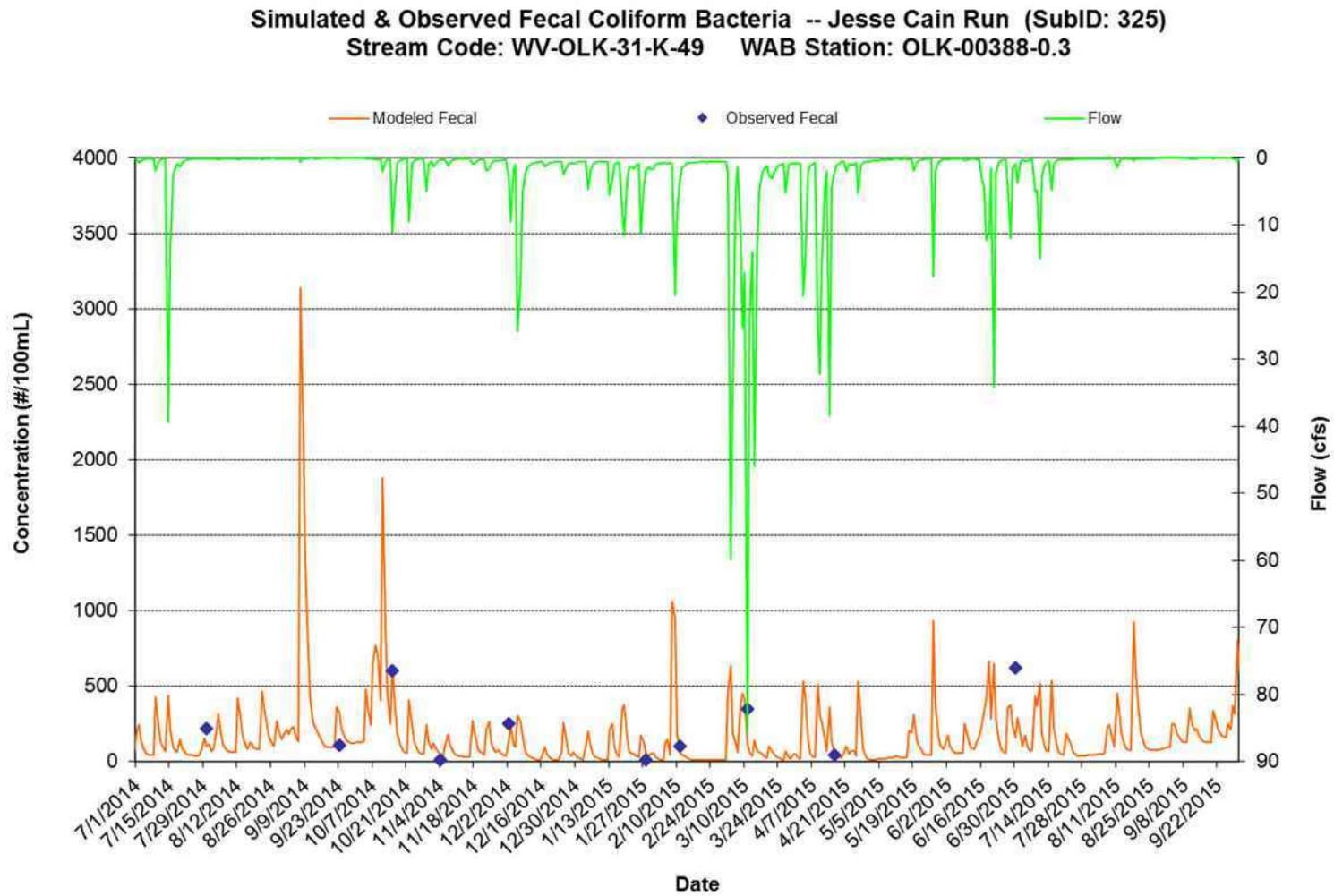


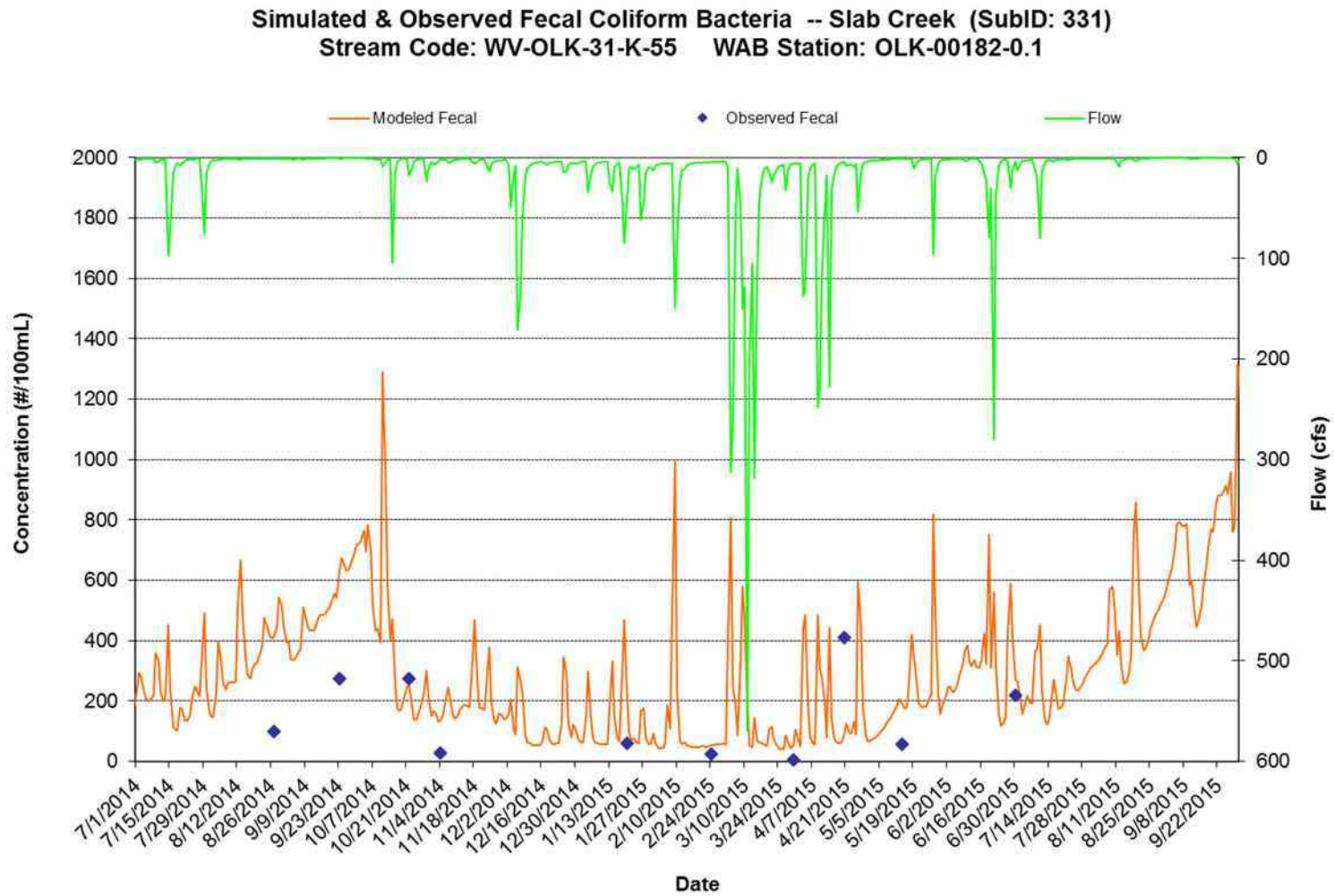


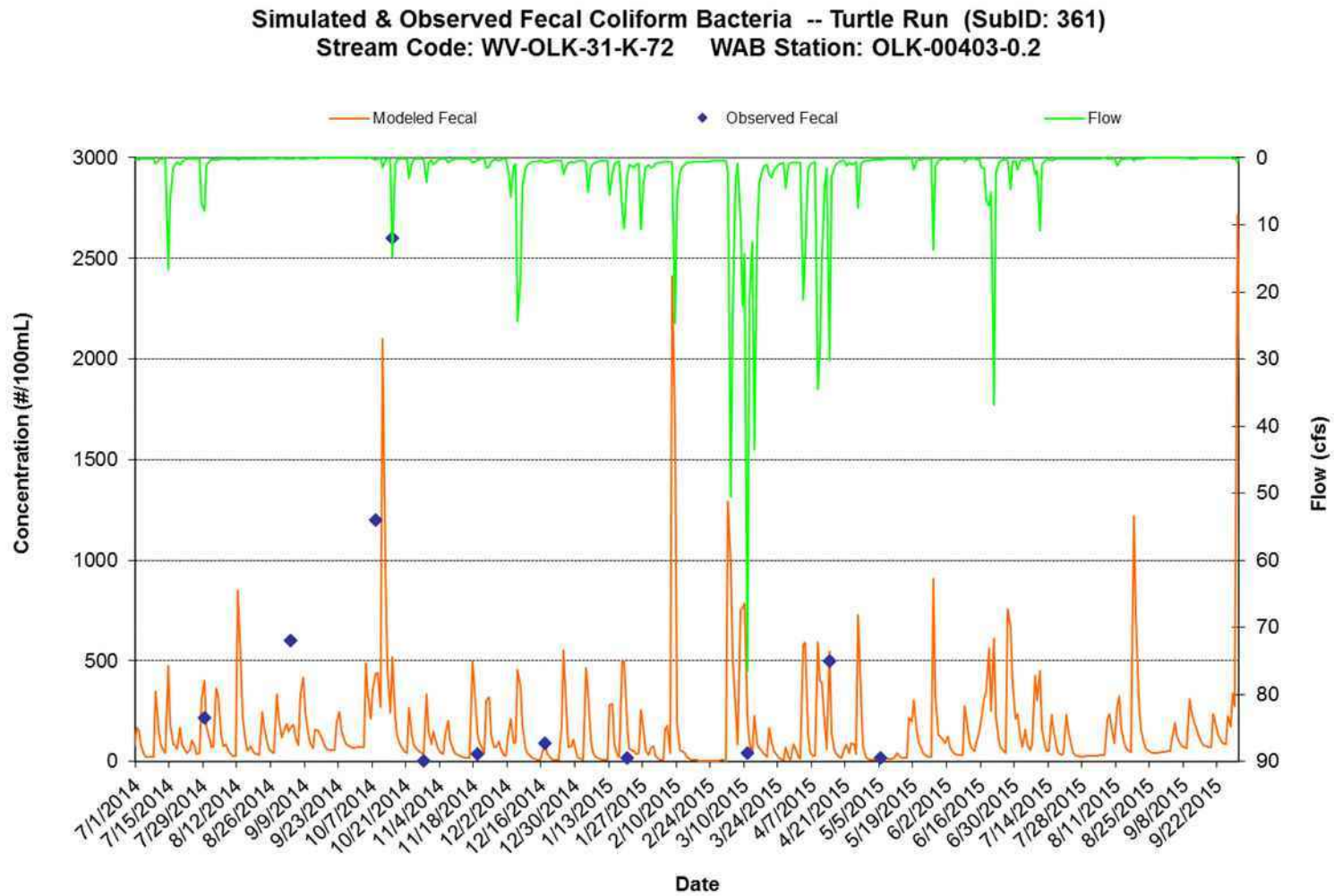


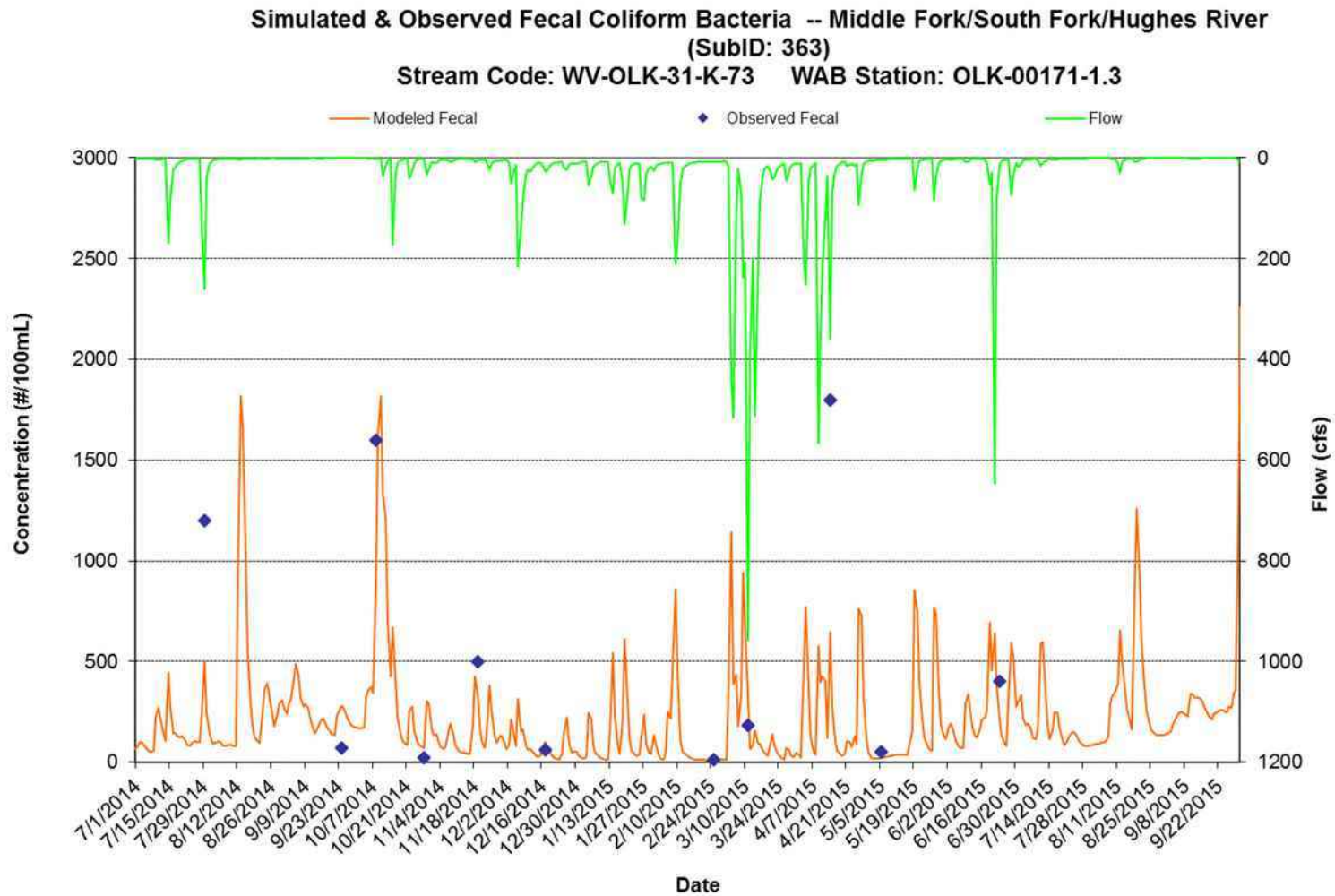


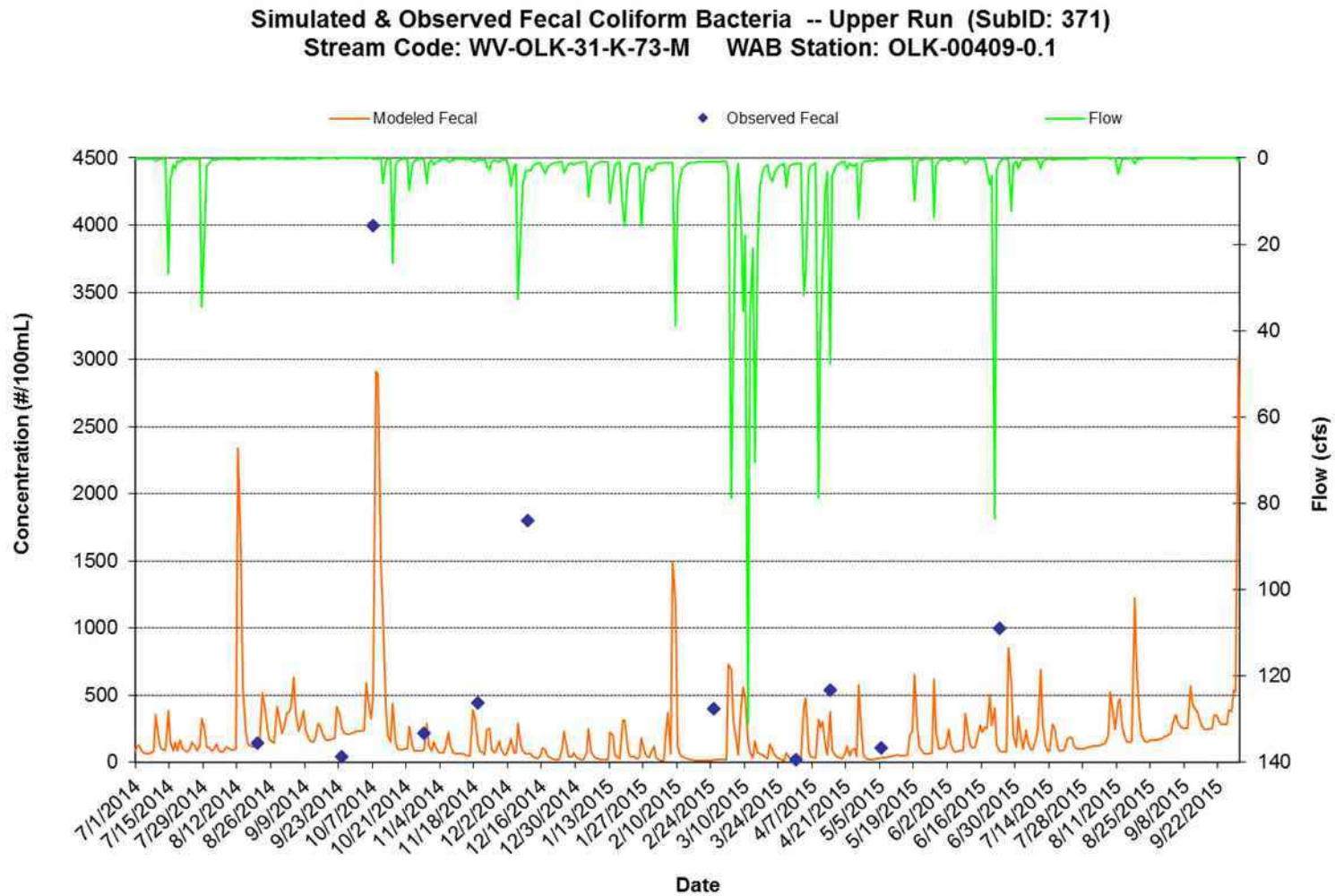


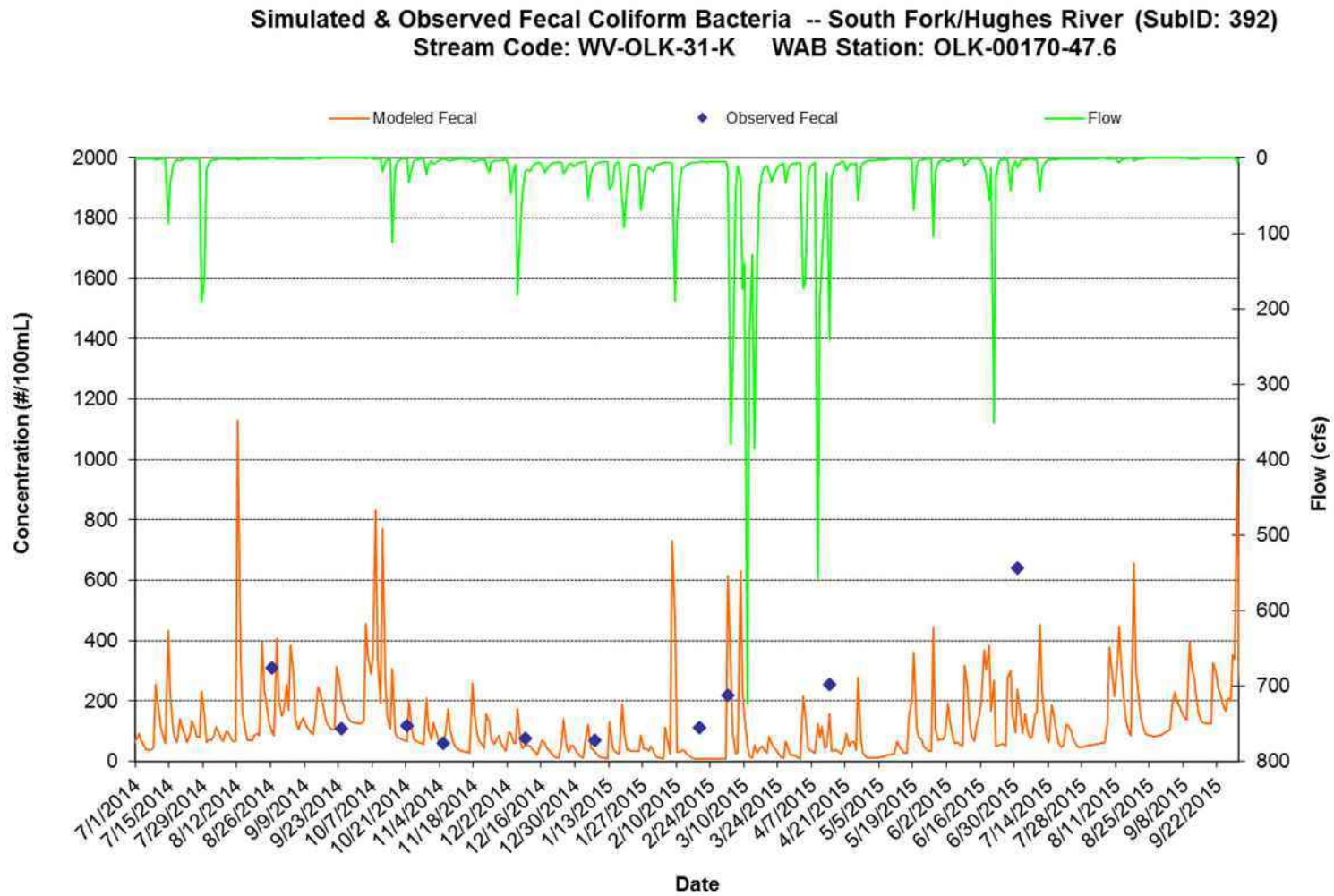


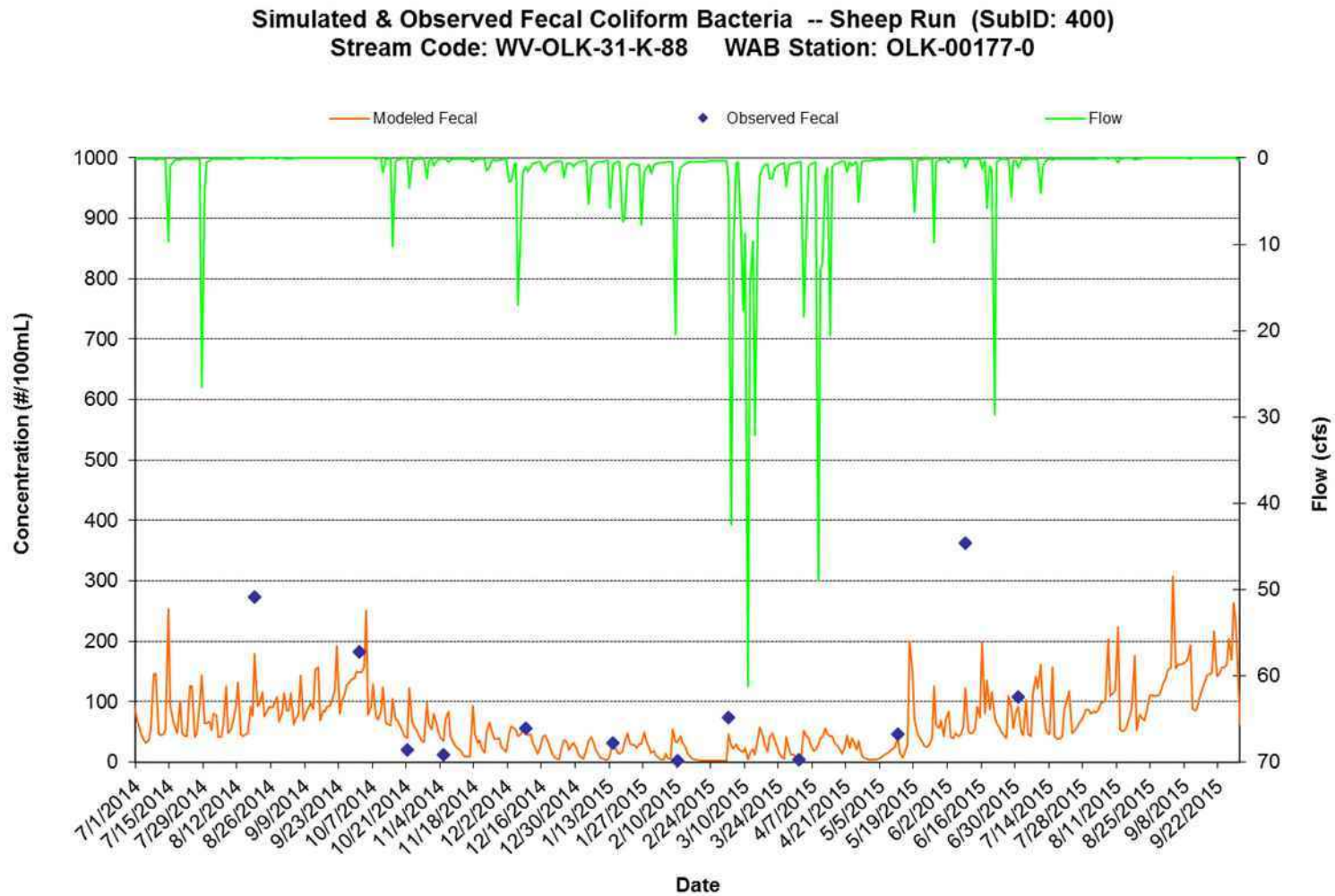


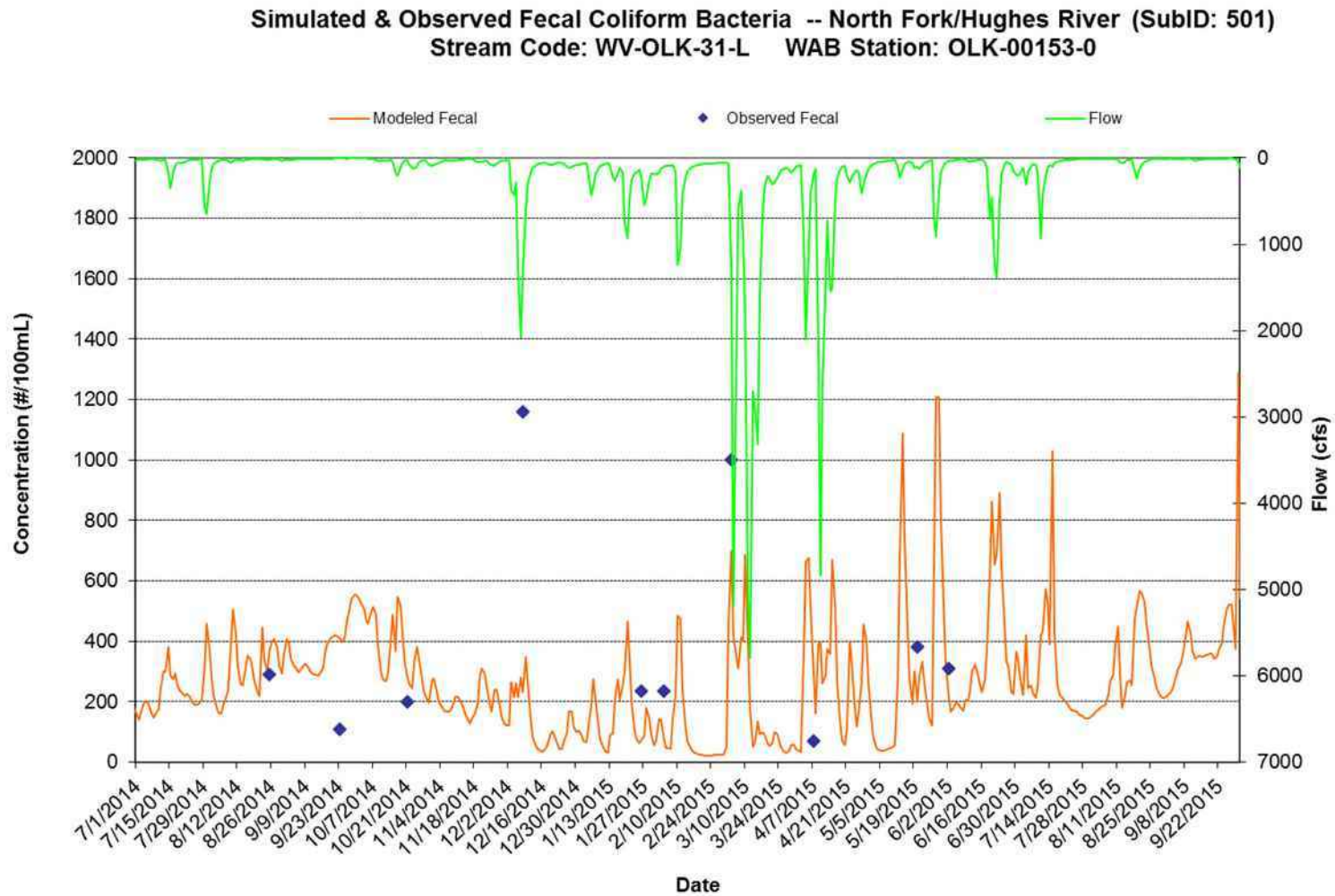


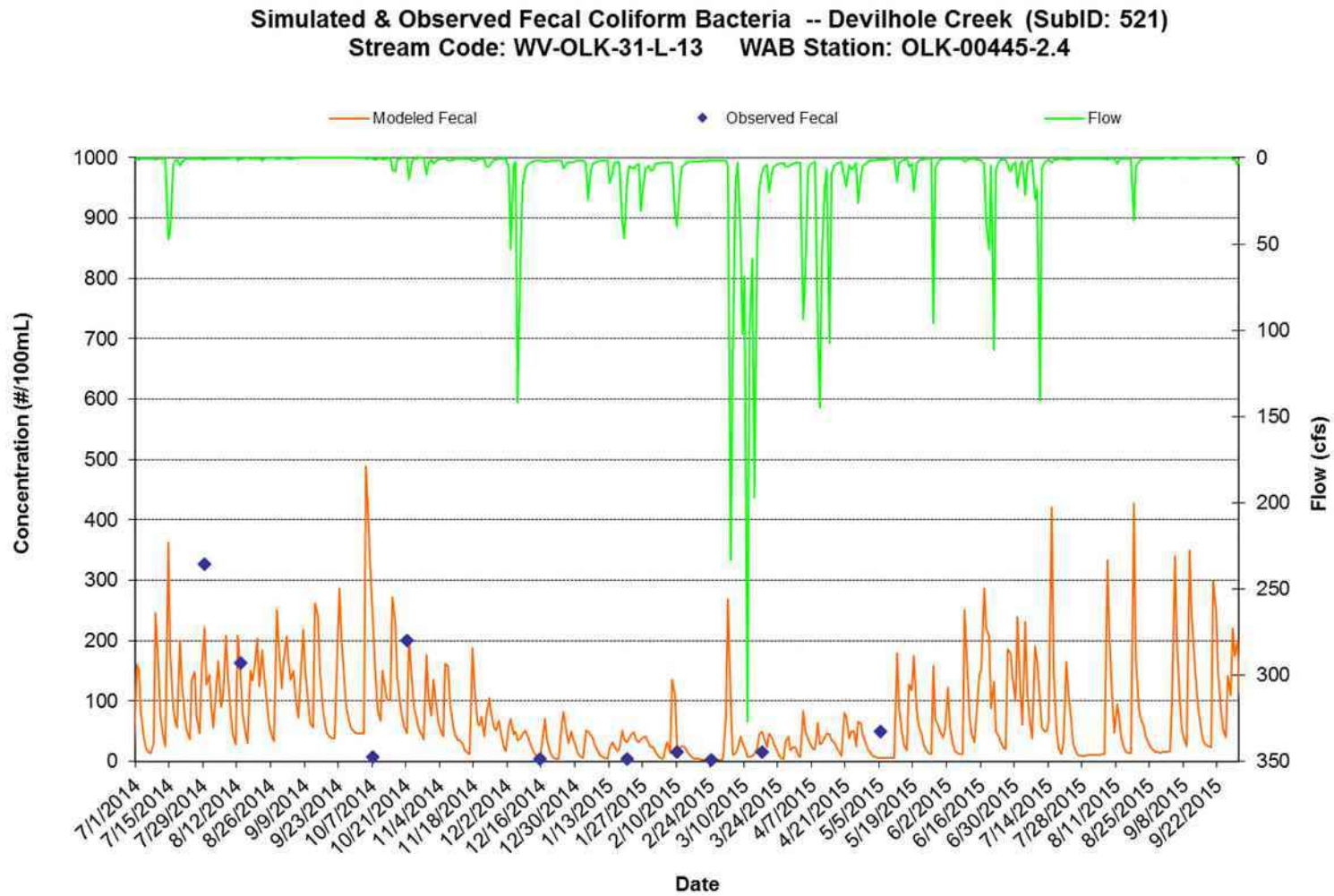


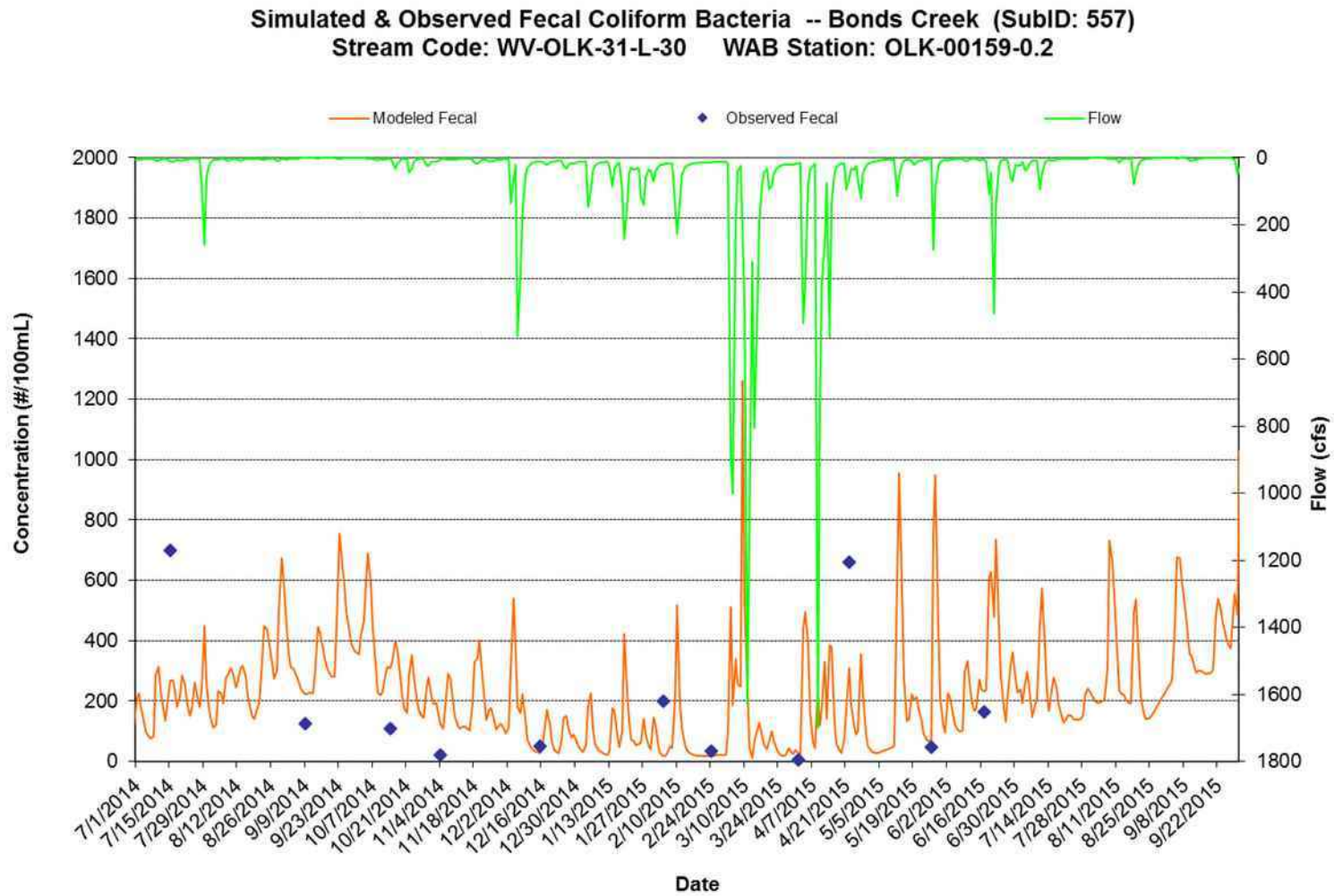


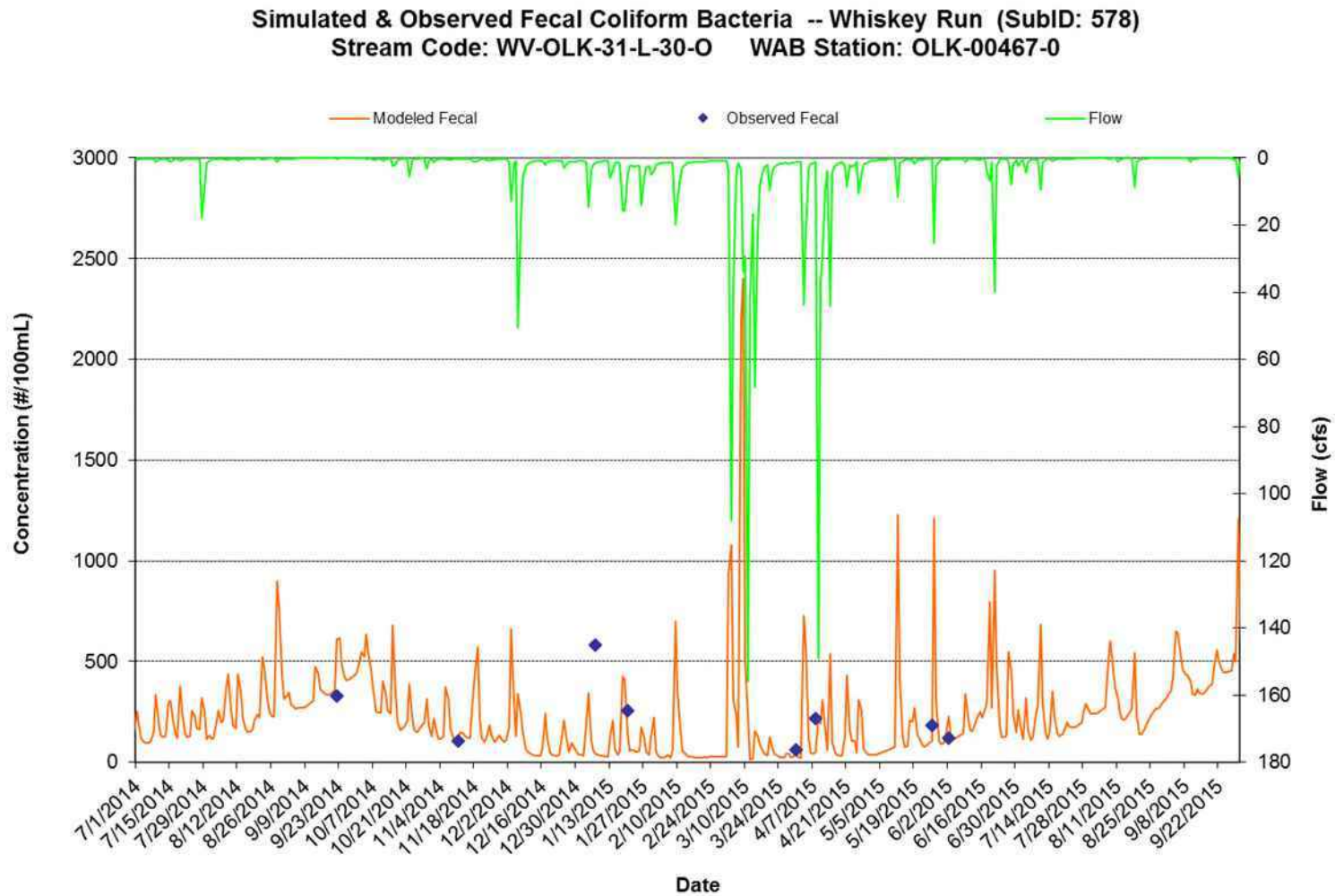


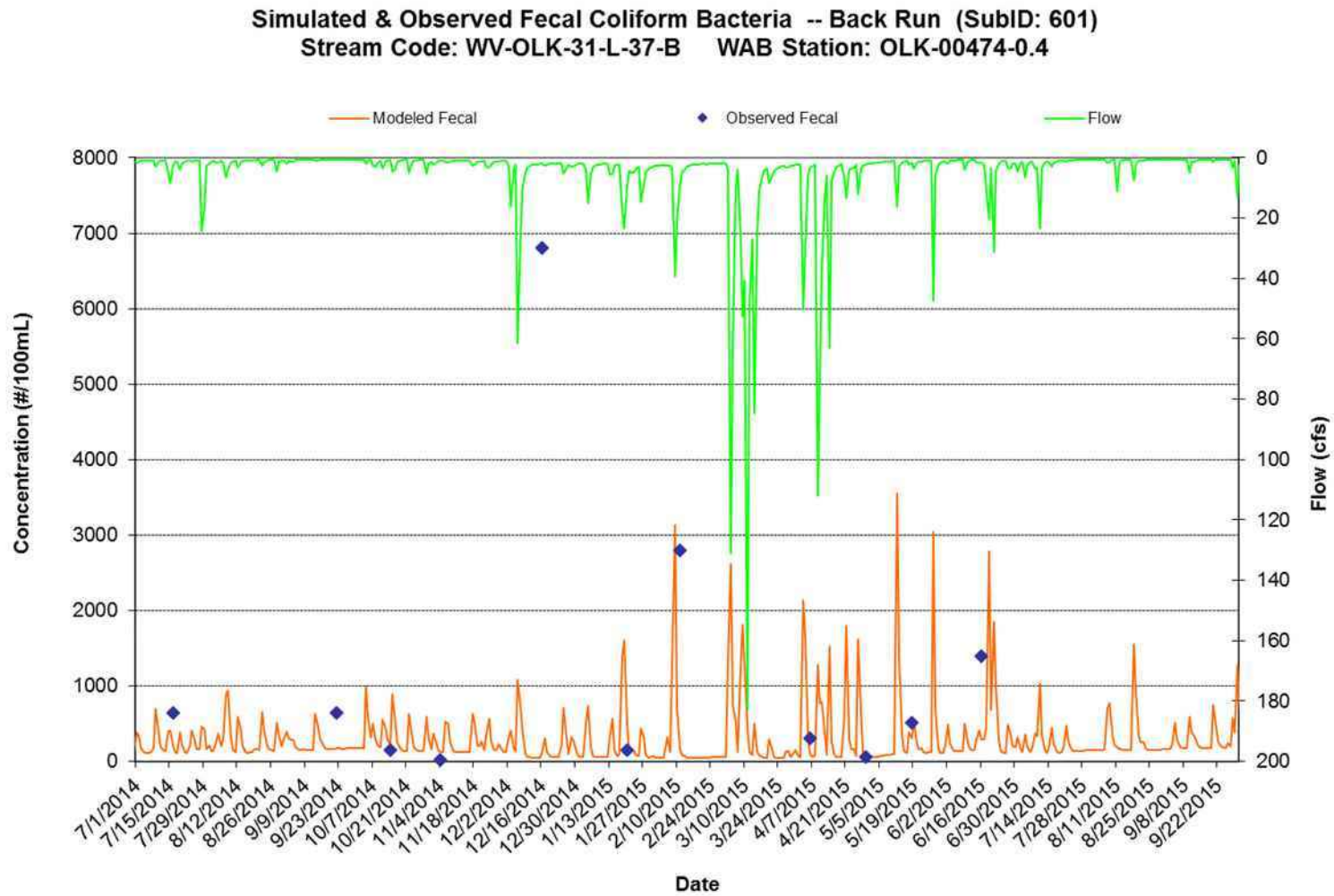


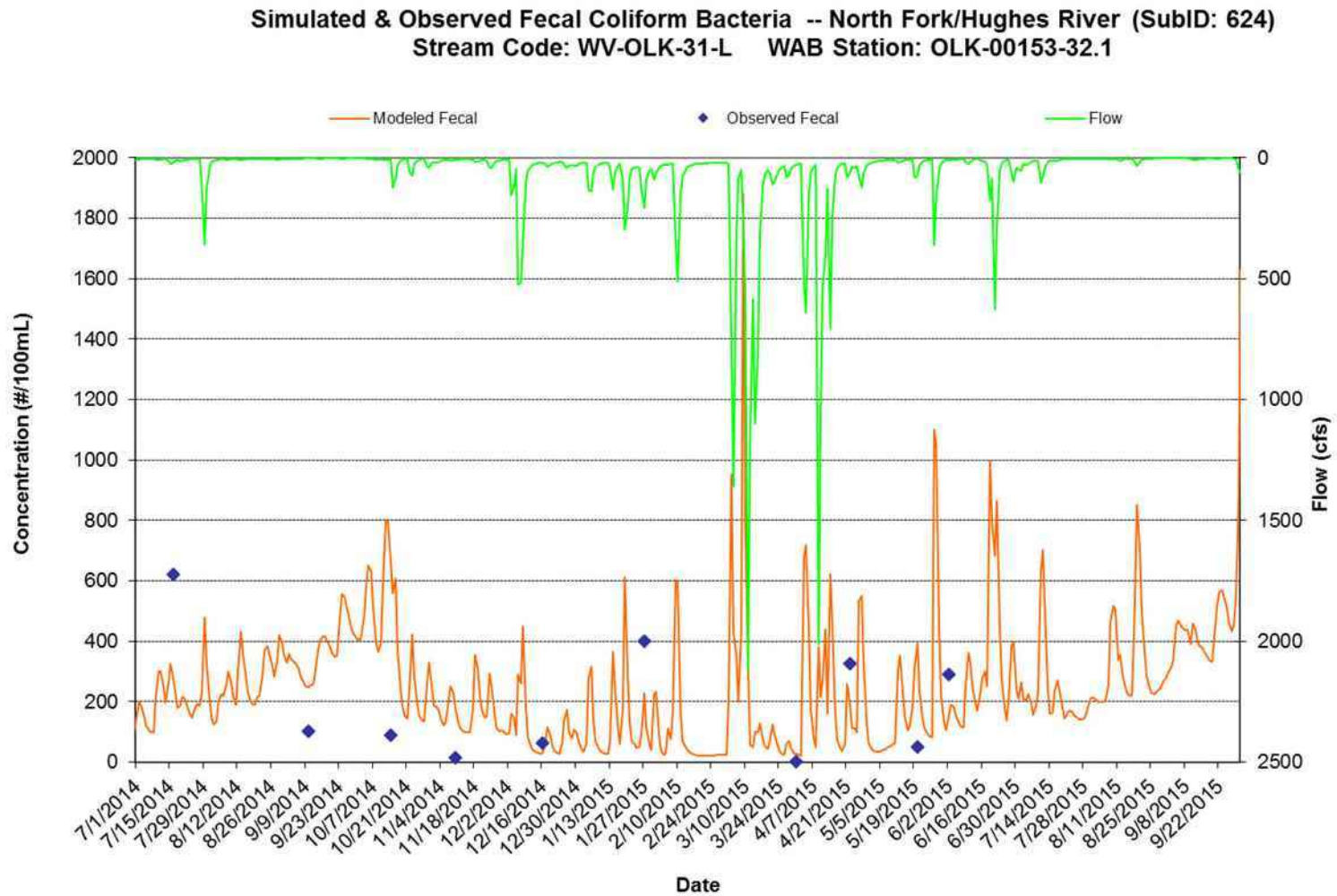


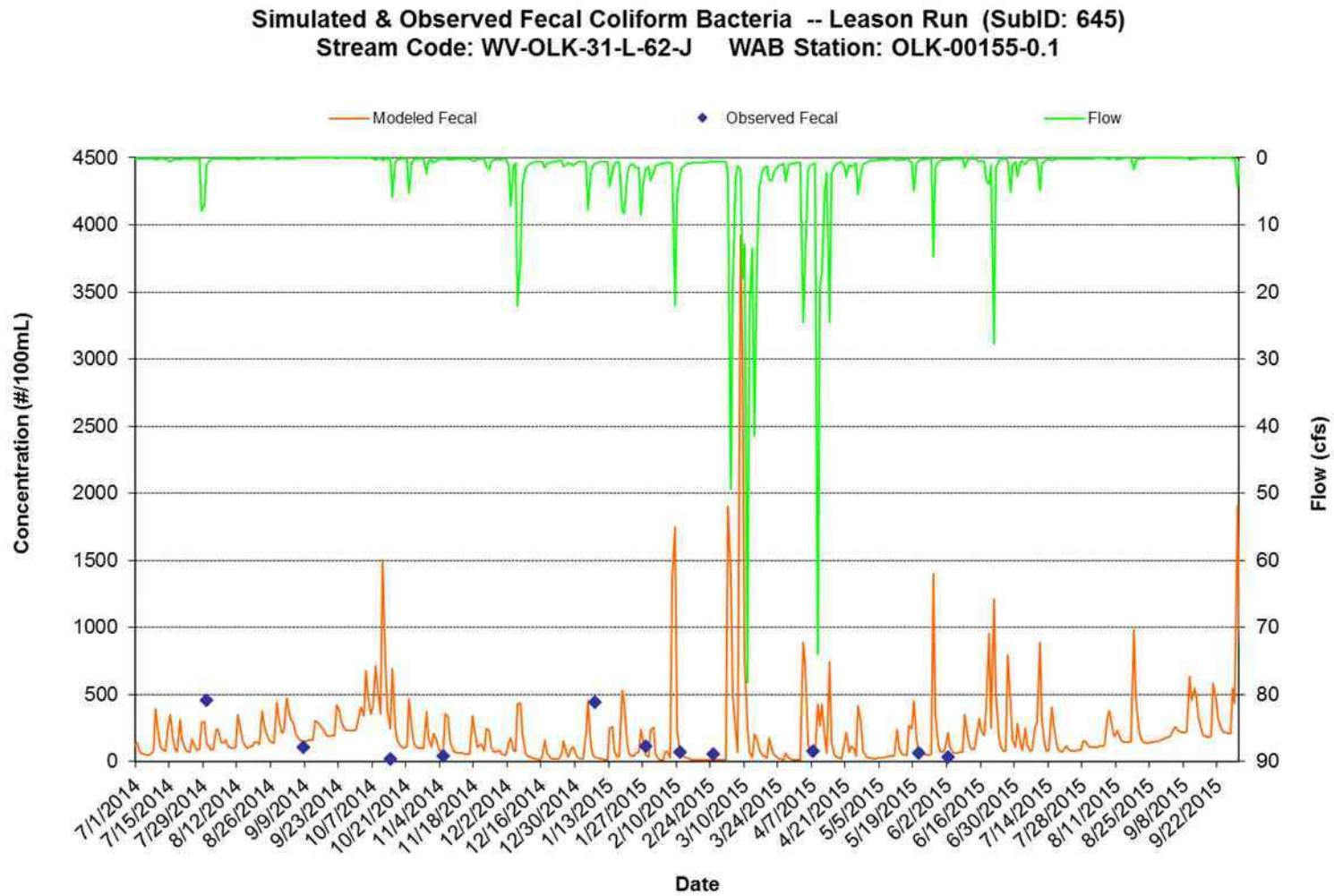


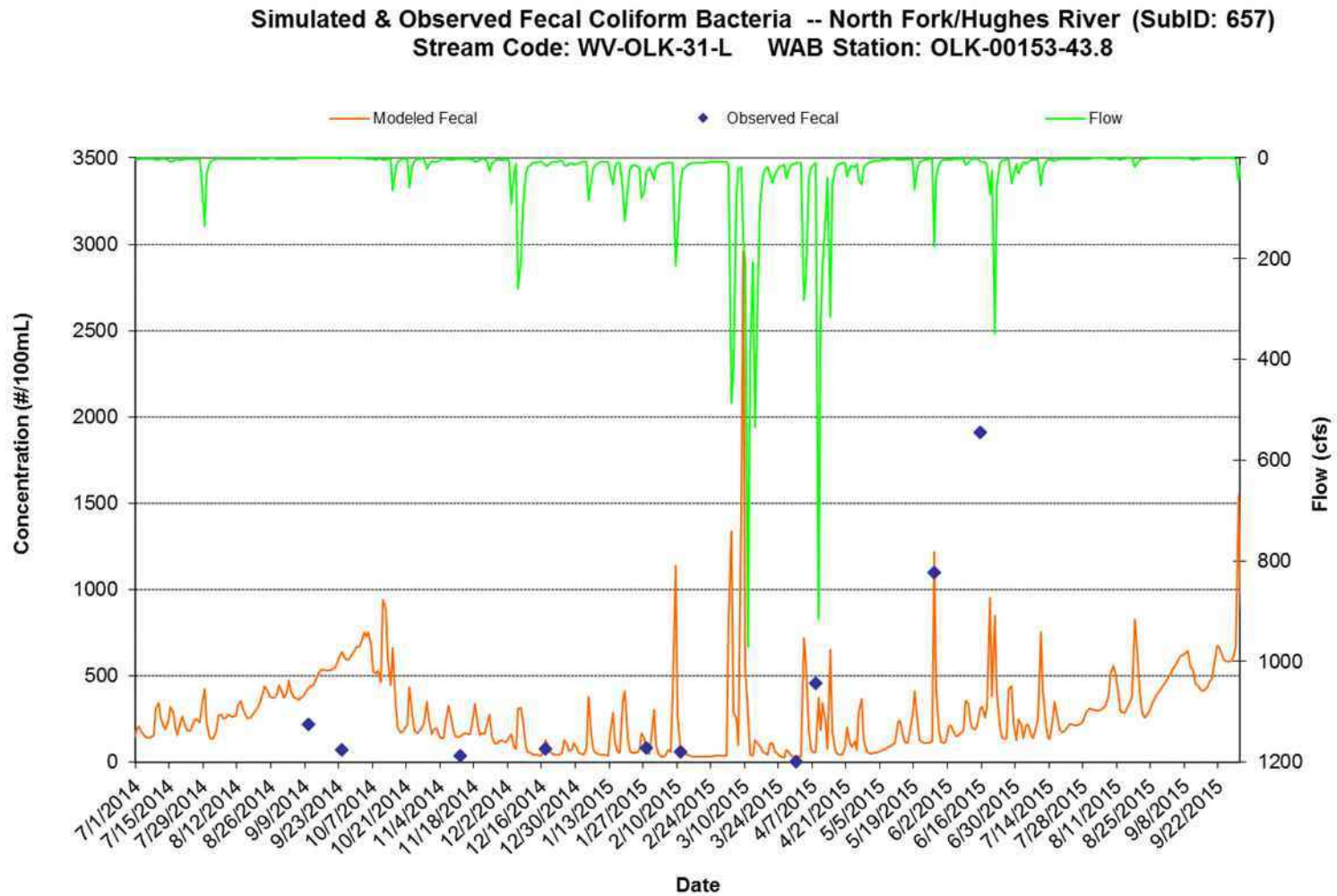


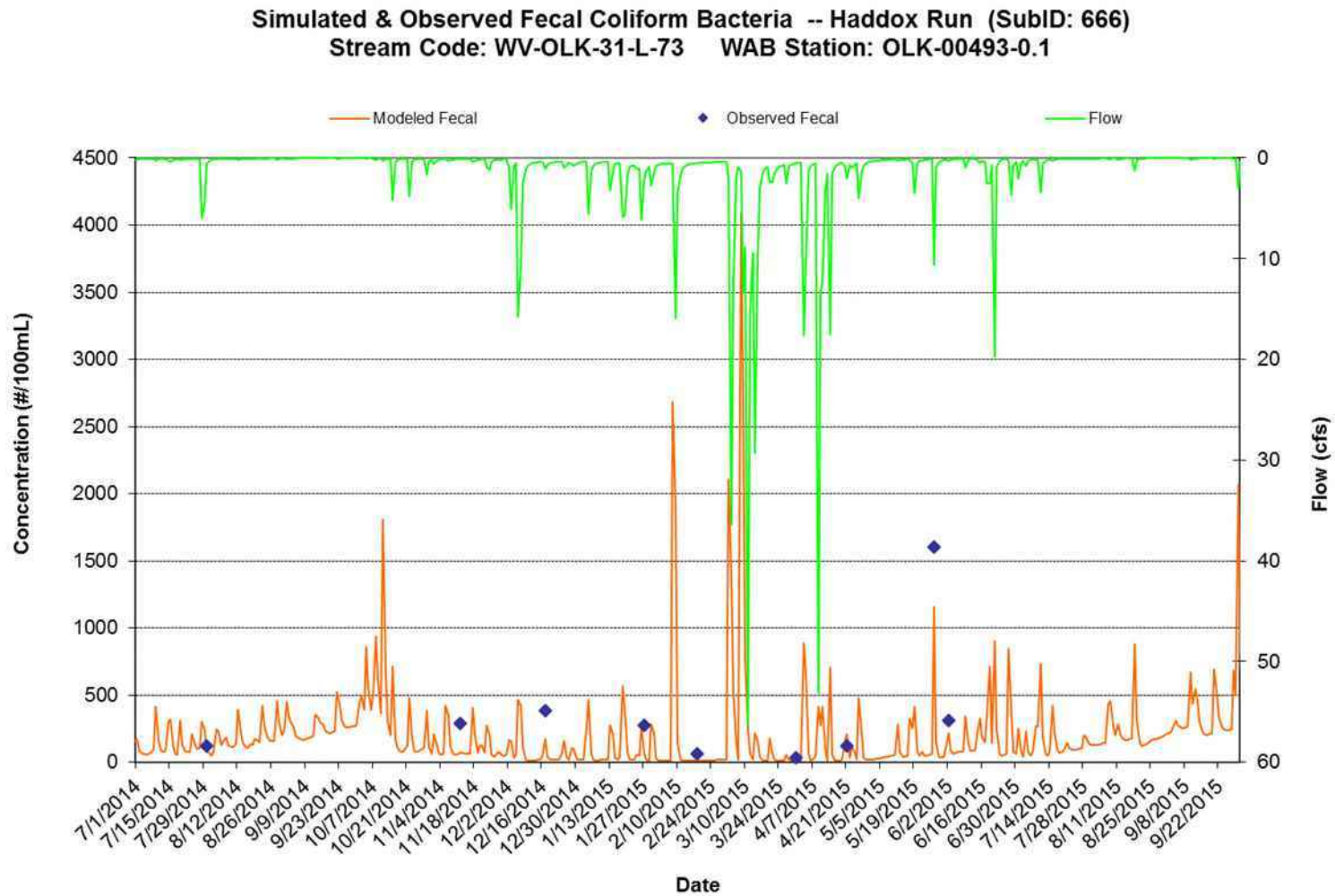










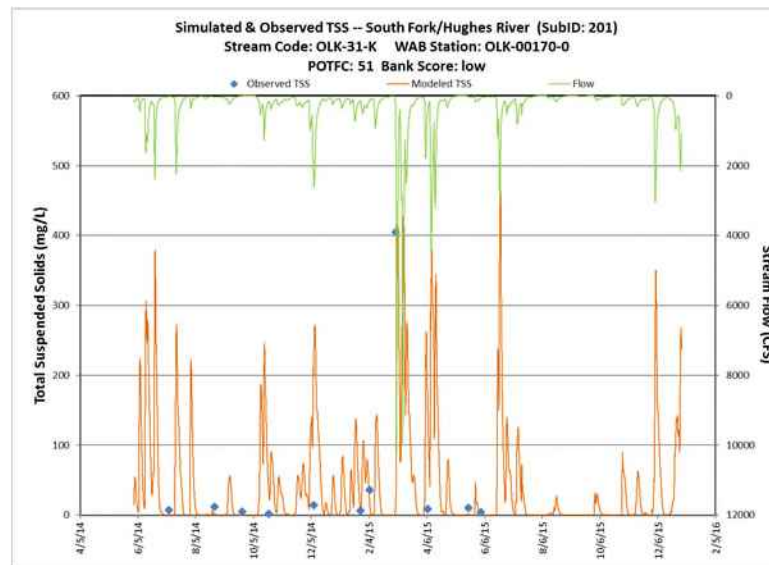
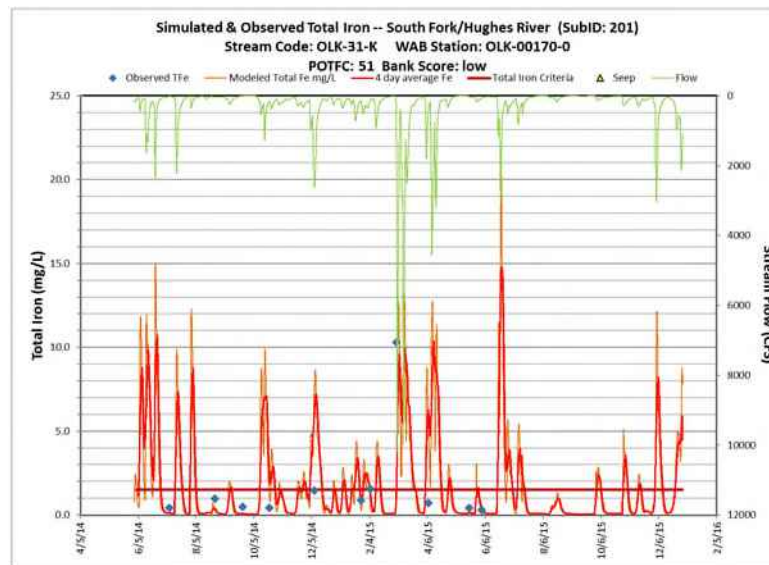


Iron Water Quality Calibration

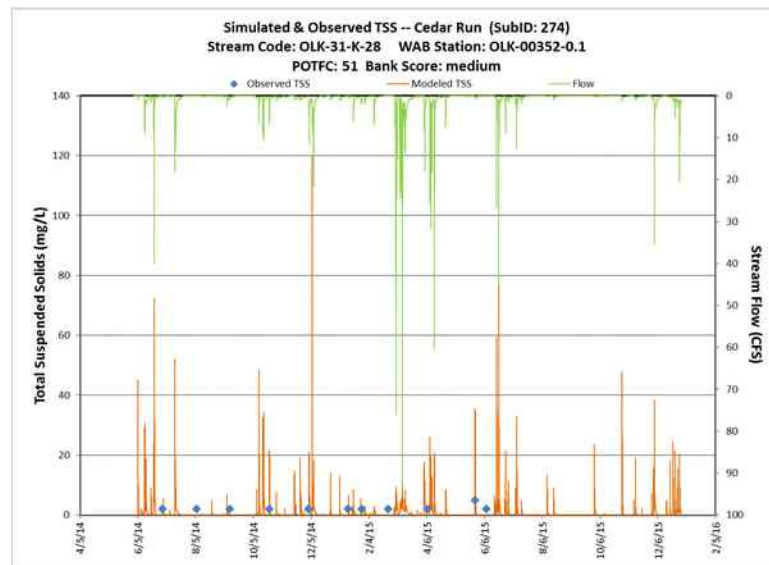
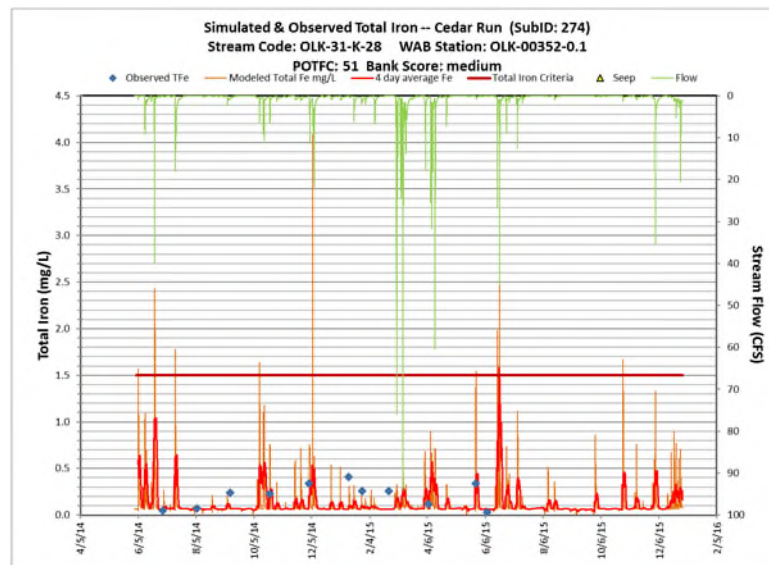
D3 Hughes River Watershed

Iron and Sediment Water Quality Calibration

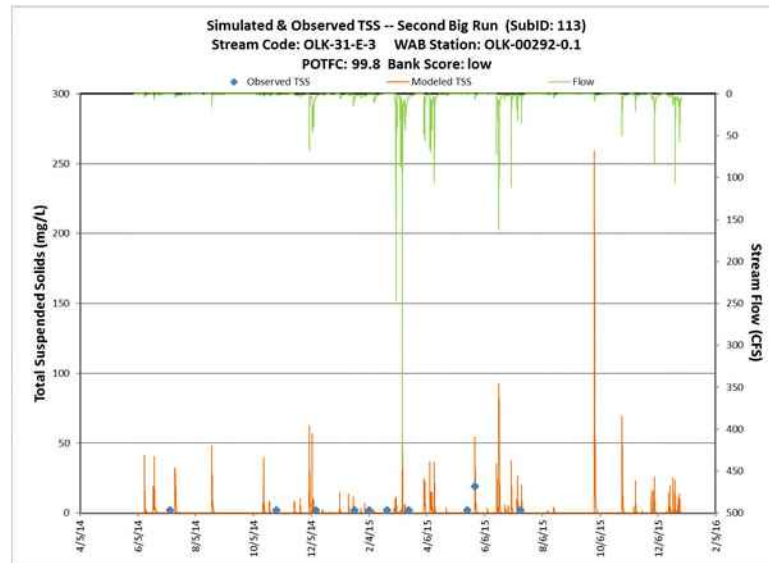
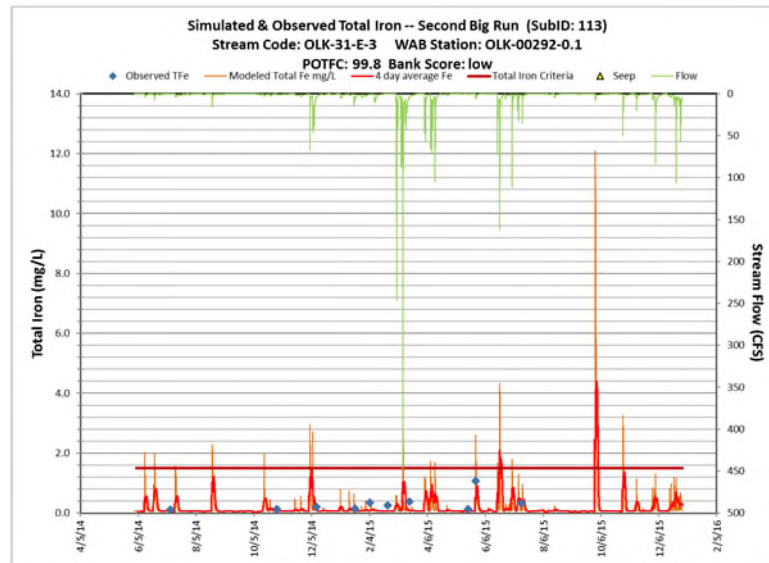
South Fork/Hughes River Watershed
 South Fork/Hughes River OLK-31-K
 Undisturbed impaired subwatershed – disturbance upstream



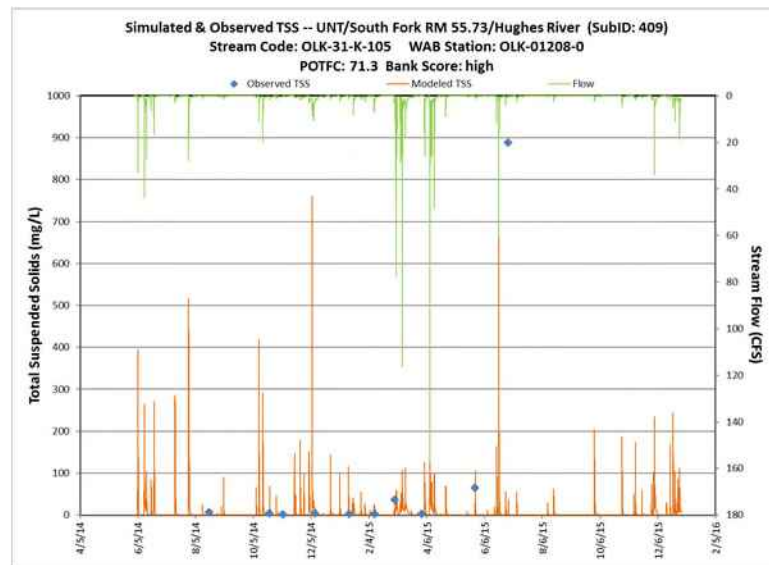
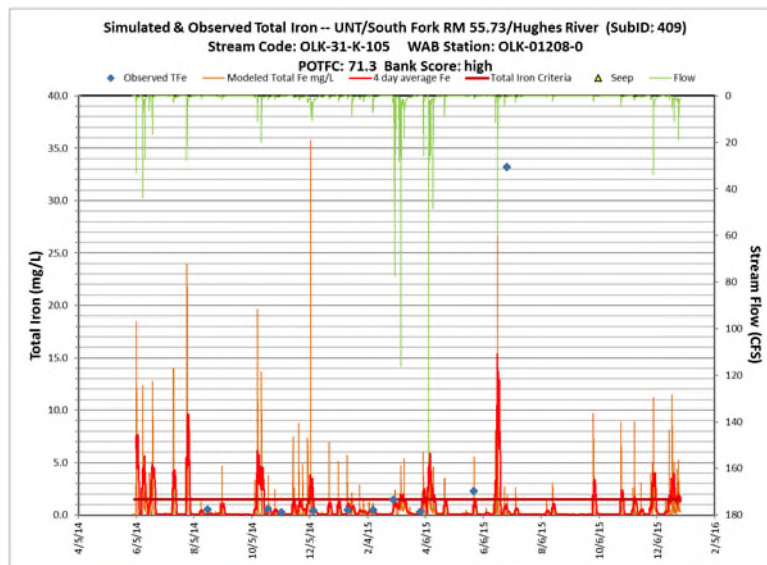
South Fork Hughes River Watershed
 Cedar Run OLK-31-K-28
 Unimpaired headwater
 Minimal disturbance (0.8% Oil and Gas)



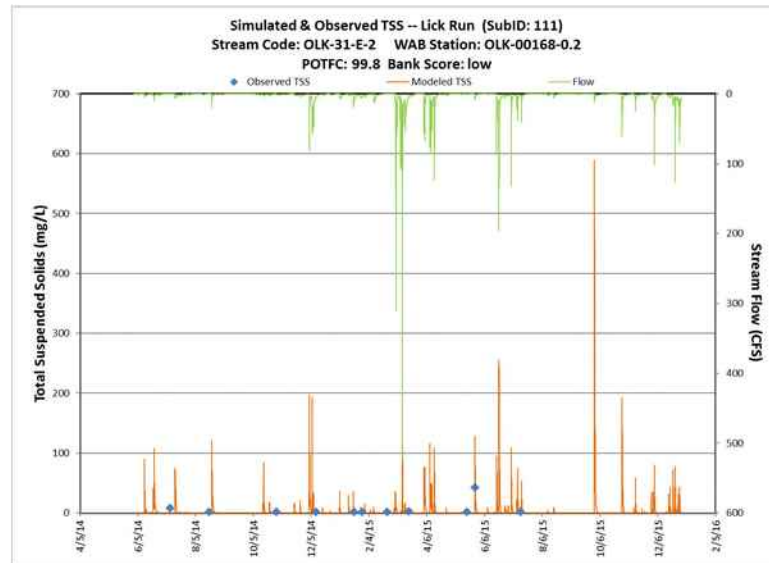
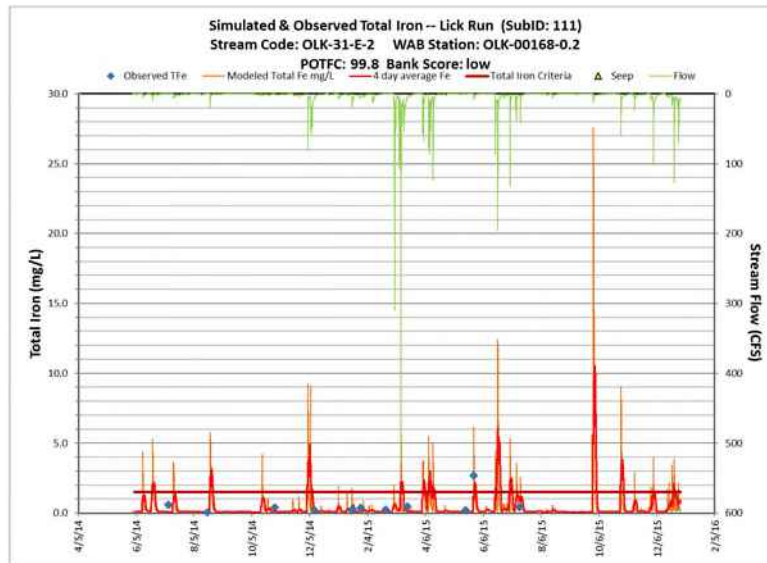
Goose Creek Watershed
 Second Big Run OLK-31-E-3
 Unimpaired headwater
 Disturbance almost exclusively agricultural (7%)



South Fork/Hughes River Watershed
 UNT/South Fork RM 55.73/Hughes River OLK-31-K-105
 Impaired headwater
 Dominant disturbance: Oil and Gas and Pipeline Construction (8%)



Goose Creek Watershed
 Lick Run OLK-31-E-2
 Unimpaired headwater
 Dominant disturbance: 11% Harvested Forest

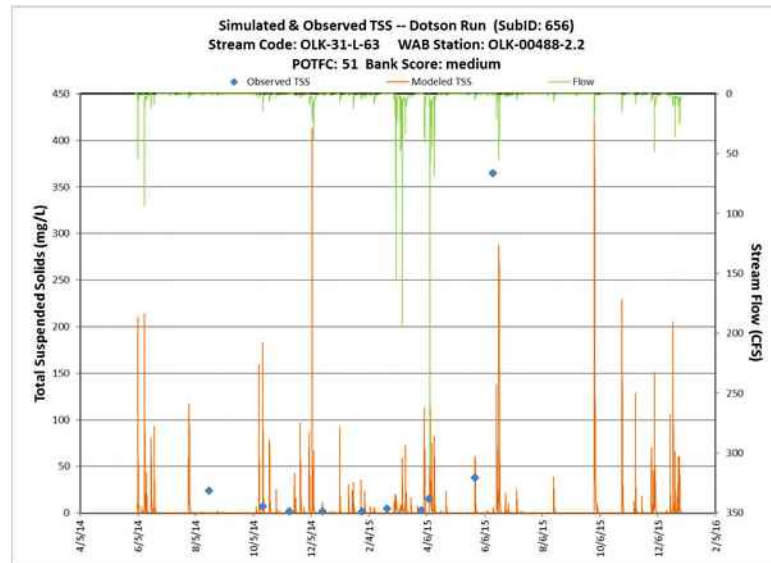
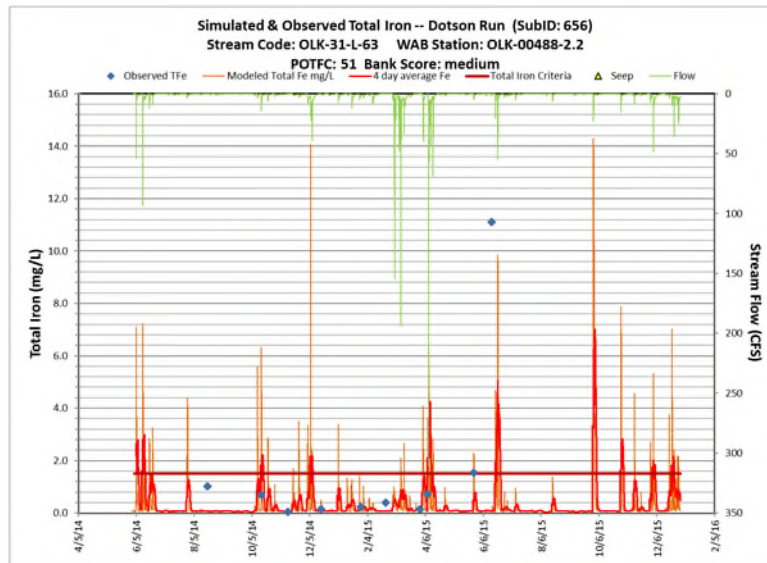


North Fork/Hughes River Watershed

Dotson Run OLK-31-L-63

Impaired headwater.

Mixed disturbance (agriculture 5%, harvested forest 3%, oil and gas 7%, pipeline construction 3%)



Goose Creek Watershed
 Oil Spring Run OLK-31-E-11
 Impaired headwater
 Dominant disturbance: urban/residential (1.4%)

