

HFE
4-29-8

sources or sinks in the reaches. The HSPF model simulates the instream processes and computes the concentrations of water quality constituents in each reach. Each reach is considered a completely mixed reactor. Modeled and observed water quality data from January 2004 through December 2005 were compared at S-79, S-78 and the Whiskey Creek (WHISGR10) water quality stations (Figure 32) to perform model calibration.

Parameters

Model calibration results for water temperature, TSS, nutrients (nitrate, ammonia and phosphate), 5-day biochemical oxygen demand (available only at the Whiskey Creek station) and dissolved oxygen at the S-79, S-78 and the Whiskey Creek stations are presented in Figures 33 through Figure 48. The modeled dissolved oxygen concentration at the Whiskey Creek station was significantly higher than the observed data and excluded from the model calibration. The low observed DO concentration at the Whiskey Creek station could be caused by local sources and/or processes (e.g. algal bloom in stormwater ponds) that could not be successfully modeled without the detail characteristics of the reaches/ponds. Additionally, an effort to model such local phenomenon using the Caloosahatchee River HSPF model would easily exceed the operational limits of the model.

Table 10 compares the mean modeled and observed concentrations of the water quality constituents. Except for the TSS concentrations during Hurricane Wilma (October 24, 2005) other modeled and observed concentrations were in good agreement and within reasonable ranges. If the modeled TSS concentrations on Oct 24-26, 2005 were excluded from the analysis (because there is no observed data during Hurricane Wilma) the mean TSS concentration at S-79 reduces from 17.49 mg/L to 5.14 mg/L, which is comparable with the long-term mean observed concentration (5.20 mg/L).

~~Wash~~ Sutcliffe scores
for hydrology?

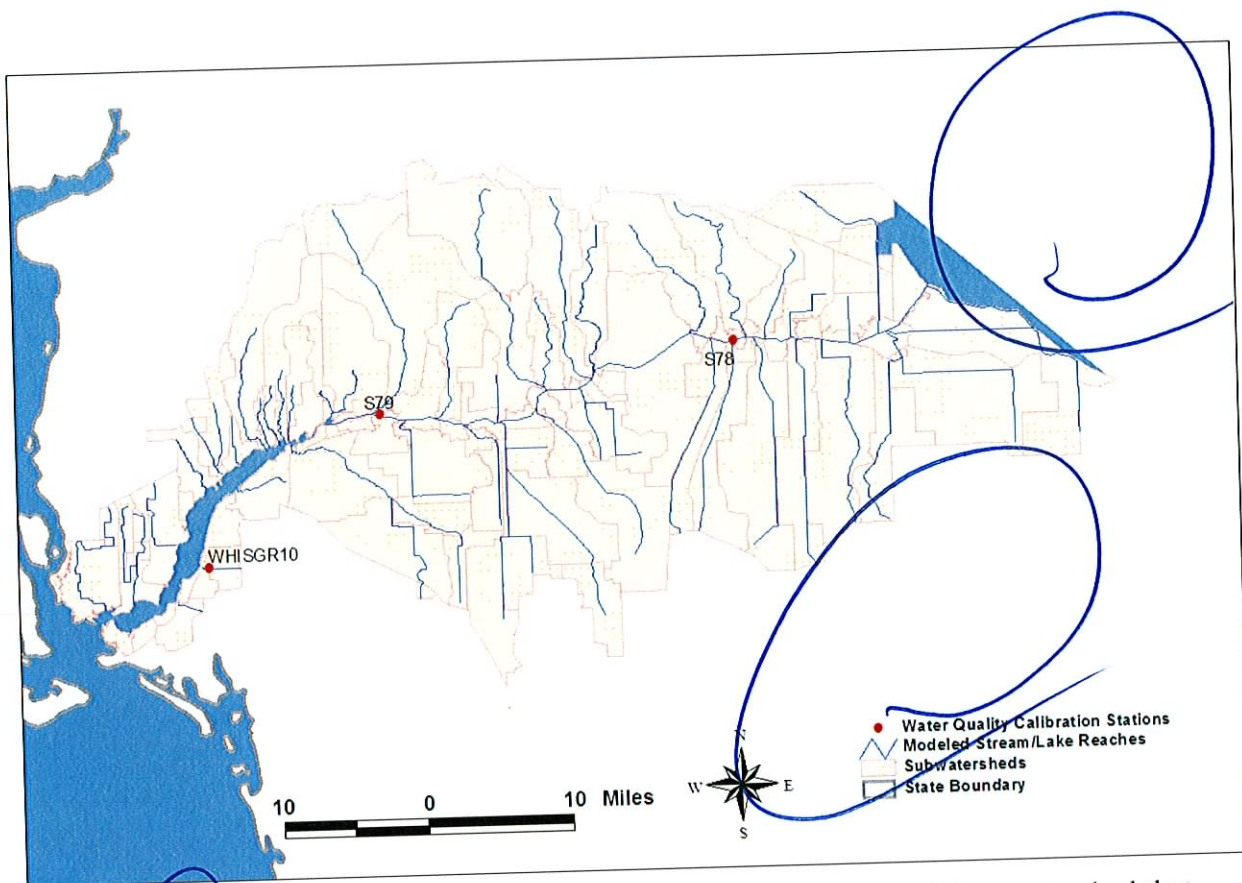


Figure 32. Water quality monitoring stations in the Caloosahatchee River watershed that were used for model calibration and validation.

Table 10. A comparison of mean modeled and observed concentrations of the water quality constituents for the model calibration run.

	Mean Concentrations of Water Quality Constituents					
	S-79		S-78		Wiskey Creek (Reach 07)	
	Modeled	Observed	Modeled	Observed	Modeled	Observed
TSS (mg/L)	17.49	5.20	13.48	11.22	1.66	1.56
BOD5 (mg/L)					0.83	1.18
DO (mg/L)	6.49	5.61	5.16	5.05	8.87	5.09
NO3 (mg/L)	0.20	0.23	0.27	0.17	0.05	0.03
PO4 (mg/L)	0.11	0.10	0.12	0.05	0.10	0.00
NH3 (mg/L)	0.05	0.04	0.09	0.04	0.07	0.04
Water Temp (deg. F)	75.04	78.80	75.31	79.28	71.89	77.28

40

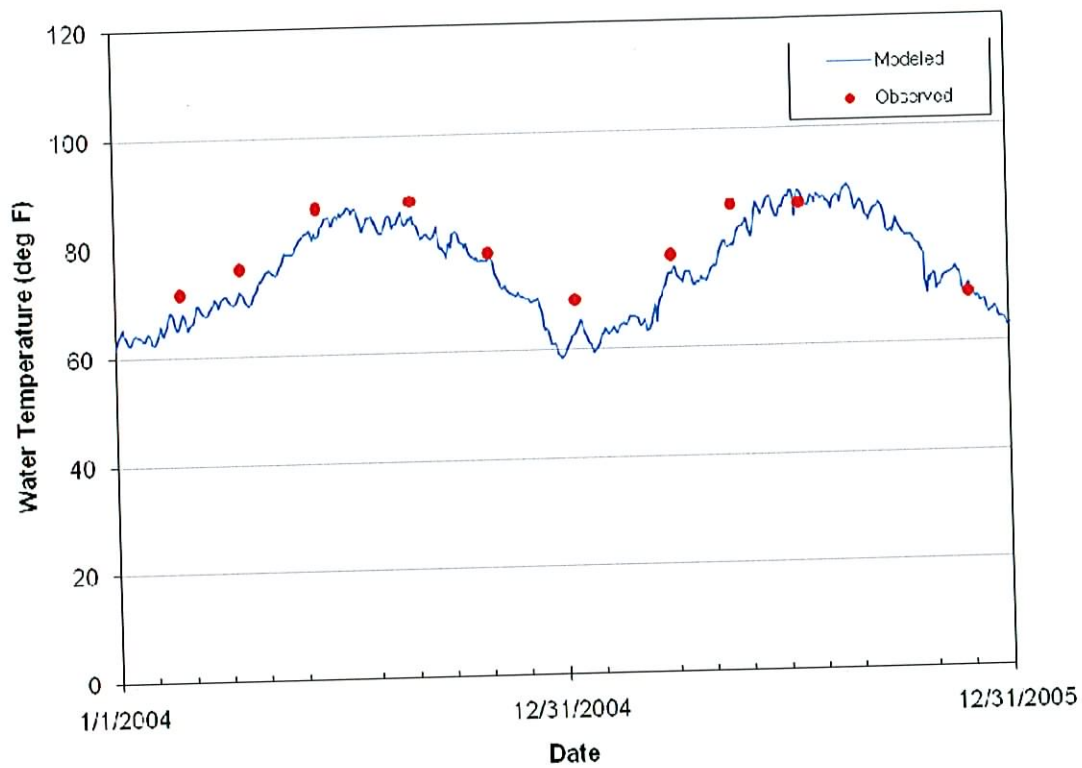


Figure 33. Modeled and observed water temperature at the S-79 station for the model calibration period.

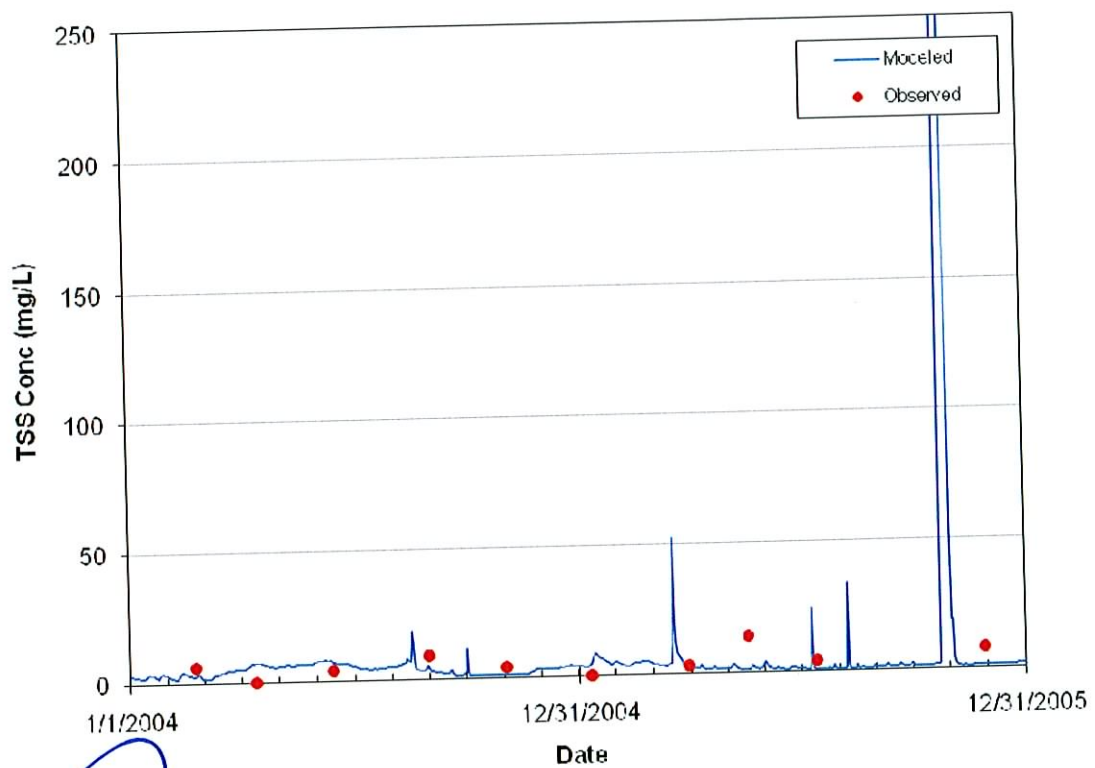


Figure 34. Modeled and observed TSS concentrations at the S-79 station for the model calibration period.

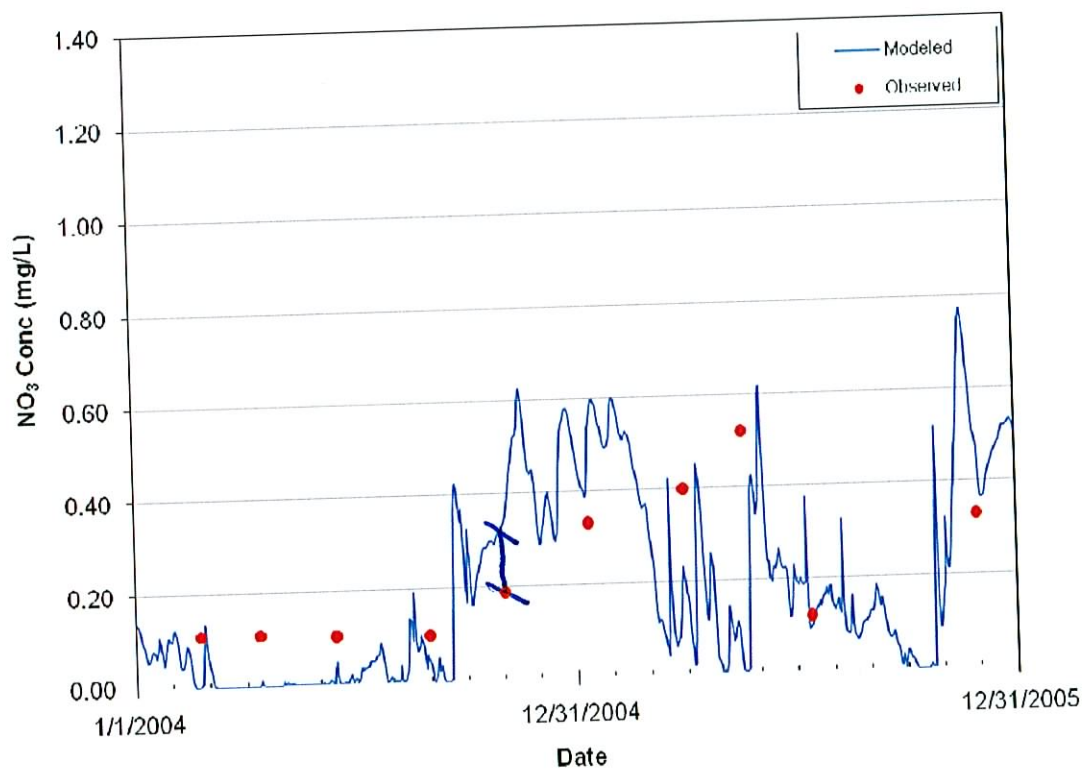


Figure 35. Modeled and observed nitrate concentrations at the S-79 station for the model calibration period.

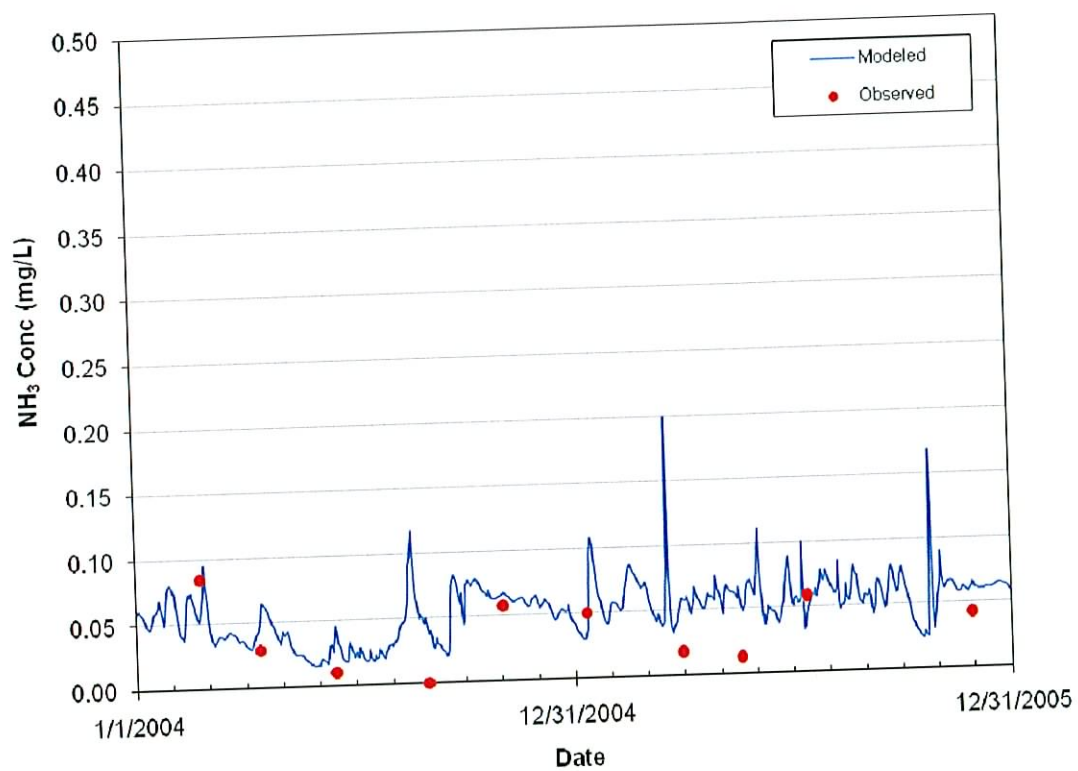


Figure 36. Modeled and observed ammonia concentrations at the S-79 station for the model calibration period.

add TP

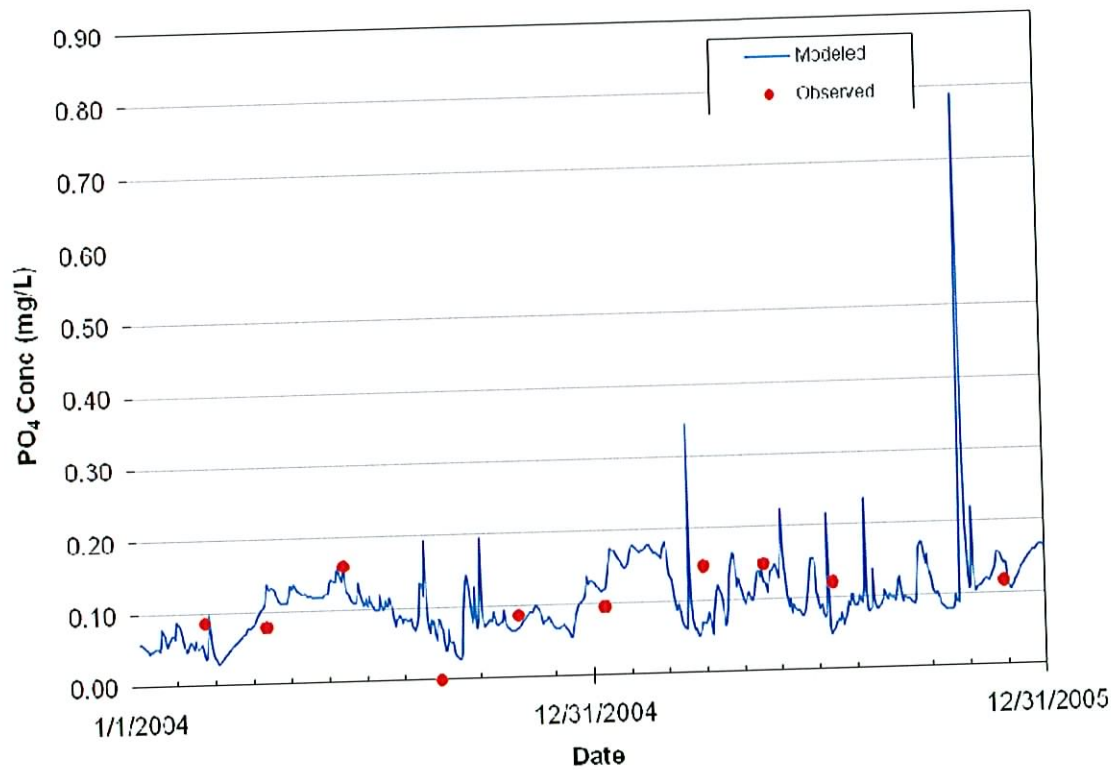


Figure 37. Modeled and observed phosphate concentrations at the S-79 station for the model calibration period.

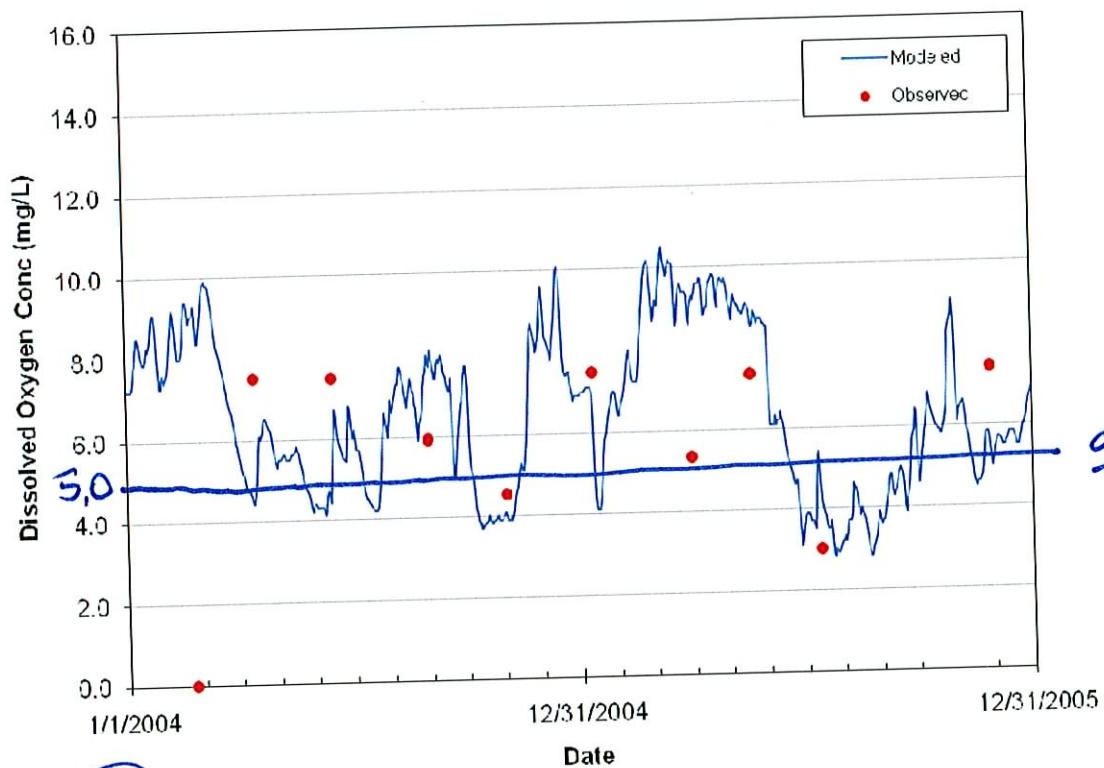


Figure 38. Modeled and observed dissolved oxygen concentrations at the S-79 station for the model calibration period.

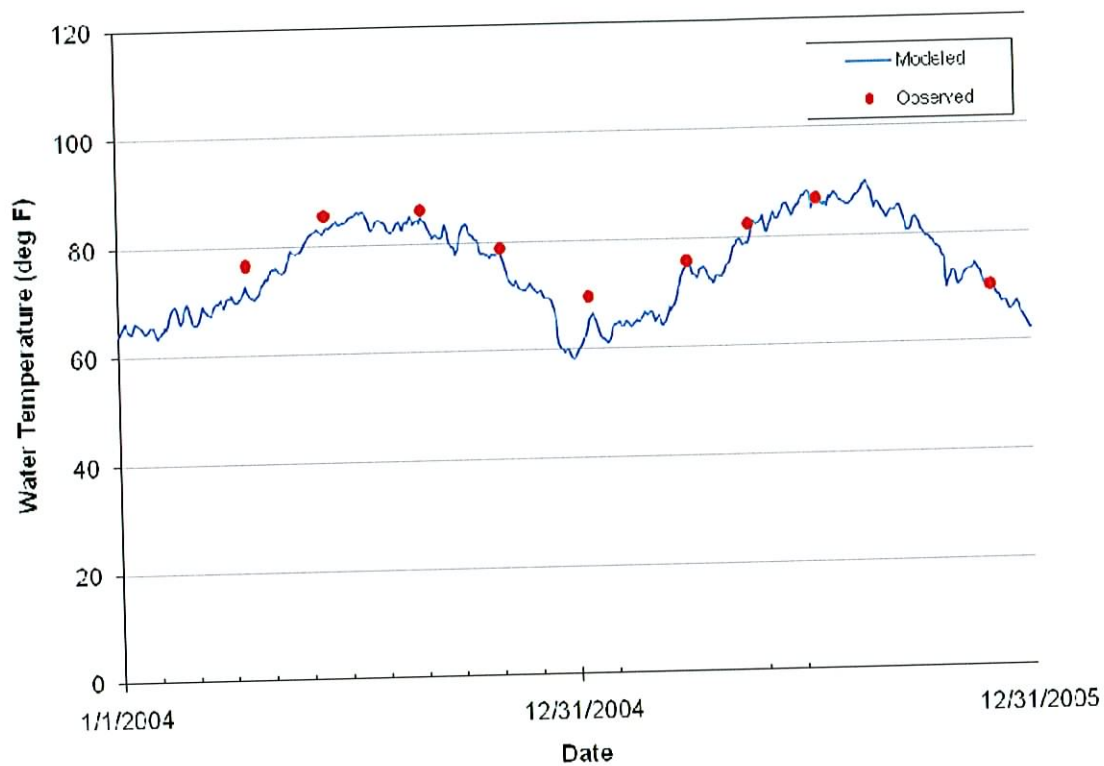


Figure 39. Modeled and observed water temperature at the S-78 station for the model calibration period.

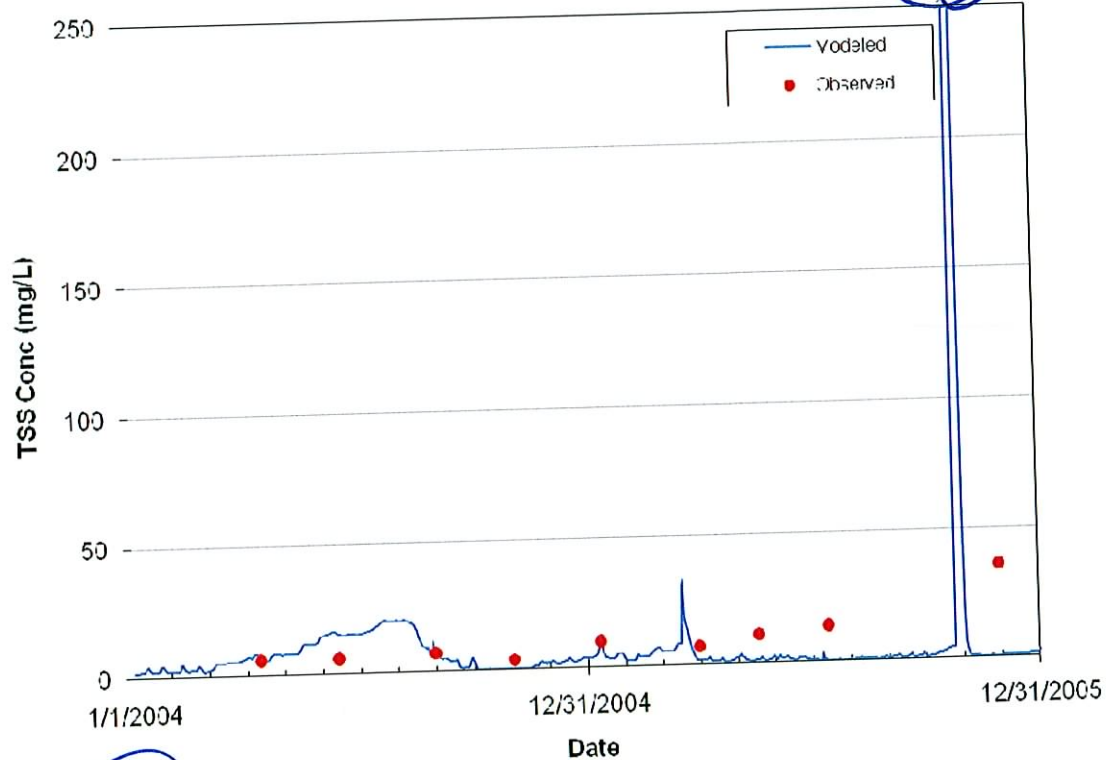


Figure 40. Modeled and observed total suspended solids concentrations at the S-78 station for the model calibration period.

Continue w/ 2/20/02

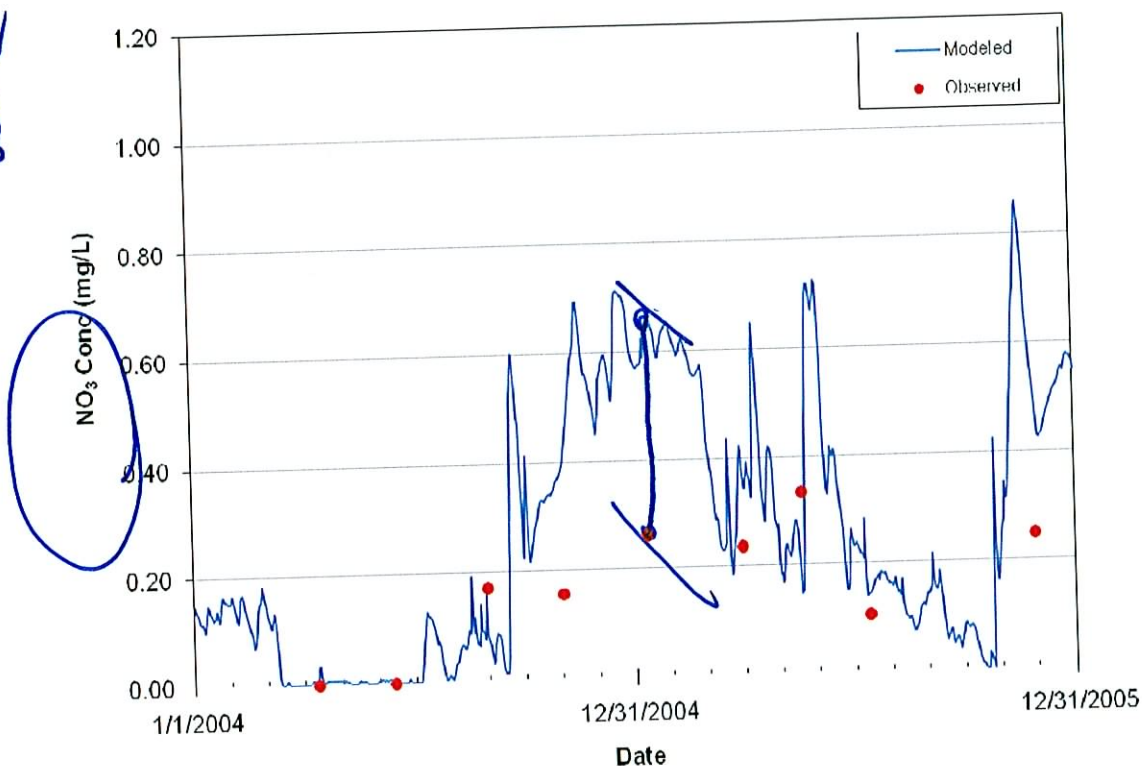


Figure 41. Modeled and observed nitrate concentrations at the S-78 station for the model calibration period.

way too high

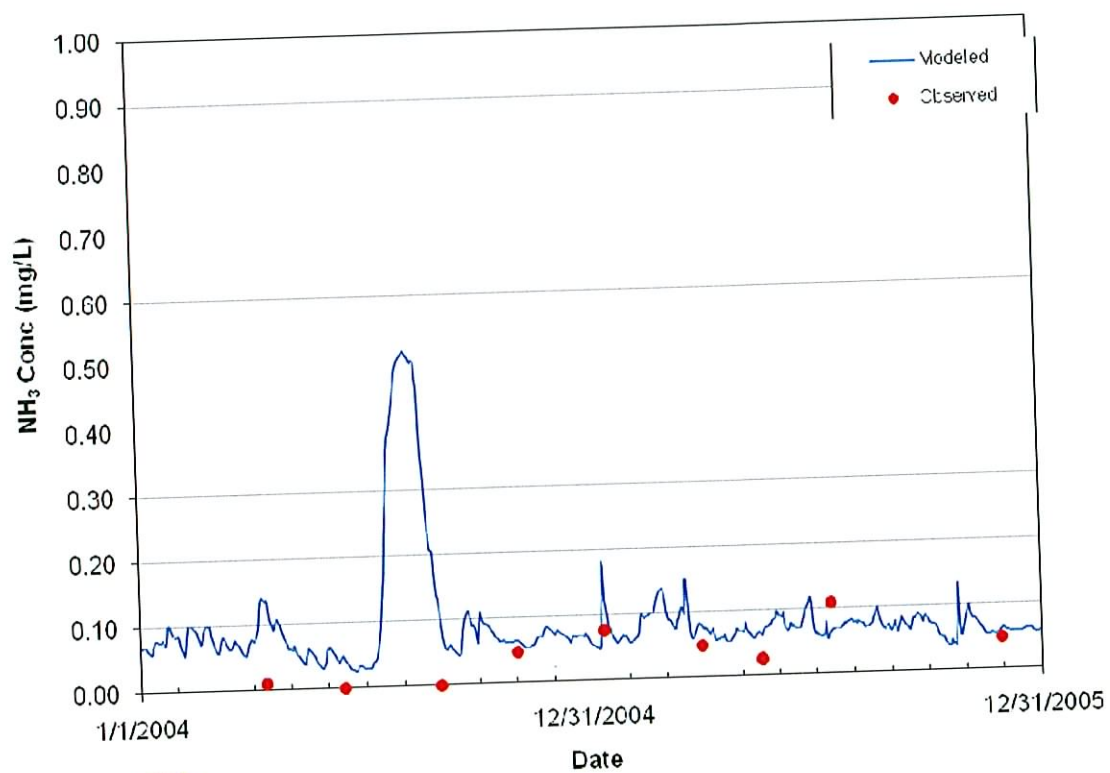


Figure 42. Modeled and observed ammonia concentrations at the S-78 station for the model calibration period.

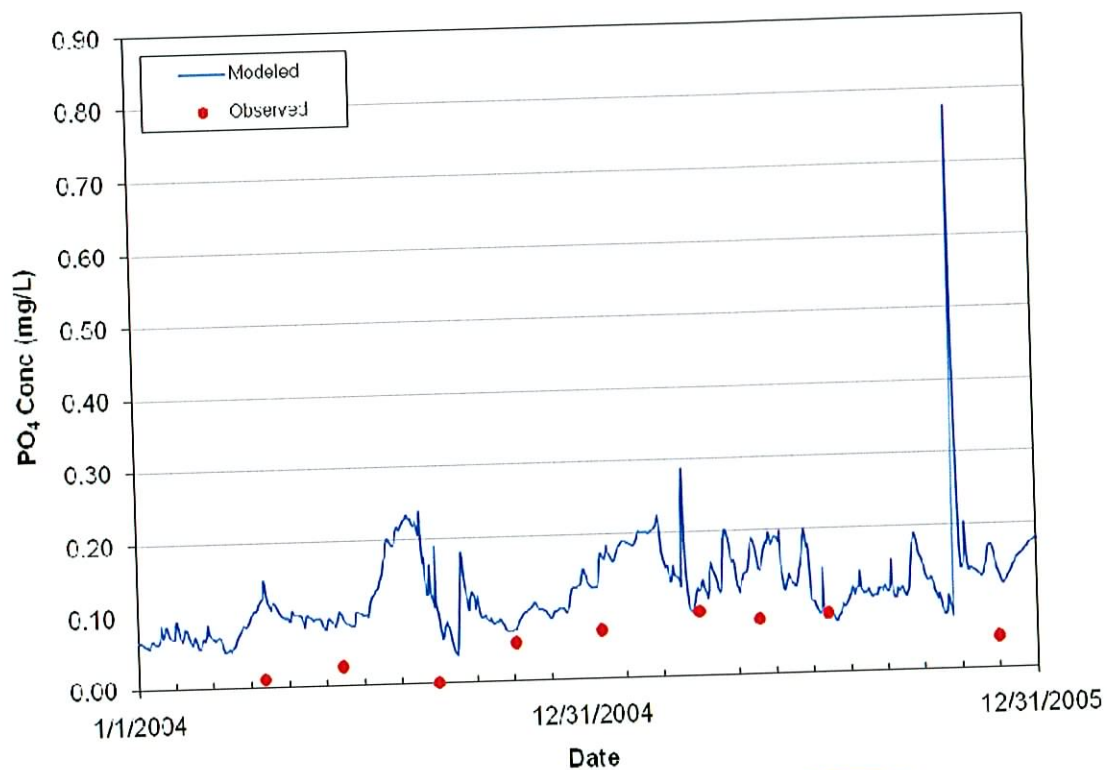


Figure 43. Modeled and observed phosphate concentrations at the S-78 station for the model calibration period.

way high

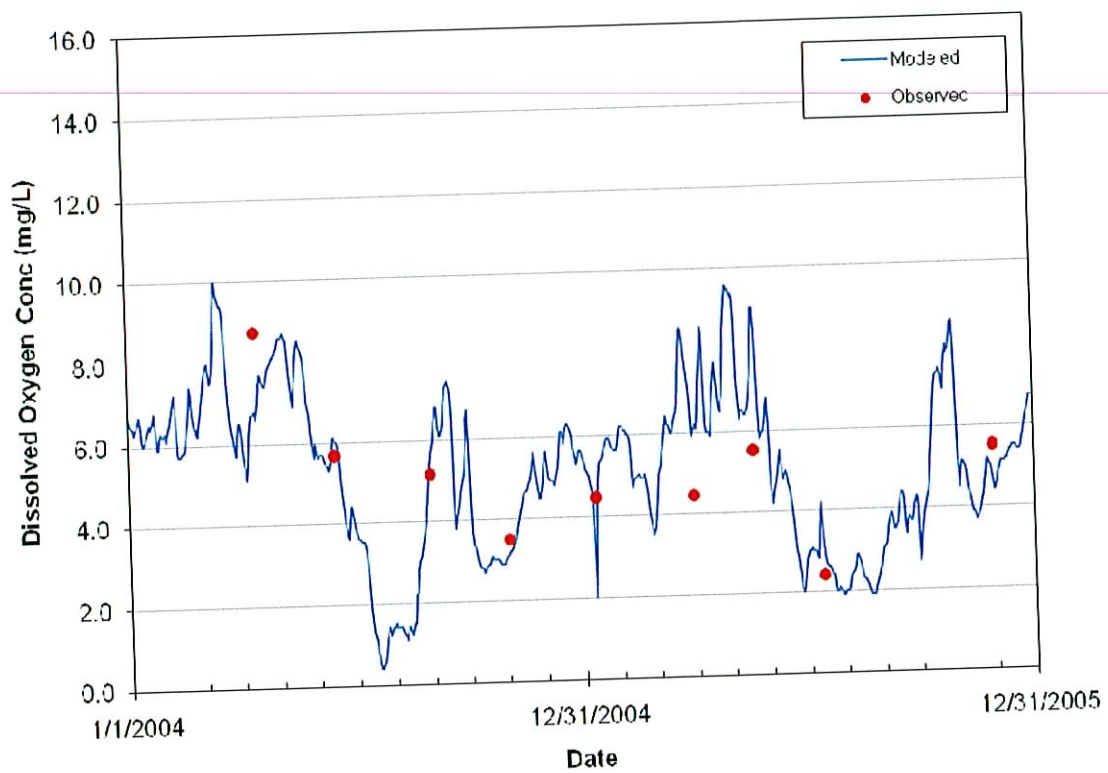


Figure 44. Modeled and observed dissolved oxygen concentrations at the S-78 station for the model calibration period.

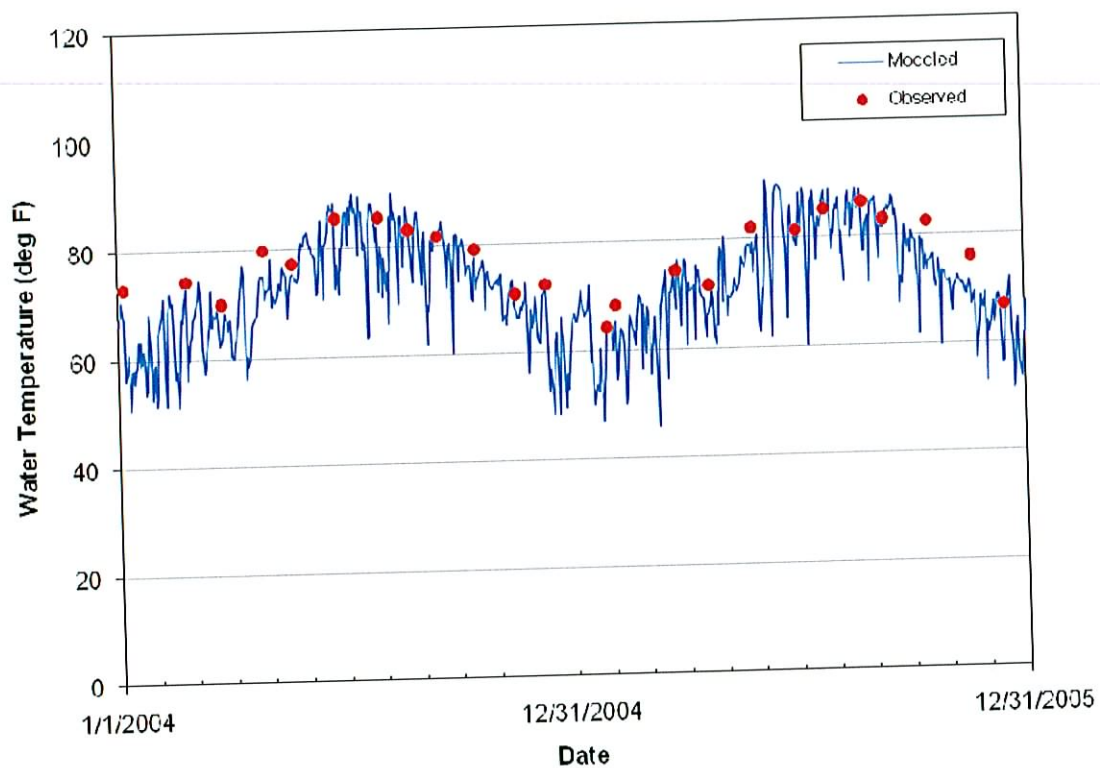


Figure 45. Modeled and observed water temperature at the Whiskey Creek station for the model calibration period.

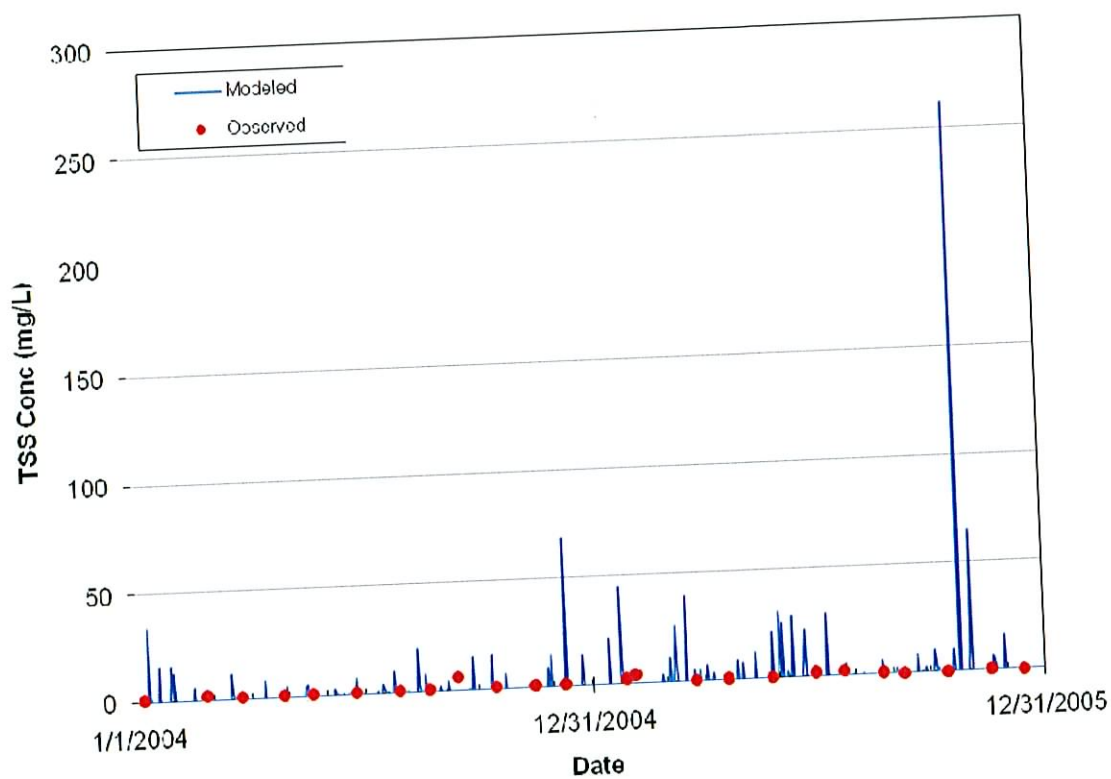


Figure 46. Modeled and observed total suspended solids concentrations at the Whiskey Creek station for the model calibration period.

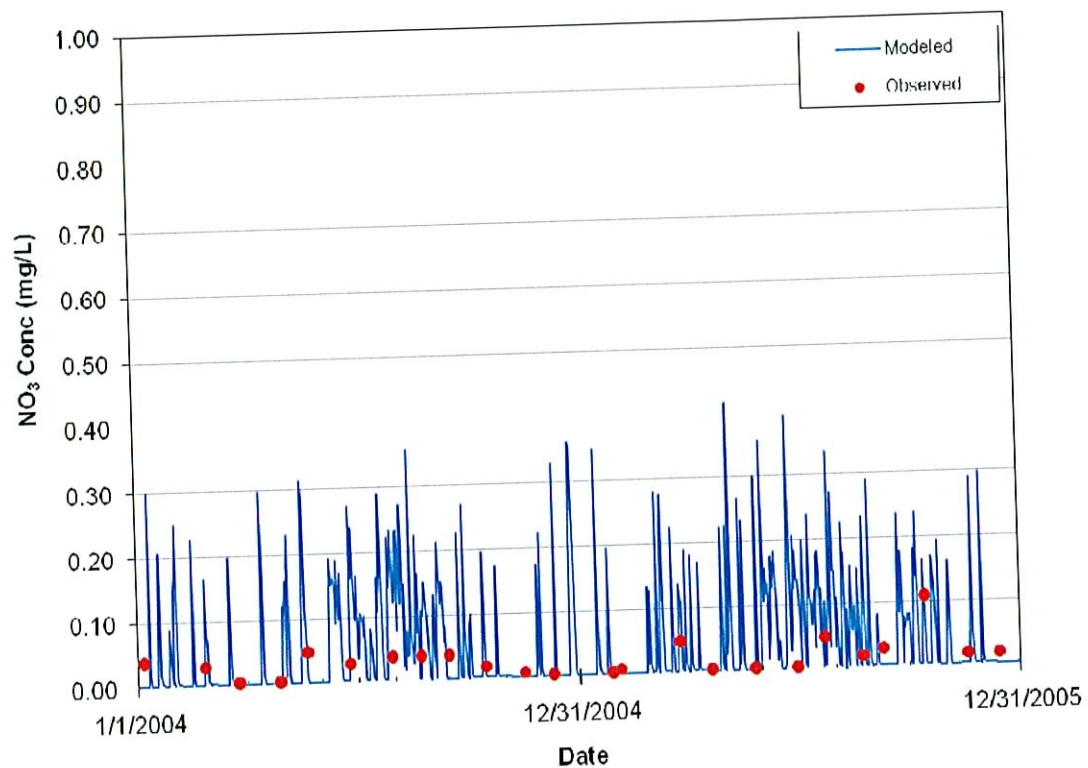


Figure 47. Modeled and observed nitrate concentrations at the Whiskey Creek station for the model calibration period.

Way high

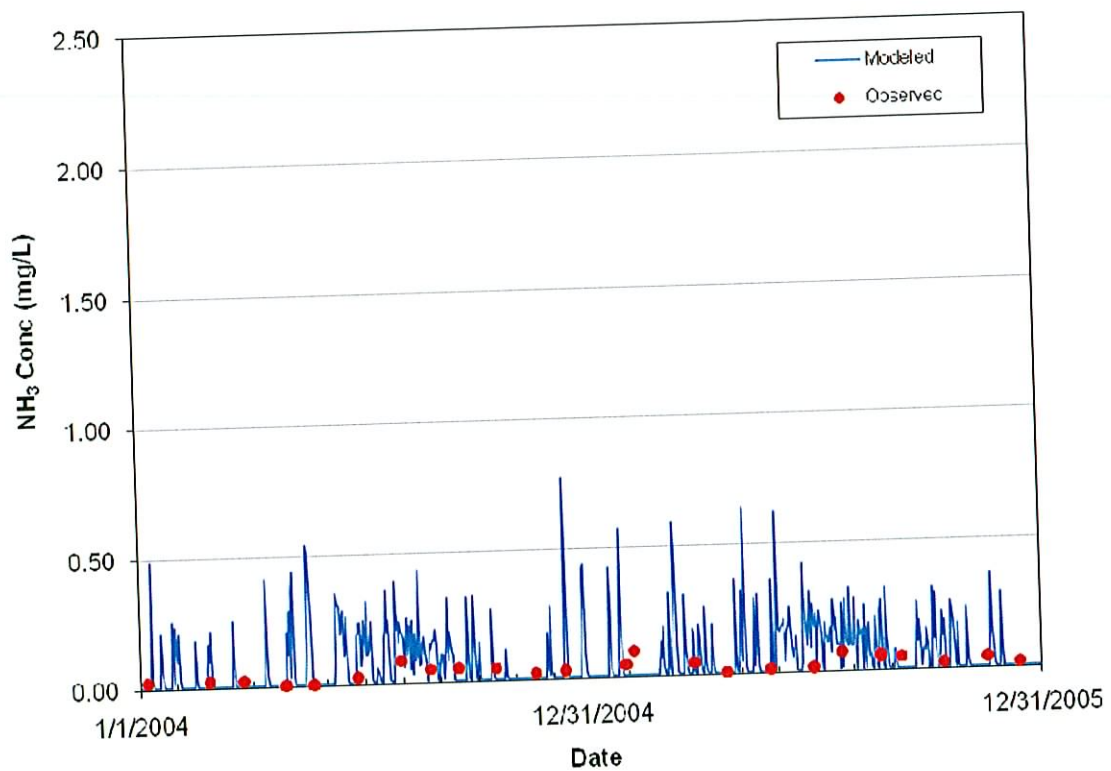


Figure 48. Modeled and observed ammonia concentrations at the Whiskey Creek station for the model calibration period.

High

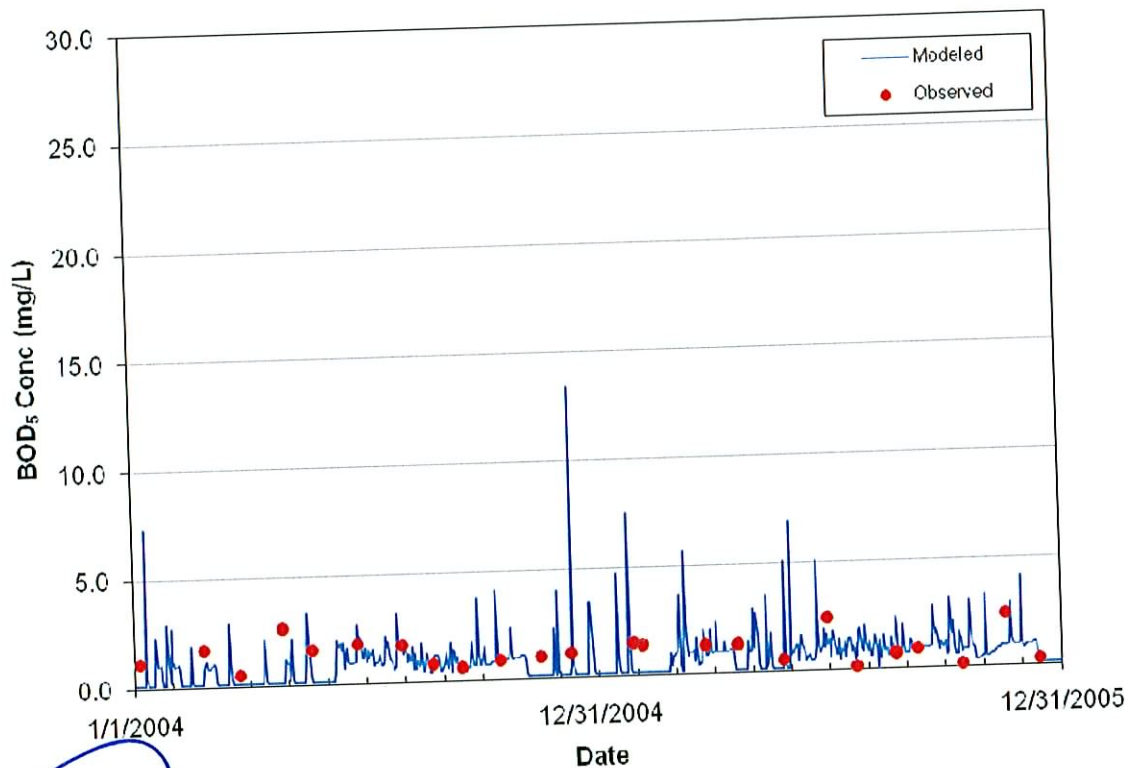


Figure 49. Modeled and observed 5-day biochemical oxygen demand at the Whiskey Creek station for the model calibration period.

BOD₅

5.6.4 HSPF Model Validation

Validation of the model was performed using the data from same water quality stations as those used for model calibration, but for a different period (January 2001 through December 2003). The model validation results at S-79, S-78 and the Whiskey Creek stations for various water quality constituents are shown in Figures 50 through 67. Table 11 shows a comparison of mean modeled and observed concentrations at S-79, S-78 and the Whiskey Creek stations for the model validation run.

Table 11. A comparison of mean modeled and observed concentrations of the water quality constituents for the model validation run.

Constituent	Mean Concentrations of Water Quality Constituents					
	S-79		S-78		Wiskey Creek (Reach 07)	
	Modeled	Observed	Modeled	Observed	Modeled	Observed
TSS (mg/L)	4.43	4.65	5.97	6.88	1.95	1.89
BOD5 (mg/L)					1.00	1.26
DO (mg/L)	6.30	6.25	5.73	5.57	8.97	5.21
NO3 (mg/L)	0.06	0.19	0.08	0.09	0.06	0.06
PO4 (mg/L)	0.08	0.13	0.08	0.06	0.12	0.00
NH3 (mg/L)	0.04	0.07	0.06	0.09	0.10	0.05
Water Temp (deg. F)	76.37	80.18	76.67	76.92	72.54	75.55

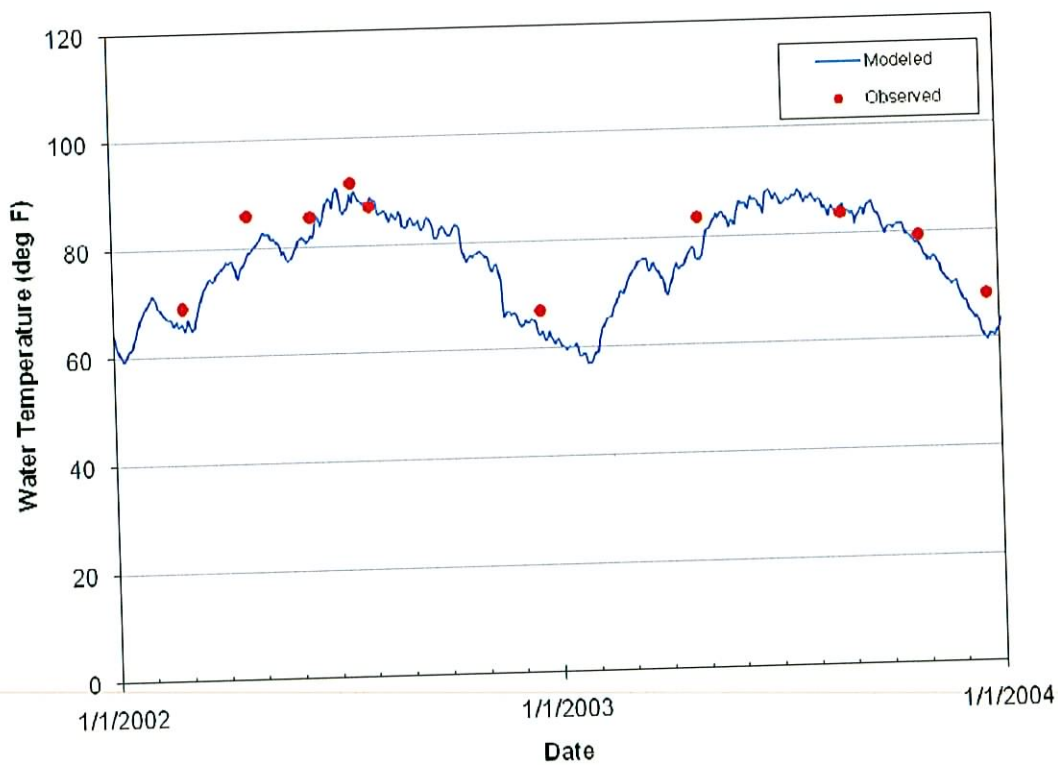


Figure 50. Modeled and observed water temperature at the S-79 station for the model validation period.

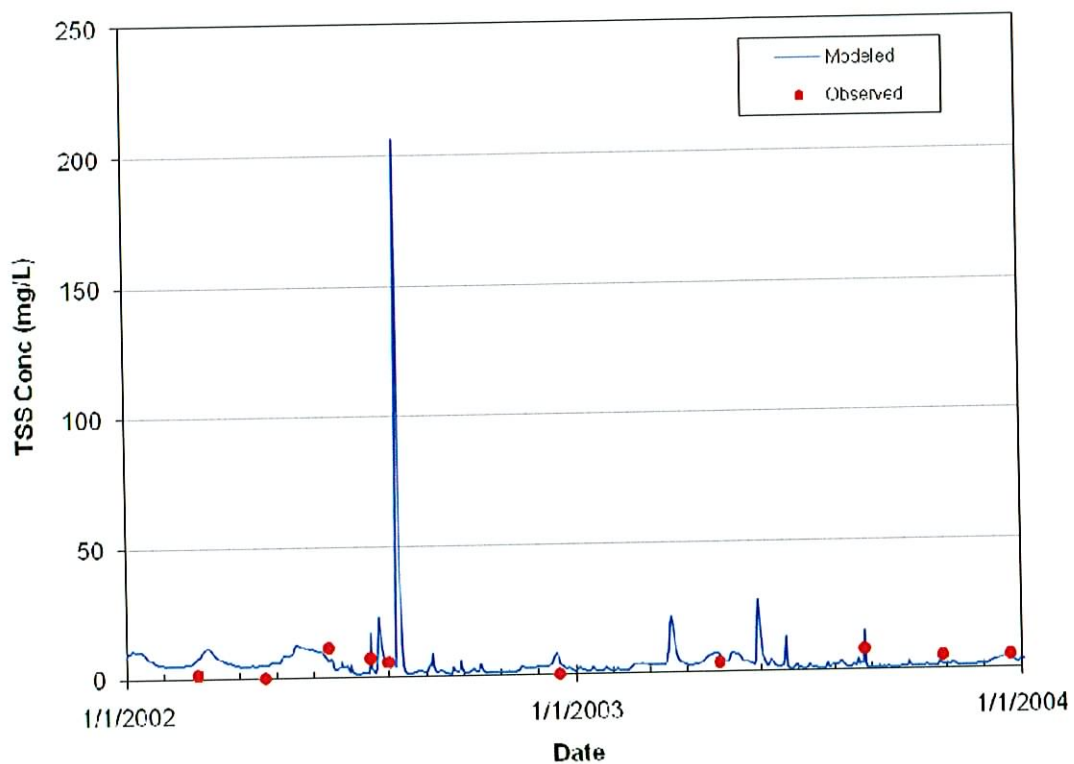


Figure 51. Modeled and observed total suspended solids concentrations at the S-79 station for the model validation period.

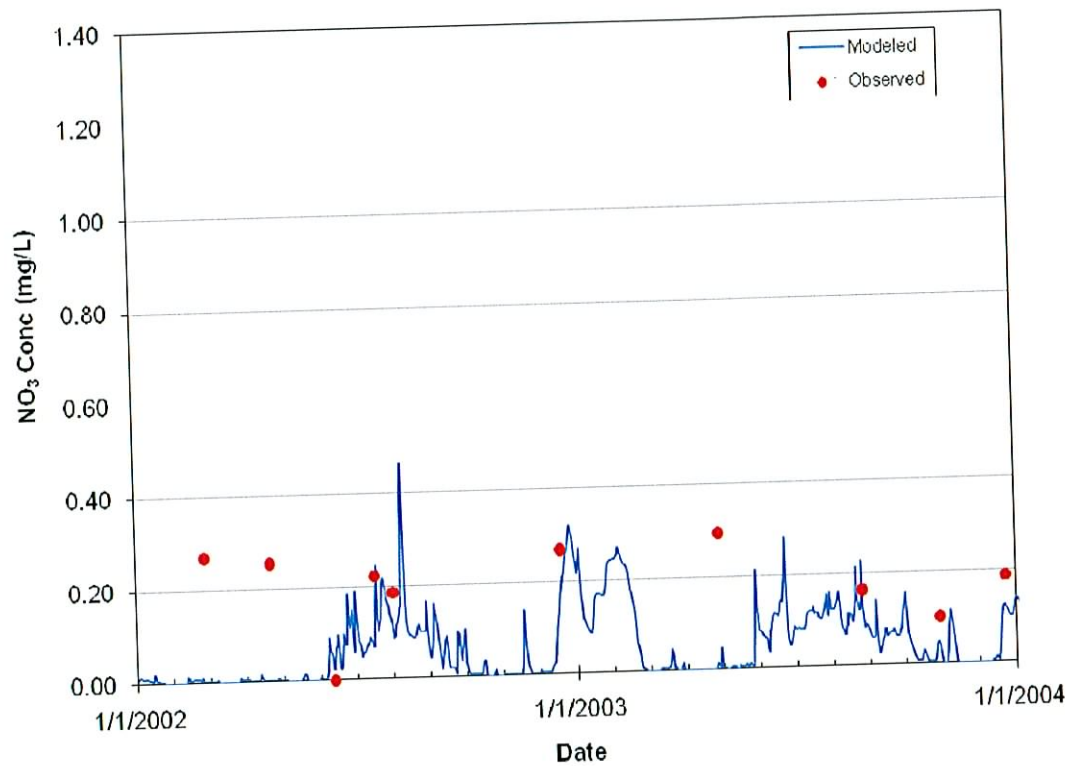


Figure 52. Modeled and observed nitrate concentrations at the S-79 station for the model validation period.

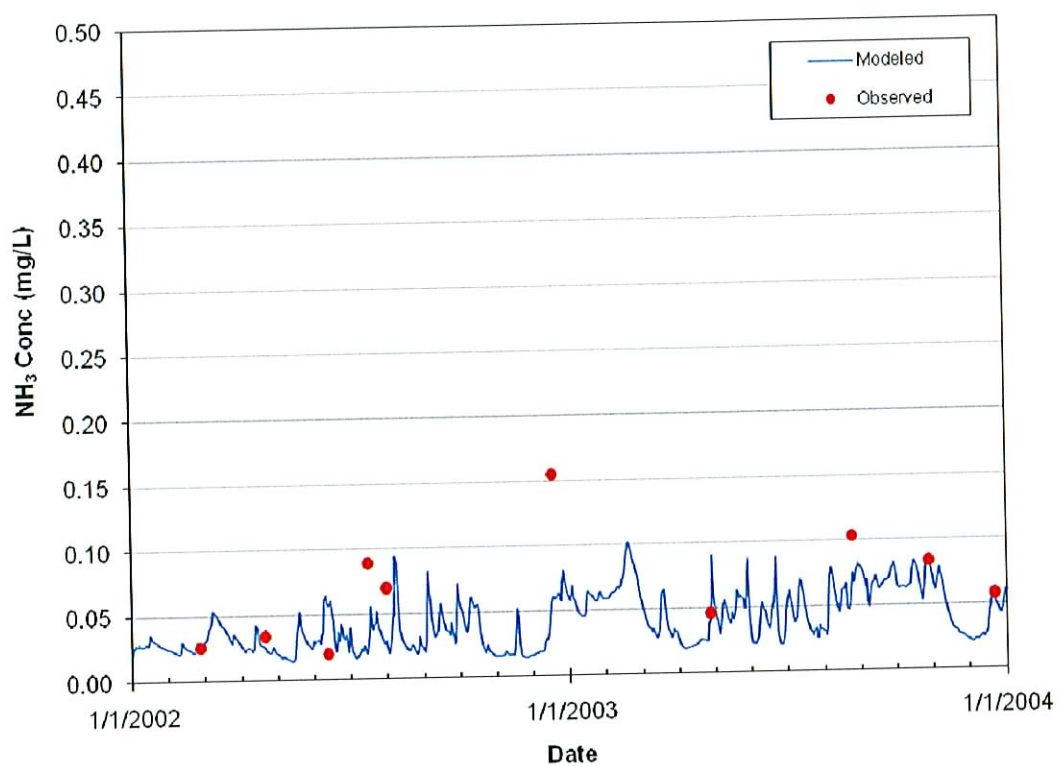


Figure 53. Modeled and observed ammonia concentrations at the S-79 station for the model validation period.

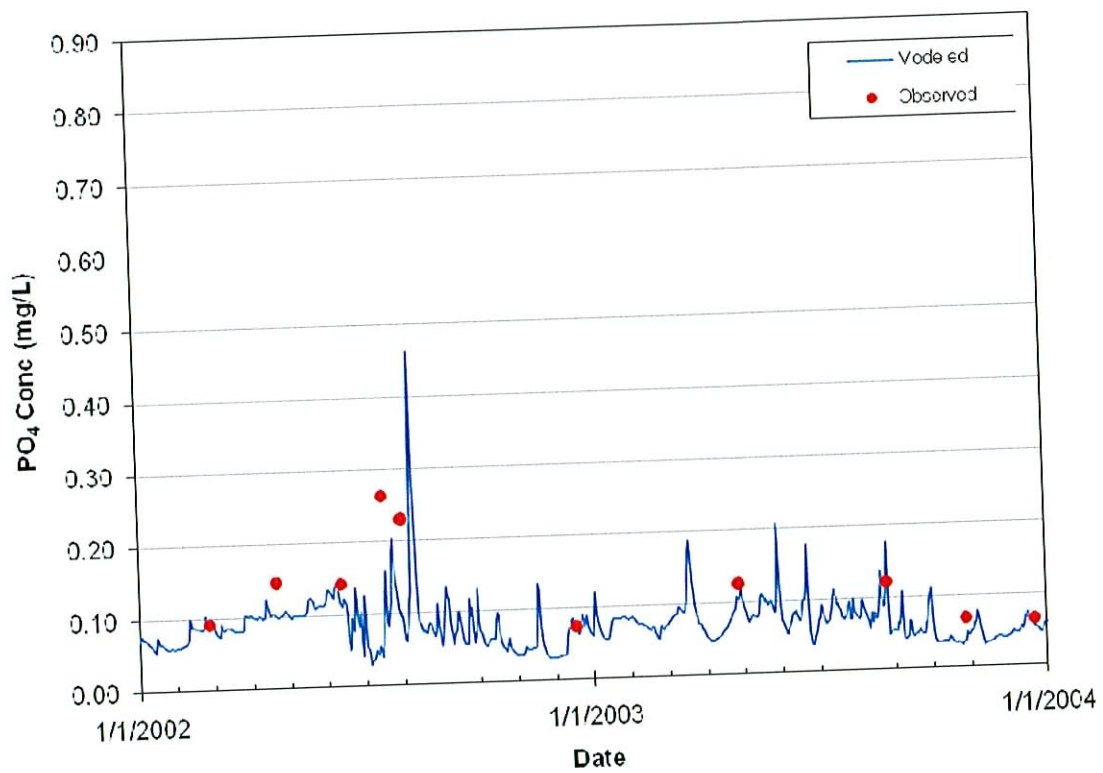


Figure 54. Modeled and observed phosphate concentrations at the S-79 station for the model validation period.

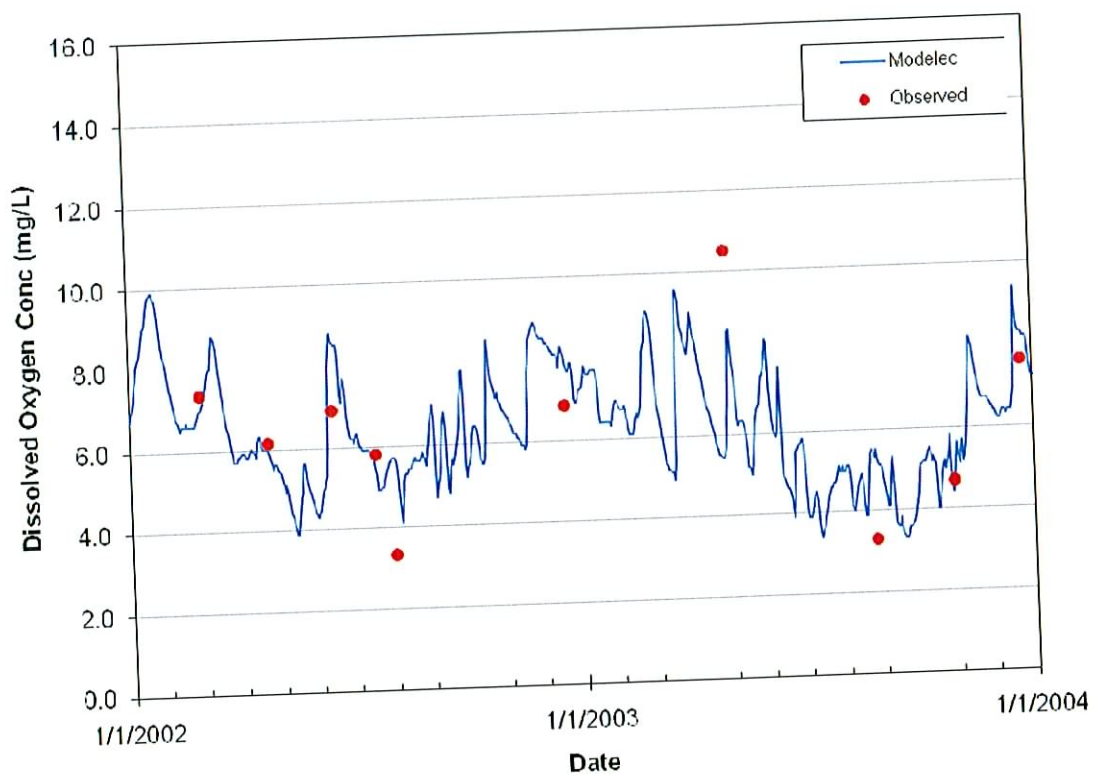


Figure 55. Modeled and observed dissolved oxygen concentrations at the S-79 station for the model validation period.

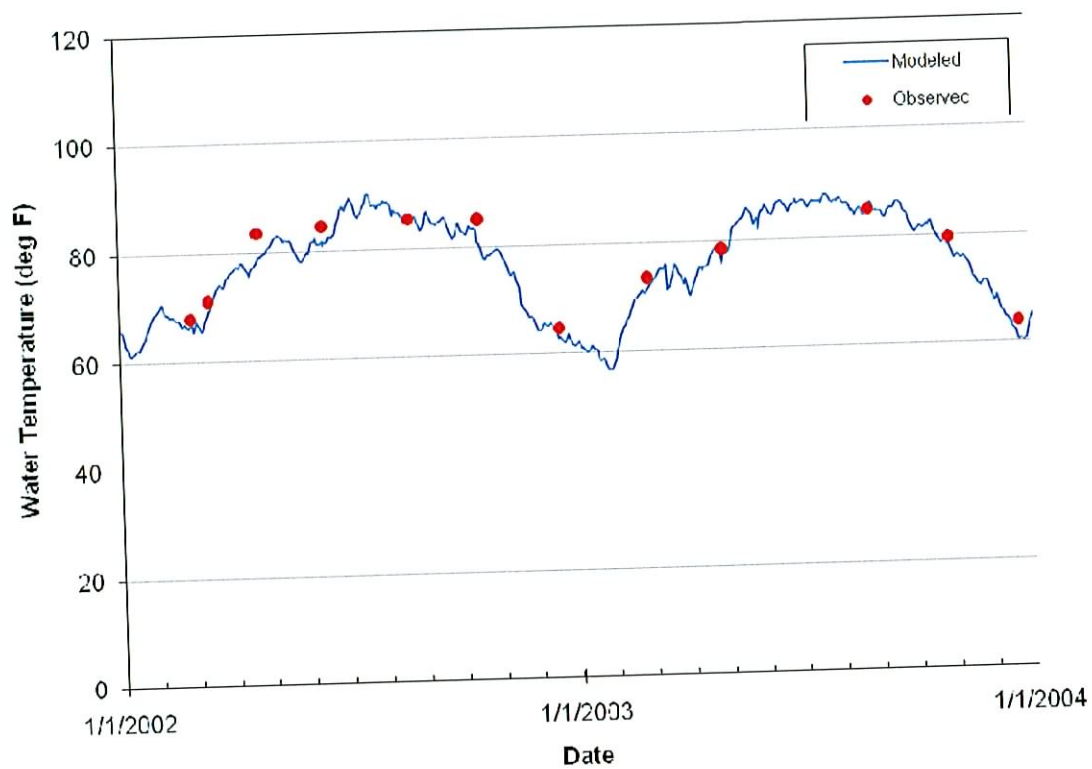


Figure 56. Modeled and observed water temperature at the S-78 station for the model validation period.

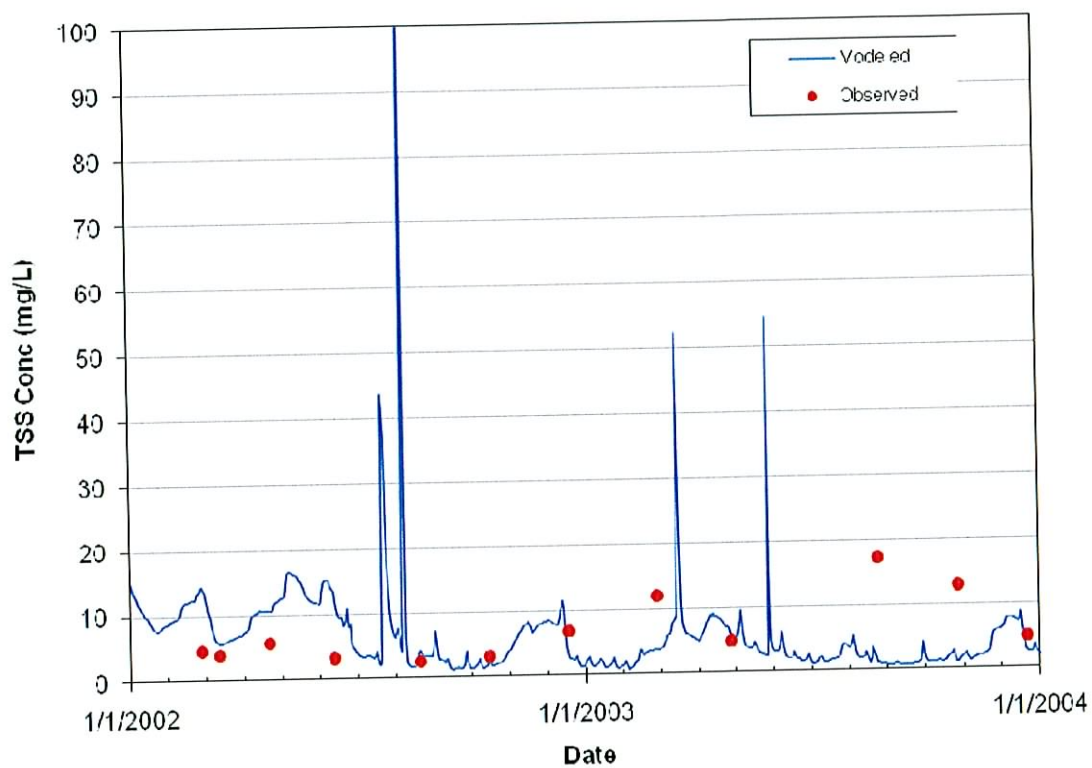


Figure 57. Modeled and observed total suspended solids concentrations at the S-78 station for the model validation period.

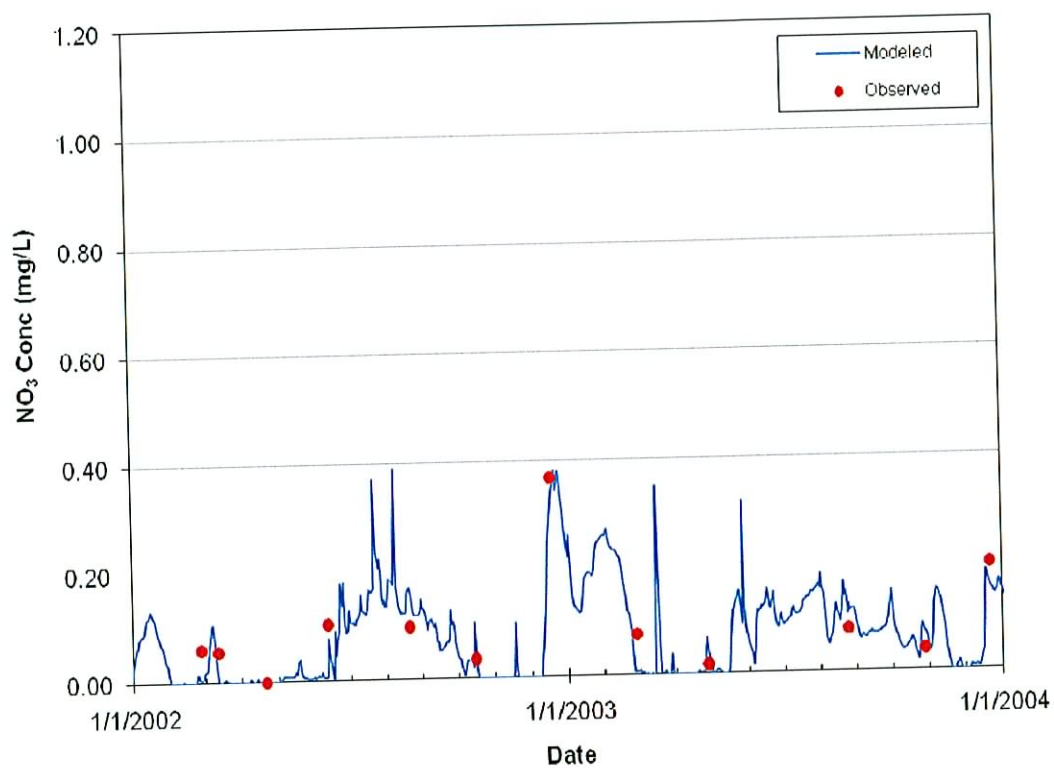


Figure 58. Modeled and observed nitrate concentrations at the S-78 station for the model validation period.

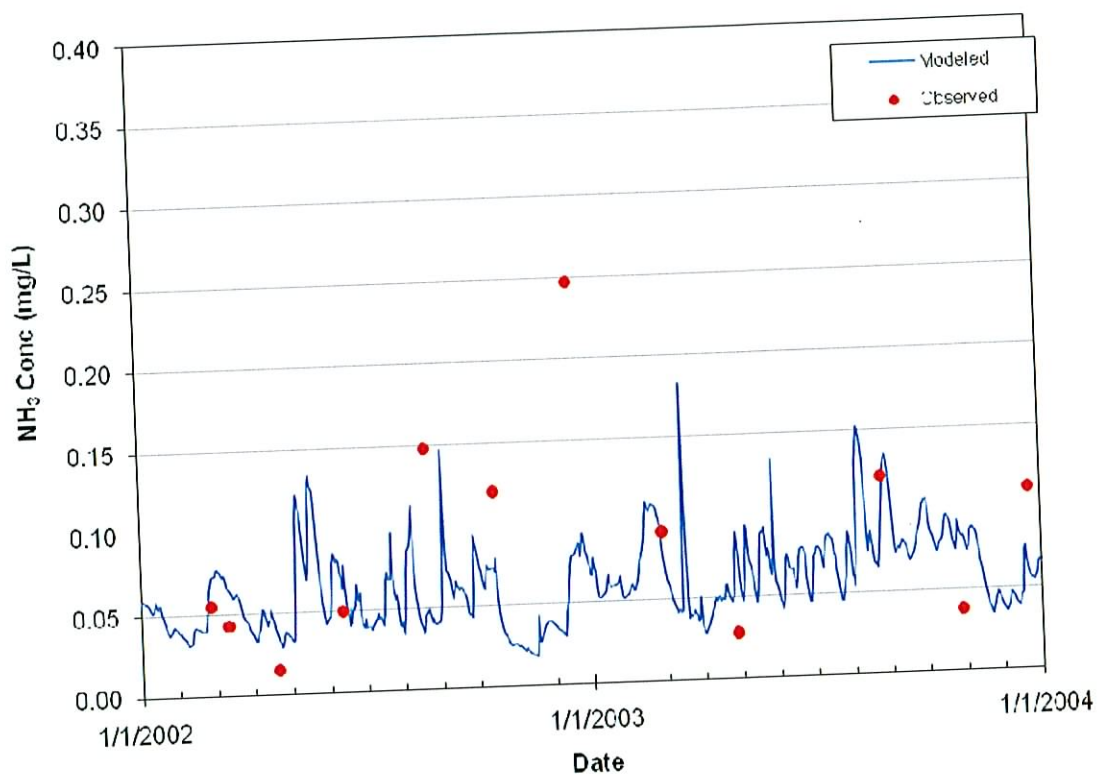


Figure 59. Modeled and observed ammonia concentrations at the S-78 station for the model validation period.

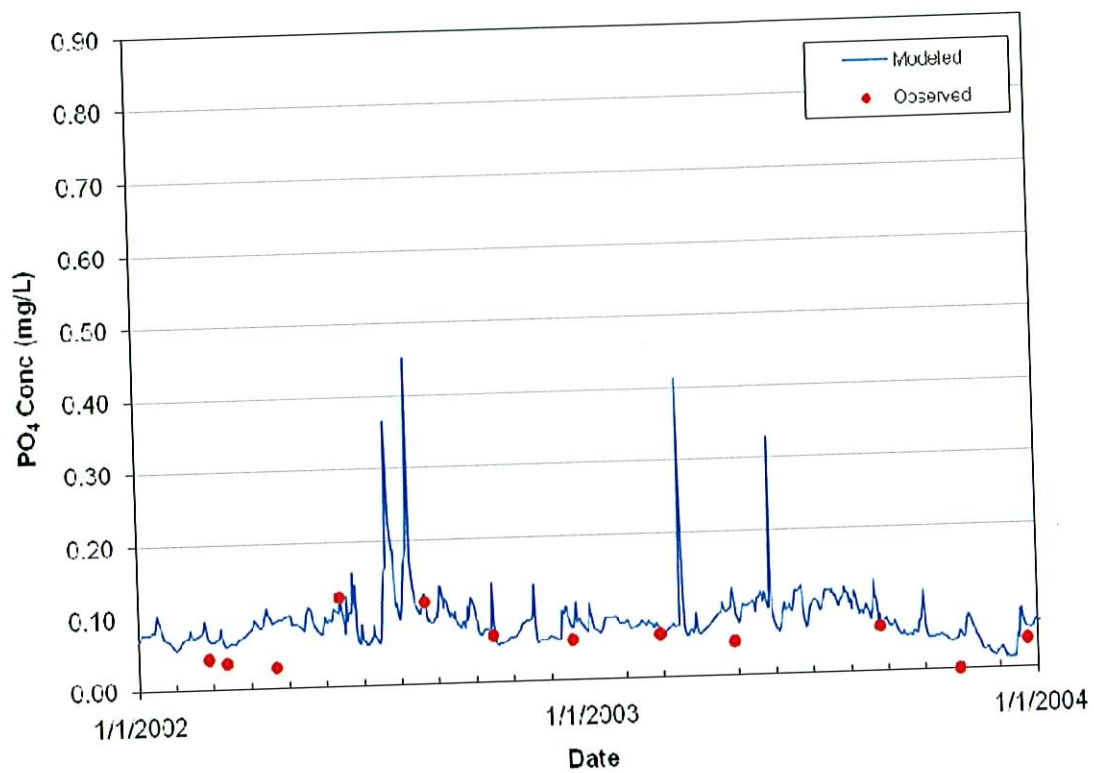


Figure 60. Modeled and observed phosphate concentrations at the S-78 station for the model validation period.

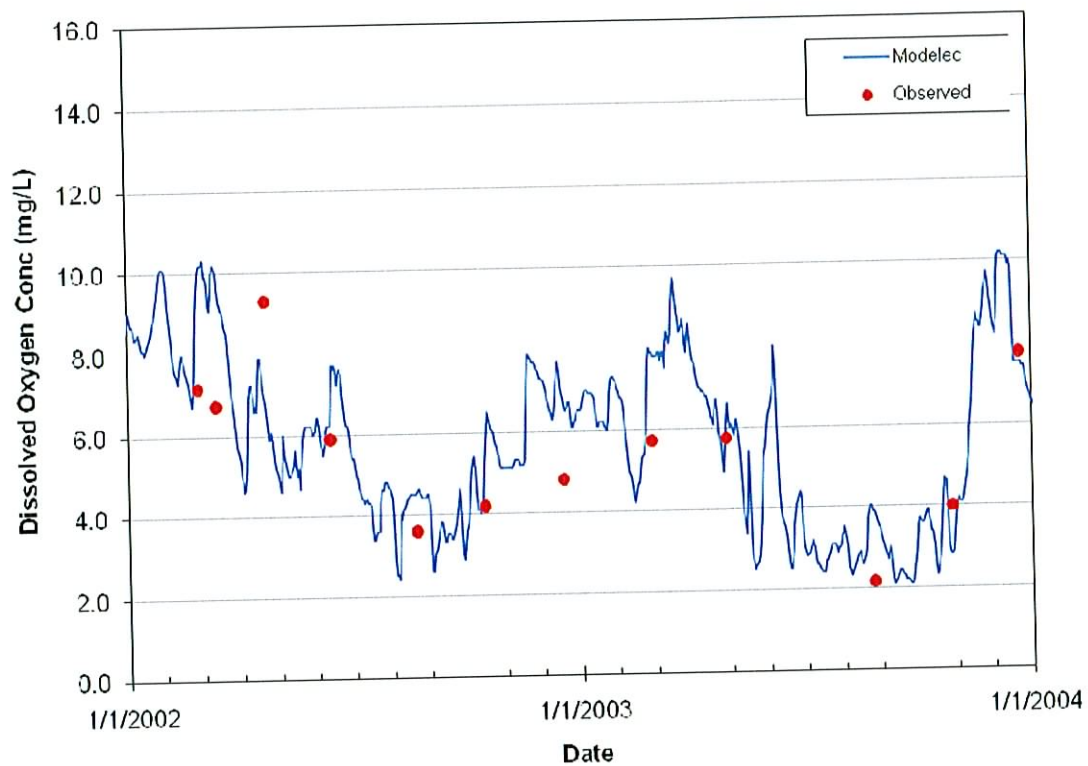


Figure 62. Modeled and observed dissolved oxygen concentrations at the S-78 station for the model validation period.

Speed and
curves

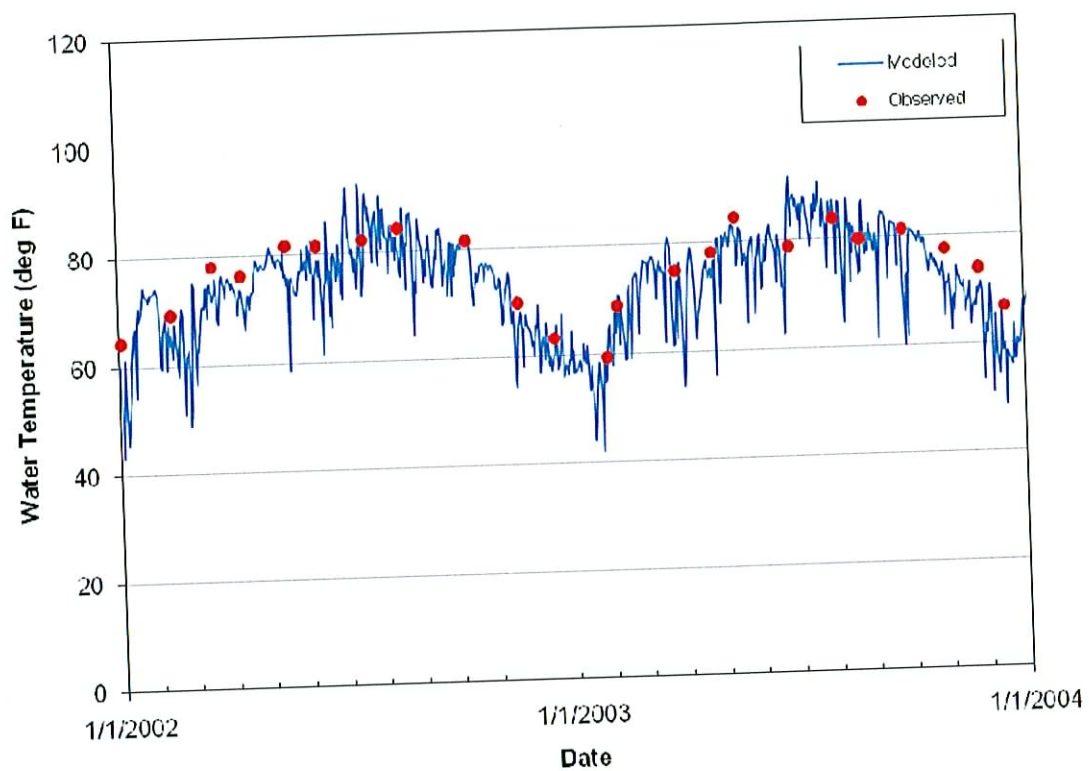


Figure 63. Modeled and observed water temperature at the Whiskey Creek station for the model validation period.

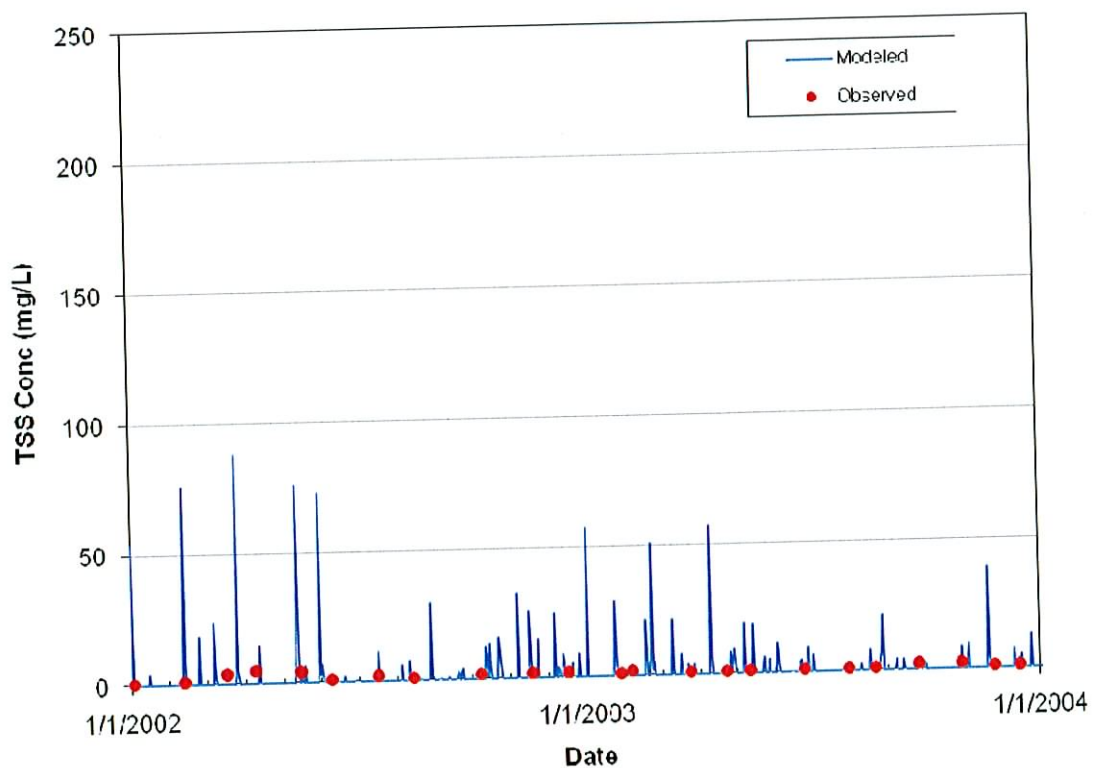


Figure 64. Modeled and observed total suspended solids concentrations at the Whiskey Creek station for the model validation period.

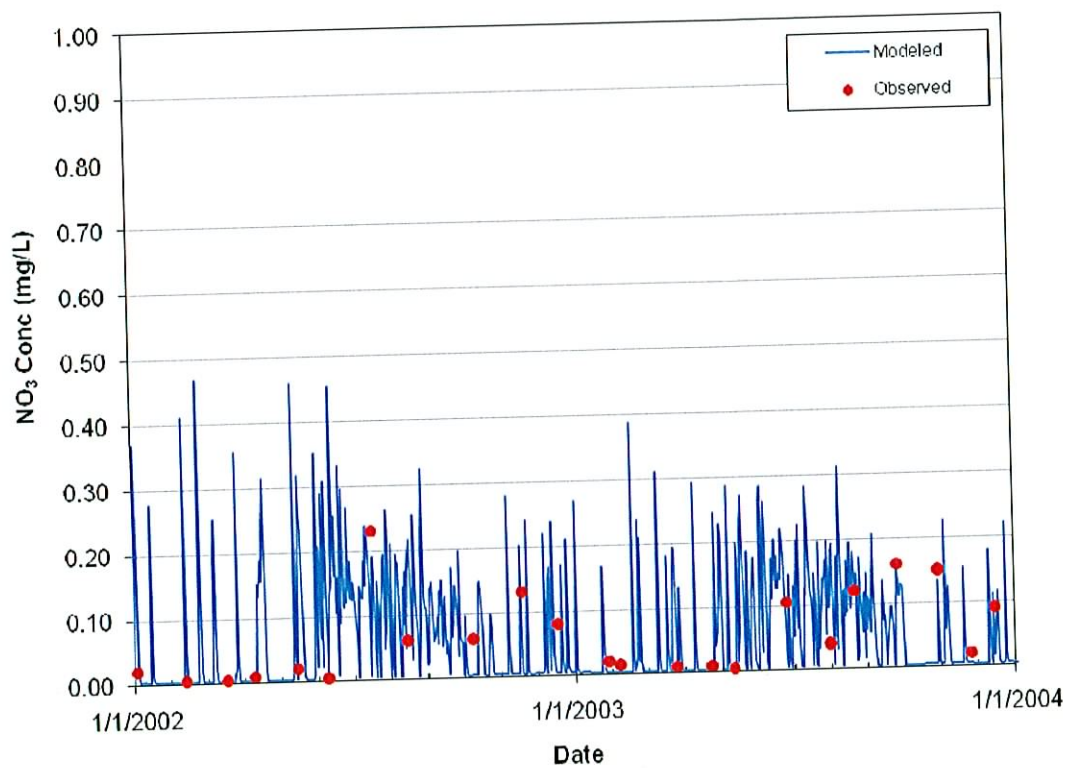


Figure 65. Modeled and observed nitrate concentrations at the Whiskey Creek station for the model validation period.

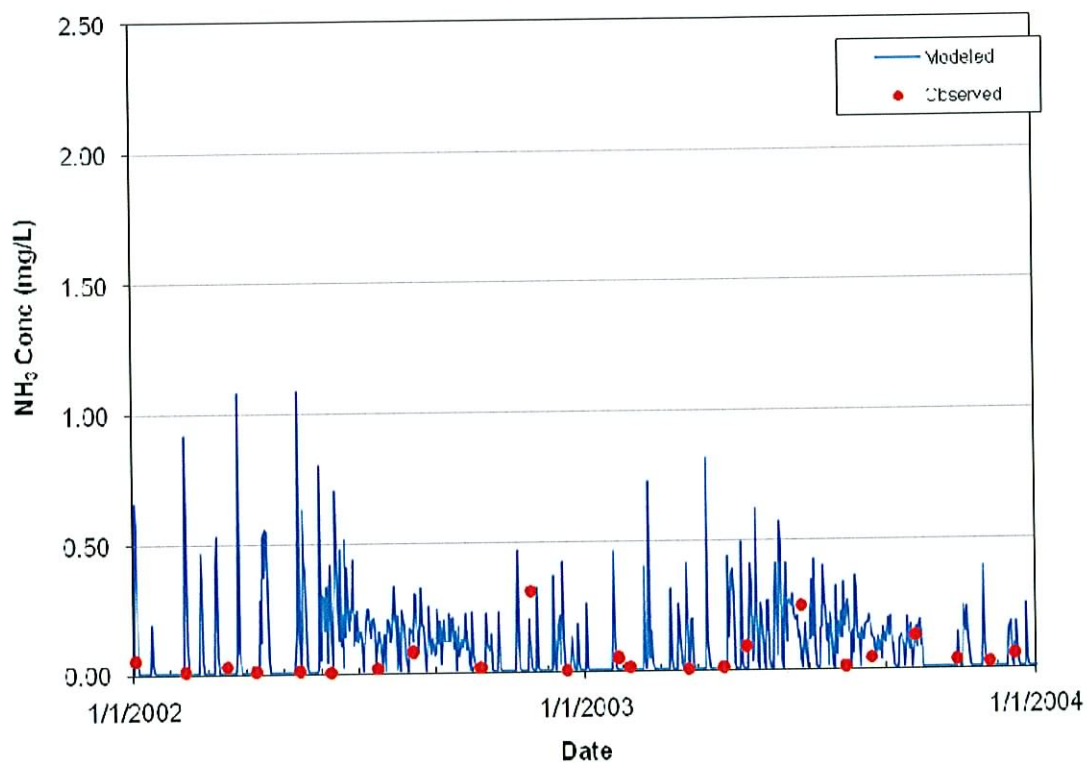


Figure 66. Modeled and observed ammonia concentrations at the Whiskey Creek station for the model validation period.

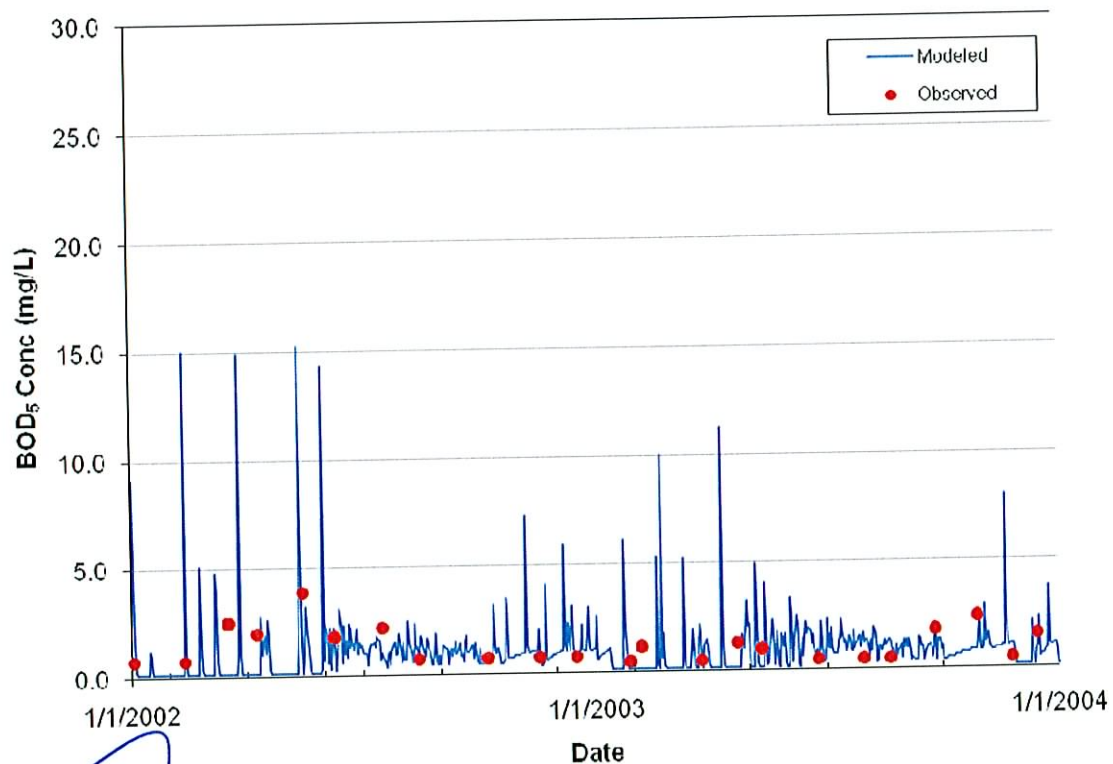


Figure 67. Modeled and observed 5-day biochemical oxygen demand at the Whiskey Creek station for the model validation period.

5.7 HSPF Output for EFDC Boundary Condition

Upon completion of the calibration and the validation the HSPF model was used to simulate the water quality constituents and provide time series output that would be used specify the boundary conditions for the EFDC model. Figure 68 shows the locations at which HSPF output were generated to use as the EFDC boundary conditions.

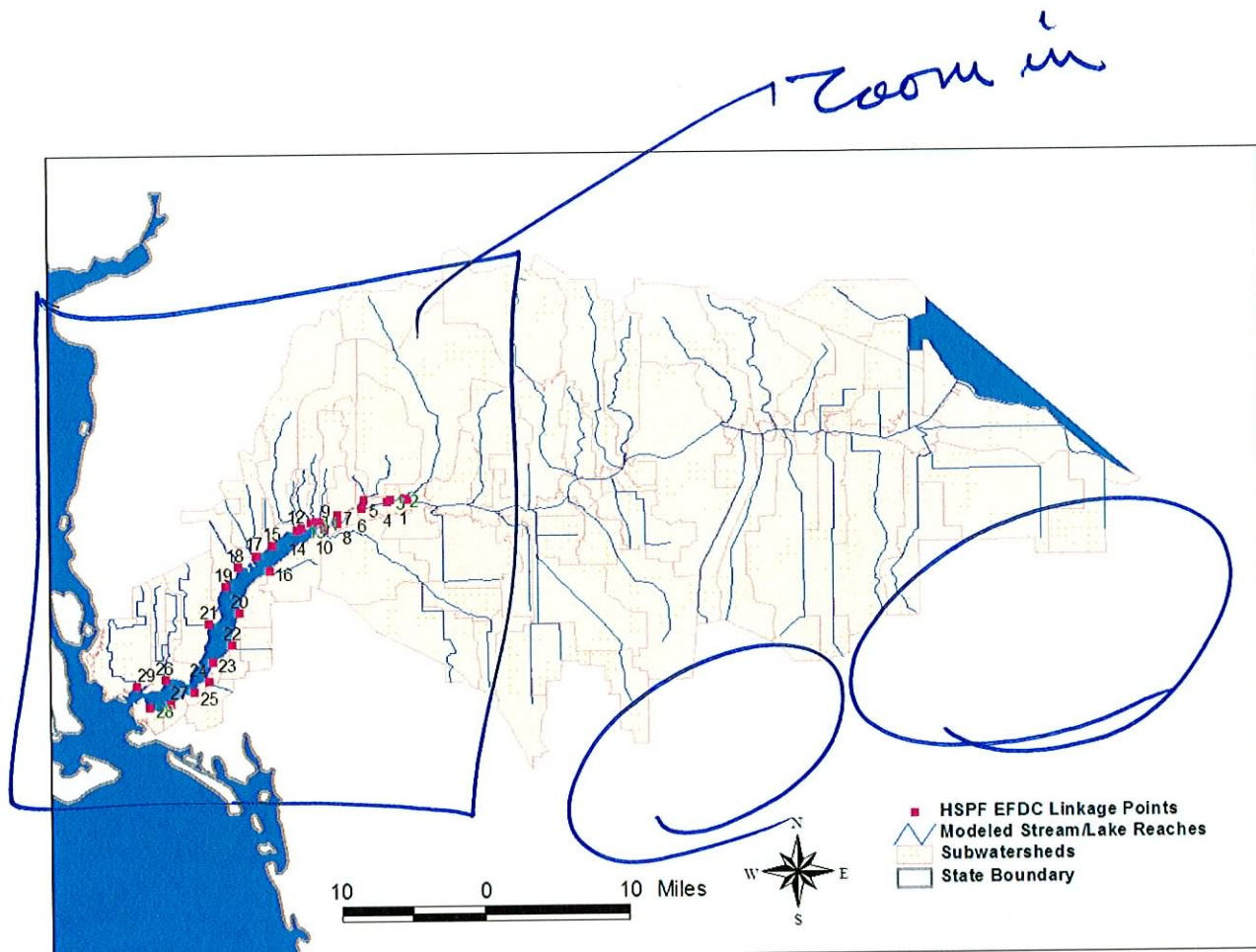


Figure 62. Locations of HSPF model output to be used as EFDC boundary condition.