



# **Lake Superior North and Lake Superior South Basins**

## **Watershed Model Development Report**

### **Appendix D**

# **Suspended Sediment and Water Quality Calibration and Validation for Lake Superior North and South Watersheds**

**Prepared for**  
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**Prepared by**



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## Amity Creek at Duluth (HYDSTRA 02038001)

### Total Suspended Solids (TSS)

Table 1. Total Suspended Solids (TSS) statistics

Count	142
Concentration Average Error	3.20%
Concentration Median Error	7.12%
Load Average Error	68.77%
Load Median Error	1.28%
Paired t concentration	0.86
Paired t load	0.07

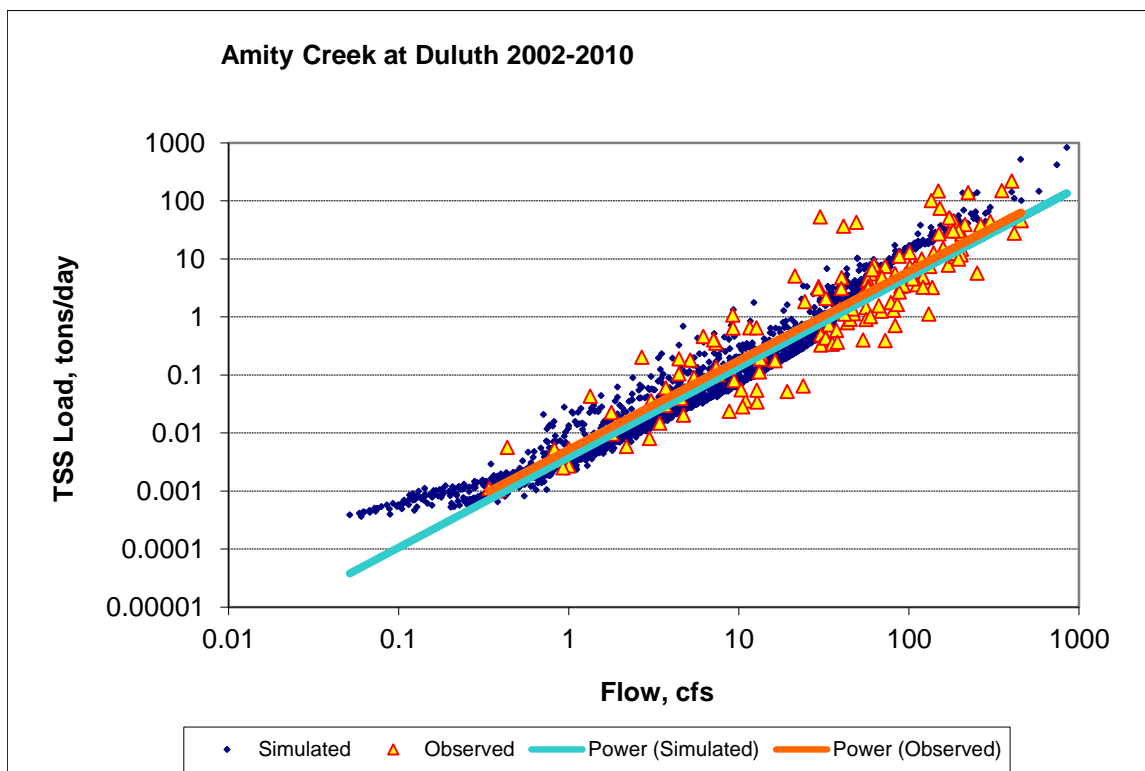


Figure 1. Power plot of simulated and observed Total Suspended Solids (TSS) load vs flow at Amity Creek at Duluth

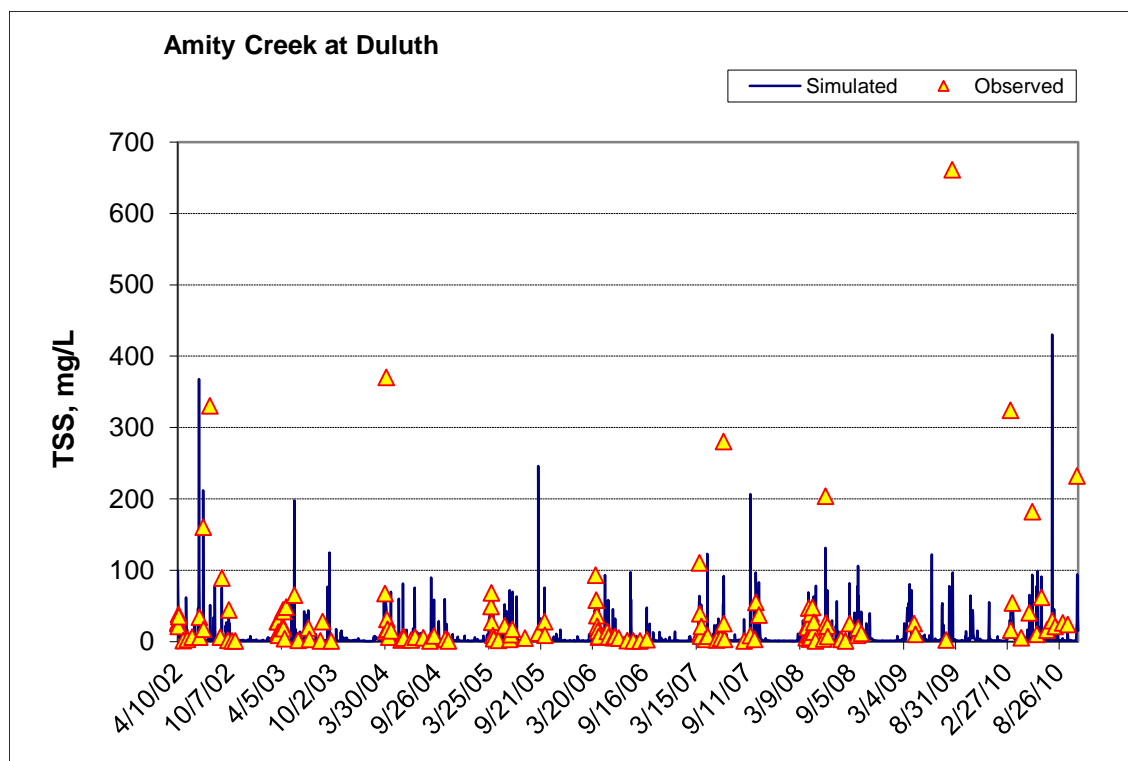


Figure 2. Time series of observed and simulated Total Suspended Solids (TSS) concentration at Amity Creek at Duluth

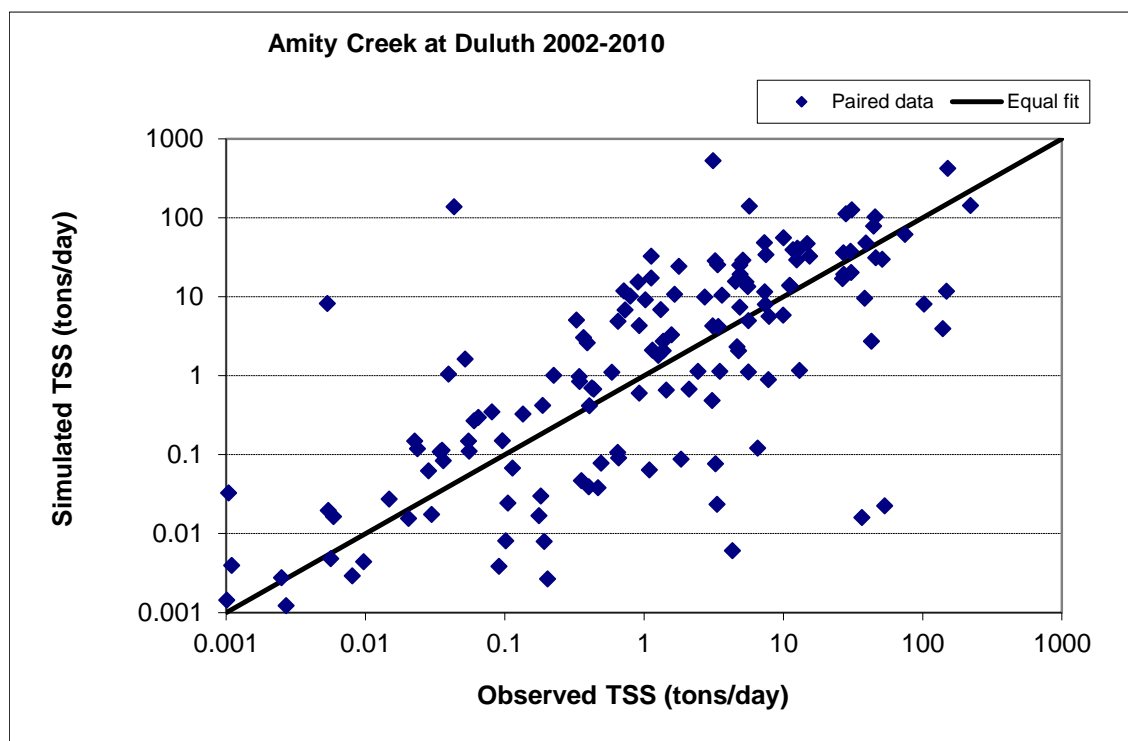
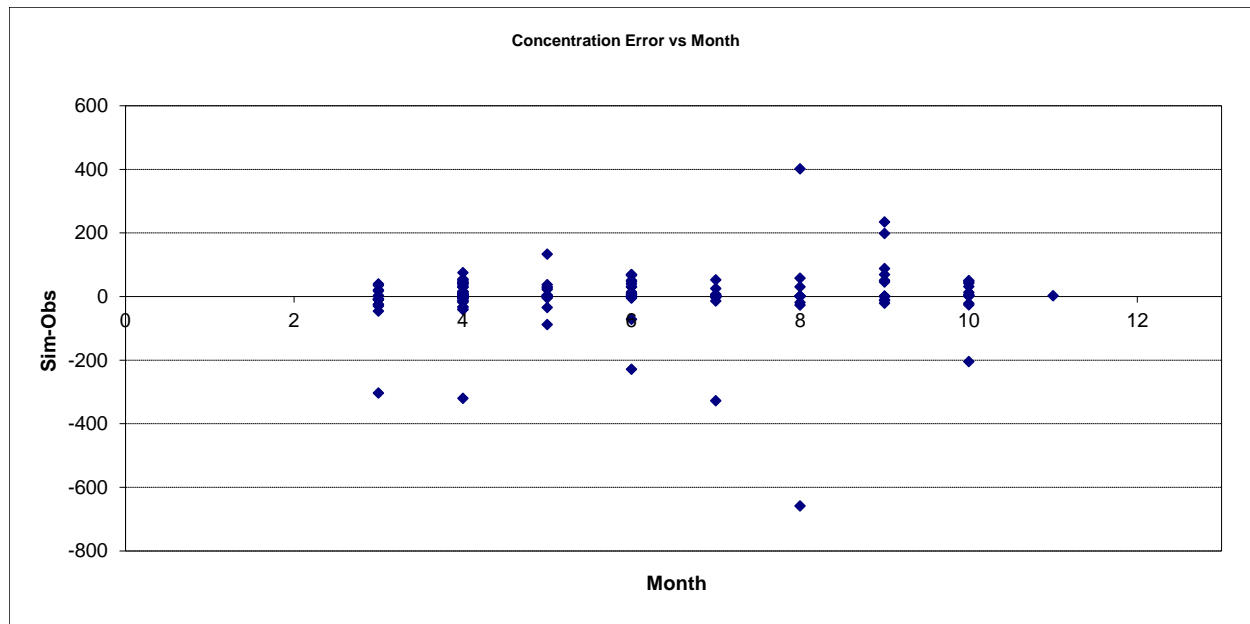
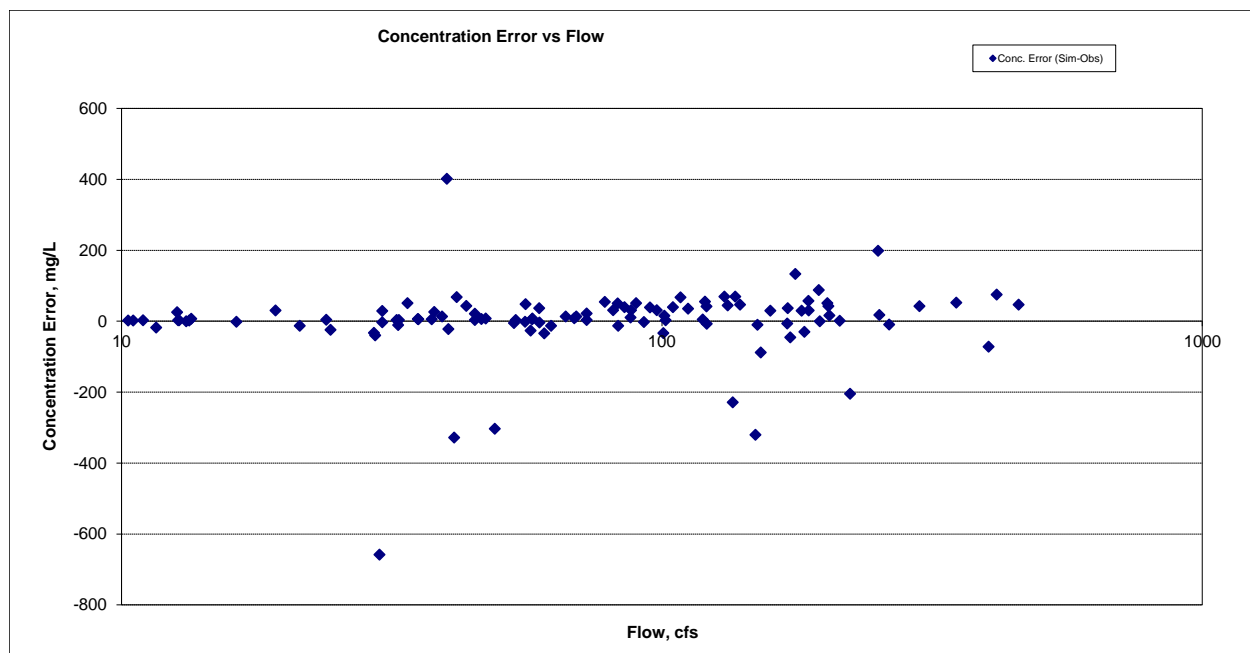


Figure 3. Paired simulated vs. observed Total Suspended Solids (TSS) load at Amity Creek at Duluth





**Figure 4. Residual (Simulated - Observed) vs. Month Total Suspended Solids (TSS) at Amity Creek at Duluth**

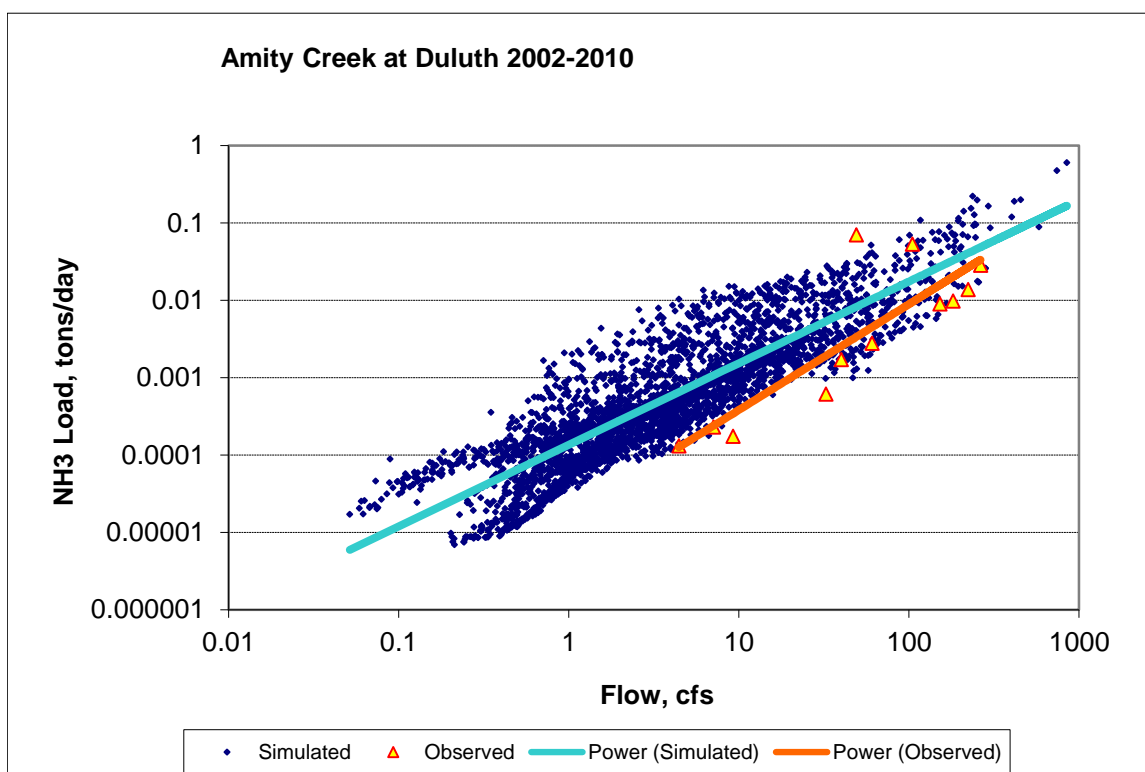


**Figure 5. Residual (Simulated - Observed) vs. Flow Total Suspended Solids (TSS) at Amity Creek at Duluth**

## Ammonia Nitrogen (NH<sub>3</sub>)

**Table 2. Ammonia Nitrogen (NH<sub>3</sub>) statistics**

Count	12
Concentration Average Error	102.43%
Concentration Median Error	127.71%
Load Average Error	138.97%
Load Median Error	30.53%
Paired t concentration	0.06
Paired t load	0.08



**Figure 6. Power plot of simulated and observed Ammonia Nitrogen (NH<sub>3</sub>) load vs flow at Amity Creek at Duluth**

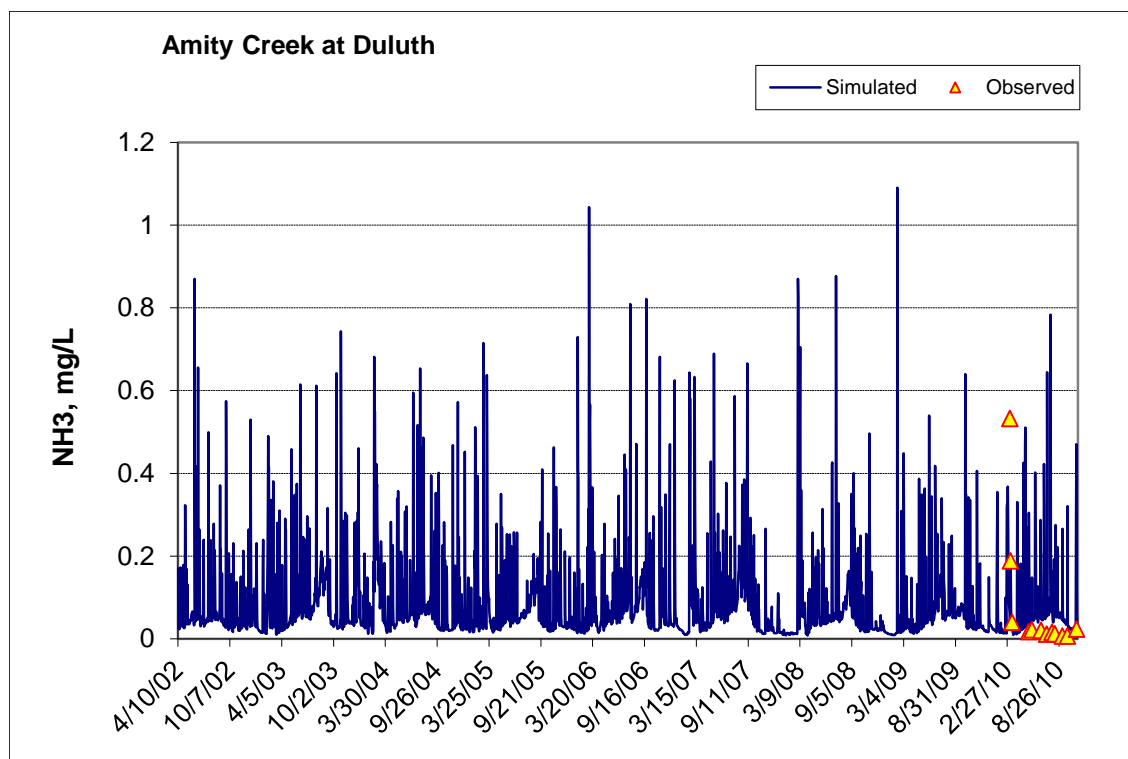


Figure 7. Time series of observed and simulated Ammonia Nitrogen (NH<sub>3</sub>) concentration at Amity Creek at Duluth

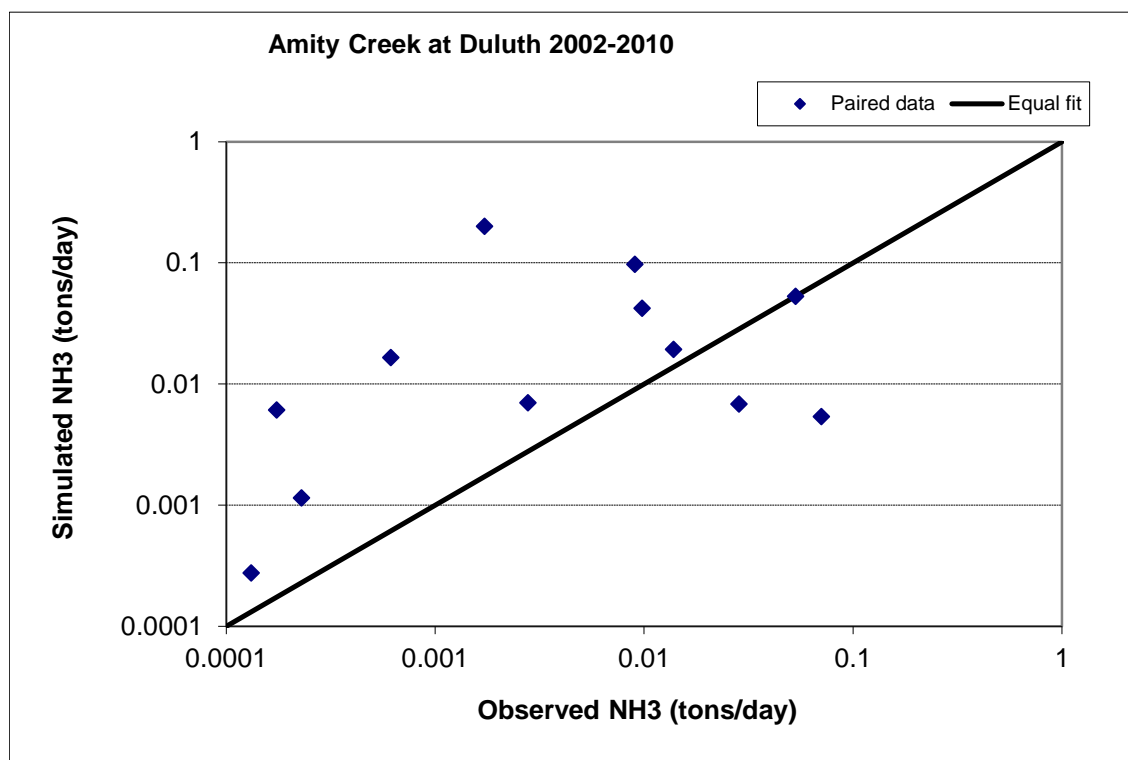


Figure 8. Paired simulated vs. observed Ammonia Nitrogen (NH<sub>3</sub>) load at Amity Creek at Duluth

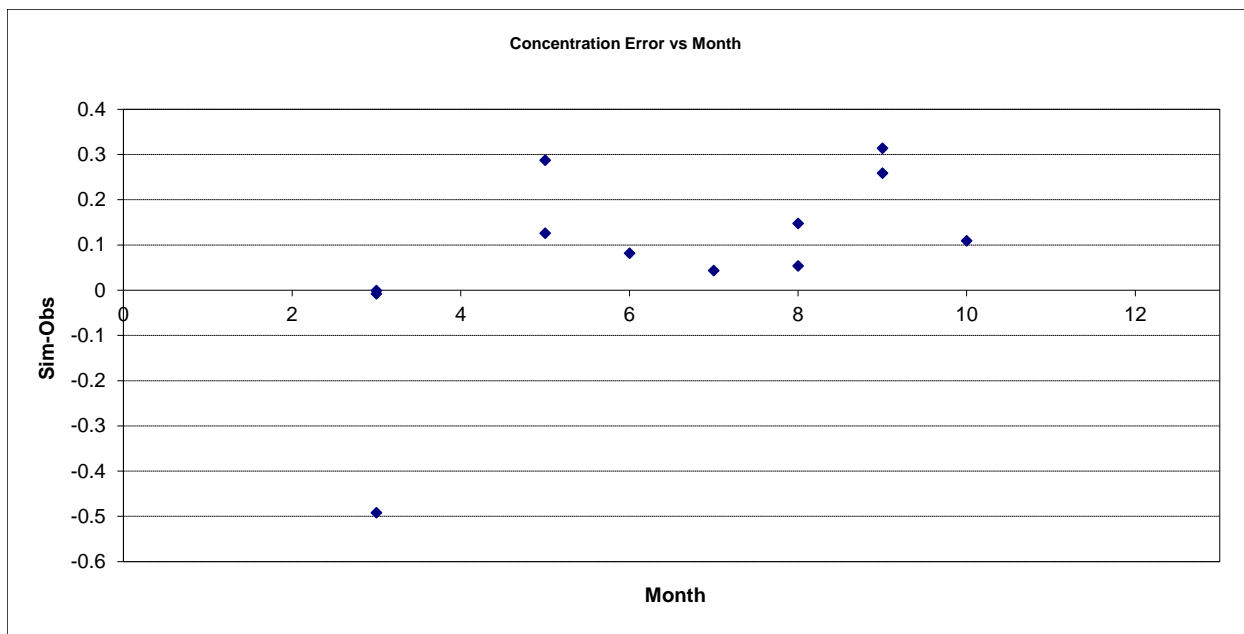


Figure 9. Residual (Simulated - Observed) vs. Month Ammonia Nitrogen (NH<sub>3</sub>) at Amity Creek at Duluth

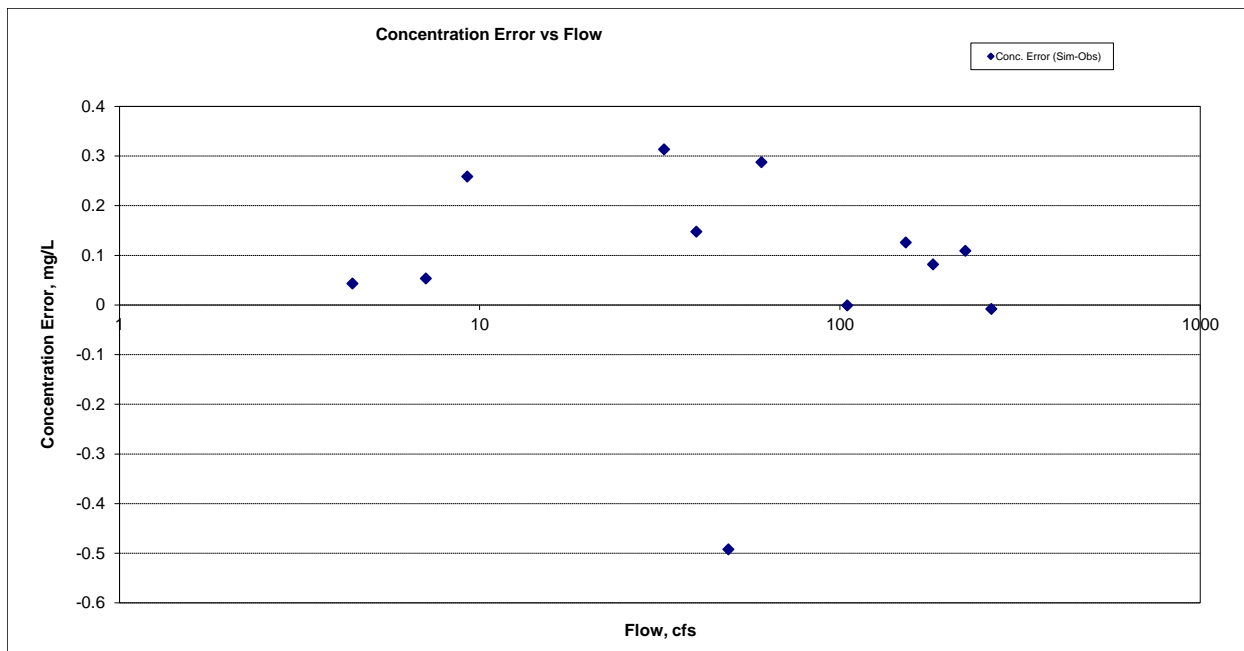
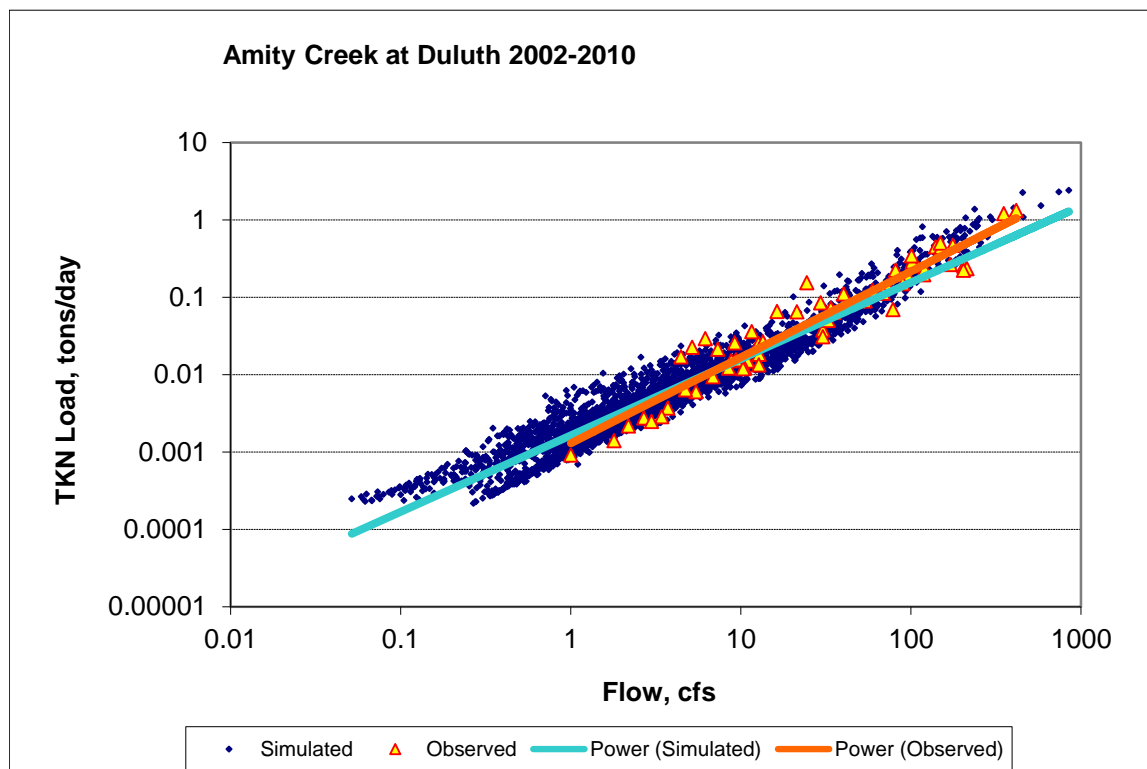


Figure 10. Residual (Simulated - Observed) vs. Flow Ammonia Nitrogen (NH<sub>3</sub>) at Amity Creek at Duluth

## Total Kjeldahl Nitrogen (TKN)

**Table 3. Total Kjeldahl Nitrogen (TKN) statistics**

Count	59
Concentration Average Error	-7.62%
Concentration Median Error	-3.39%
Load Average Error	20.55%
Load Median Error	-0.73%
Paired t concentration	0.97
Paired t load	0.49



**Figure 11. Power plot of simulated and observed Total Kjeldahl Nitrogen (TKN) load vs flow at Amity Creek at Duluth**

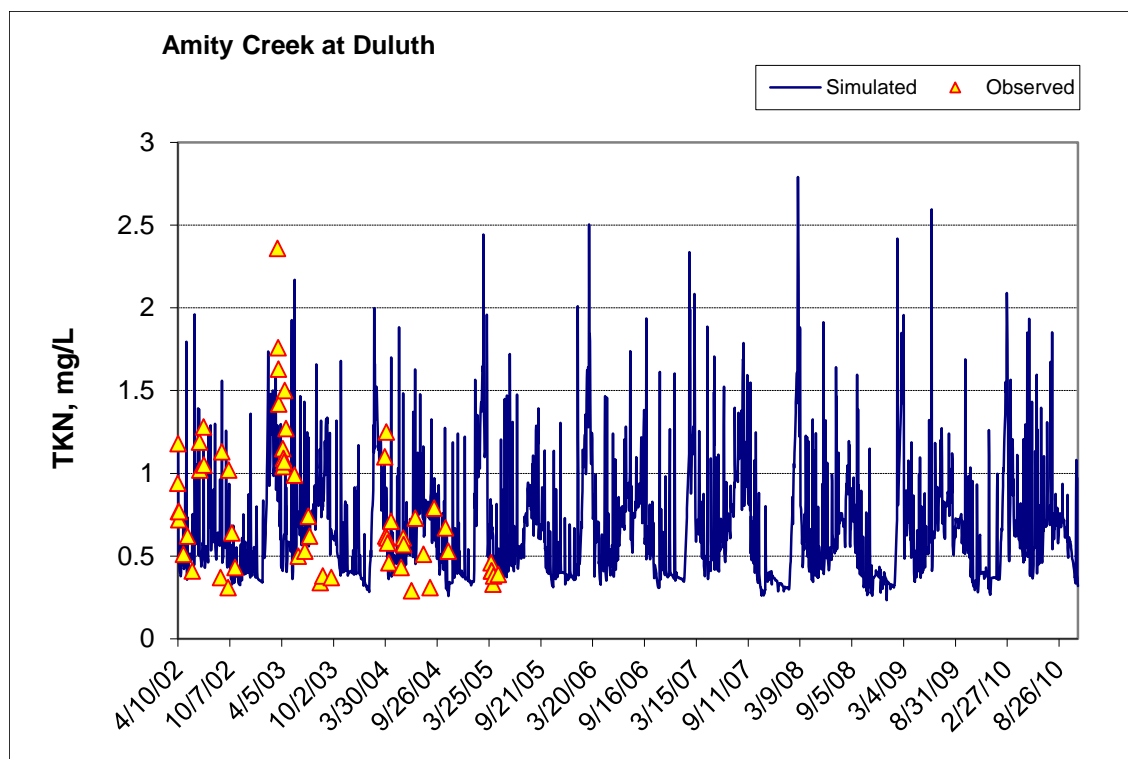


Figure 12. Time series of observed and simulated Total Kjeldahl Nitrogen (TKN) concentration at Amity Creek at Duluth

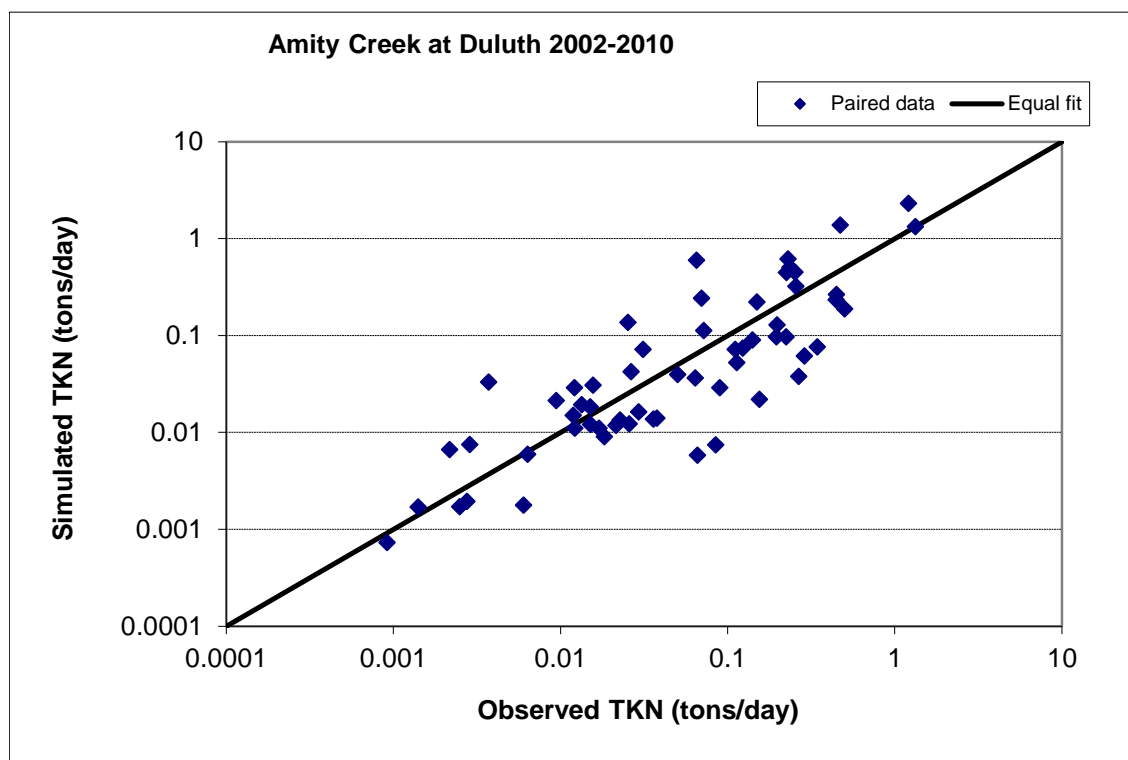
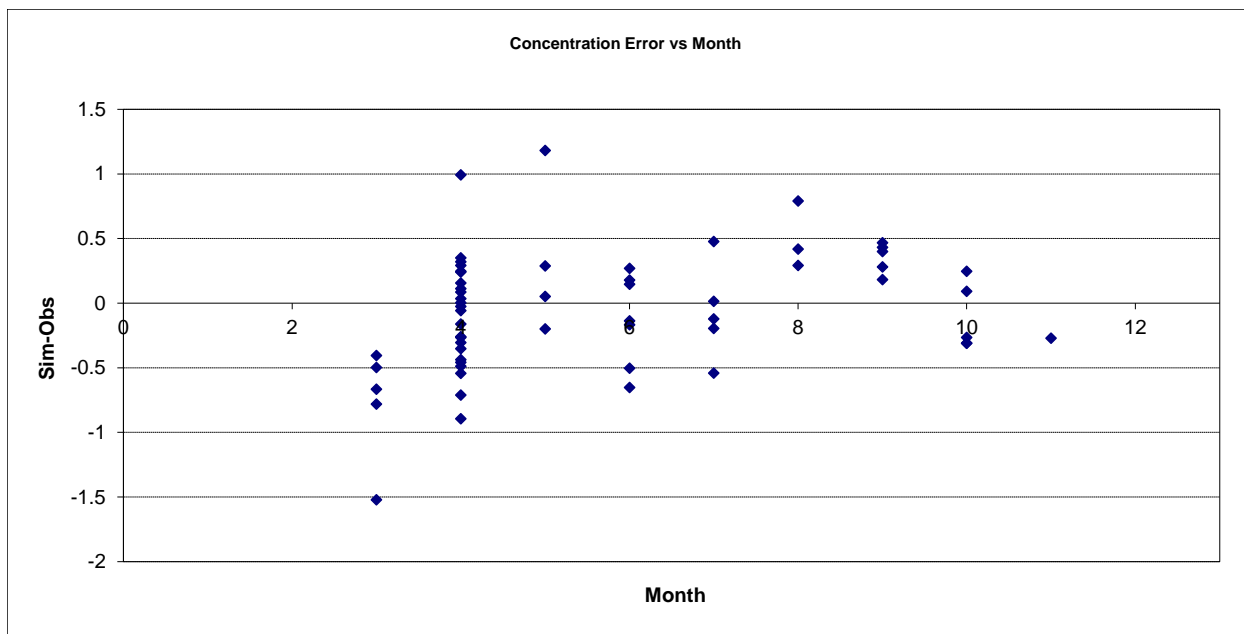
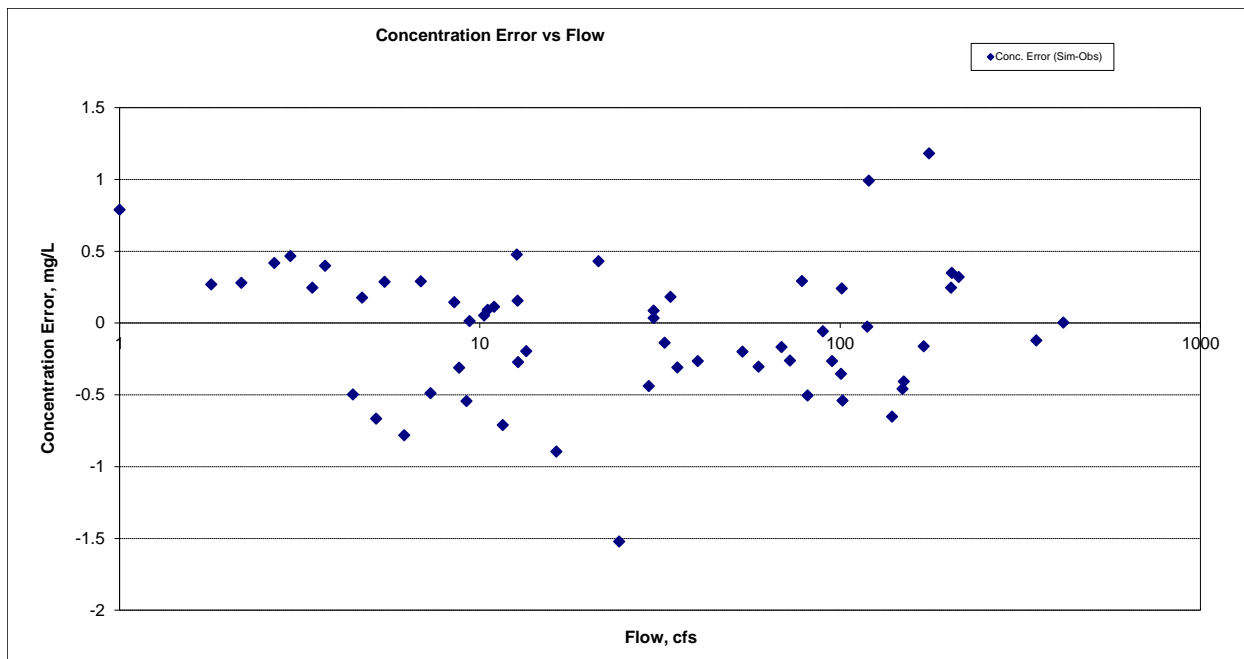


Figure 13. Paired simulated vs. observed Total Kjeldahl Nitrogen (TKN) load at Amity Creek at Duluth



**Figure 14. Residual (Simulated - Observed) vs. Month Total Kjeldahl Nitrogen (TKN) at Amity Creek at Duluth**

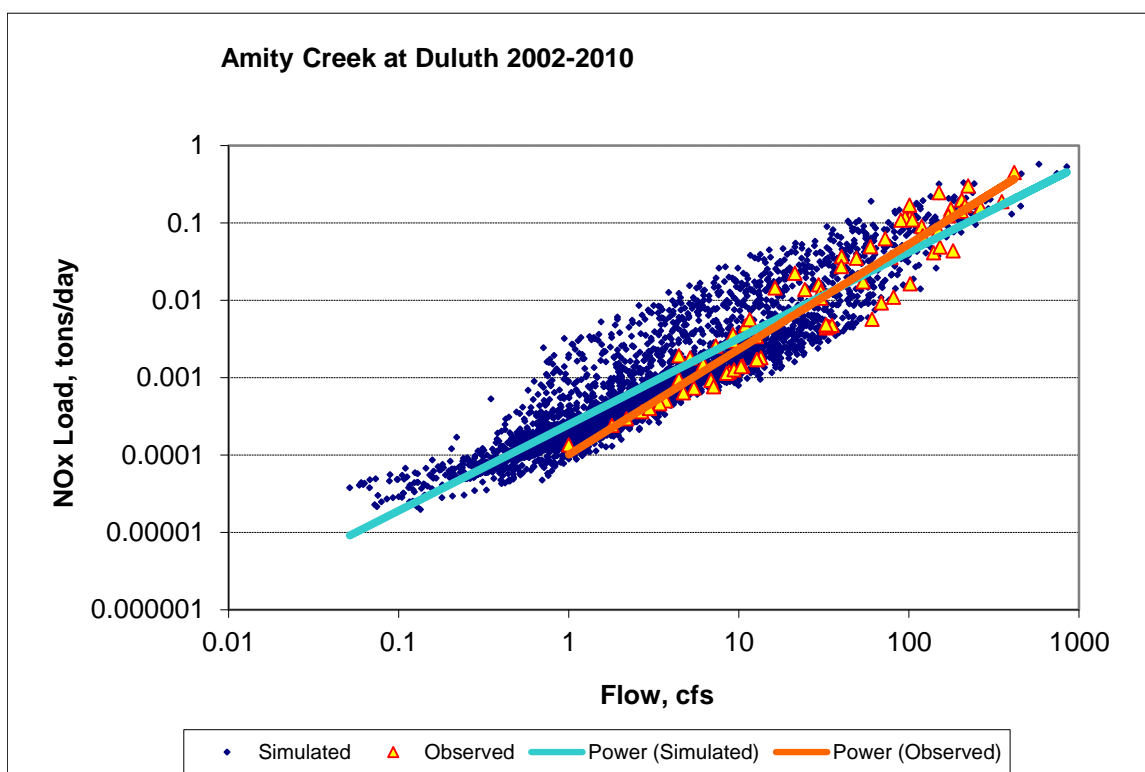


**Figure 15. Residual (Simulated - Observed) vs. Flow Total Kjeldahl Nitrogen (TKN) at Amity Creek at Duluth**

## Nitrite+ Nitrate Nitrogen (NOx)

**Table 4. Nitrite+ Nitrate Nitrogen (NOx) statistics**

Count	71
Concentration Average Error	13.95%
Concentration Median Error	2.23%
Load Average Error	-2.60%
Load Median Error	0.31%
Paired t concentration	0.73
Paired t load	0.81



**Figure 16. Power plot of simulated and observed Nitrite+ Nitrate Nitrogen (NOx) load vs flow at Amity Creek at Duluth**



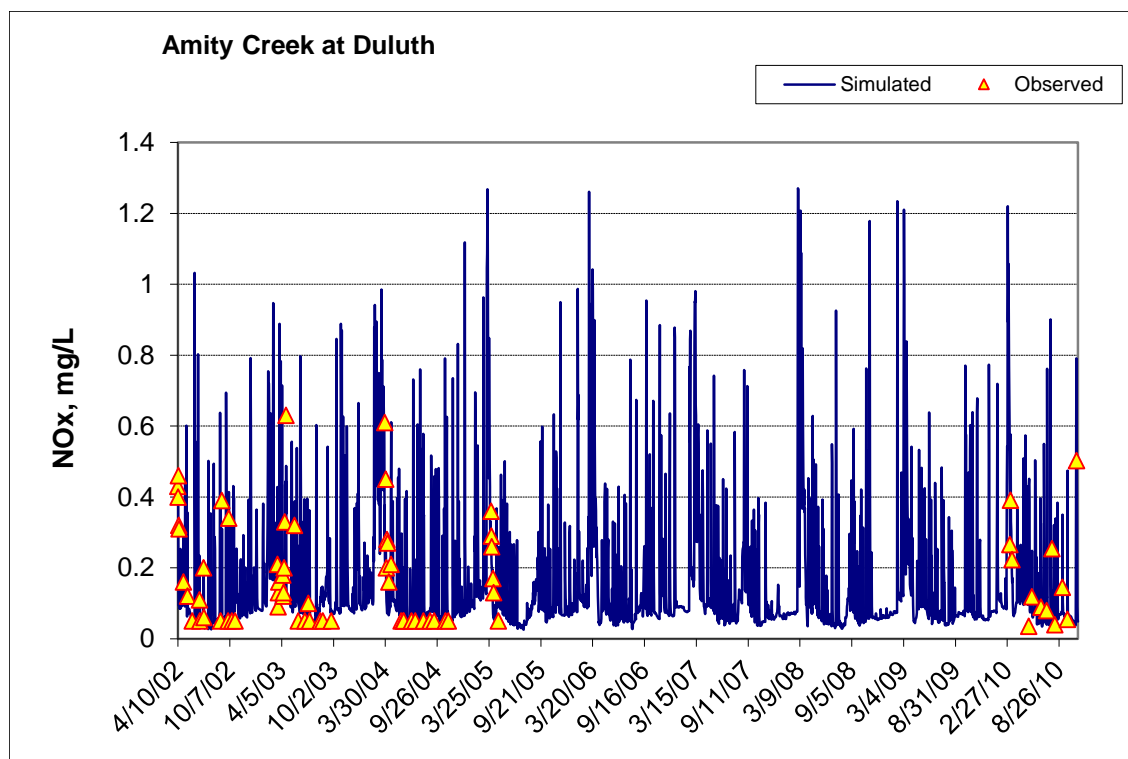


Figure 17. Time series of observed and simulated Nitrite+ Nitrate Nitrogen (NOx) concentration at Amity Creek at Duluth

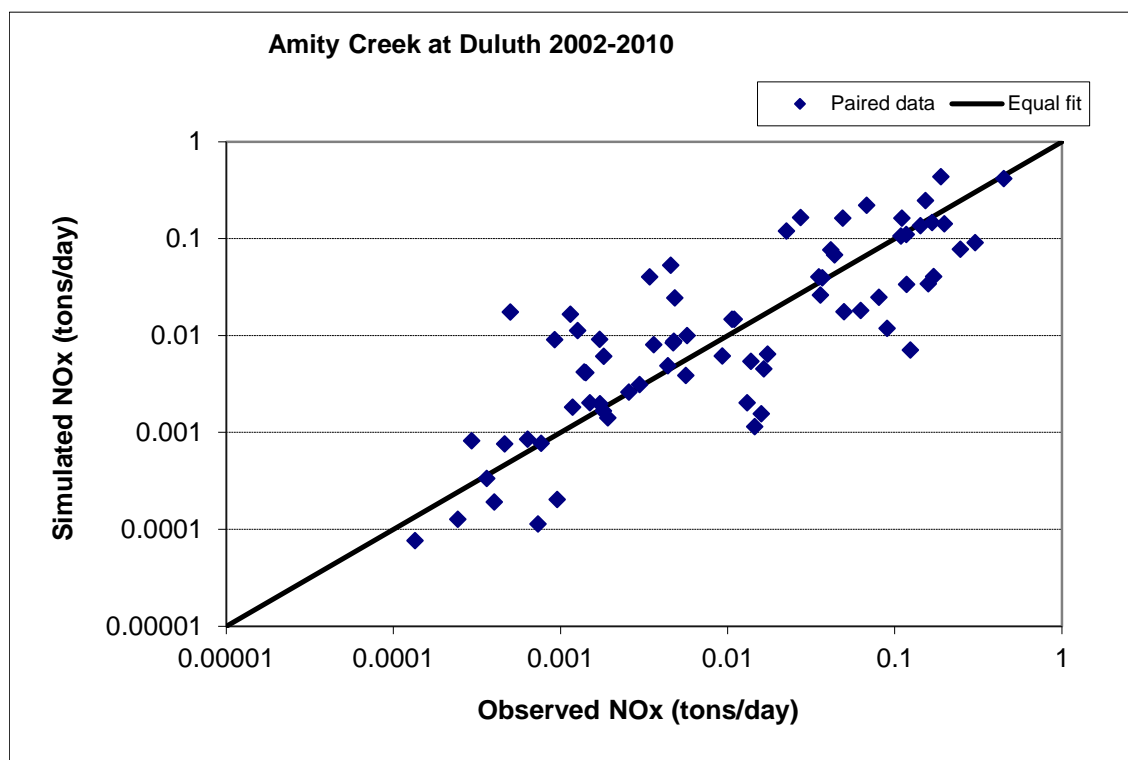
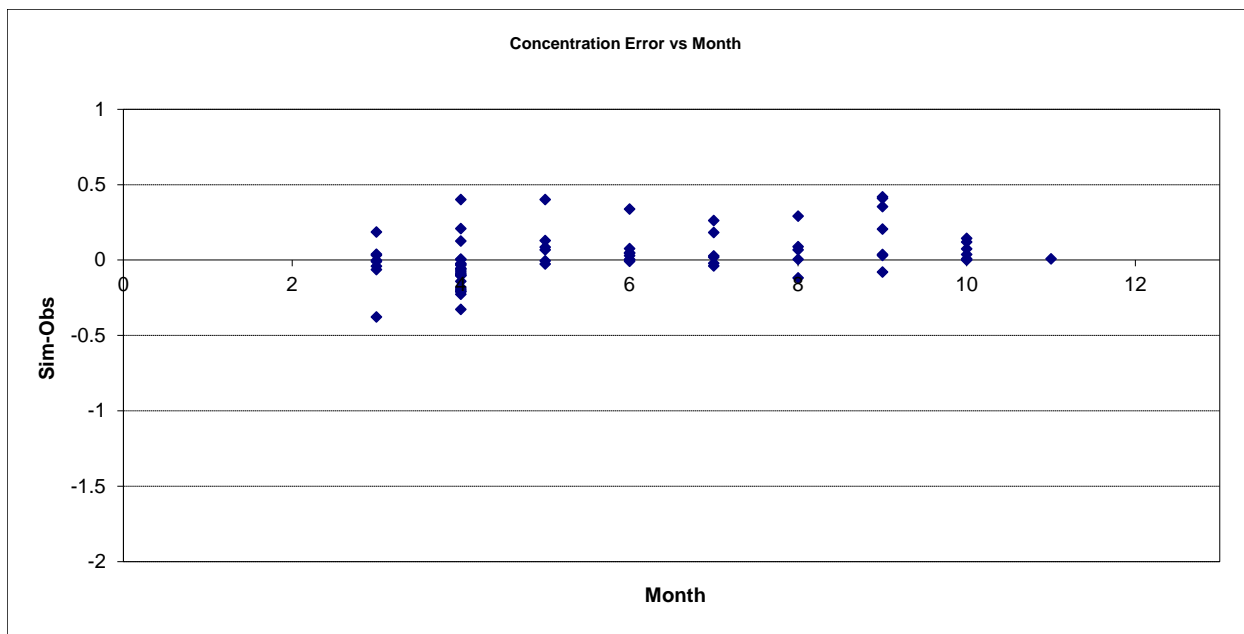
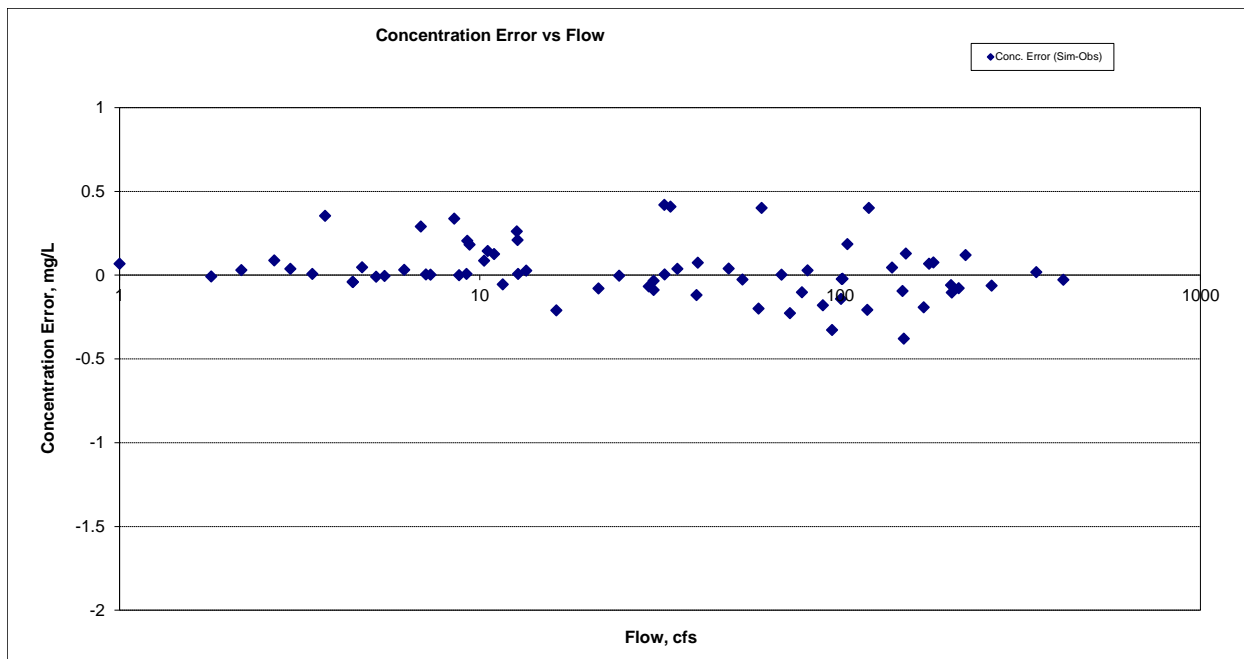


Figure 18. Paired simulated vs. observed Nitrite+ Nitrate Nitrogen (NOx) load at Amity Creek at Duluth



**Figure 19. Residual (Simulated - Observed) vs. Month Nitrite+ Nitrate Nitrogen (NOx) at Amity Creek at Duluth**

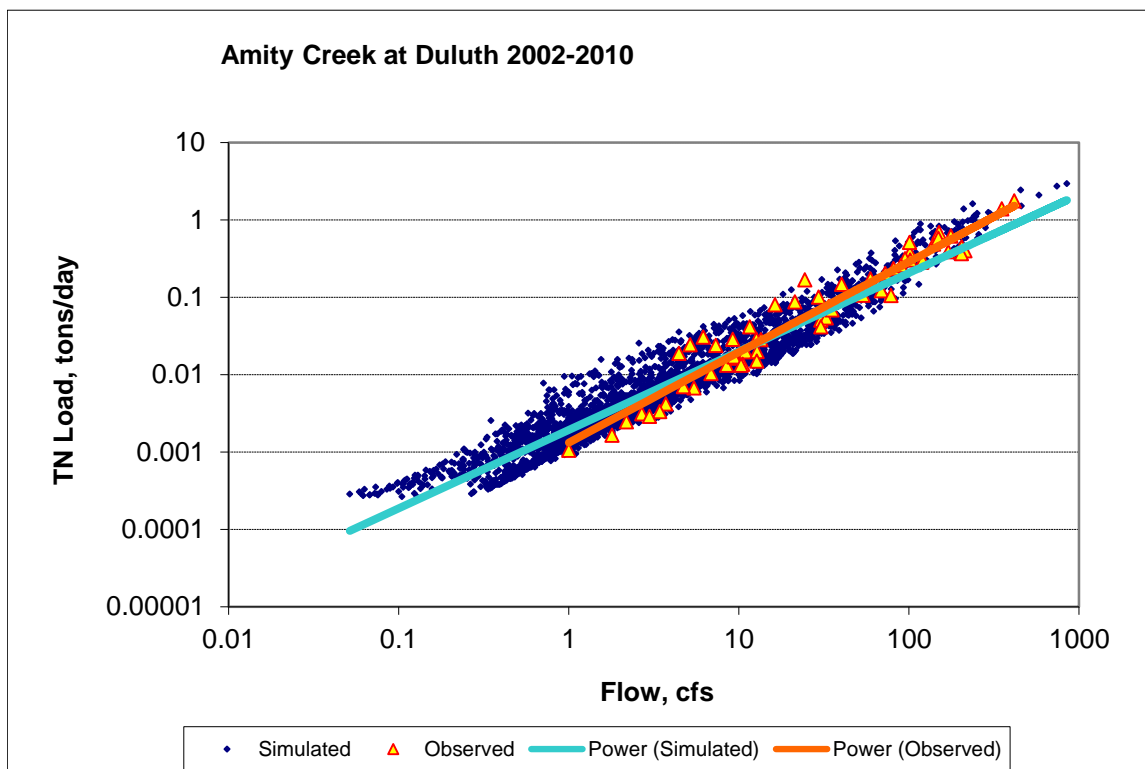


**Figure 20. Residual (Simulated - Observed) vs. Flow Nitrite+ Nitrate Nitrogen (NOx) at Amity Creek at Duluth**

## Total Nitrogen (TN)

**Table 5. Total Nitrogen (TN) statistics**

Count	59
Concentration Average Error	-5.49%
Concentration Median Error	-10.85%
Load Average Error	14.55%
Load Median Error	-1.21%
Paired t concentration	0.99
Paired t load	0.58



**Figure 21. Power plot of simulated and observed Total Nitrogen (TN) load vs flow at Amity Creek at Duluth**

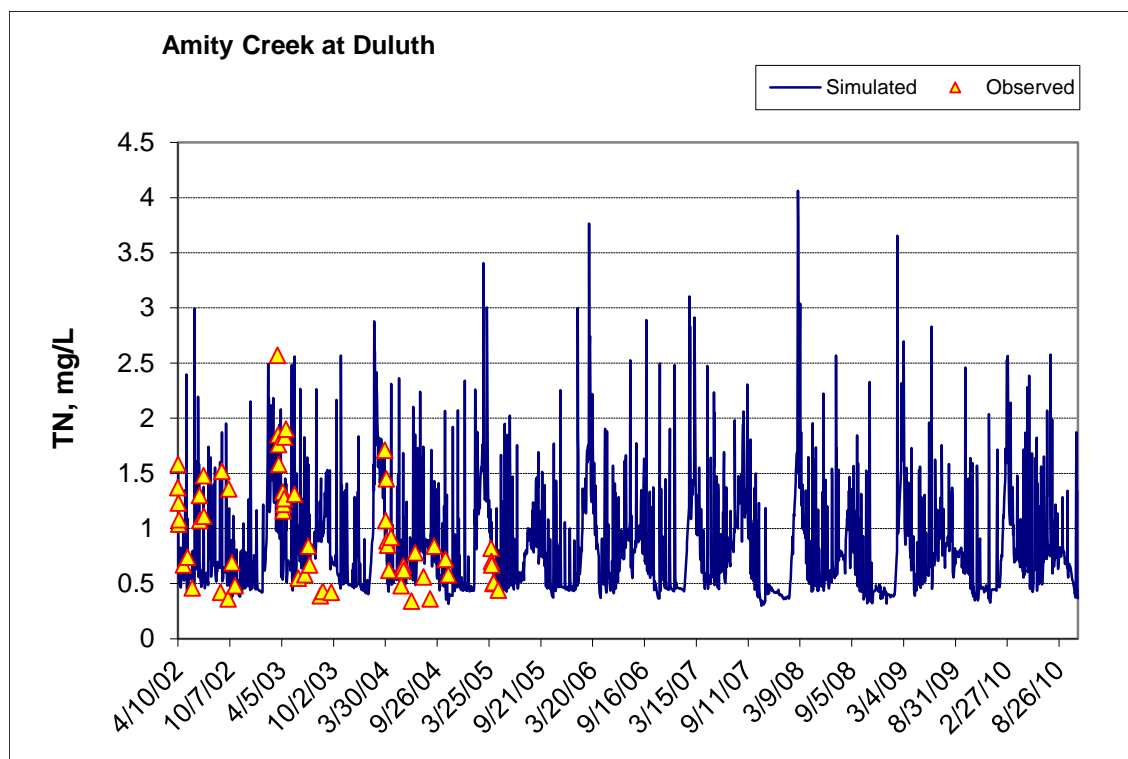


Figure 22. Time series of observed and simulated Total Nitrogen (TN) concentration at Amity Creek at Duluth

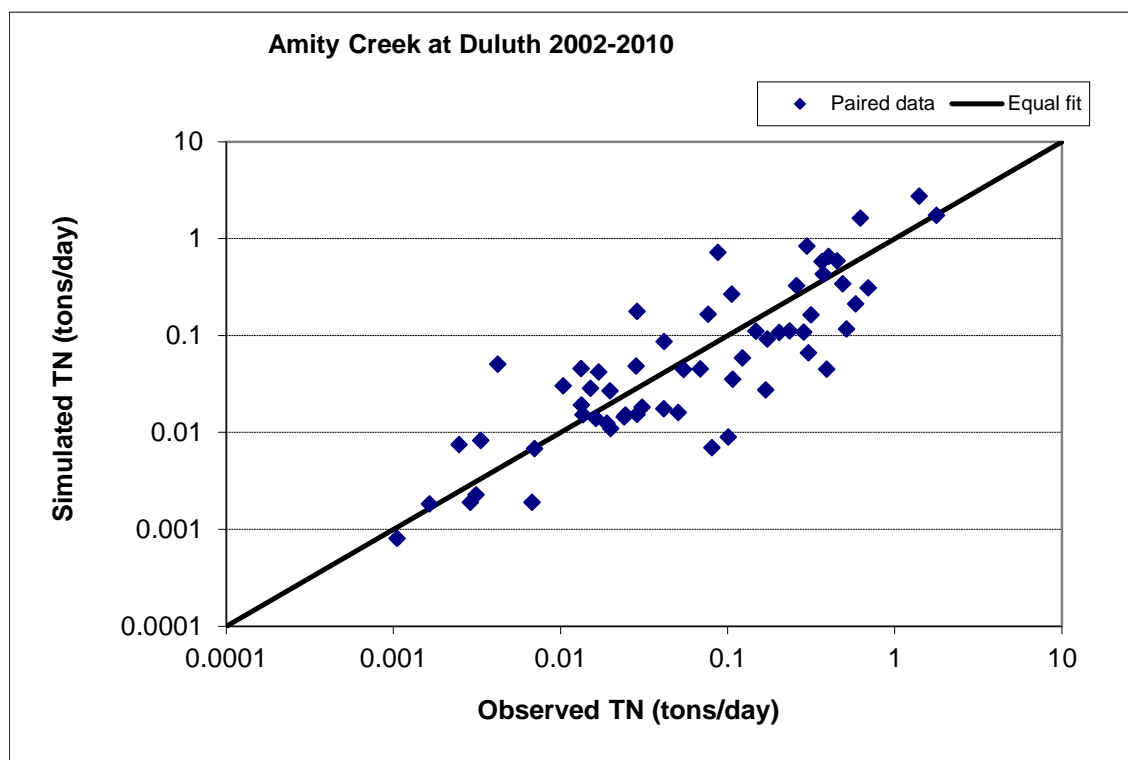


Figure 23. Paired simulated vs. observed Total Nitrogen (TN) load at Amity Creek at Duluth

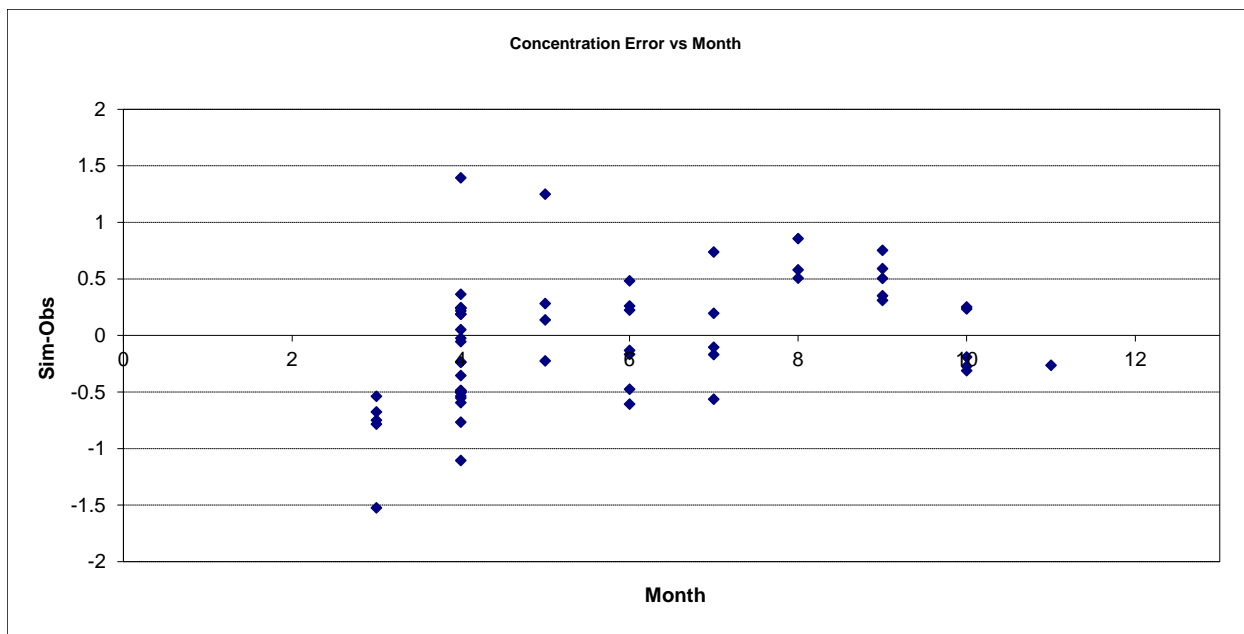


Figure 24. Residual (Simulated - Observed) vs. Month Total Nitrogen (TN) at Amity Creek at Duluth

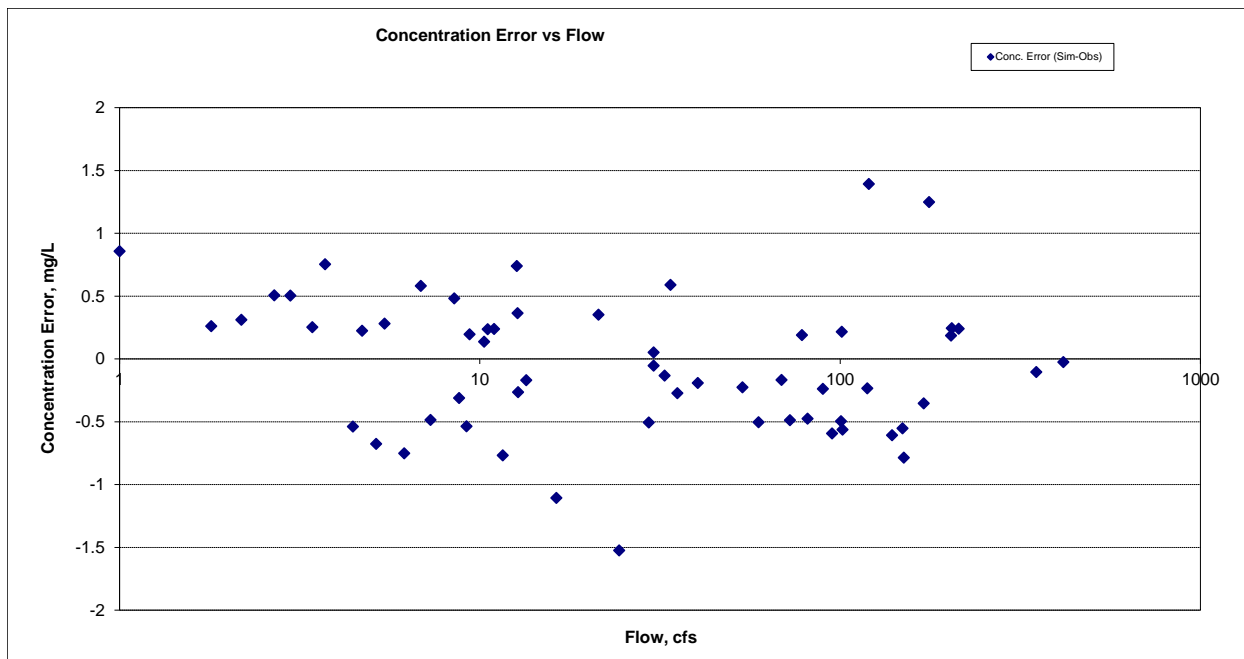
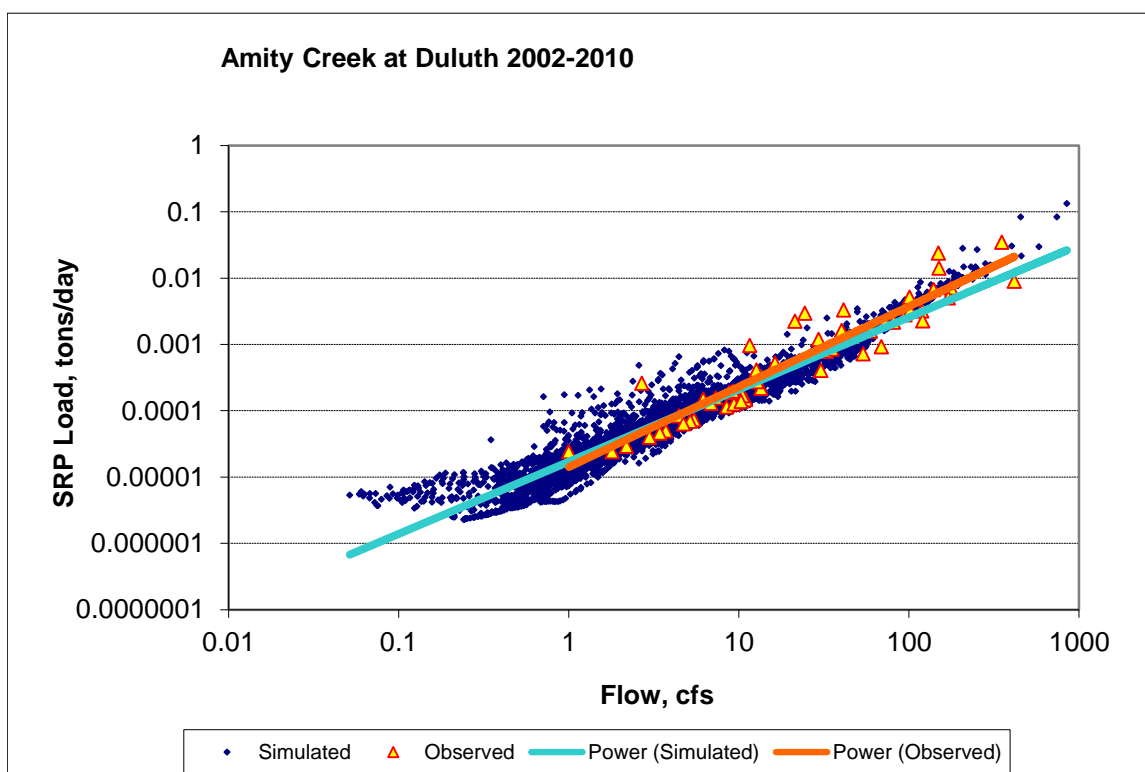


Figure 25. Residual (Simulated - Observed) vs. Flow Total Nitrogen (TN) at Amity Creek at Duluth

## Soluble Reactive Phosphorus (SRP)

**Table 6. Soluble Reactive Phosphorus (SRP) statistics**

Count	53
Concentration Average Error	-19.54%
Concentration Median Error	5.67%
Load Average Error	21.14%
Load Median Error	-0.13%
Paired t concentration	0.52
Paired t load	0.49



**Figure 26. Power plot of simulated and observed Soluble Reactive Phosphorus (SRP) load vs flow at Amity Creek at Duluth**

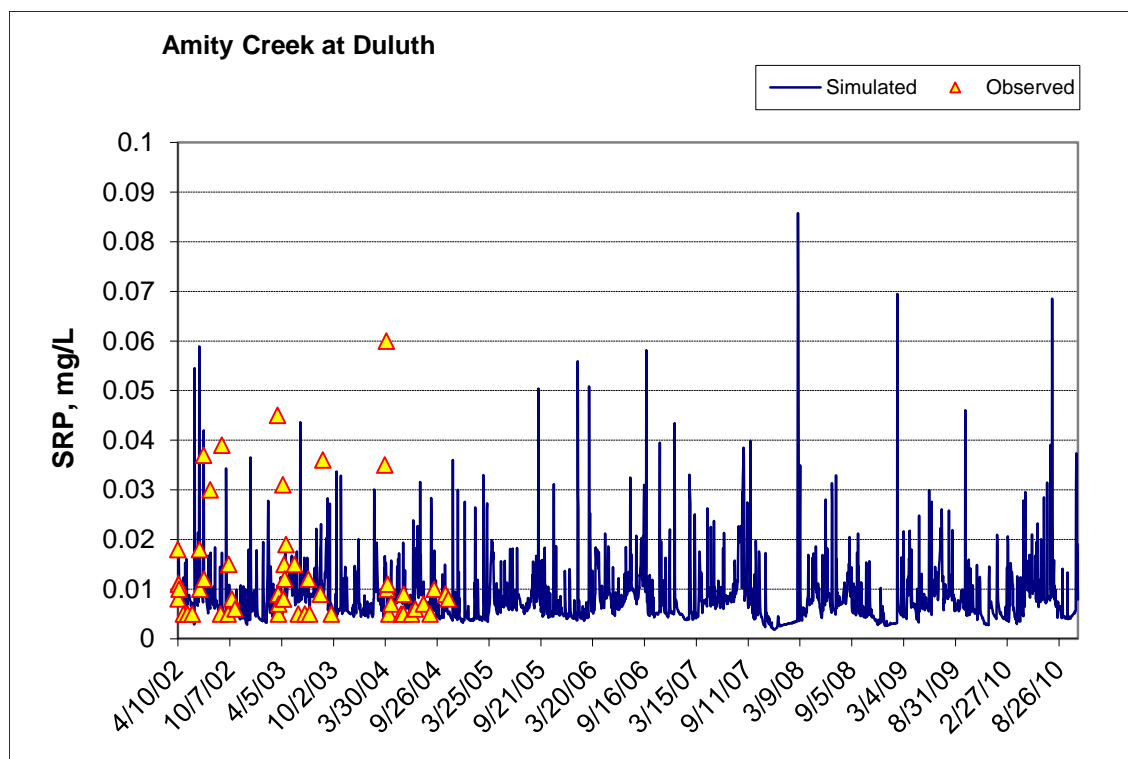


Figure 27. Time series of observed and simulated Soluble Reactive Phosphorus (SRP) concentration at Amity Creek at Duluth

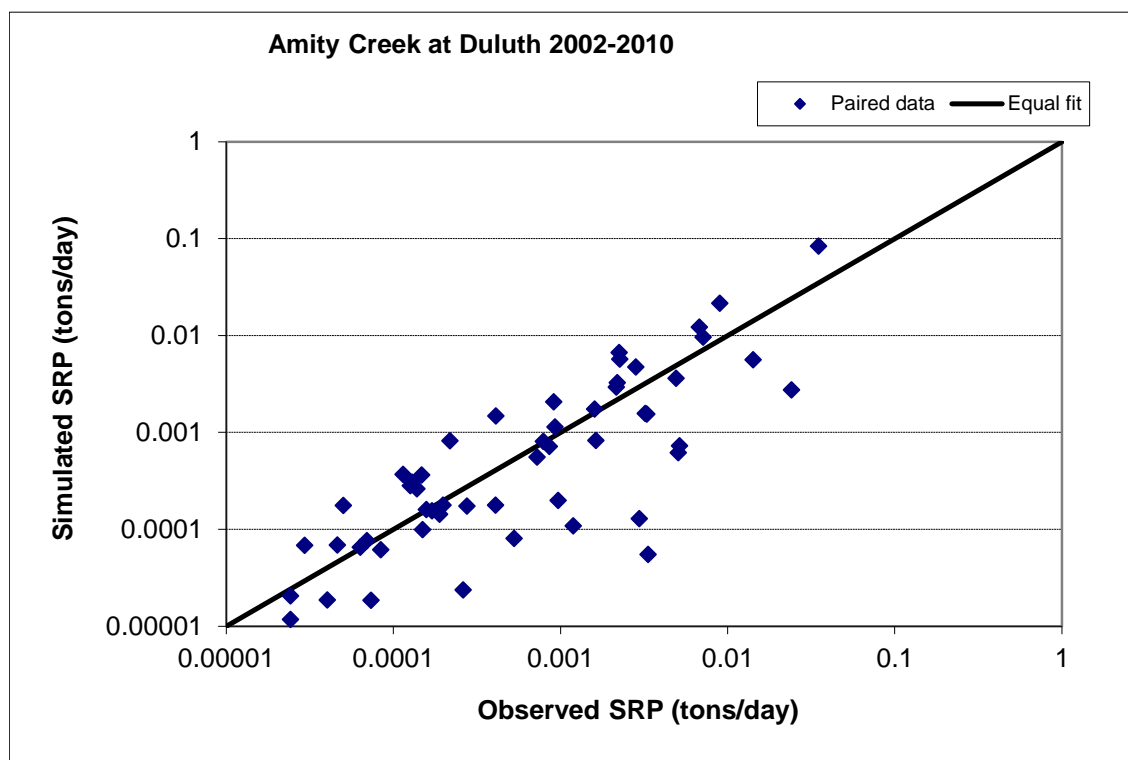
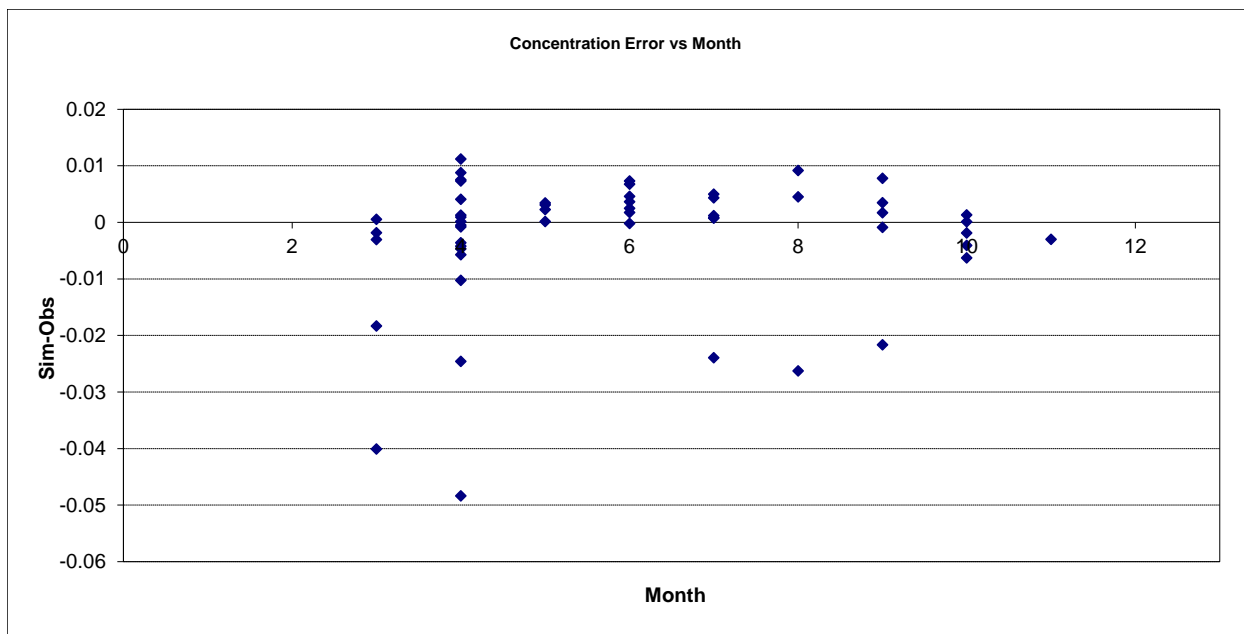
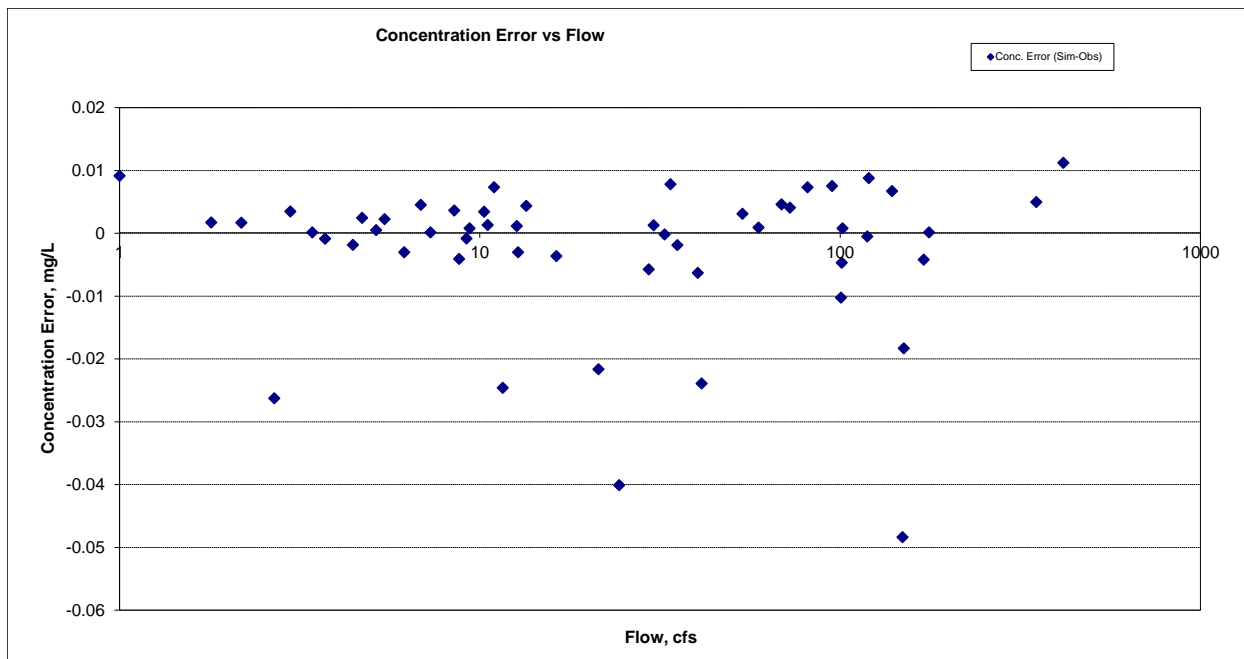


Figure 28. Paired simulated vs. observed Soluble Reactive Phosphorus (SRP) load at Amity Creek at Duluth



**Figure 29. Residual (Simulated - Observed) vs. Month Soluble Reactive Phosphorus (SRP) at Amity Creek at Duluth**



**Figure 30. Residual (Simulated - Observed) vs. Flow Soluble Reactive Phosphorus (SRP) at Amity Creek at Duluth**



## Organic Phosphorus (OrgP)

Table 7. Organic Phosphorus (OrgP) statistics

Count	51
Concentration Average Error	-53.25%
Concentration Median Error	-19.15%
Load Average Error	-26.02%
Load Median Error	-6.65%
Paired t concentration	0.00
Paired t load	0.42

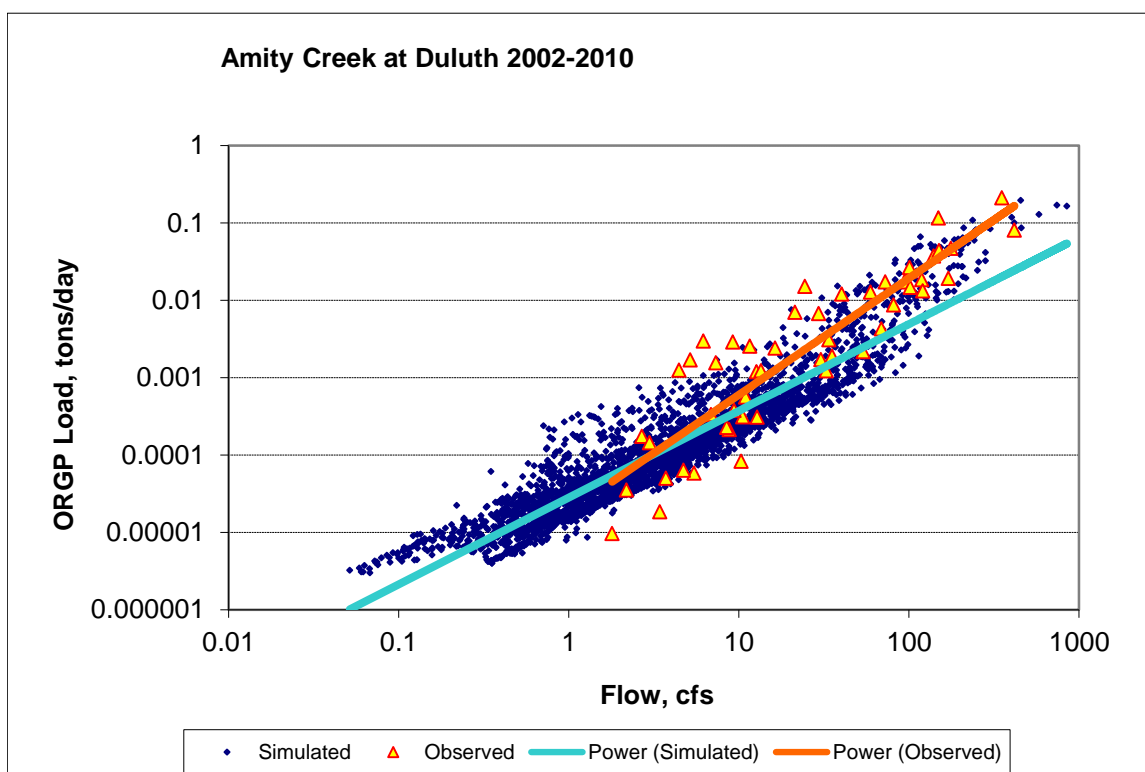


Figure 31. Power plot of simulated and observed Organic Phosphorus (OrgP) load vs flow at Amity Creek at Duluth

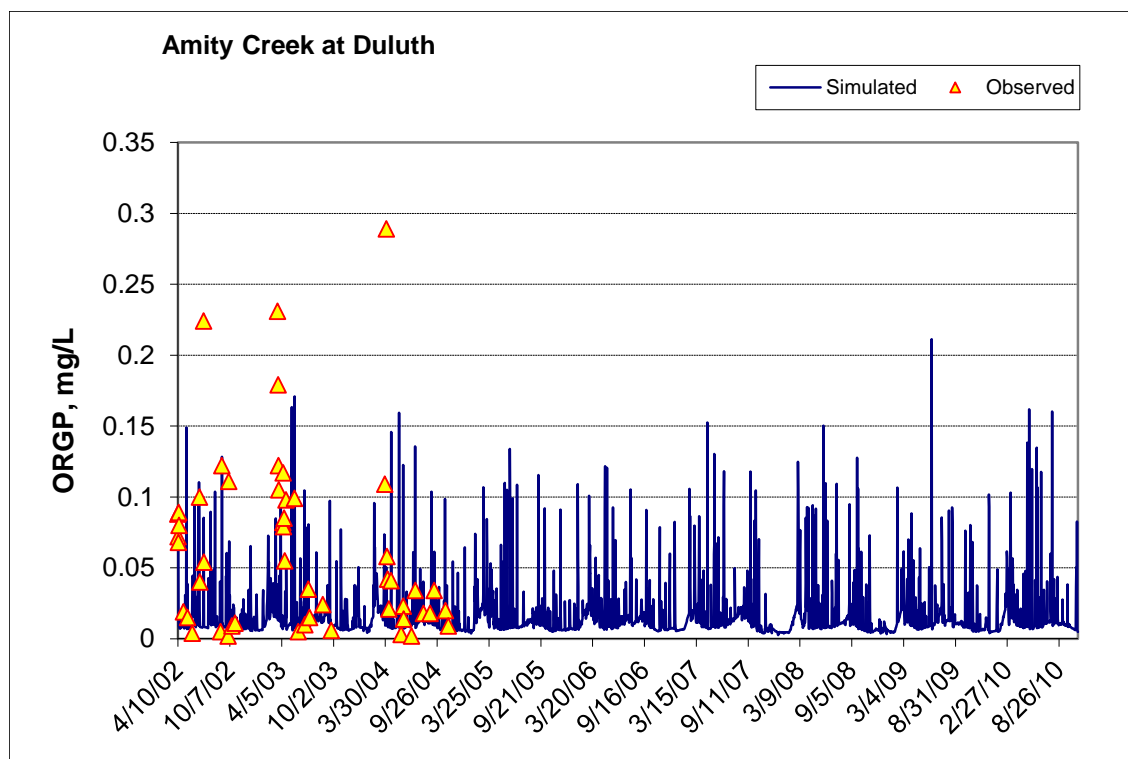


Figure 32. Time series of observed and simulated Organic Phosphorus (OrgP) concentration at Amity Creek at Duluth

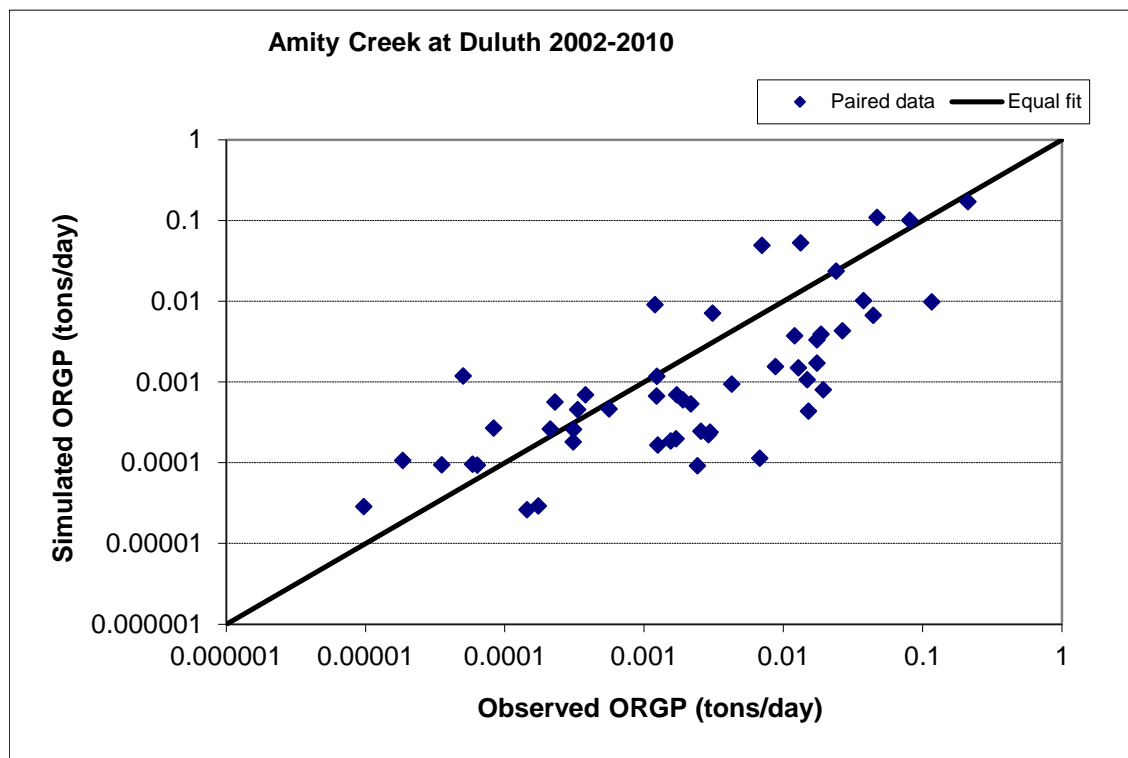
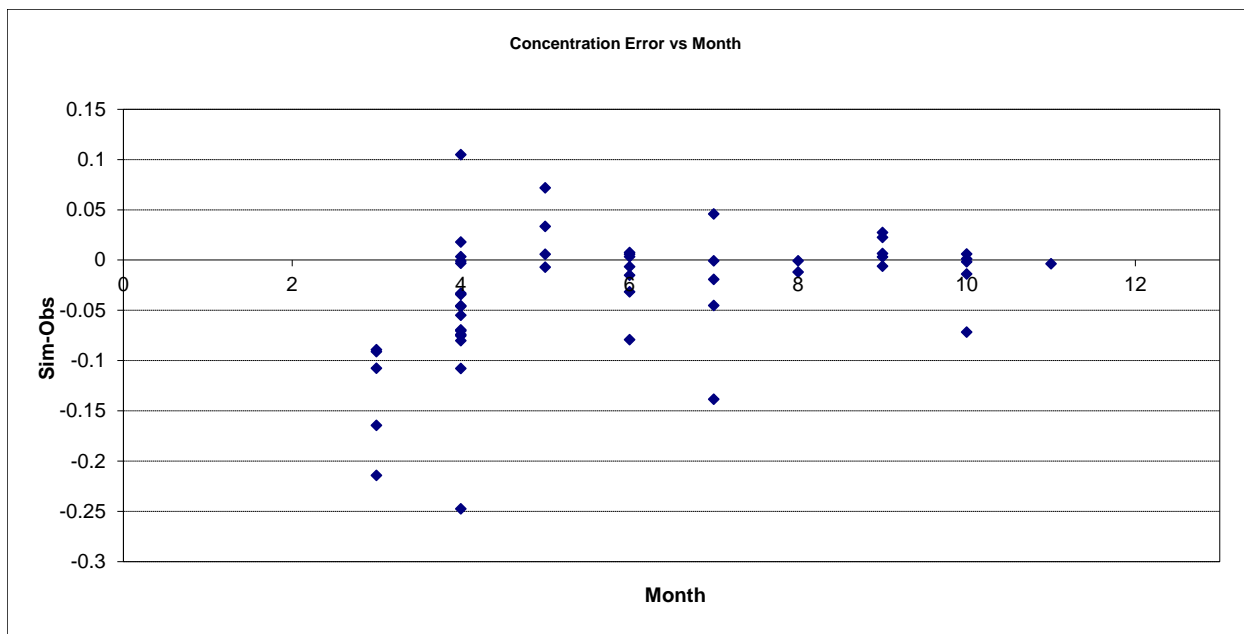
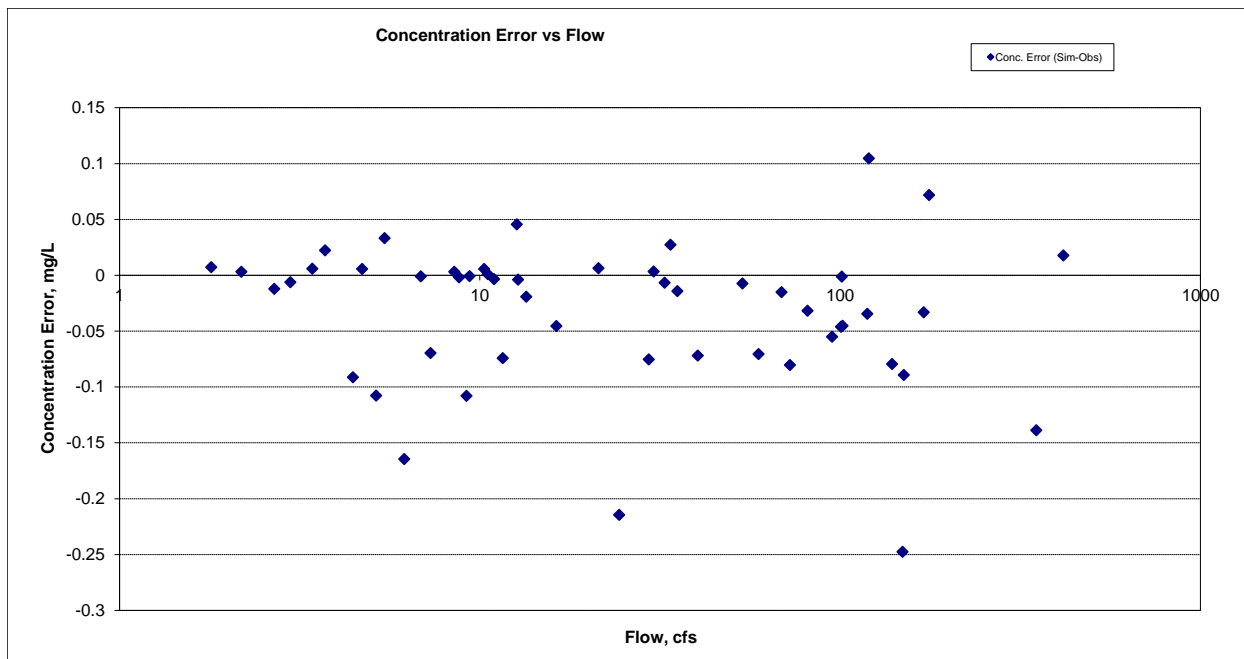


Figure 33. Paired simulated vs. observed Organic Phosphorus (OrgP) load at Amity Creek at Duluth



**Figure 34. Residual (Simulated - Observed) vs. Month Organic Phosphorus (OrgP) at Amity Creek at Duluth**

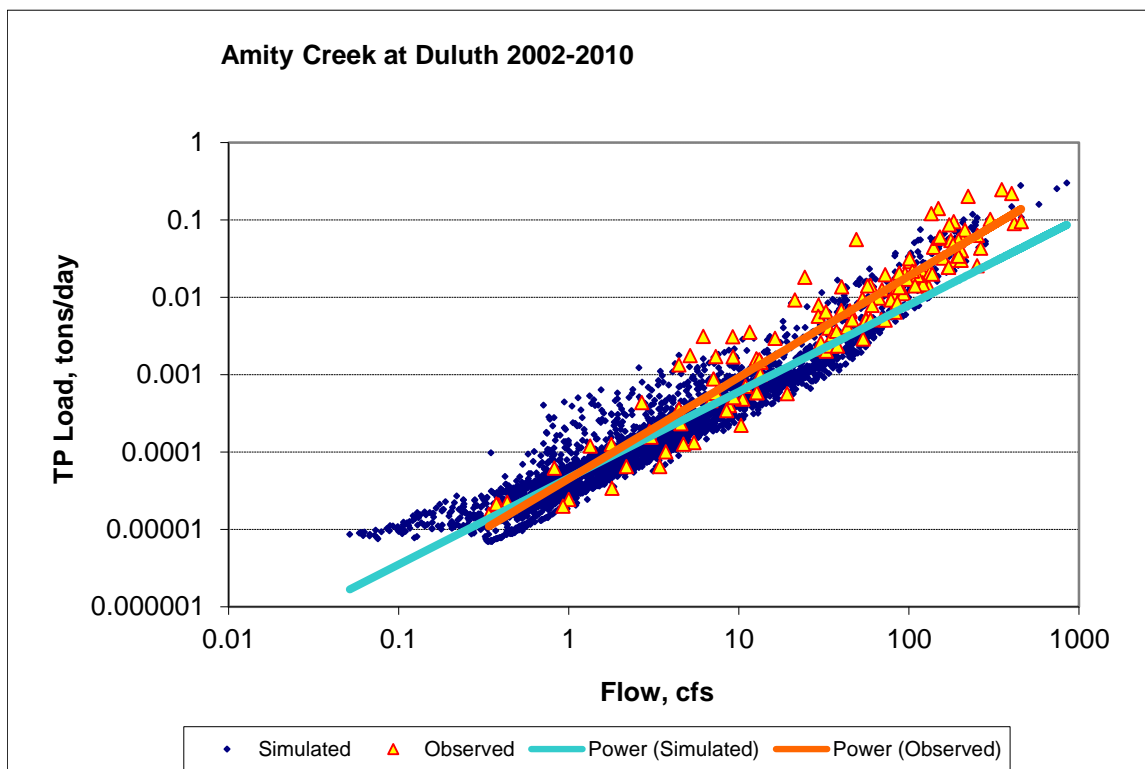


**Figure 35. Residual (Simulated - Observed) vs. Flow Organic Phosphorus (OrgP) at Amity Creek at Duluth**

## Total Phosphorus (TP)

**Table 8. Total Phosphorus (TP) statistics**

Count	127
Concentration Average Error	-27.28%
Concentration Median Error	-9.56%
Load Average Error	-6.24%
Load Median Error	-0.62%
Paired t concentration	0.17
Paired t load	0.80



**Figure 36. Power plot of simulated and observed Total Phosphorus (TP) load vs flow at Amity Creek at Duluth**

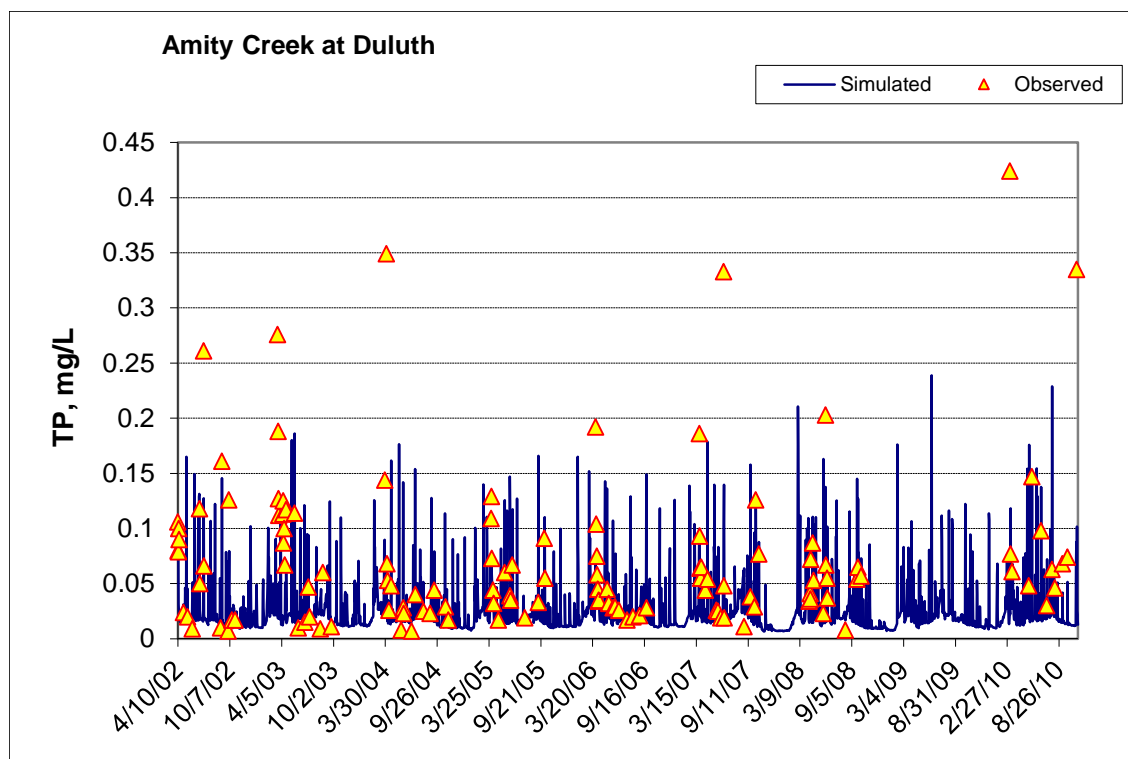


Figure 37. Time series of observed and simulated Total Phosphorus (TP) concentration at Amity Creek at Duluth

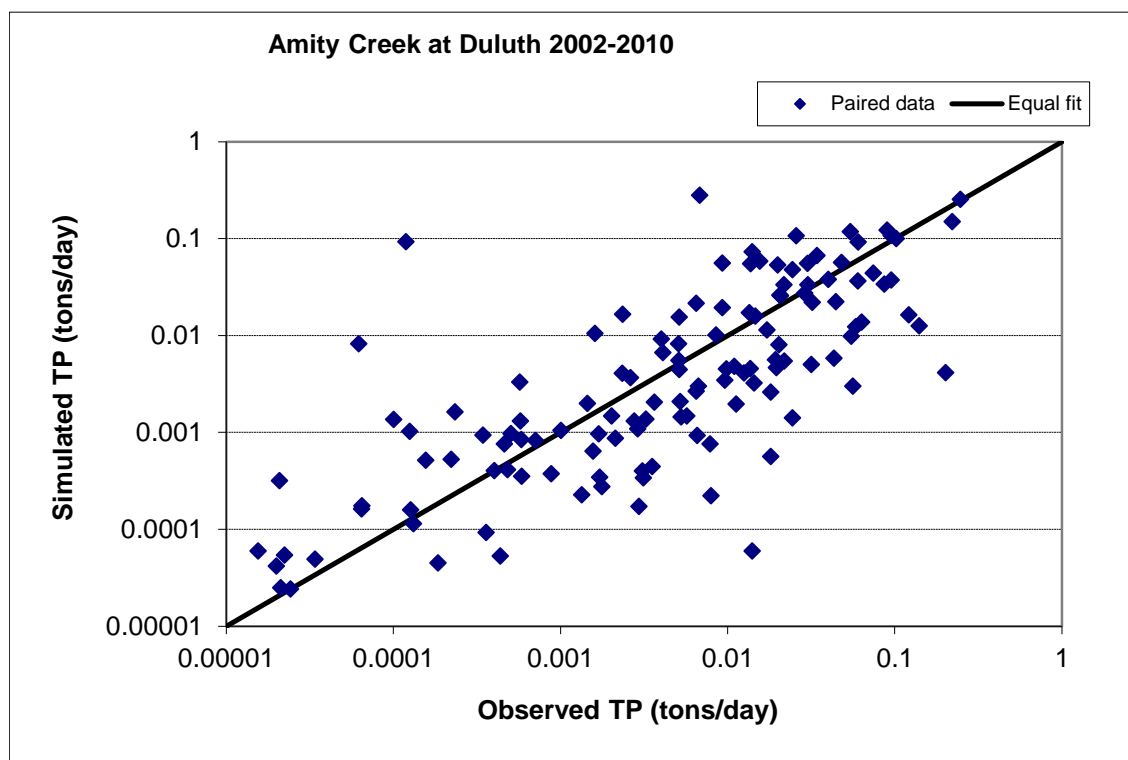


Figure 38. Paired simulated vs. observed Total Phosphorus (TP) load at Amity Creek at Duluth

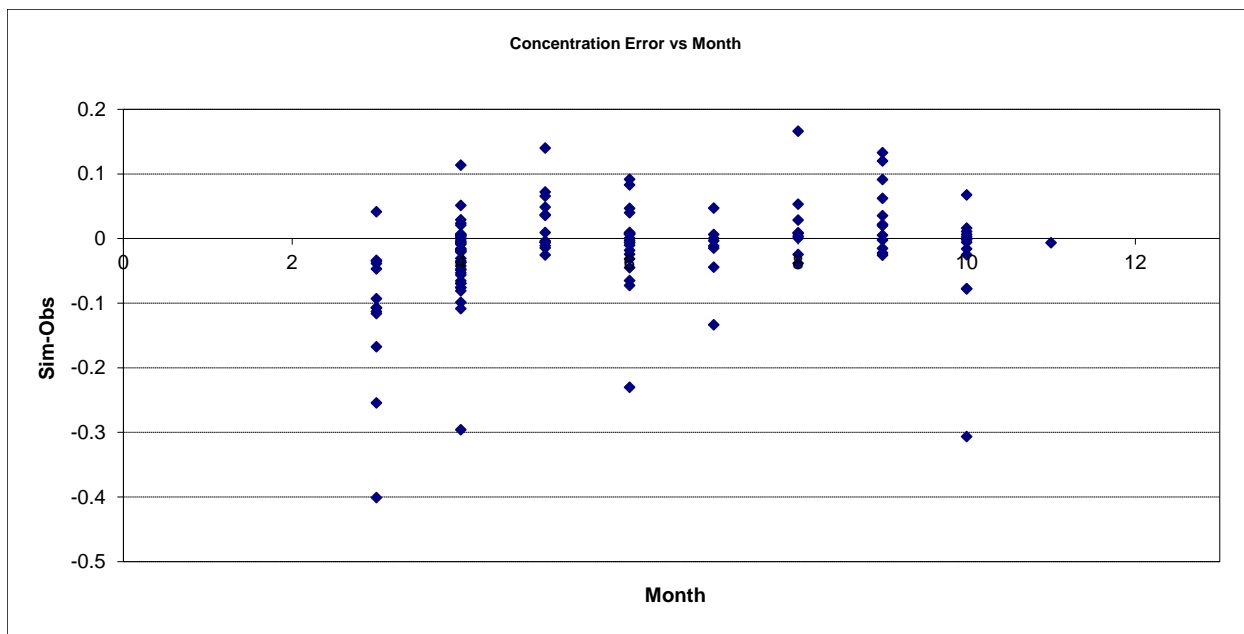


Figure 39. Residual (Simulated - Observed) vs. Month Total Phosphorus (TP) at Amity Creek at Duluth

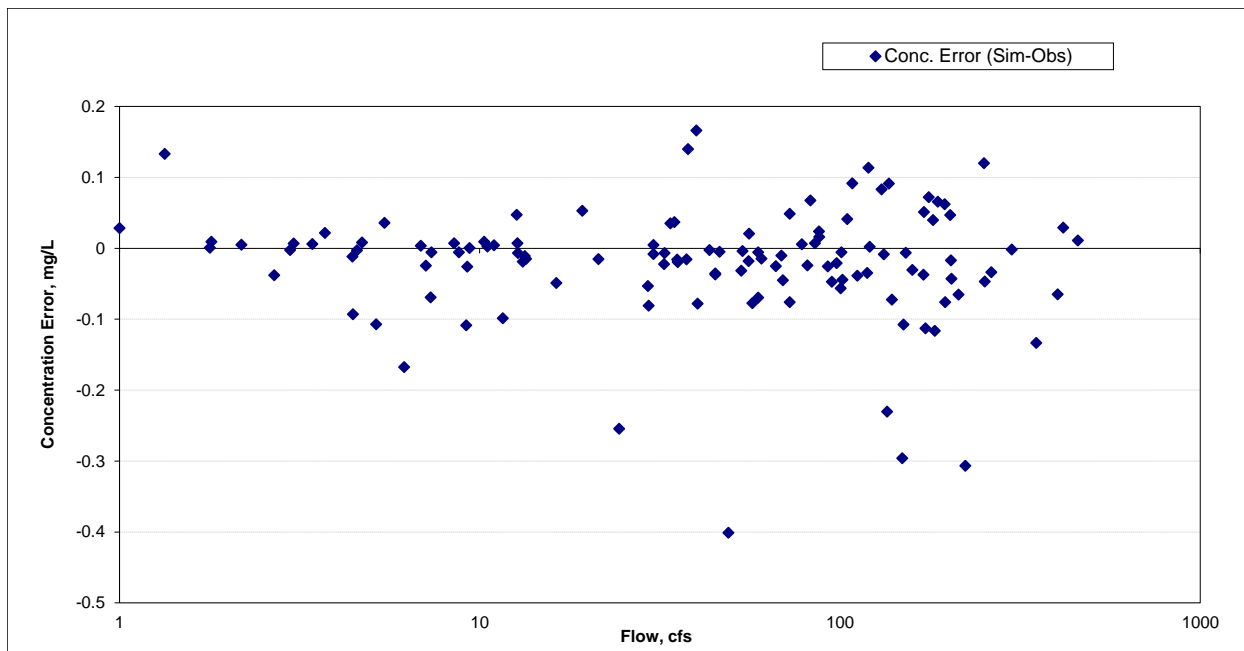


Figure 40. Residual (Simulated - Observed) vs. Flow Total Phosphorus (TP) at Amity Creek at Duluth

## Talmadge River near Duluth (HYDSTRA 02035001)

### Total Suspended Solids (TSS)

Table 9. Total Suspended Solids (TSS) statistics

Count	114
Concentration Average Error	23.53%
Concentration Median Error	0.06%
Load Average Error	-16.39%
Load Median Error	-0.03%
Paired t concentration	0.44
Paired t load	0.54

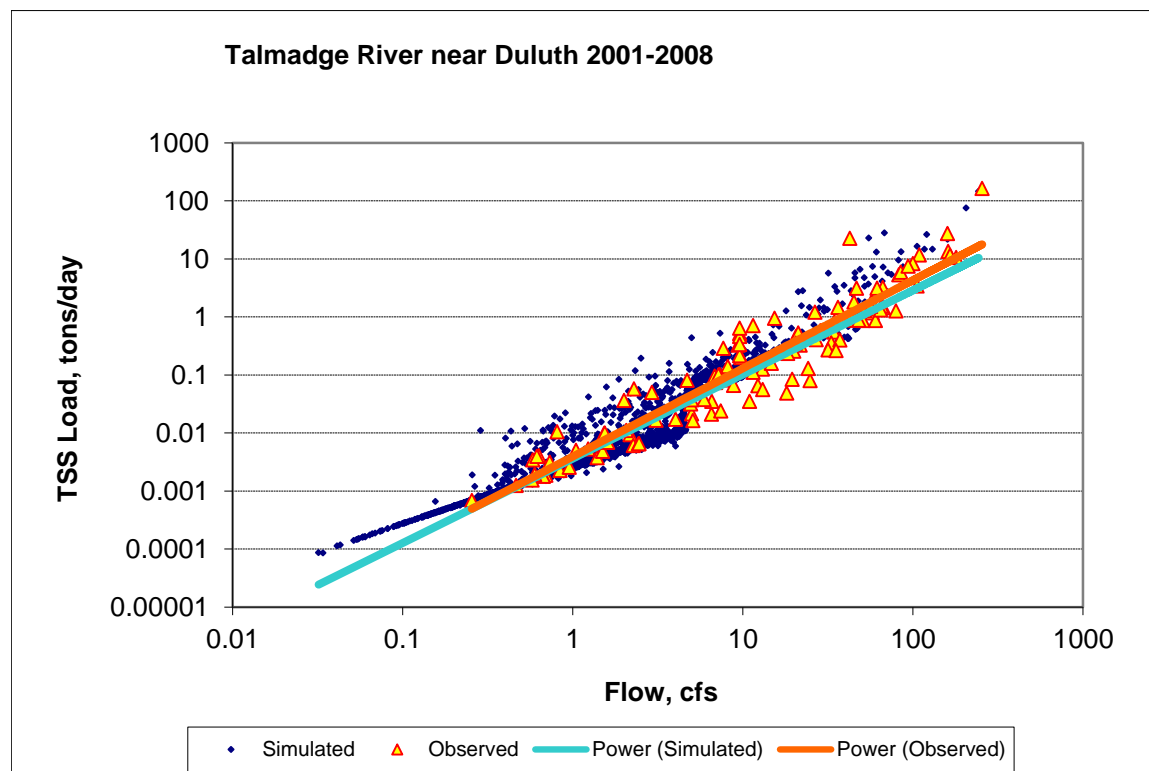


Figure 41. Power plot of simulated and observed Total Suspended Solids (TSS) load vs flow at Talmadge River near Duluth

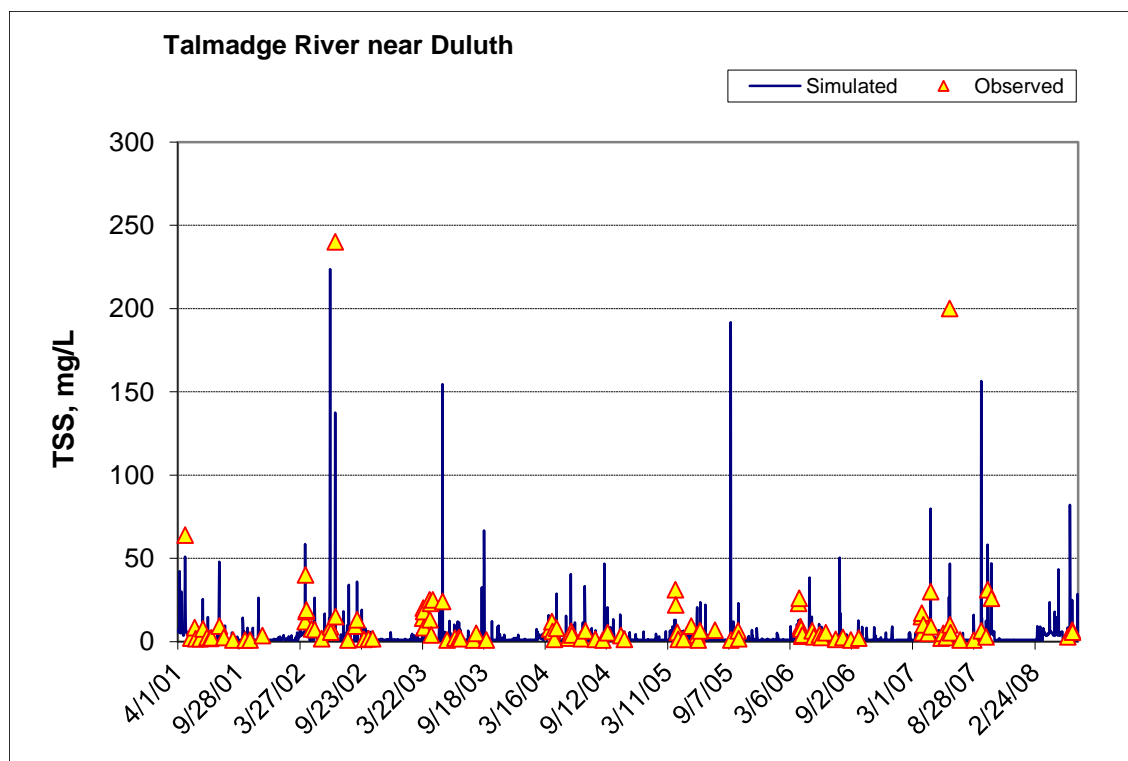


Figure 42. Time series of observed and simulated Total Suspended Solids (TSS) concentration at Talmadge River near Duluth

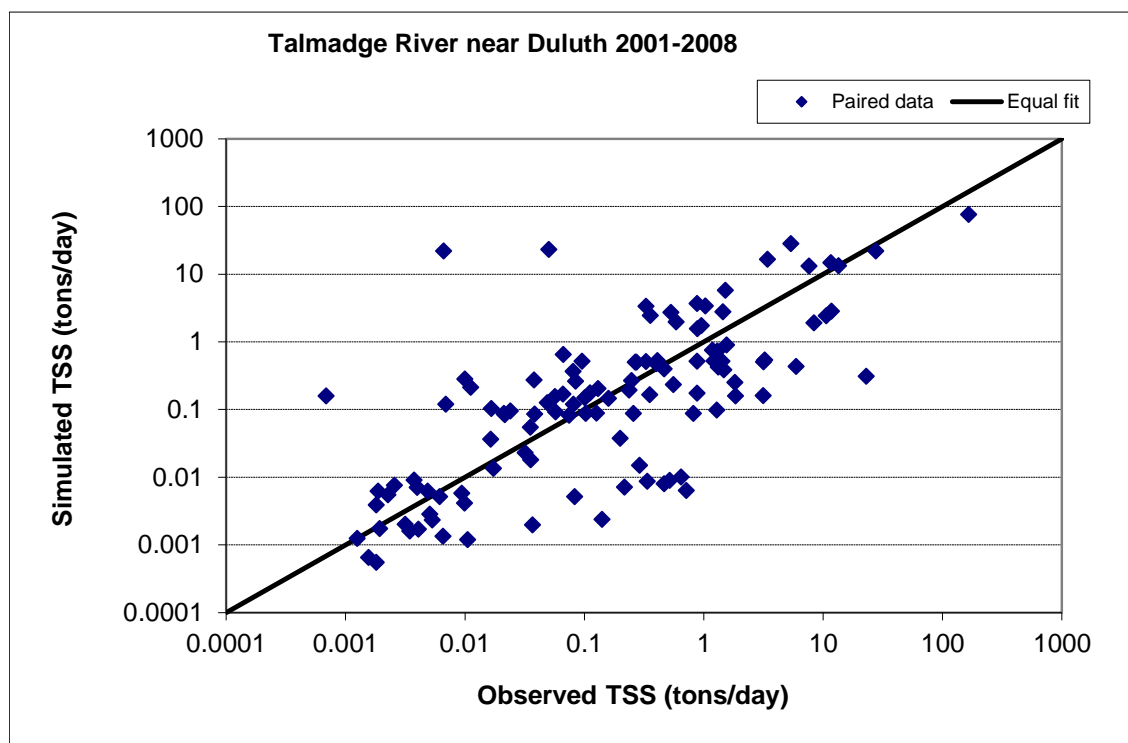
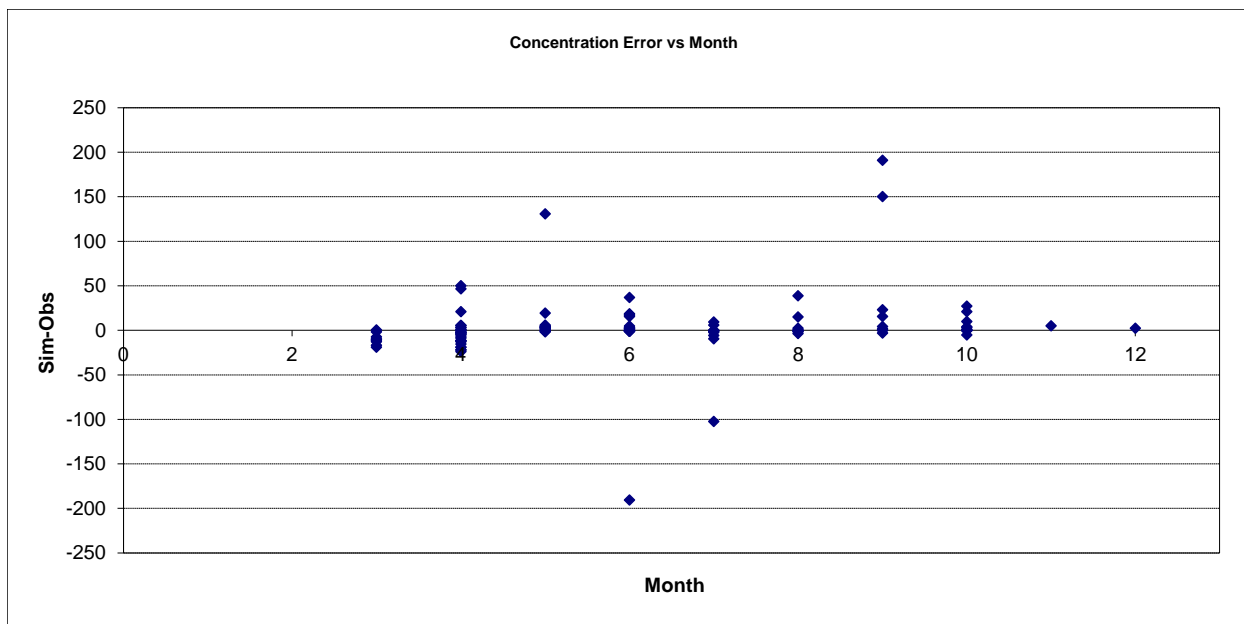
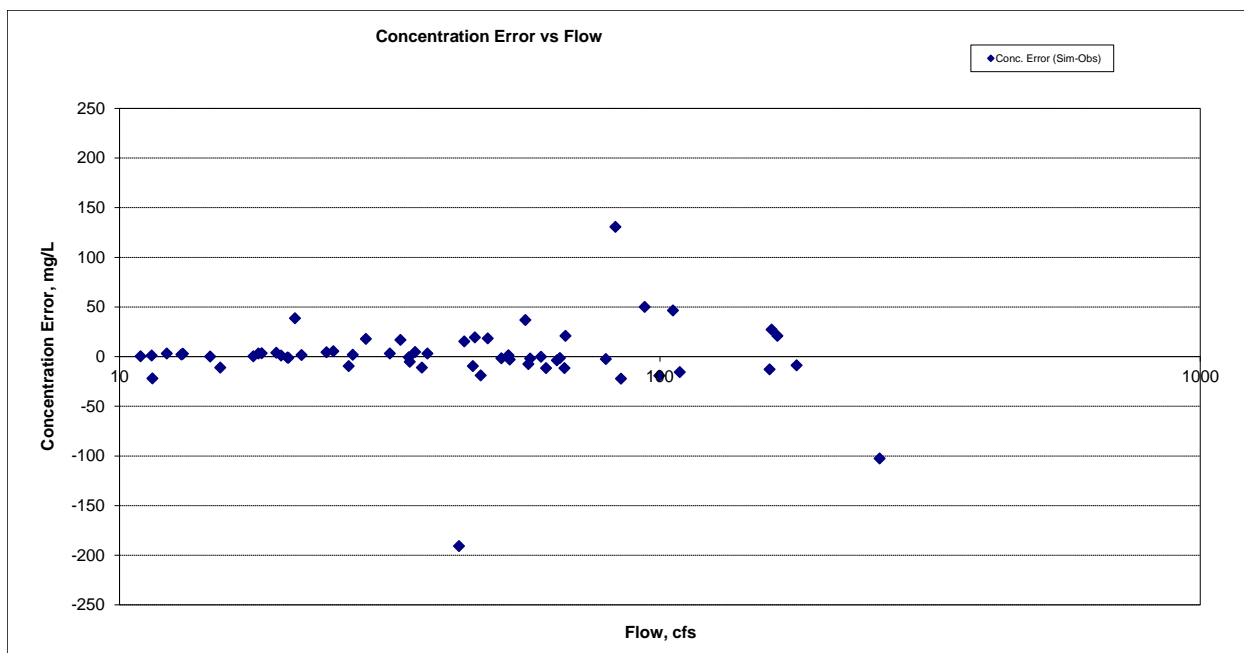


Figure 43. Paired simulated vs. observed Total Suspended Solids (TSS) load at Talmadge River near Duluth





**Figure 44. Residual (Simulated - Observed) vs. Month Total Suspended Solids (TSS) at Talmadge River near Duluth**



**Figure 45. Residual (Simulated - Observed) vs. Flow Total Suspended Solids (TSS) at Talmadge River near Duluth**

## Total Kjeldahl Nitrogen (TKN)

Table 10. Total Kjeldahl Nitrogen (TKN) statistics

Count	70
Concentration Average Error	-12.88%
Concentration Median Error	-20.60%
Load Average Error	-20.19%
Load Median Error	-3.03%
Paired t concentration	0.87
Paired t load	0.50

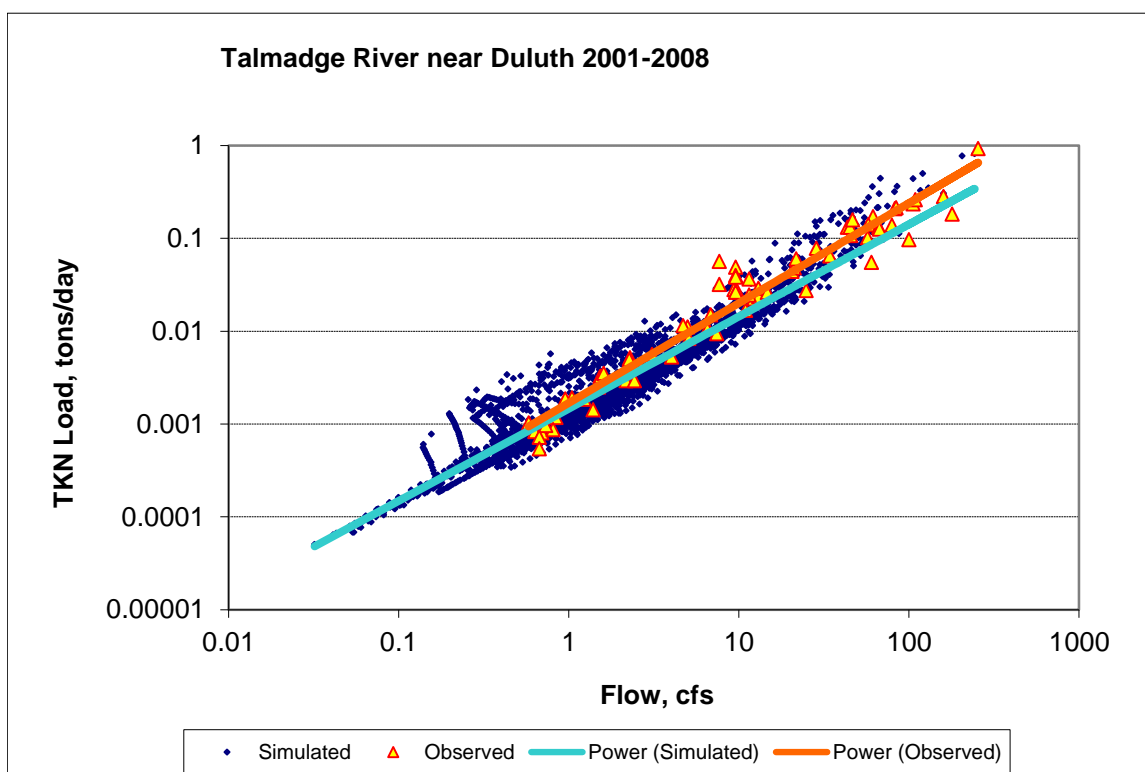


Figure 46. Power plot of simulated and observed Total Kjeldahl Nitrogen (TKN) load vs flow at Talmadge River near Duluth

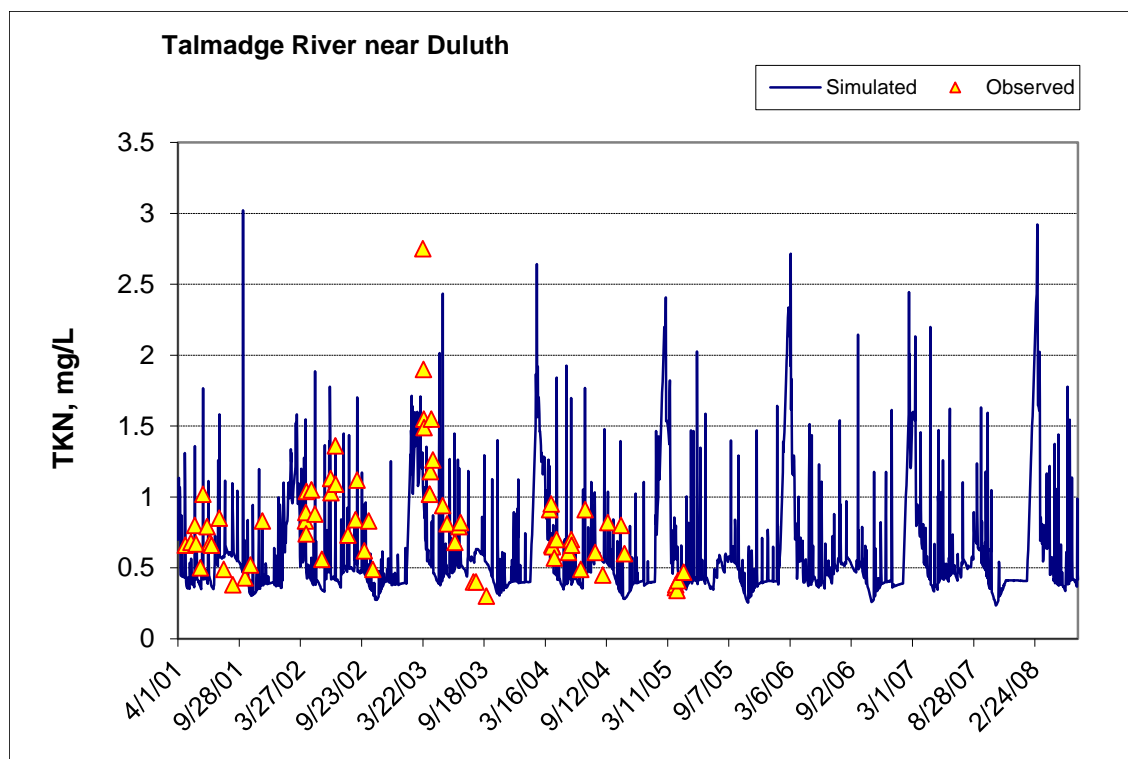


Figure 47. Time series of observed and simulated Total Kjeldahl Nitrogen (TKN) concentration at Talmadge River near Duluth

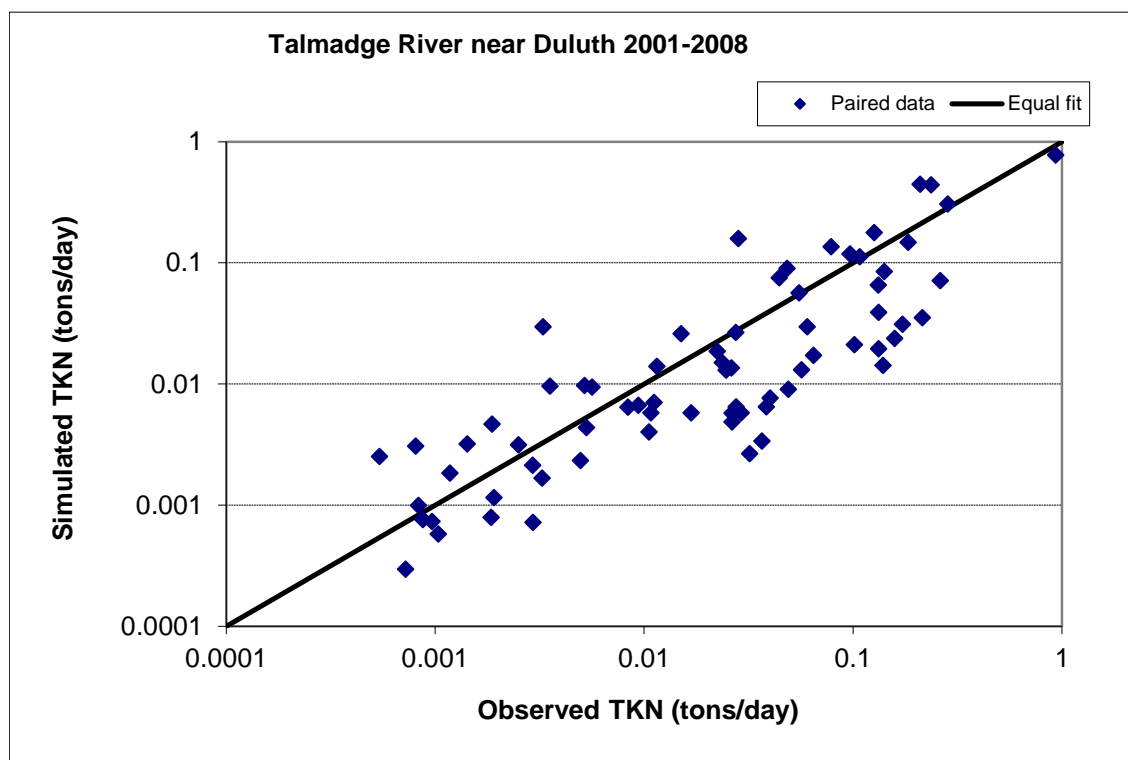
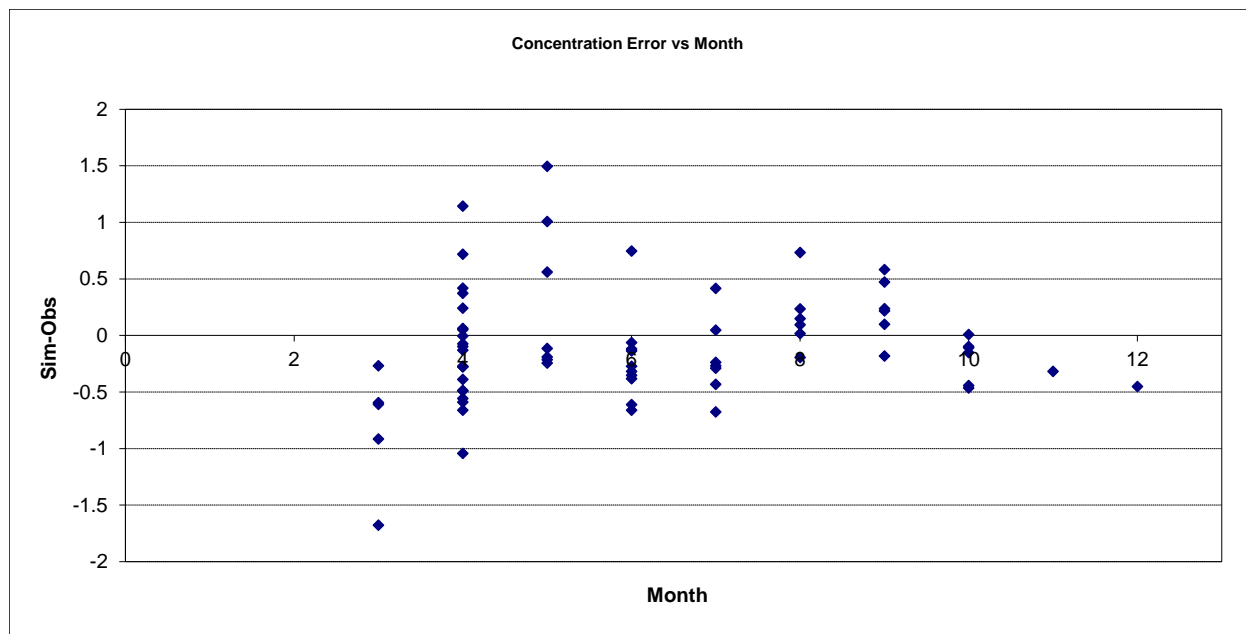
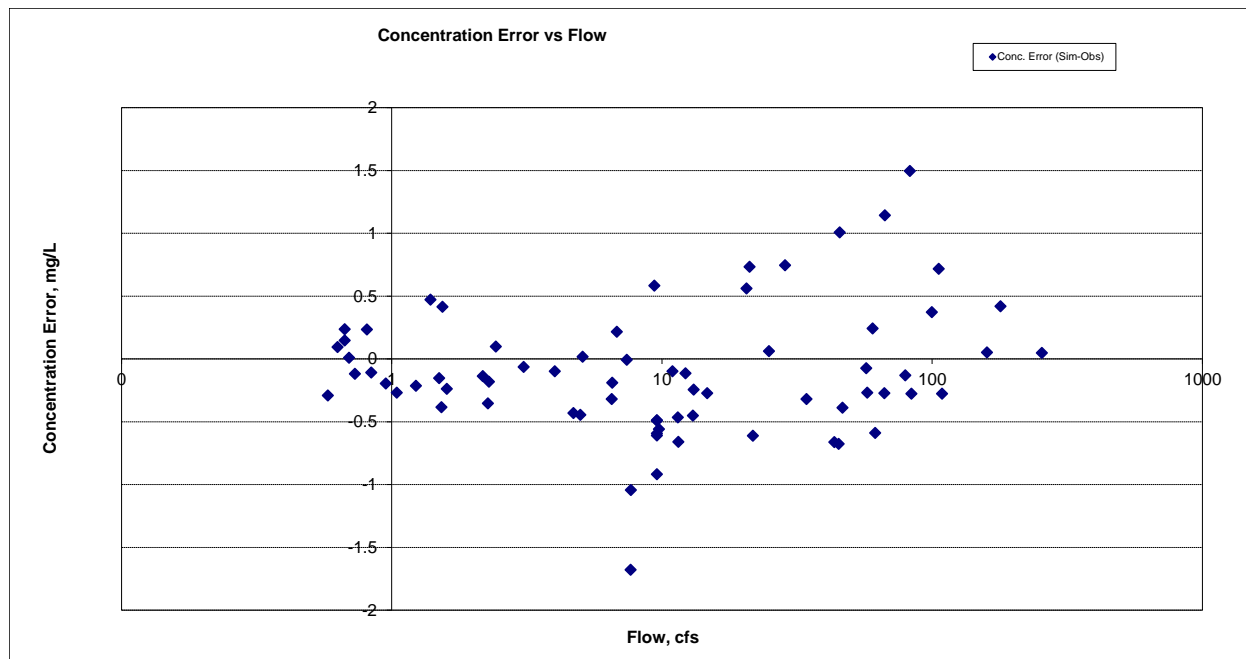


Figure 48. Paired simulated vs. observed Total Kjeldahl Nitrogen (TKN) load at Talmadge River near Duluth



**Figure 49. Residual (Simulated - Observed) vs. Month Total Kjeldahl Nitrogen (TKN) at Talmadge River near Duluth**

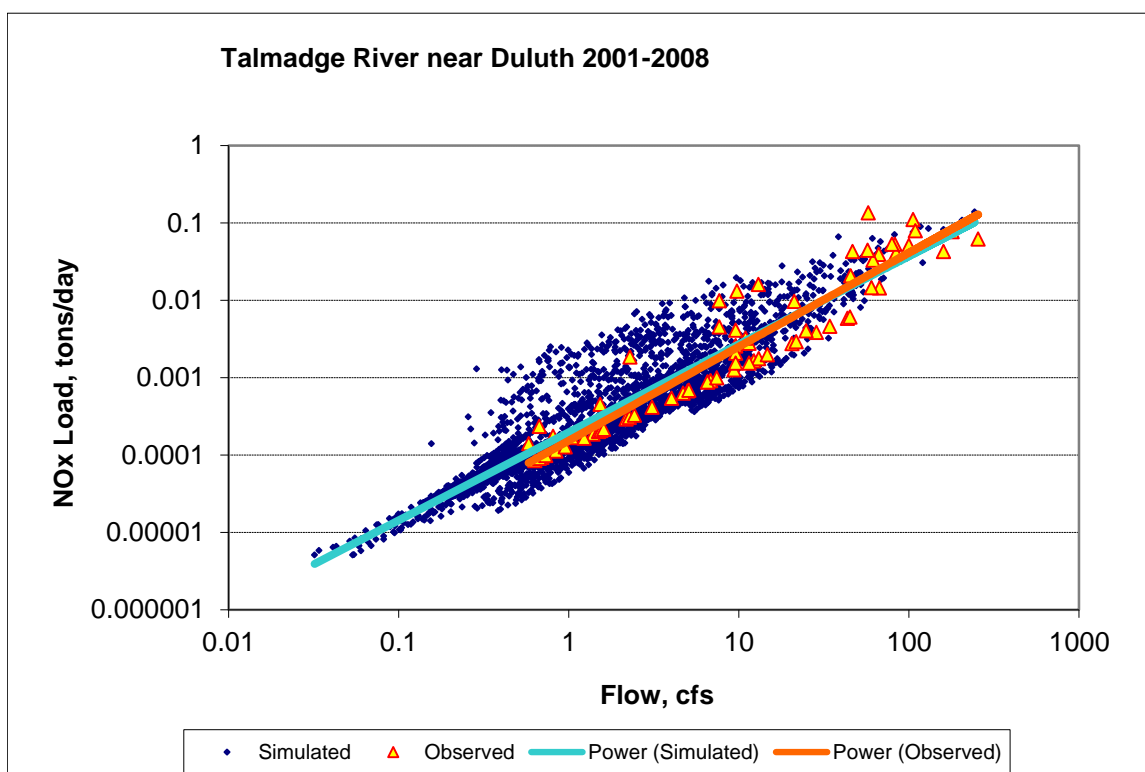


**Figure 50. Residual (Simulated - Observed) vs. Flow Total Kjeldahl Nitrogen (TKN) at Talmadge River near Duluth**

## Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>)

**Table 11. Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) statistics**

Count	70
Concentration Average Error	-7.02%
Concentration Median Error	-4.06%
Load Average Error	-39.41%
Load Median Error	-0.63%
Paired t concentration	0.88
Paired t load	0.16



**Figure 51. Power plot of simulated and observed Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) load vs flow at Talmadge River near Duluth**

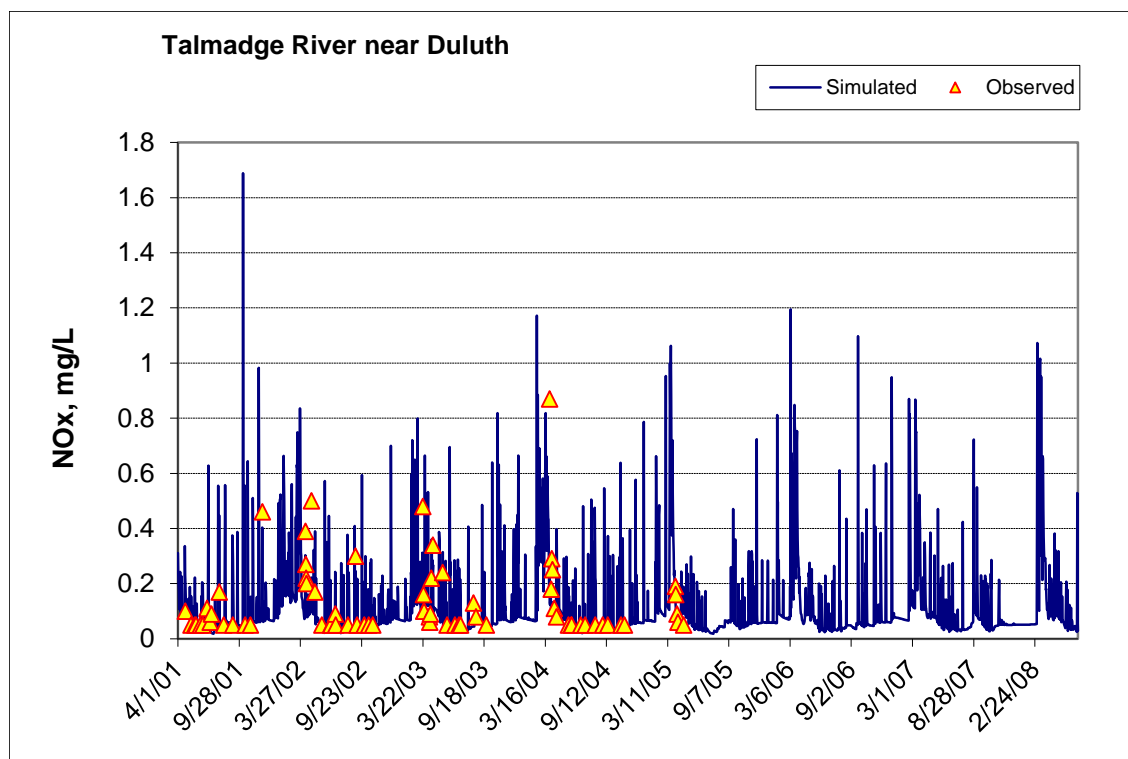


Figure 52. Time series of observed and simulated Nitrite+ Nitrate Nitrogen (NOx) concentration at Talmadge River near Duluth

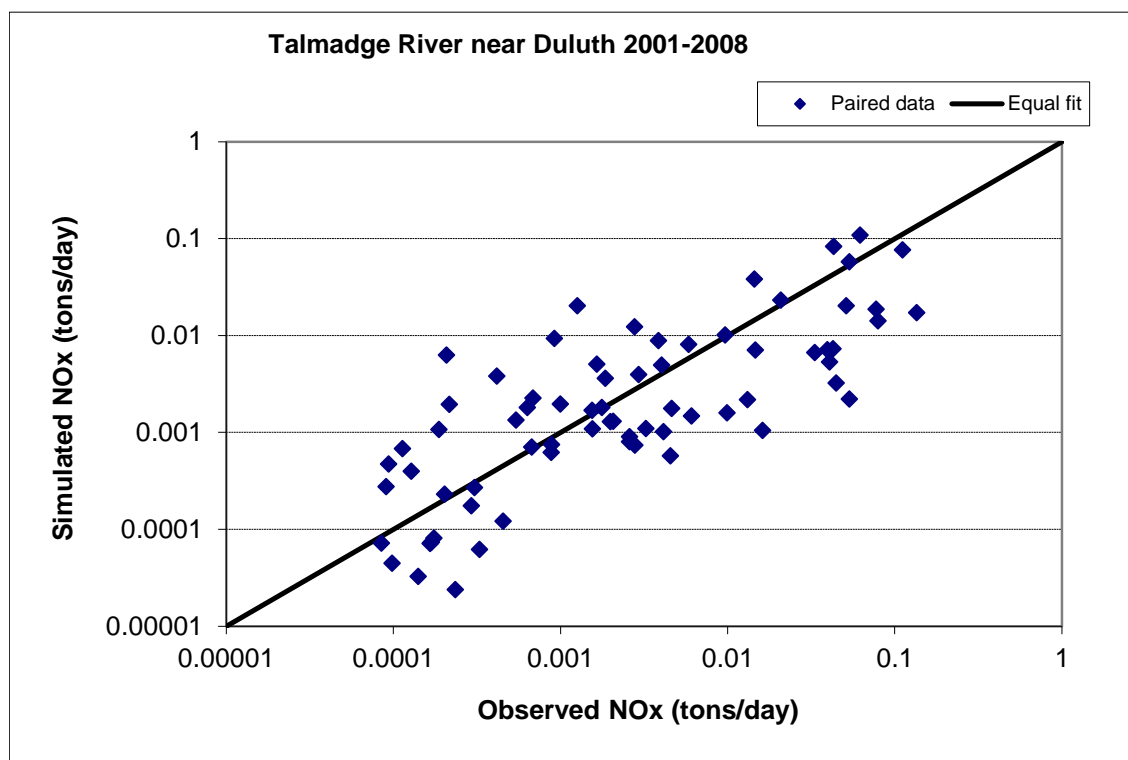


Figure 53. Paired simulated vs. observed Nitrite+ Nitrate Nitrogen (NOx) load at Talmadge River near Duluth

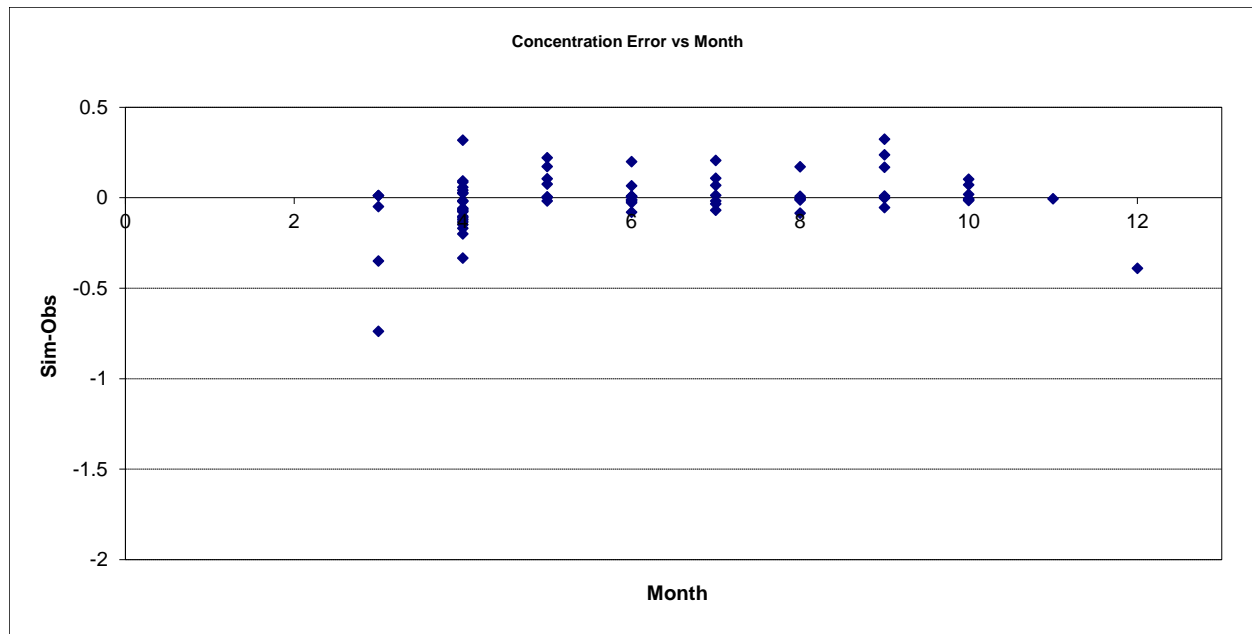


Figure 54. Residual (Simulated - Observed) vs. Month Nitrite+ Nitrate Nitrogen (NOx) at Talmadge River near Duluth

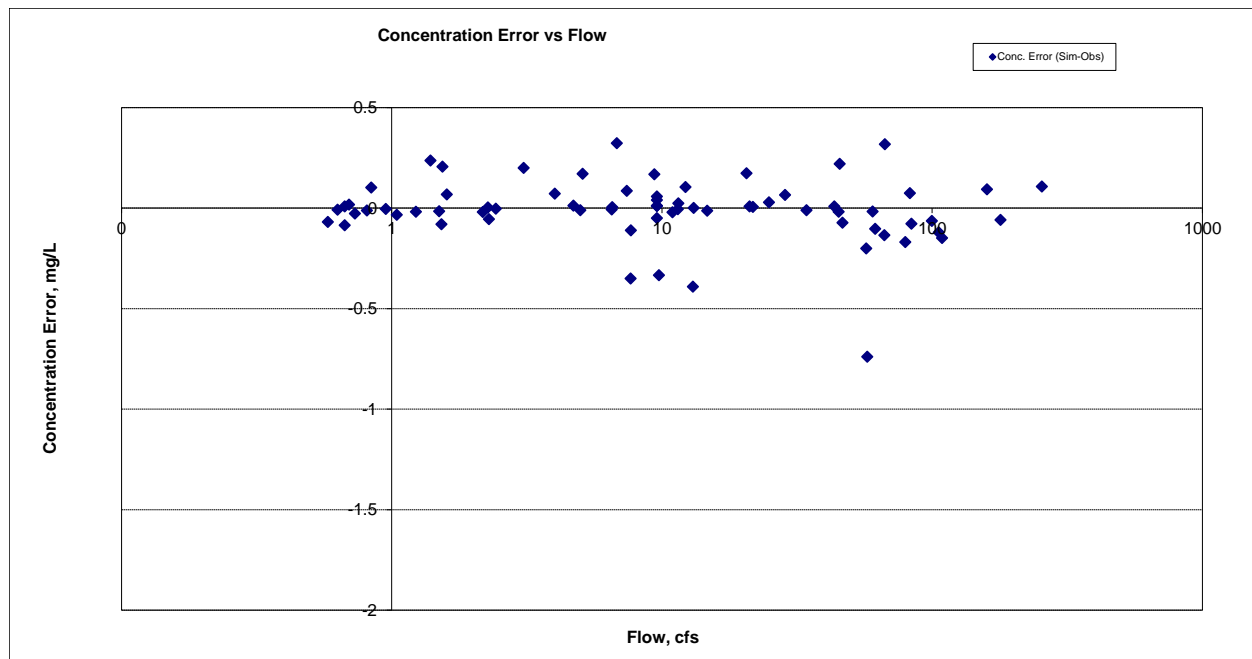
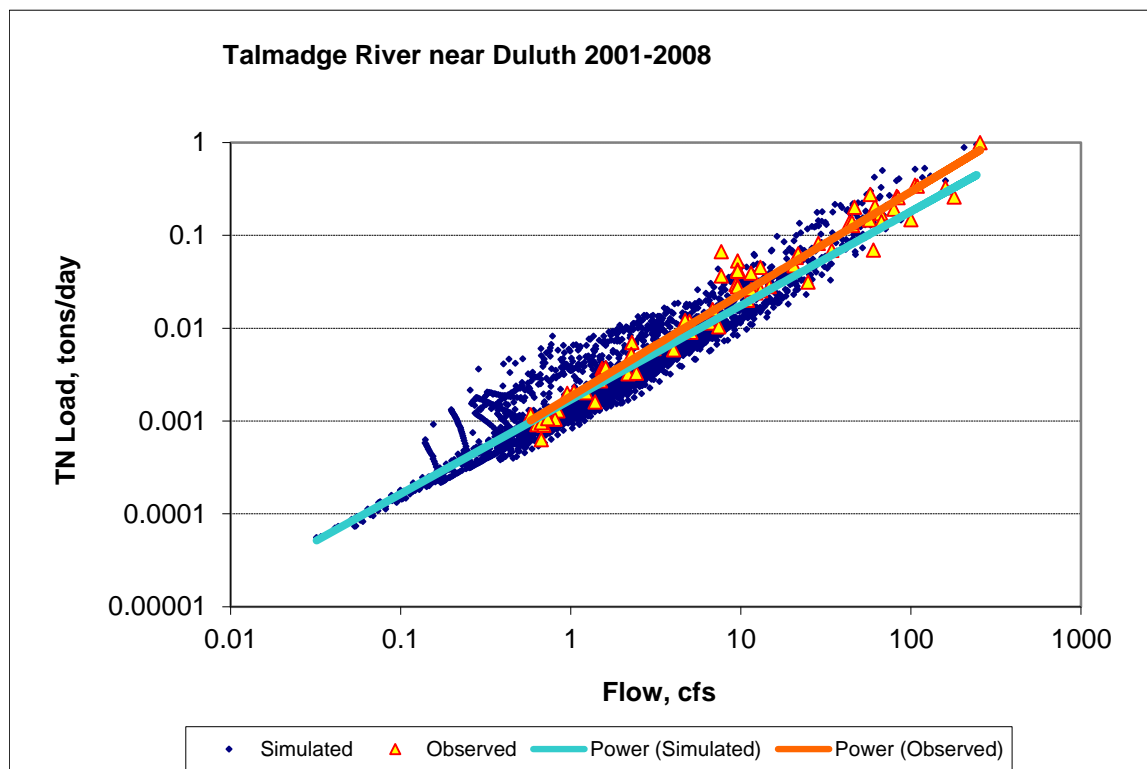


Figure 55. Residual (Simulated - Observed) vs. Flow Nitrite+ Nitrate Nitrogen (NOx) at Talmadge River near Duluth

## Total Nitrogen (TN)

**Table 12. Total Nitrogen (TN) statistics**

Count	70
Concentration Average Error	-12.07%
Concentration Median Error	-20.40%
Load Average Error	-23.62%
Load Median Error	-2.65%
Paired t concentration	0.90
Paired t load	0.43



**Figure 56. Power plot of simulated and observed Total Nitrogen (TN) load vs flow at Talmadge River near Duluth**



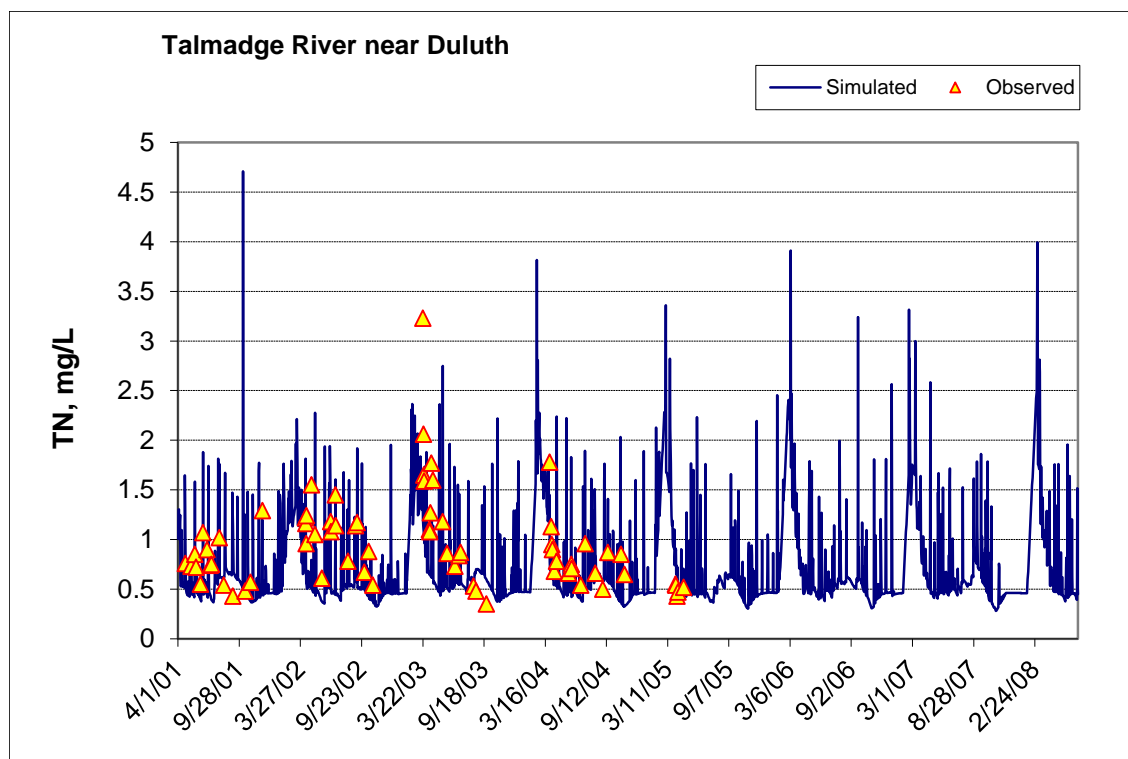


Figure 57. Time series of observed and simulated Total Nitrogen (TN) concentration at Talmadge River near Duluth

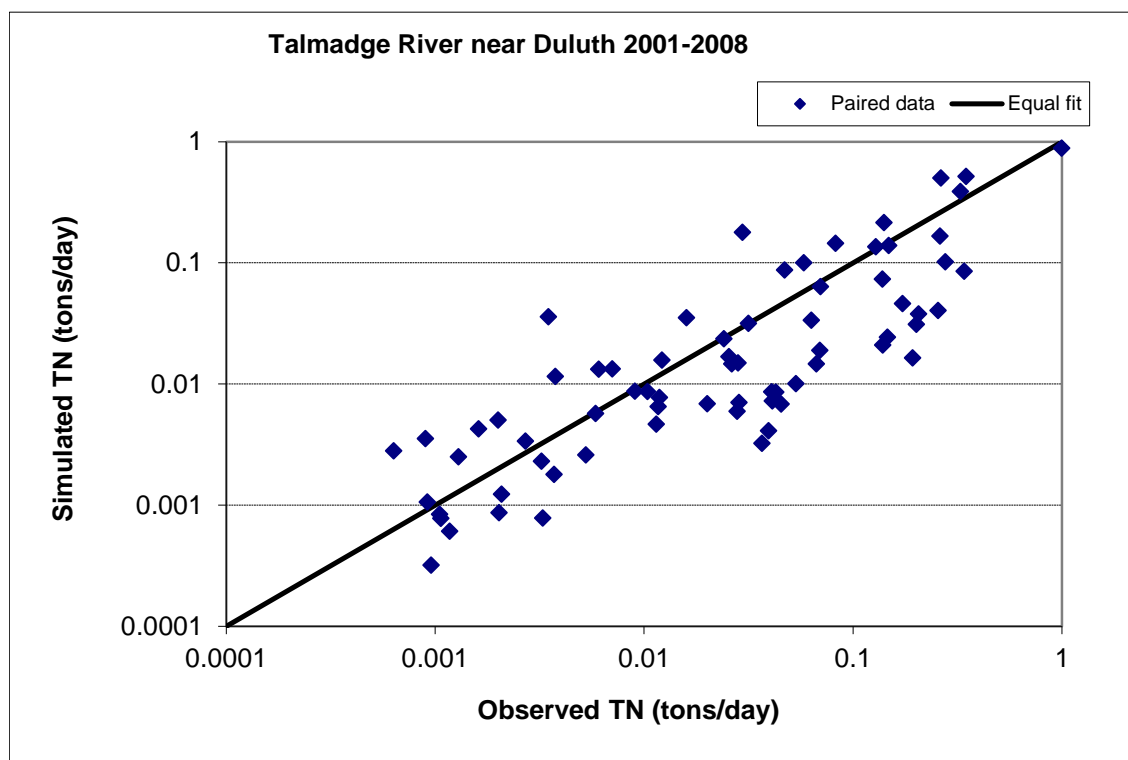
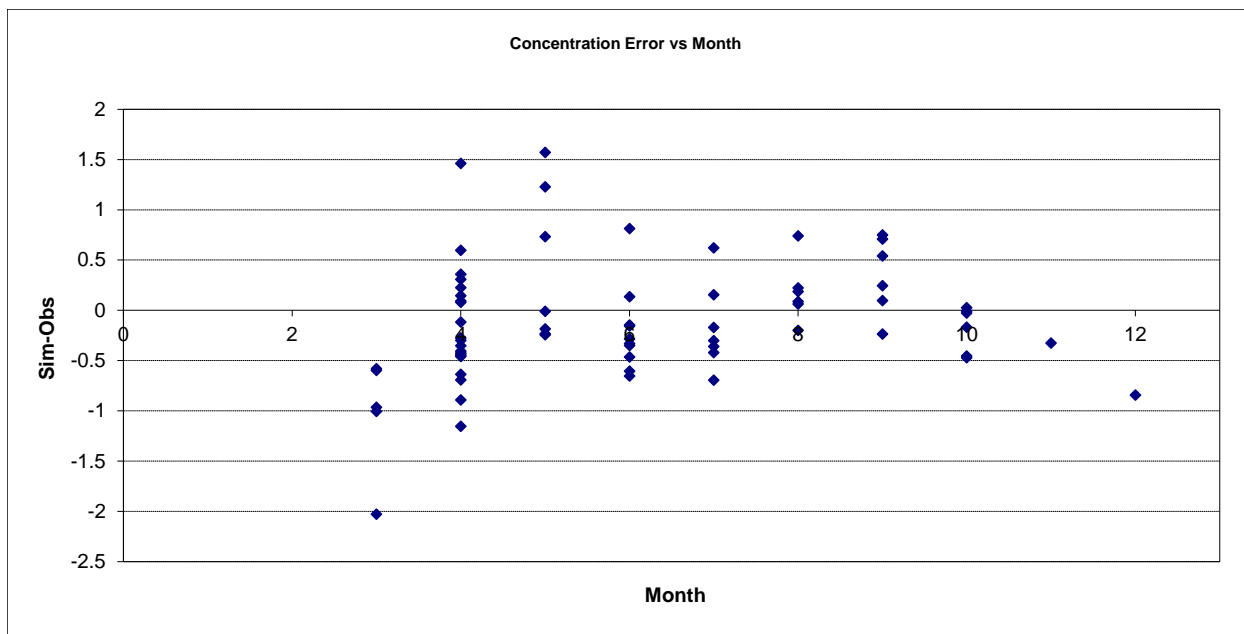
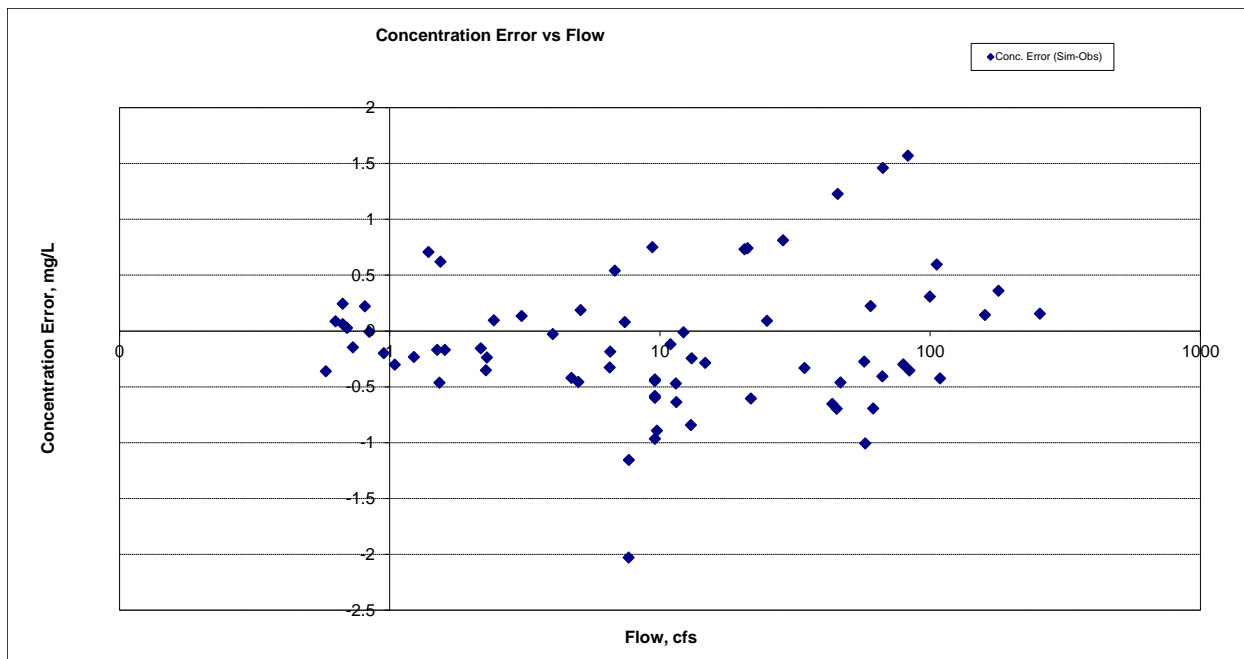


Figure 58. Paired simulated vs. observed Total Nitrogen (TN) load at Talmadge River near Duluth



**Figure 59. Residual (Simulated - Observed) vs. Month Total Nitrogen (TN) at Talmadge River near Duluth**

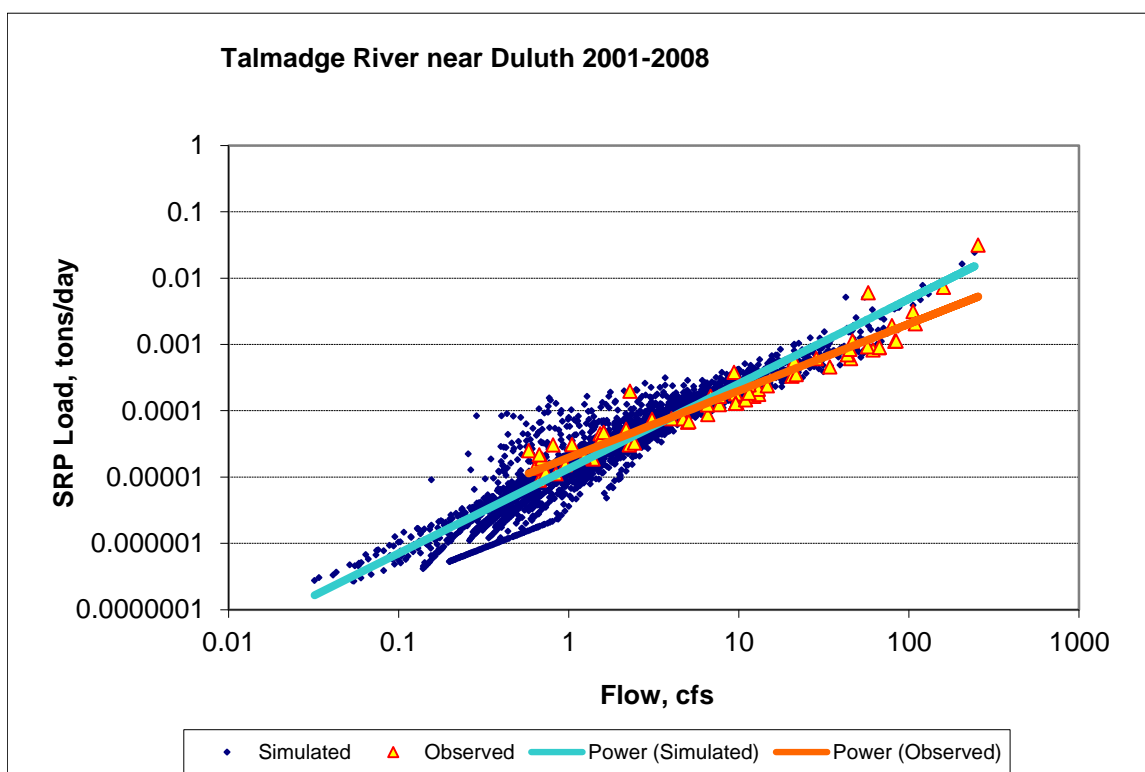


**Figure 60. Residual (Simulated - Observed) vs. Flow Total Nitrogen (TN) at Talmadge River near Duluth**

## Soluble Reactive Phosphorus (SRP)

**Table 13. Soluble Reactive Phosphorus (SRP) statistics**

Count	65
Concentration Average Error	5.08%
Concentration Median Error	17.91%
Load Average Error	-25.02%
Load Median Error	-0.22%
Paired t concentration	0.95
Paired t load	0.45



**Figure 61. Power plot of simulated and observed Soluble Reactive Phosphorus (SRP) load vs flow at Talmadge River near Duluth**

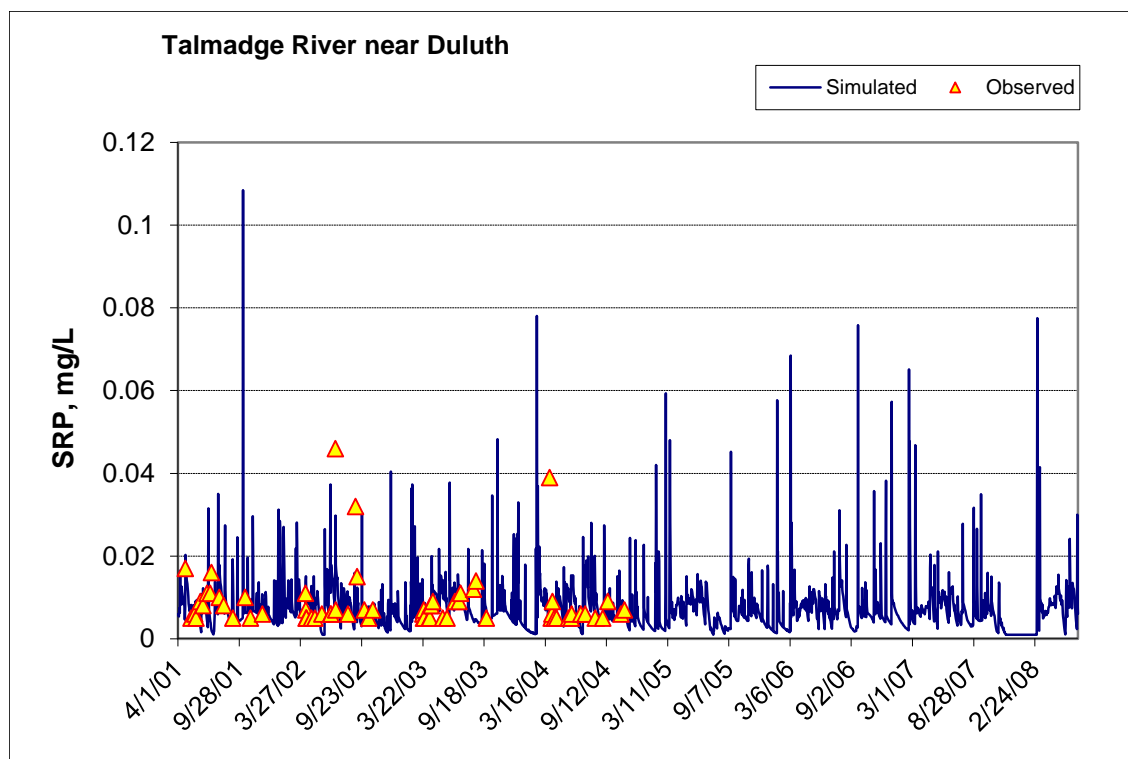


Figure 62. Time series of observed and simulated Soluble Reactive Phosphorus (SRP) concentration at Talmadge River near Duluth

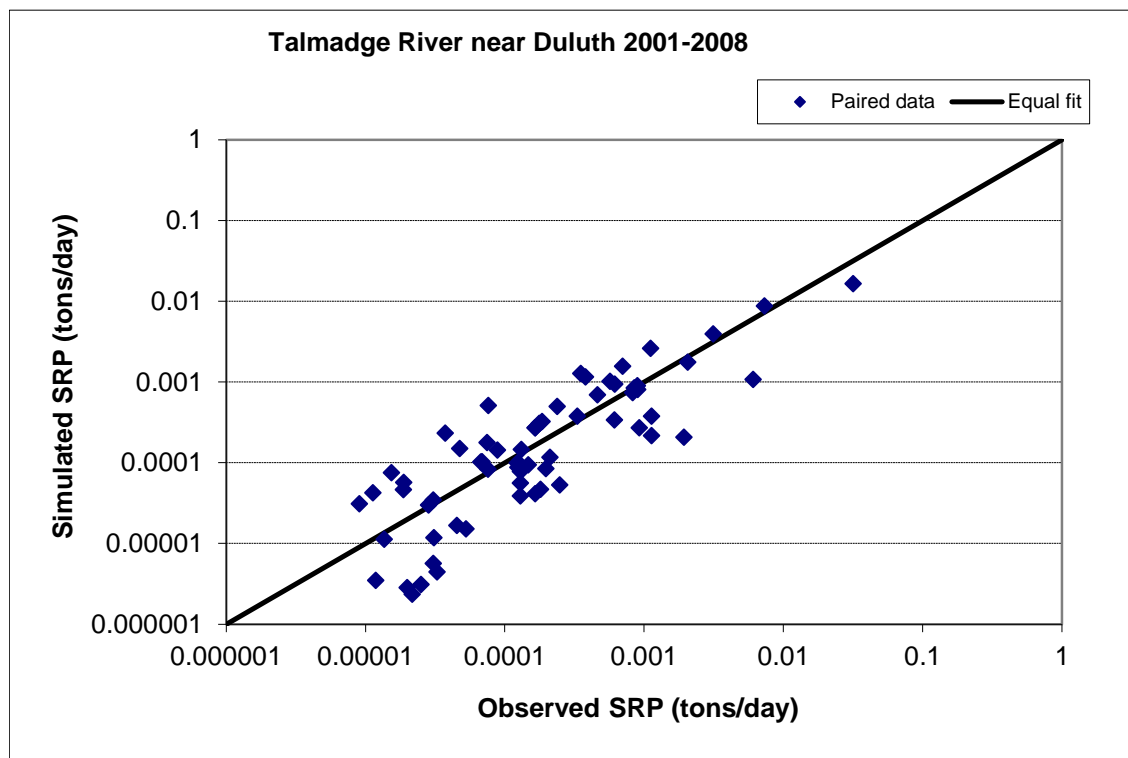
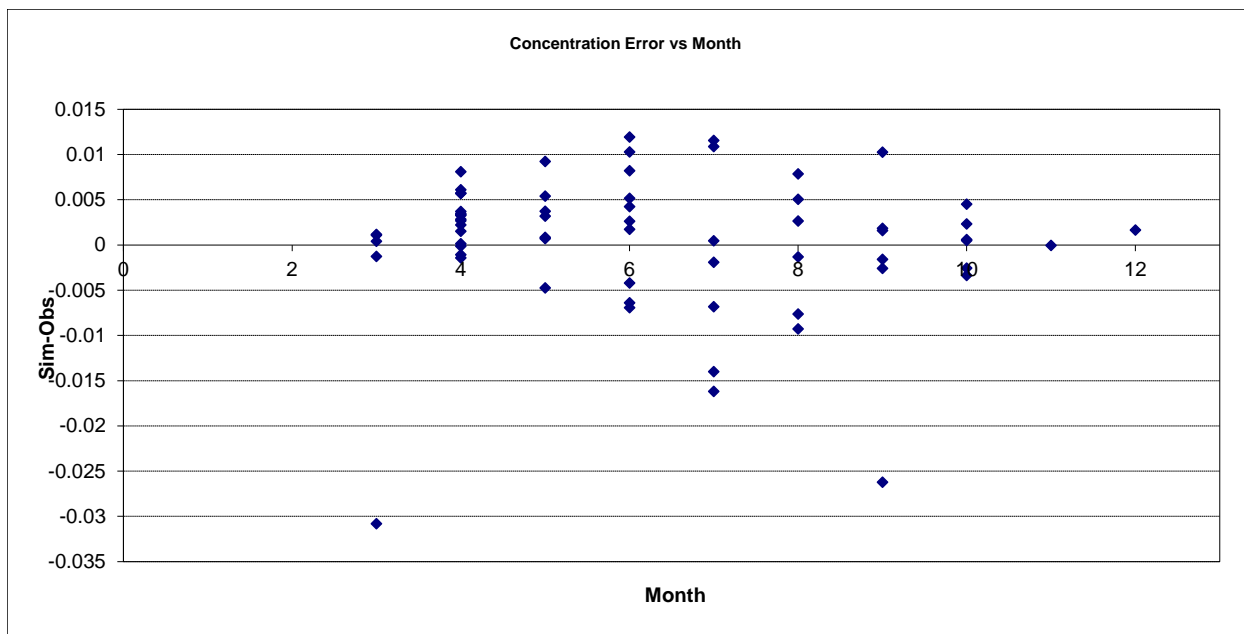
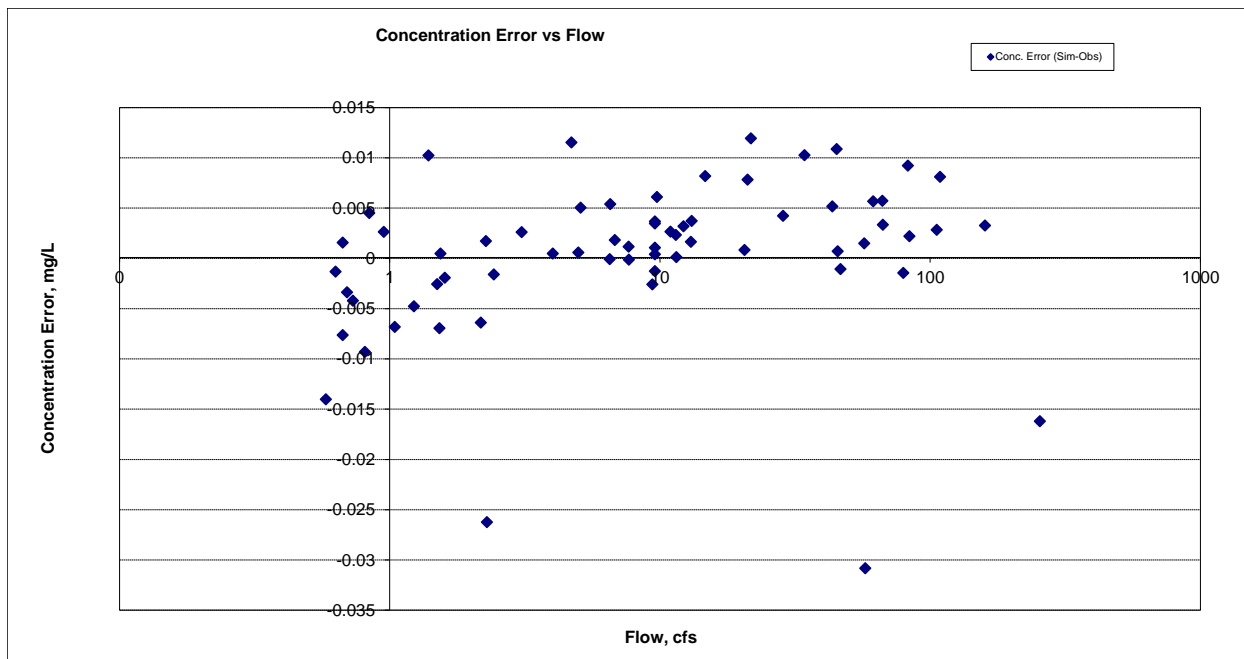


Figure 63. Paired simulated vs. observed Soluble Reactive Phosphorus (SRP) load at Talmadge River near Duluth



**Figure 64. Residual (Simulated - Observed) vs. Month Soluble Reactive Phosphorus (SRP) at Talmadge River near Duluth**

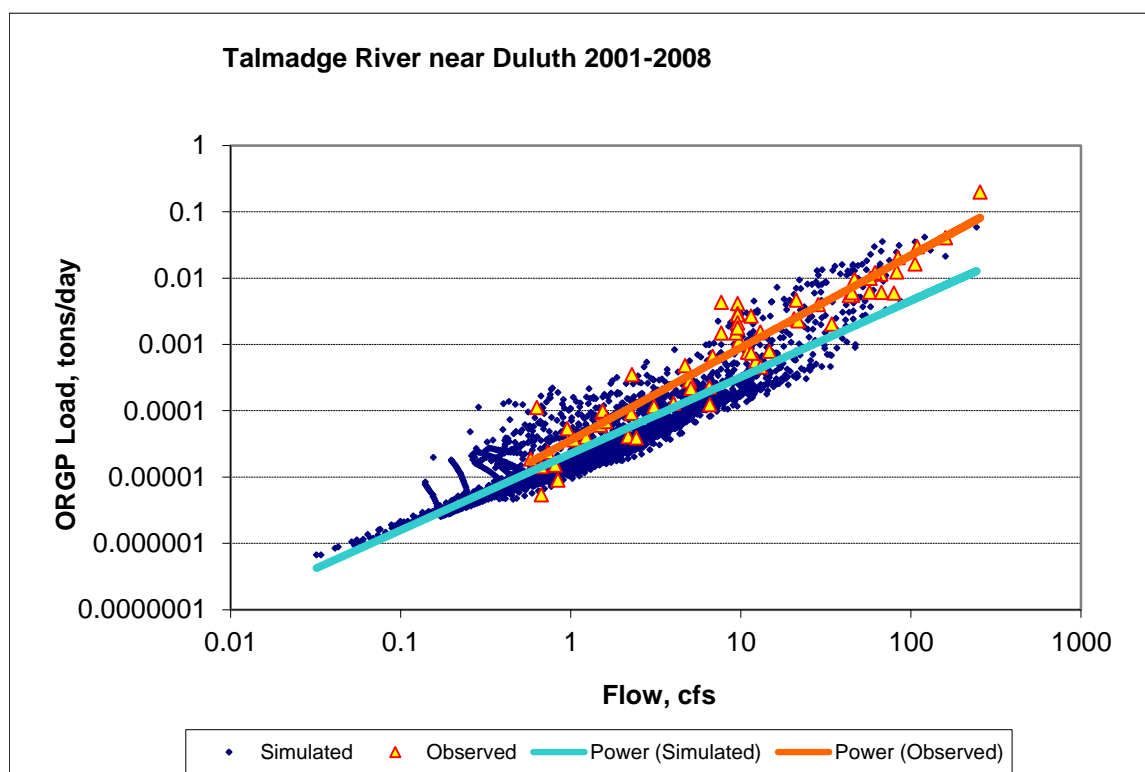


**Figure 65. Residual (Simulated - Observed) vs. Flow Soluble Reactive Phosphorus (SRP) at Talmadge River near Duluth**

## Organic Phosphorus (OrgP)

**Table 14. Organic Phosphorus (OrgP) statistics**

Count	63
Concentration Average Error	-35.31%
Concentration Median Error	-28.81%
Load Average Error	-47.16%
Load Median Error	-1.52%
Paired t concentration	0.11
Paired t load	0.22



**Figure 66. Power plot of simulated and observed Organic Phosphorus (OrgP) load vs flow at Talmadge River near Duluth**

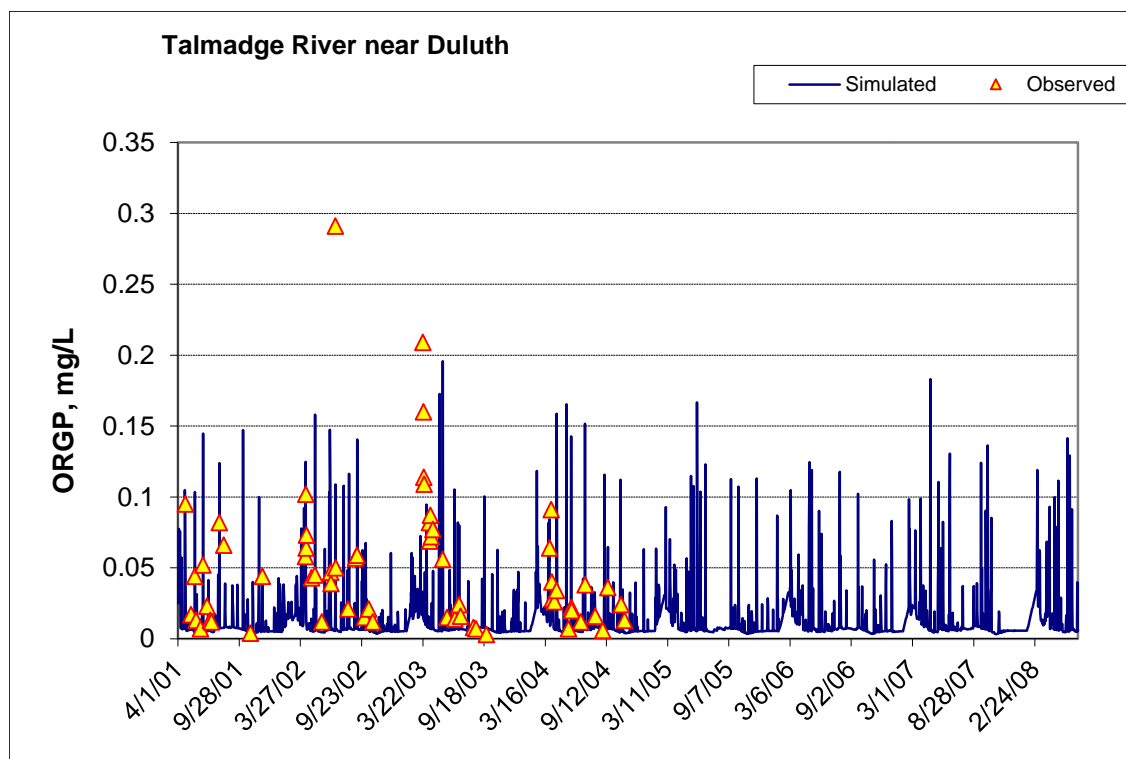


Figure 67. Time series of observed and simulated Organic Phosphorus (OrgP) concentration at Talmadge River near Duluth

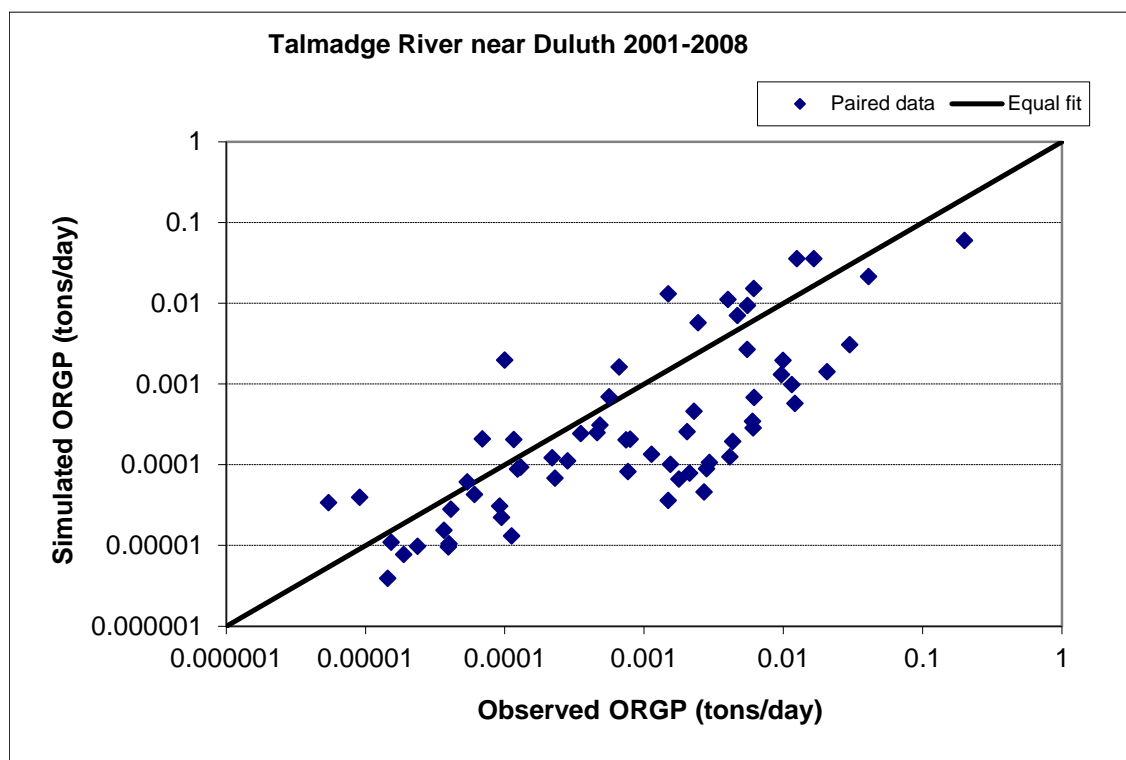
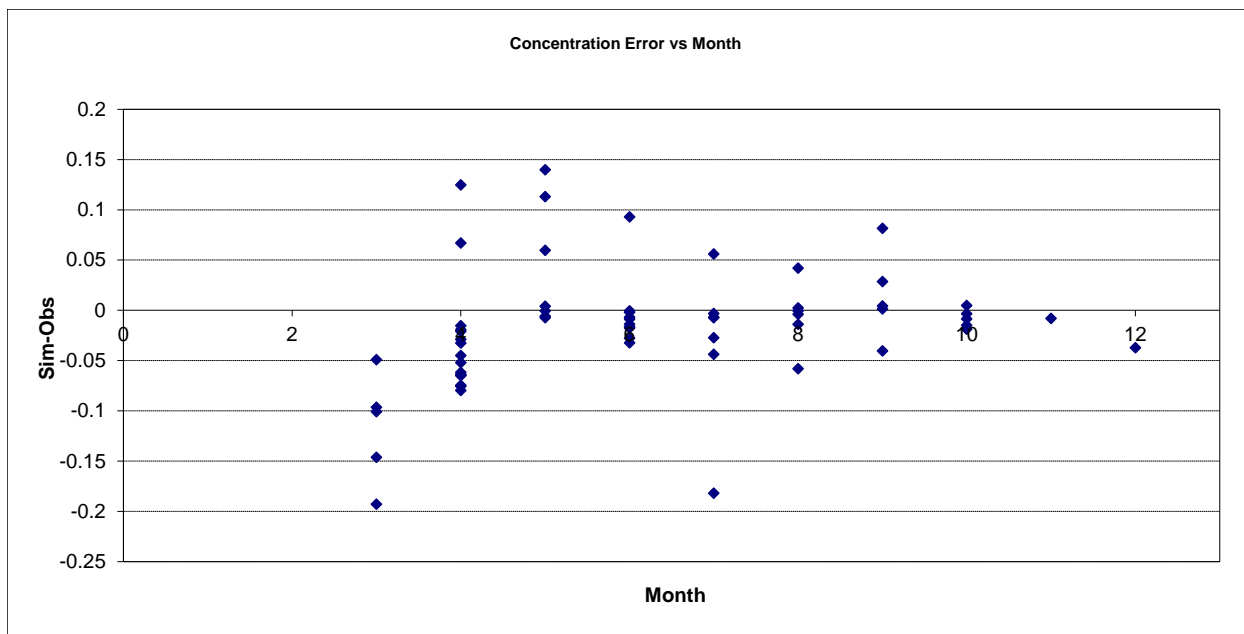
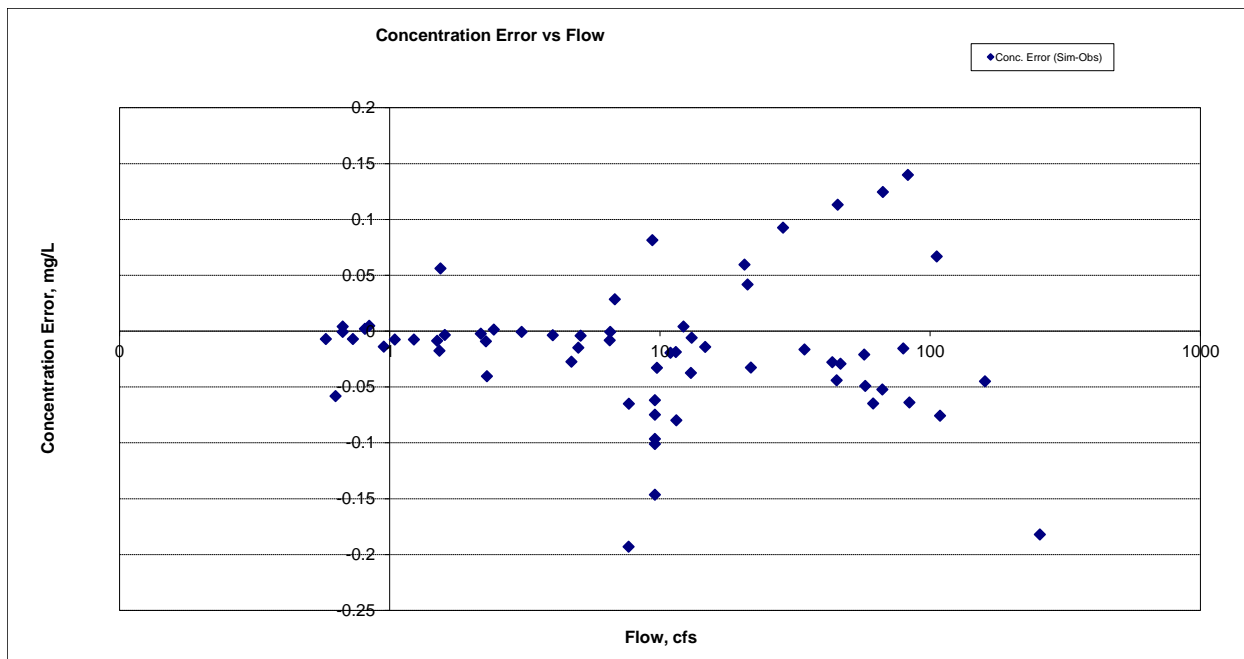


Figure 68. Paired simulated vs. observed Organic Phosphorus (OrgP) load at Talmadge River near Duluth



**Figure 69. Residual (Simulated - Observed) vs. Month Organic Phosphorus (OrgP) at Talmadge River near Duluth**



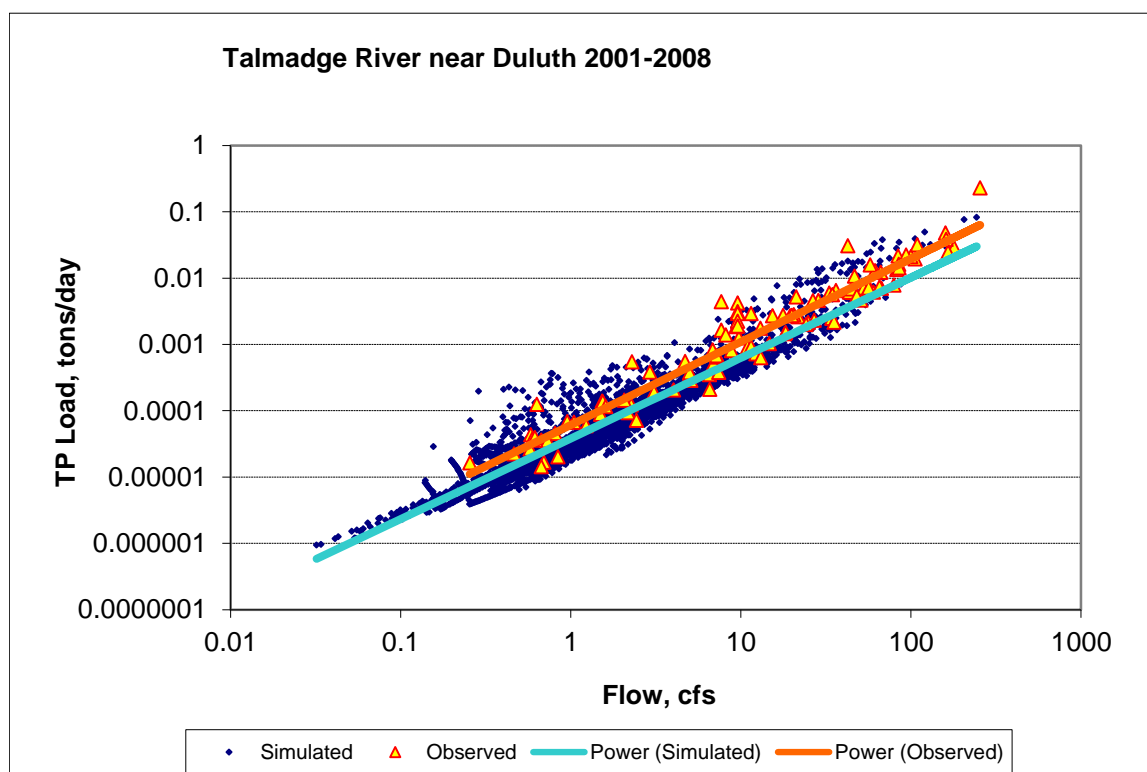
**Figure 70. Residual (Simulated - Observed) vs. Flow Organic Phosphorus (OrgP) at Talmadge River near Duluth**



## Total Phosphorus (TP)

**Table 15. Total Phosphorus (TP) statistics**

Count	108
Concentration Average Error	-14.20%
Concentration Median Error	-20.08%
Load Average Error	-33.01%
Load Median Error	-1.49%
Paired t concentration	0.75
Paired t load	0.29



**Figure 71. Power plot of simulated and observed Total Phosphorus (TP) load vs flow at Talmadge River near Duluth**

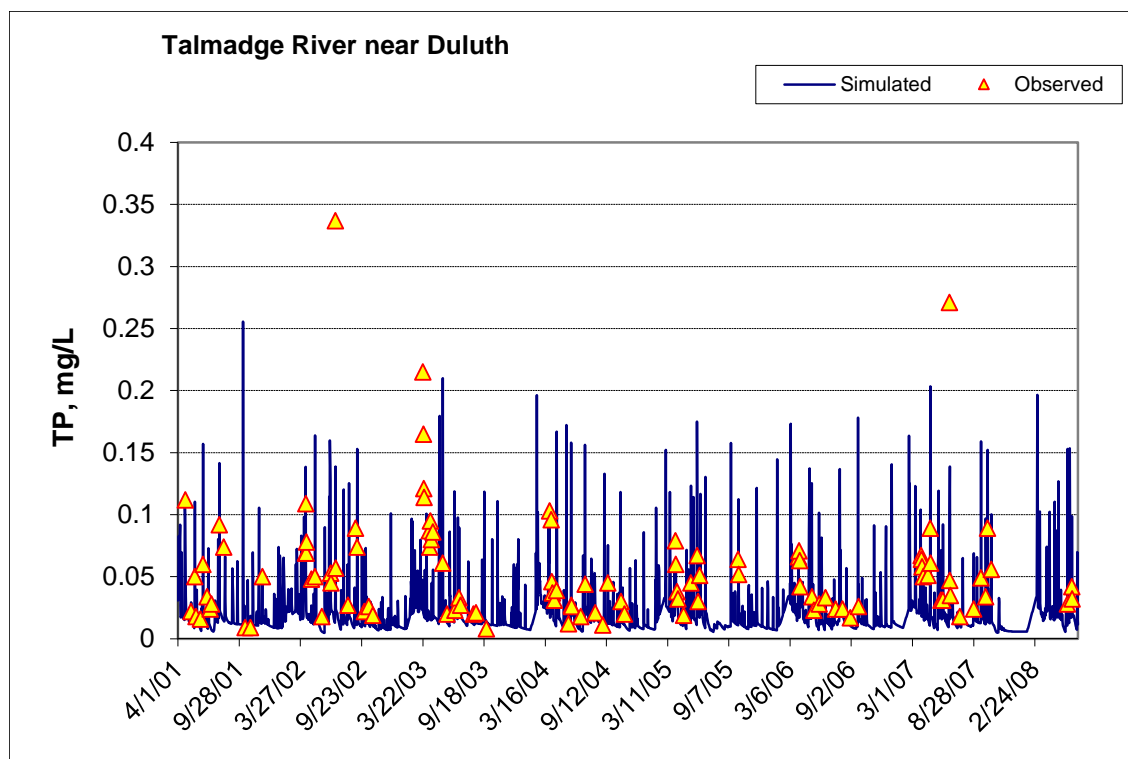


Figure 72. Time series of observed and simulated Total Phosphorus (TP) concentration at Talmadge River near Duluth

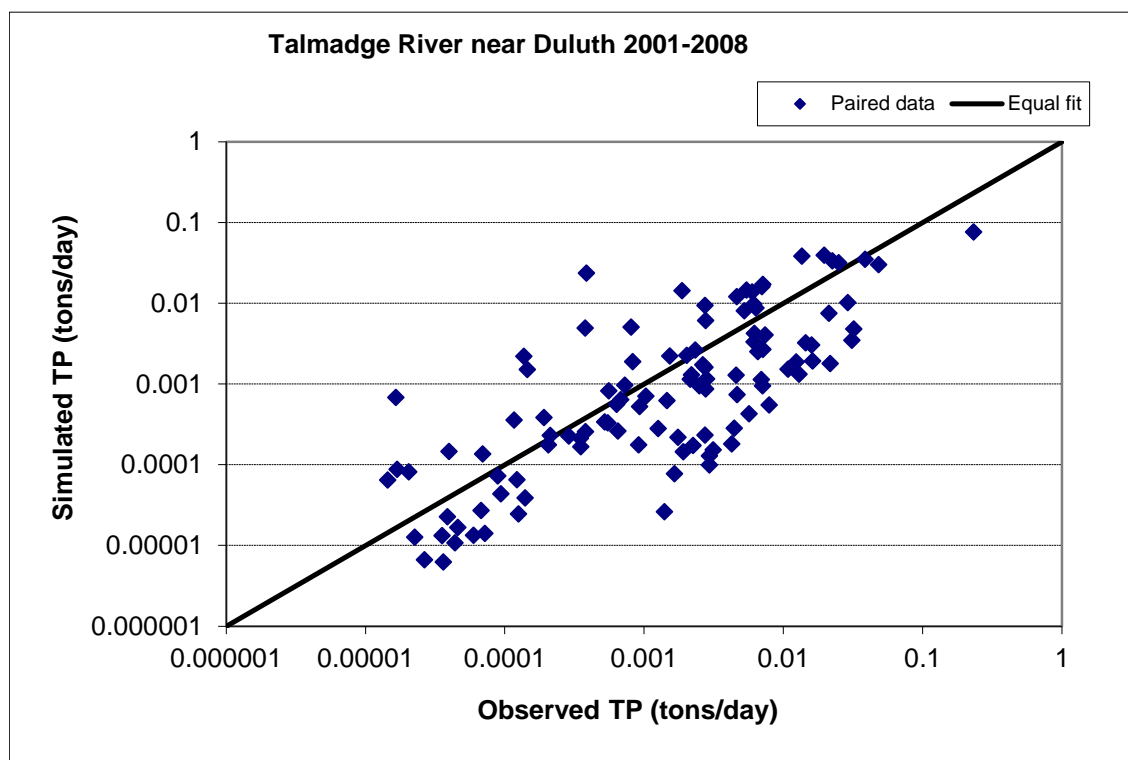
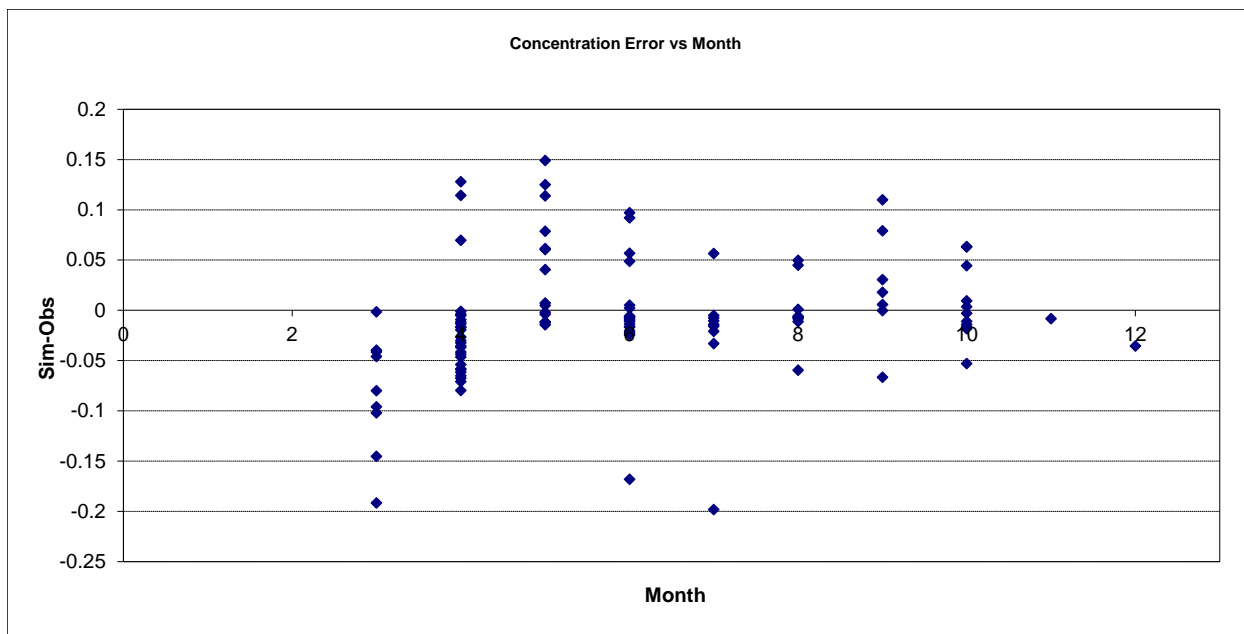
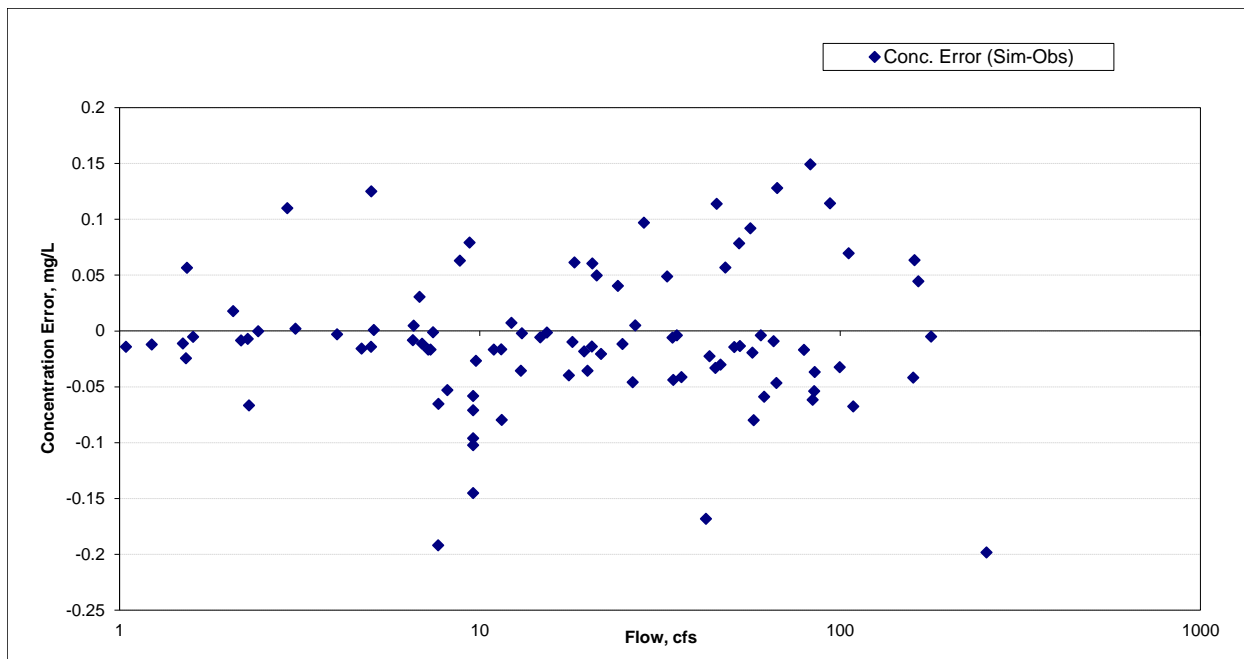


Figure 73. Paired simulated vs. observed Total Phosphorus (TP) load at Talmadge River near Duluth



**Figure 74. Residual (Simulated - Observed) vs. Month Total Phosphorus (TP) at Talmadge River near Duluth**



**Figure 75. Residual (Simulated - Observed) vs. Flow Total Phosphorus (TP) at Talmadge River near Duluth**

## French River (EQUIS S001-754)

### Total Suspended Solids (TSS)

Table 16. Total Suspended Solids (TSS) statistics

Count	114
Concentration Average Error	39.18%
Concentration Median Error	10.99%
Load Average Error	8.59%
Load Median Error	0.54%
Paired t concentration	0.12
Paired t load	0.63

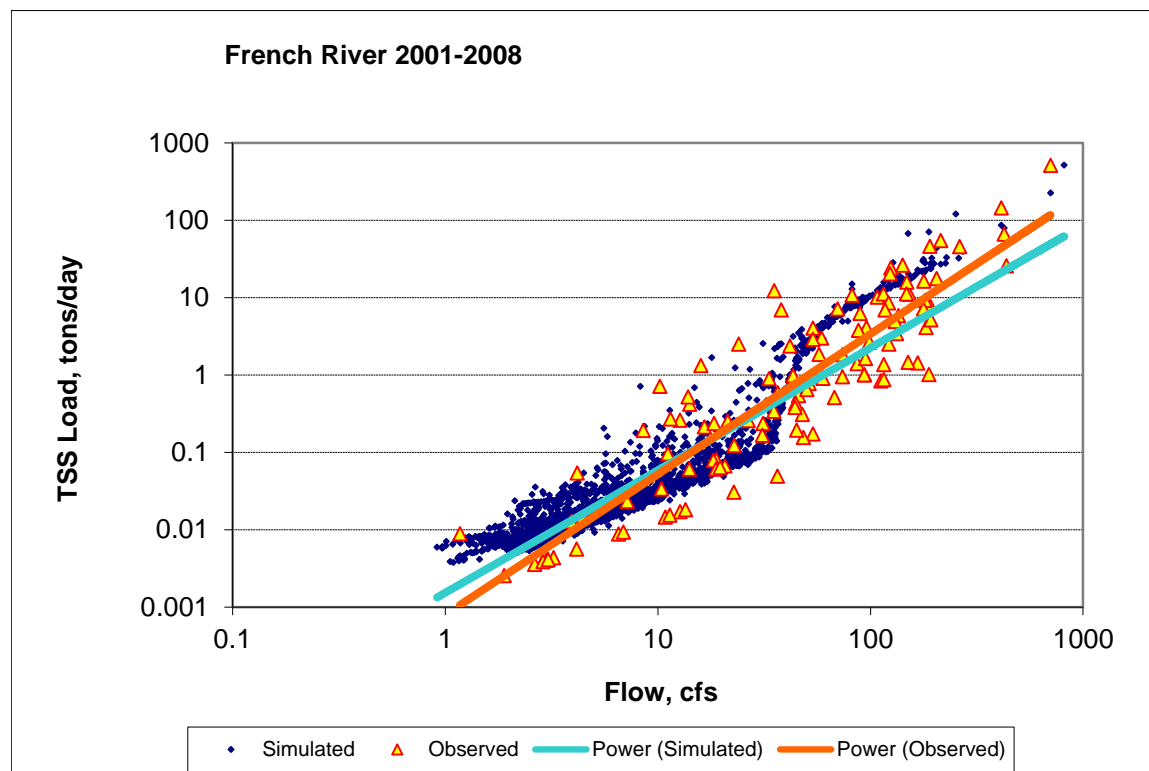


Figure 76. Power plot of simulated and observed Total Suspended Solids (TSS) load vs flow at French River

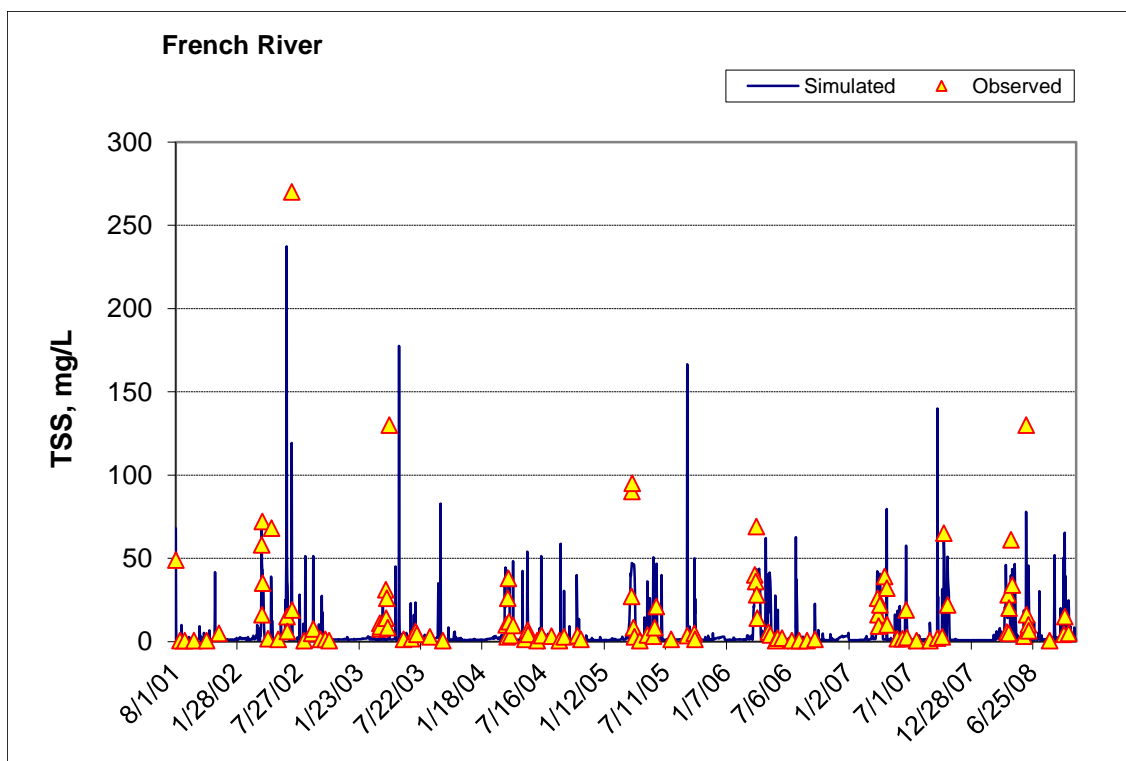


Figure 77. Time series of observed and simulated Total Suspended Solids (TSS) concentration at French River

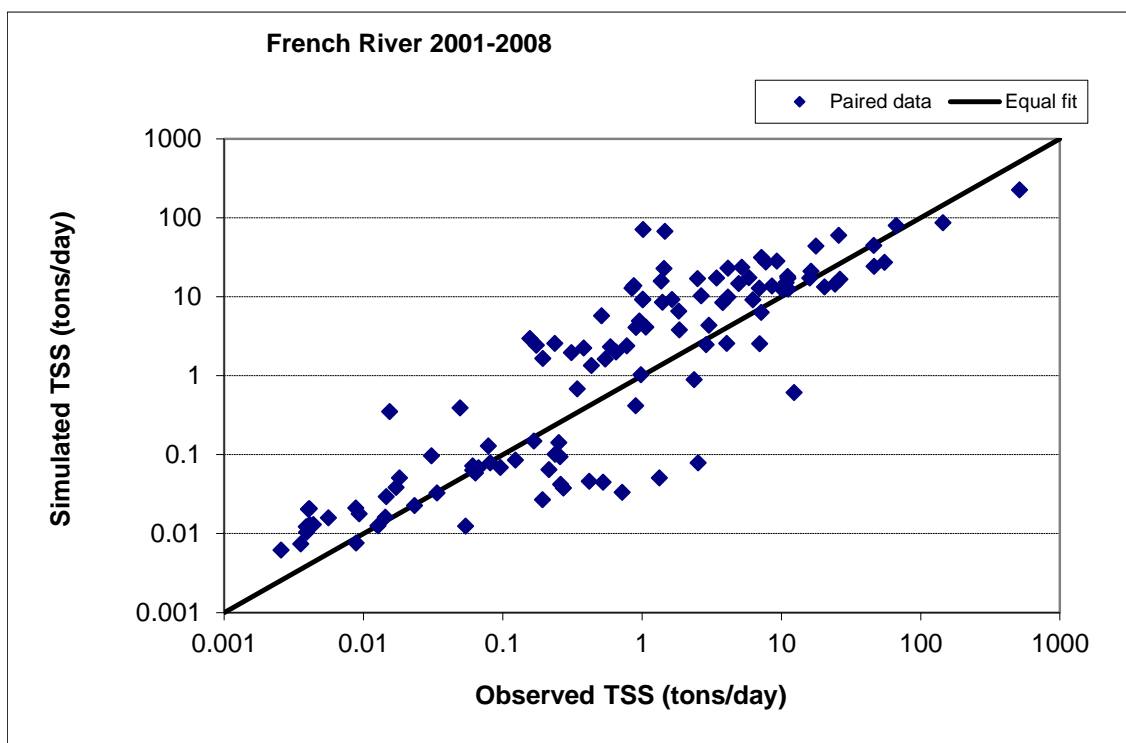
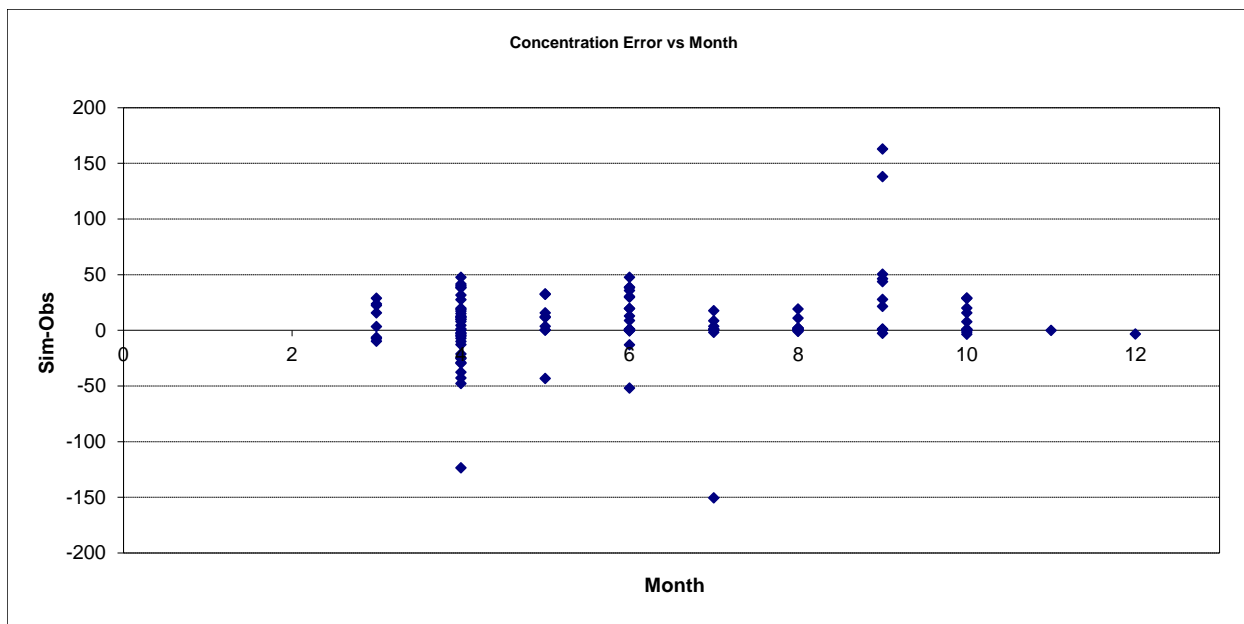
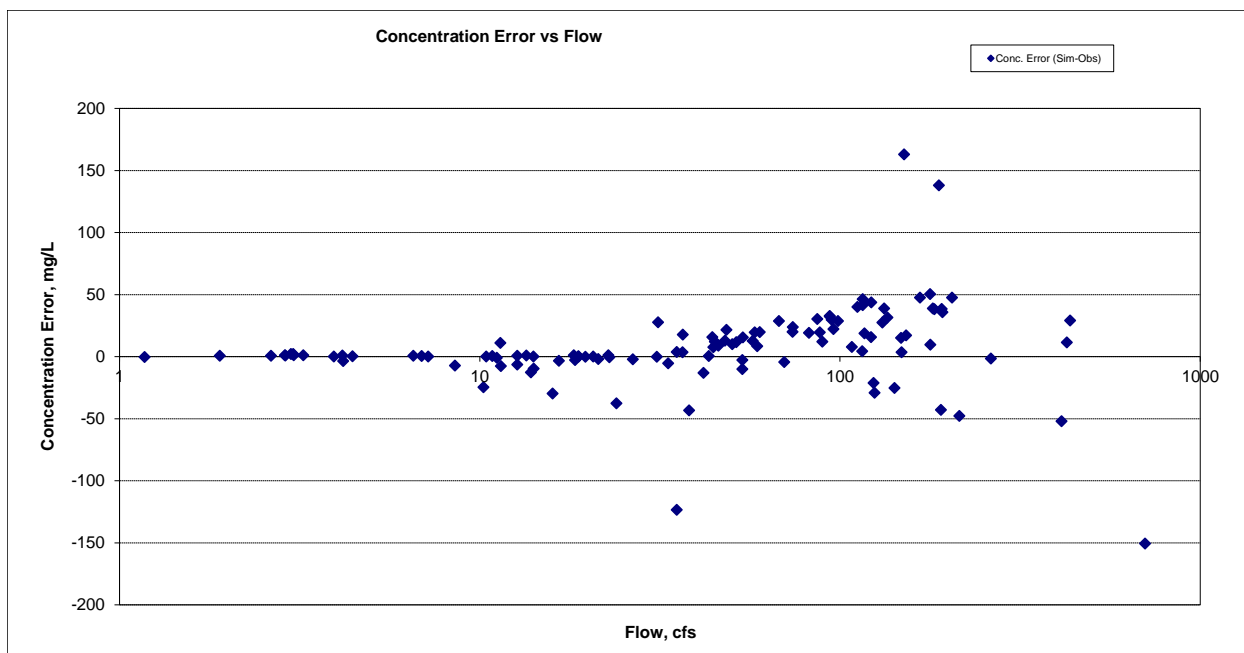


Figure 78. Paired simulated vs. observed Total Suspended Solids (TSS) load at French River



**Figure 79. Residual (Simulated - Observed) vs. Month Total Suspended Solids (TSS) at French River**

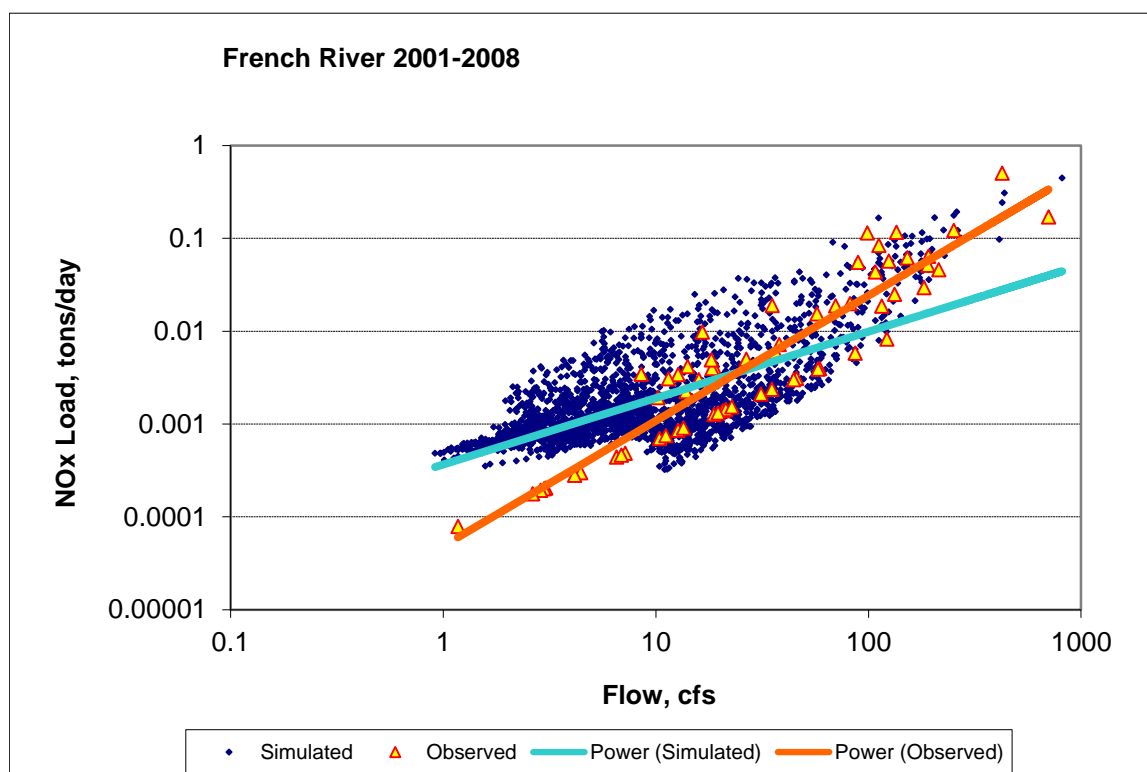


**Figure 80. Residual (Simulated - Observed) vs. Flow Total Suspended Solids (TSS) at French River**

## Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>)

**Table 17. Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) statistics**

Count	61
Concentration Average Error	-5.15%
Concentration Median Error	-3.46%
Load Average Error	-13.54%
Load Median Error	-0.68%
Paired t concentration	0.90
Paired t load	0.59



**Figure 81. Power plot of simulated and observed Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) load vs flow at French River**

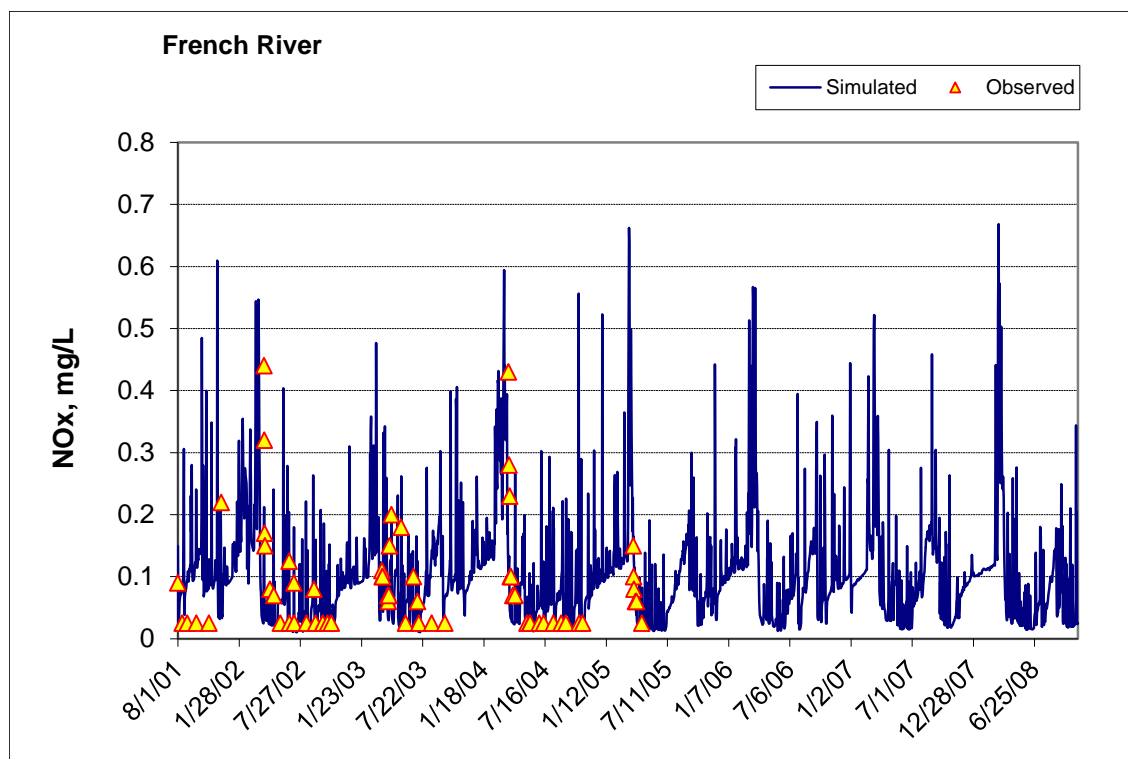


Figure 82. Time series of observed and simulated Nitrite+ Nitrate Nitrogen (NOx) concentration at French River

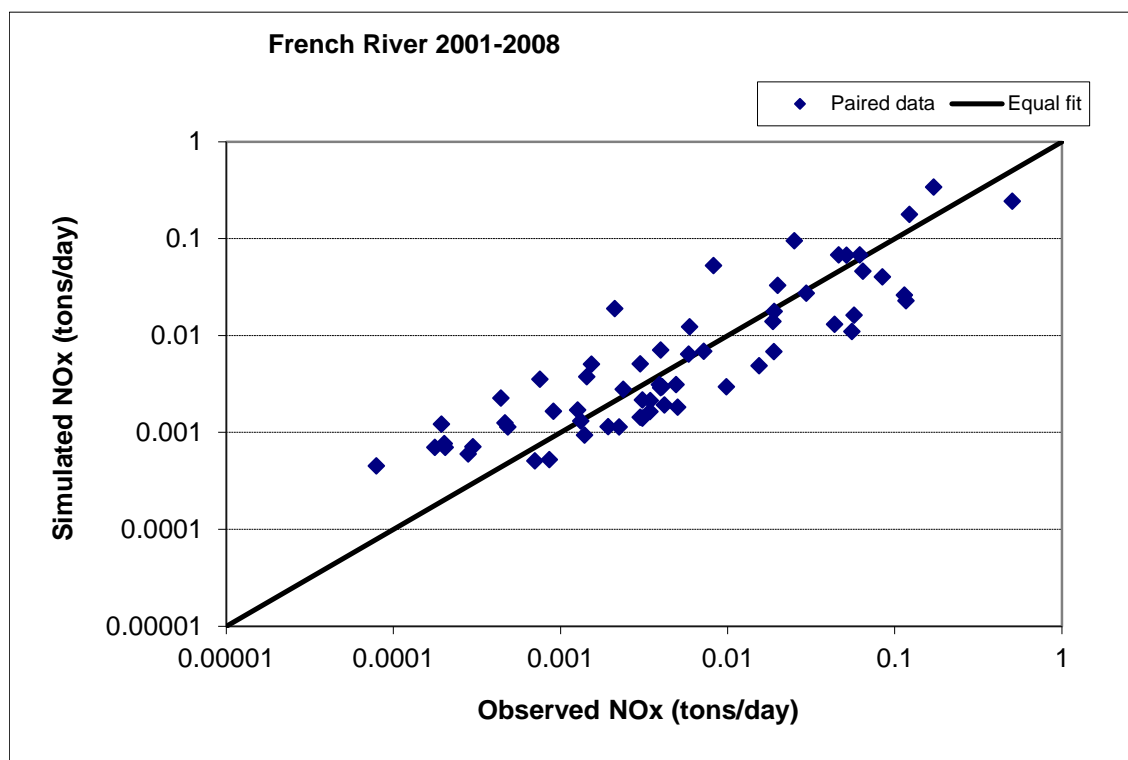


Figure 83. Paired simulated vs. observed Nitrite+ Nitrate Nitrogen (NOx) load at French River



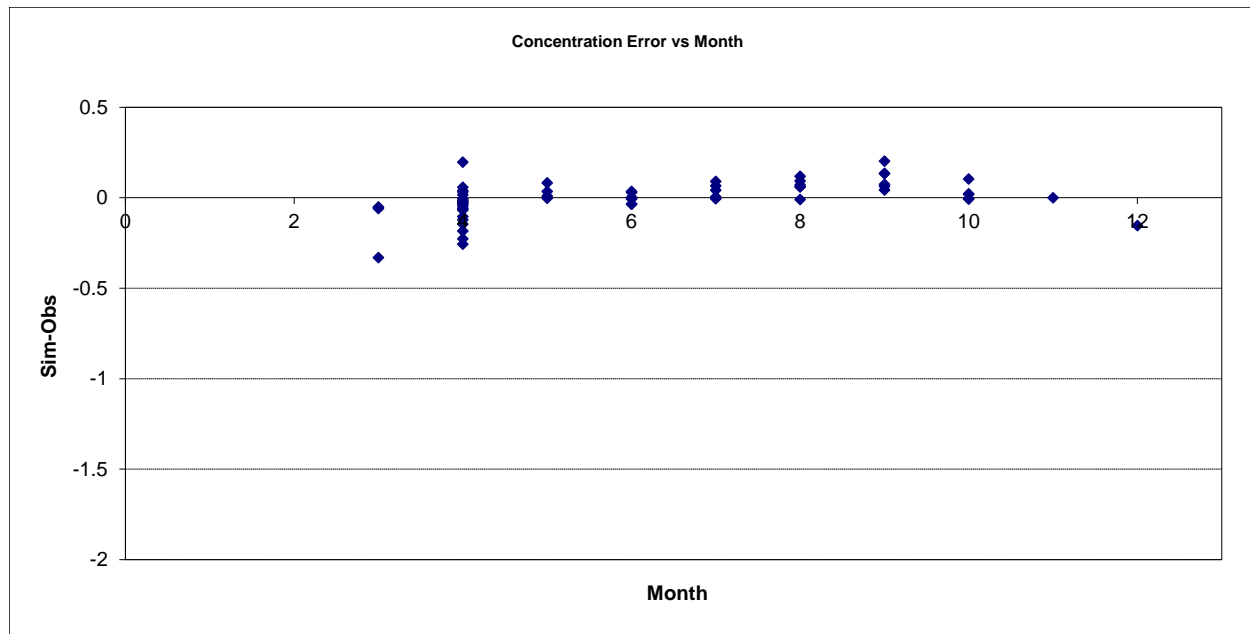


Figure 84. Residual (Simulated - Observed) vs. Month Nitrite+ Nitrate Nitrogen (NOx) at French River

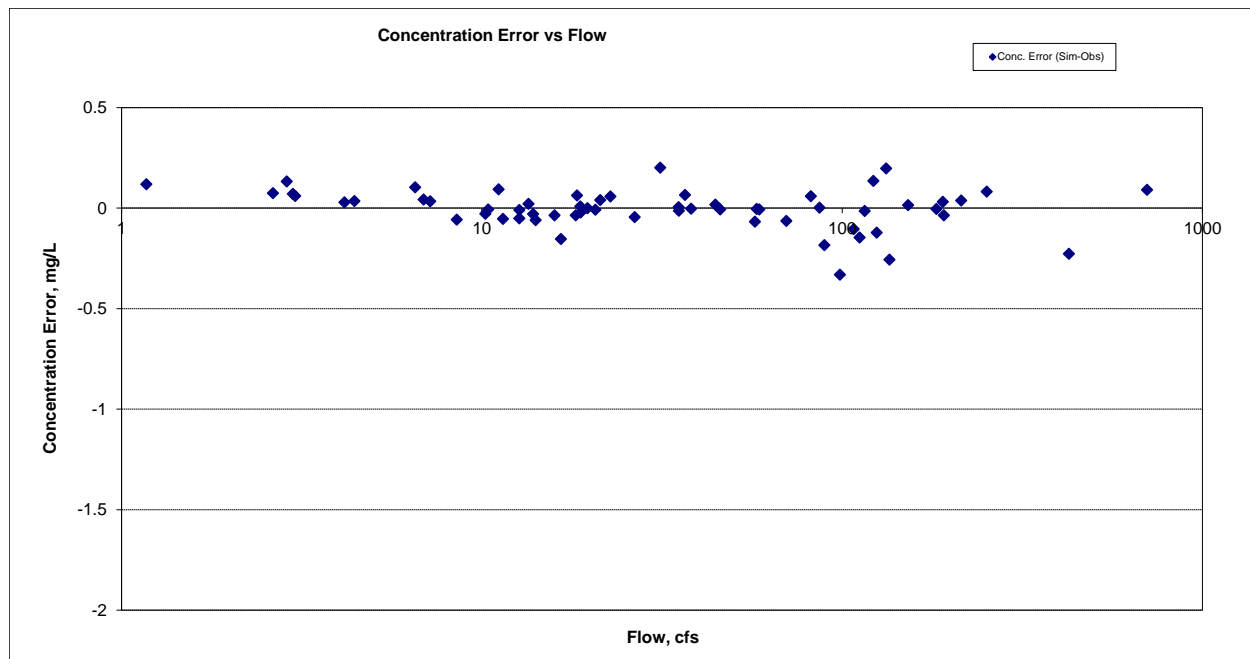
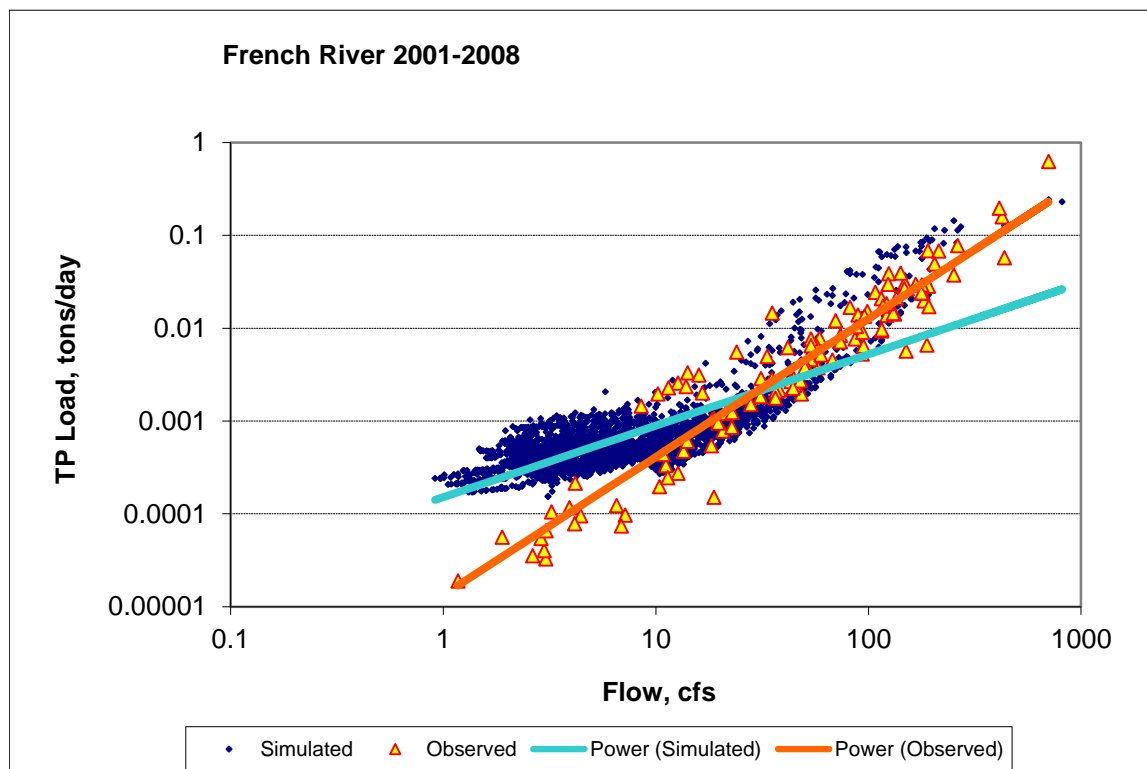


Figure 85. Residual (Simulated - Observed) vs. Flow Nitrite+ Nitrate Nitrogen (NOx) at French River

## Total Phosphorus (TP)

**Table 18. Total Phosphorus (TP) statistics**

Count	114
Concentration Average Error	35.69%
Concentration Median Error	4.00%
Load Average Error	15.10%
Load Median Error	0.74%
Paired t concentration	0.07
Paired t load	0.57



**Figure 86. Power plot of simulated and observed Total Phosphorus (TP) load vs flow at French River**

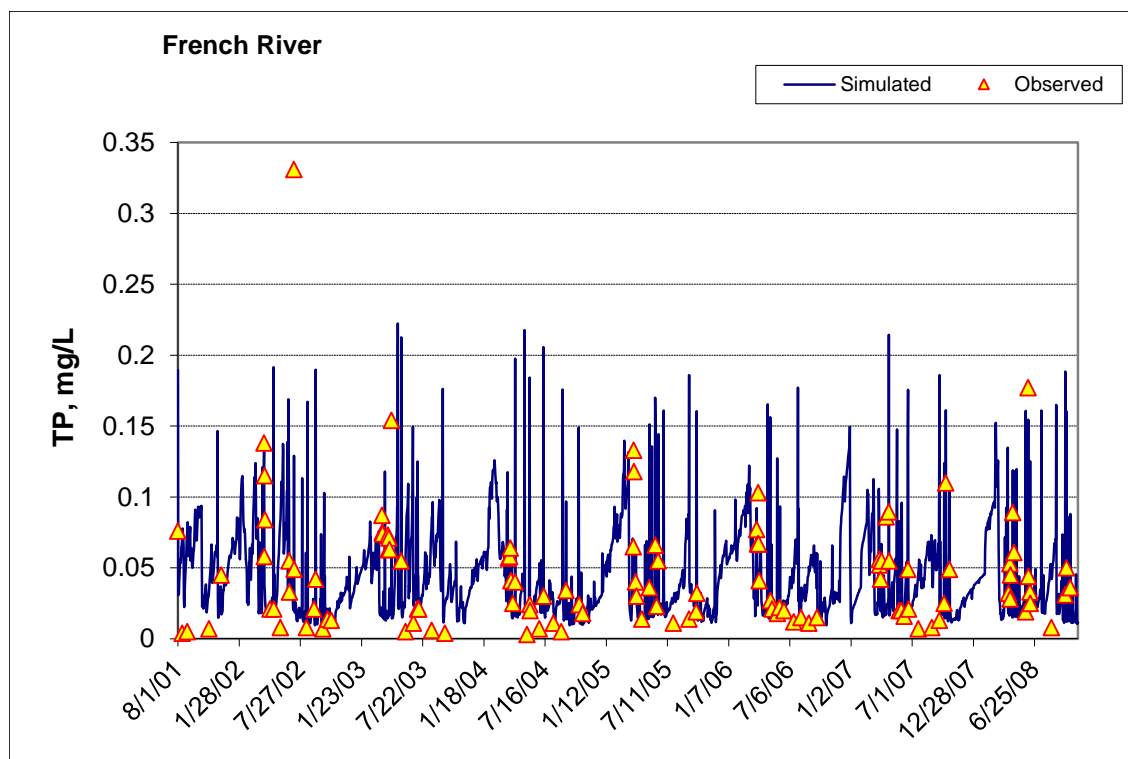


Figure 87. Time series of observed and simulated Total Phosphorus (TP) concentration at French River

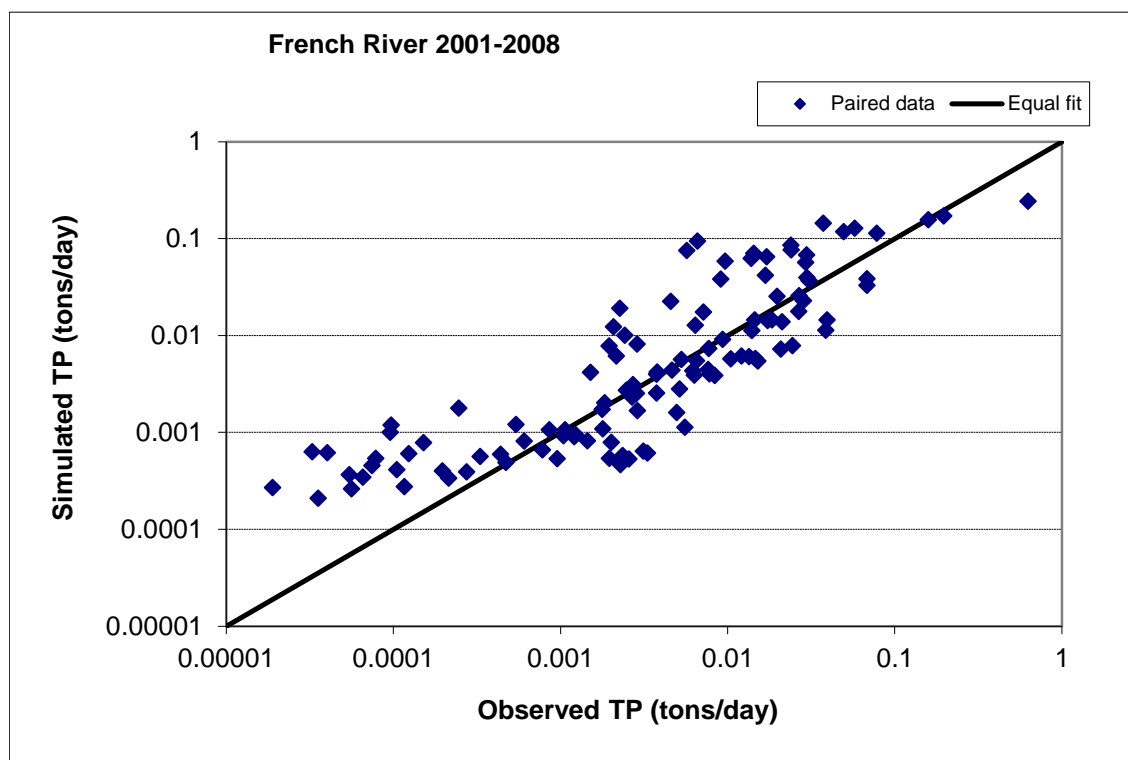


Figure 88. Paired simulated vs. observed Total Phosphorus (TP) load at French River

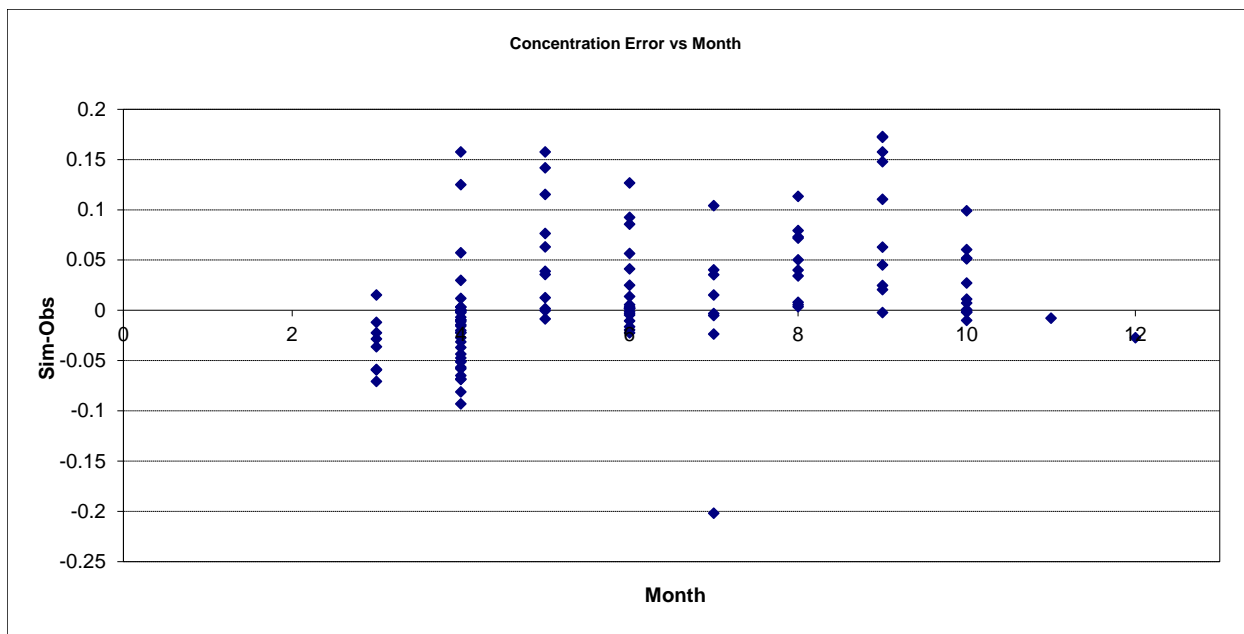


Figure 89. Residual (Simulated - Observed) vs. Month Total Phosphorus (TP) at French River

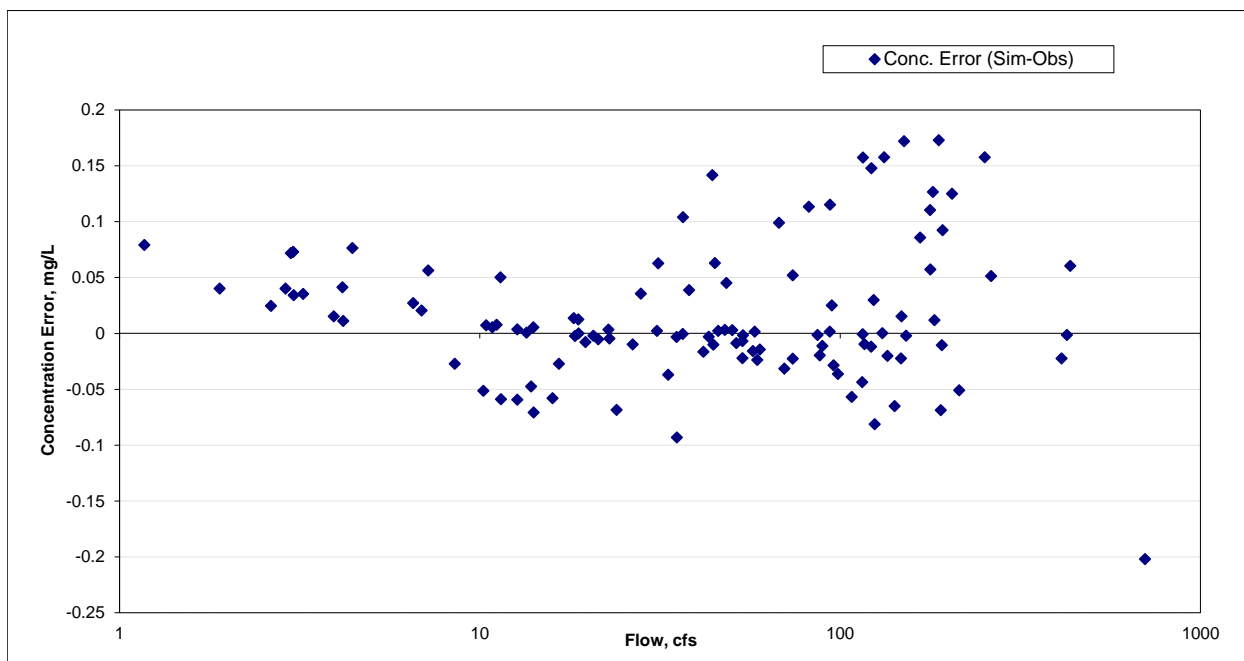


Figure 90. Residual (Simulated - Observed) vs. Flow Total Phosphorus (TP) at French River

## Sucker River near Palmers (HYDSTRA 02031001)

### Total Suspended Solids (TSS)

Table 19. Total Suspended Solids (TSS) statistics

Count	231
Concentration Average Error	-11.69%
Concentration Median Error	-2.83%
Load Average Error	-29.17%
Load Median Error	-0.13%
Paired t concentration	0.78
Paired t load	0.33

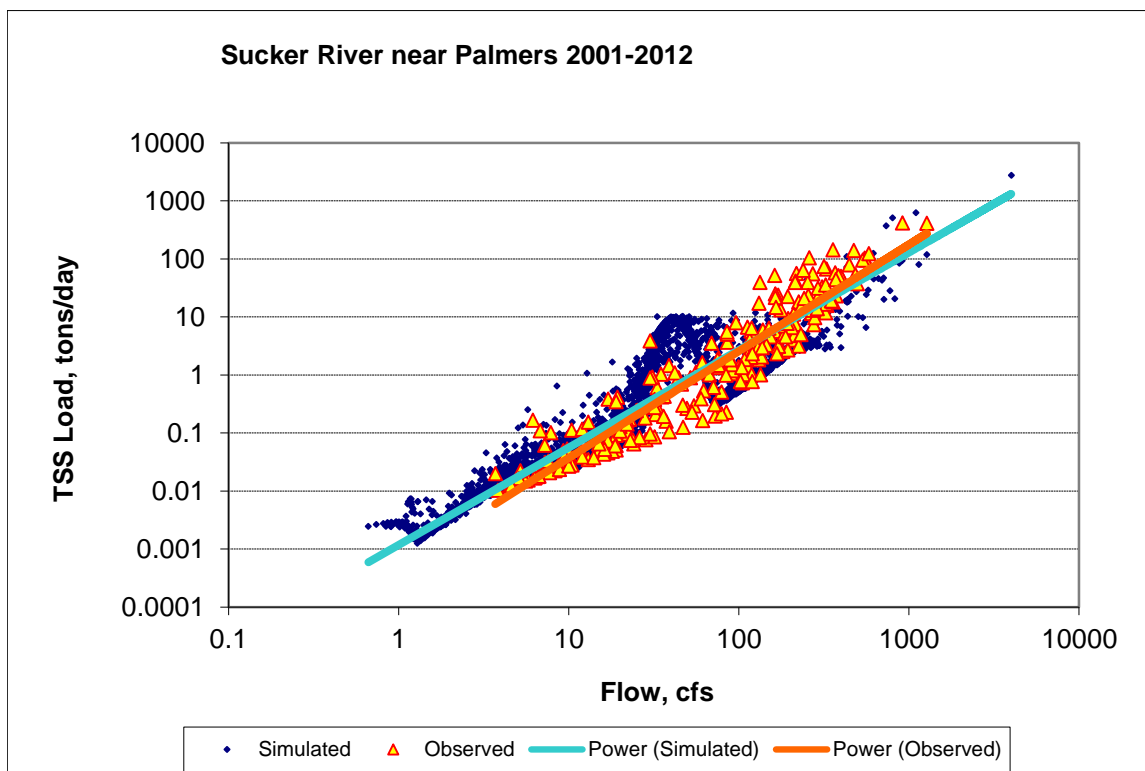
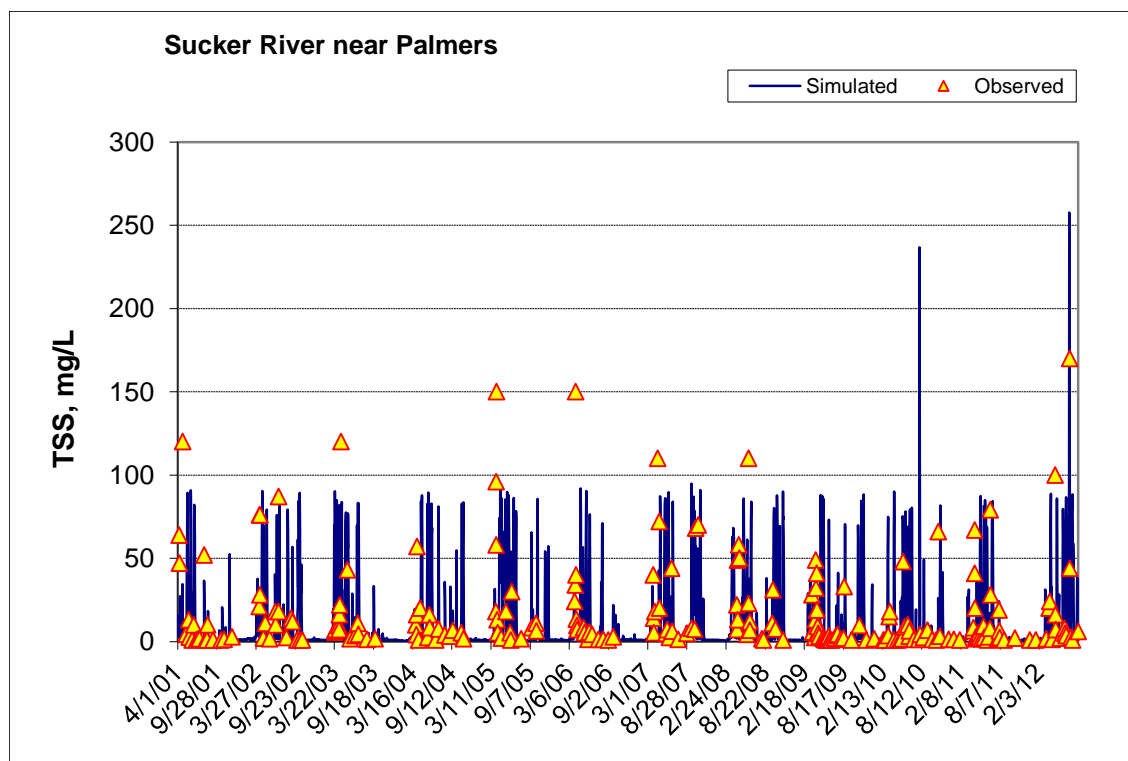
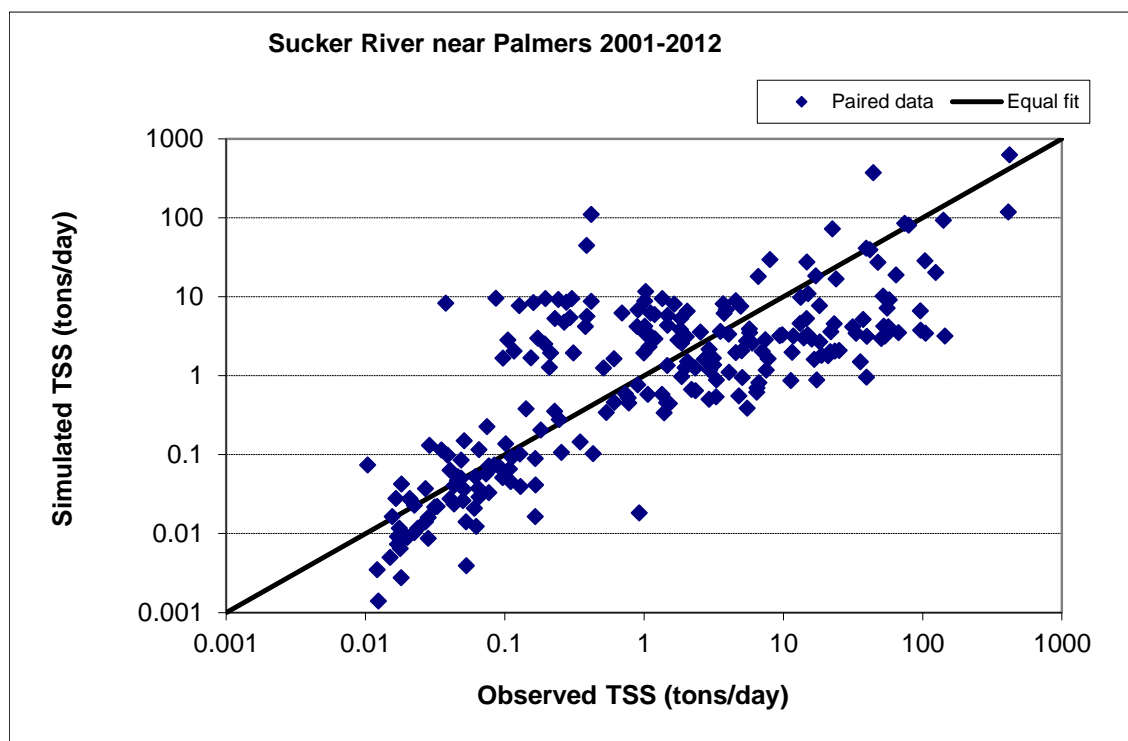


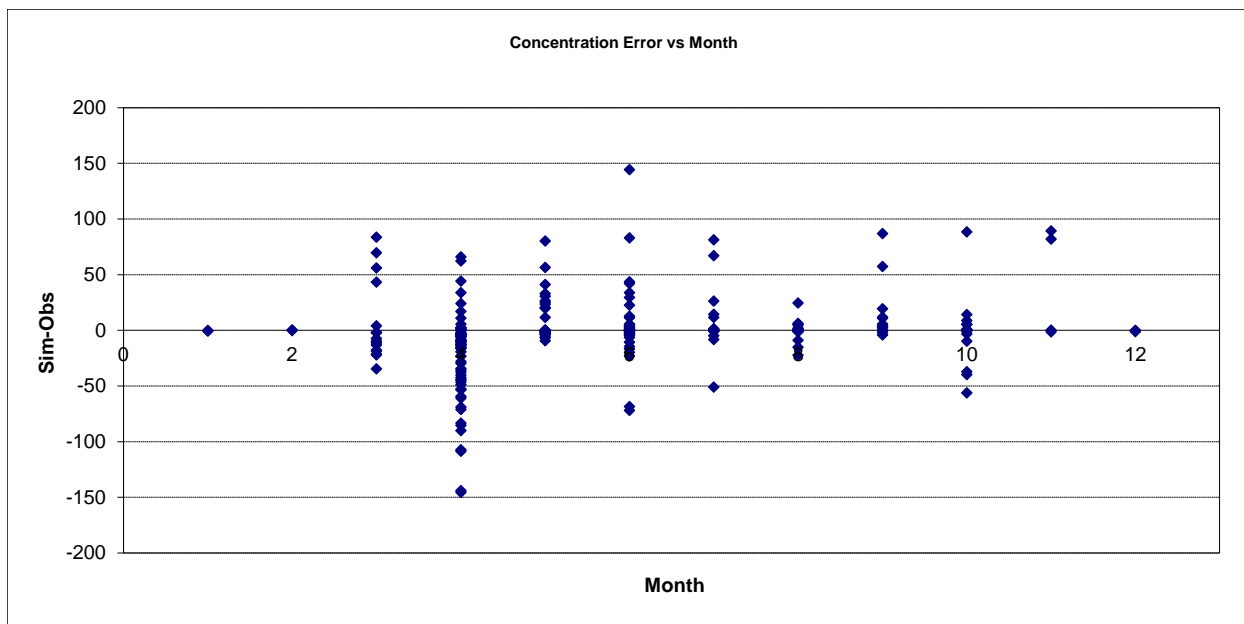
Figure 91. Power plot of simulated and observed Total Suspended Solids (TSS) load vs flow at Sucker River near Palmers



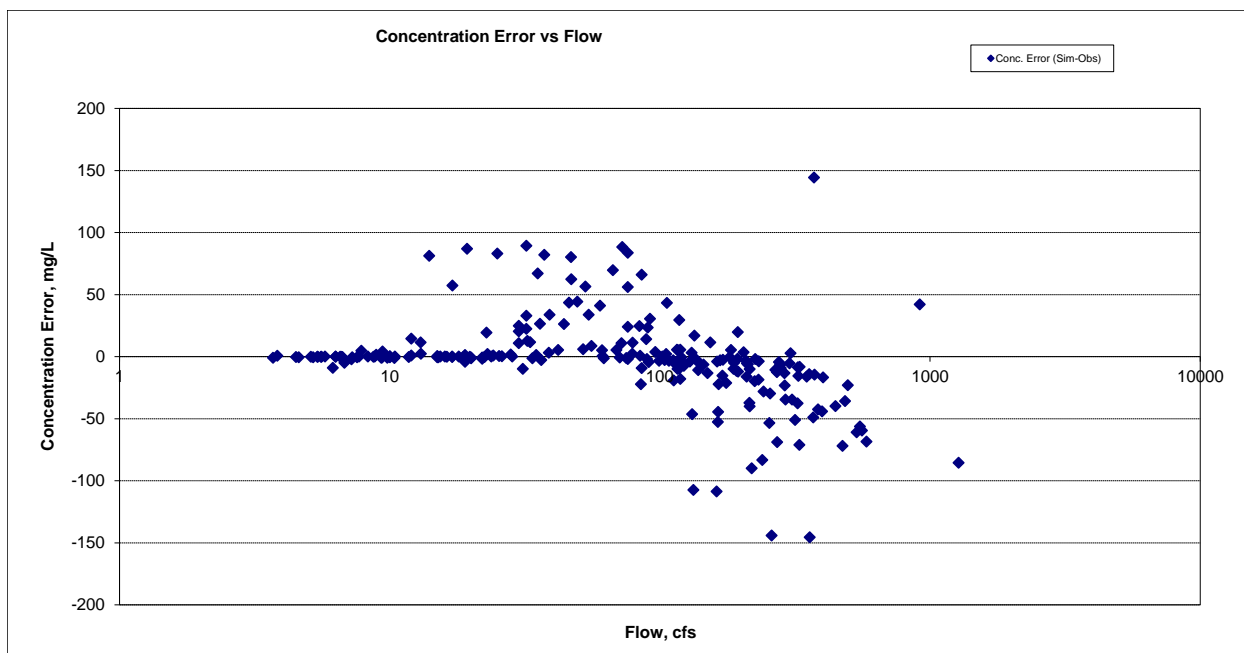
**Figure 92. Time series of observed and simulated Total Suspended Solids (TSS) concentration at Sucker River near Palmers**



**Figure 93. Paired simulated vs. observed Total Suspended Solids (TSS) load at Sucker River near Palmers**



**Figure 94. Residual (Simulated - Observed) vs. Month Total Suspended Solids (TSS) at Sucker River near Palmers**

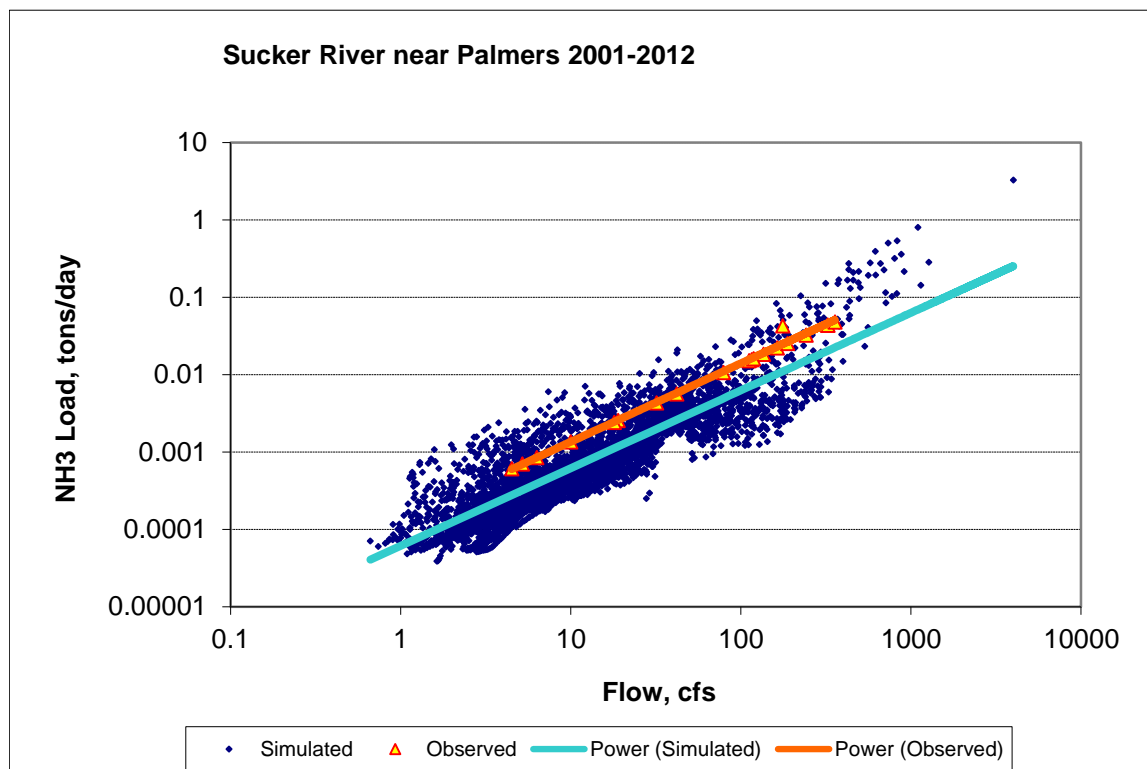


**Figure 95. Residual (Simulated - Observed) vs. Flow Total Suspended Solids (TSS) at Sucker River near Palmers**

## Ammonia Nitrogen (NH<sub>3</sub>)

**Table 20. Ammonia Nitrogen (NH<sub>3</sub>) statistics**

Count	20
Concentration Average Error	-57.50%
Concentration Median Error	-73.36%
Load Average Error	-69.26%
Load Median Error	-50.61%
Paired t concentration	0.00
Paired t load	0.00



**Figure 96. Power plot of simulated and observed Ammonia Nitrogen (NH<sub>3</sub>) load vs flow at Sucker River near Palmers**



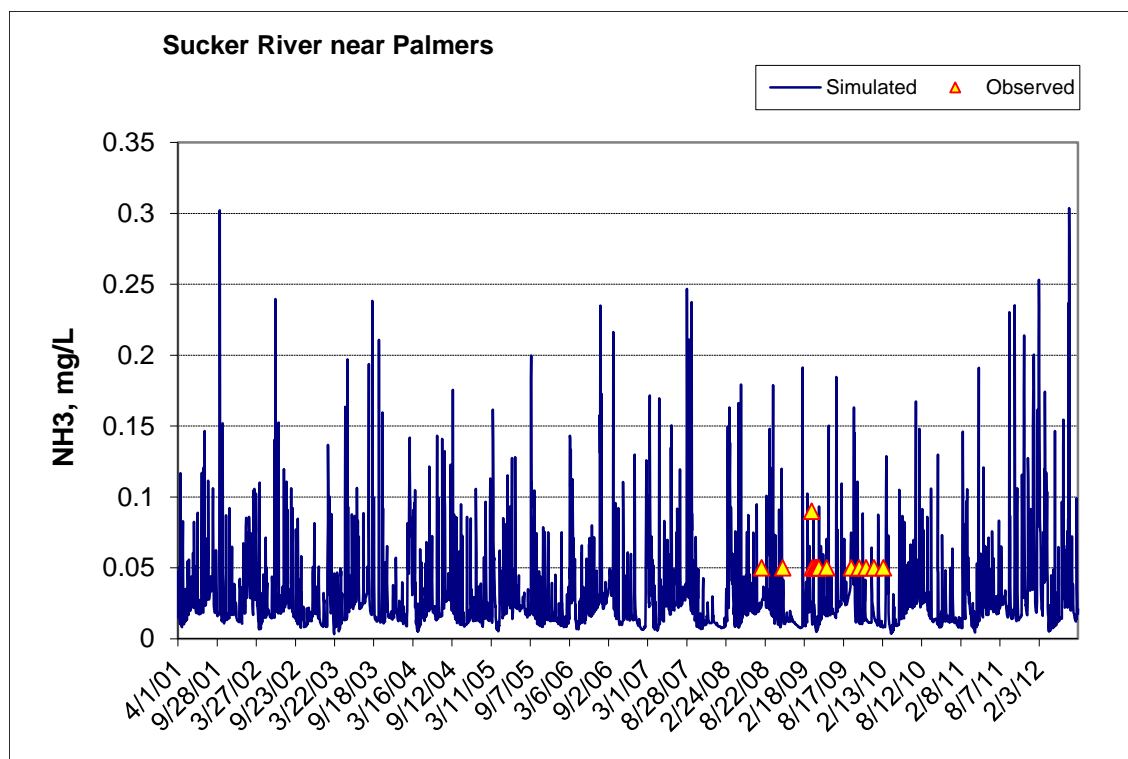


Figure 97. Time series of observed and simulated Ammonia Nitrogen (NH<sub>3</sub>) concentration at Sucker River near Palmers

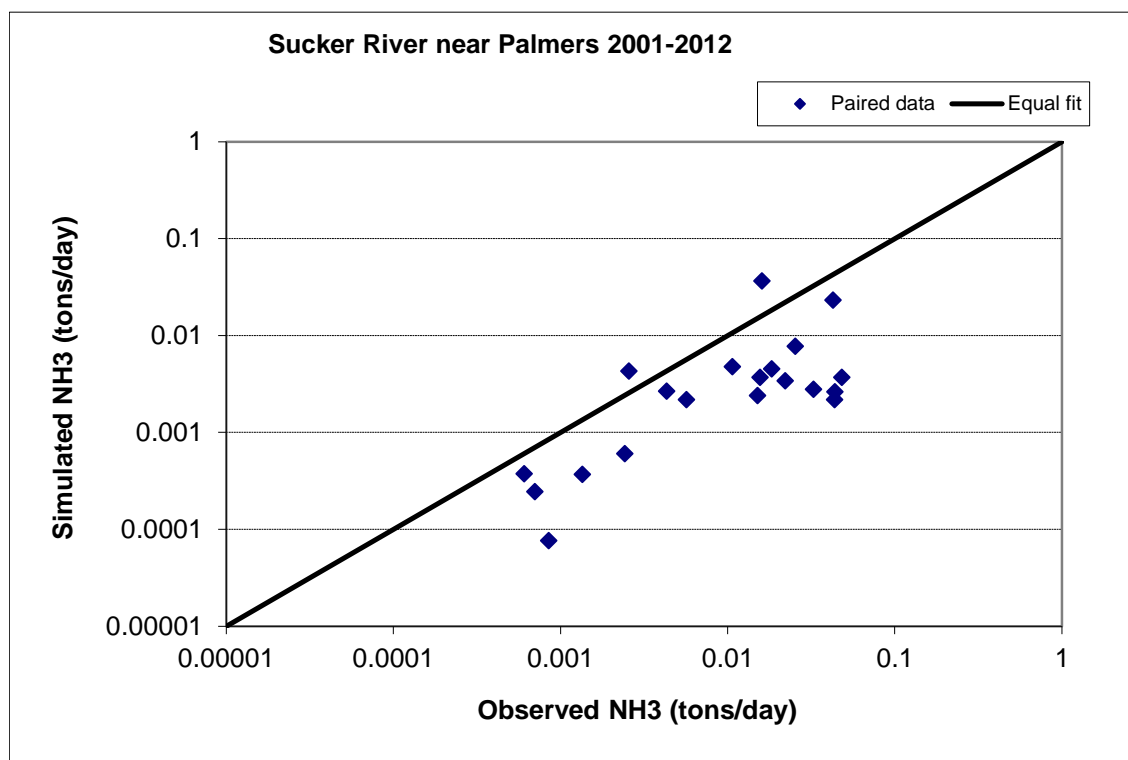
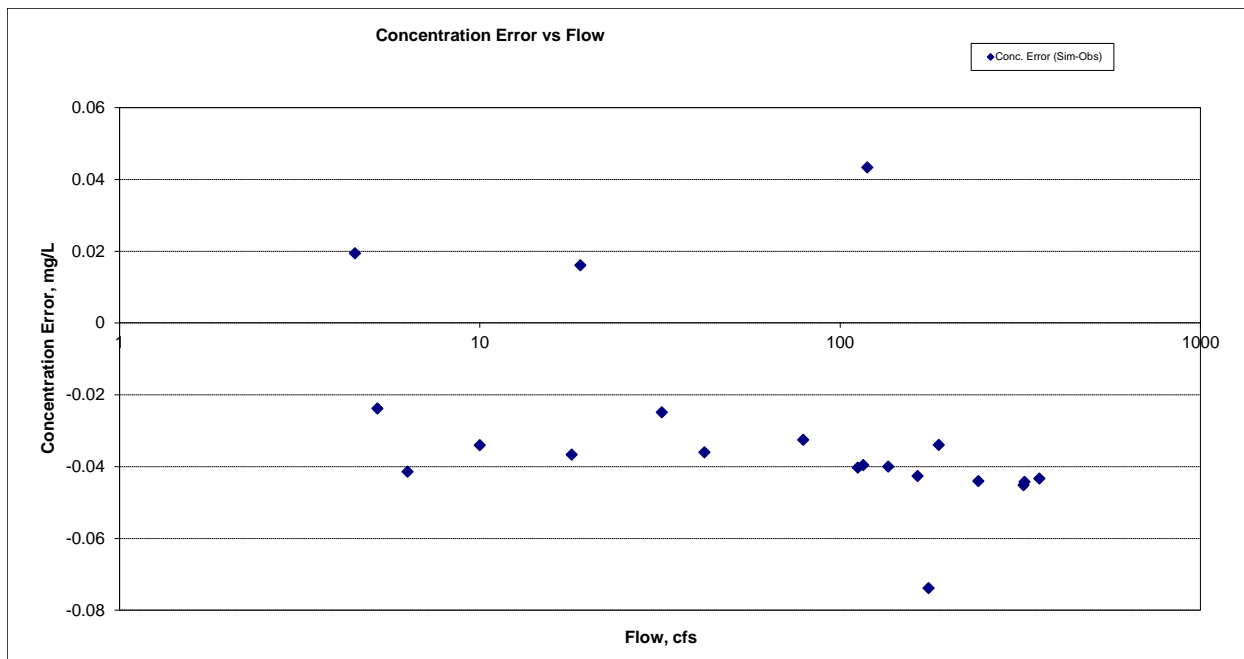


Figure 98. Paired simulated vs. observed Ammonia Nitrogen (NH<sub>3</sub>) load at Sucker River near Palmers



**Figure 99. Residual (Simulated - Observed) vs. Month Ammonia Nitrogen (NH3) at Sucker River near Palmers**



**Figure 100. Residual (Simulated - Observed) vs. Flow Ammonia Nitrogen (NH3) at Sucker River near Palmers**

## Organic Nitrogen (OrgN)

Table 21. Organic Nitrogen (OrgN) statistics

Count	20
Concentration Average Error	1.42%
Concentration Median Error	-14.39%
Load Average Error	25.62%
Load Median Error	-3.91%
Paired t concentration	0.94
Paired t load	0.43

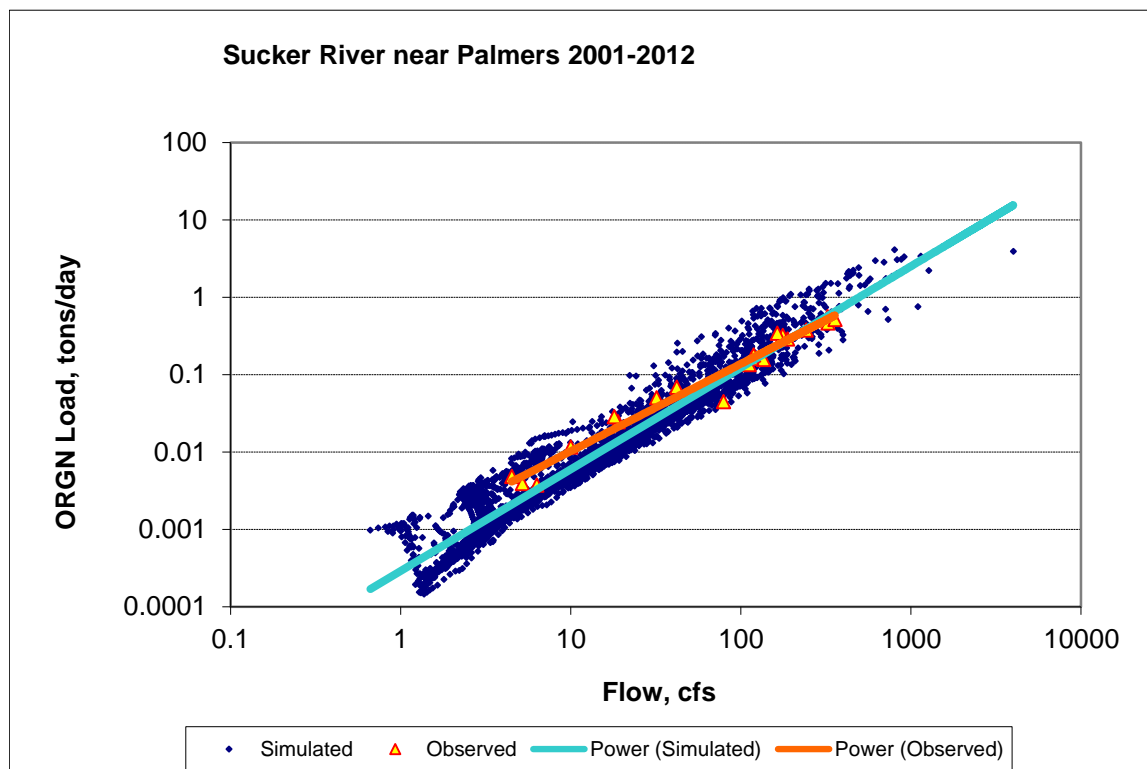


Figure 101. Power plot of simulated and observed Organic Nitrogen (OrgN) load vs flow at Sucker River near Palmers

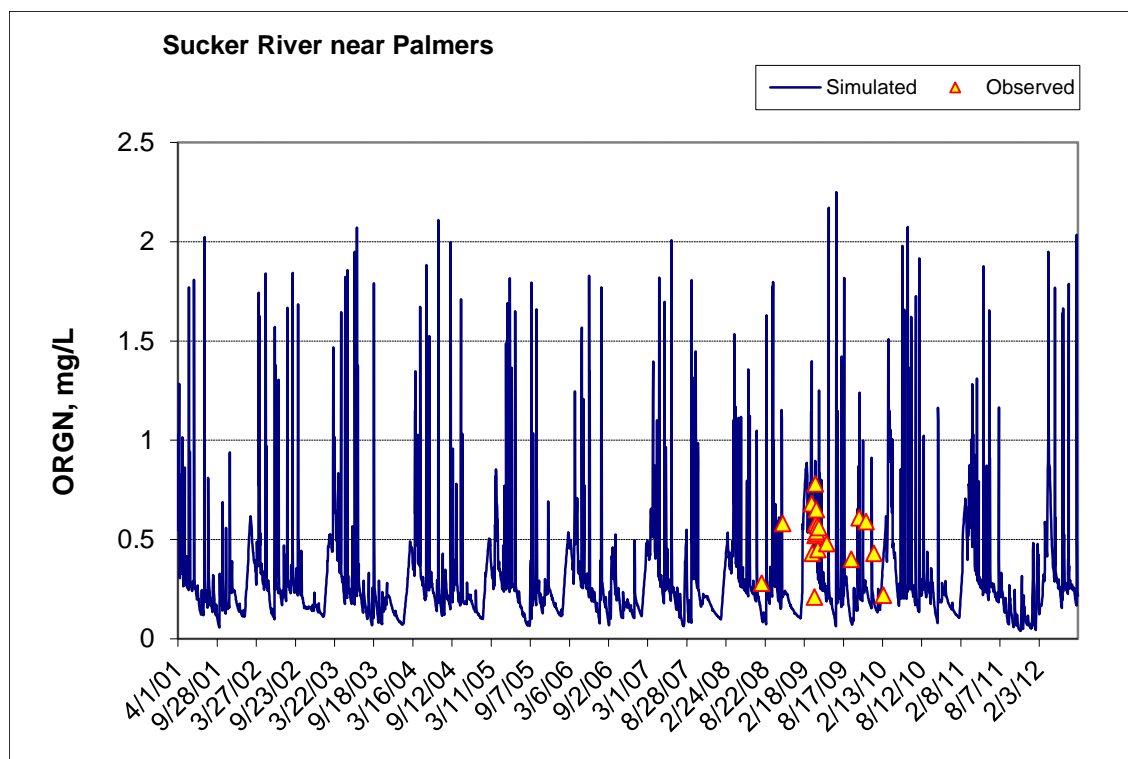


Figure 102. Time series of observed and simulated Organic Nitrogen (OrgN) concentration at Sucker River near Palmers

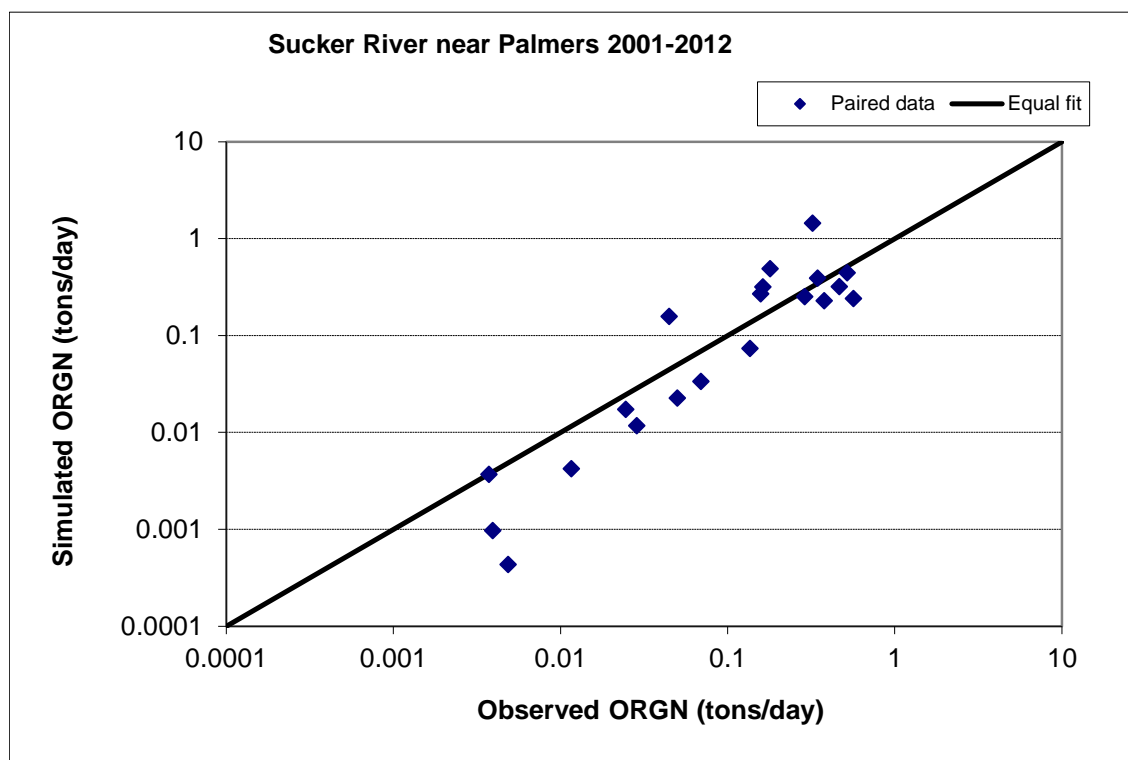
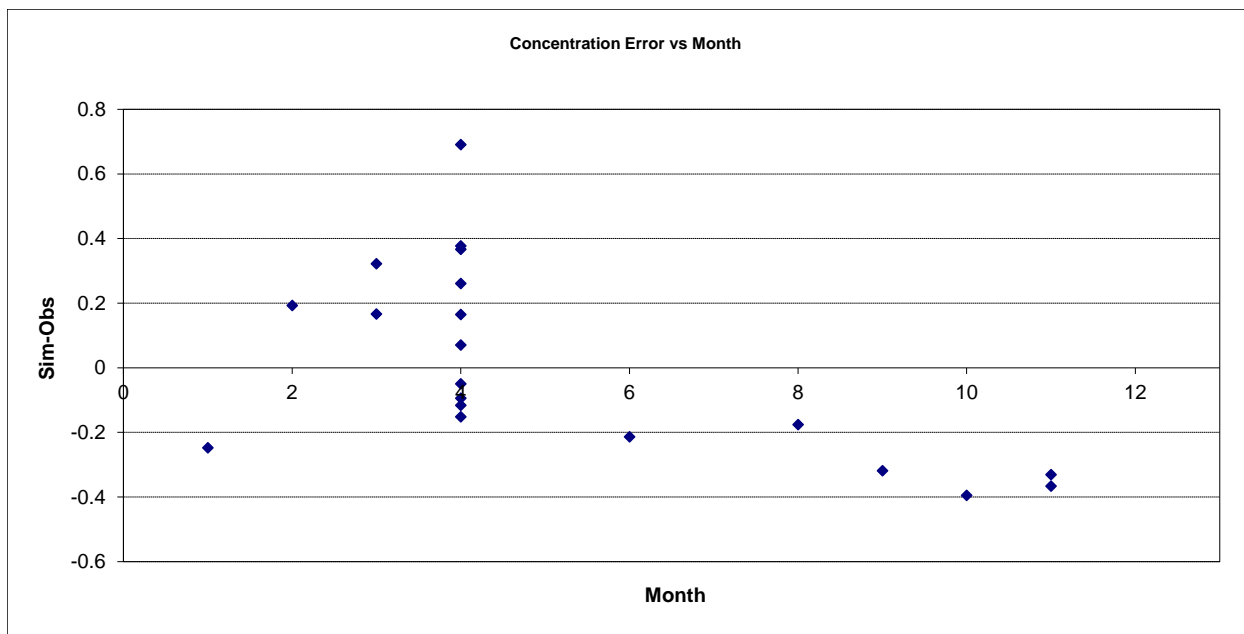
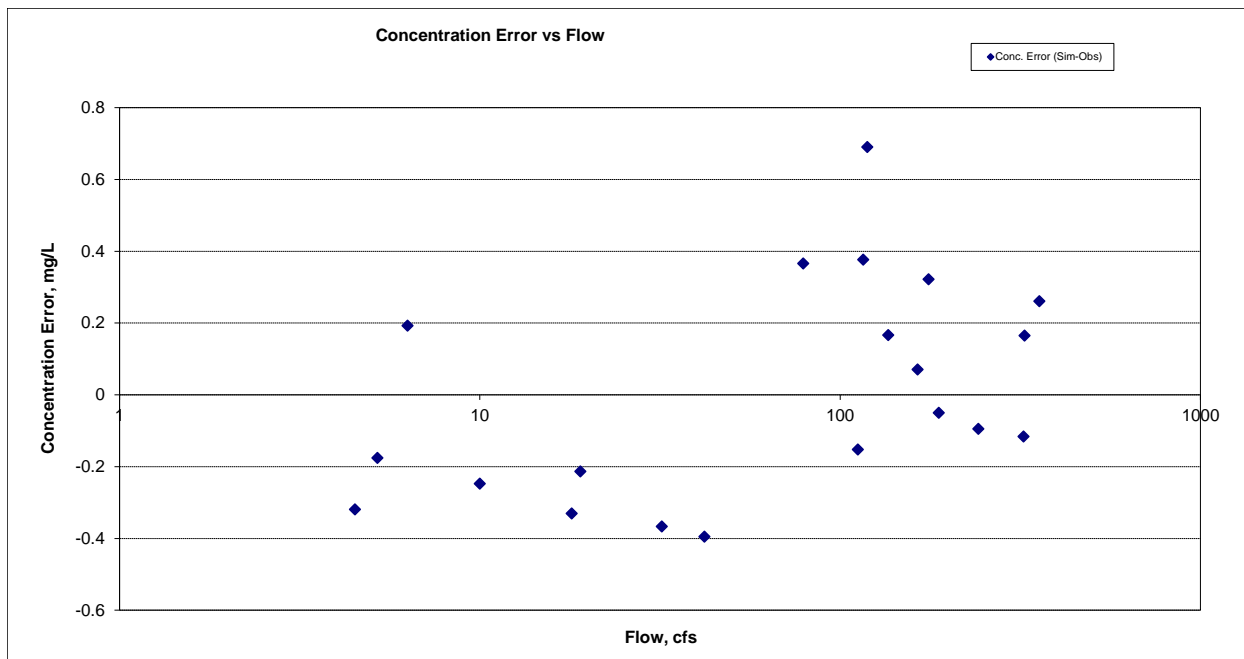


Figure 103. Paired simulated vs. observed Organic Nitrogen (OrgN) load at Sucker River near Palmers



**Figure 104. Residual (Simulated - Observed) vs. Month Organic Nitrogen (OrgN) at Sucker River near Palmers**



**Figure 105. Residual (Simulated - Observed) vs. Flow Organic Nitrogen (OrgN) at Sucker River near Palmers**

## Total Kjeldahl Nitrogen (TKN)

Table 22. Total Kjeldahl Nitrogen (TKN) statistics

Count	175
Concentration Average Error	-16.68%
Concentration Median Error	-34.49%
Load Average Error	12.00%
Load Median Error	-5.08%
Paired t concentration	0.77
Paired t load	0.71

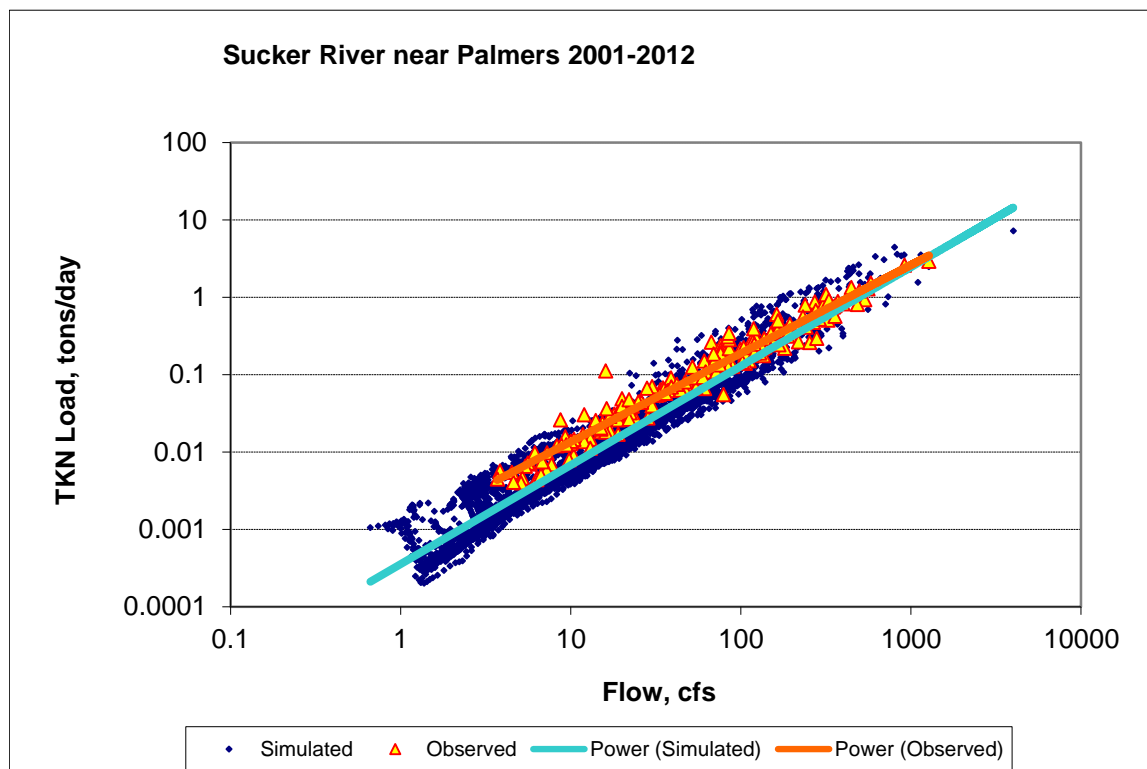


Figure 106. Power plot of simulated and observed Total Kjeldahl Nitrogen (TKN) load vs flow at Sucker River near Palmers

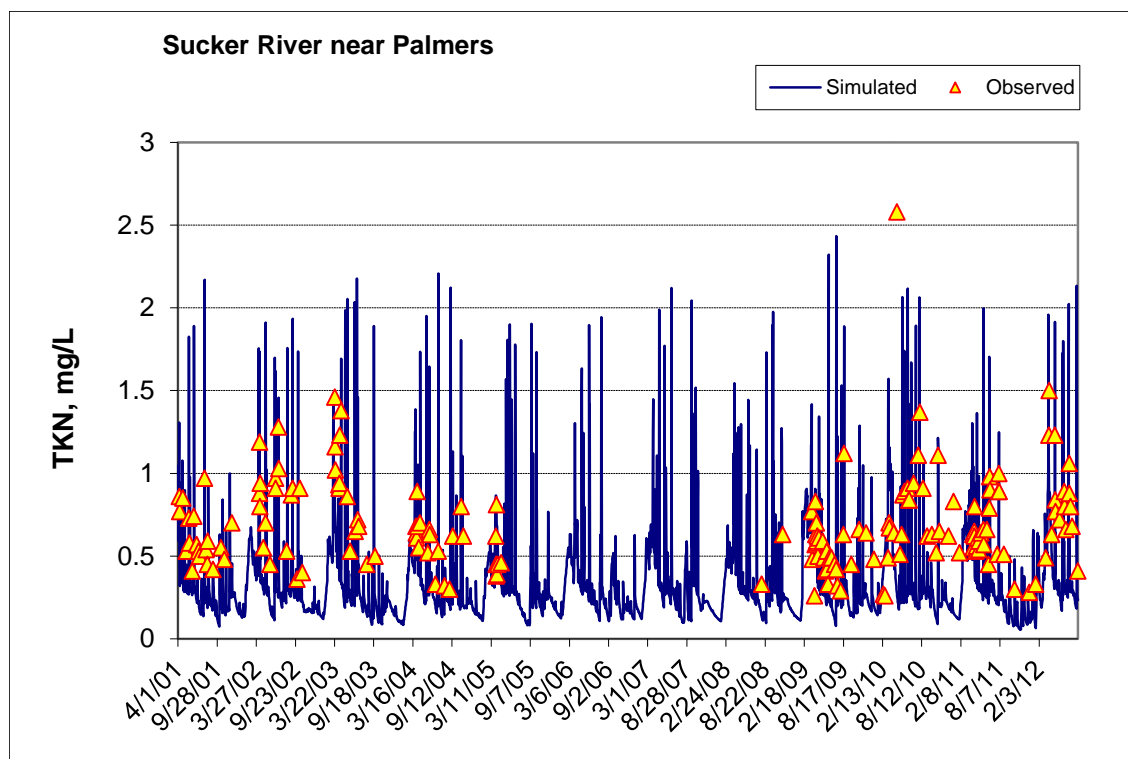


Figure 107. Time series of observed and simulated Total Kjeldahl Nitrogen (TKN) concentration at Sucker River near Palmers

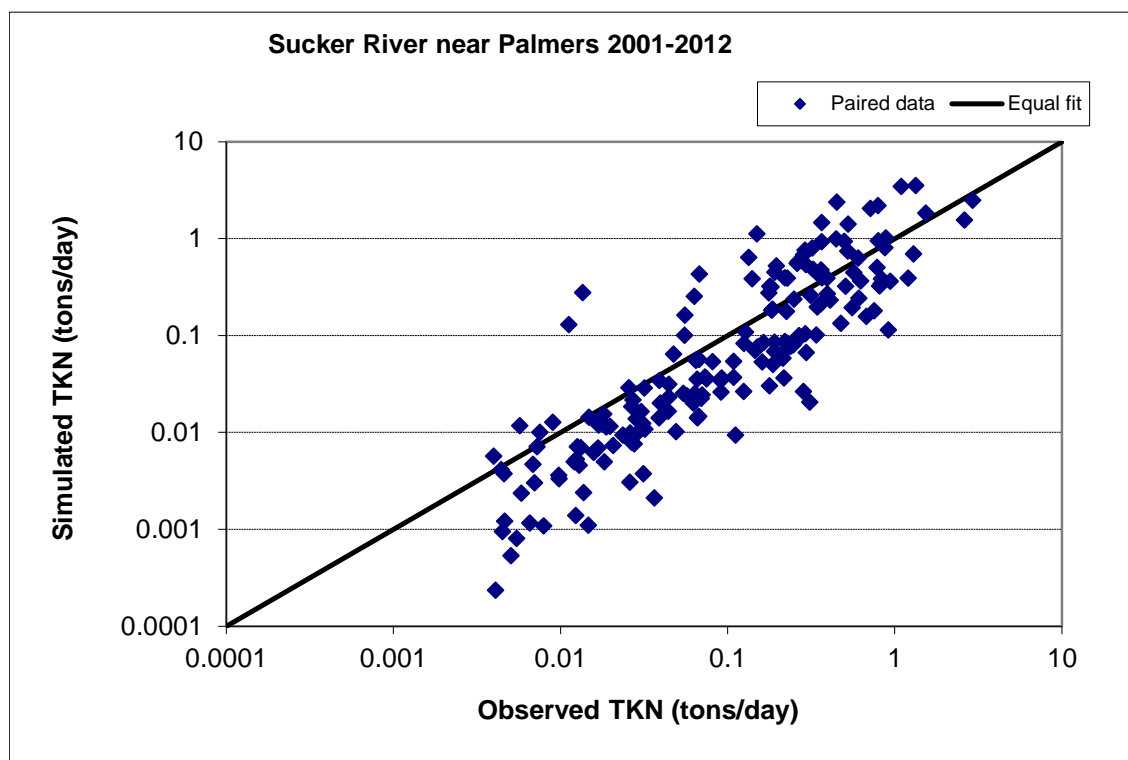
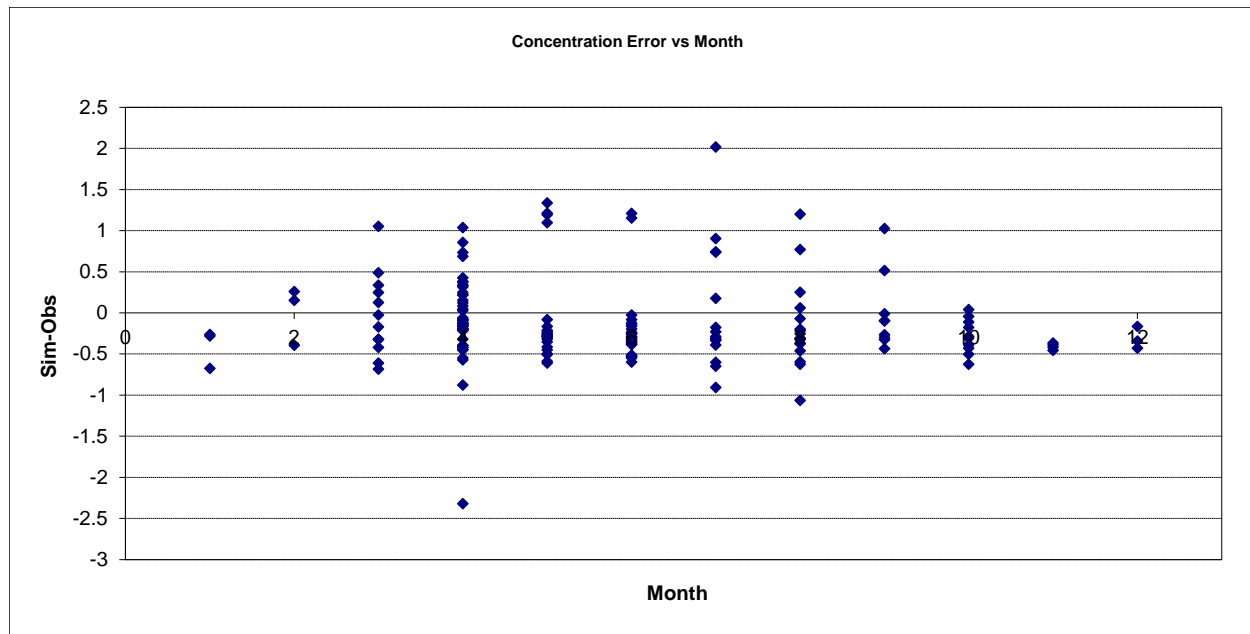
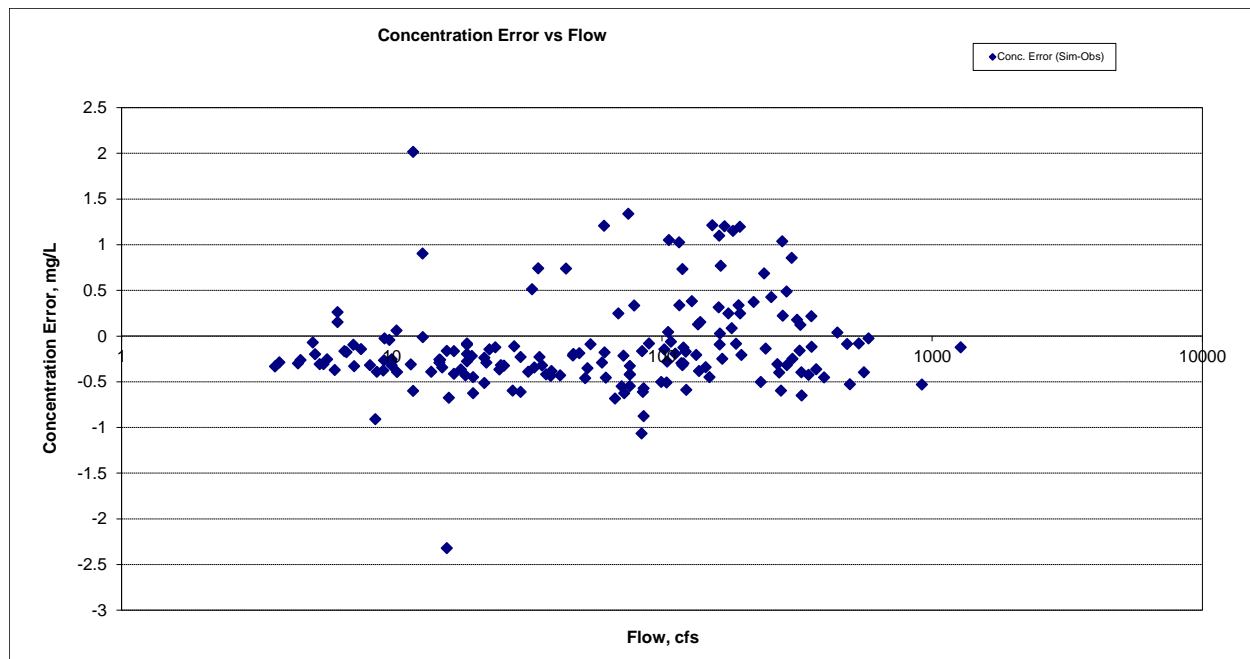


Figure 108. Paired simulated vs. observed Total Kjeldahl Nitrogen (TKN) load at Sucker River near Palmers



**Figure 109. Residual (Simulated - Observed) vs. Month Total Kjeldahl Nitrogen (TKN) at Sucker River near Palmers**



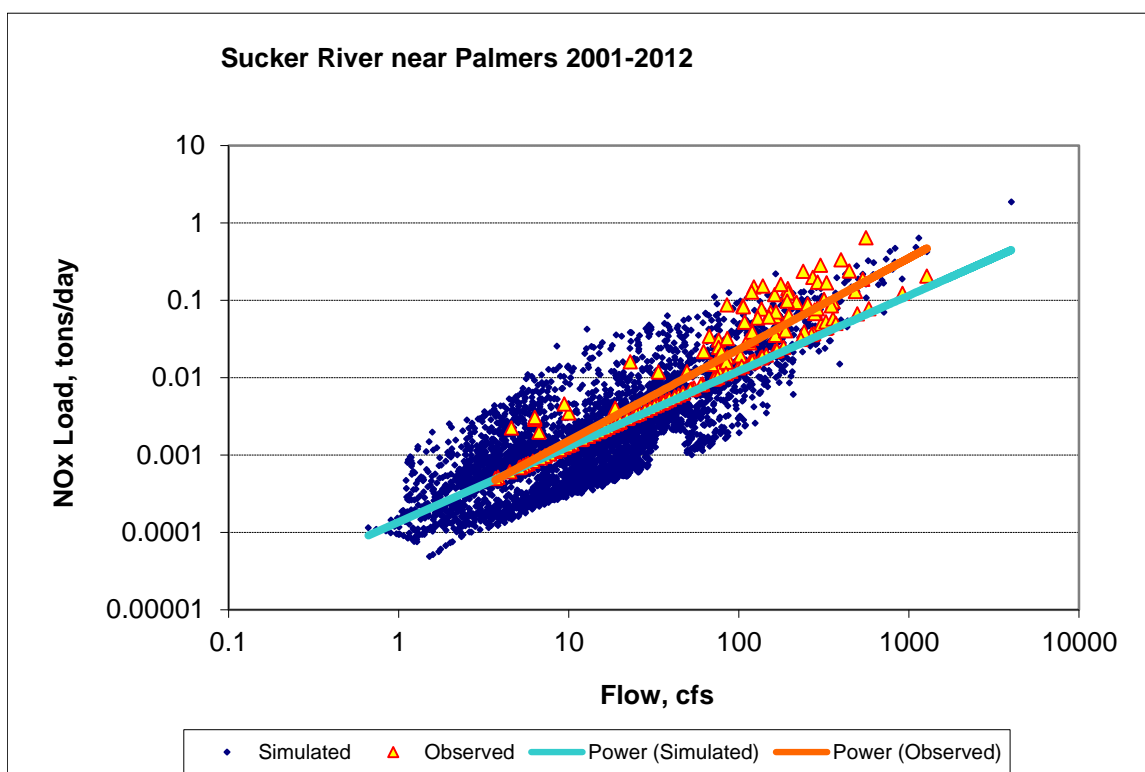
**Figure 110. Residual (Simulated - Observed) vs. Flow Total Kjeldahl Nitrogen (TKN) at Sucker River near Palmers**



## Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>)

**Table 23. Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) statistics**

Count	175
Concentration Average Error	-29.71%
Concentration Median Error	-26.18%
Load Average Error	-15.88%
Load Median Error	-4.81%
Paired t concentration	0.04
Paired t load	0.61



**Figure 111. Power plot of simulated and observed Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) load vs flow at Sucker River near Palmers**

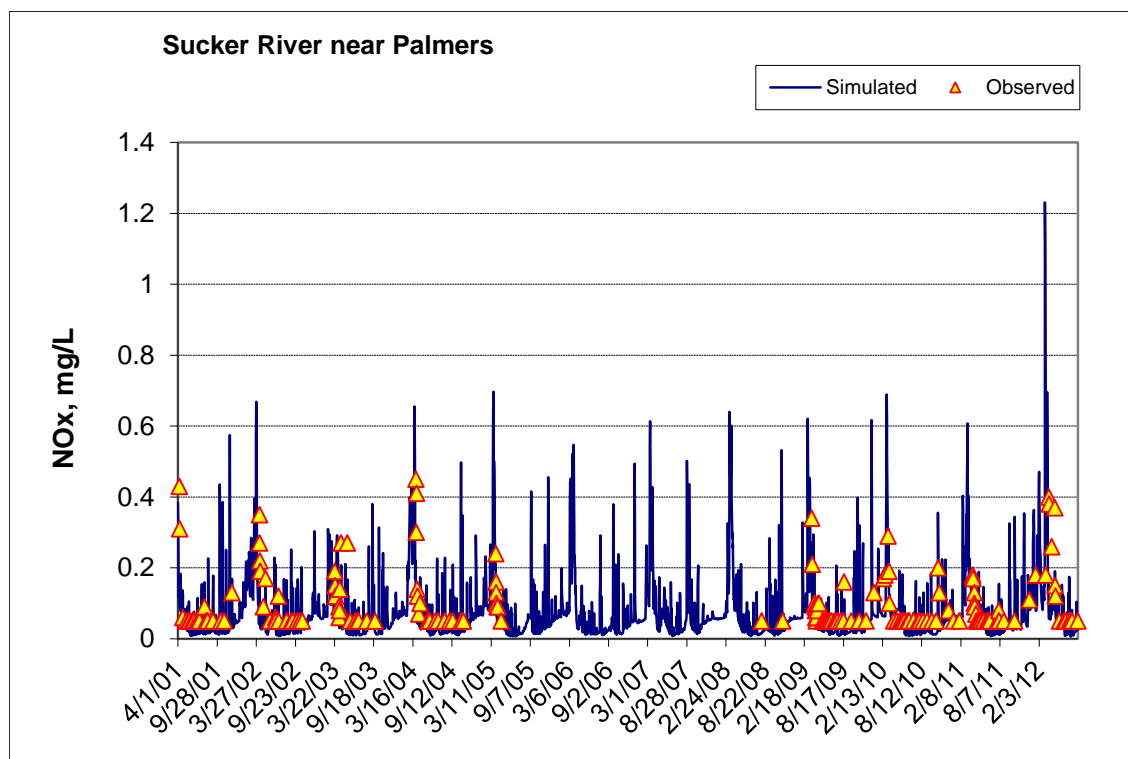


Figure 112. Time series of observed and simulated Nitrite+ Nitrate Nitrogen (NOx) concentration at Sucker River near Palmers

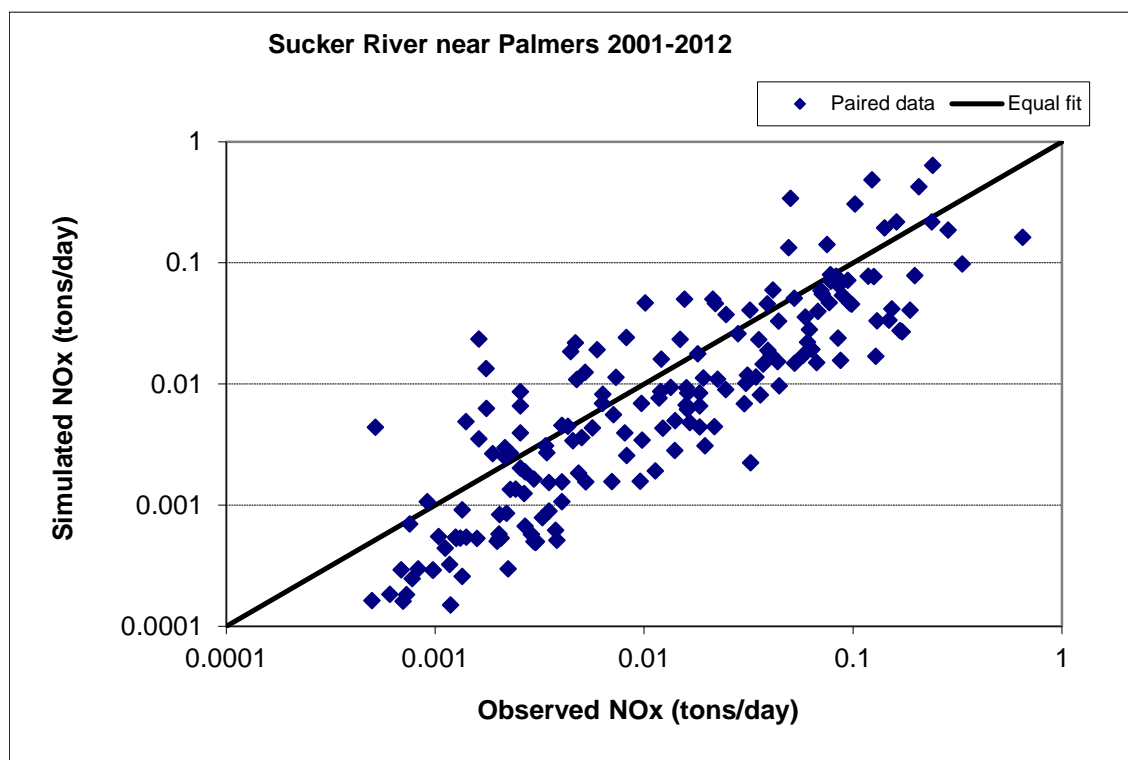
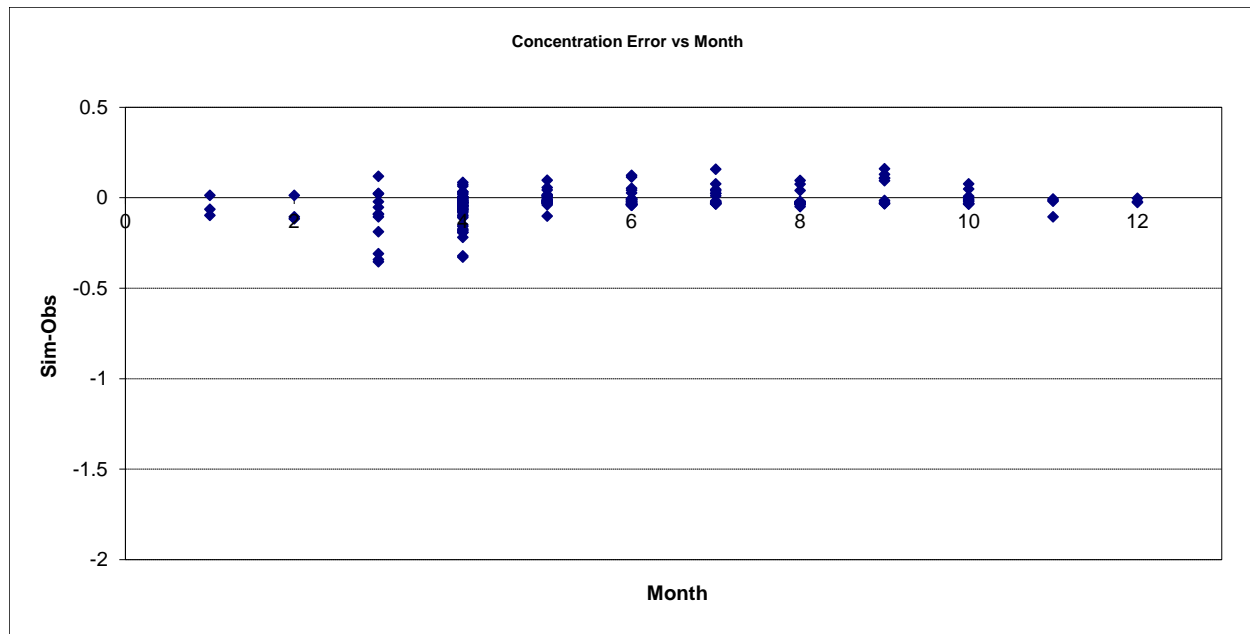
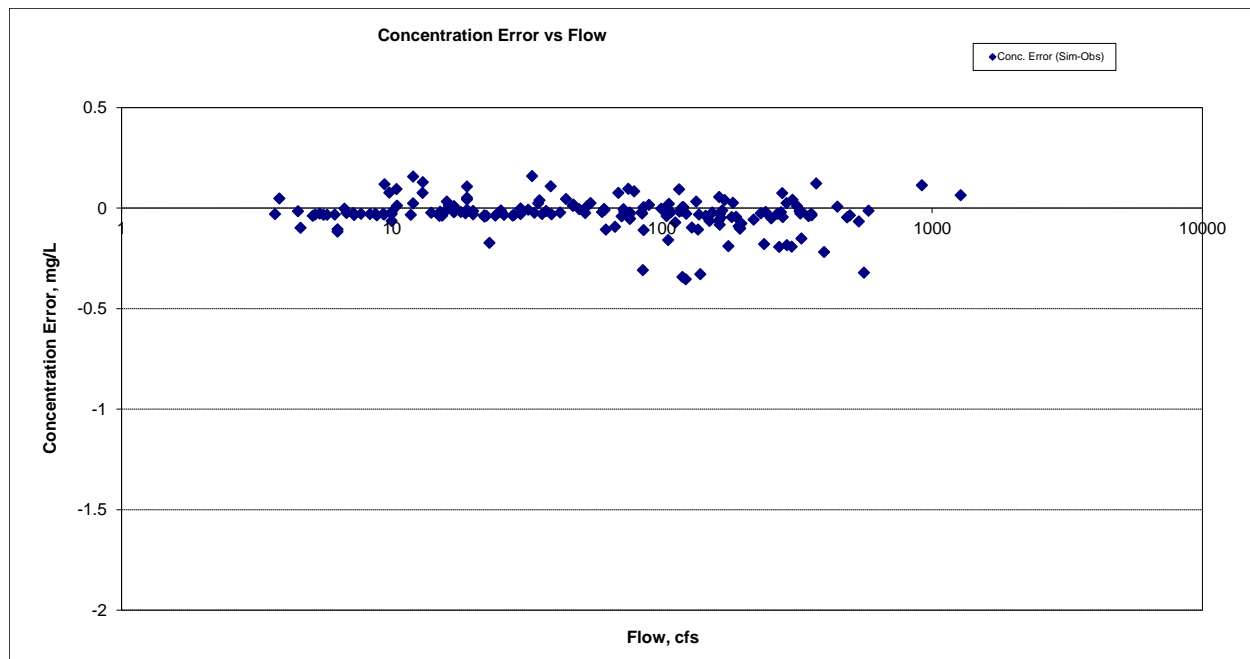


Figure 113. Paired simulated vs. observed Nitrite+ Nitrate Nitrogen (NOx) load at Sucker River near Palmers



**Figure 114. Residual (Simulated - Observed) vs. Month Nitrite+ Nitrate Nitrogen (NOx) at Sucker River near Palmers**

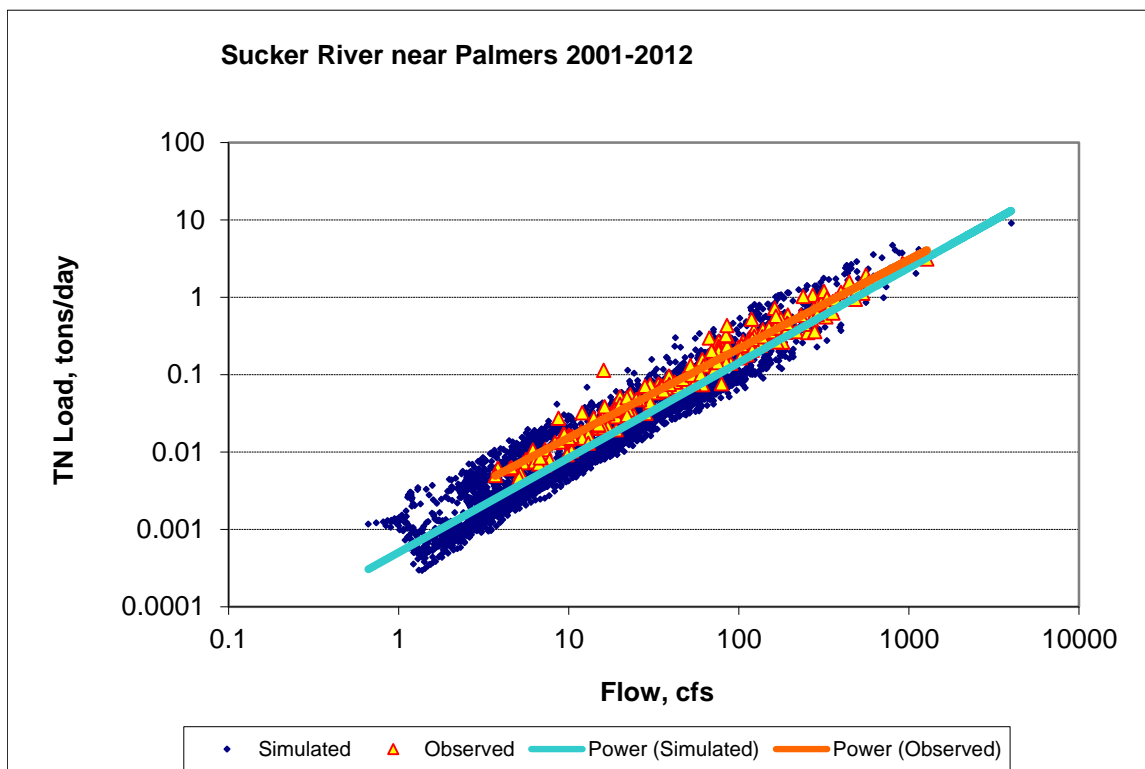


**Figure 115. Residual (Simulated - Observed) vs. Flow Nitrite+ Nitrate Nitrogen (NOx) at Sucker River near Palmers**

## Total Nitrogen (TN)

**Table 24. Total Nitrogen (TN) statistics**

Count	175
Concentration Average Error	-18.31%
Concentration Median Error	-33.29%
Load Average Error	8.23%
Load Median Error	-4.82%
Paired t concentration	0.65
Paired t load	0.80



**Figure 116. Power plot of simulated and observed Total Nitrogen (TN) load vs flow at Sucker River near Palmers**

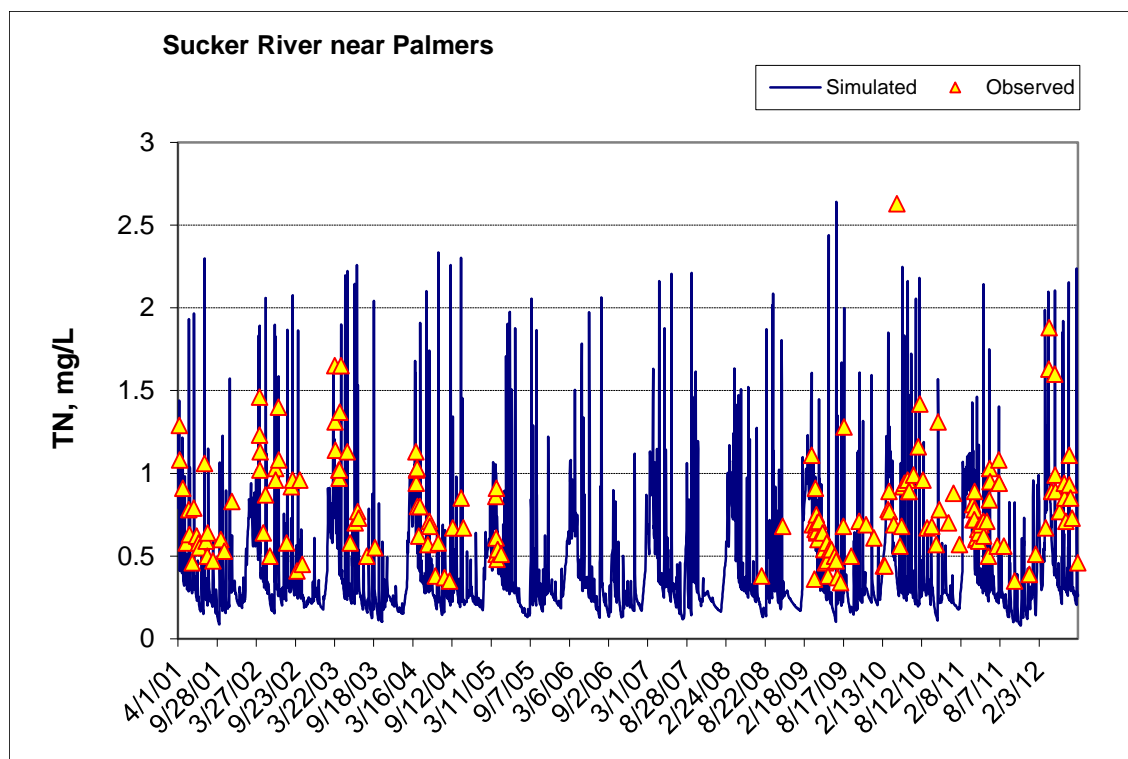


Figure 117. Time series of observed and simulated Total Nitrogen (TN) concentration at Sucker River near Palmers

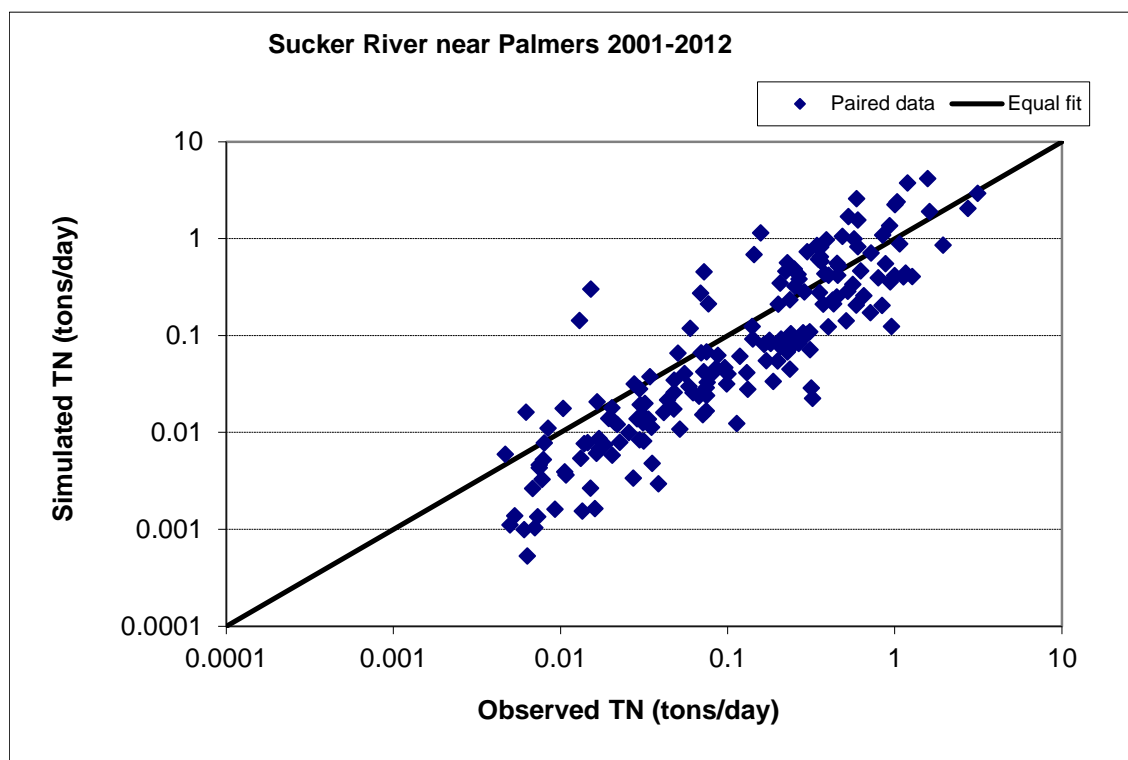
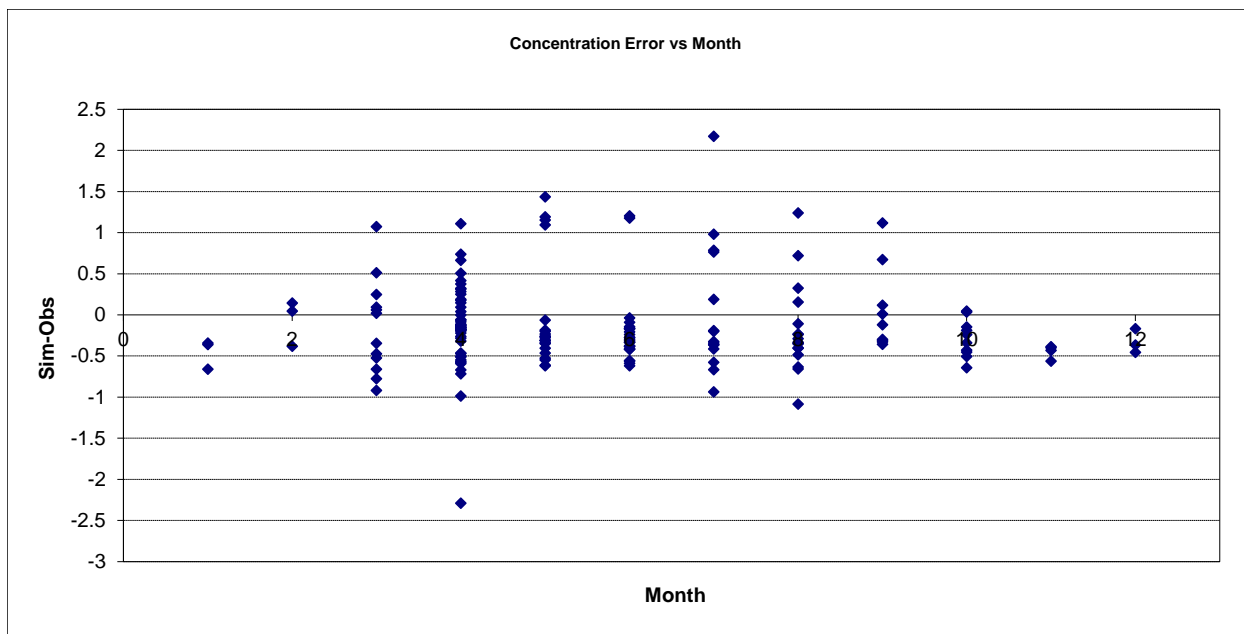
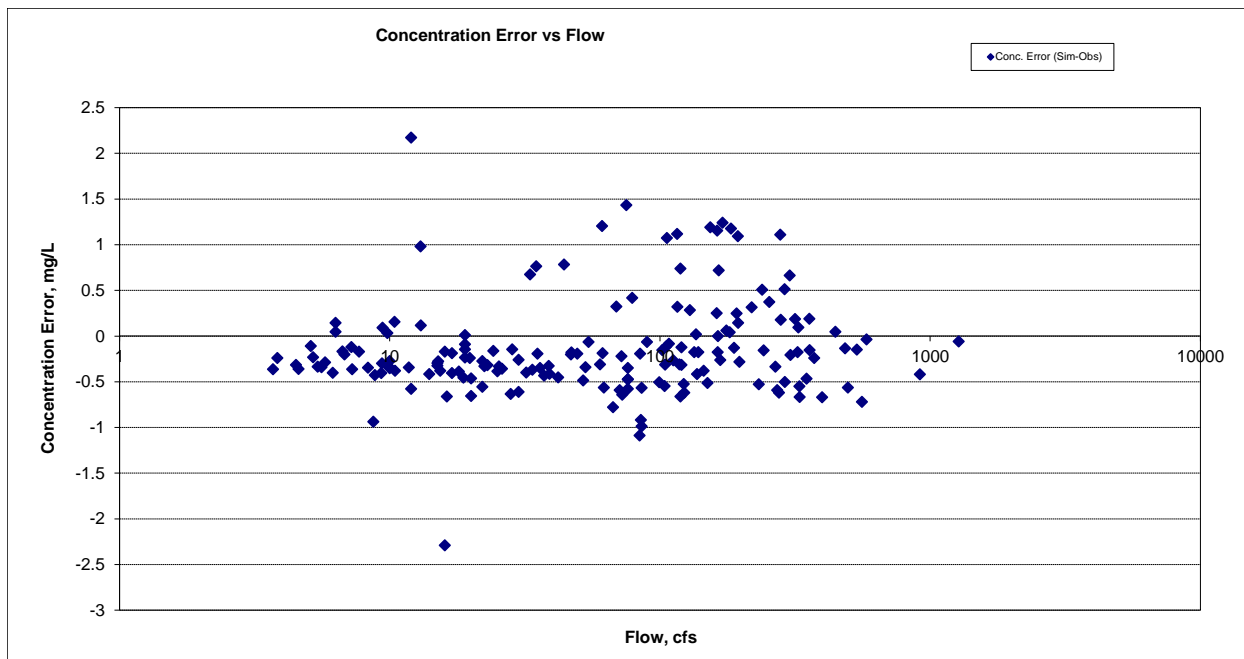


Figure 118. Paired simulated vs. observed Total Nitrogen (TN) load at Sucker River near Palmers



**Figure 119. Residual (Simulated - Observed) vs. Month Total Nitrogen (TN) at Sucker River near Palmers**



**Figure 120. Residual (Simulated - Observed) vs. Flow Total Nitrogen (TN) at Sucker River near Palmers**

## Soluble Reactive Phosphorus (SRP)

Table 25. Soluble Reactive Phosphorus (SRP) statistics

Count	168
Concentration Average Error	-5.32%
Concentration Median Error	-18.81%
Load Average Error	-35.09%
Load Median Error	-2.09%
Paired t concentration	0.98
Paired t load	0.22

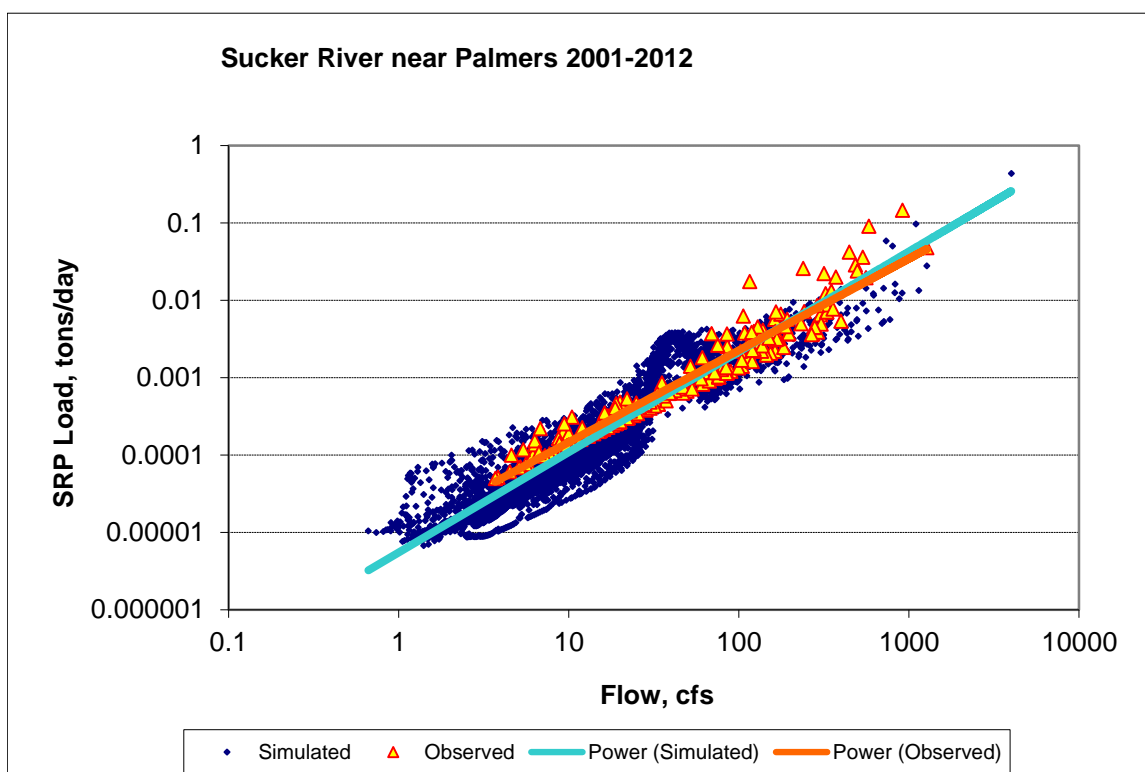


Figure 121. Power plot of simulated and observed Soluble Reactive Phosphorus (SRP) load vs flow at Sucker River near Palmers

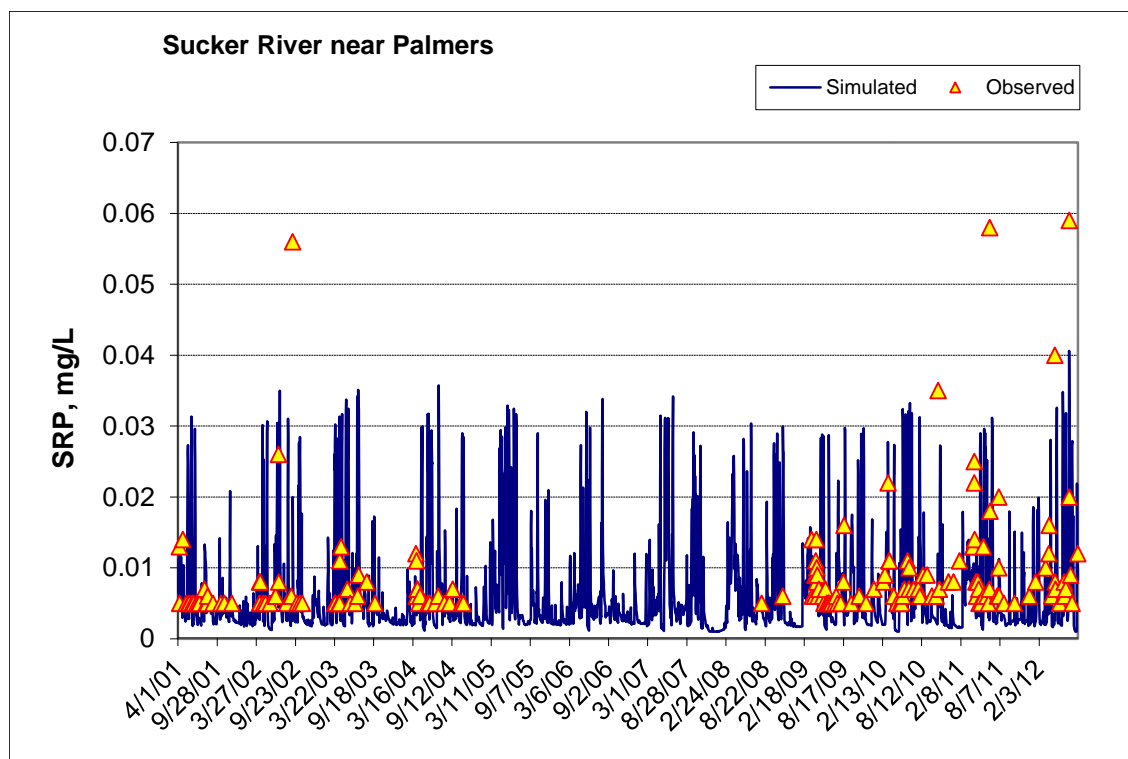


Figure 122. Time series of observed and simulated Soluble Reactive Phosphorus (SRP) concentration at Sucker River near Palmers

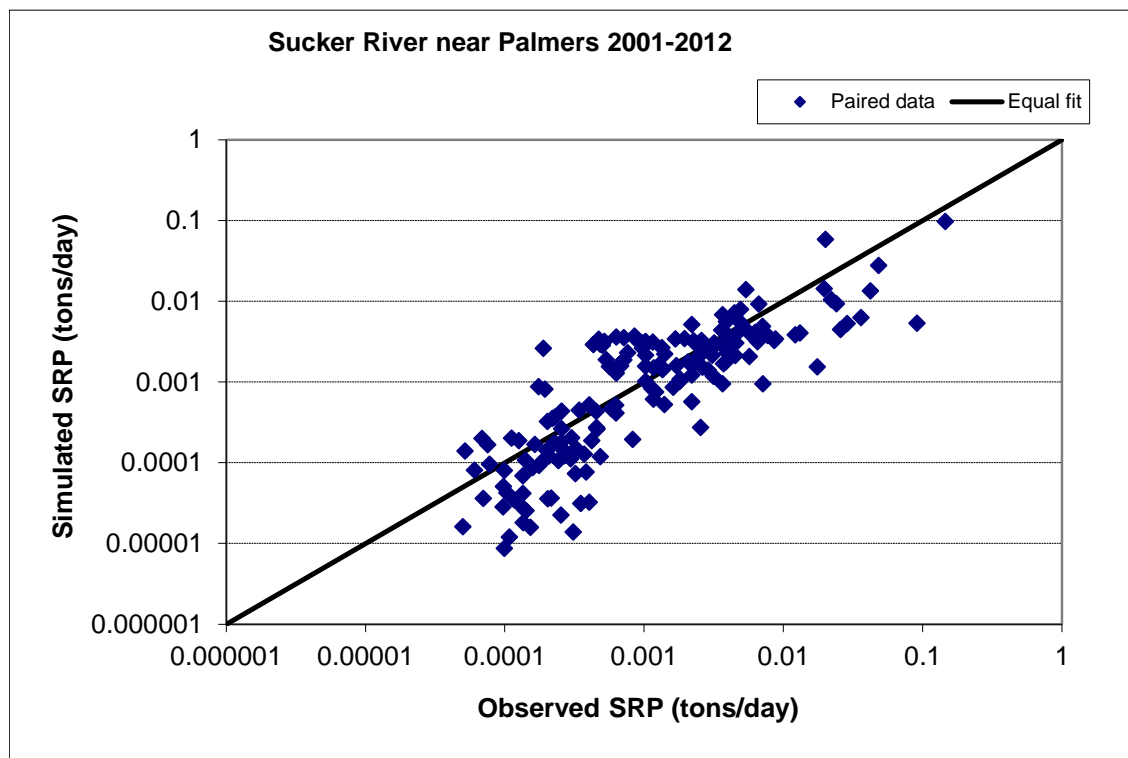
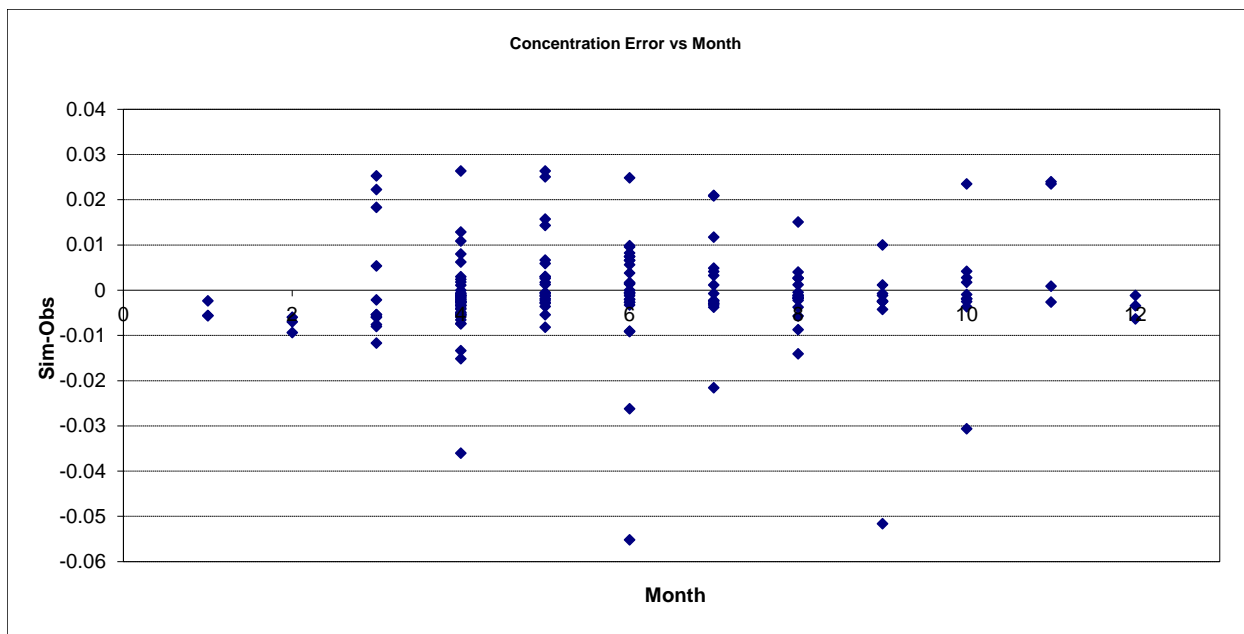
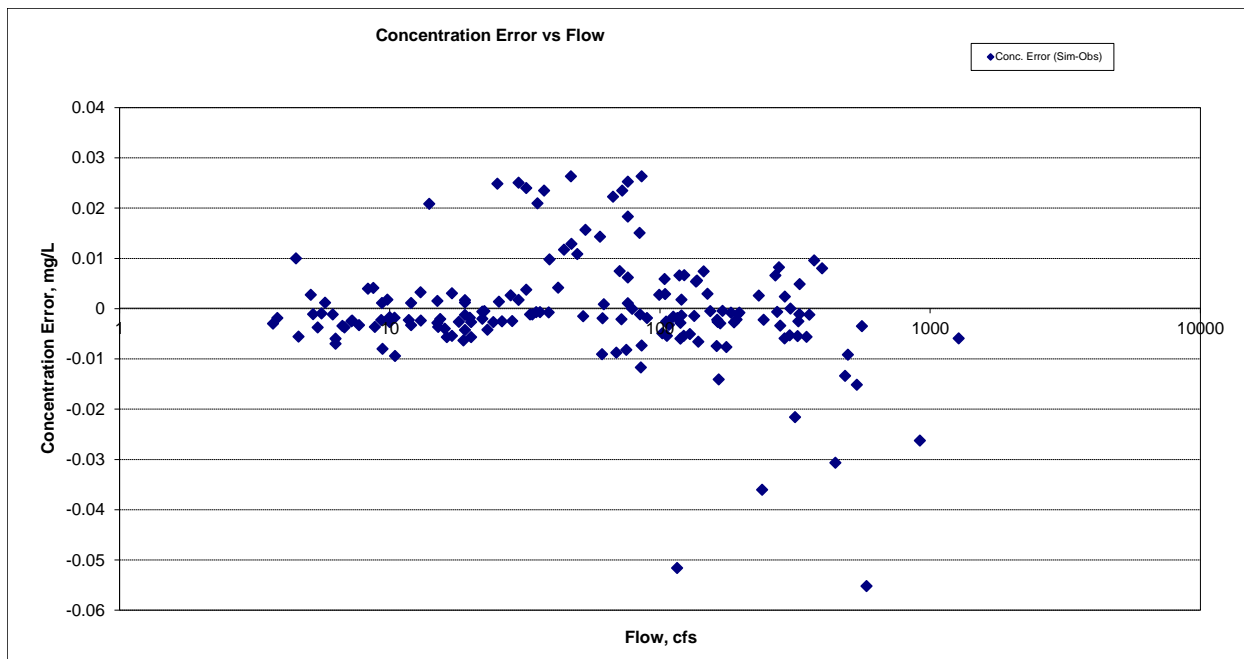


Figure 123. Paired simulated vs. observed Soluble Reactive Phosphorus (SRP) load at Sucker River near Palmers





**Figure 124. Residual (Simulated - Observed) vs. Month Soluble Reactive Phosphorus (SRP) at Sucker River near Palmers**



**Figure 125. Residual (Simulated - Observed) vs. Flow Soluble Reactive Phosphorus (SRP) at Sucker River near Palmers**

## Organic Phosphorus (OrgP)

Table 26. Organic Phosphorus (OrgP) statistics

Count	166
Concentration Average Error	11.37%
Concentration Median Error	-12.68%
Load Average Error	10.69%
Load Median Error	-1.26%
Paired t concentration	0.78
Paired t load	0.67

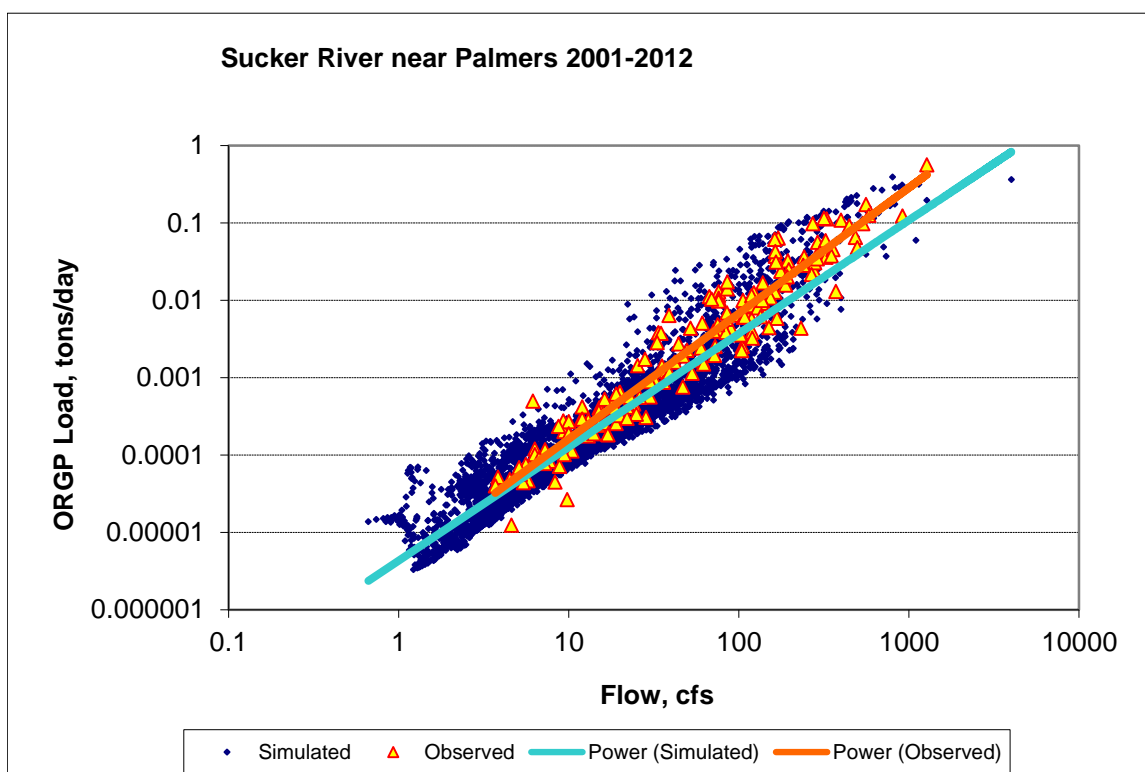


Figure 126. Power plot of simulated and observed Organic Phosphorus (OrgP) load vs flow at Sucker River near Palmers

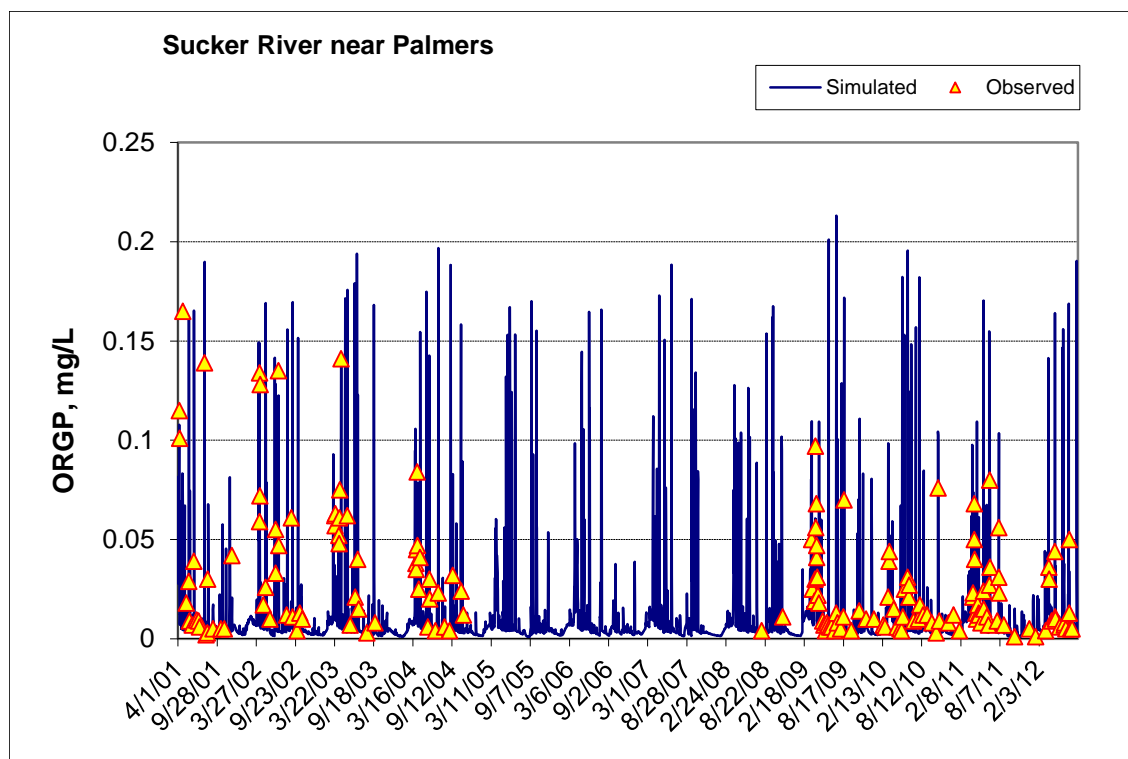


Figure 127. Time series of observed and simulated Organic Phosphorus (OrgP) concentration at Sucker River near Palmers

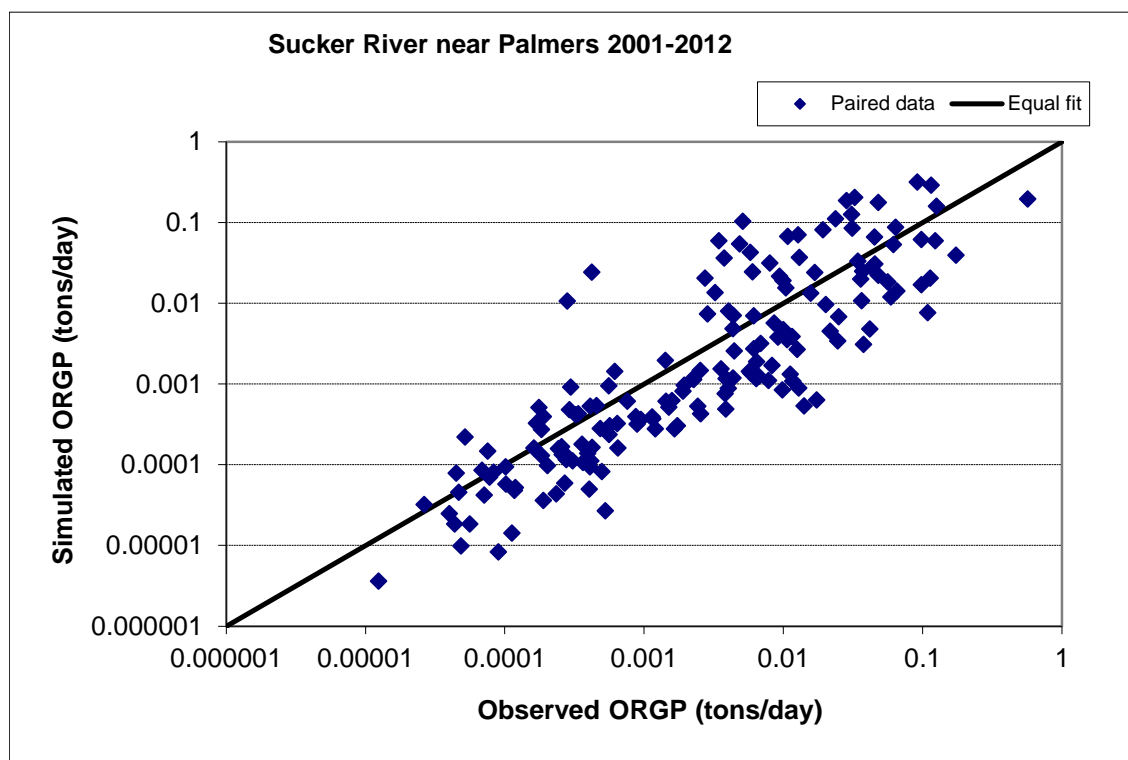
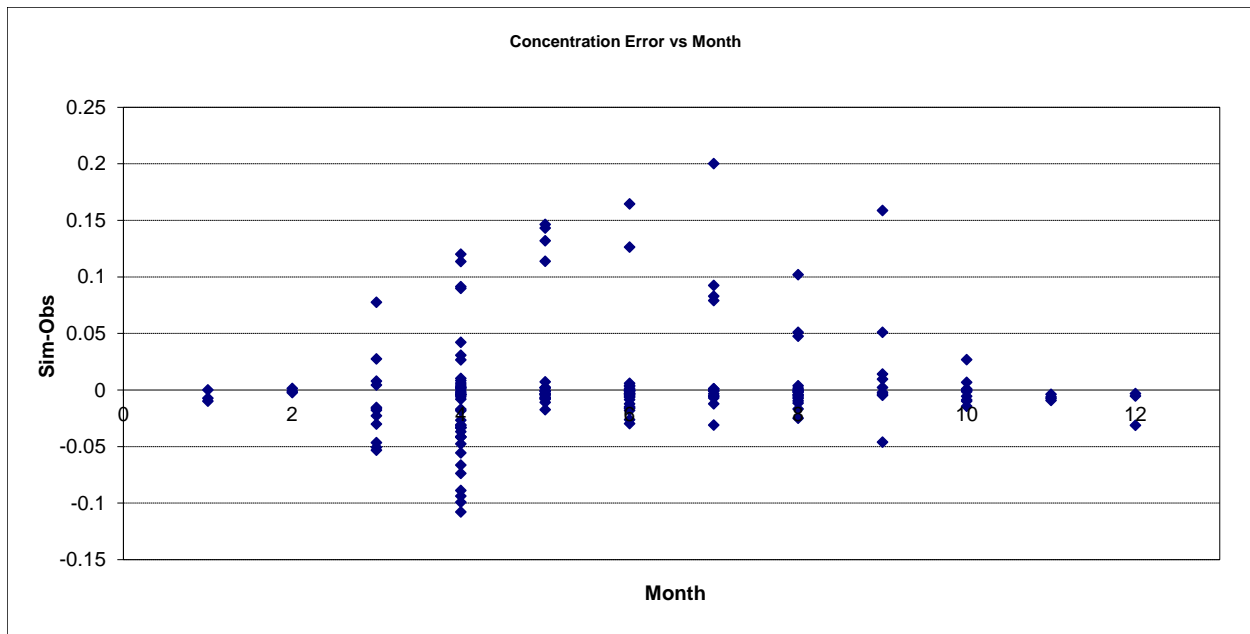
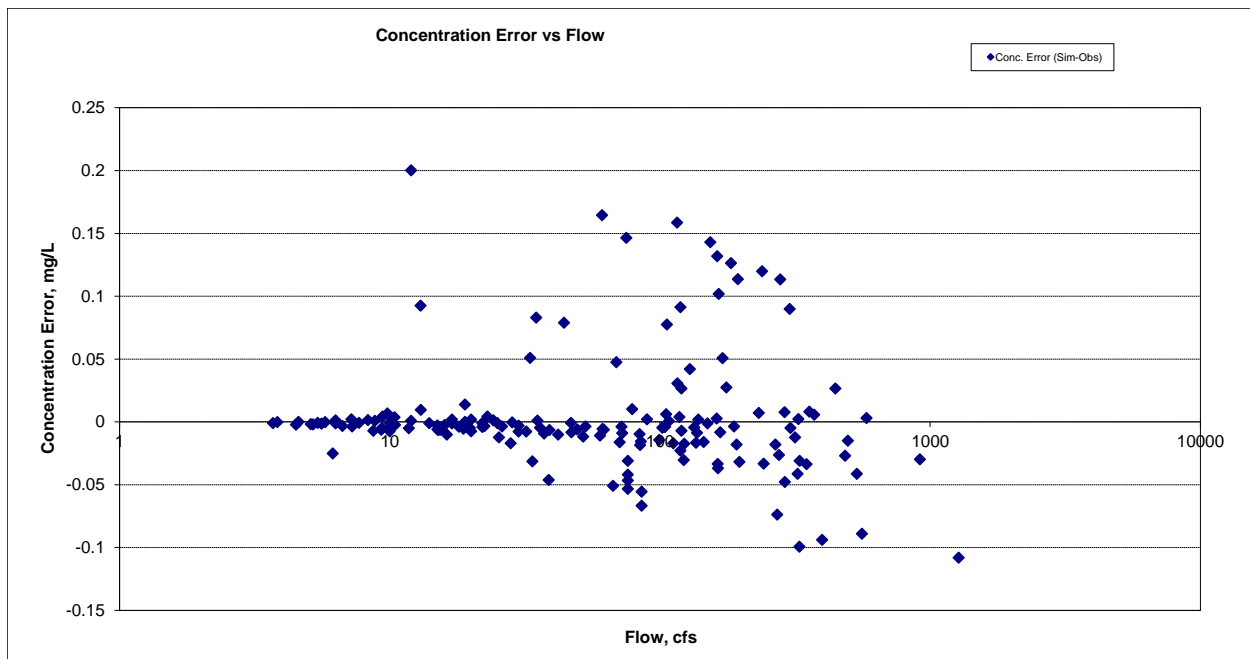


Figure 128. Paired simulated vs. observed Organic Phosphorus (OrgP) load at Sucker River near Palmers



**Figure 129. Residual (Simulated - Observed) vs. Month Organic Phosphorus (OrgP) at Sucker River near Palmers**

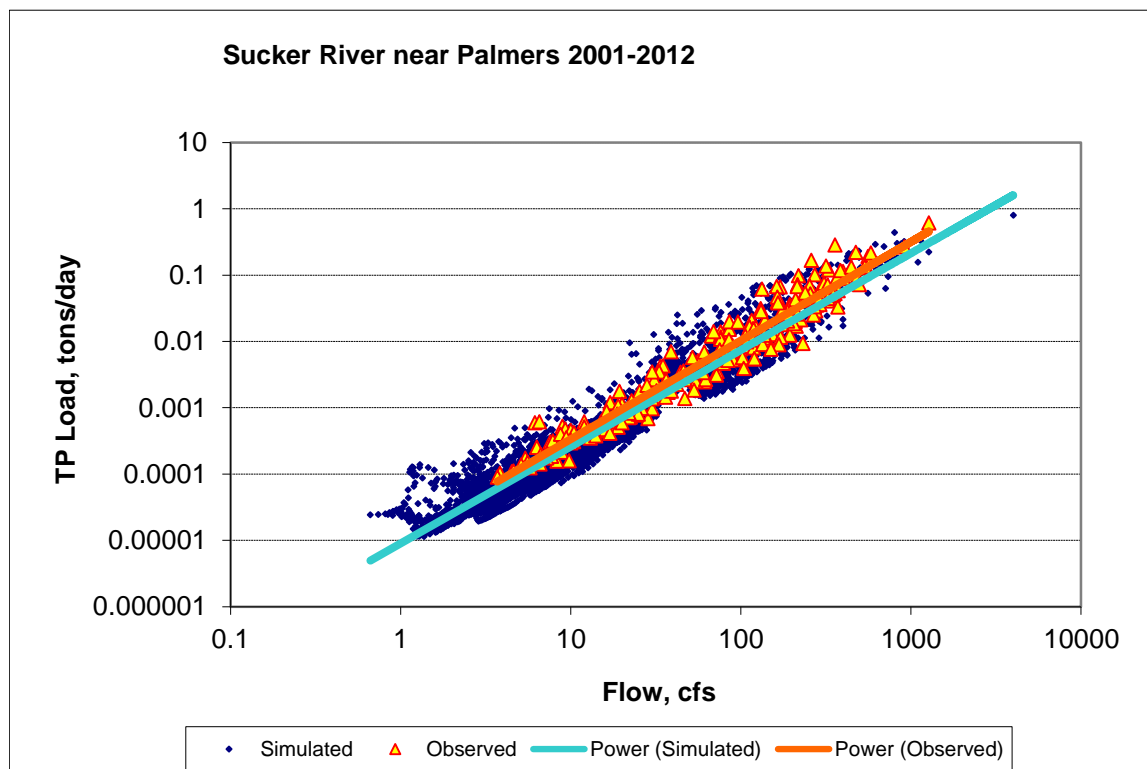


**Figure 130. Residual (Simulated - Observed) vs. Flow Organic Phosphorus (OrgP) at Sucker River near Palmers**

## Total Phosphorus (TP)

**Table 27. Total Phosphorus (TP) statistics**

Count	232
Concentration Average Error	5.14%
Concentration Median Error	-9.19%
Load Ave Error	9.67%
Load Median Error	-0.58%
Paired t concentration	0.98
Paired t load	0.77



**Figure 131. Power plot of simulated and observed Total Phosphorus (TP) load vs flow at Sucker River near Palmers**

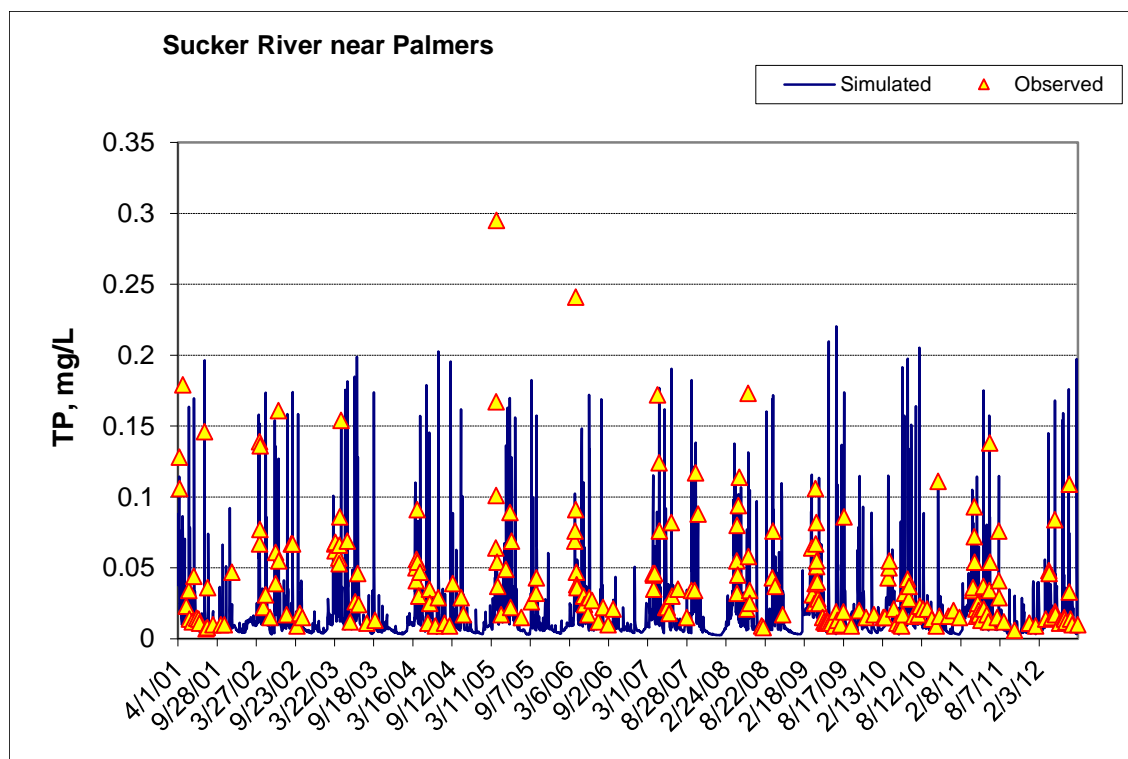


Figure 132. Time series of observed and simulated Total Phosphorus (TP) concentration at Sucker River near Palmers

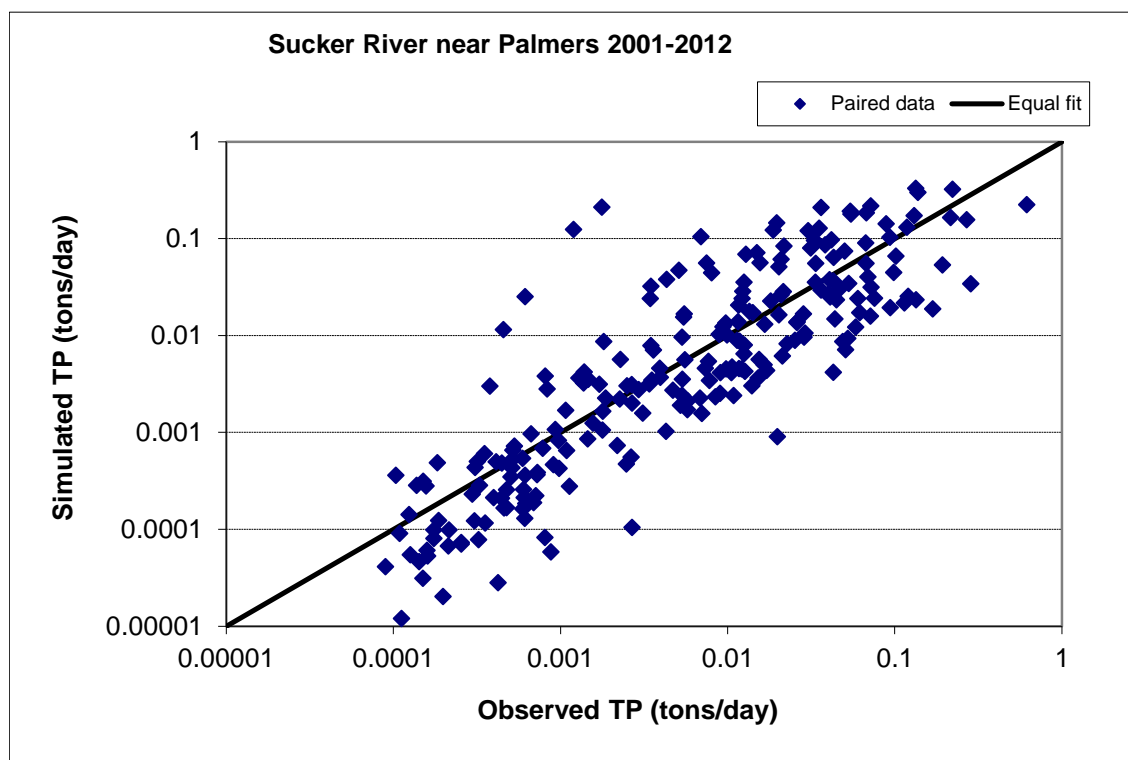
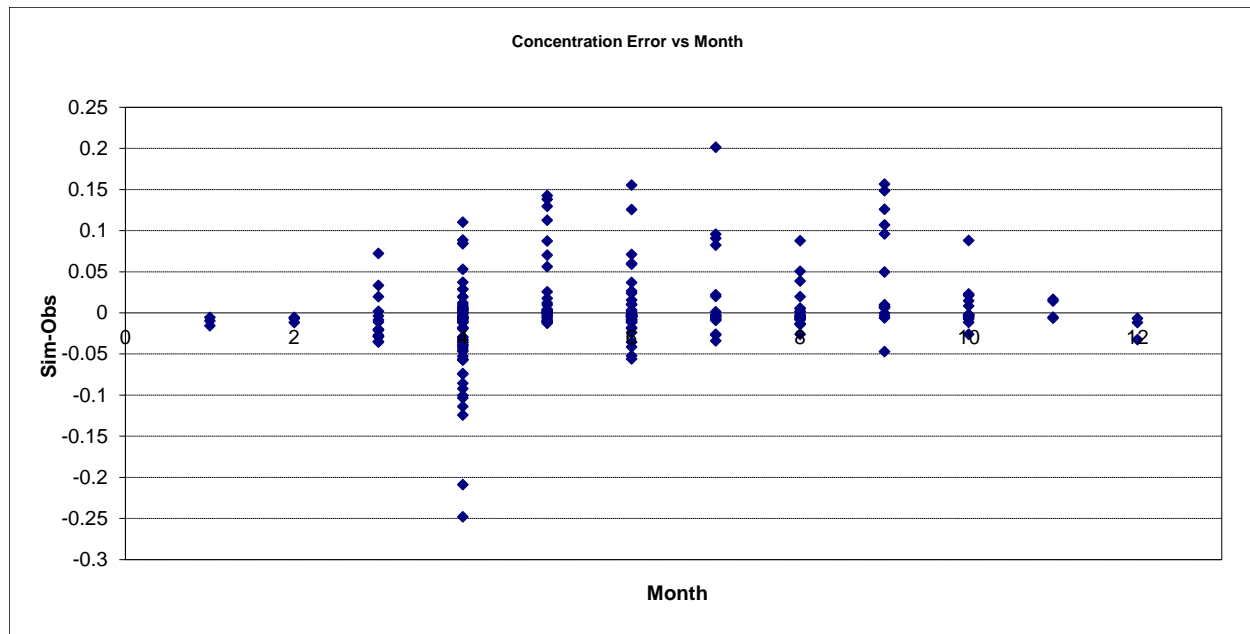
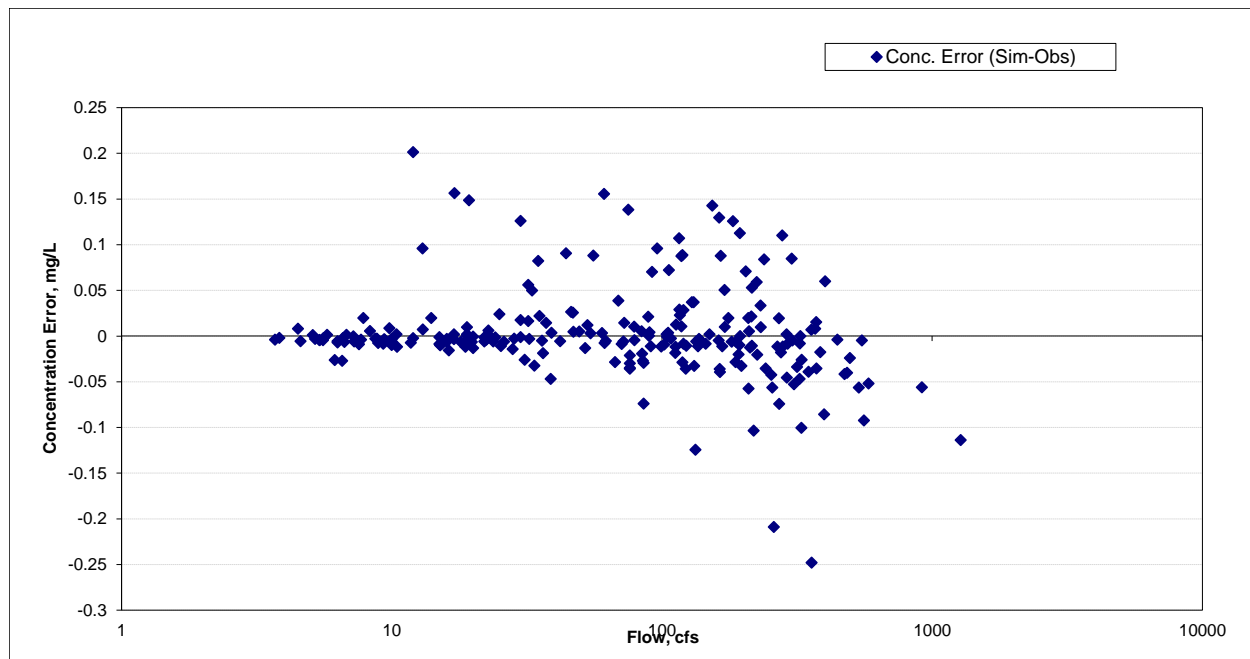


Figure 133. Paired simulated vs. observed Total Phosphorus (TP) load at Sucker River near Palmers



**Figure 134. Residual (Simulated - Observed) vs. Month Total Phosphorus (TP) at Sucker River near Palmers**



**Figure 135. Residual (Simulated - Observed) vs. Flow Total Phosphorus (TP) at Sucker River near Palmers**

## Knife River near Two Harbors (HYDSTRA 02026001)

### Total Suspended Solids (TSS)

Table 28. Total Suspended Solids (TSS) statistics

Count	231
Concentration Average Error	-11.69%
Concentration Median Error	-2.83%
Load Average Error	-29.17%
Load Median Error	-0.13%
Paired t concentration	0.78
Paired t load	0.33

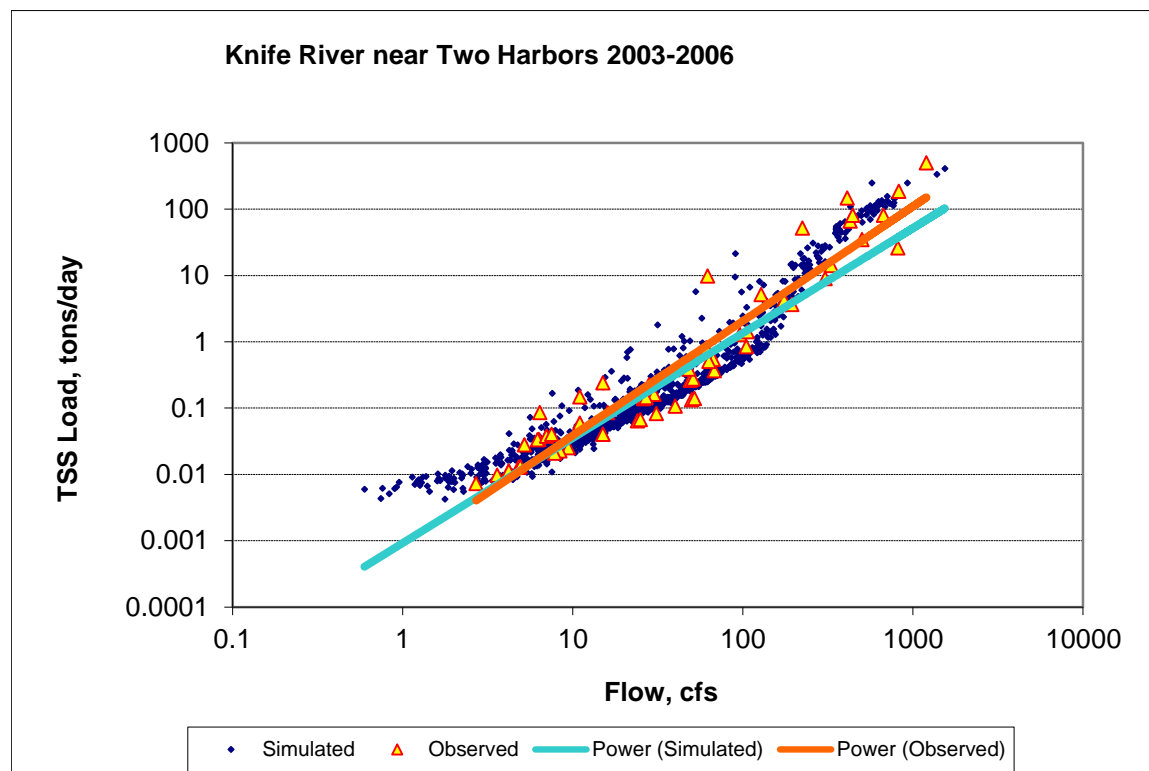


Figure 136. Power plot of simulated and observed Total Suspended Solids (TSS) load vs flow at Knife River near Two Harbors



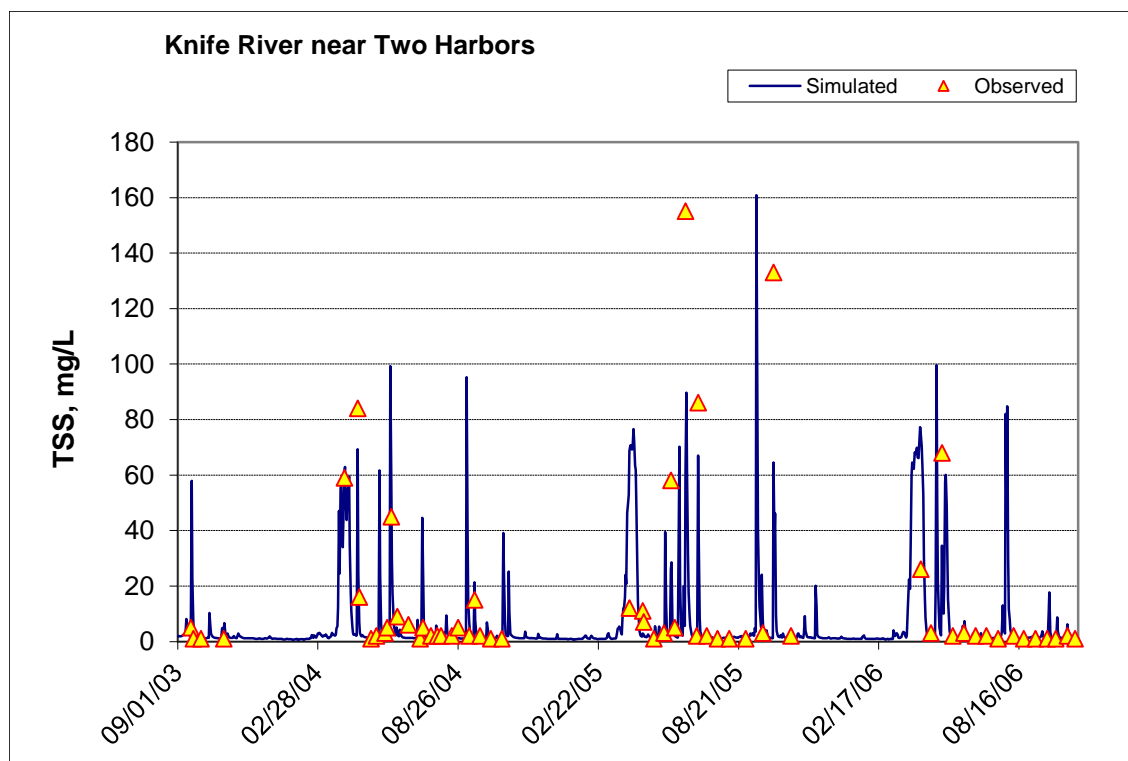


Figure 137. Time series of observed and simulated Total Suspended Solids (TSS) concentration at Knife River near Two Harbors

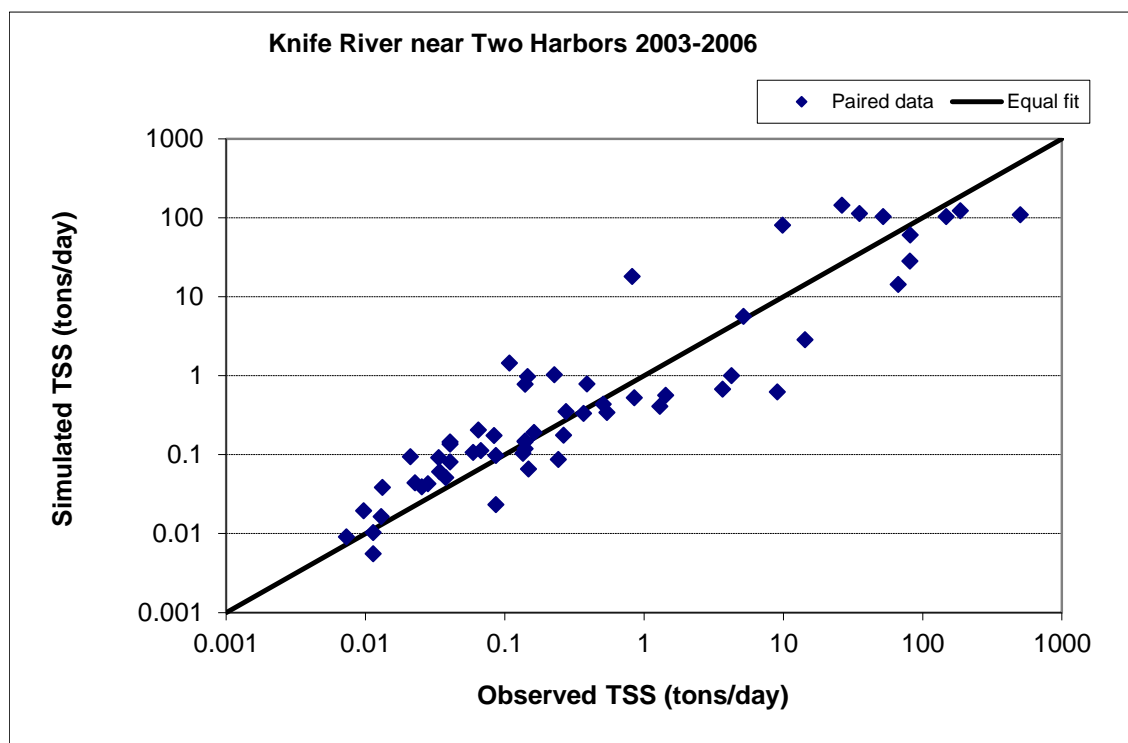
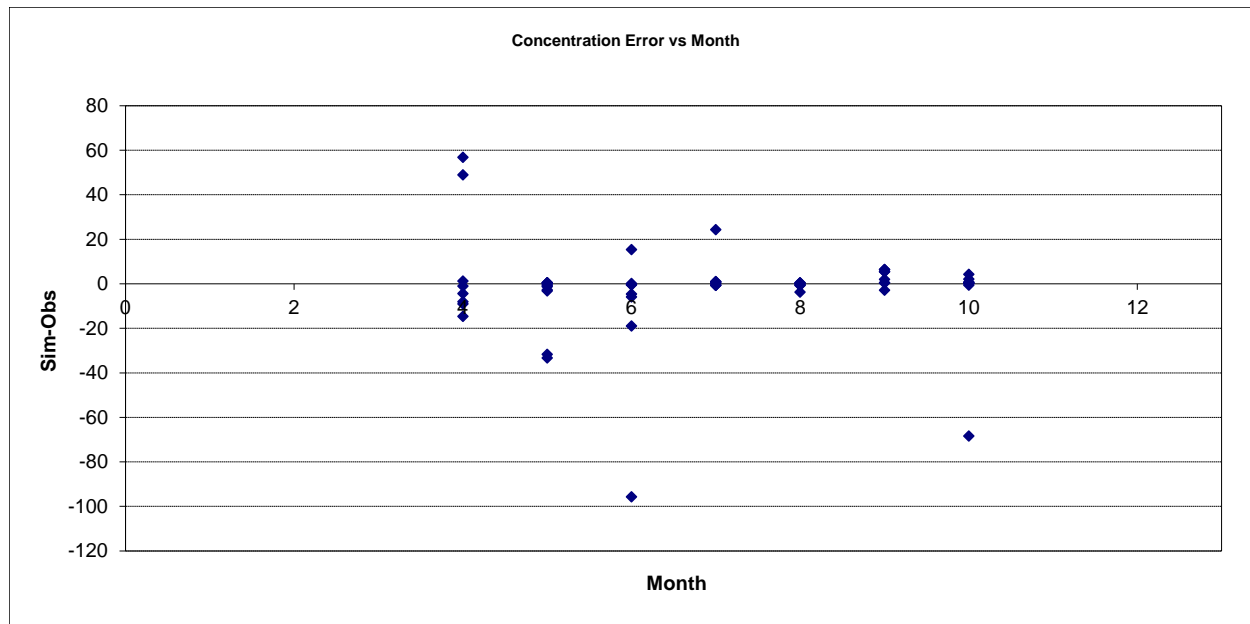
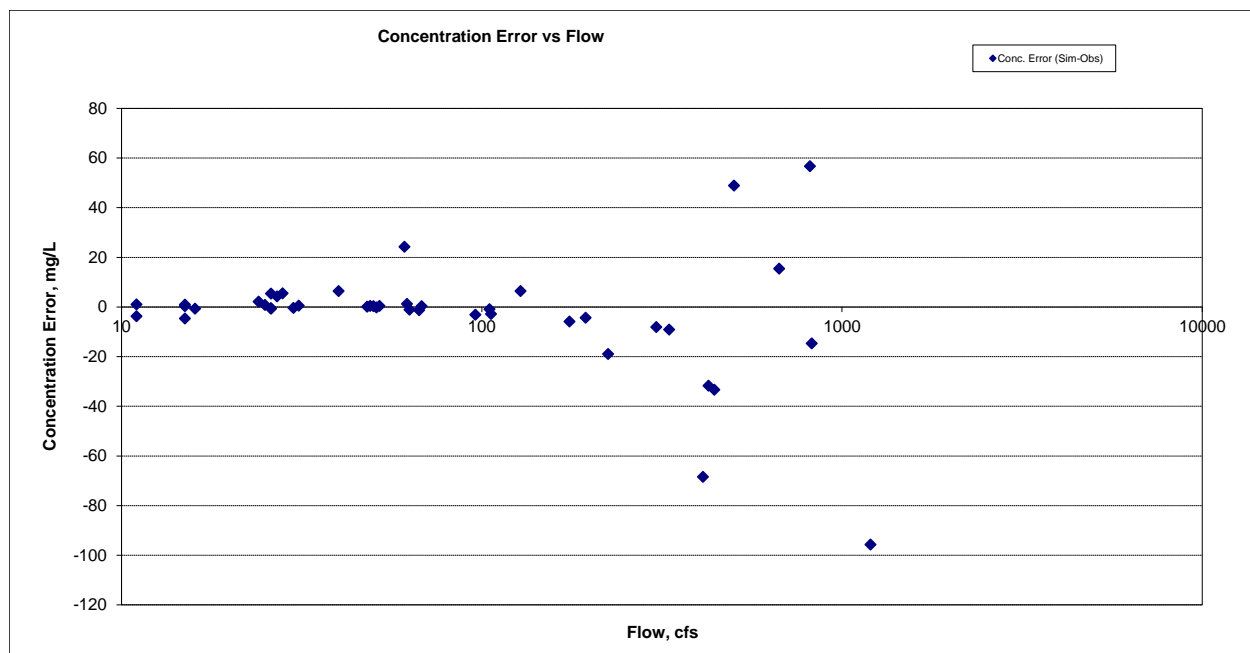


Figure 138. Paired simulated vs. observed Total Suspended Solids (TSS) load at Knife River near Two Harbors



**Figure 139. Residual (Simulated - Observed) vs. Month Total Suspended Solids (TSS) at Knife River near Two Harbors**



**Figure 140. Residual (Simulated - Observed) vs. Flow Total Suspended Solids (TSS) at Knife River near Two Harbors**

## Knife River near Two Harbors (EQUIS S000-257)

### Total Suspended Solids (TSS)

Table 29. Total Suspended Solids (TSS) statistics

Count	86	21
Concentration Average Error	-21.65%	5.42%
Concentration Median Error	1.07%	16.98%
Load Ave Error	-64.01%	119.29%
Load Median Error	0.01%	4.88%
Paired t concentration	0.47	0.70
Paired t load	0.22	0.09

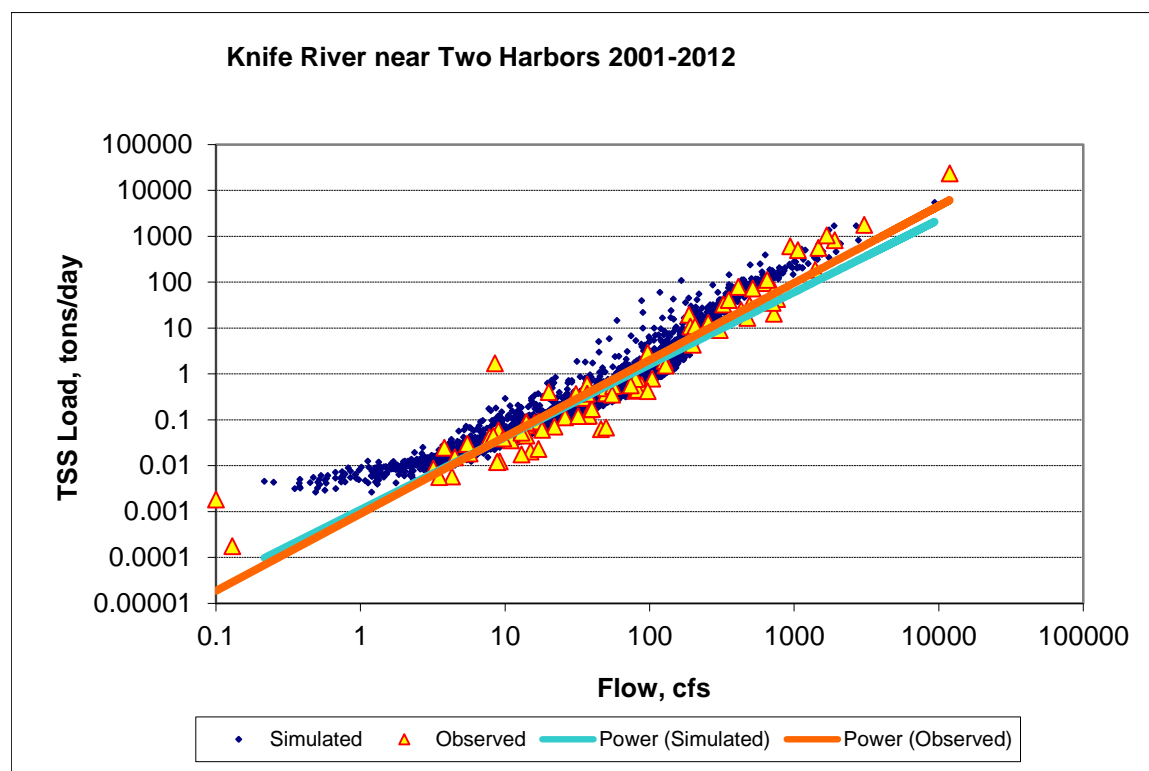


Figure 141. Power plot of simulated and observed Total Suspended Solids (TSS) load vs flow at Knife River near Two Harbors (calibration period)

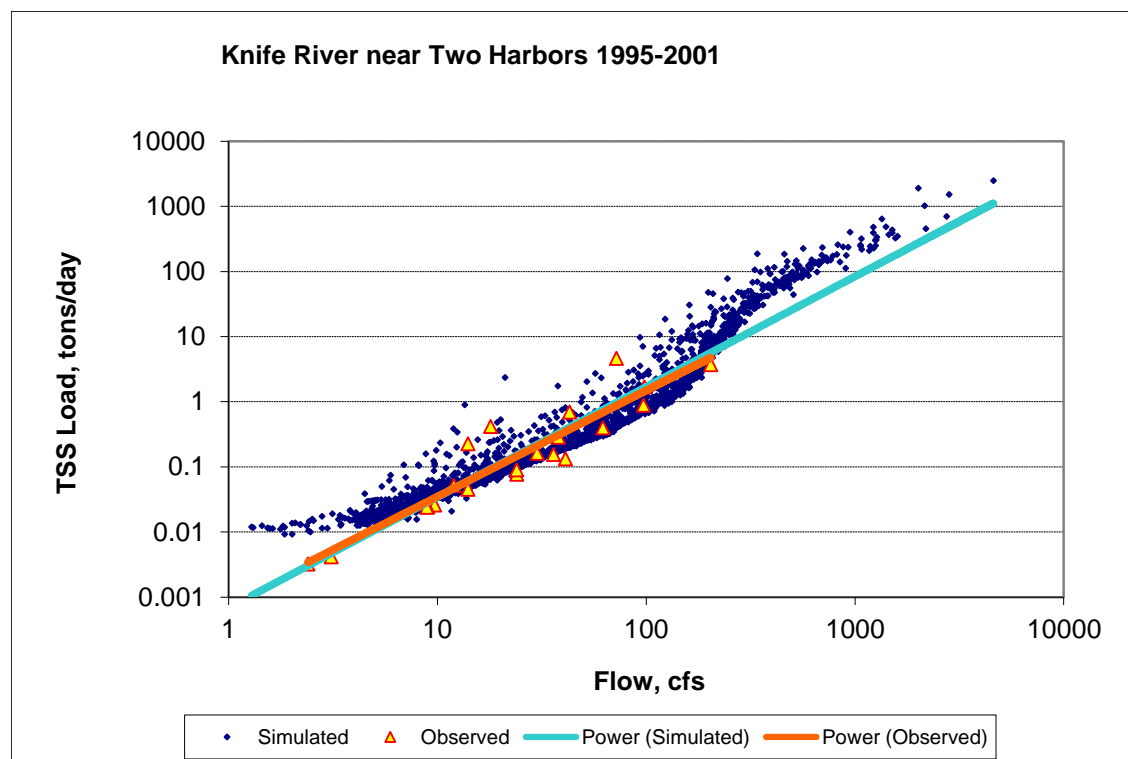


Figure 142. Power plot of simulated and observed Total Suspended Solids (TSS) load vs flow at Knife River near Two Harbors (validation period)

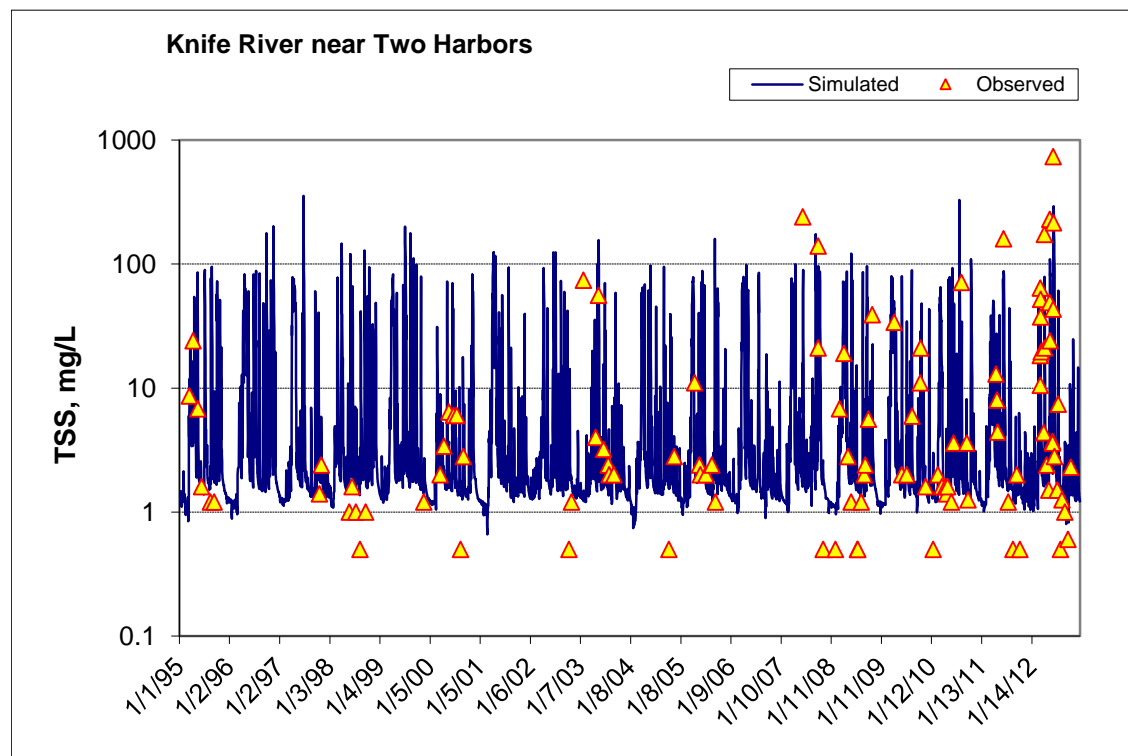


Figure 143. Time series of observed and simulated Total Suspended Solids (TSS) concentration at Knife River near Two Harbors (calibration period)

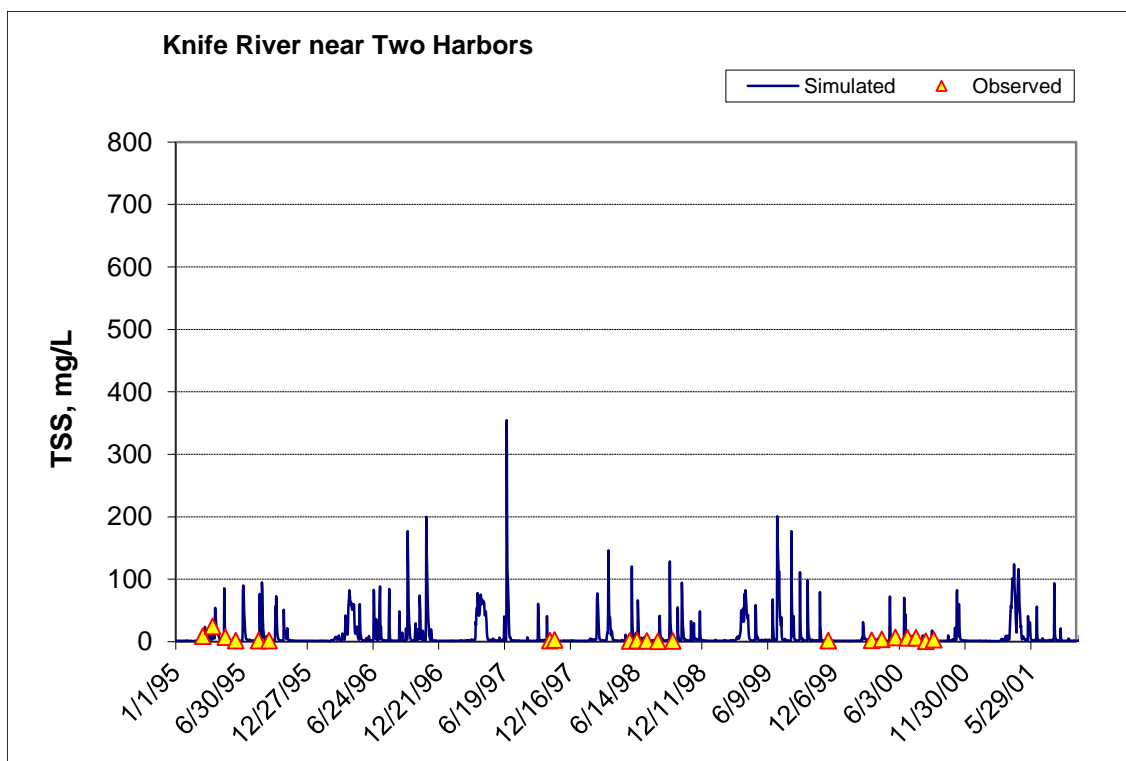


Figure 144. Time series of observed and simulated Total Suspended Solids (TSS) concentration at Knife River near Two Harbors (validation period)

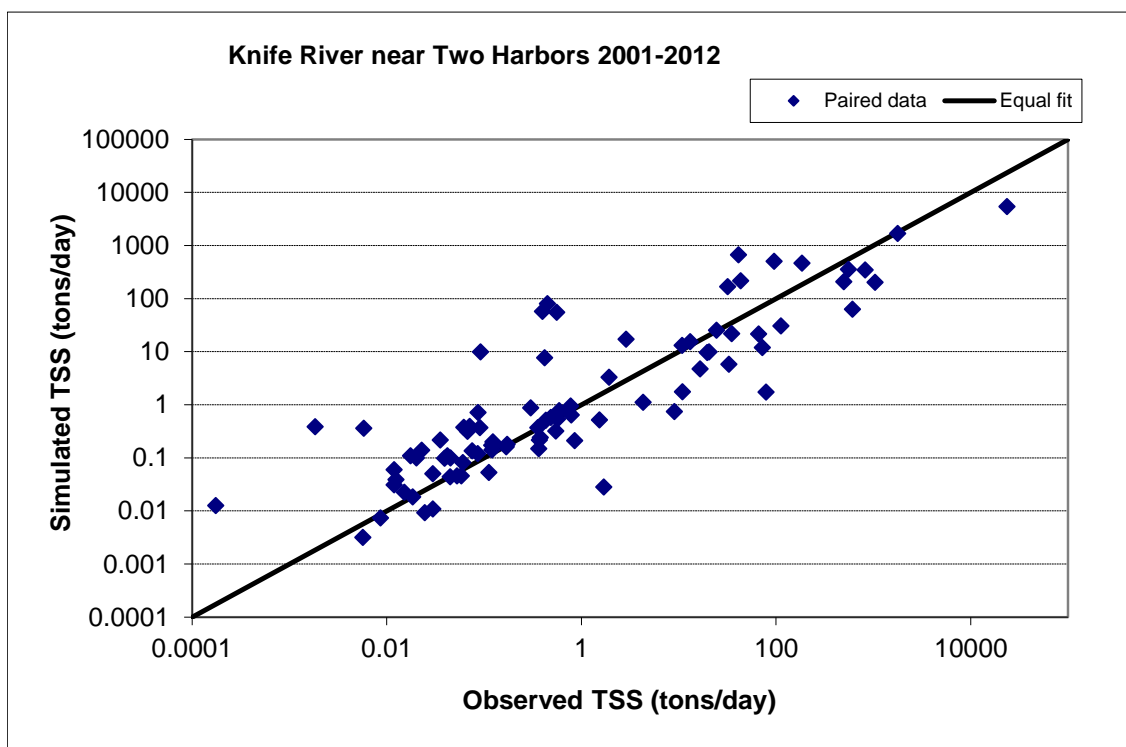


Figure 145. Paired simulated vs. observed Total Suspended Solids (TSS) load at Knife River near Two Harbors (calibration period)

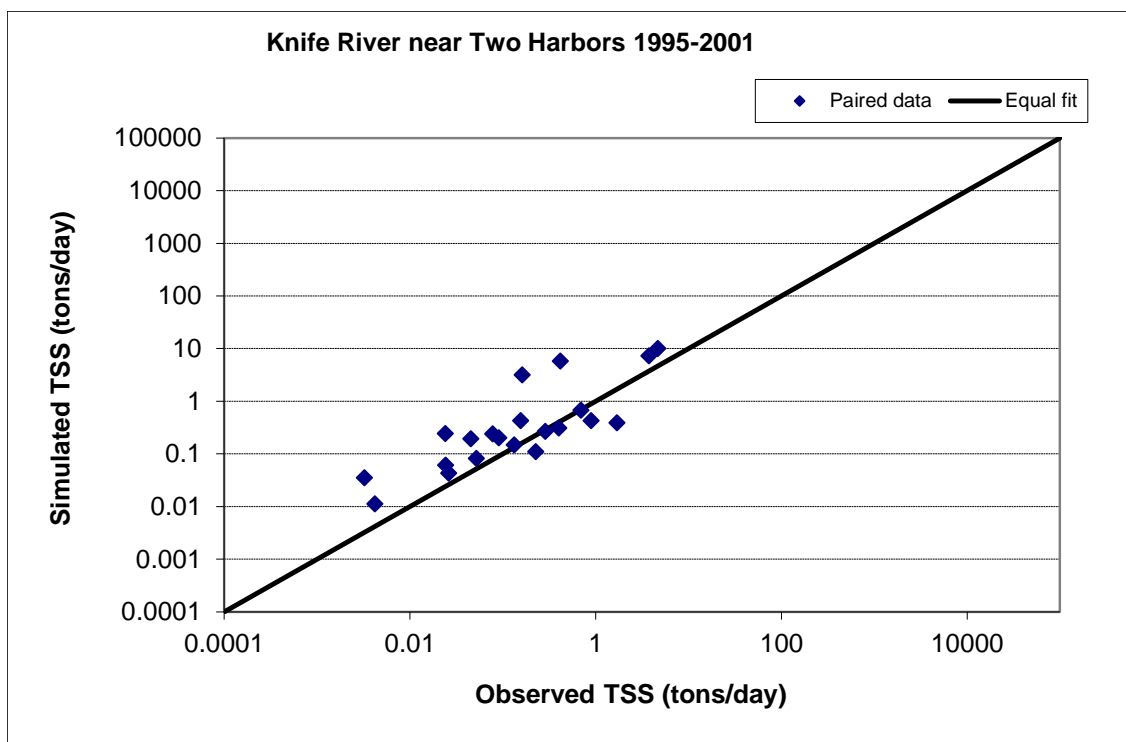


Figure 146. Paired simulated vs. observed Total Suspended Solids (TSS) load at Knife River near Two Harbors (validation period)

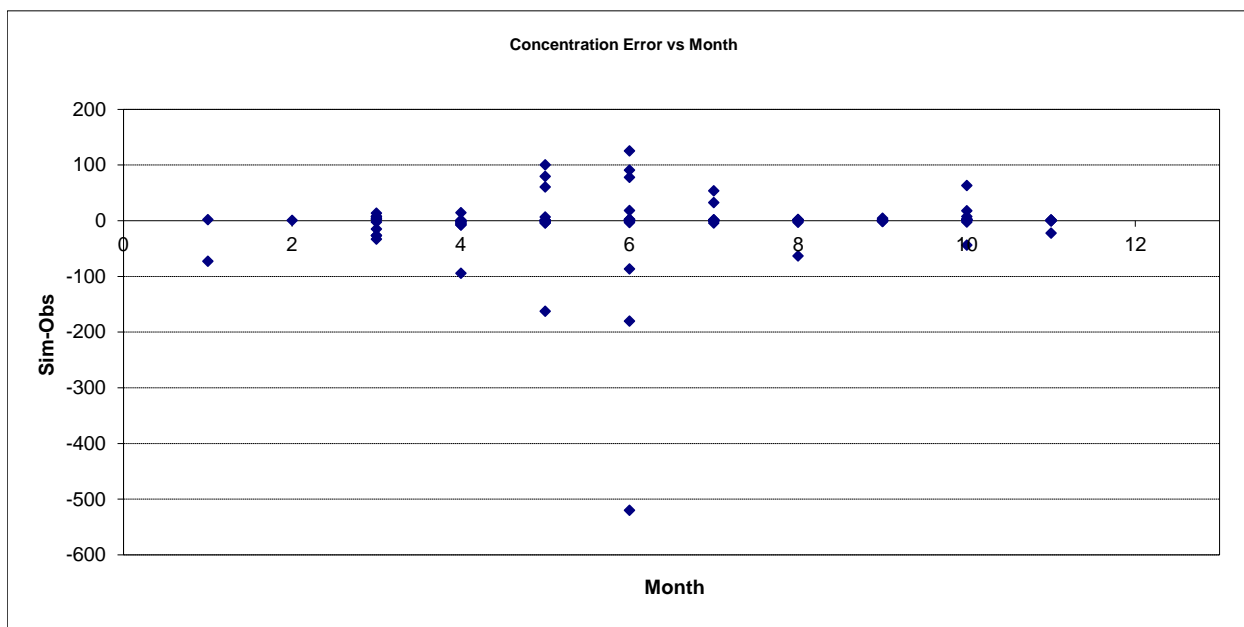
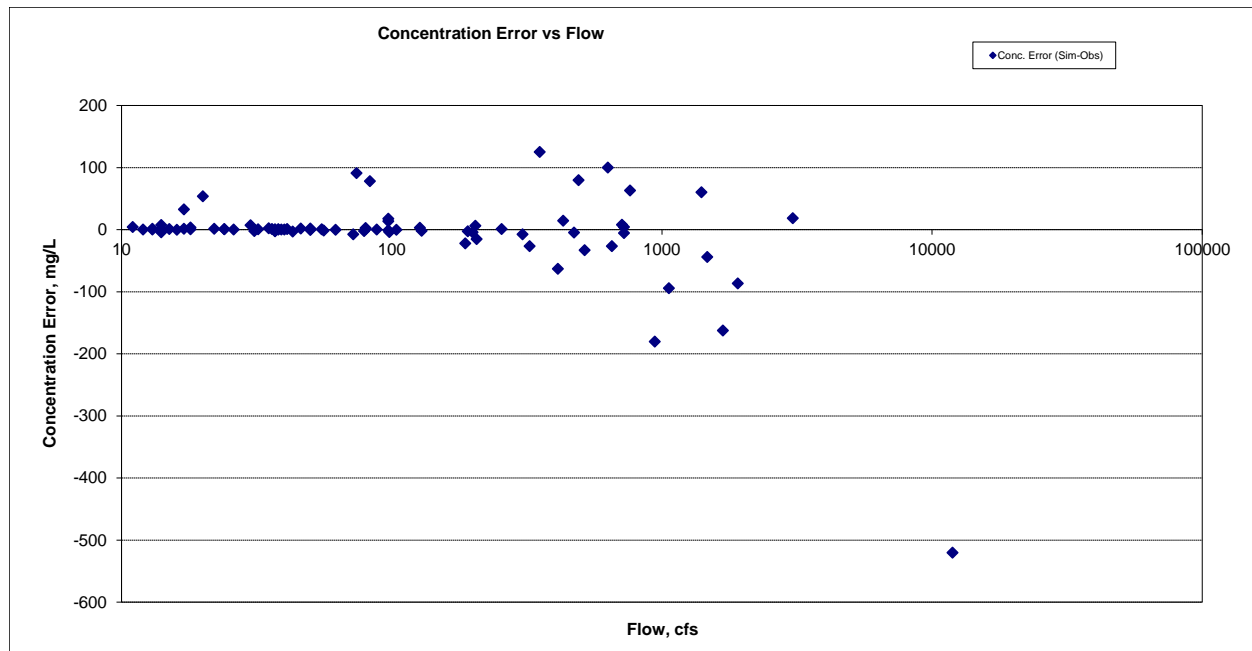


Figure 147. Residual (Simulated - Observed) vs. Month Total Suspended Solids (TSS) at Knife River near Two Harbors

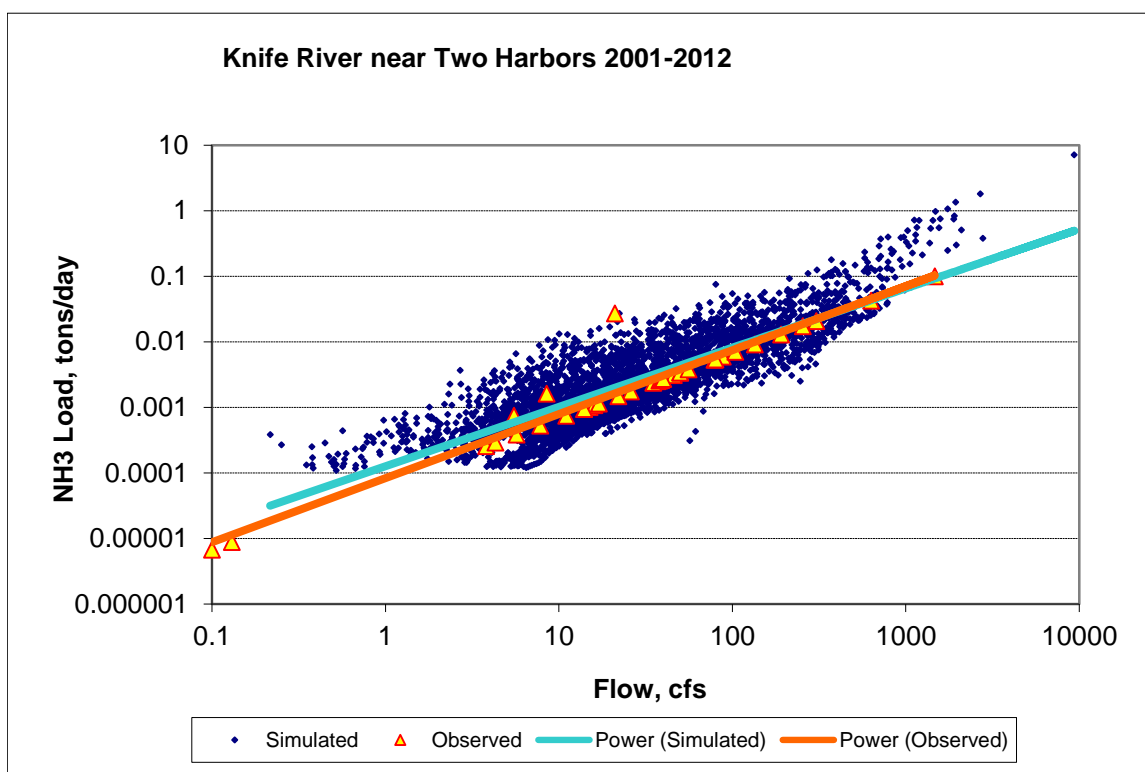


**Figure 148. Residual (Simulated - Observed) vs. Flow Total Suspended Solids (TSS) at Knife River near Two Harbors**

## Ammonia Nitrogen (NH<sub>3</sub>)

**Table 30. Ammonia Nitrogen (NH<sub>3</sub>) statistics**

Count	36	28
Concentration Average Error	15.19%	80.64%
Concentration Median Error	21.20%	87.62%
Load Ave Error	318.68%	224.87%
Load Median Error	1.14%	131.23%
Paired t concentration	0.57	0.01
Paired t load	0.06	0.00



**Figure 149. Power plot of simulated and observed Ammonia Nitrogen (NH<sub>3</sub>) load vs flow at Knife River near Two Harbors (calibration period)**



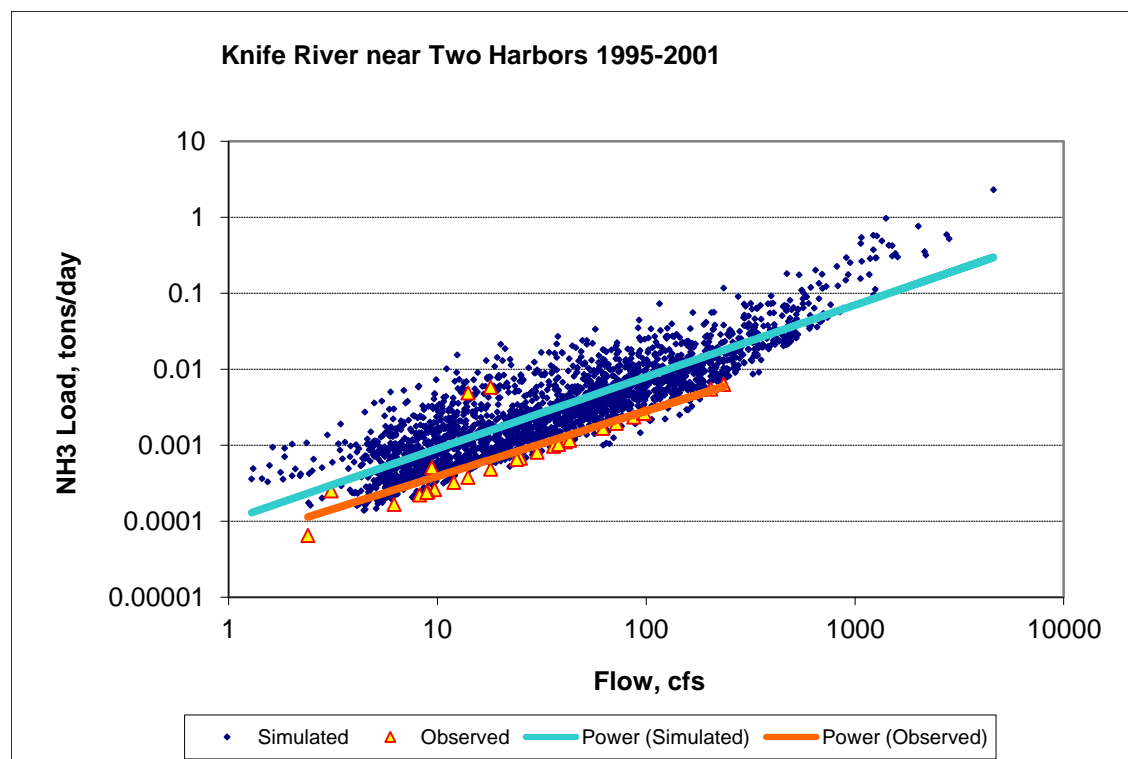


Figure 150. Power plot of simulated and observed Ammonia Nitrogen (NH<sub>3</sub>) load vs flow at Knife River near Two Harbors (validation period)

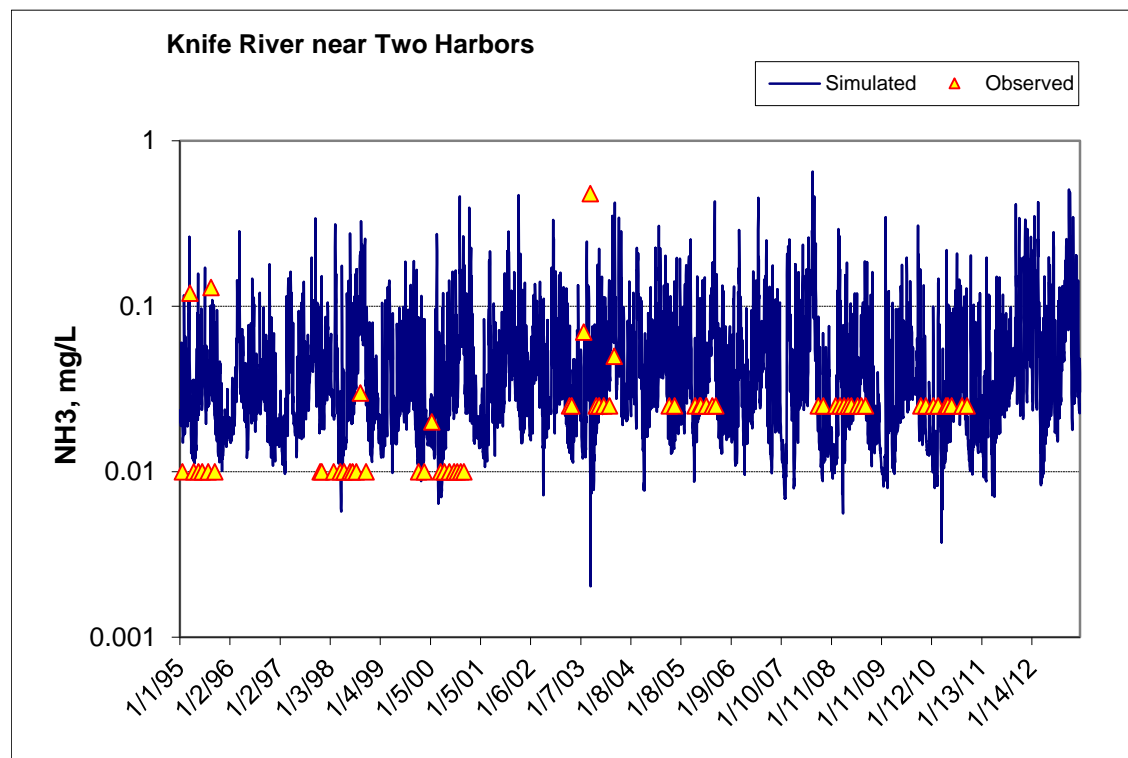


Figure 151. Time series of observed and simulated Ammonia Nitrogen (NH<sub>3</sub>) concentration at Knife River near Two Harbors (calibration period)

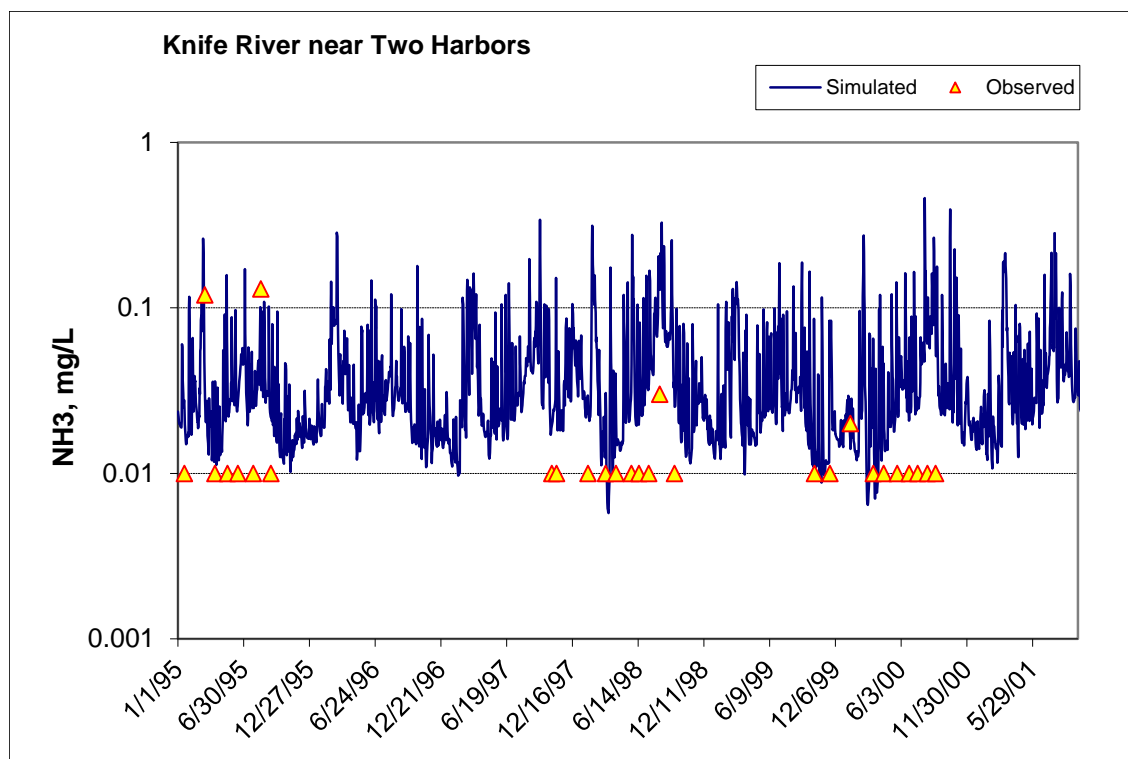


Figure 152. Time series of observed and simulated Ammonia Nitrogen (NH<sub>3</sub>) concentration at Knife River near Two Harbors (validation period)

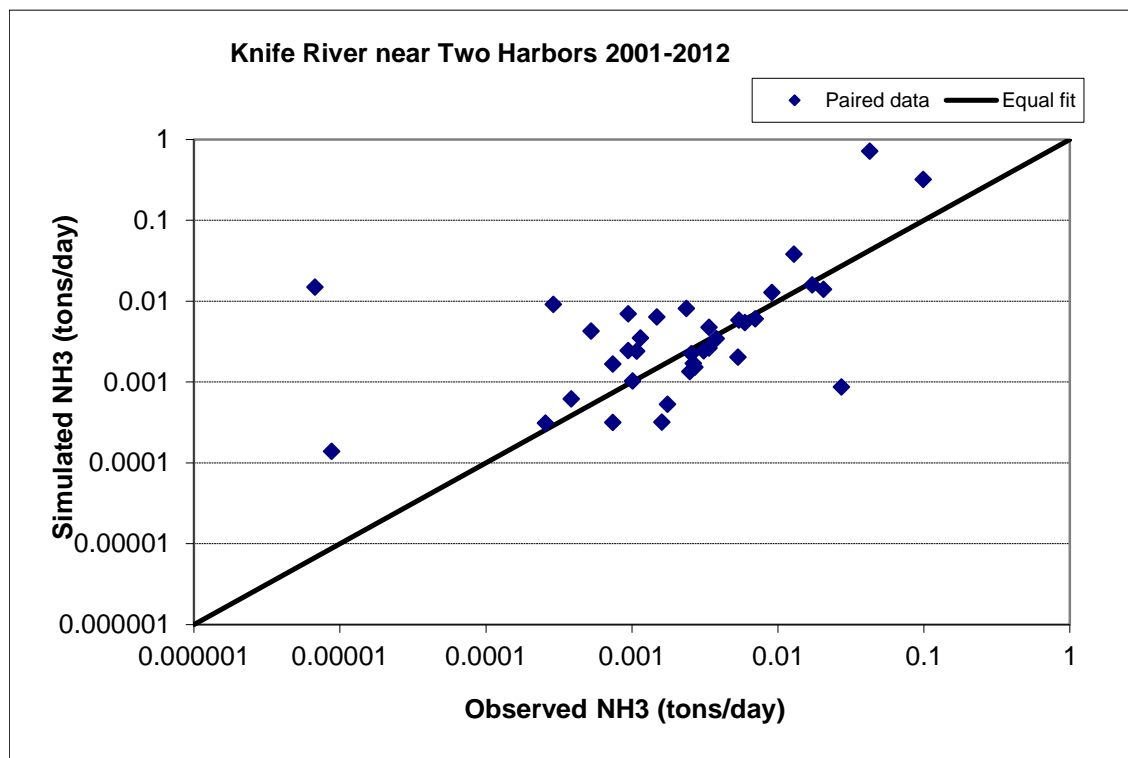


Figure 153. Paired simulated vs. observed Ammonia Nitrogen (NH<sub>3</sub>) load at Knife River near Two Harbors (calibration period)

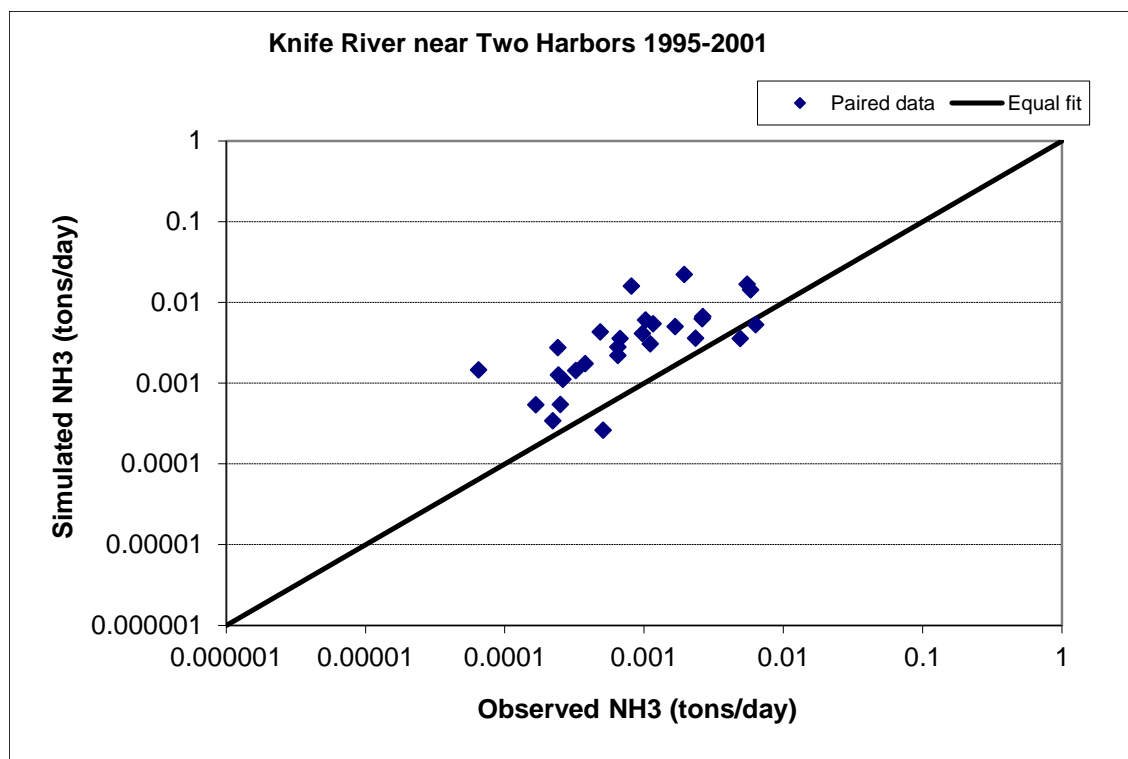


Figure 154. Paired simulated vs. observed Ammonia Nitrogen (NH3) load at Knife River near Two Harbors (validation period)

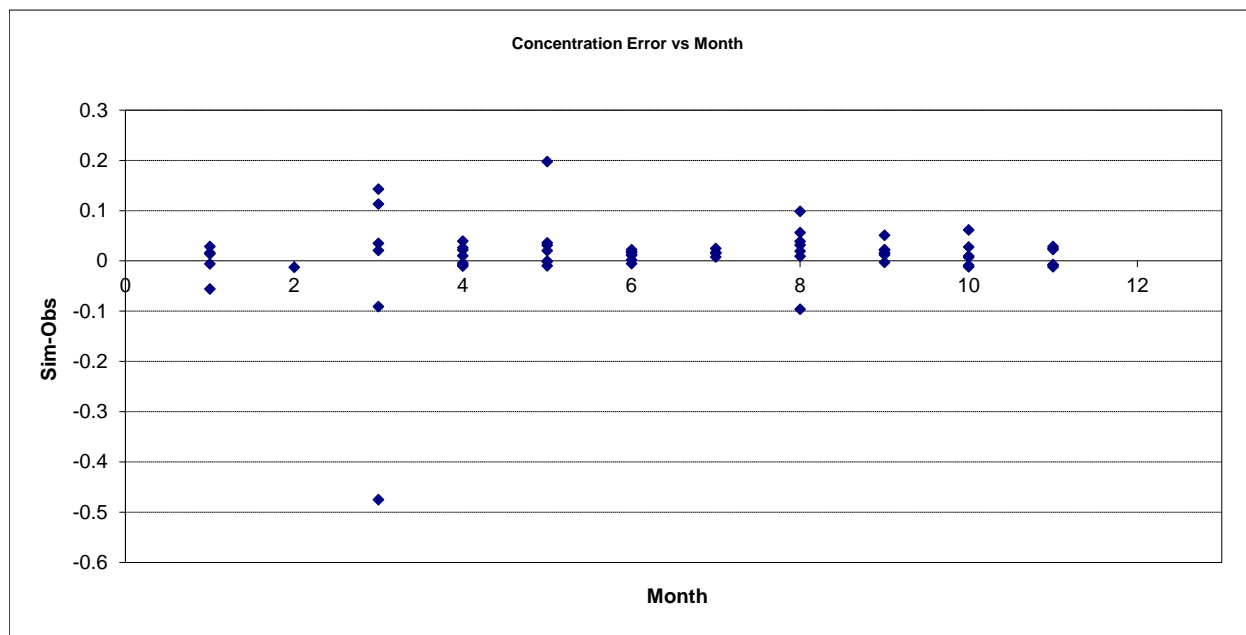


Figure 155. Residual (Simulated - Observed) vs. Month Ammonia Nitrogen (NH3) at Knife River near Two Harbors

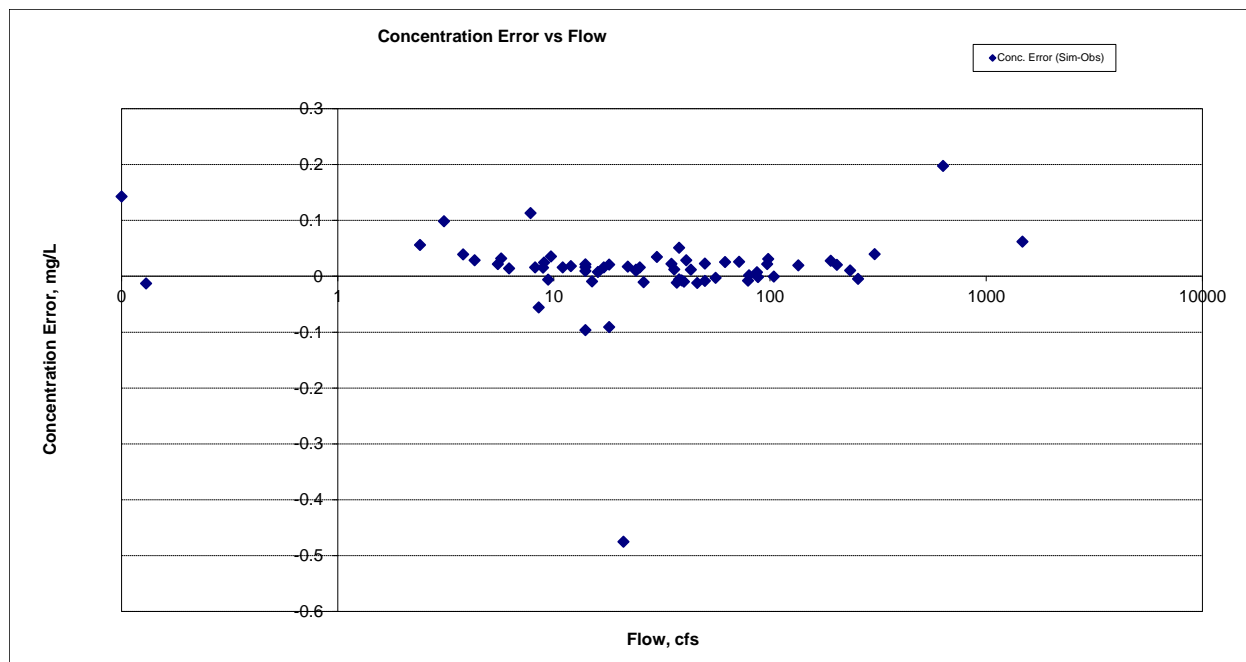
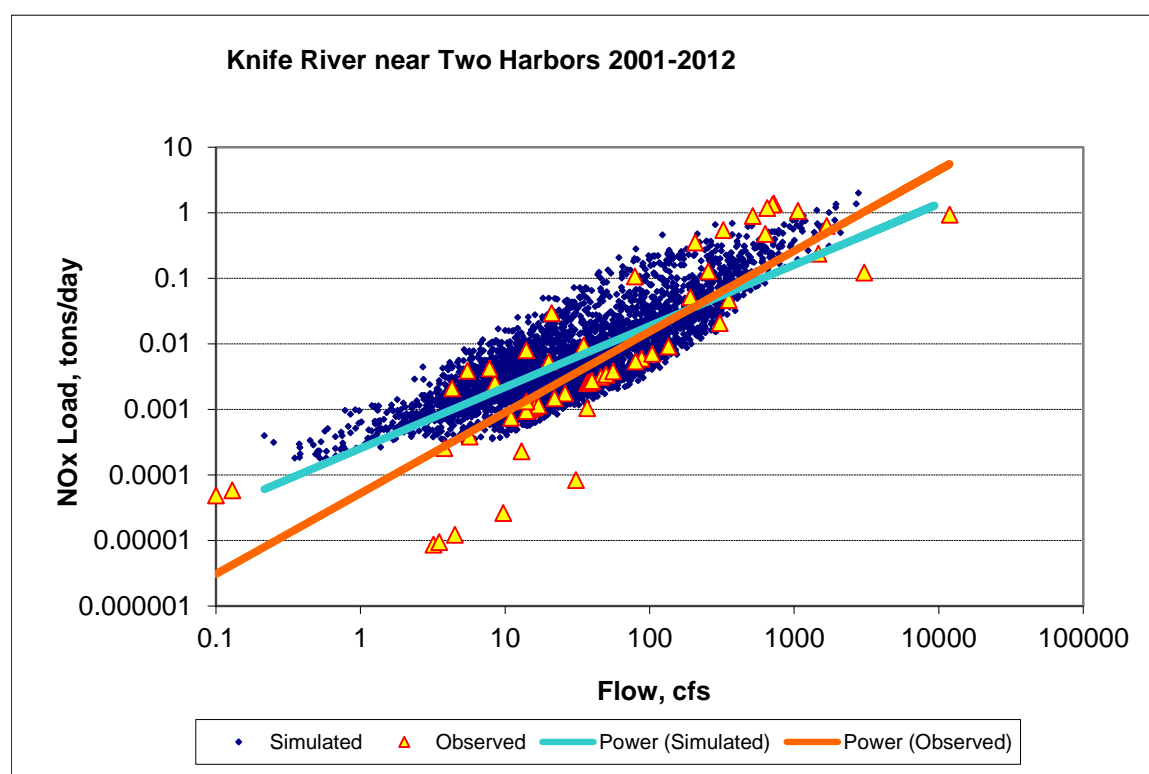


Figure 156. Residual (Simulated - Observed) vs. Flow Ammonia Nitrogen (NH<sub>3</sub>) at Knife River near Two Harbors

## Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>)

**Table 31. Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) statistics**

Count	56	28
Concentration Average Error	27.92%	-14.05%
Concentration Median Error	13.35%	8.31%
Load Ave Error	280.83%	4.15%
Load Median Error	21.07%	0.48%
Paired t concentration	0.39	0.64
Paired t load	0.01	0.66



**Figure 157. Power plot of simulated and observed Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) load vs flow at Knife River near Two Harbors (calibration period)**

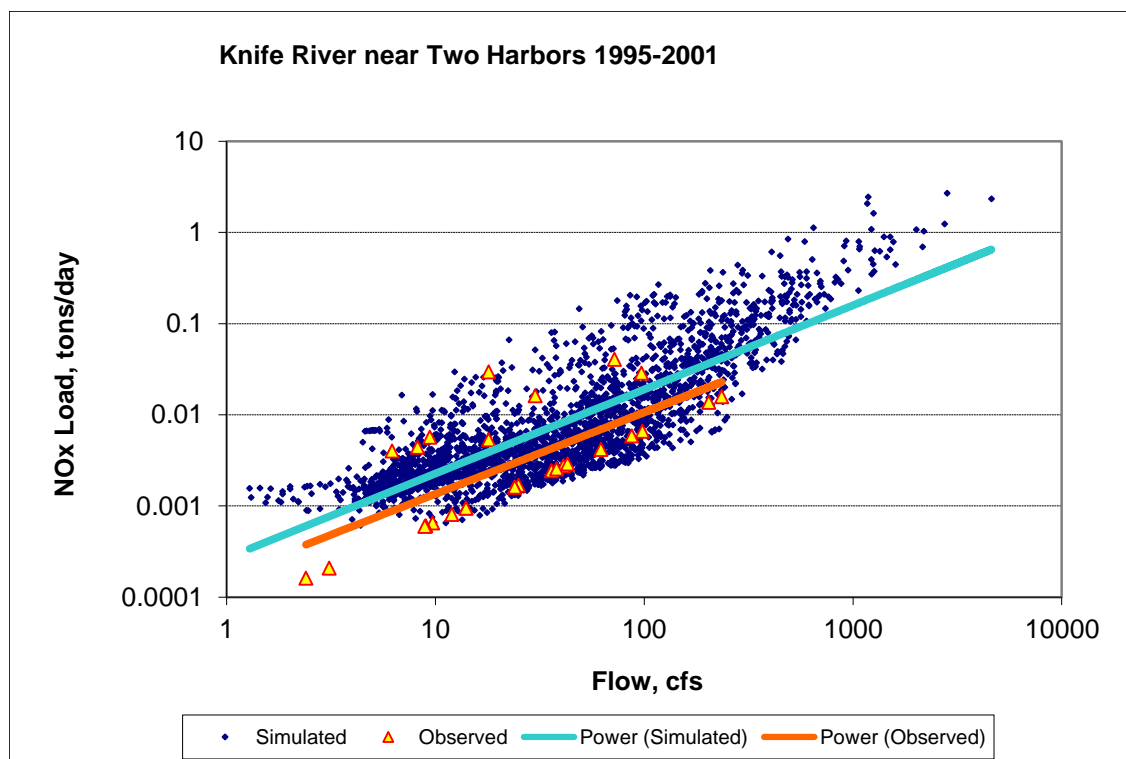


Figure 158. Power plot of simulated and observed Nitrite+ Nitrate Nitrogen (NOx) load vs flow at Knife River near Two Harbors (validation period)

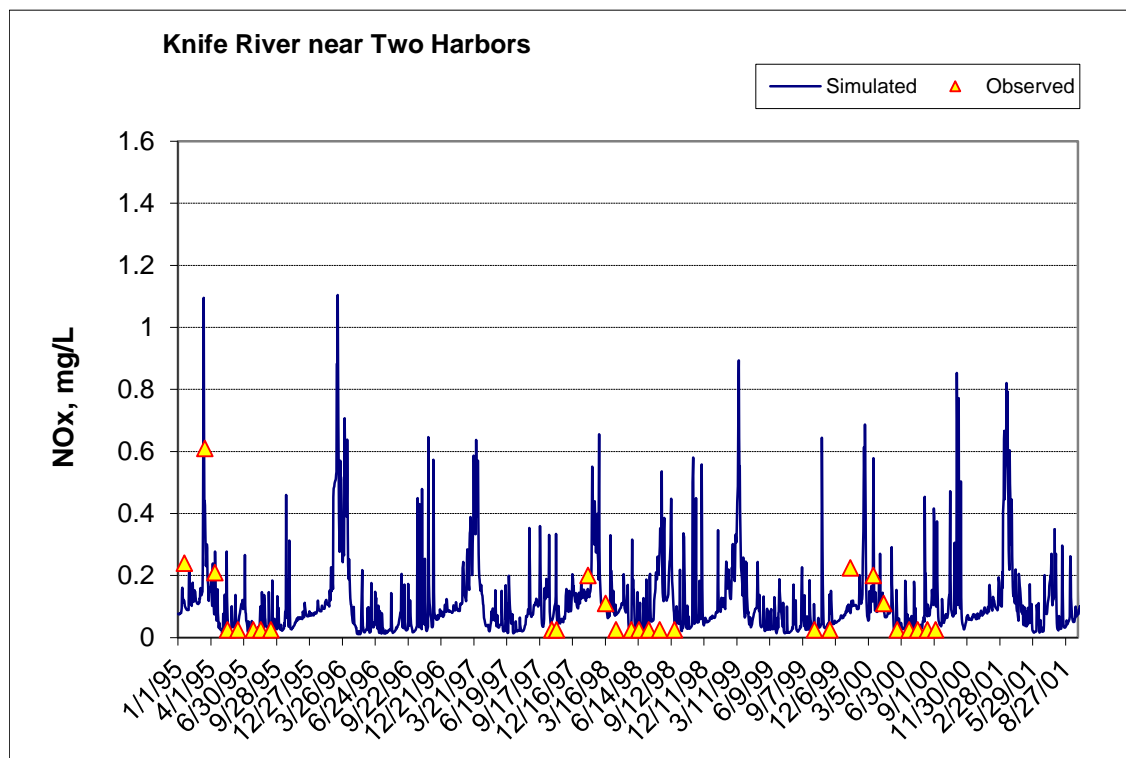


Figure 159. Time series of observed and simulated Nitrite+ Nitrate Nitrogen (NOx) concentration at Knife River near Two Harbors (calibration period)

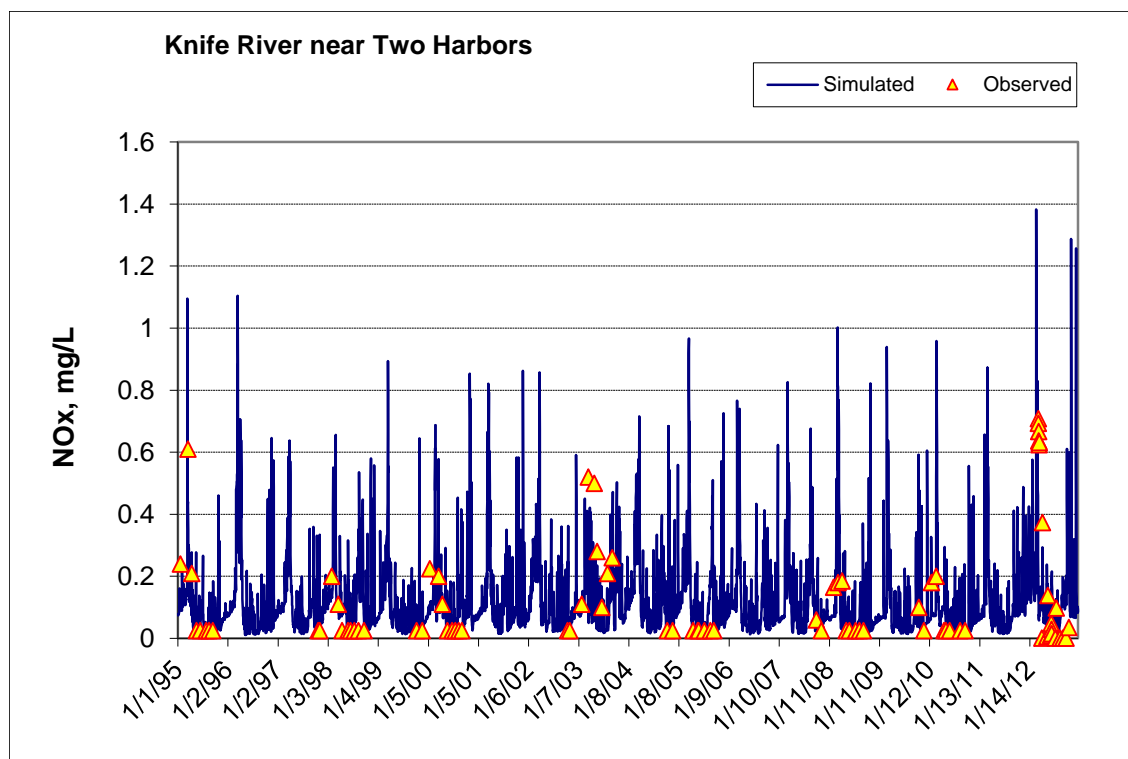


Figure 160. Time series of observed and simulated Nitrite+ Nitrate Nitrogen (NOx) concentration at Knife River near Two Harbors (validation period)

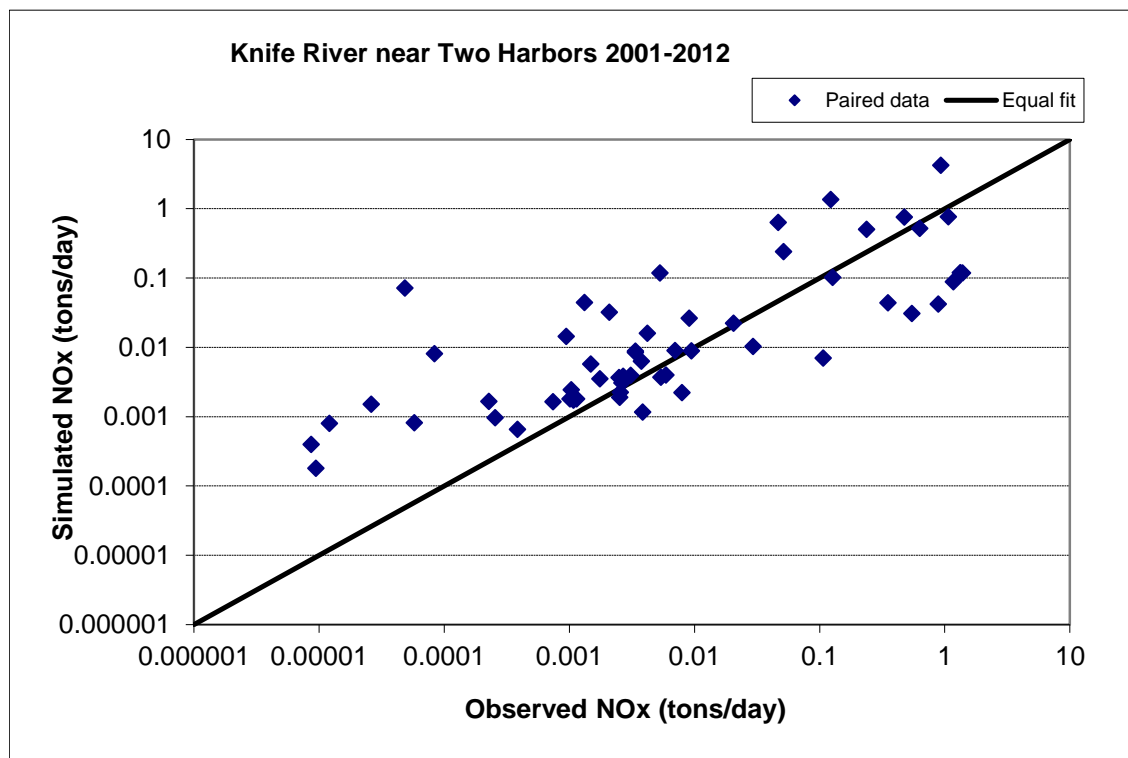


Figure 161. Paired simulated vs. observed Nitrite+ Nitrate Nitrogen (NOx) load at Knife River near Two Harbors (calibration period)

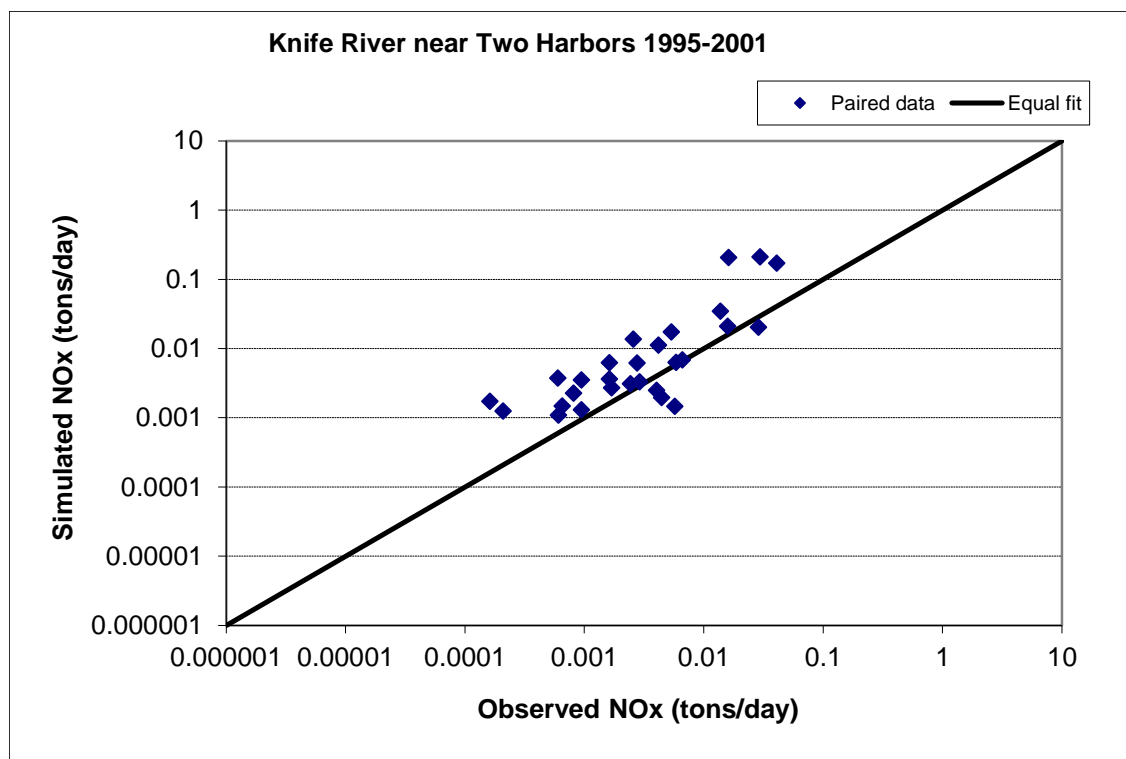


Figure 162. Paired simulated vs. observed Nitrite+ Nitrate Nitrogen (NOx) load at Knife River near Two Harbors (validation period)

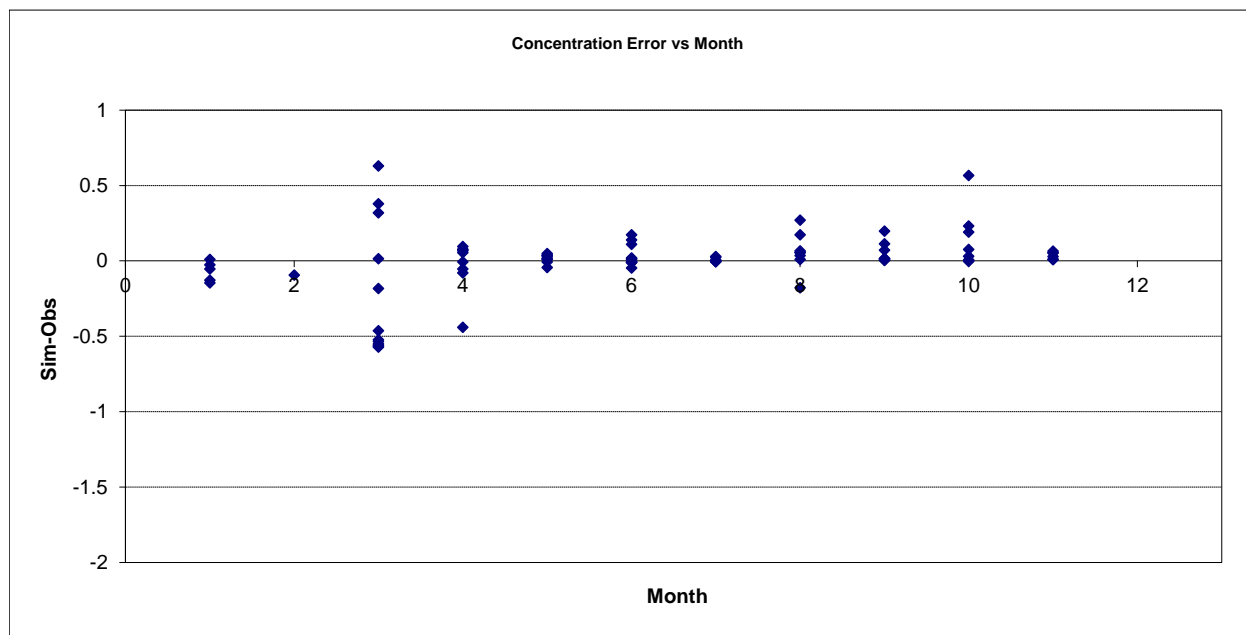
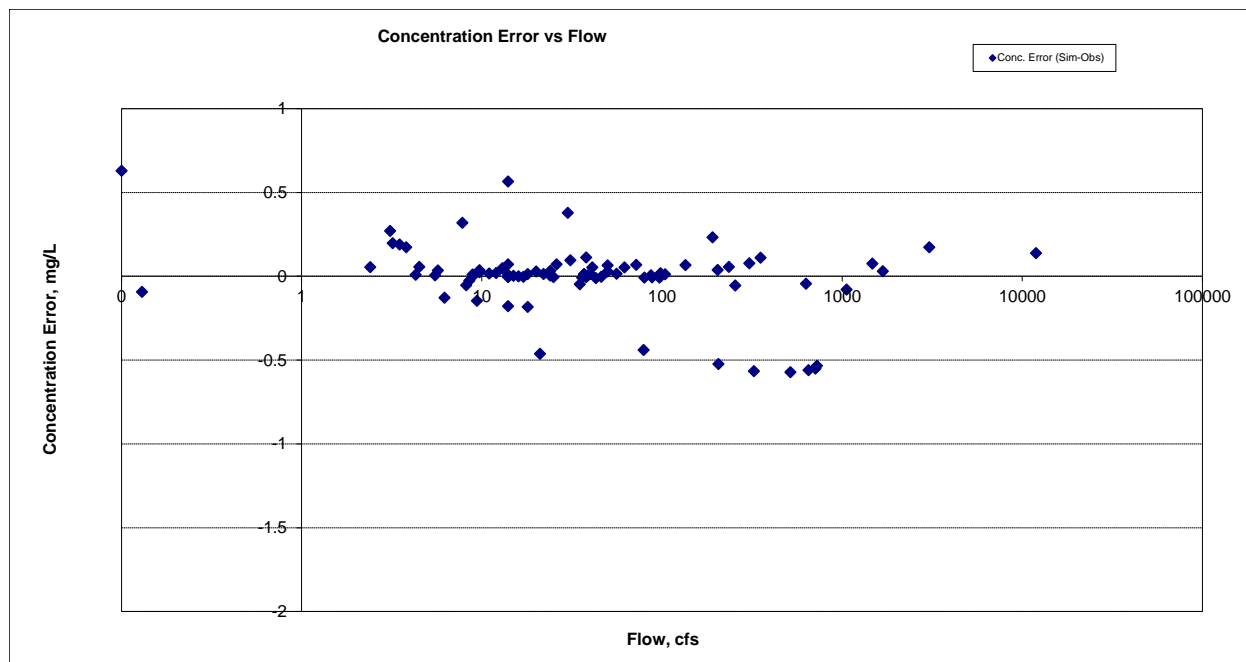


Figure 163. Residual (Simulated - Observed) vs. Month Nitrite+ Nitrate Nitrogen (NOx) at Knife River near Two Harbors



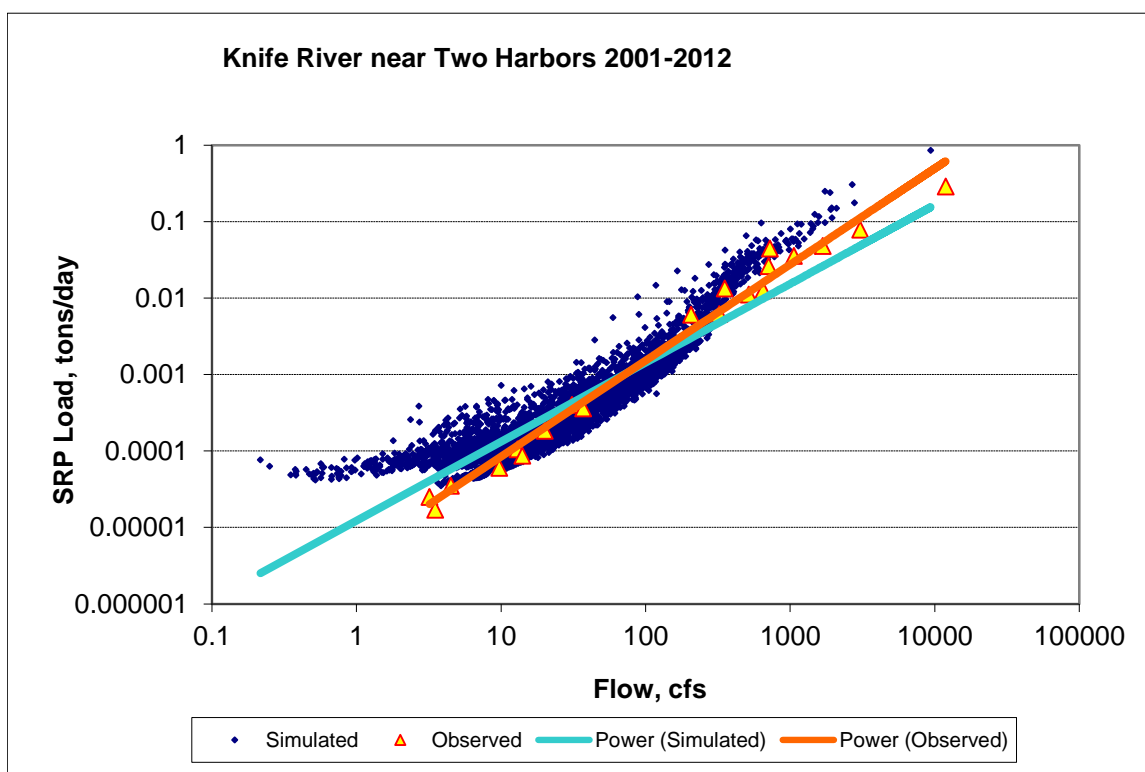


**Figure 164. Residual (Simulated - Observed) vs. Flow Nitrite+ Nitrate Nitrogen (NOx) at Knife River near Two Harbors**

## Soluble Reactive Phosphorus (SRP)

**Table 32. Soluble Reactive Phosphorus (SRP) statistics**

Count	20
Concentration Average Error	97.92%
Concentration Median Error	44.24%
Load Ave Error	149.57%
Load Median Error	0.10%
Paired t concentration	0.01
Paired t load	0.14



**Figure 165. Power plot of simulated and observed Soluble Reactive Phosphorus (SRP) load vs flow at Knife River near Two Harbors (calibration period)**

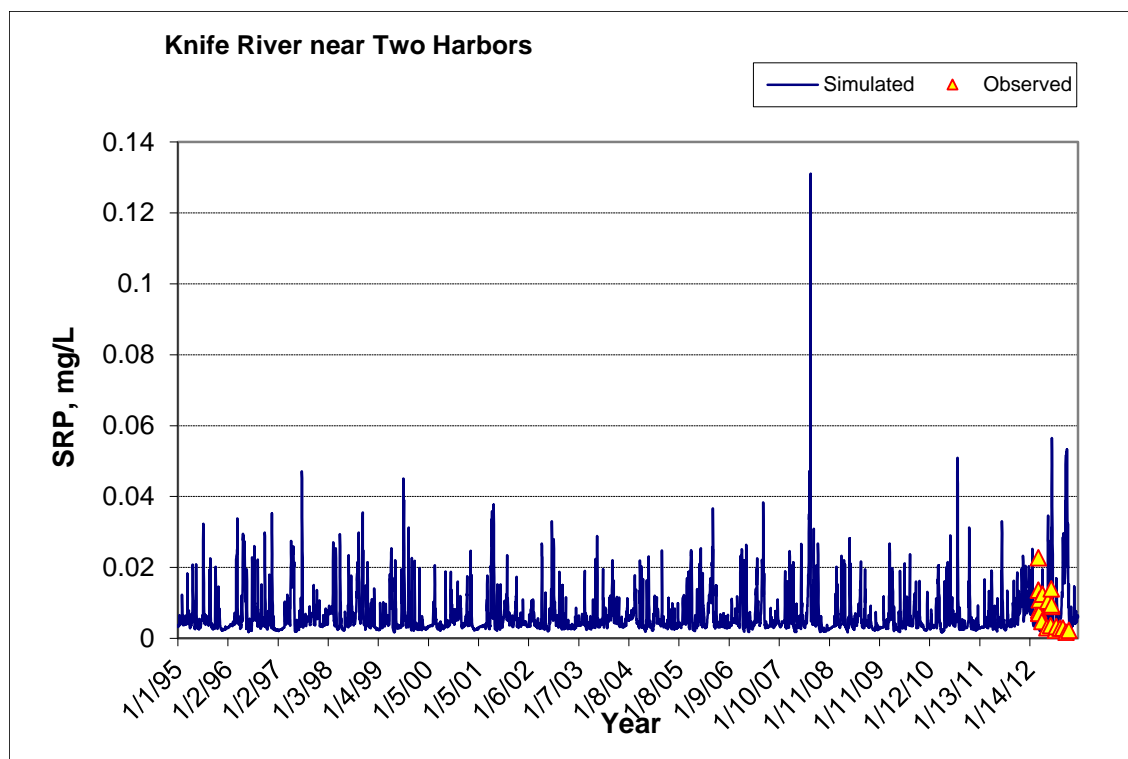


Figure 166. Time series of observed and simulated Soluble Reactive Phosphorus (SRP) concentration at Knife River near Two Harbors (calibration period)

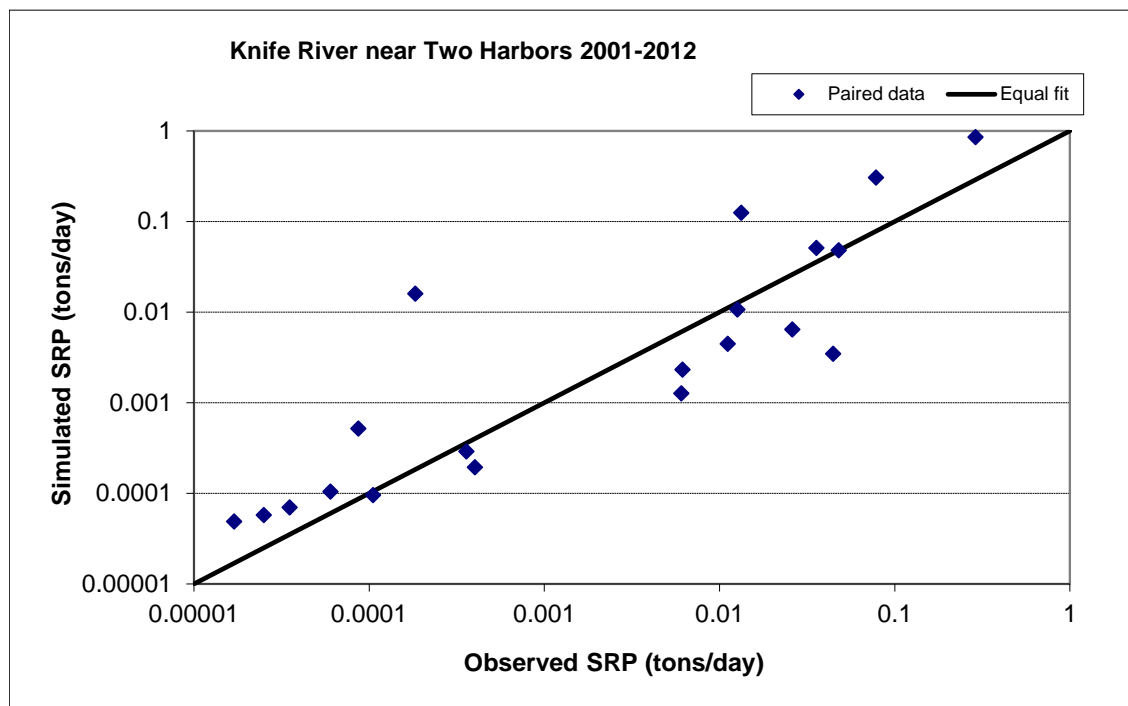
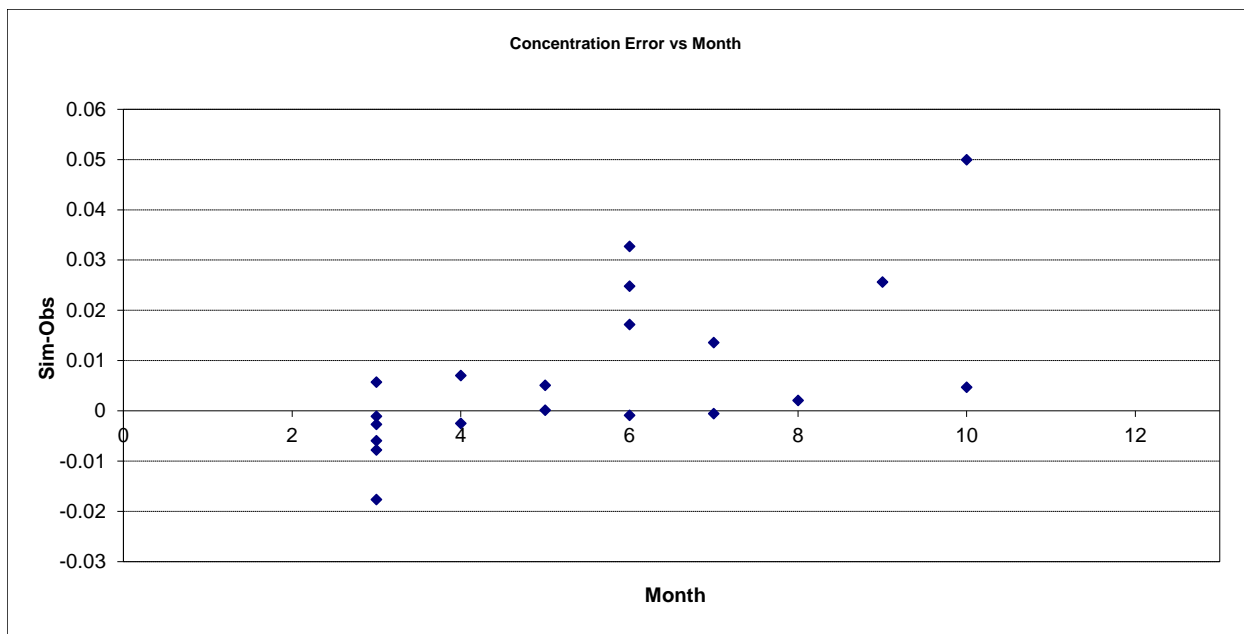
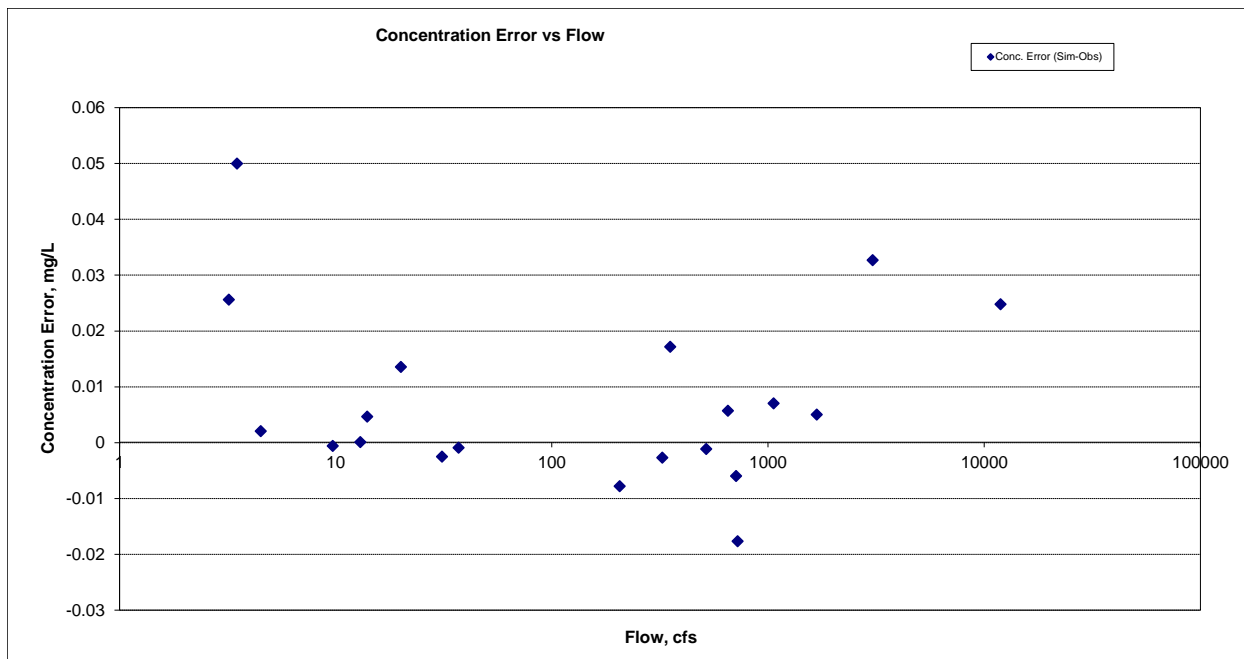


Figure 167. Paired simulated vs. observed Soluble Reactive Phosphorus (SRP) load at Knife River near Two Harbors (calibration period)



**Figure 168. Residual (Simulated - Observed) vs. Month Soluble Reactive Phosphorus (SRP) at Knife River near Two Harbors**

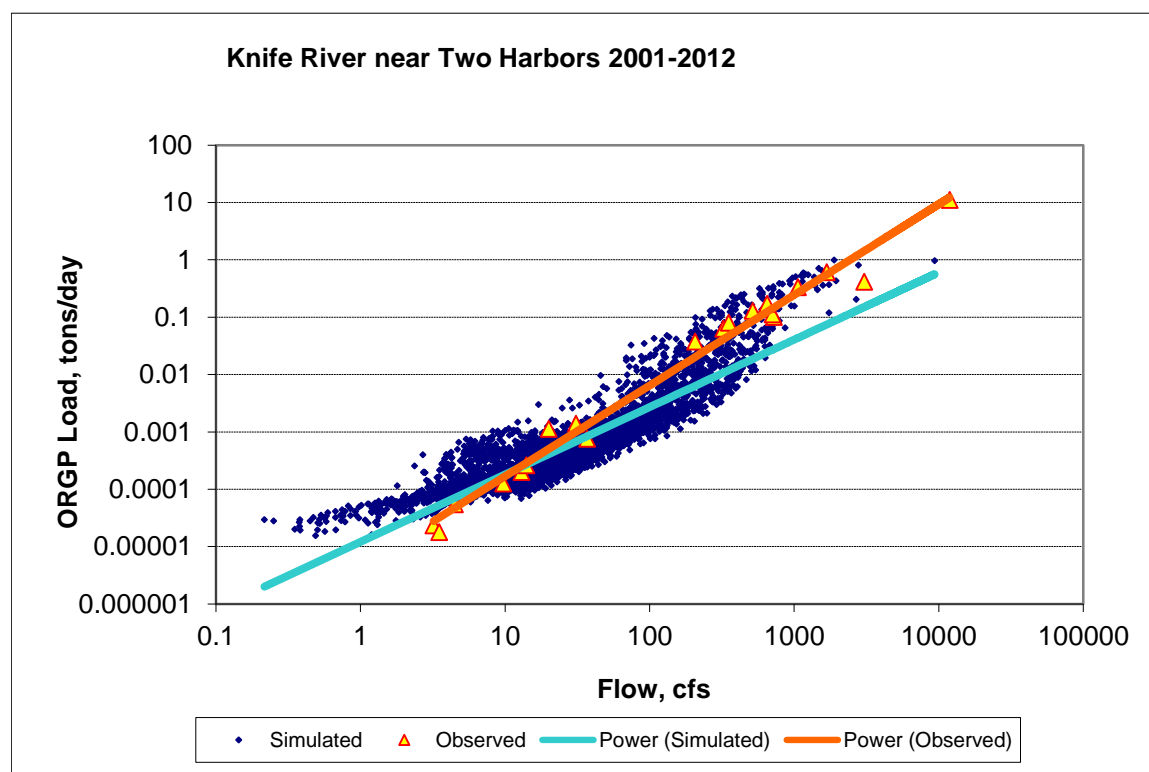


**Figure 169. Residual (Simulated - Observed) vs. Flow Soluble Reactive Phosphorus (SRP) at Knife River near Two Harbors**

## Organic Phosphorus (OrgP)

**Table 33. Organic Phosphorus (OrgP) statistics**

Count	20
Concentration Average Error	-13.25%
Concentration Median Error	-2.48%
Load Ave Error	-75.60%
Load Median Error	-0.10%
Paired t concentration	0.60
Paired t load	0.18



**Figure 170. Power plot of simulated and observed Organic Phosphorus (OrgP) load vs flow at Knife River near Two Harbors (calibration period)**

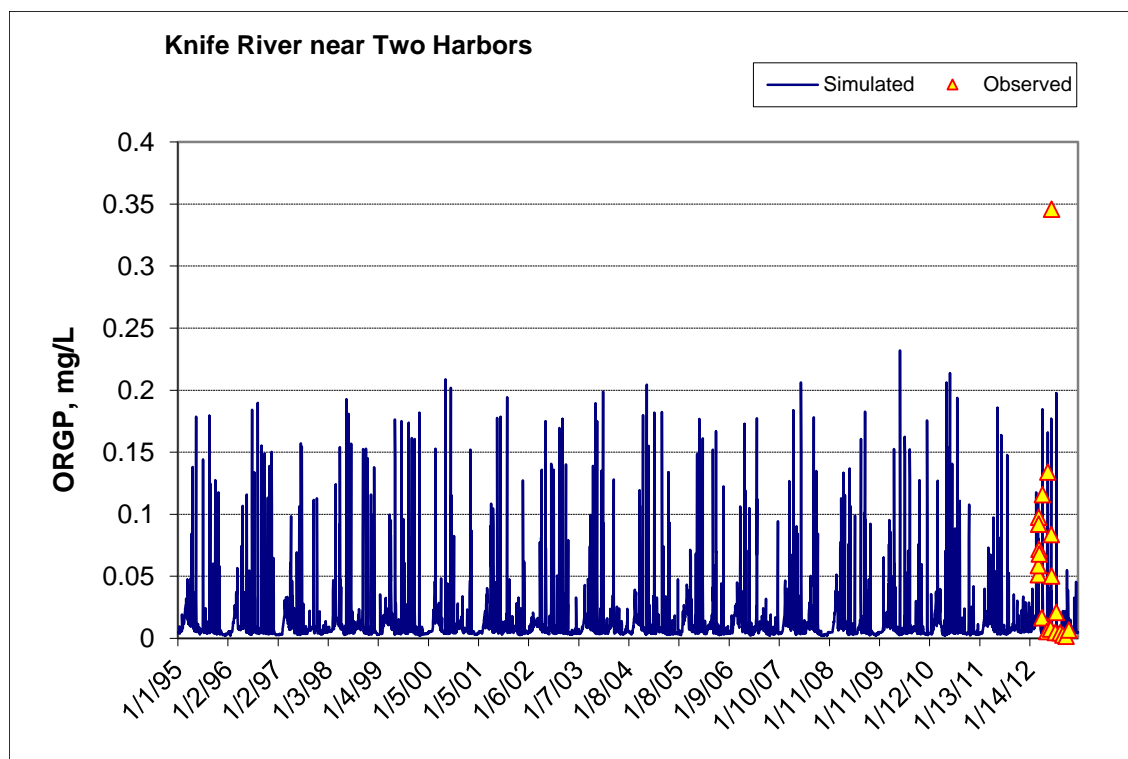


Figure 171. Time series of observed and simulated Organic Phosphorus (OrgP) concentration at Knife River near Two Harbors (calibration period)

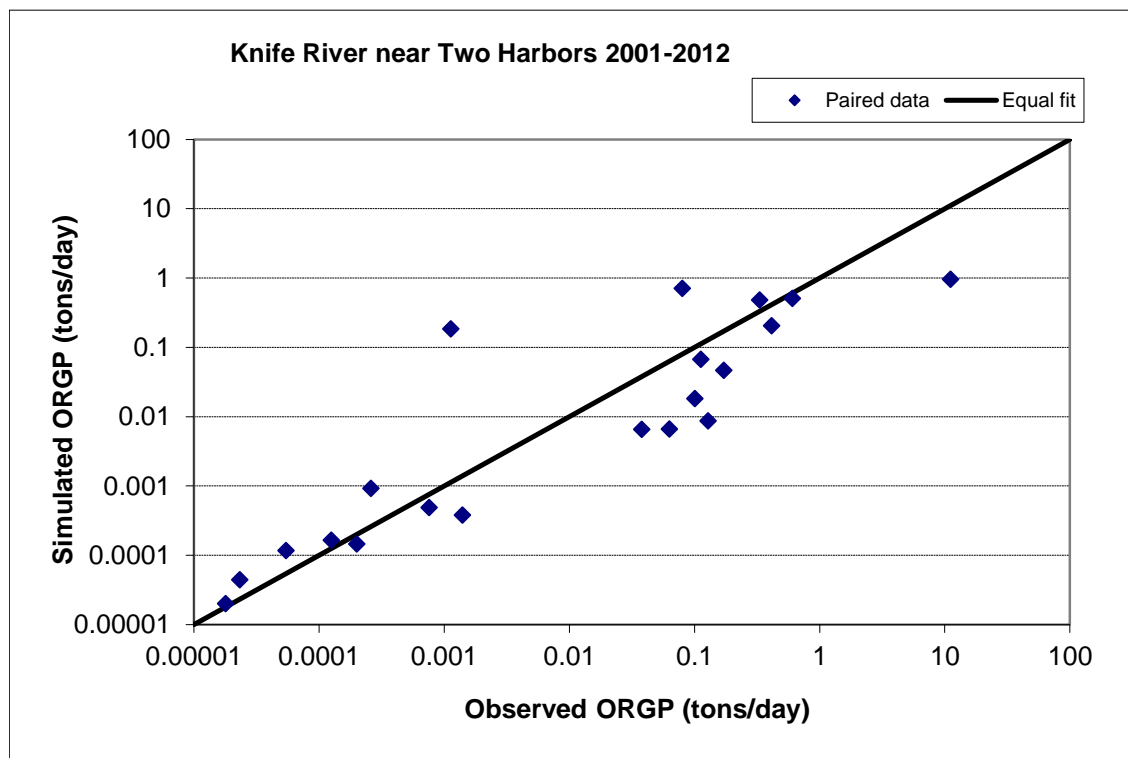


Figure 172. Paired simulated vs. observed Organic Phosphorus (OrgP) load at Knife River near Two Harbors (calibration period)

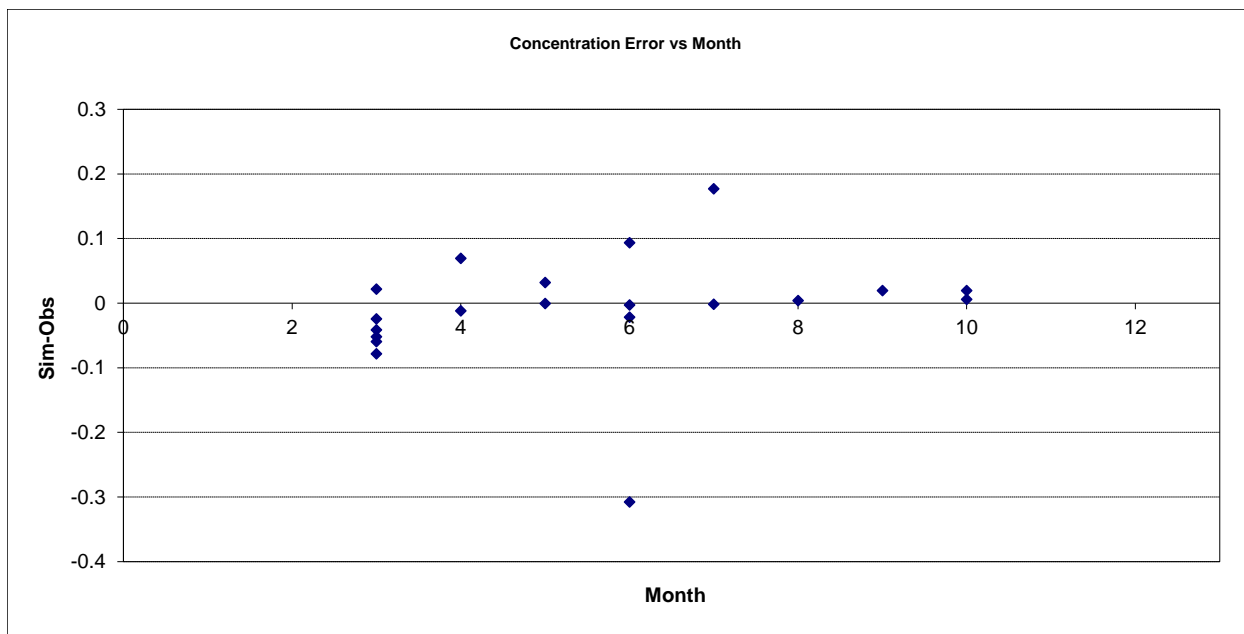


Figure 173. Residual (Simulated - Observed) vs. Month Organic Phosphorus (OrgP) at Knife River near Two Harbors

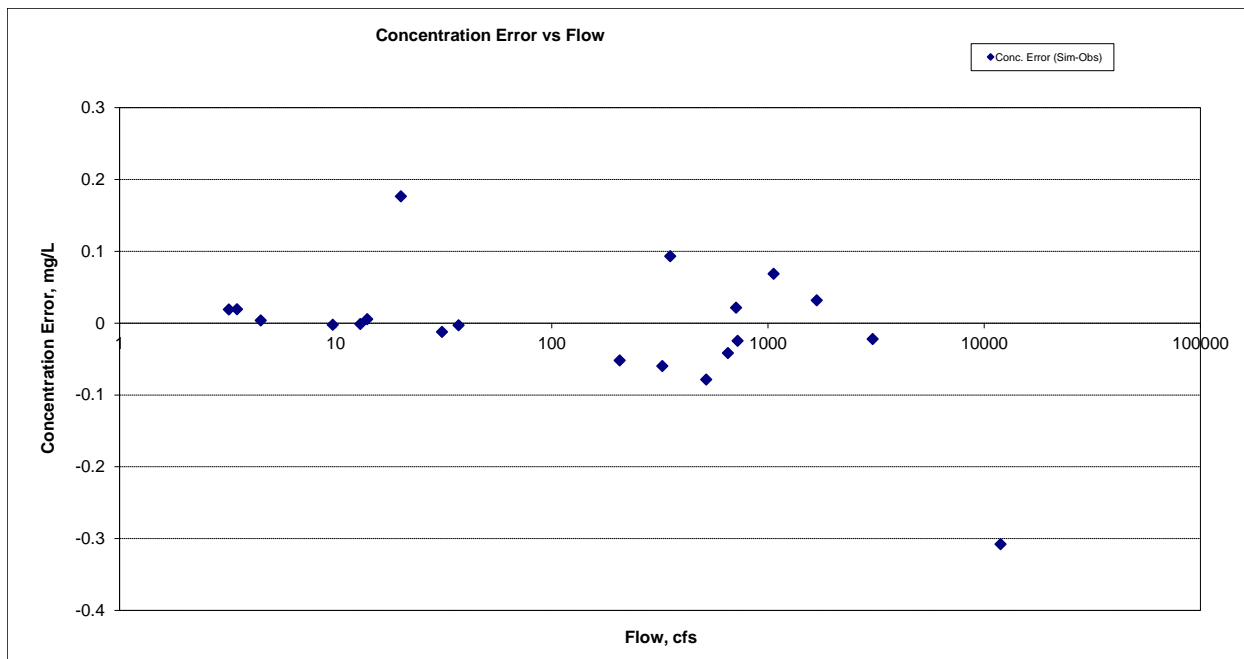
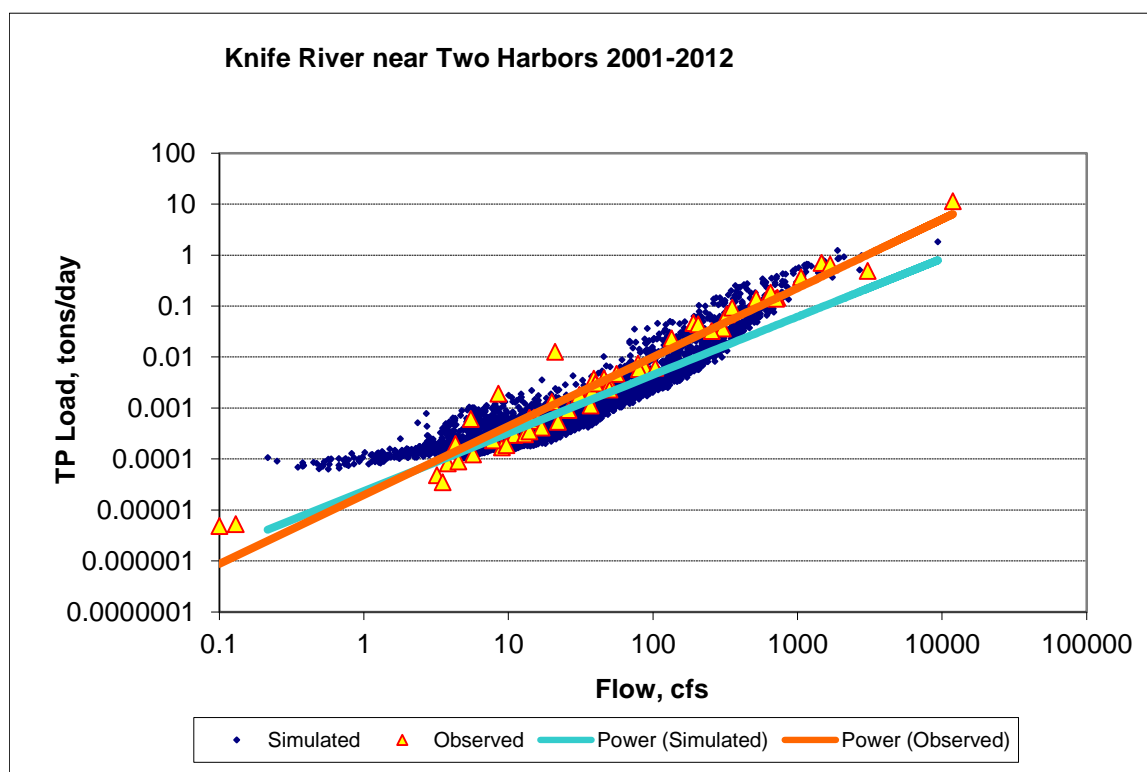


Figure 174. Residual (Simulated - Observed) vs. Flow Organic Phosphorus (OrgP) at Knife River near Two Harbors

## Total Phosphorus (TP)

**Table 34. Total Phosphorus (TP) statistics**

Count	57	21
Concentration Average Error	-63.06%	-17.79%
Concentration Median Error	-24.45%	-14.98%
Load Ave Error	3.31%	-59.57%
Load Median Error	-4.27%	-0.18%
Paired t concentration	0.06	0.55
Paired t load	0.65	0.24



**Figure 175. Power plot of simulated and observed Total Phosphorus (TP) load vs flow at Knife River near Two Harbors (calibration period)**



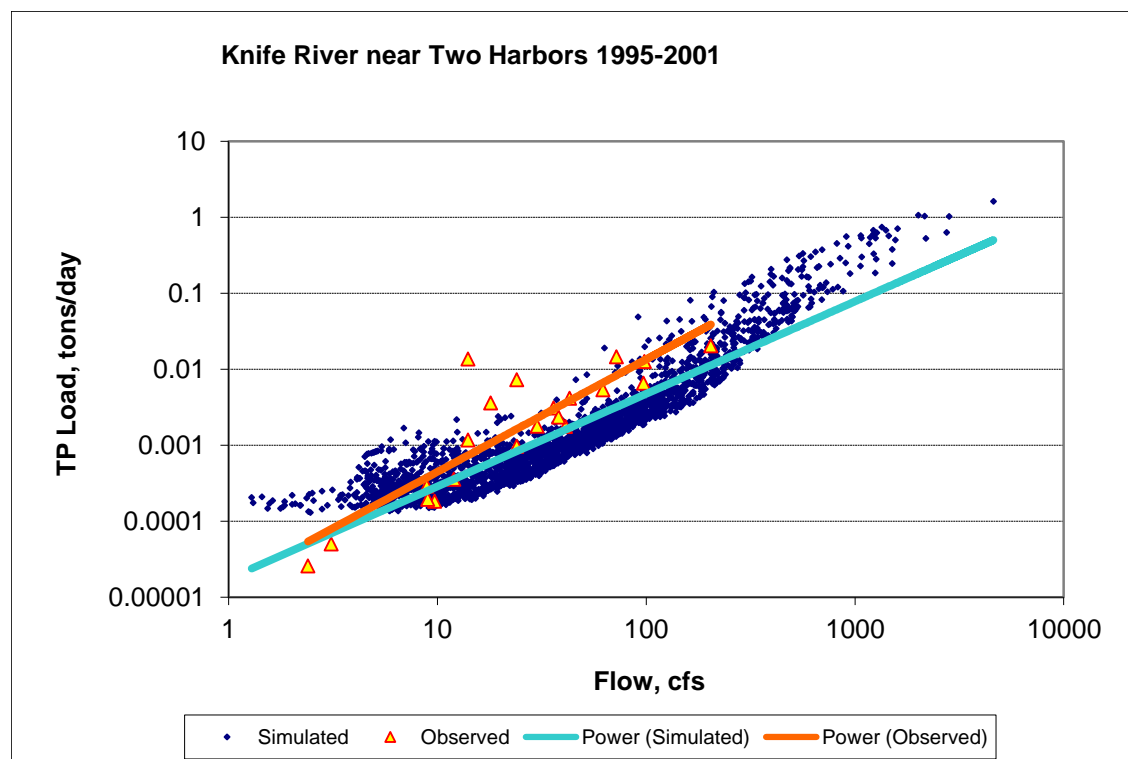


Figure 176. Power plot of simulated and observed Total Phosphorus (TP) load vs flow at Knife River near Two Harbors (validation period)

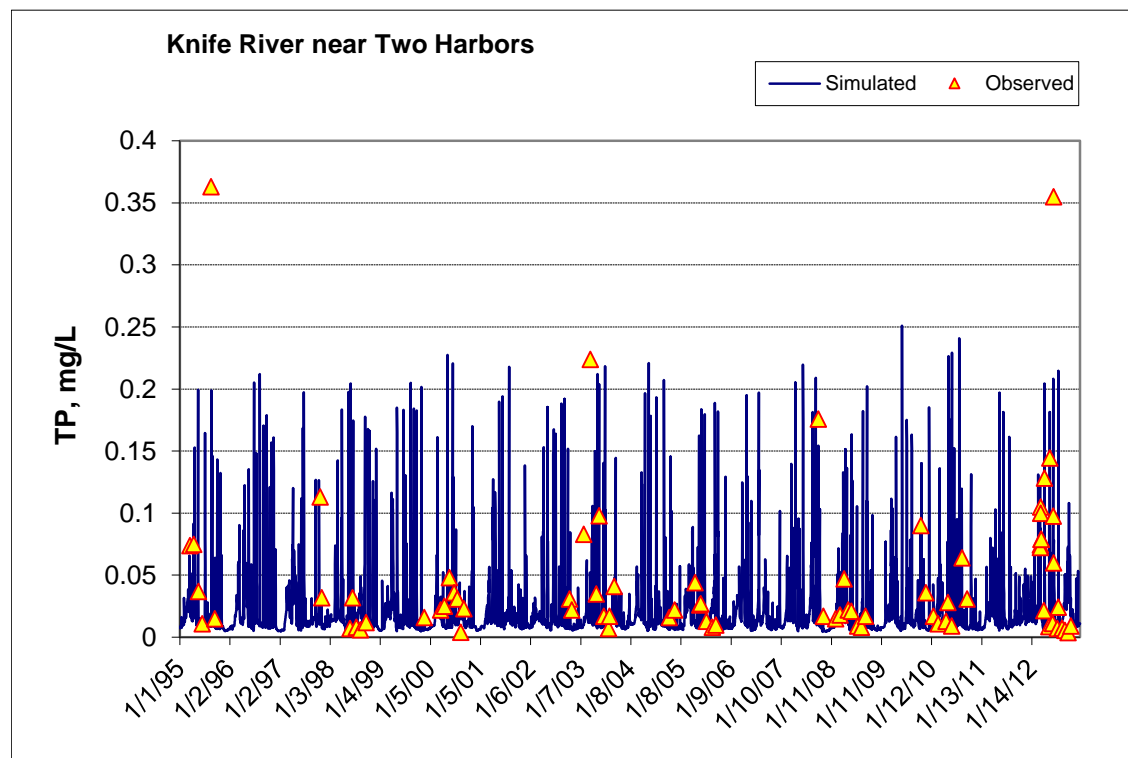


Figure 177. Time series of observed and simulated Total Phosphorus (TP) concentration at Knife River near Two Harbors (calibration period)

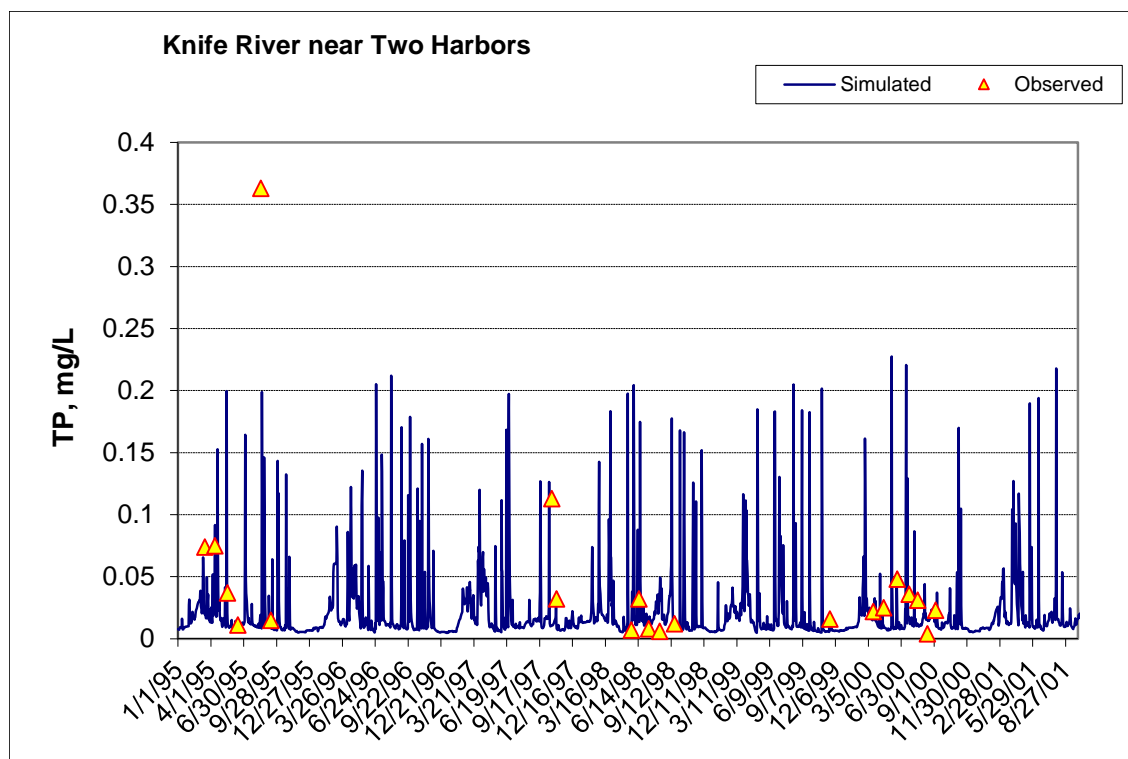


Figure 178. Time series of observed and simulated Total Phosphorus (TP) concentration at Knife River near Two Harbors (validation period)

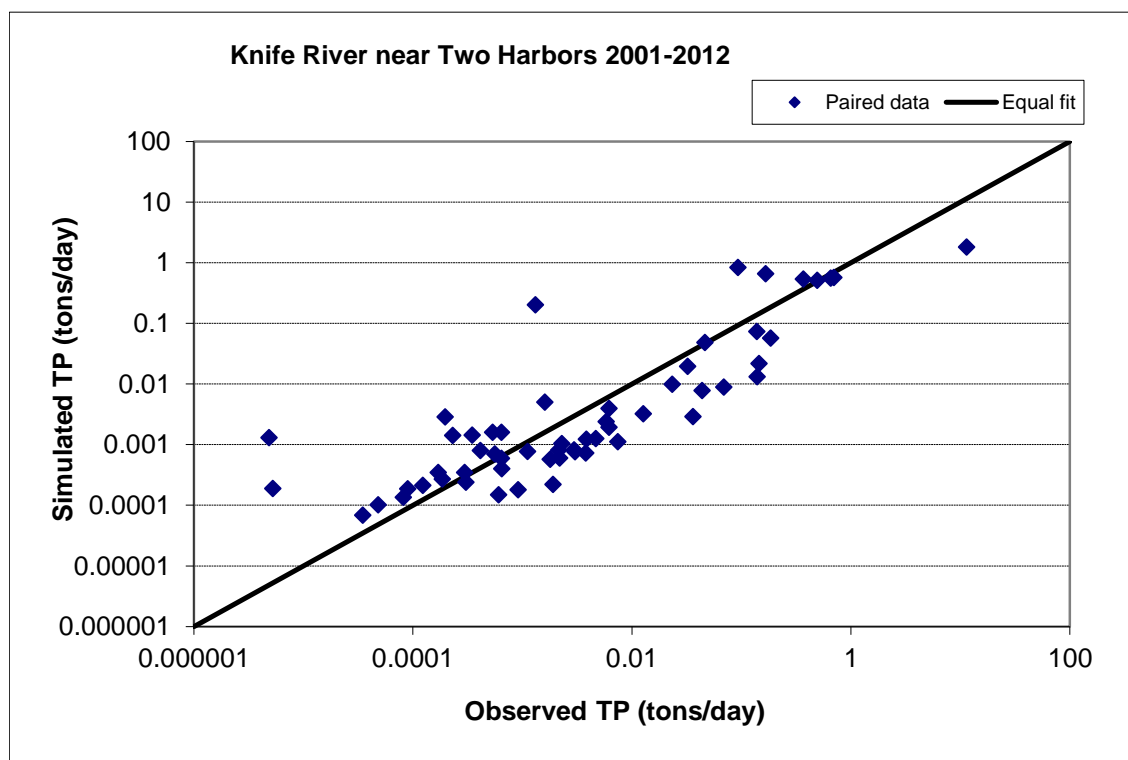


Figure 179. Paired simulated vs. observed Total Phosphorus (TP) load at Knife River near Two Harbors (calibration period)

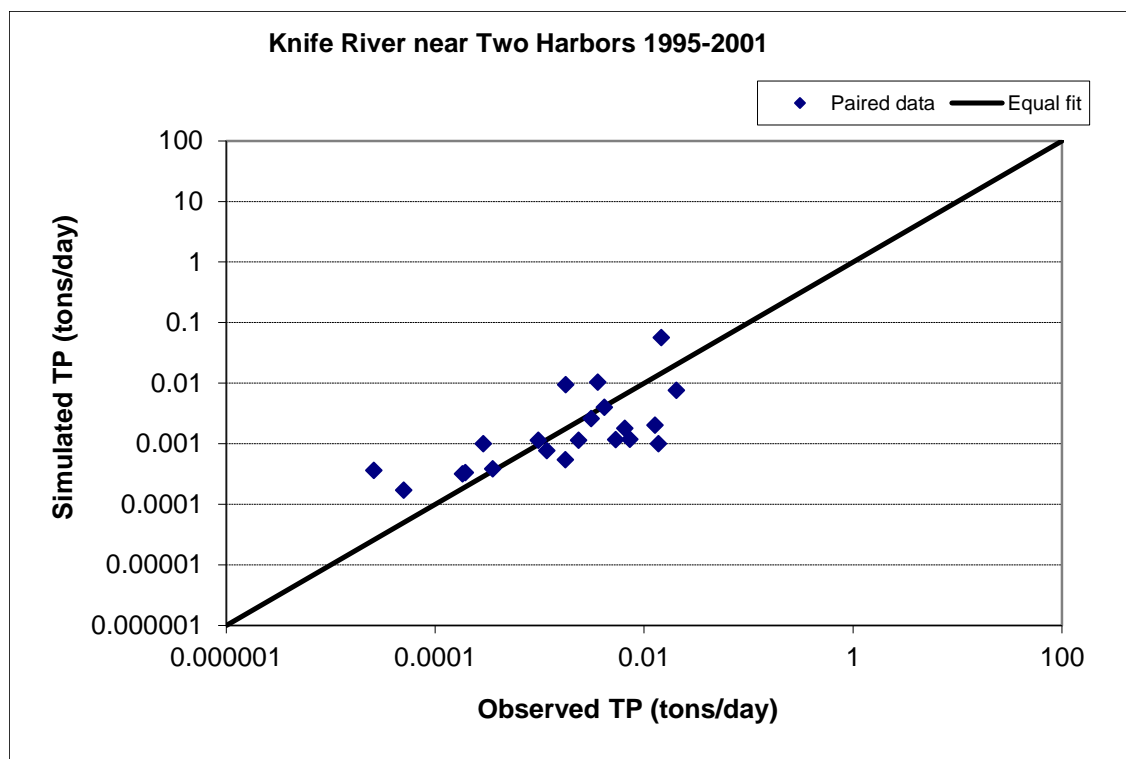


Figure 180. Paired simulated vs. observed Total Phosphorus (TP) load at Knife River near Two Harbors (validation period)

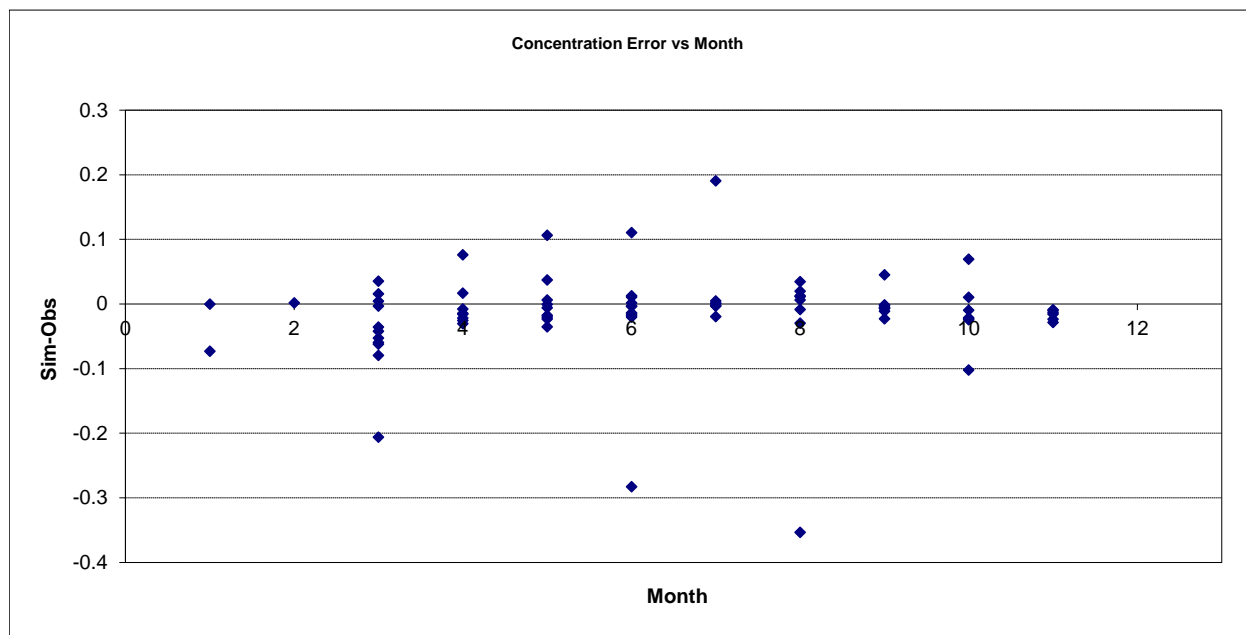
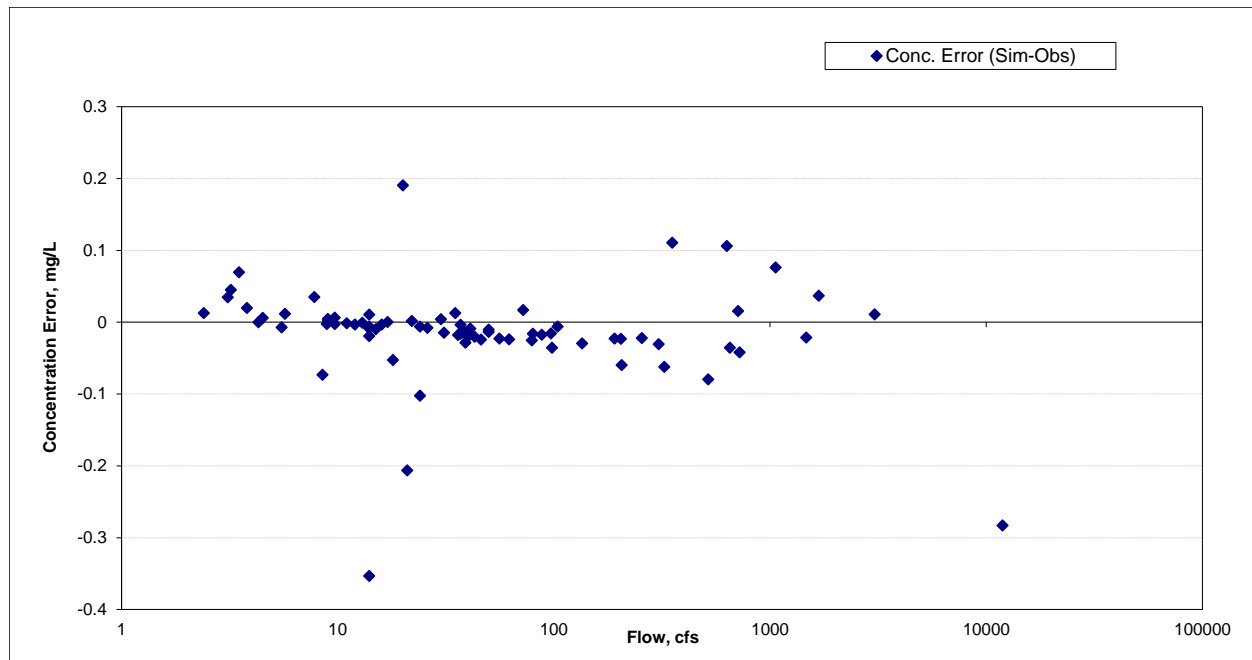


Figure 181. Residual (Simulated - Observed) vs. Month Total Phosphorus (TP) at Knife River near Two Harbors



**Figure 182. Residual (Simulated - Observed) vs. Flow Total Phosphorus (TP) at Knife River near Two Harbors**

## Split Rock River (EQUIS S000-263 and S006-235)

### Total Suspended Solids (TSS)

Table 35. Total Suspended Solids (TSS) statistics

Count	29
Concentration Average Error	-40.23%
Concentration Median Error	-2.71%
Load Average Error	-36.73%
Load Median Error	-0.08%
Paired t concentration	0.27
Paired t load	0.40

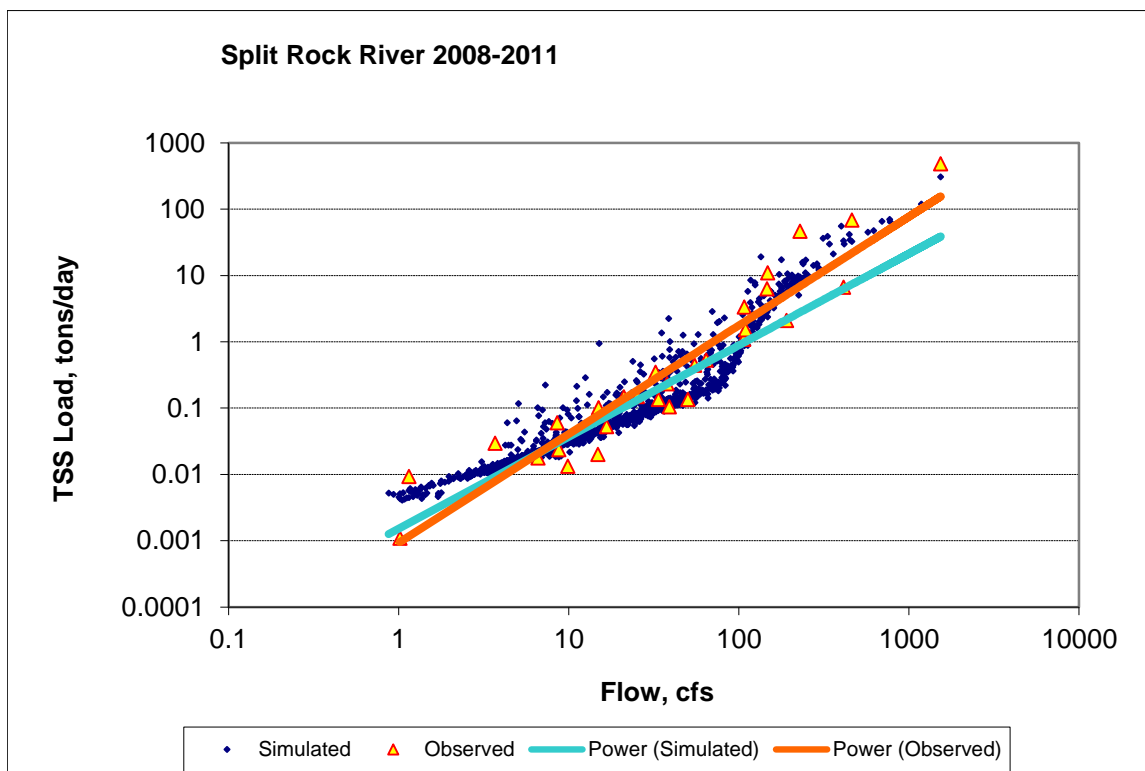


Figure 183. Power plot of simulated and observed Total Suspended Solids (TSS) load vs flow at Split Rock River

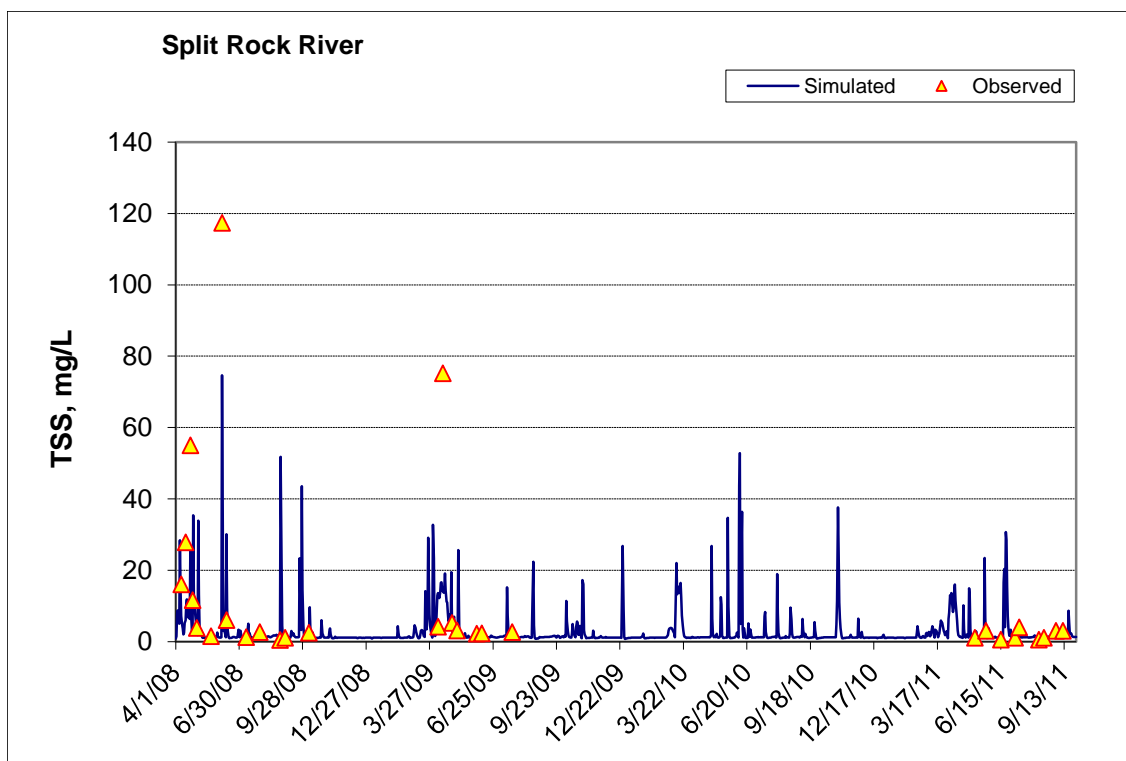


Figure 184. Time series of observed and simulated Total Suspended Solids (TSS) concentration at Split Rock River

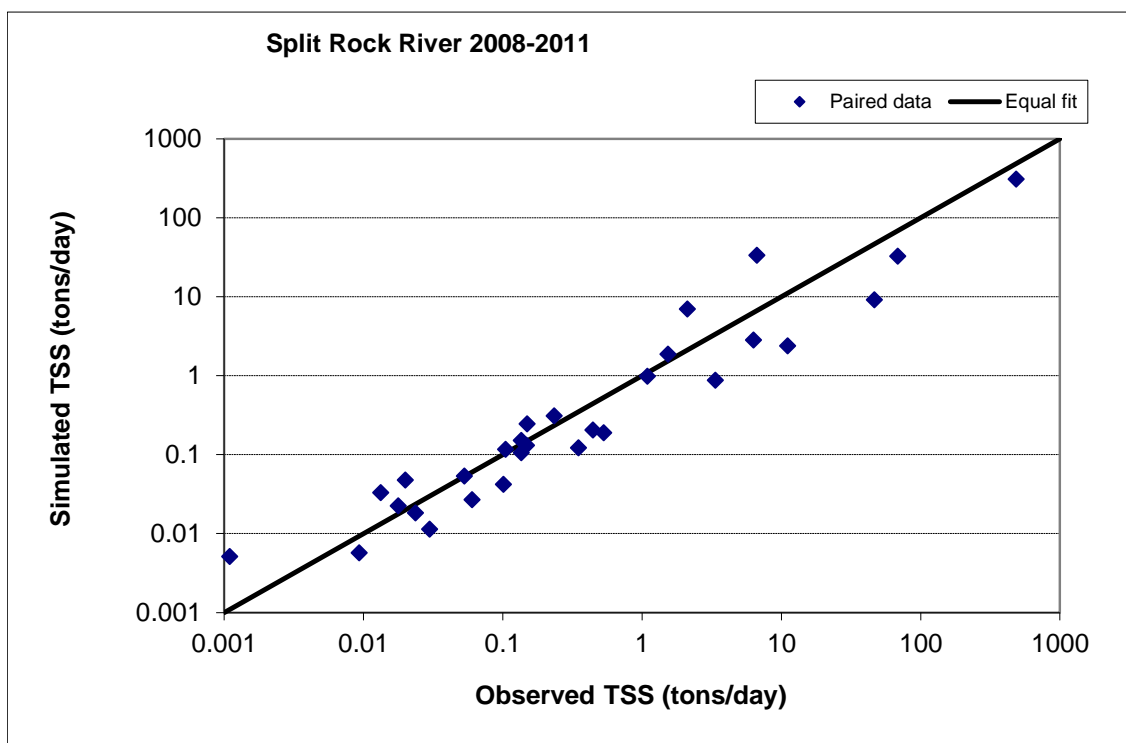
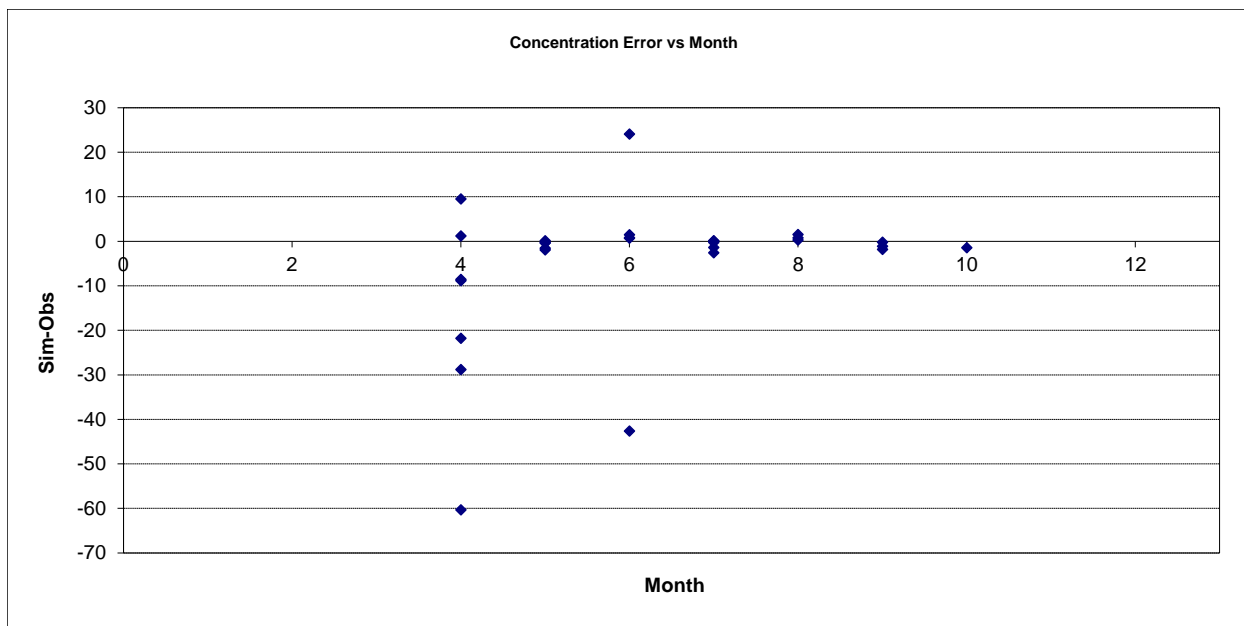
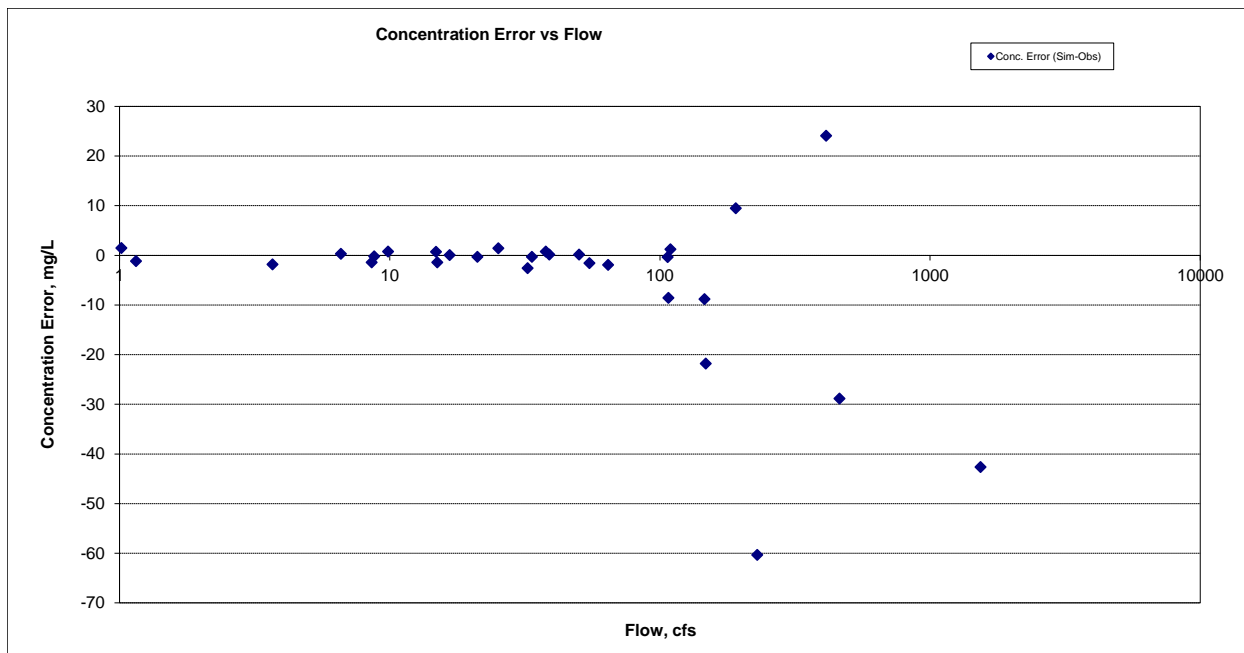


Figure 185. Paired simulated vs. observed Total Suspended Solids (TSS) load at Split Rock River



**Figure 186. Residual (Simulated - Observed) vs. Month Total Suspended Solids (TSS) at Split Rock River**

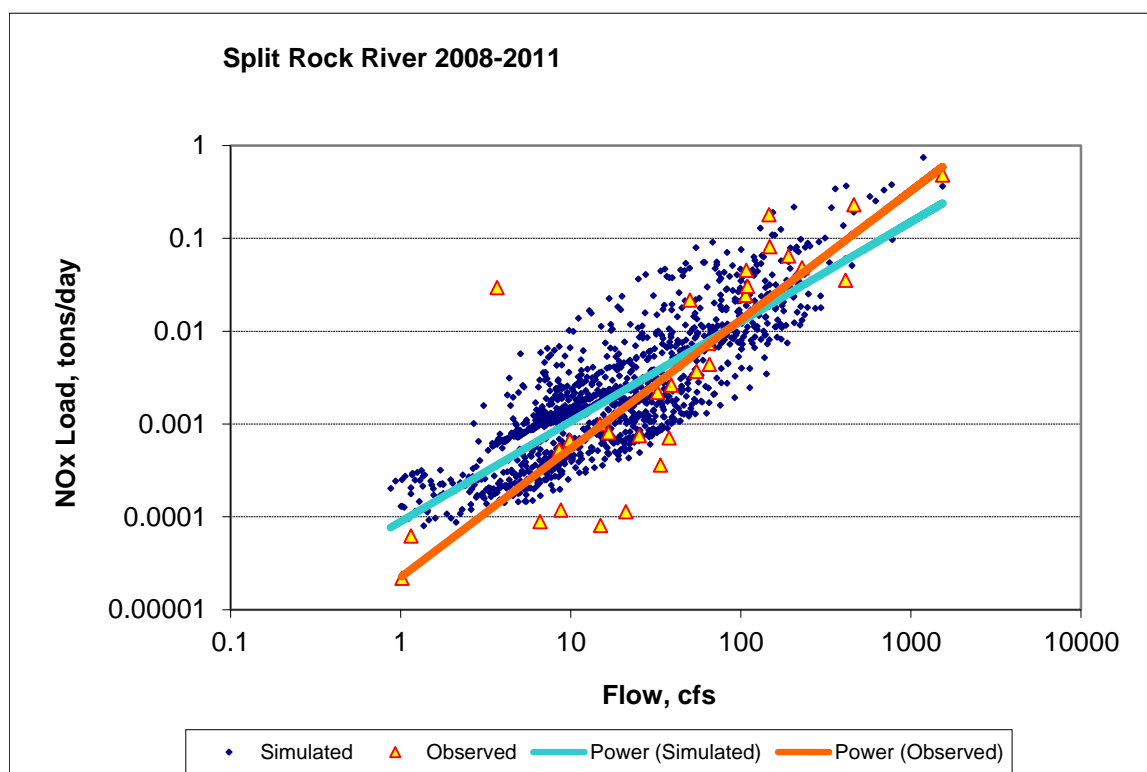


**Figure 187. Residual (Simulated - Observed) vs. Flow Total Suspended Solids (TSS) at Split Rock River**

## Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>)

**Table 36. Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) statistics**

Count	30
Concentration Average Error	-67.83%
Concentration Median Error	2.24%
Load Average Error	-35.33%
Load Median Error	0.21%
Paired t concentration	0.13
Paired t load	0.34



**Figure 188. Power plot of simulated and observed Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) load vs flow at Split Rock River**



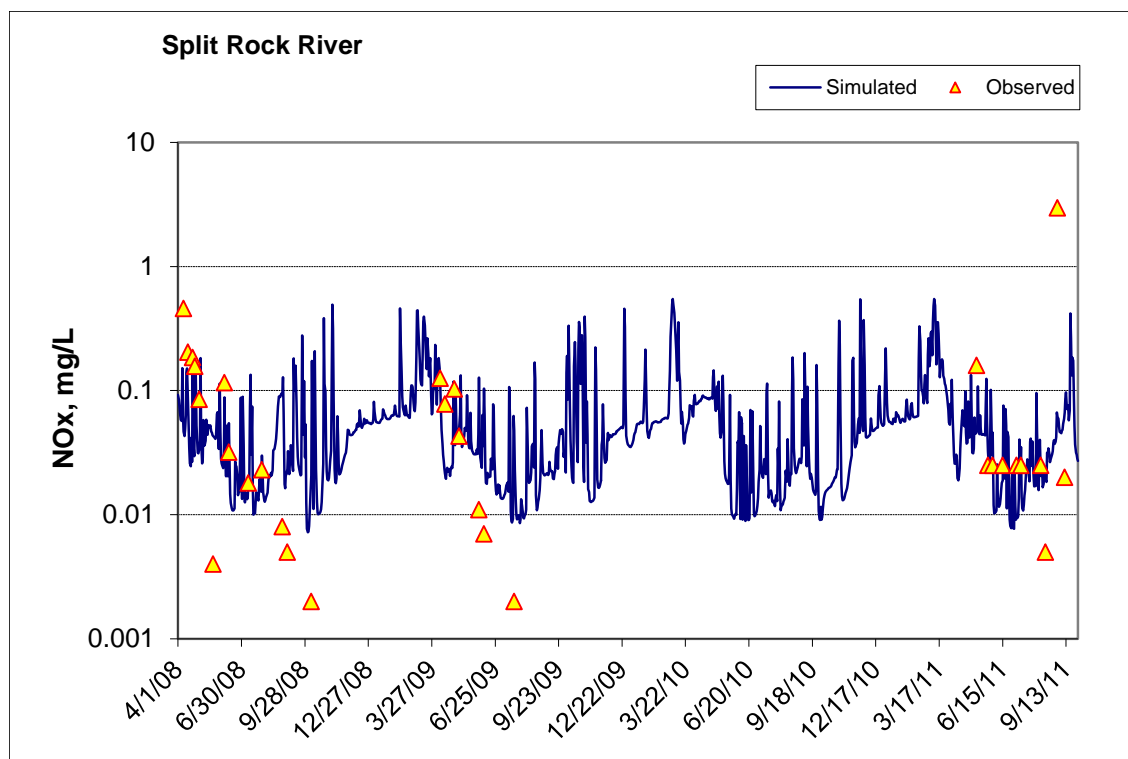


Figure 189. Time series of observed and simulated Nitrite+ Nitrate Nitrogen (NOx) concentration at Split Rock River

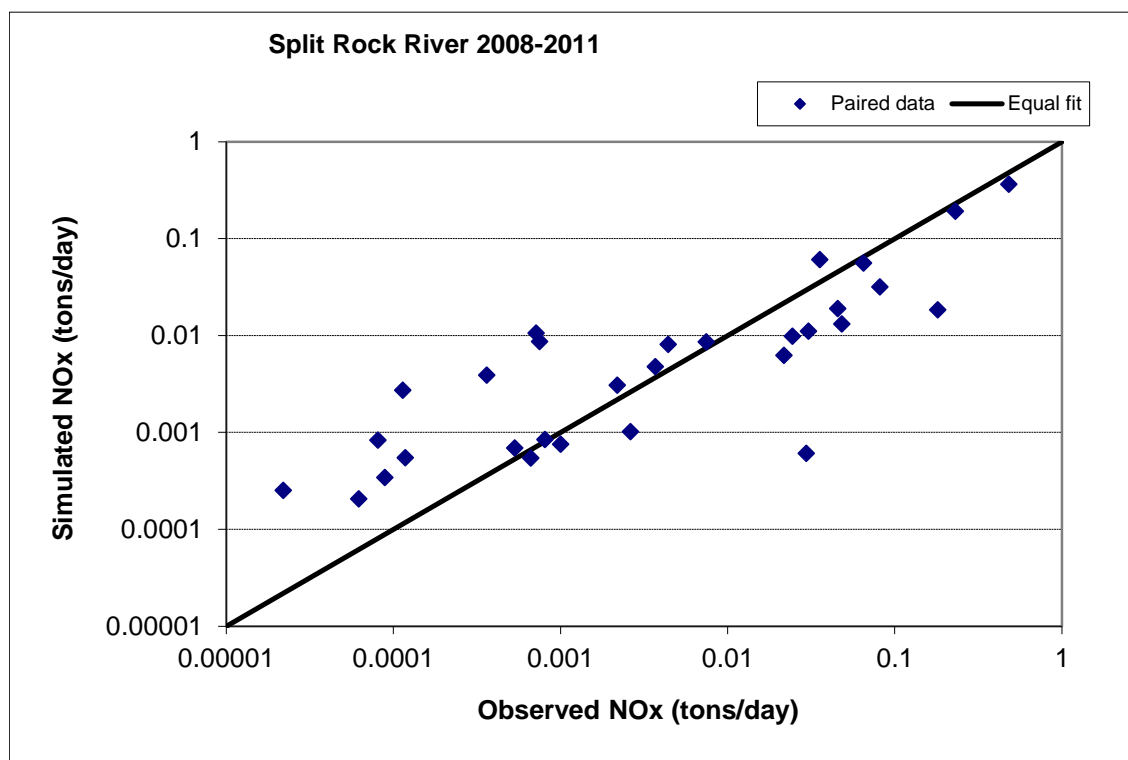
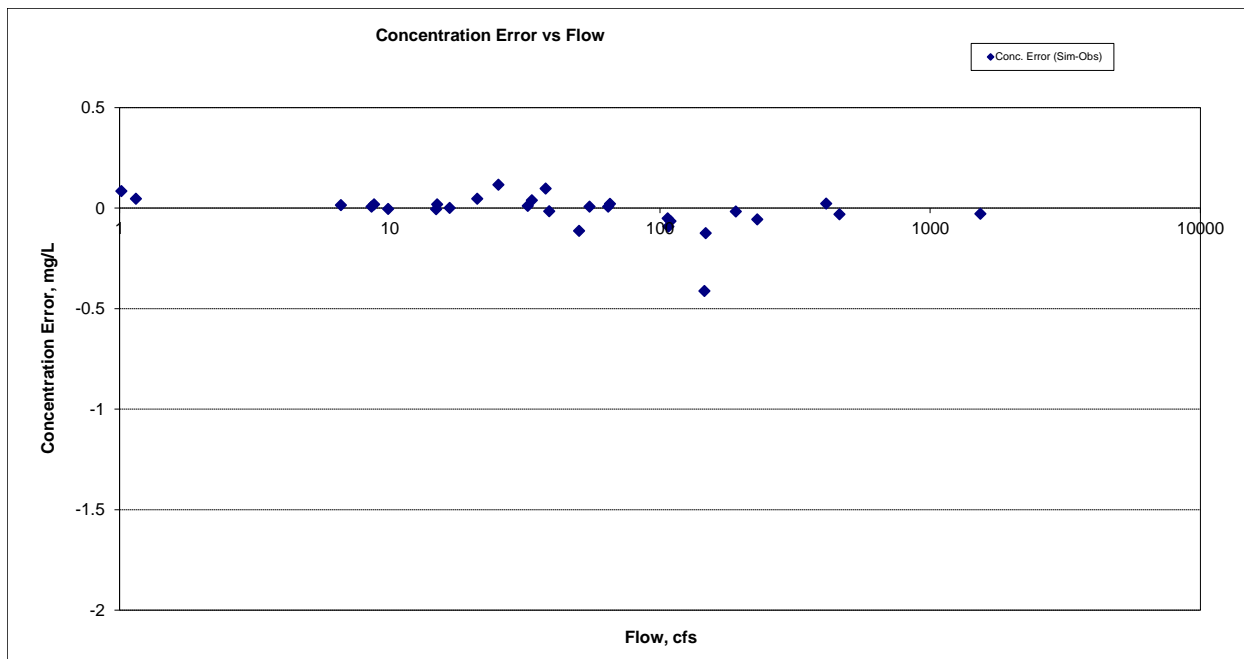


Figure 190. Paired simulated vs. observed Nitrite+ Nitrate Nitrogen (NOx) load at Split Rock River



**Figure 191. Residual (Simulated - Observed) vs. Month Nitrite+ Nitrate Nitrogen (NOx) at Split Rock River**

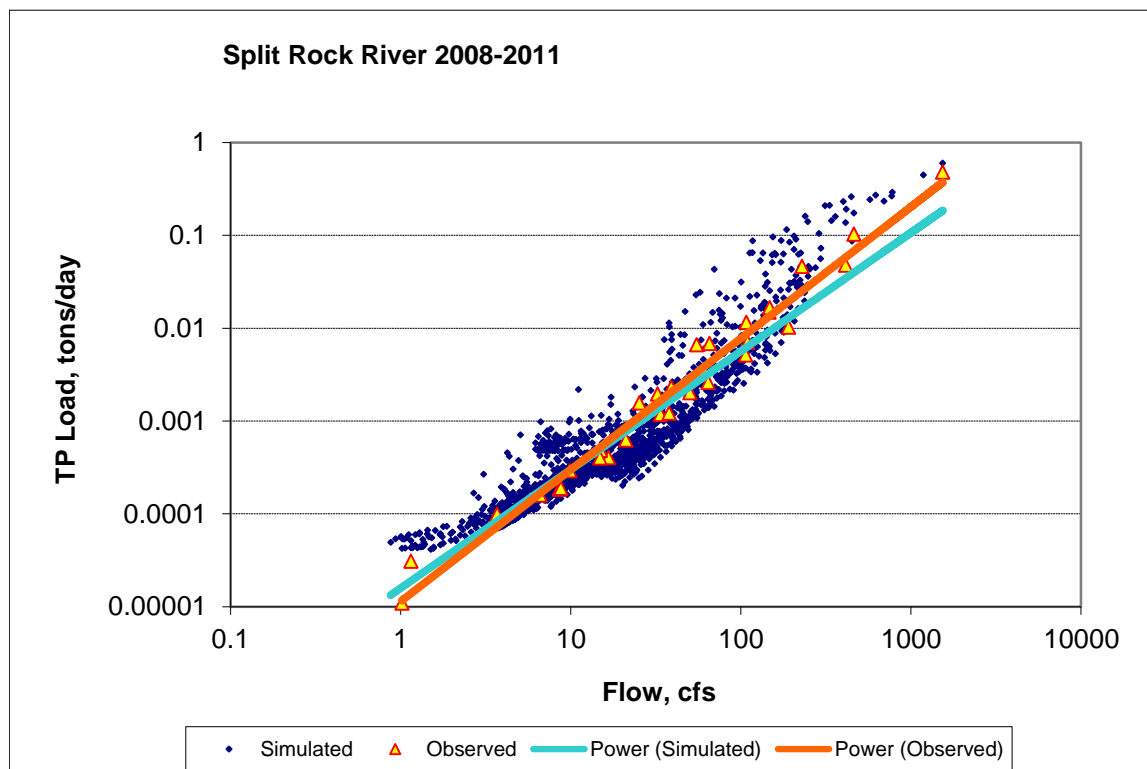


**Figure 192. Residual (Simulated - Observed) vs. Flow Nitrite+ Nitrate Nitrogen (NOx) at Split Rock River**

## Total Phosphorus (TP)

**Table 37. Total Phosphorus (TP) statistics**

Count	30
Concentration Average Error	21.01%
Concentration Median Error	-7.68%
Load Average Error	35.76%
Load Median Error	-0.35%
Paired t concentration	0.48
Paired t load	0.41



**Figure 193. Power plot of simulated and observed Total Phosphorus (TP) load vs flow at Split Rock River**

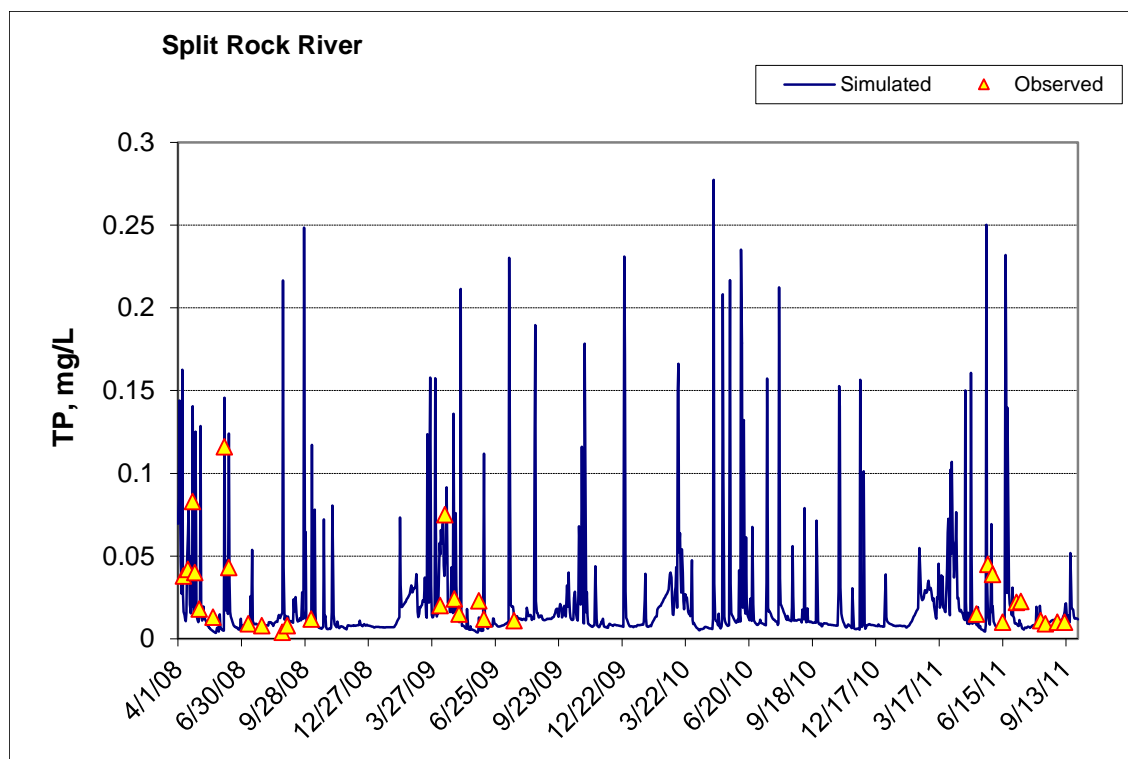


Figure 194. Time series of observed and simulated Total Phosphorus (TP) concentration at Split Rock River

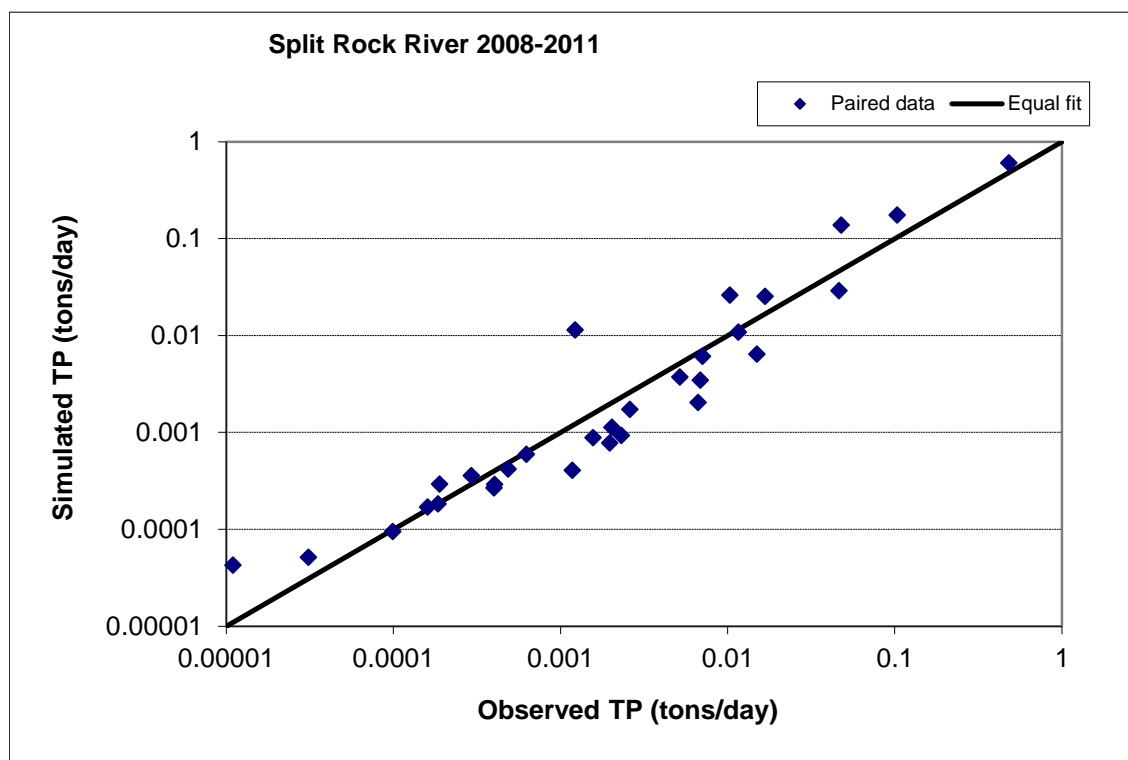


Figure 195. Paired simulated vs. observed Total Phosphorus (TP) load at Split Rock River

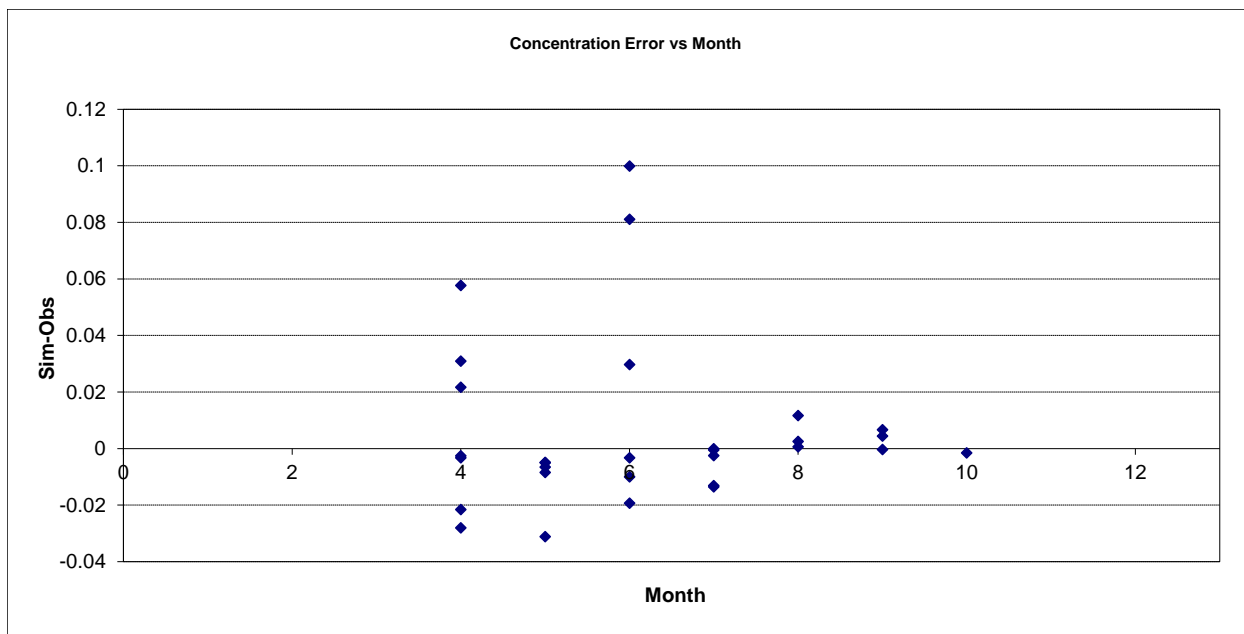


Figure 196. Residual (Simulated - Observed) vs. Month Total Phosphorus (TP) at Split Rock River

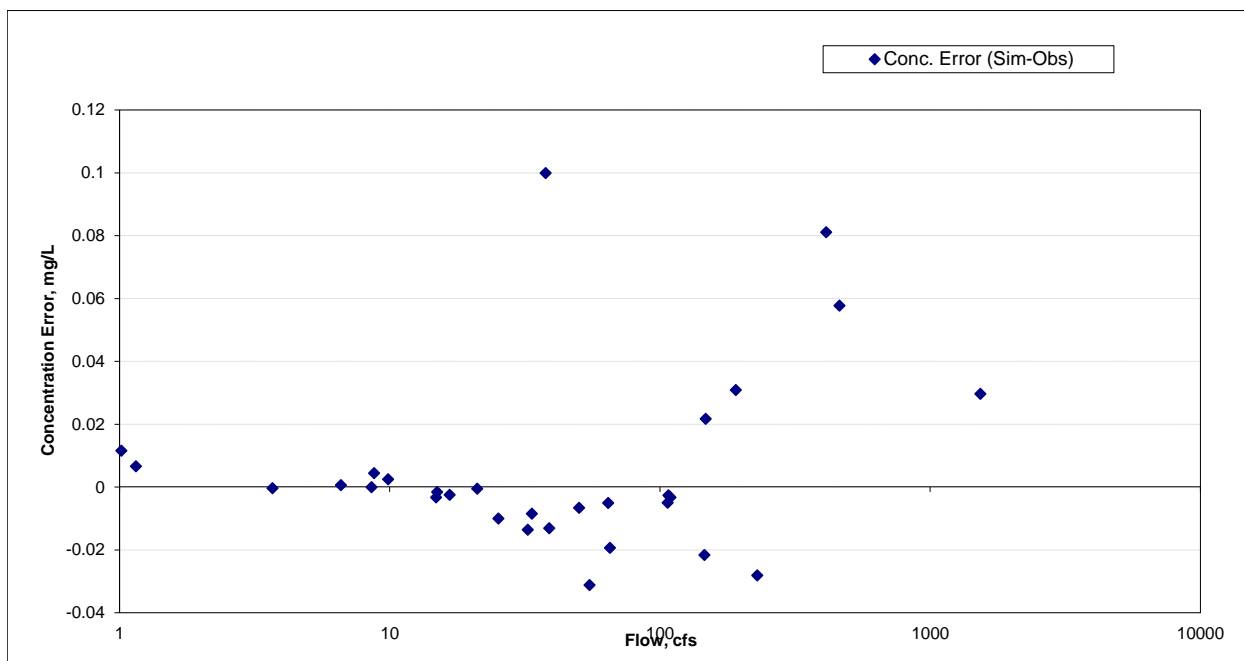


Figure 197. Residual (Simulated - Observed) vs. Flow Total Phosphorus (TP) at Split Rock River

## Gooseberry River (EQUIS S000-256)

### Total Suspended Solids (TSS)

Table 38. Total Suspended Solids (TSS) statistics

Count	30
Concentration Average Error	-83.40%
Concentration Median Error	-6.84%
Load Average Error	-84.34%
Load Median Error	-0.32%
Paired t concentration	0.02
Paired t load	0.13

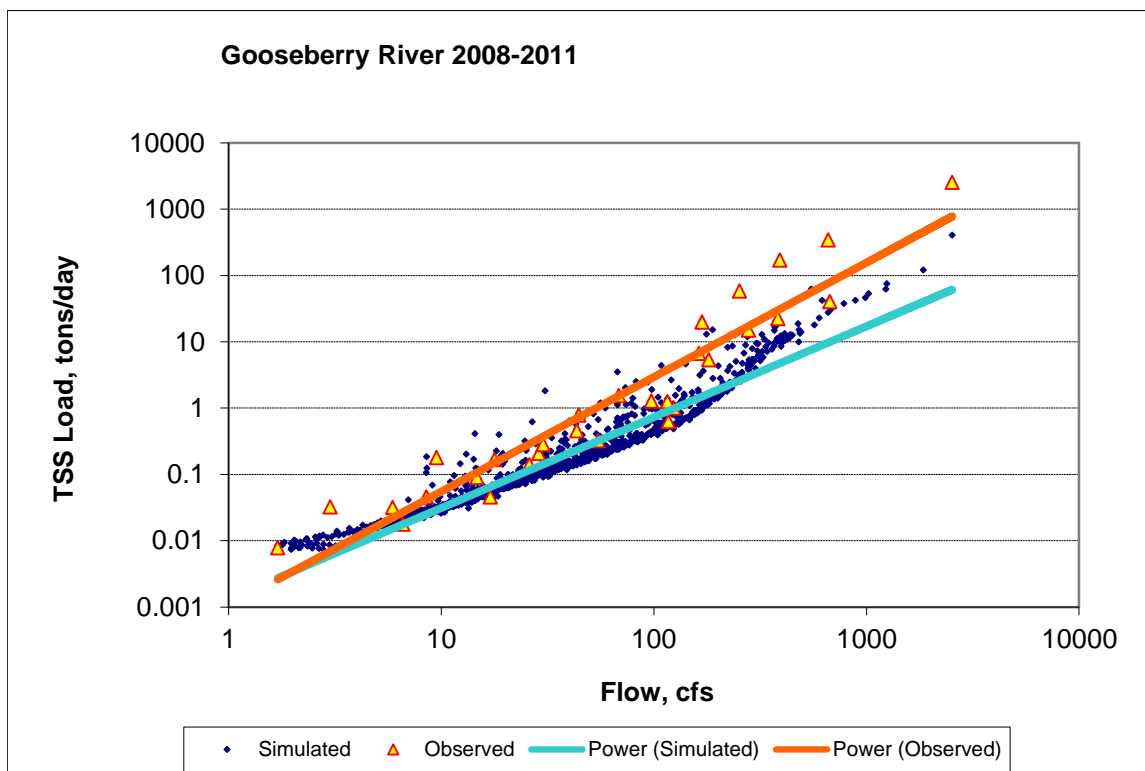
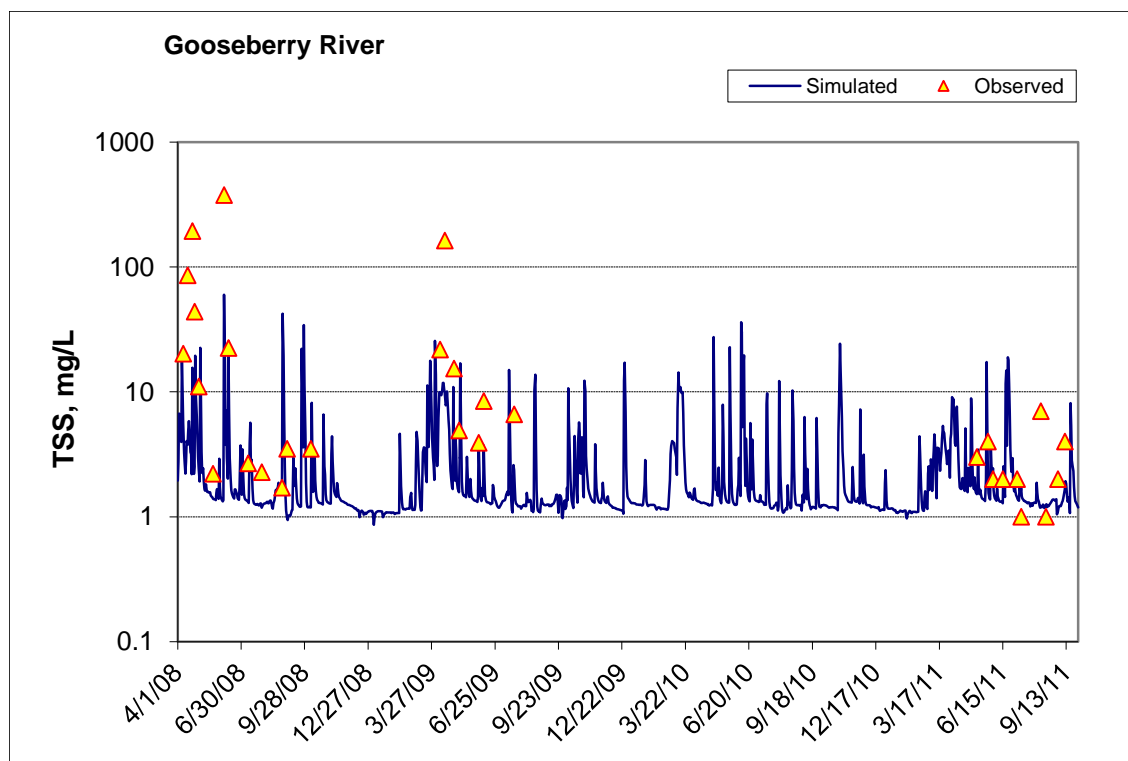
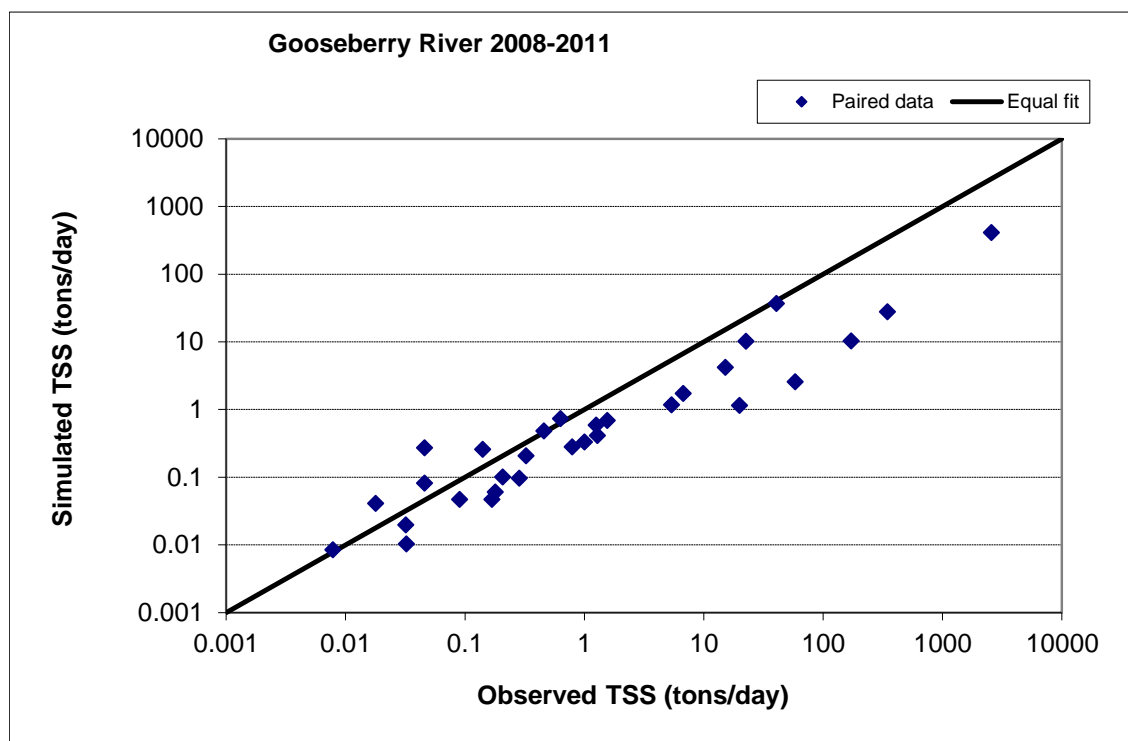


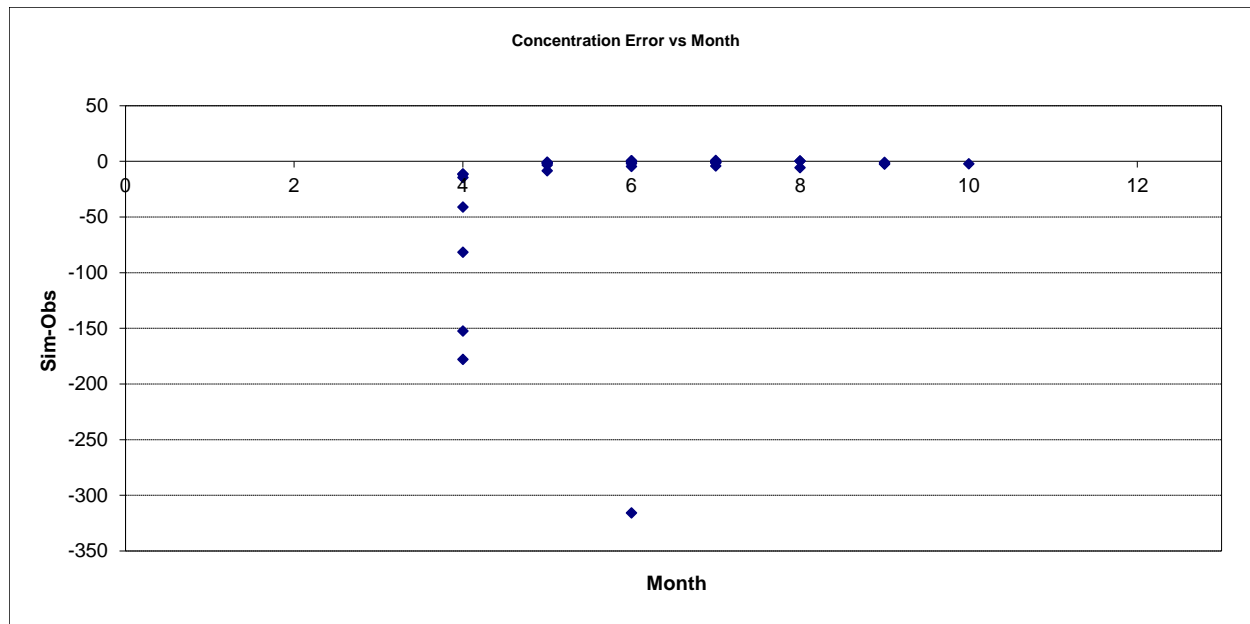
Figure 198. Power plot of simulated and observed Total Suspended Solids (TSS) load vs flow at Gooseberry River



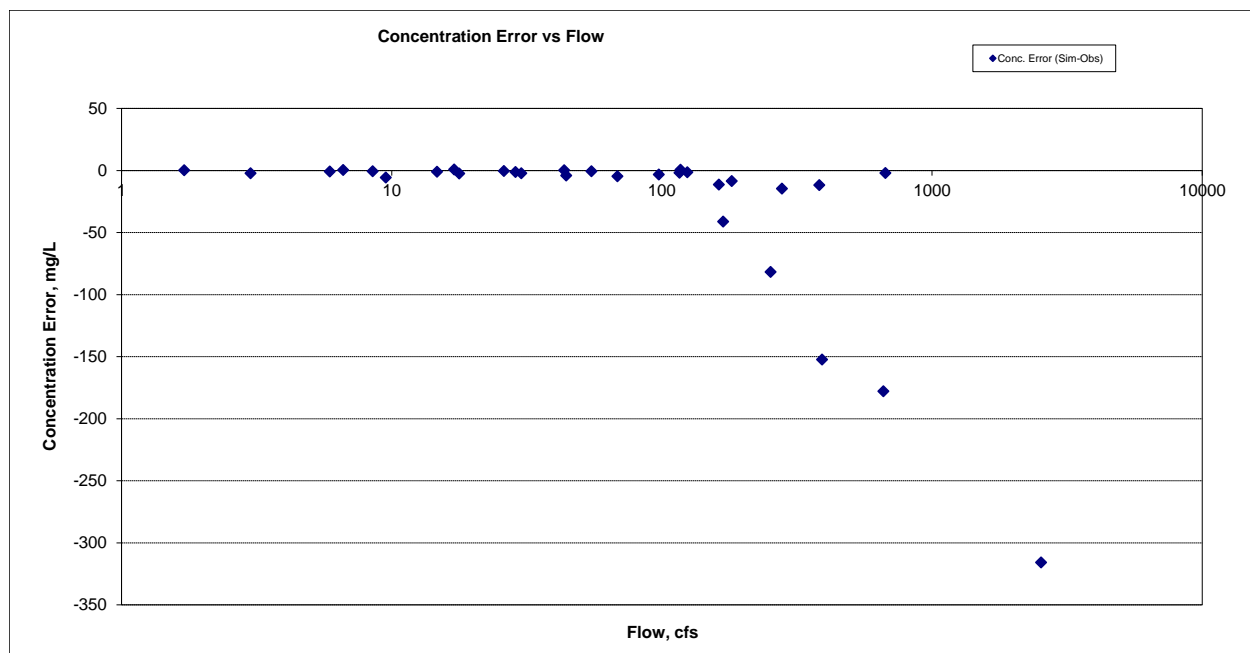
**Figure 199. Time series of observed and simulated Total Suspended Solids (TSS) concentration at Gooseberry River**



**Figure 200. Paired simulated vs. observed Total Suspended Solids (TSS) load at Gooseberry River**



**Figure 201. Residual (Simulated - Observed) vs. Month Total Suspended Solids (TSS) at Gooseberry River**



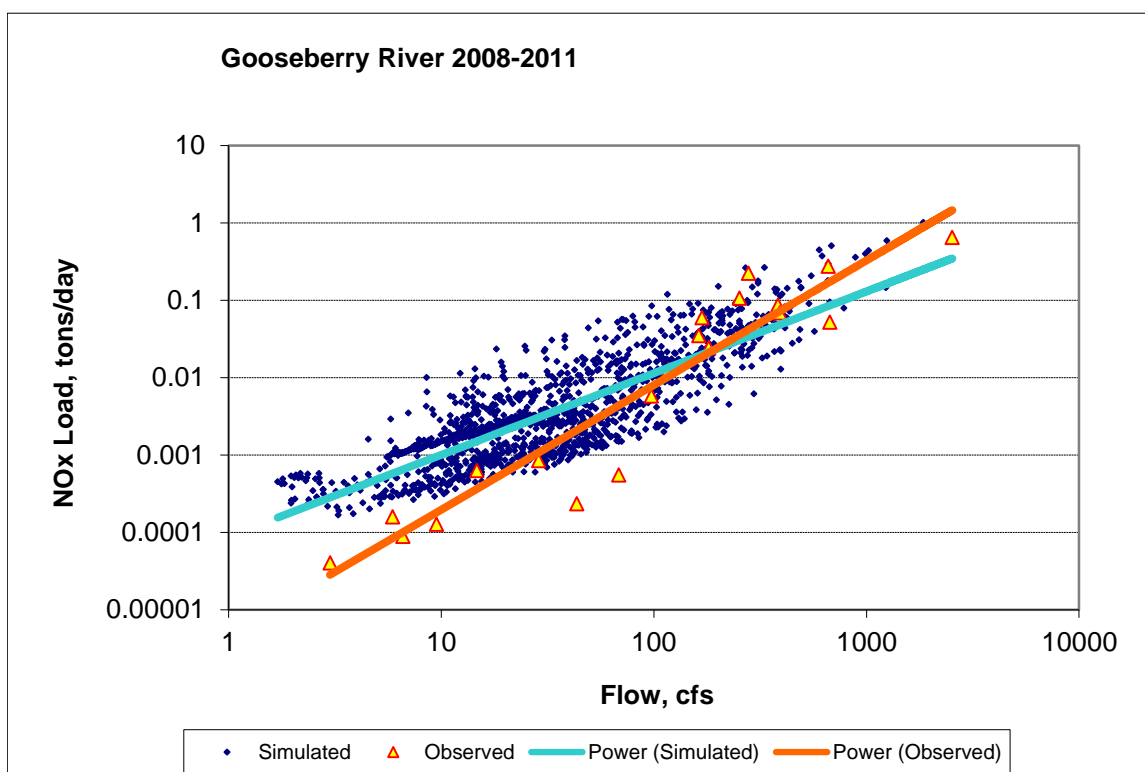
**Figure 202. Residual (Simulated - Observed) vs. Flow Total Suspended Solids (TSS) at Gooseberry River**



## Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>)

**Table 39. Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) statistics**

Count	20
Concentration Average Error	-0.62%
Concentration Median Error	12.36%
Load Average Error	-18.58%
Load Median Error	0.58%
Paired t concentration	0.81
Paired t load	0.51



**Figure 203. Power plot of simulated and observed Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) load vs flow at Gooseberry River**

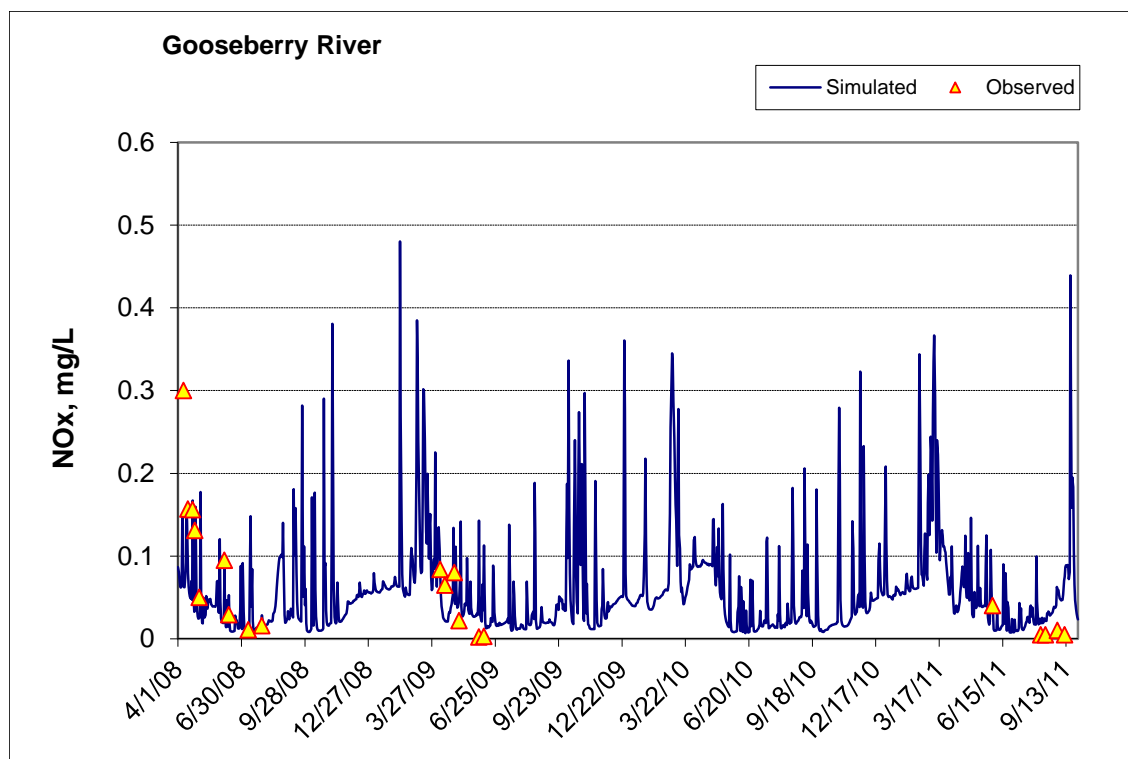


Figure 204. Time series of observed and simulated Nitrite+ Nitrate Nitrogen (NOx) concentration at Gooseberry River

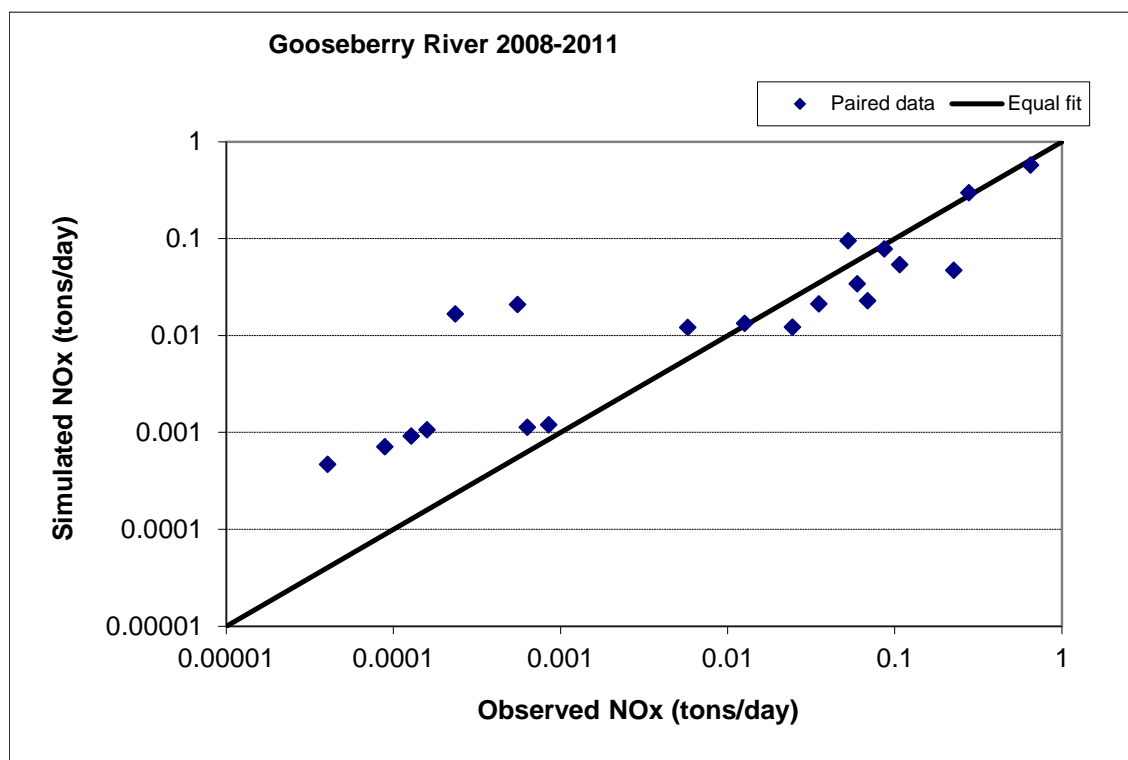


Figure 205. Paired simulated vs. observed Nitrite+ Nitrate Nitrogen (NOx) load at Gooseberry River



Figure 206. Residual (Simulated - Observed) vs. Month Nitrite+ Nitrate Nitrogen (NOx) at Gooseberry River

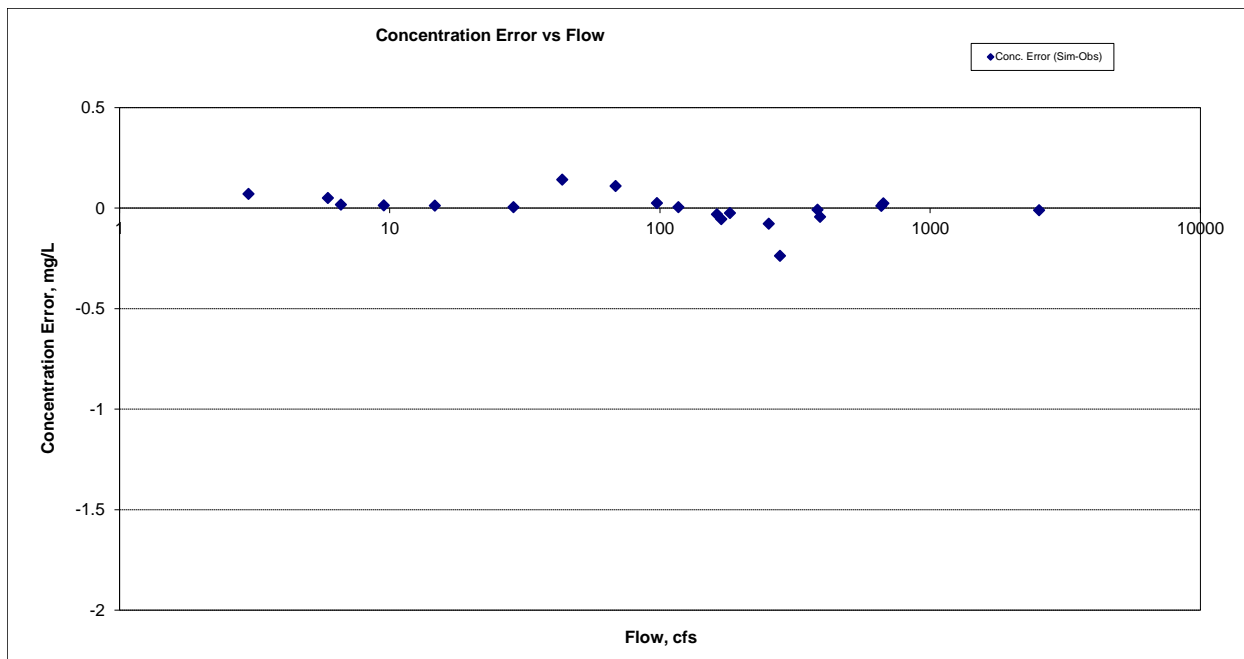
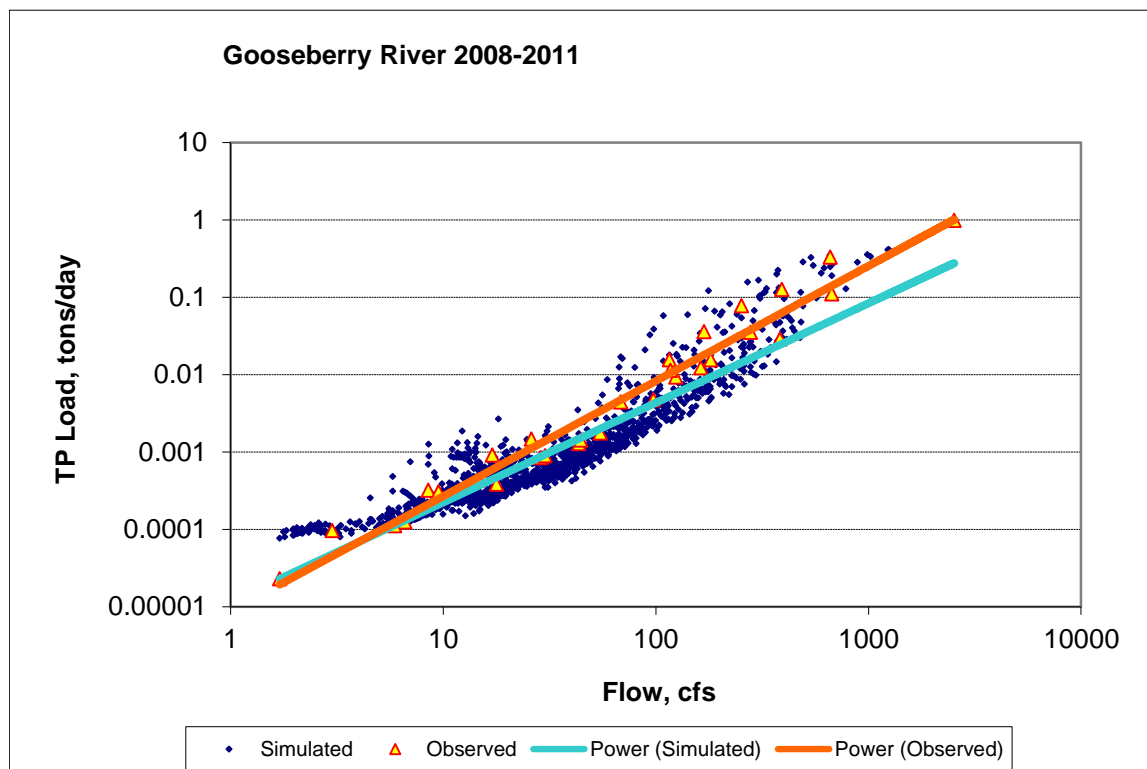


Figure 207. Residual (Simulated - Observed) vs. Flow Nitrite+ Nitrate Nitrogen (NOx) at Gooseberry River

## Total Phosphorus (TP)

**Table 40. Total Phosphorus (TP) statistics**

Count	30
Concentration Average Error	-26.83%
Concentration Median Error	-15.49%
Load Ave Error	-13.20%
Load Median Error	-0.53%
Paired t concentration	0.37
Paired t load	0.55



**Figure 208. Power plot of simulated and observed Total Phosphorus (TP) load vs flow at Gooseberry River**

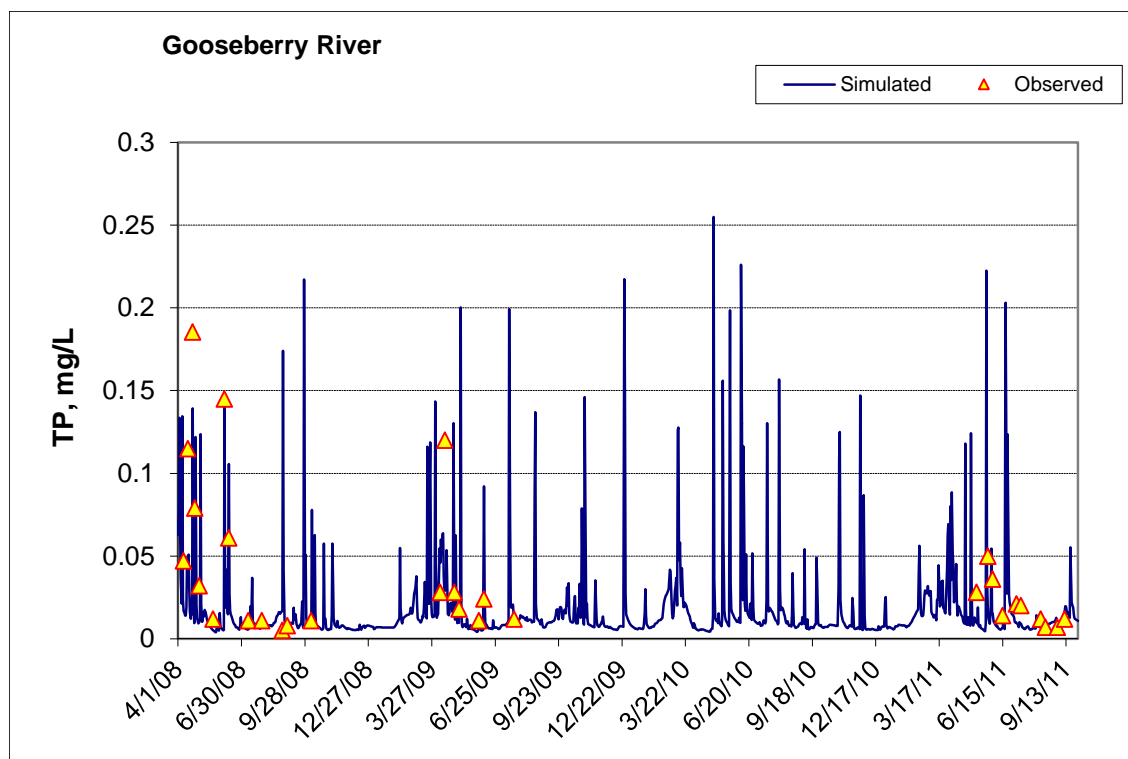


Figure 209. Time series of observed and simulated Total Phosphorus (TP) concentration at Gooseberry River

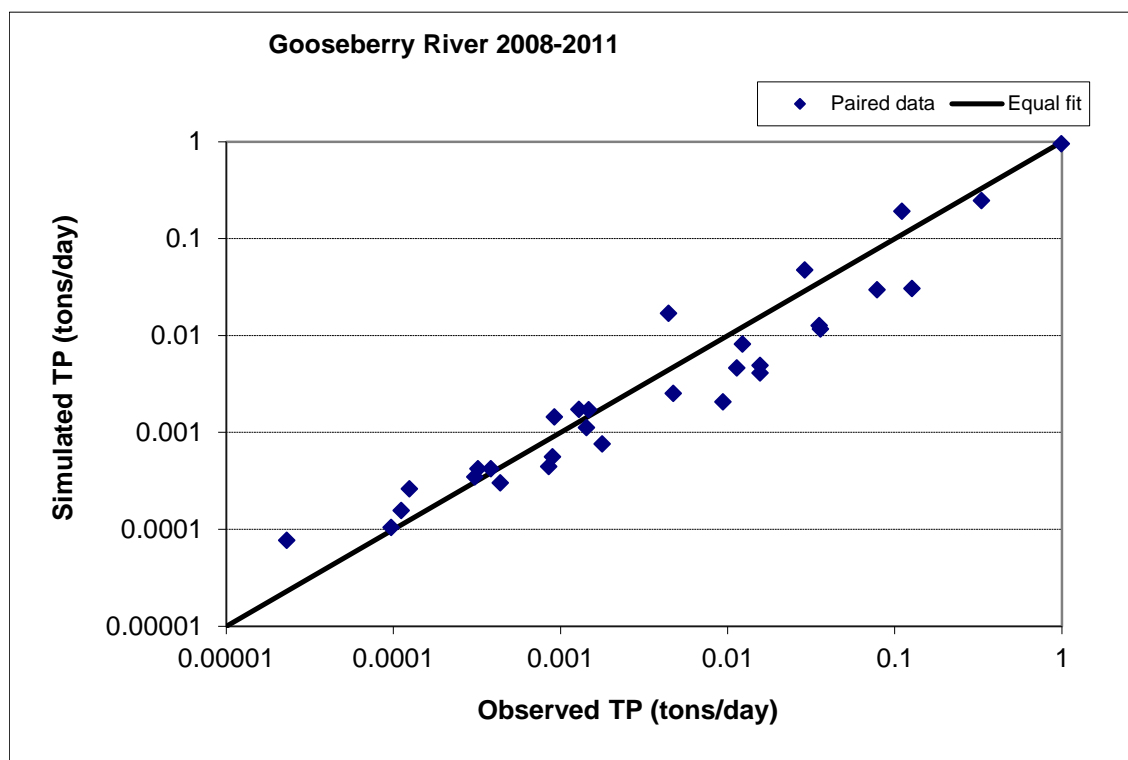


Figure 210. Paired simulated vs. observed Total Phosphorus (TP) load at Gooseberry River

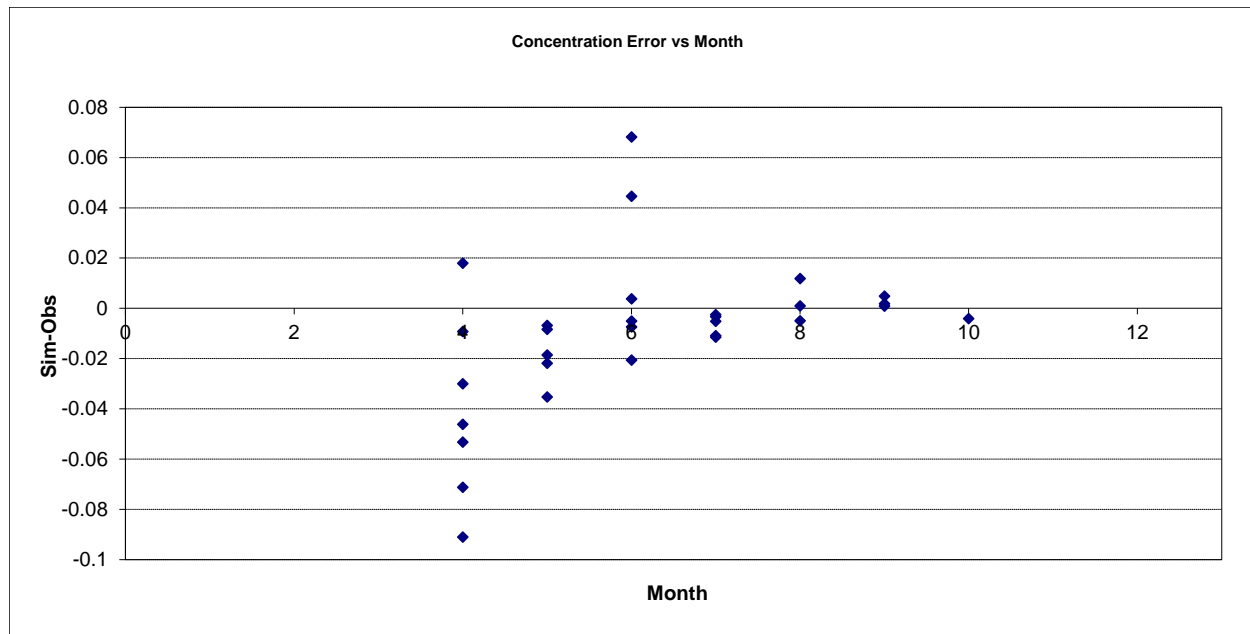


Figure 211. Residual (Simulated - Observed) vs. Month Total Phosphorus (TP) at Gooseberry River

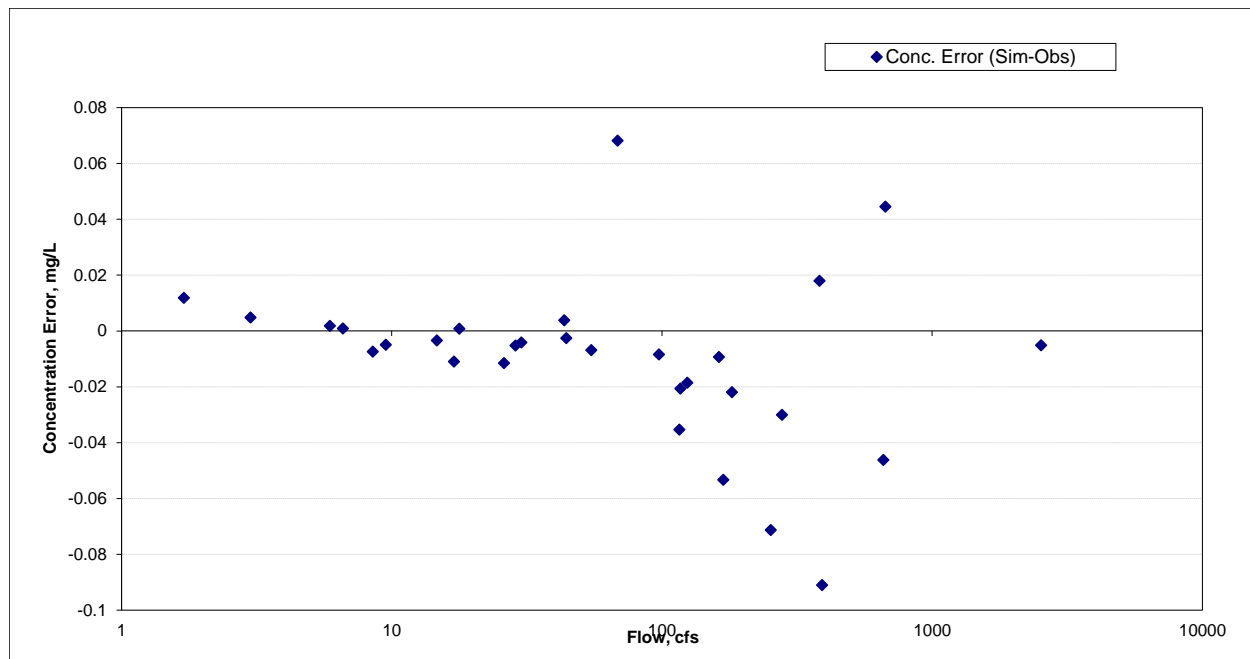


Figure 212. Residual (Simulated - Observed) vs. Flow Total Phosphorus (TP) at Gooseberry River

## Baptism River near Beaver Bay (HYDSTRA 01092001)

### Total Suspended Solids (TSS)

Table 41. Total Suspended Solids (TSS) statistics

Count	105
Concentration Average Error	-5.16%
Concentration Median Error	12.79%
Load Ave Error	-30.31%
Load Median Error	0.96%
Paired t concentration	0.83
Paired t load	0.34

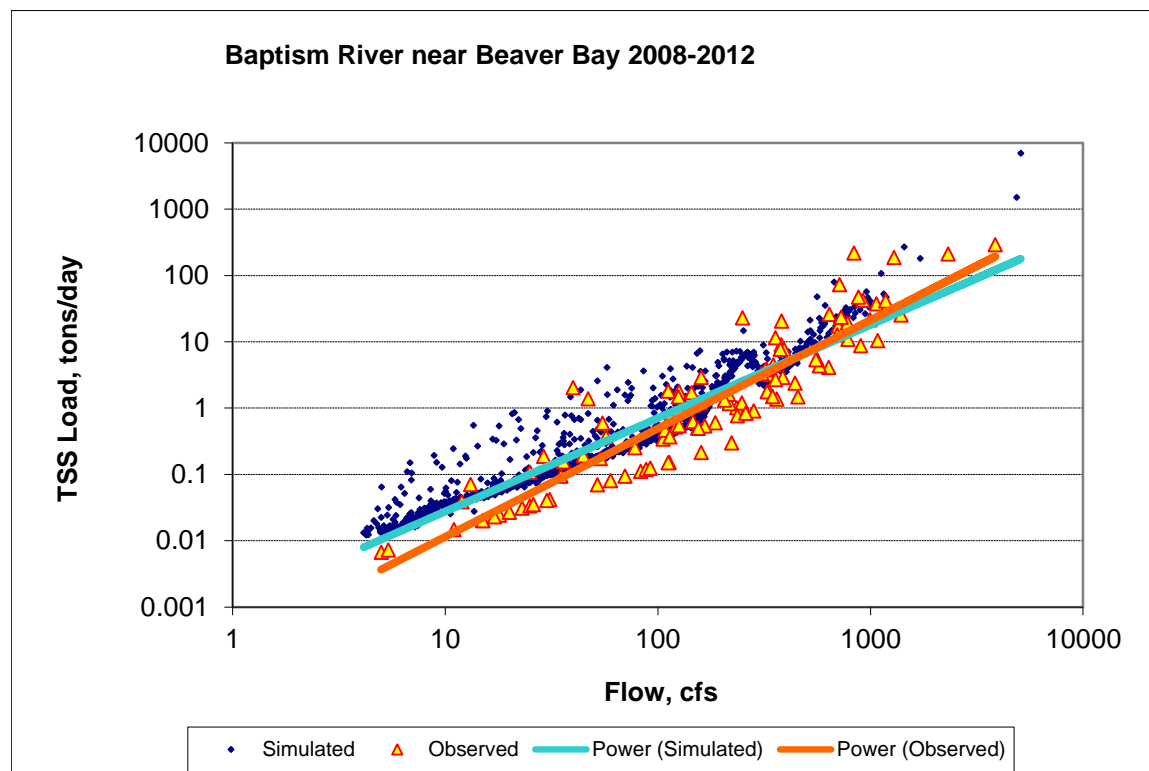
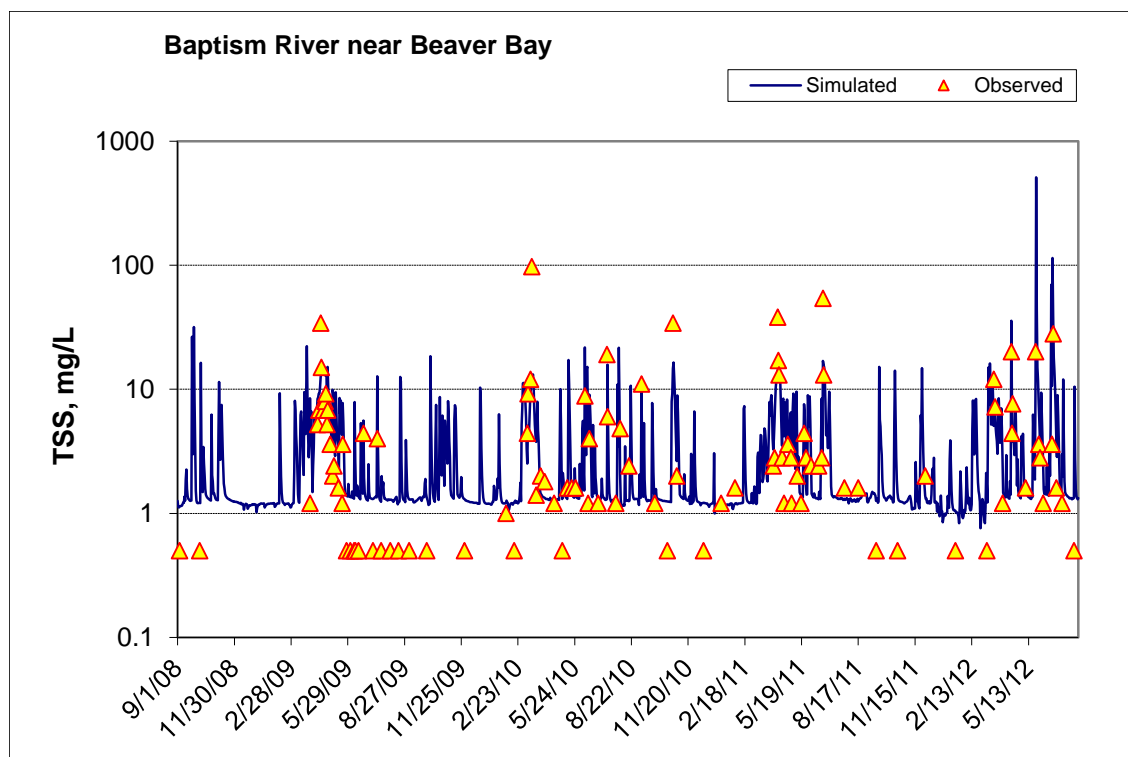
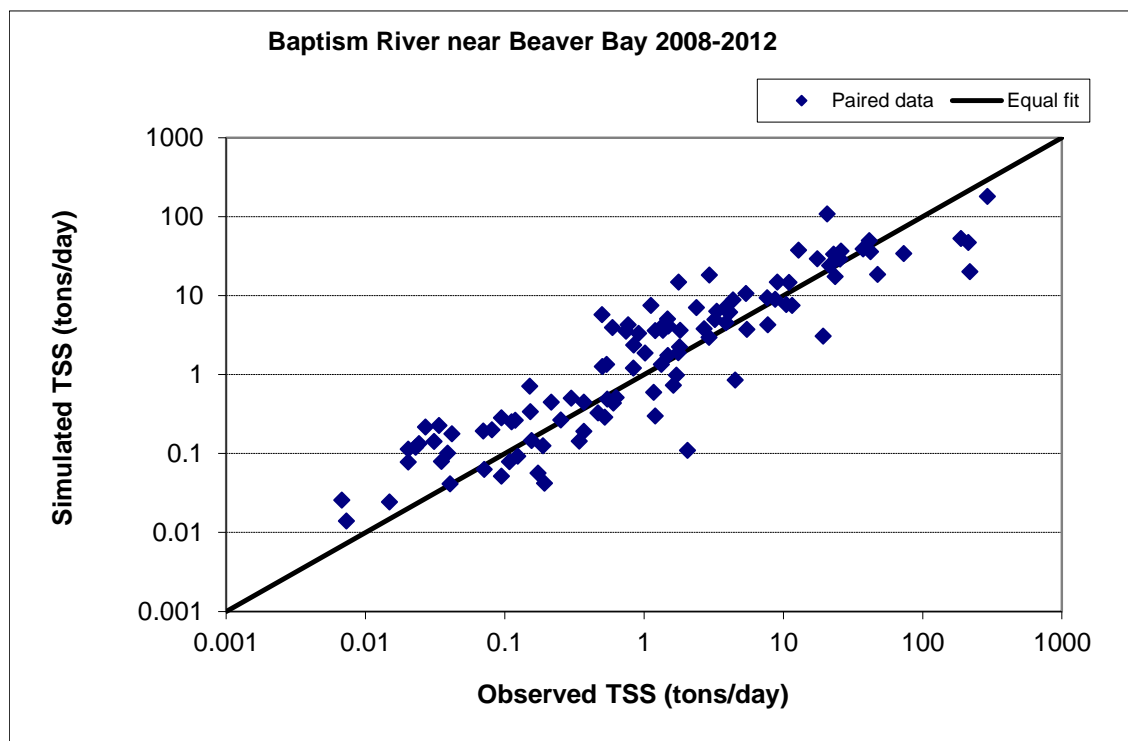


Figure 213. Power plot of simulated and observed Total Suspended Solids (TSS) load vs flow at Baptism River near Beaver Bay

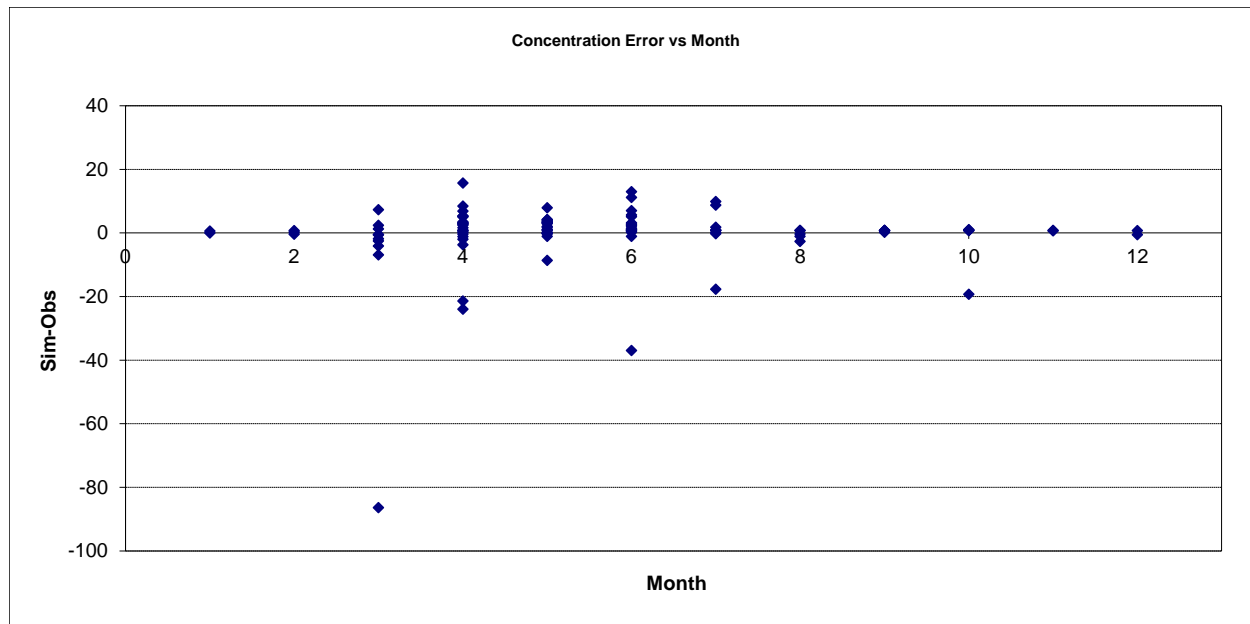


**Figure 214. Time series of observed and simulated Total Suspended Solids (TSS) concentration at Baptism River near Beaver Bay**

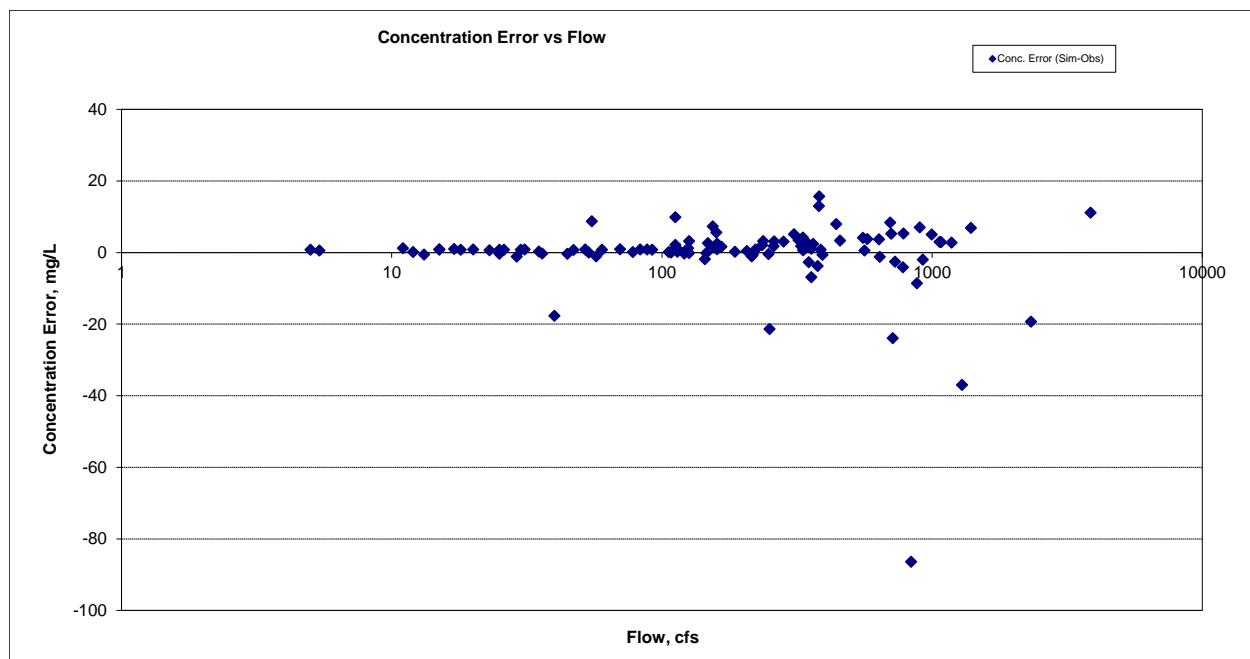


**Figure 215. Paired simulated vs. observed Total Suspended Solids (TSS) load at Baptism River near Beaver Bay**





**Figure 216. Residual (Simulated - Observed) vs. Month Total Suspended Solids (TSS) at Baptism River near Beaver Bay**

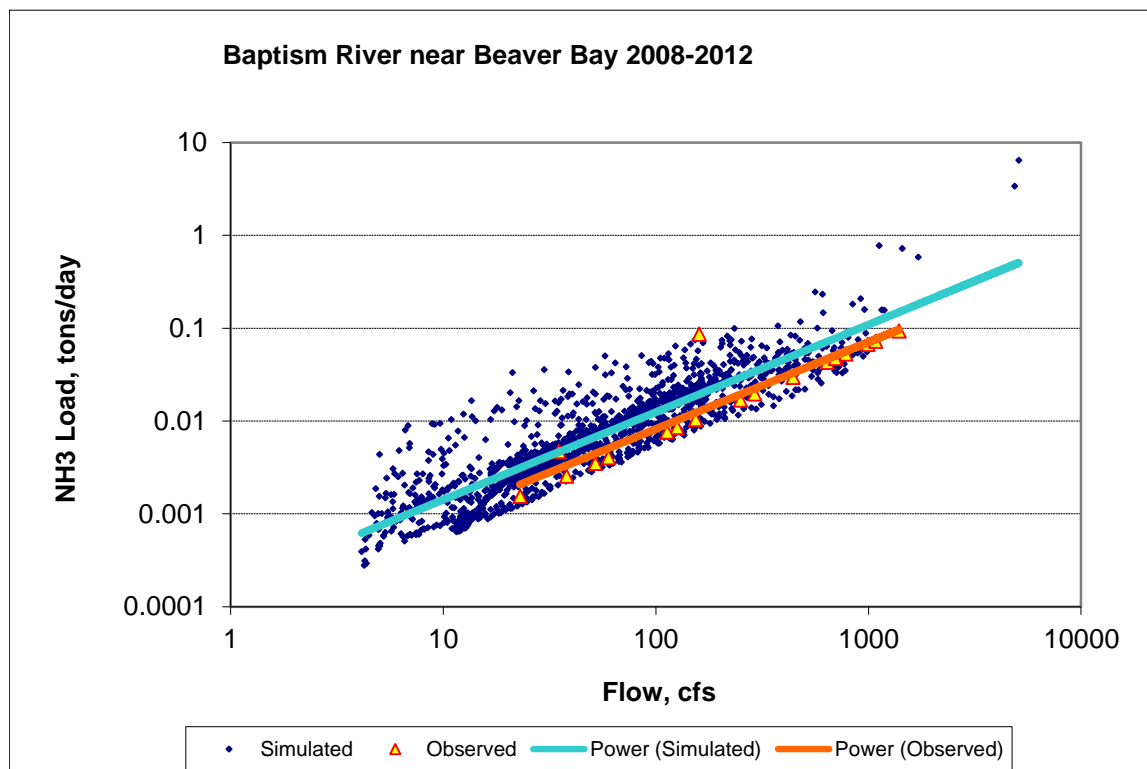


**Figure 217. Residual (Simulated - Observed) vs. Flow Total Suspended Solids (TSS) at Baptism River near Beaver Bay**

## Ammonia Nitrogen (NH<sub>3</sub>)

**Table 42. Ammonia Nitrogen (NH<sub>3</sub>) statistics**

Count	19
Concentration Average Error	6.02%
Concentration Median Error	27.81%
Load Ave Error	38.31%
Load Median Error	5.58%
Paired t concentration	0.75
Paired t load	0.26



**Figure 218. Power plot of simulated and observed Ammonia Nitrogen (NH<sub>3</sub>) load vs flow at Baptism River near Beaver Bay**

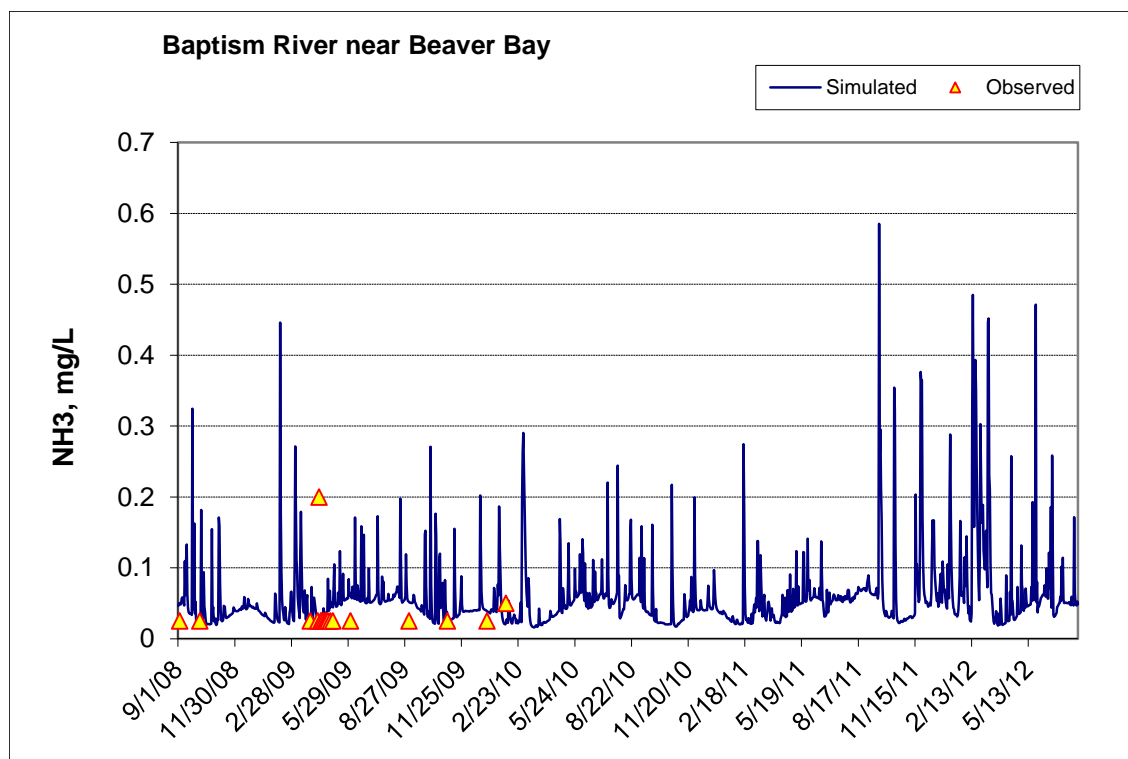


Figure 219. Time series of observed and simulated Ammonia Nitrogen (NH<sub>3</sub>) concentration at Baptism River near Beaver Bay

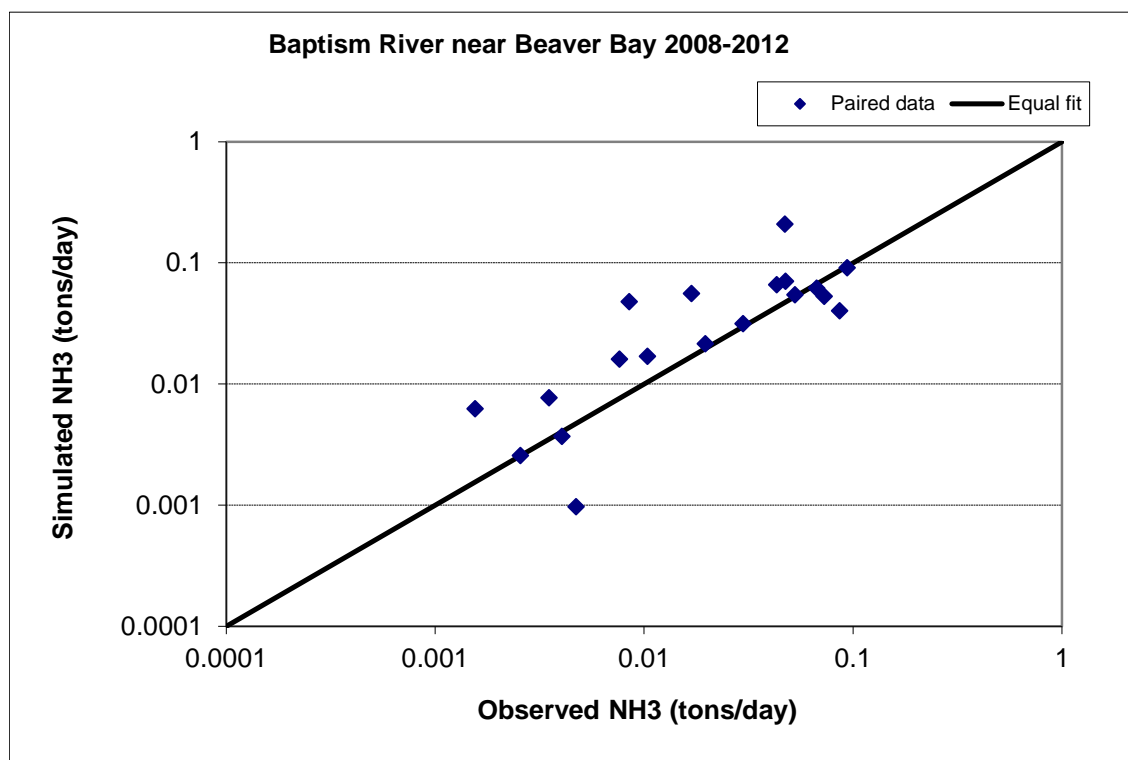
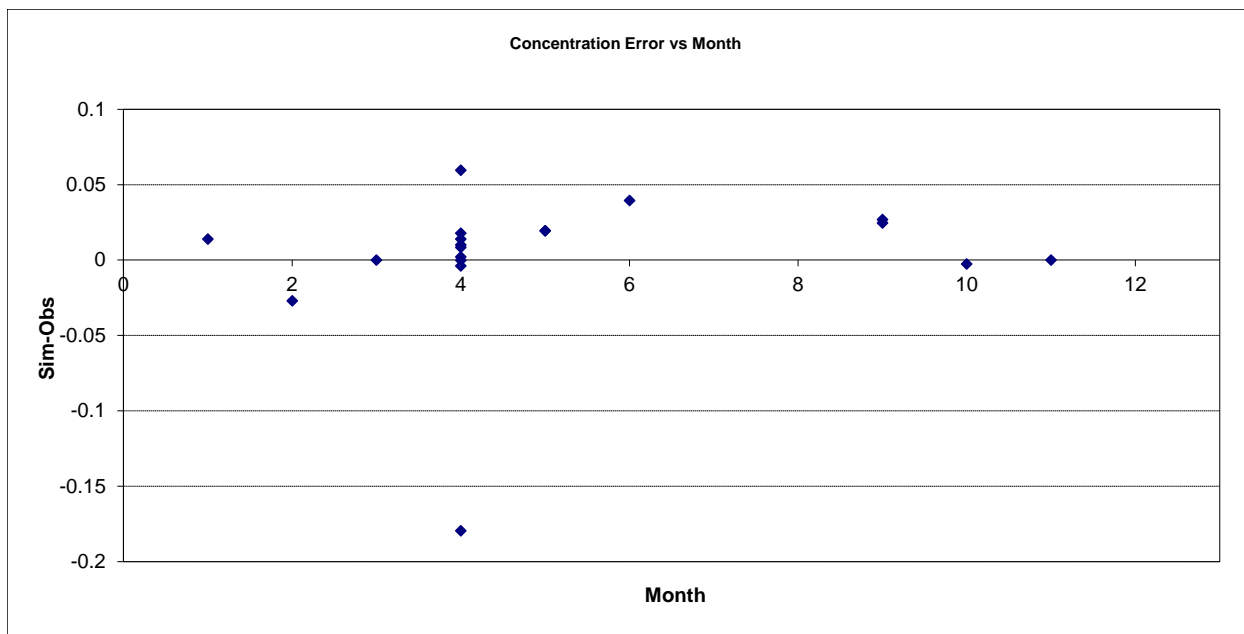
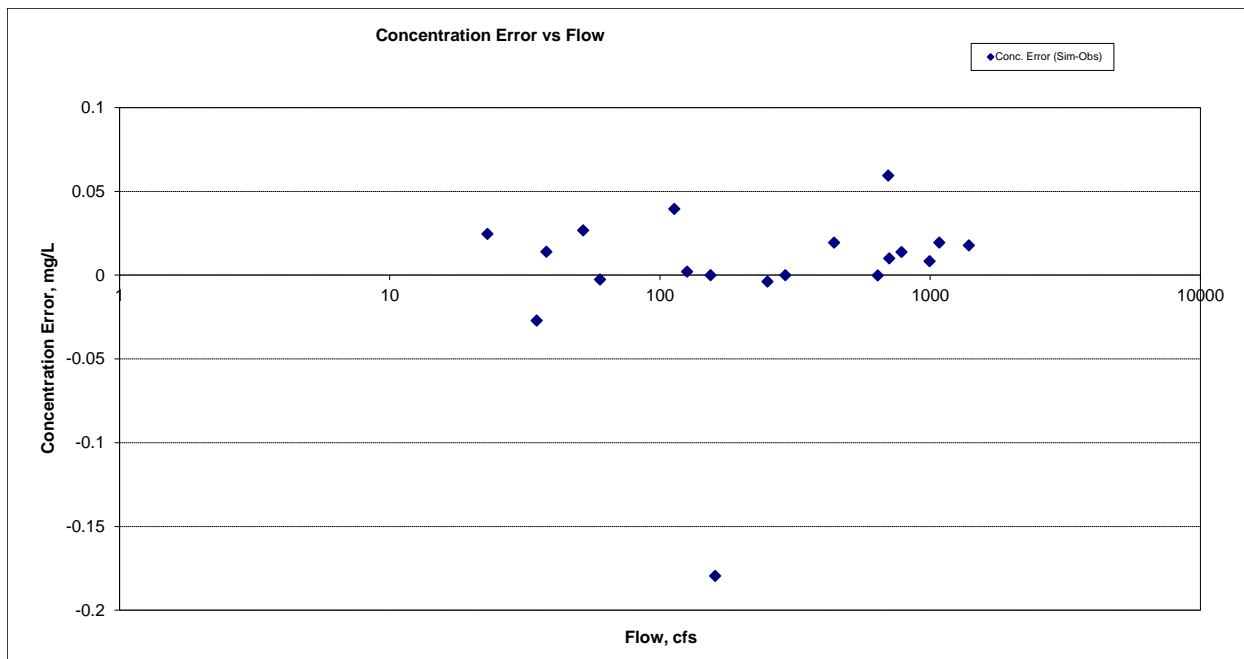


Figure 220. Paired simulated vs. observed Ammonia Nitrogen (NH<sub>3</sub>) load at Baptism River near Beaver Bay



**Figure 221. Residual (Simulated - Observed) vs. Month Ammonia Nitrogen (NH3) at Baptism River near Beaver Bay**



**Figure 222. Residual (Simulated - Observed) vs. Flow Ammonia Nitrogen (NH3) at Baptism River near Beaver Bay**

## Organic Nitrogen (OrgN)

Table 43. Organic Nitrogen (OrgN) statistics

Count	19
Concentration Average Error	9.20%
Concentration Median Error	10.97%
Load Ave Error	37.31%
Load Median Error	-3.69%
Paired t concentration	0.93
Paired t load	0.26

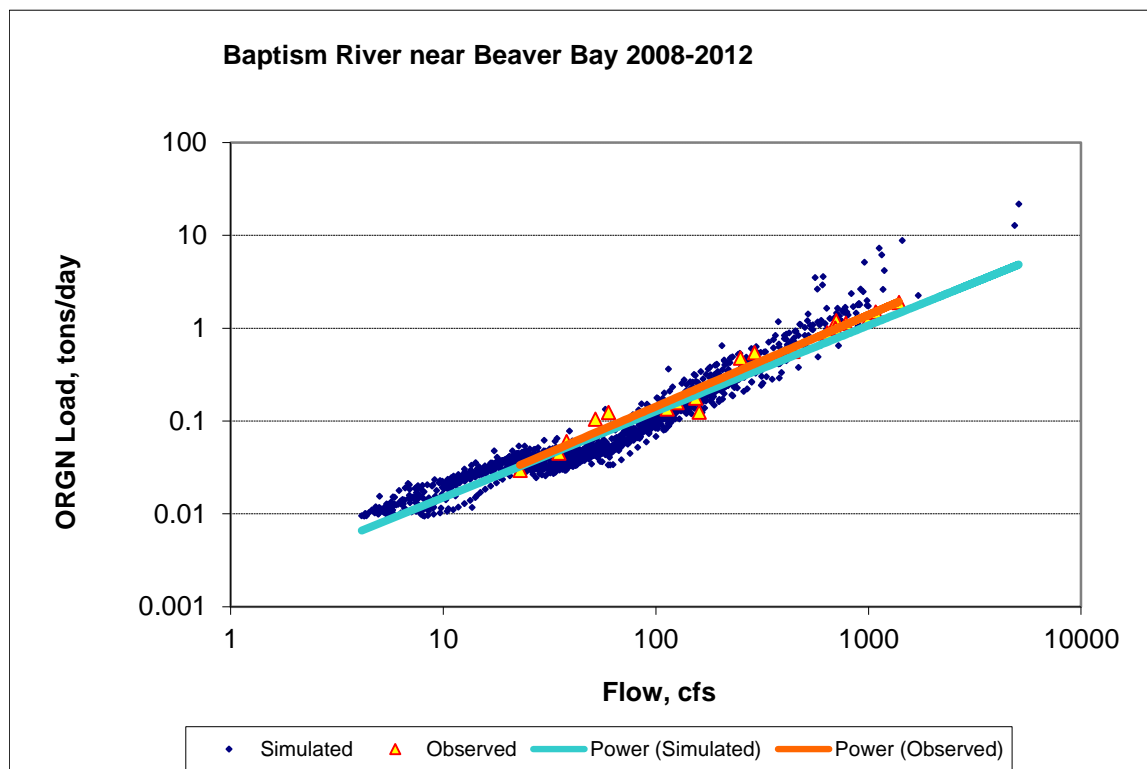


Figure 223. Power plot of simulated and observed Organic Nitrogen (OrgN) load vs flow at Baptism River near Beaver Bay

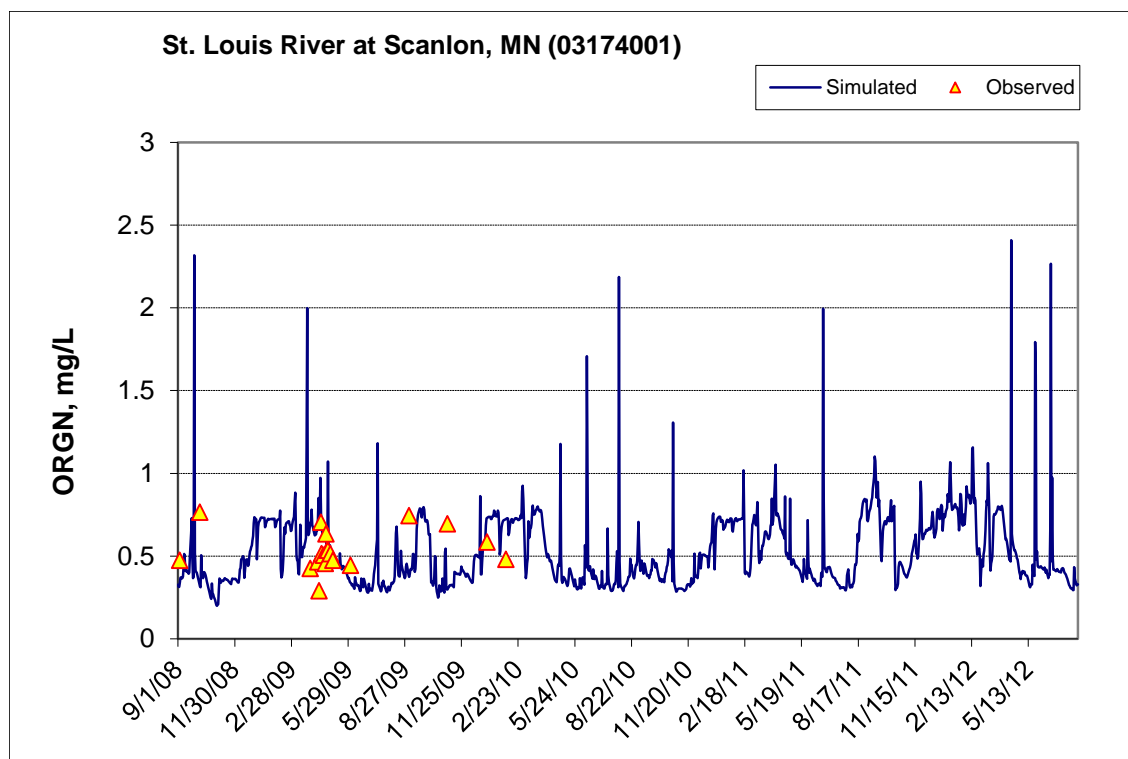


Figure 224. Time series of observed and simulated Organic Nitrogen (OrgN) concentration at Baptism River near Beaver Bay

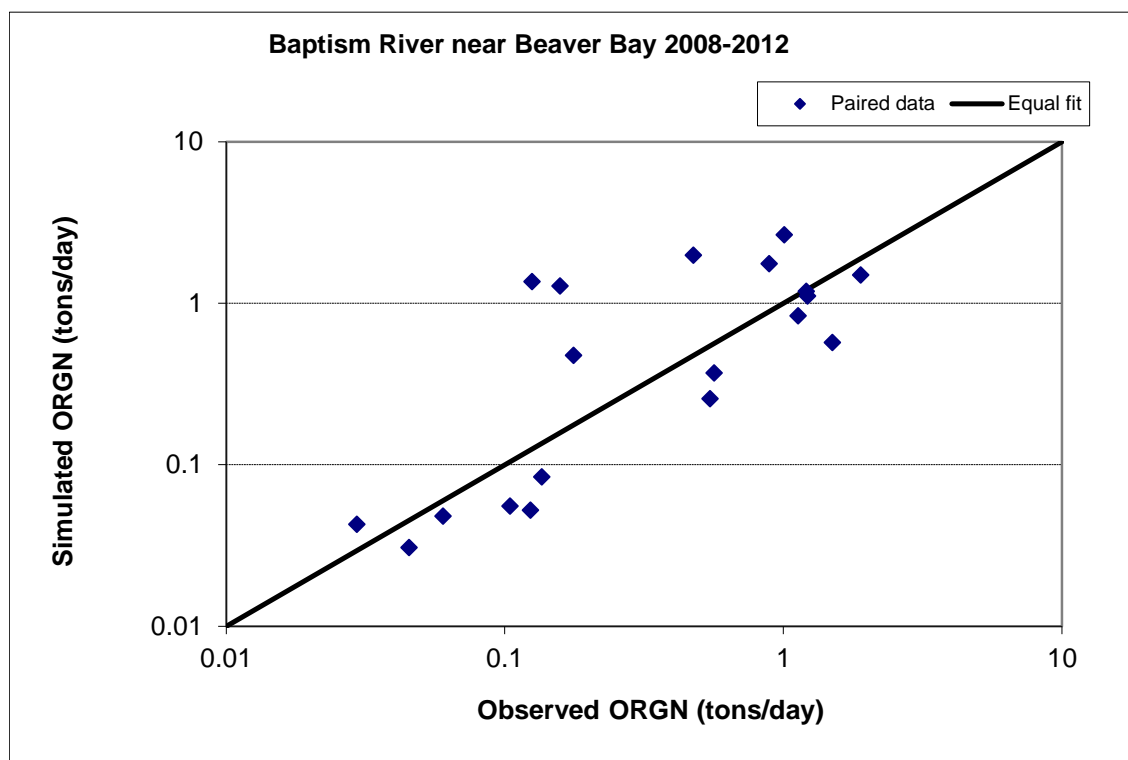
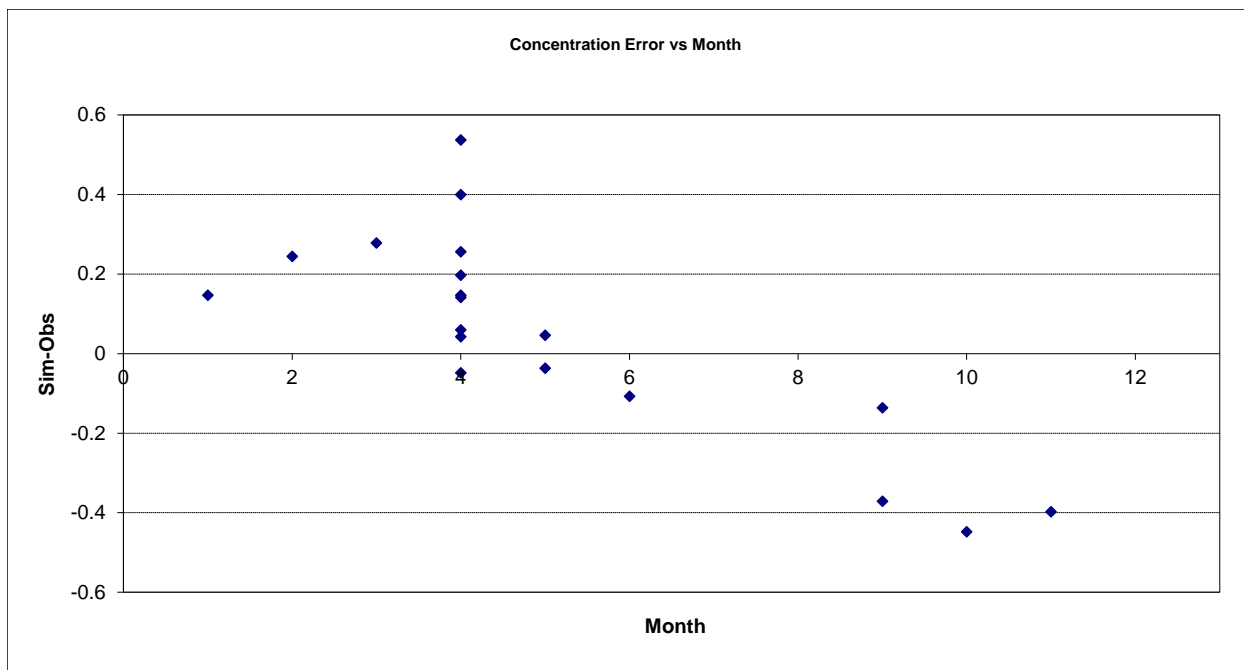
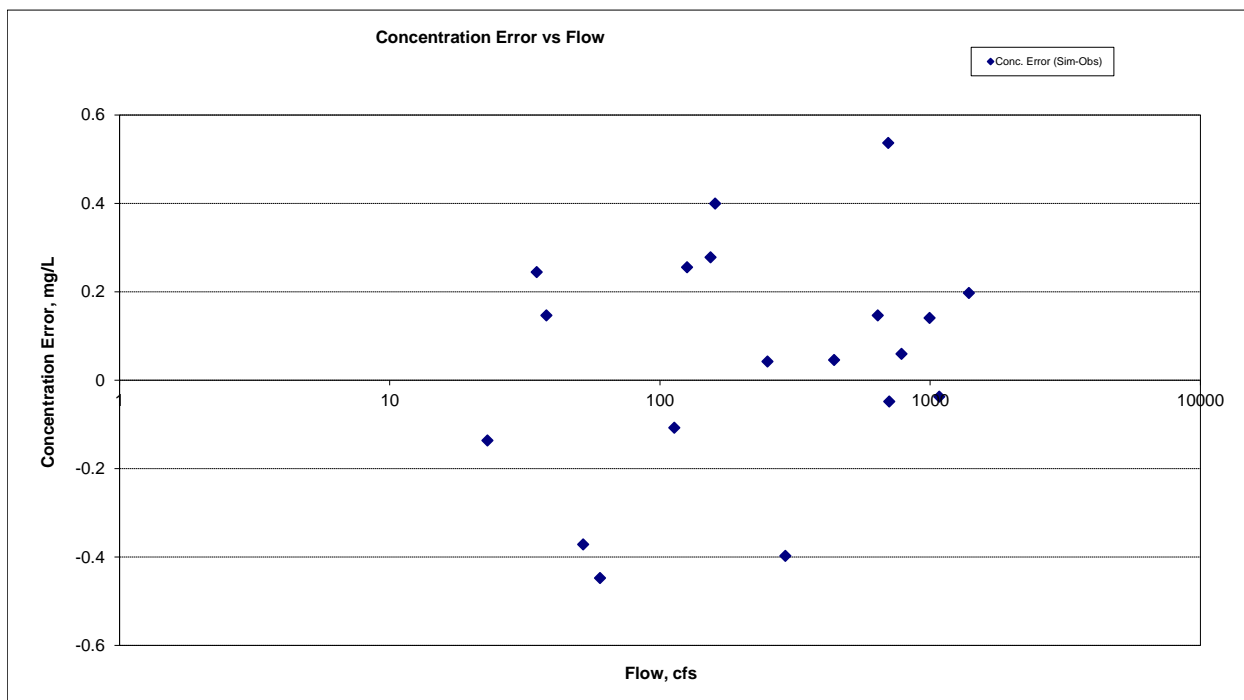


Figure 225. Paired simulated vs. observed Organic Nitrogen (OrgN) load at Baptism River near Beaver Bay



**Figure 226. Residual (Simulated - Observed) vs. Month Organic Nitrogen (OrgN) at Baptism River near Beaver Bay**

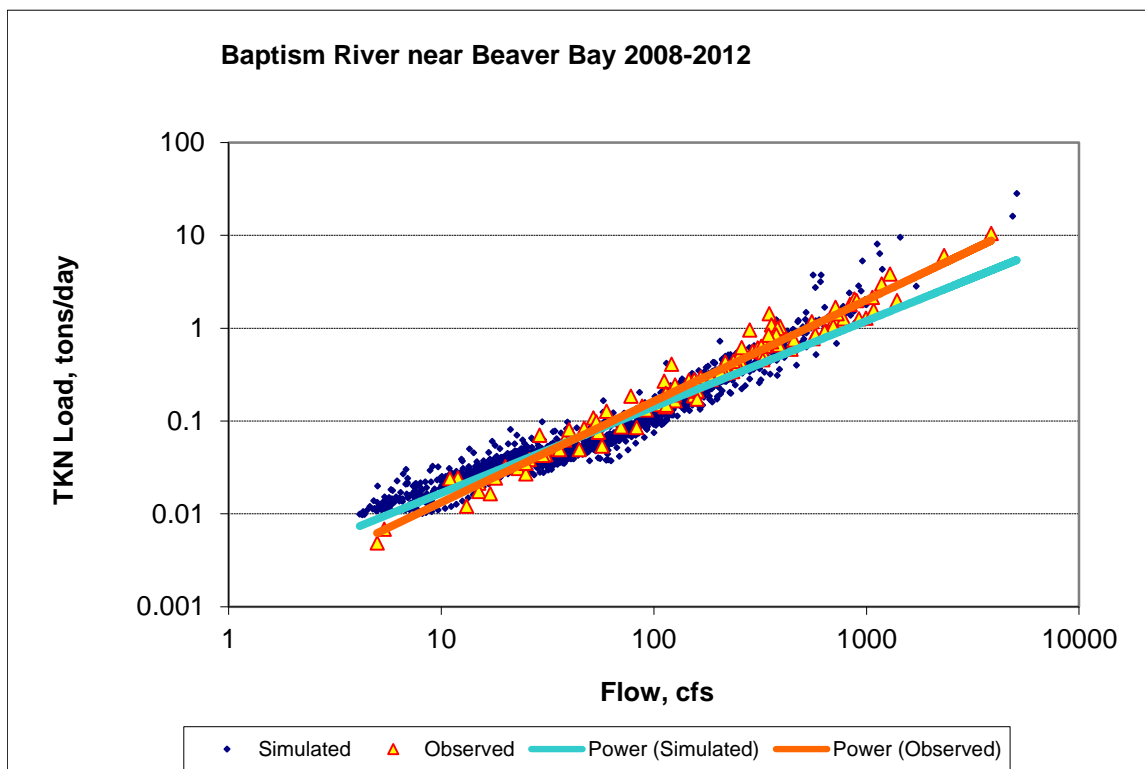


**Figure 227. Residual (Simulated - Observed) vs. Flow Organic Nitrogen (OrgN) at Baptism River near Beaver Bay**

## Total Kjeldahl Nitrogen (TKN)

**Table 44. Total Kjeldahl Nitrogen (TKN) statistics**

Count	106
Concentration Average Error	-3.24%
Concentration Median Error	-7.17%
Load Ave Error	-4.15%
Load Median Error	-6.57%
Paired t concentration	1.00
Paired t load	0.83



**Figure 228. Power plot of simulated and observed Total Kjeldahl Nitrogen (TKN) load vs flow at Baptism River near Beaver Bay**



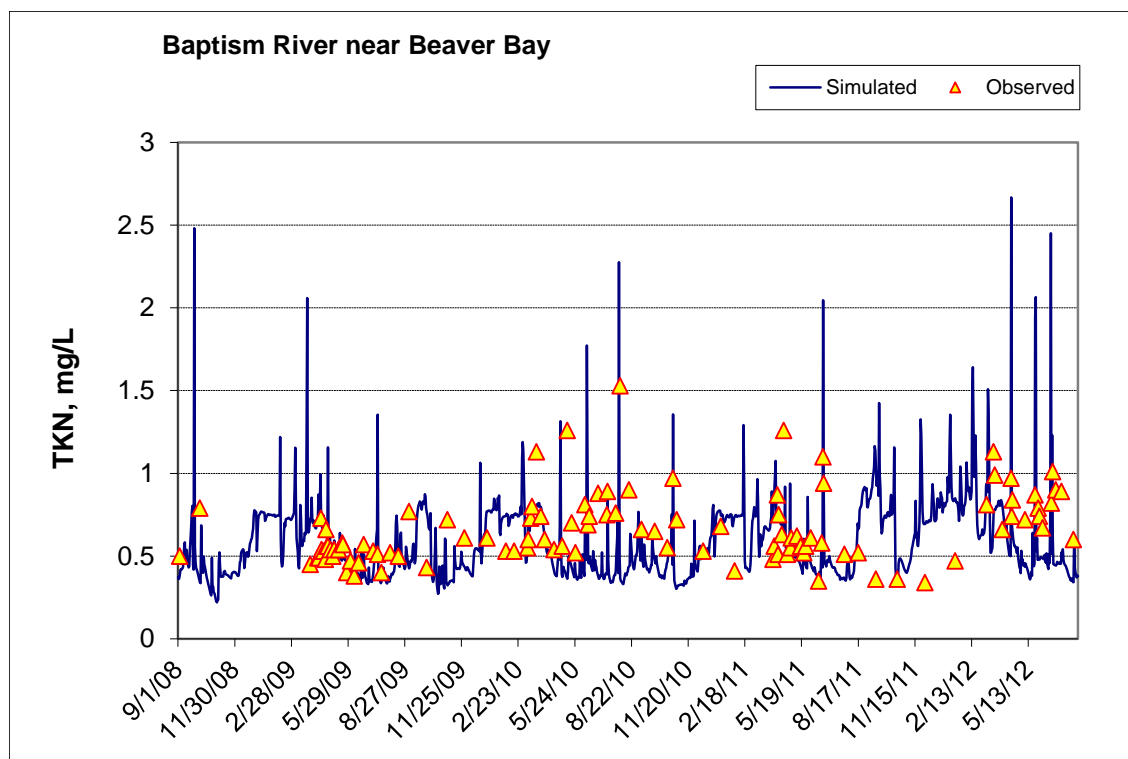


Figure 229. Time series of observed and simulated Total Kjeldahl Nitrogen (TKN) concentration at Baptism River near Beaver Bay

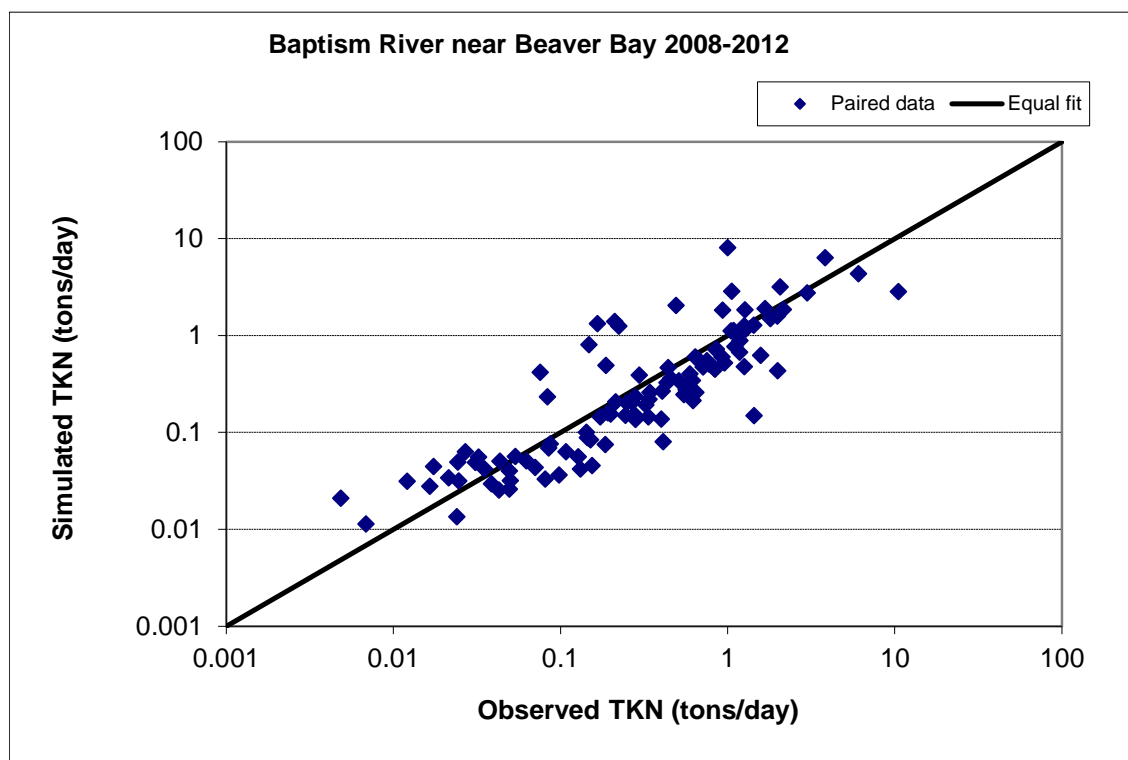
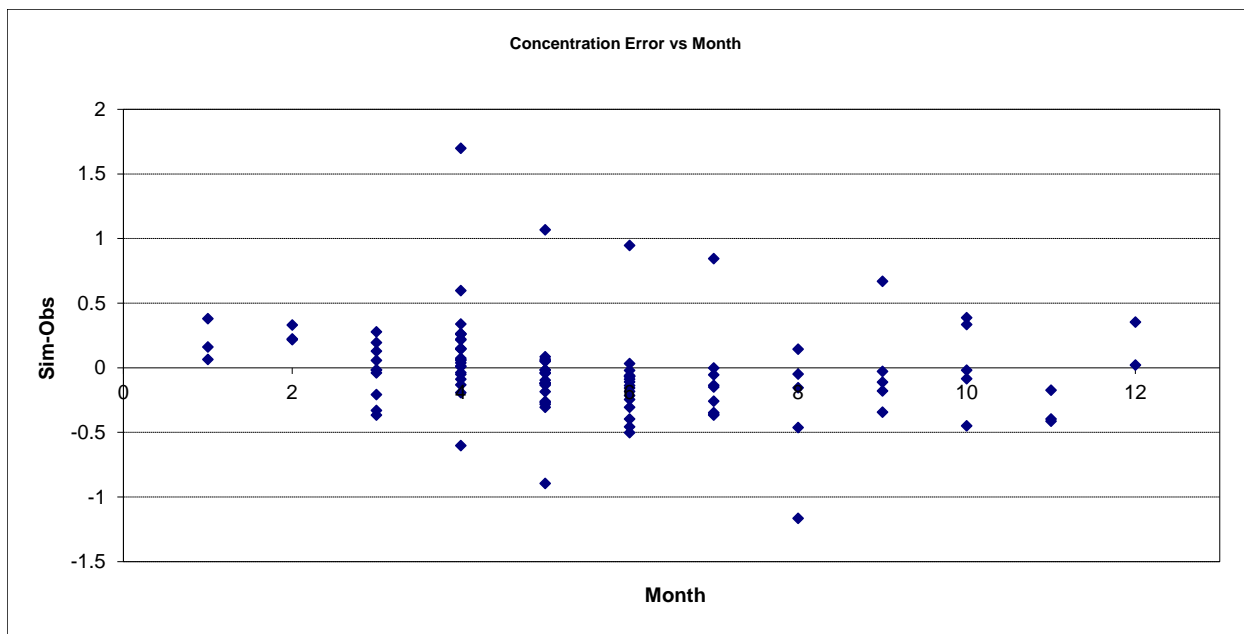
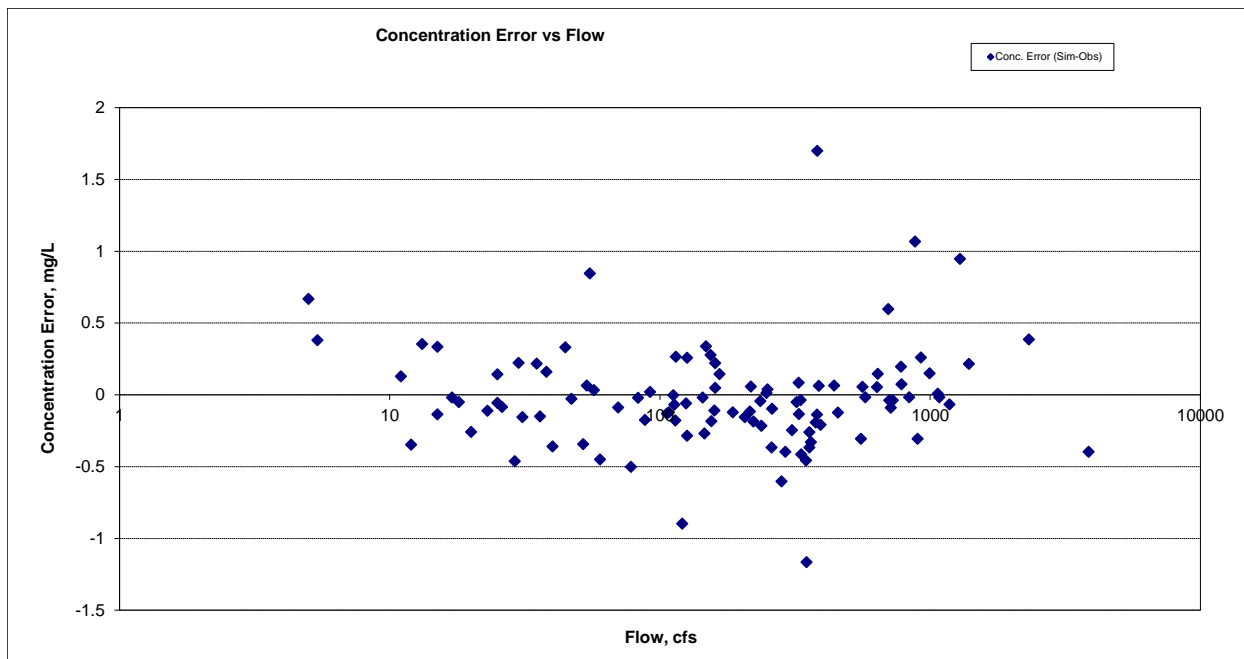


Figure 230. Paired simulated vs. observed Total Kjeldahl Nitrogen (TKN) load at Baptism River near Beaver Bay



**Figure 231. Residual (Simulated - Observed) vs. Month Total Kjeldahl Nitrogen (TKN) at Baptism River near Beaver Bay**

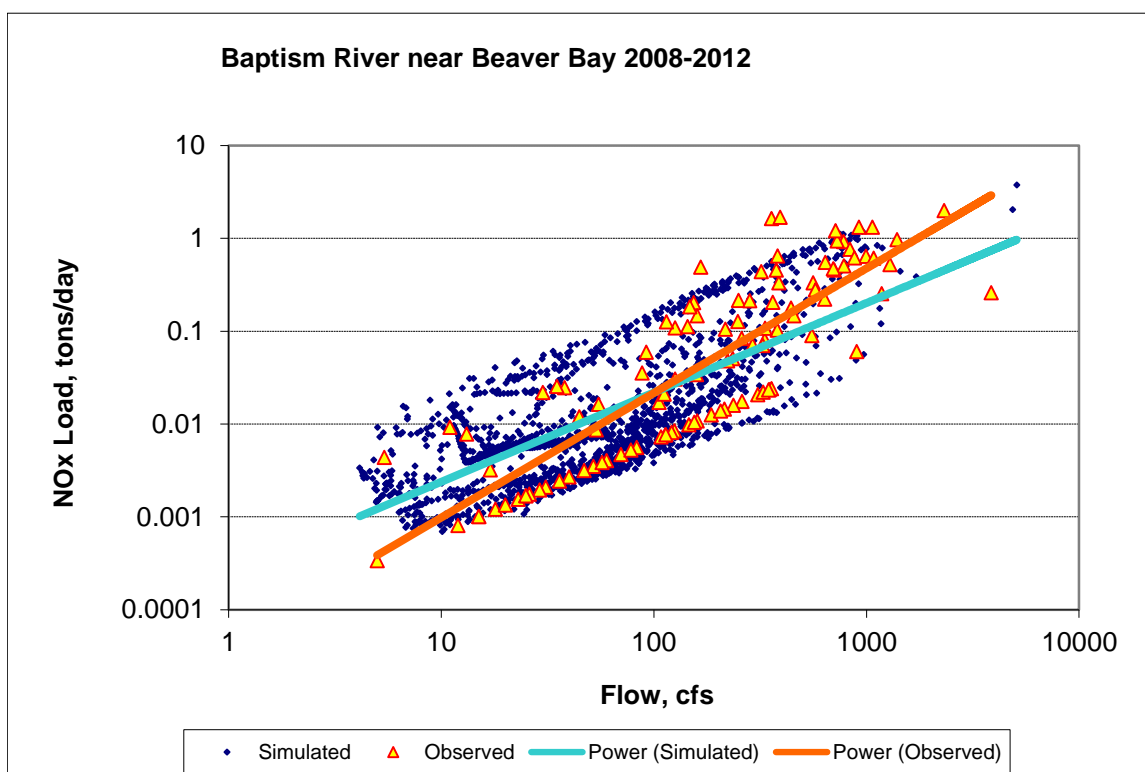


**Figure 232. Residual (Simulated - Observed) vs. Flow Total Kjeldahl Nitrogen (TKN) at Baptism River near Beaver Bay**

## Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>)

**Table 45. Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) statistics**

Count	106
Concentration Average Error	-13.97%
Concentration Median Error	-2.57%
Load Ave Error	-19.15%
Load Median Error	-0.71%
Paired t concentration	0.70
Paired t load	0.52



**Figure 233. Power plot of simulated and observed Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) load vs flow at Baptism River near Beaver Bay**

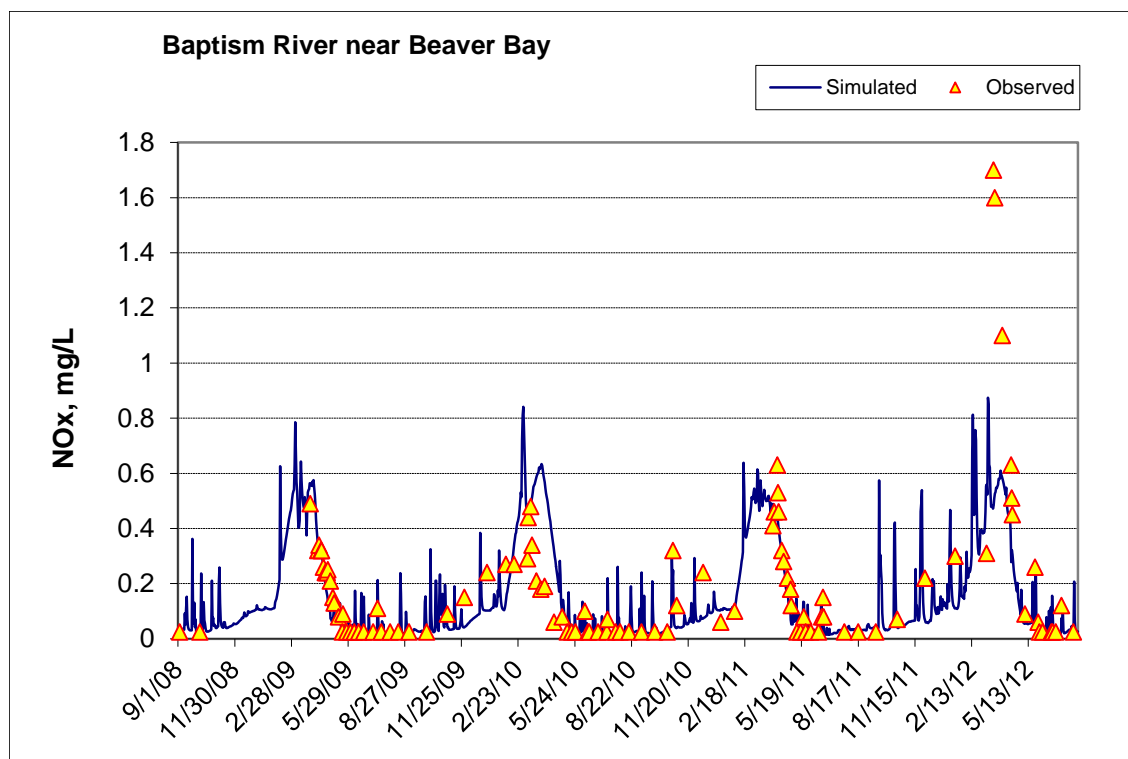


Figure 234. Time series of observed and simulated Nitrite+ Nitrate Nitrogen (NOx) concentration at Baptism River near Beaver Bay

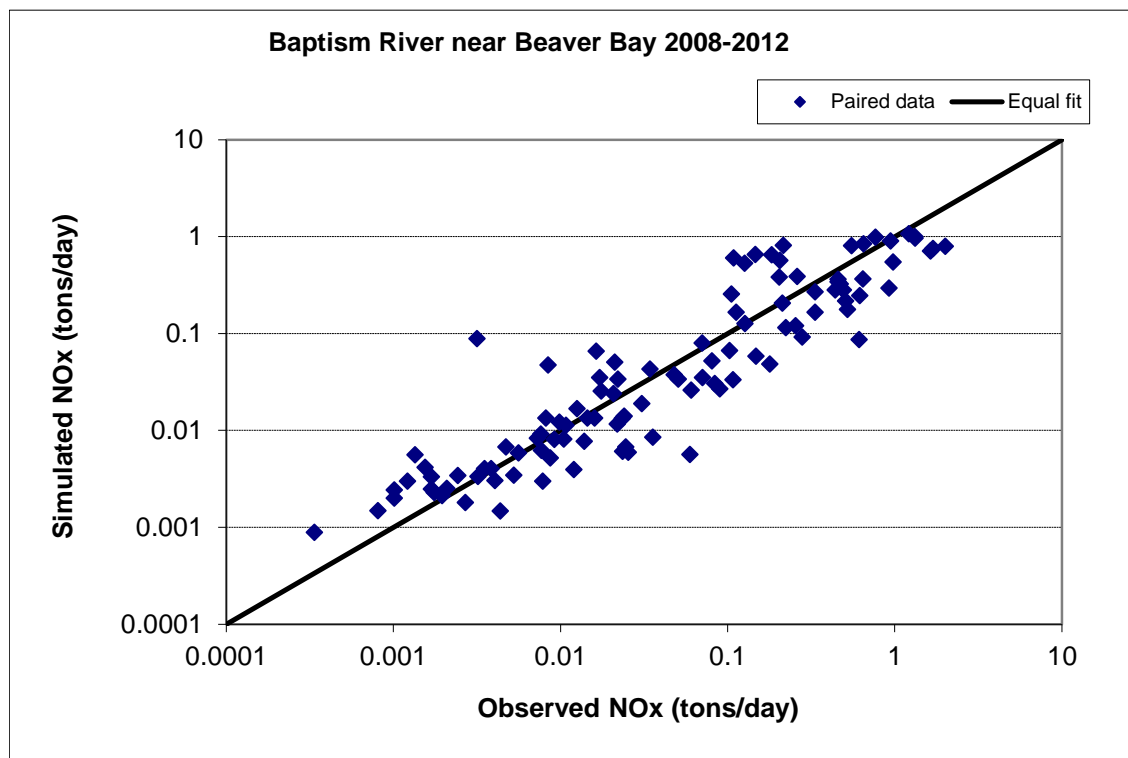
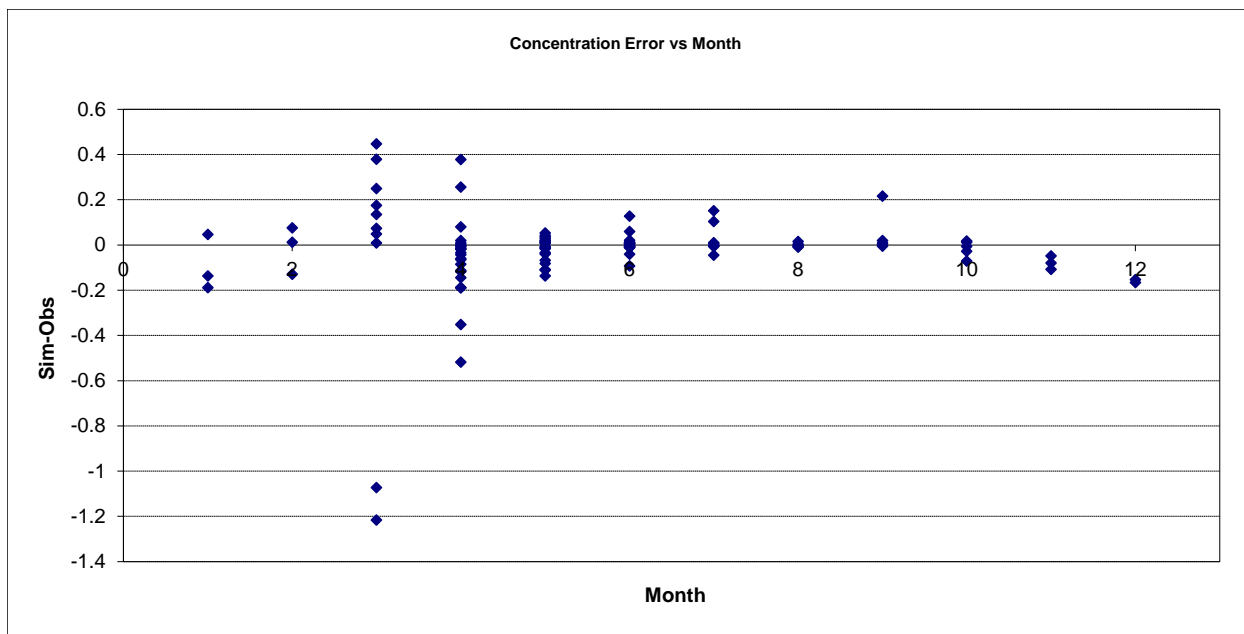
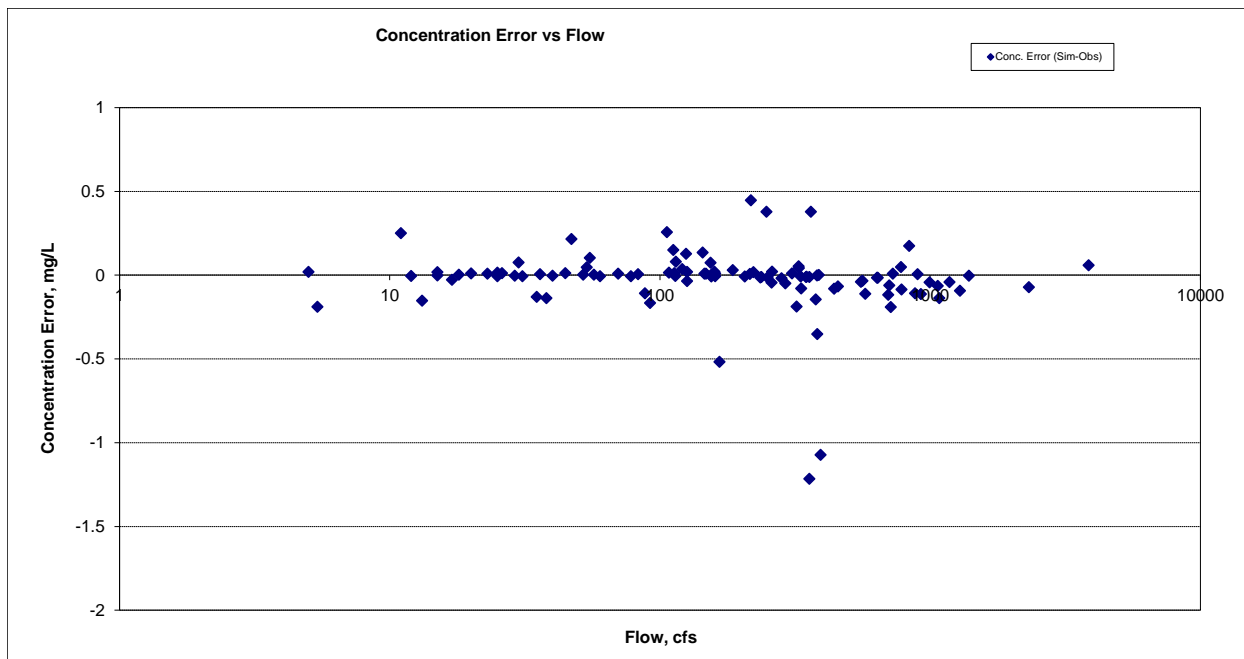


Figure 235. Paired simulated vs. observed Nitrite+ Nitrate Nitrogen (NOx) load at Baptism River near Beaver Bay



**Figure 236. Residual (Simulated - Observed) vs. Month Nitrite+ Nitrate Nitrogen (NOx) at Baptism River near Beaver Bay**

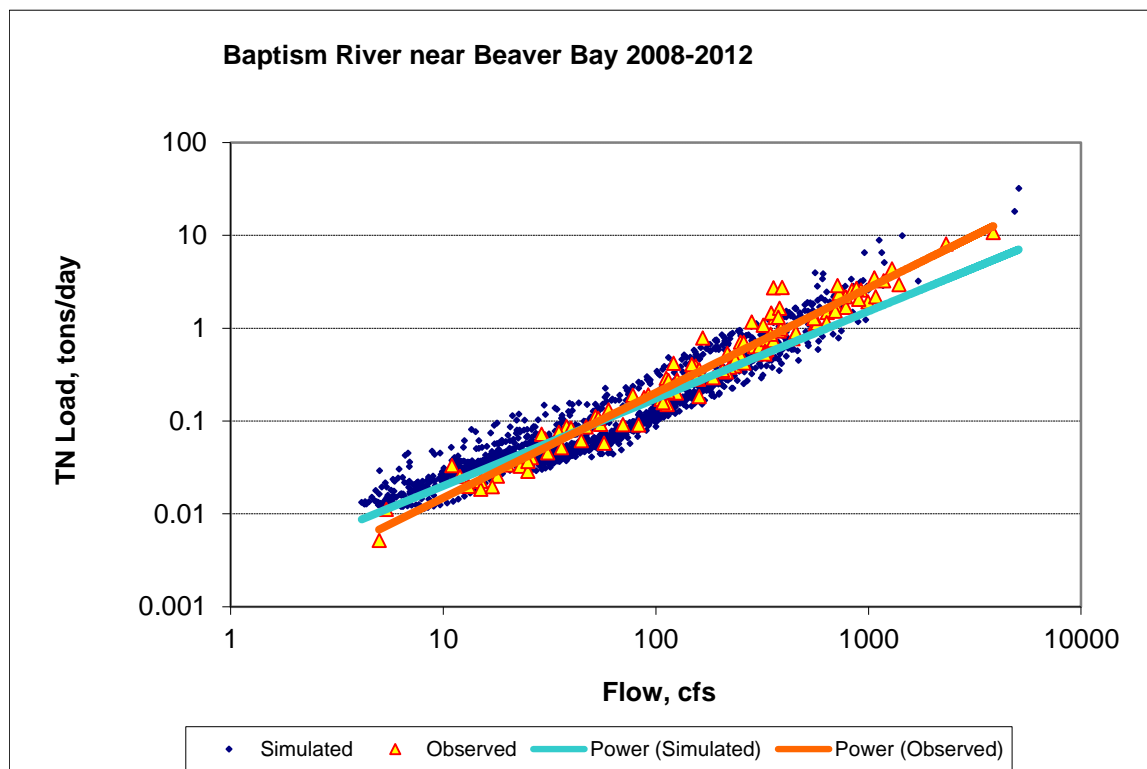


**Figure 237. Residual (Simulated - Observed) vs. Flow Nitrite+ Nitrate Nitrogen (NOx) at Baptism River near Beaver Bay**

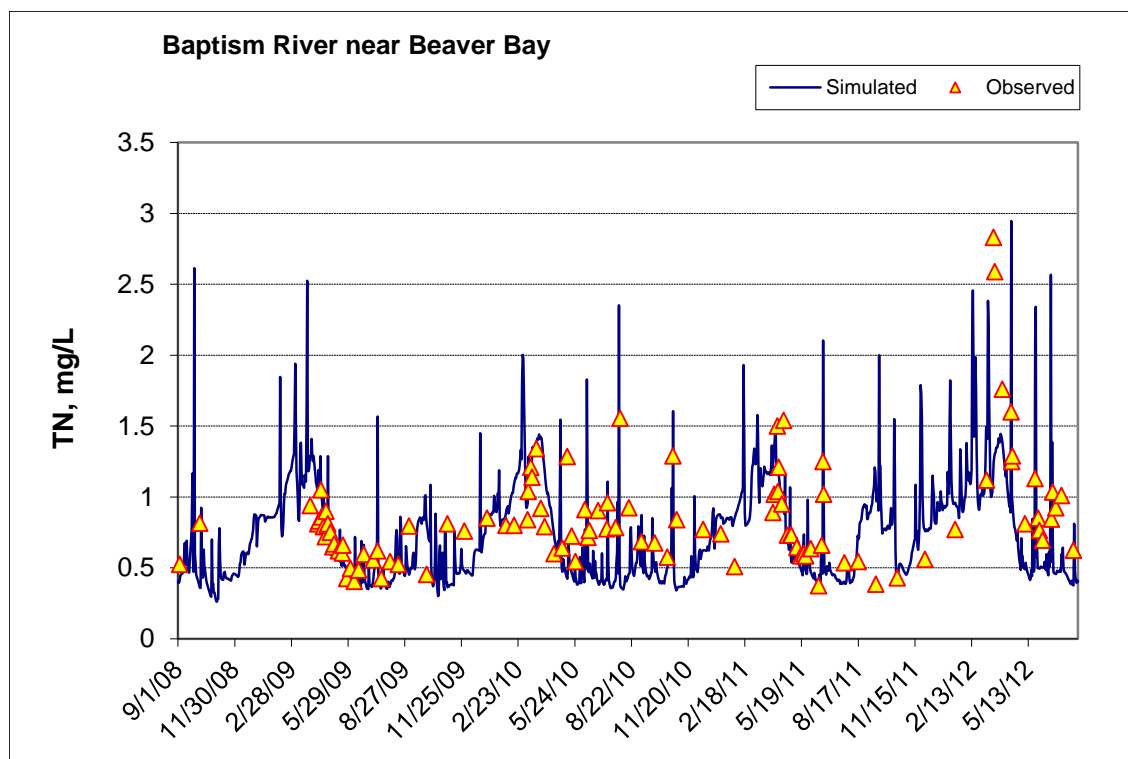
## Total Nitrogen (TN)

**Table 46. Total Nitrogen (TN) statistics**

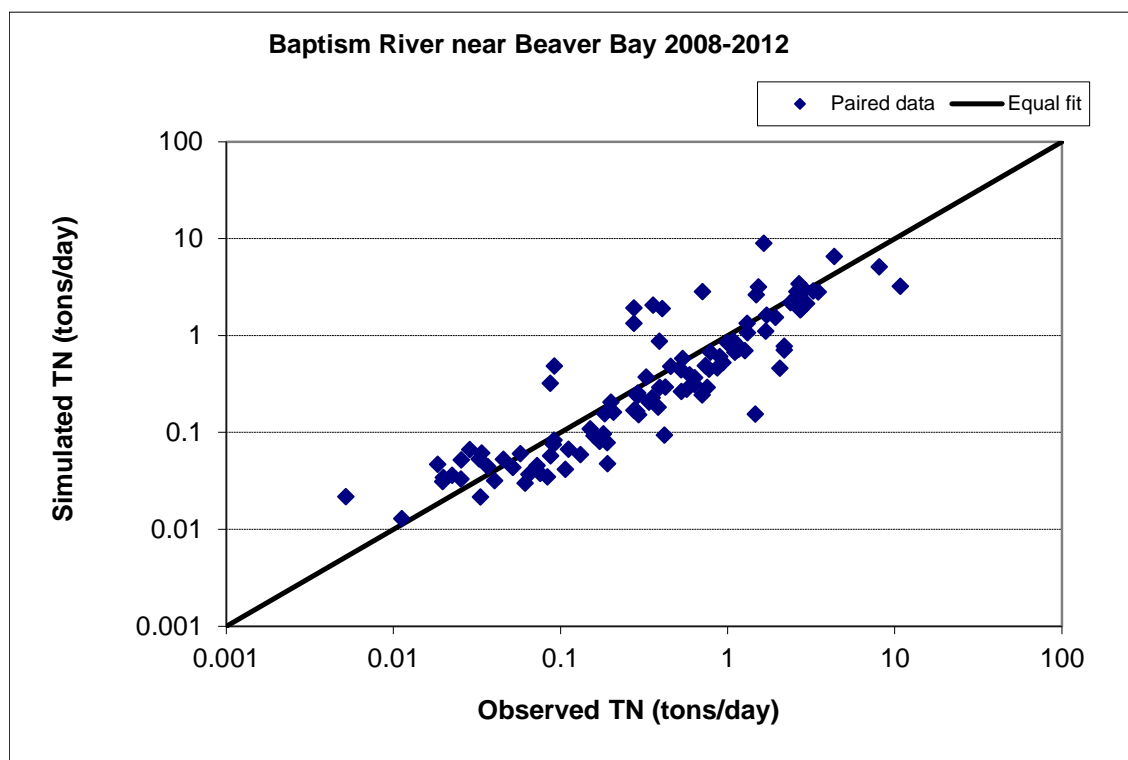
Count	106
Concentration Average Error	-5.67%
Concentration Median Error	-7.15%
Load Ave Error	-7.77%
Load Median Error	-6.92%
Paired t concentration	1.00
Paired t load	0.79



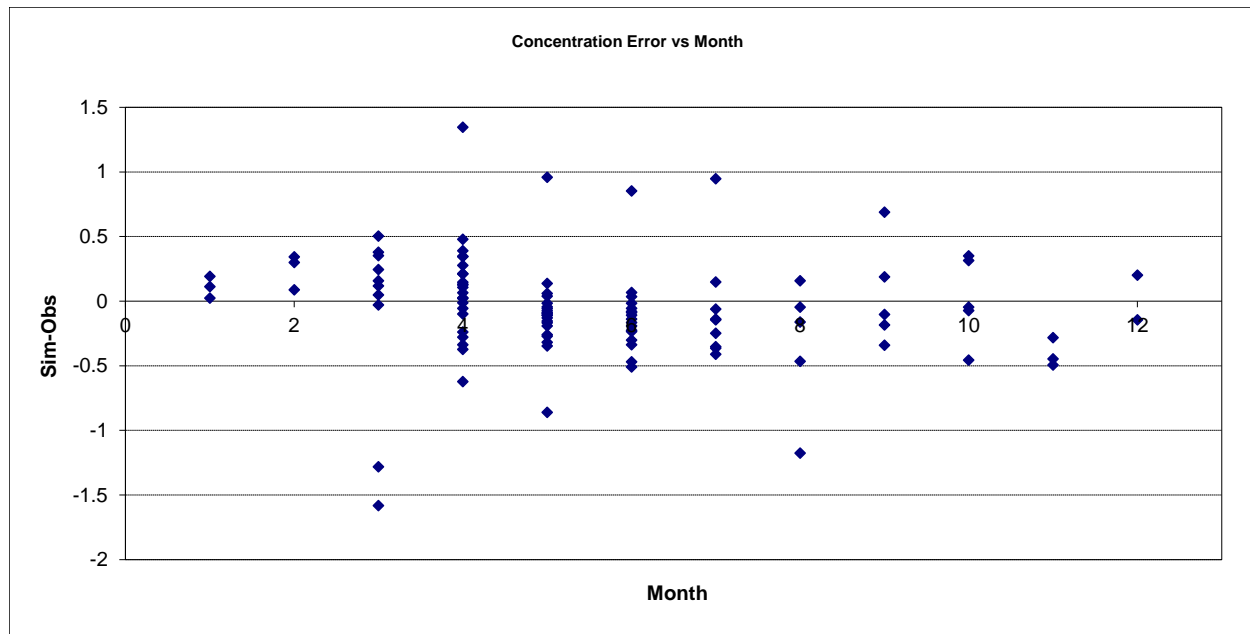
**Figure 238. Power plot of simulated and observed Total Nitrogen (TN) load vs flow at Baptism River near Beaver Bay**



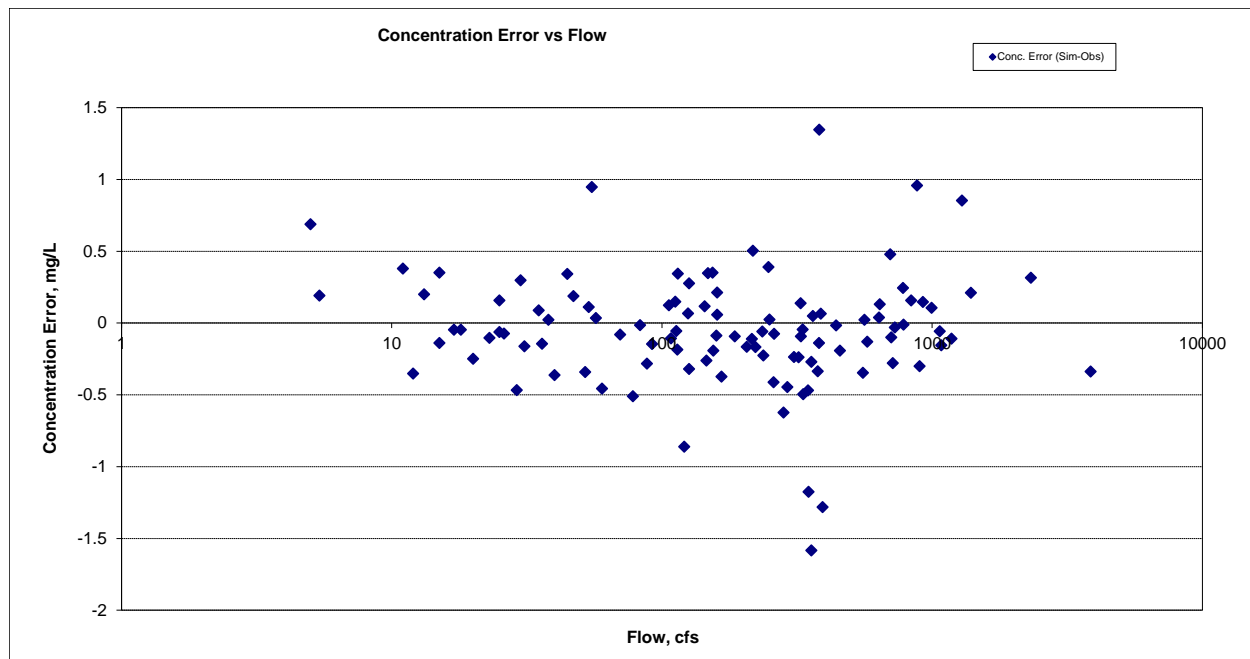
**Figure 239. Time series of observed and simulated Total Nitrogen (TN) concentration at Baptism River near Beaver Bay**



**Figure 240. Paired simulated vs. observed Total Nitrogen (TN) load at Baptism River near Beaver Bay**



**Figure 241. Residual (Simulated - Observed) vs. Month Total Nitrogen (TN) at Baptism River near Beaver Bay**



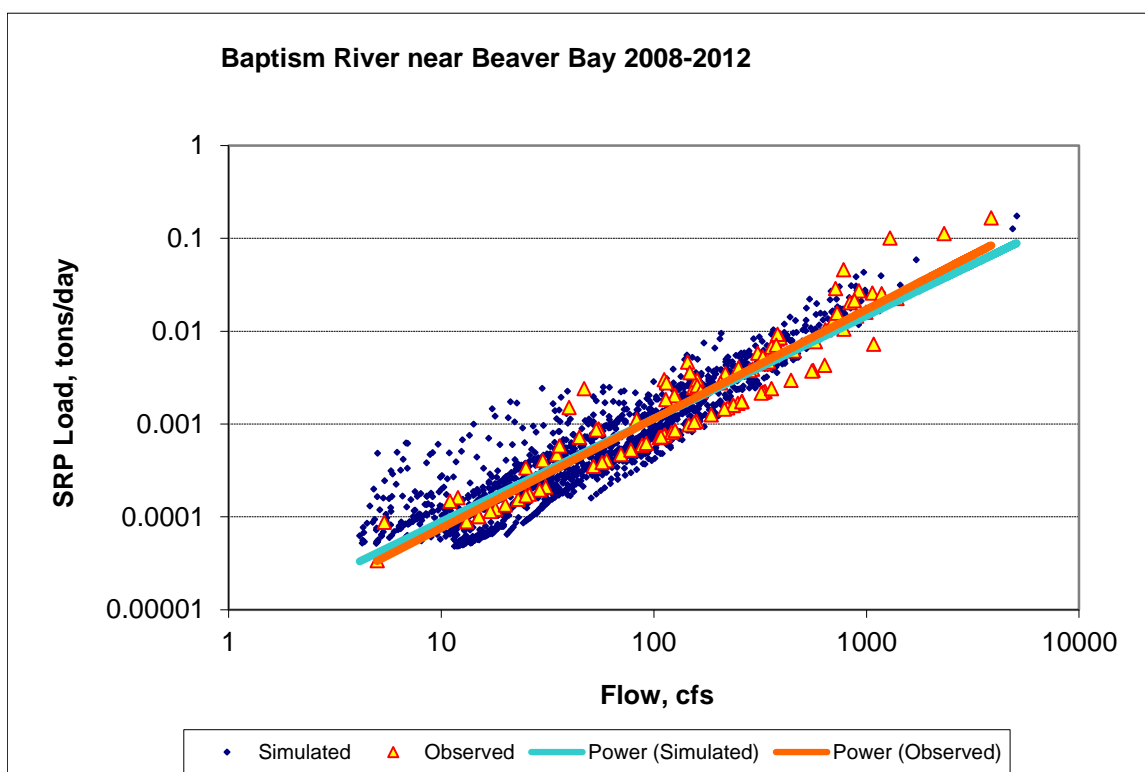
**Figure 242. Residual (Simulated - Observed) vs. Flow Total Nitrogen (TN) at Baptism River near Beaver Bay**



## Soluble Reactive Phosphorus (SRP)

**Table 47. Soluble Reactive Phosphorus (SRP) statistics**

Count	106
Concentration Average Error	-3.35%
Concentration Median Error	4.43%
Load Ave Error	-28.22%
Load Median Error	-0.20%
Paired t concentration	0.99
Paired t load	0.34



**Figure 243. Power plot of simulated and observed Soluble Reactive Phosphorus (SRP) load vs flow at Baptism River near Beaver Bay**

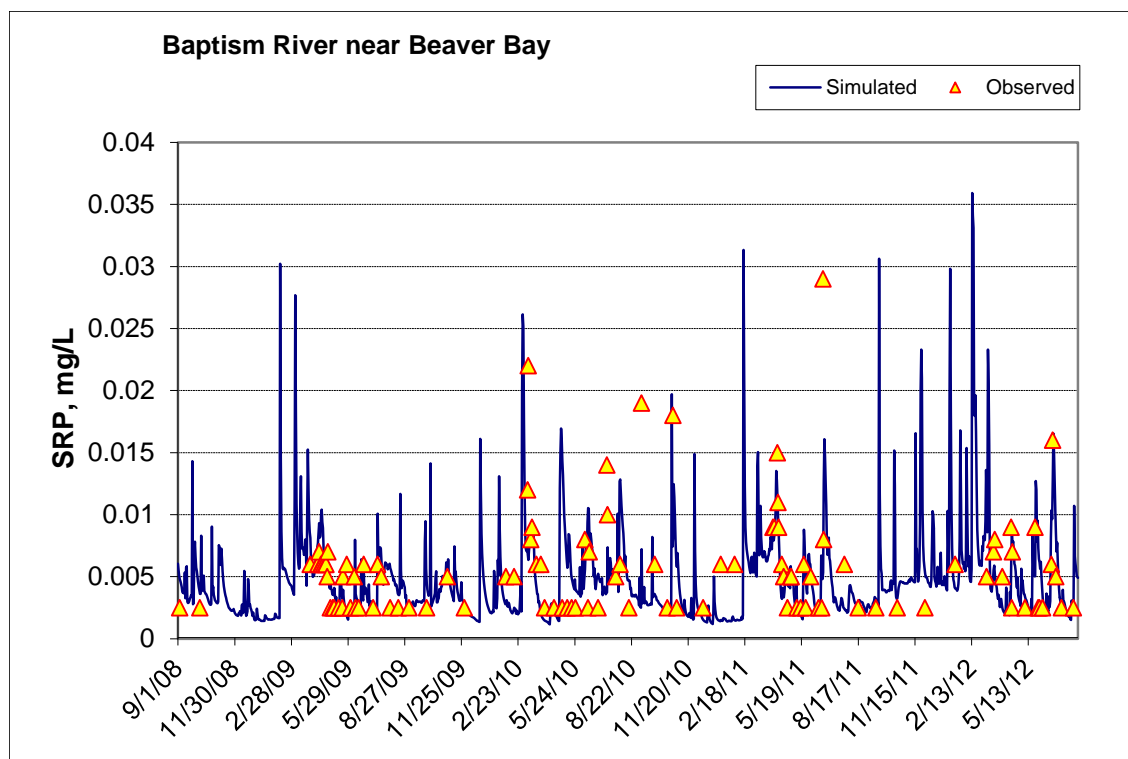


Figure 244. Time series of observed and simulated Soluble Reactive Phosphorus (SRP) concentration at Baptism River near Beaver Bay

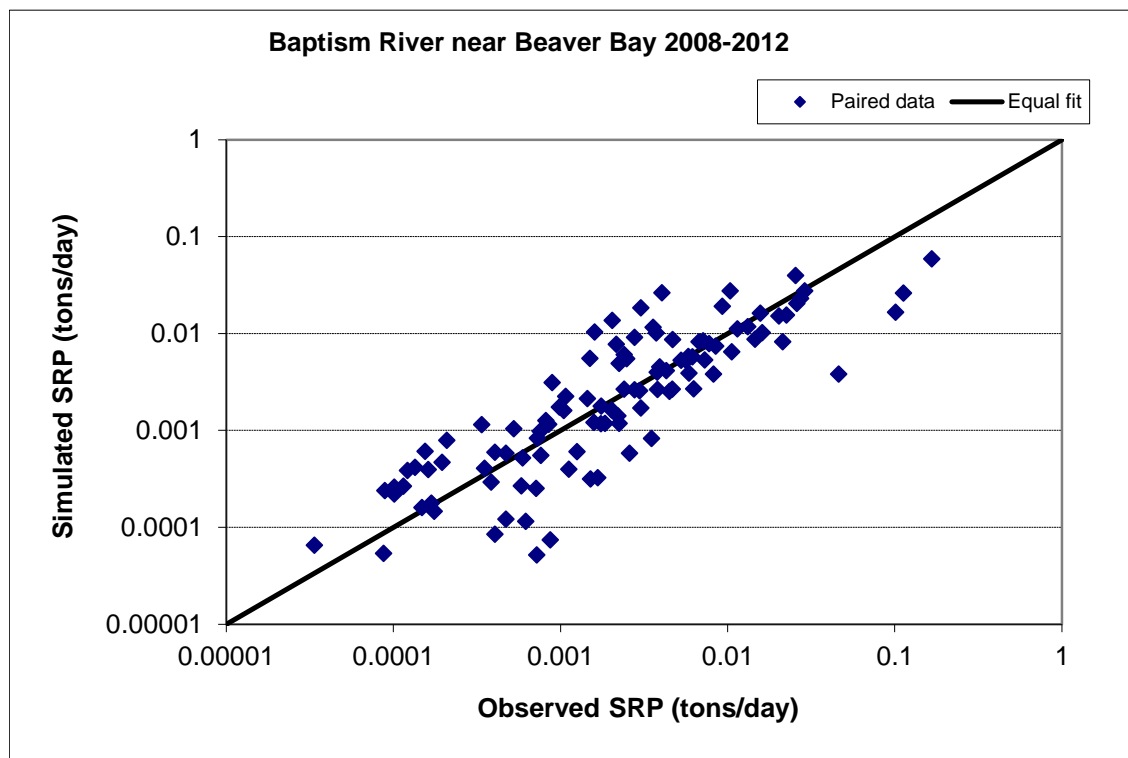
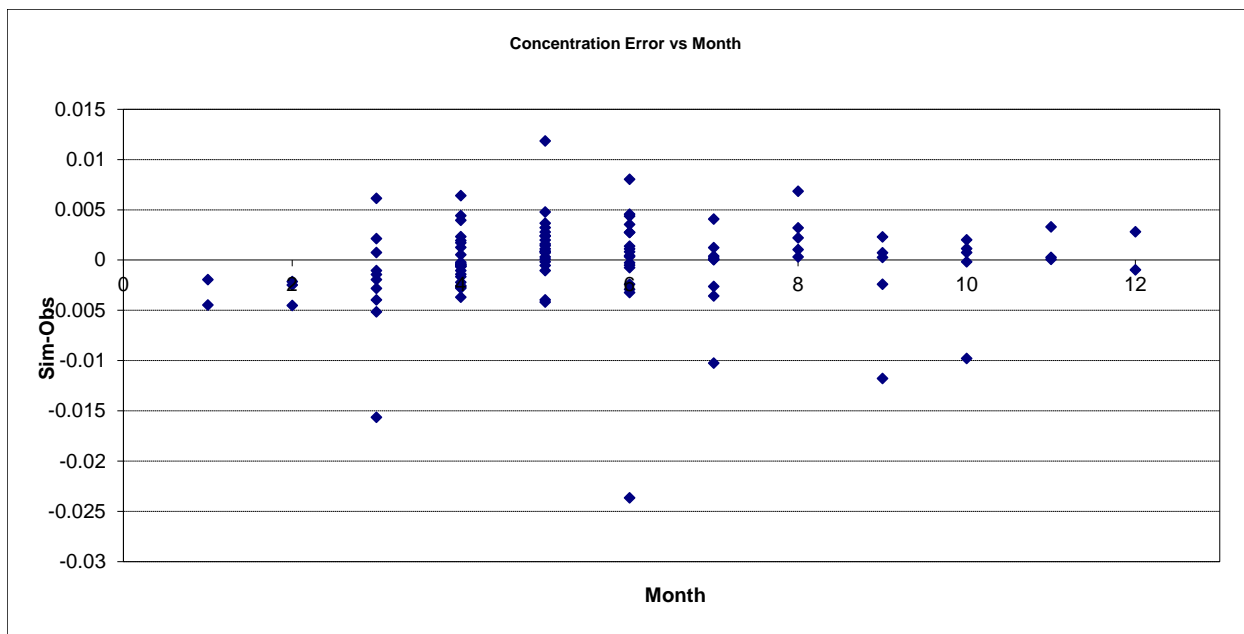
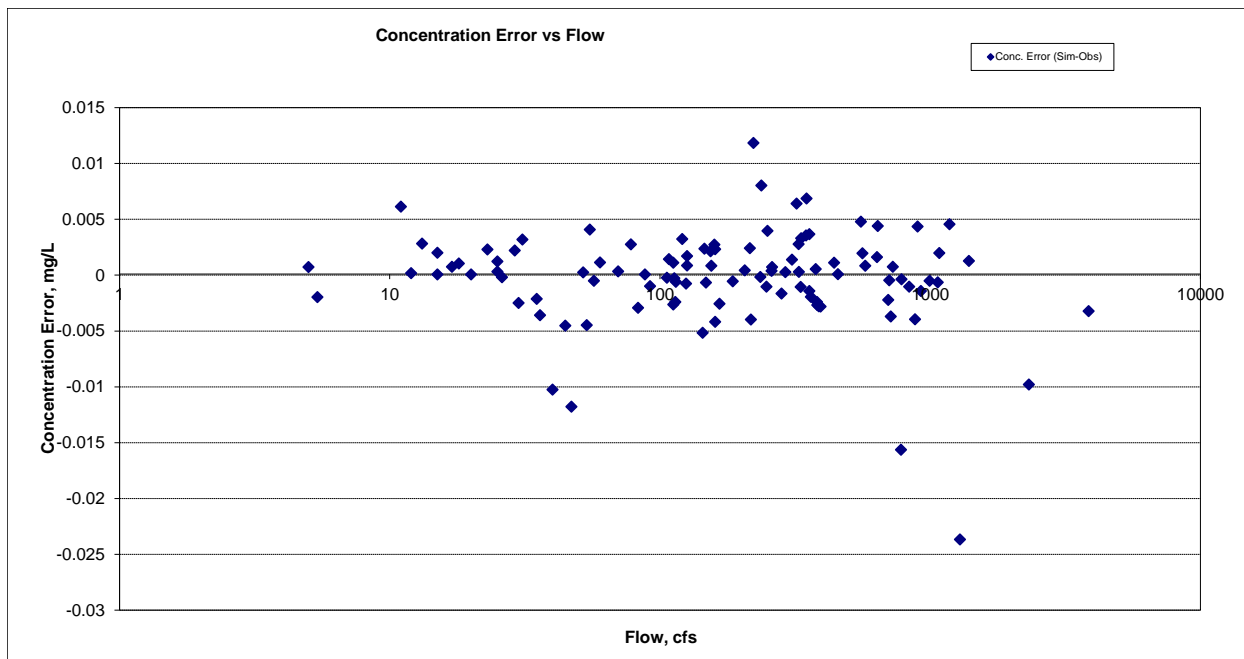


Figure 245. Paired simulated vs. observed Soluble Reactive Phosphorus (SRP) load at Baptism River near Beaver Bay



**Figure 246. Residual (Simulated - Observed) vs. Month Soluble Reactive Phosphorus (SRP) at Baptism River near Beaver Bay**



**Figure 247. Residual (Simulated - Observed) vs. Flow Soluble Reactive Phosphorus (SRP) at Baptism River near Beaver Bay**

## Organic Phosphorus (OrgP)

Table 48. Organic Phosphorus (OrgP) statistics

Count	104
Concentration Average Error	13.11%
Concentration Median Error	1.43%
Load Ave Error	15.97%
Load Median Error	-3.20%
Paired t concentration	0.69
Paired t load	0.56

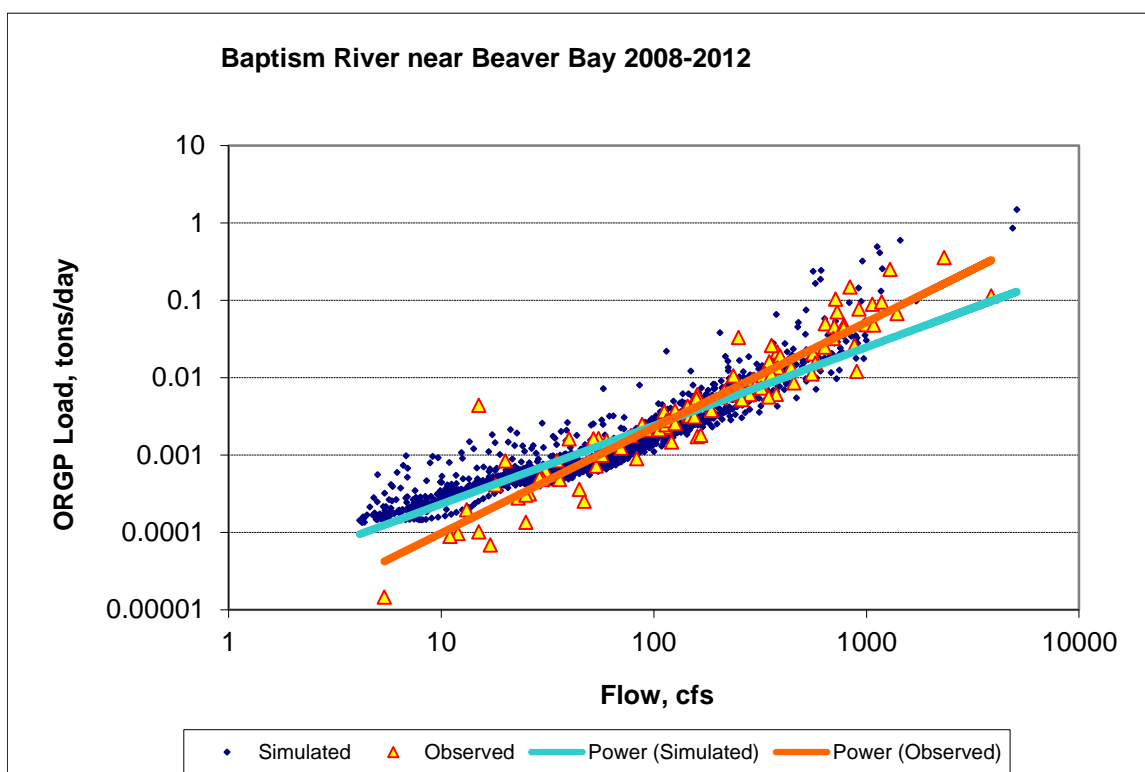


Figure 248. Power plot of simulated and observed Organic Phosphorus (OrgP) load vs flow at Baptism River near Beaver Bay

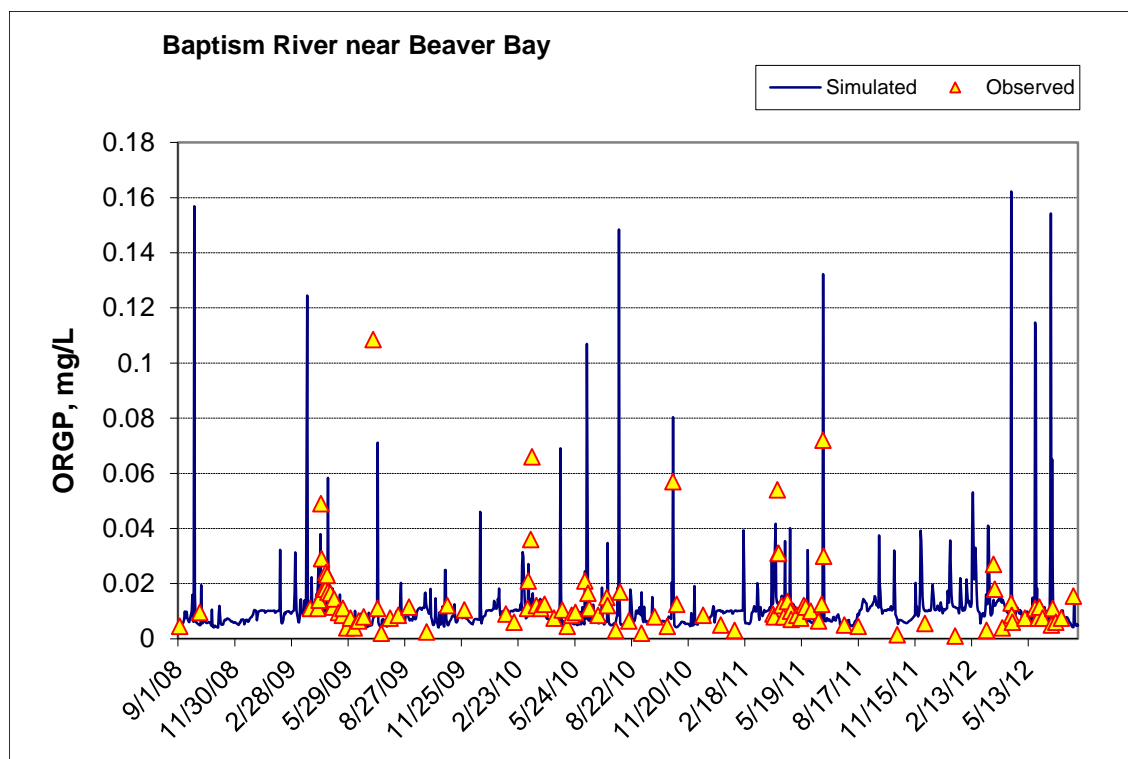


Figure 249. Time series of observed and simulated Organic Phosphorus (OrgP) concentration at Baptism River near Beaver Bay

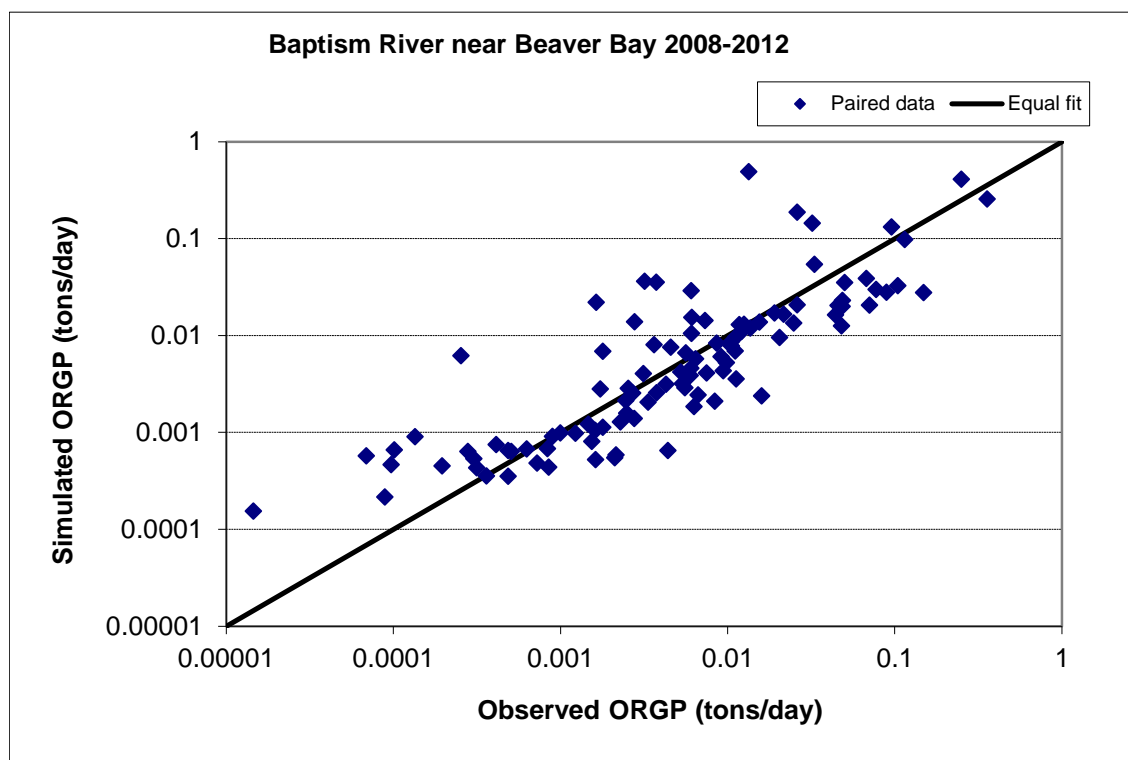
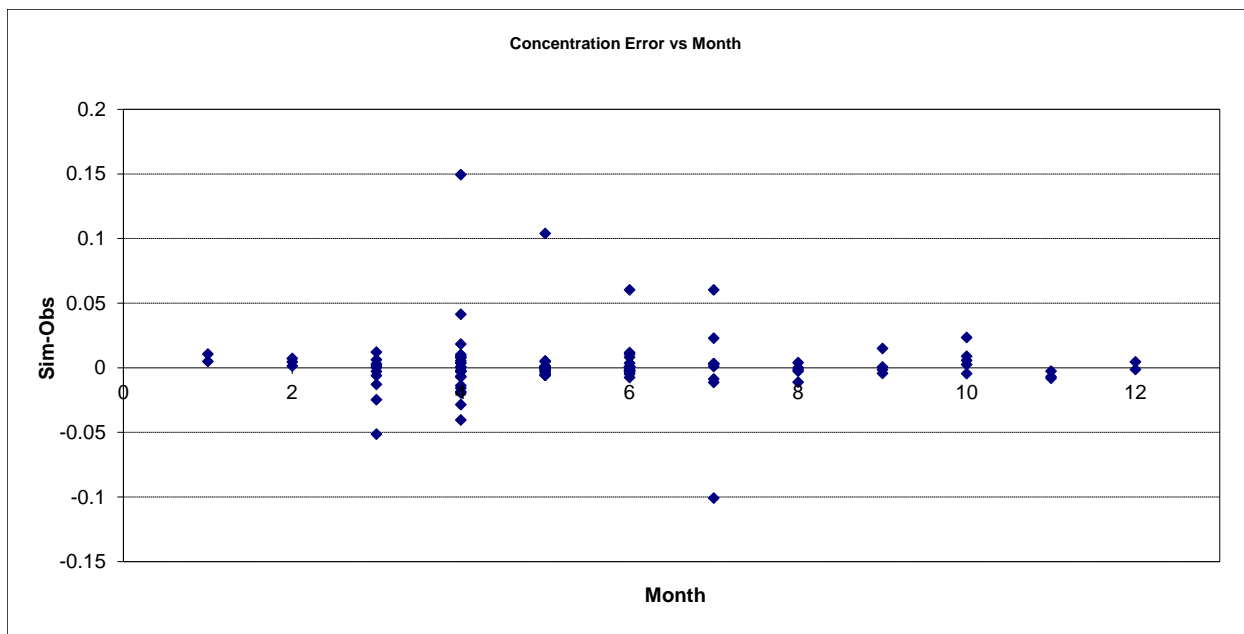
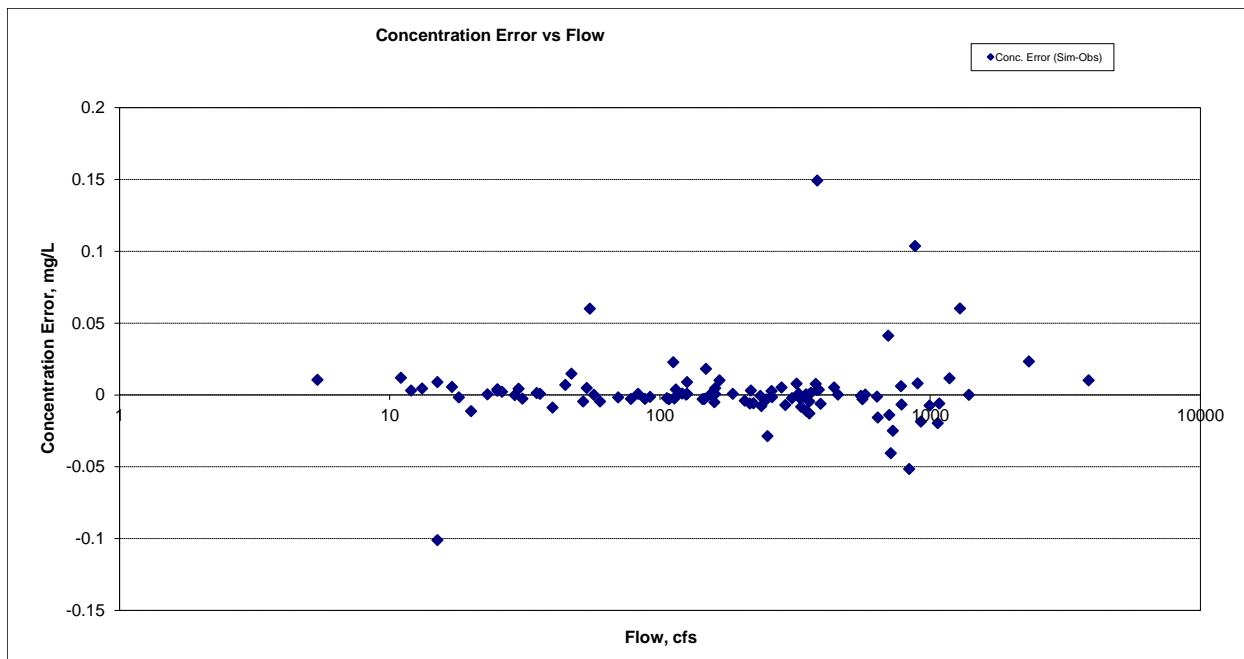


Figure 250. Paired simulated vs. observed Organic Phosphorus (OrgP) load at Baptism River near Beaver Bay



**Figure 251. Residual (Simulated - Observed) vs. Month Organic Phosphorus (OrgP) at Baptism River near Beaver Bay**

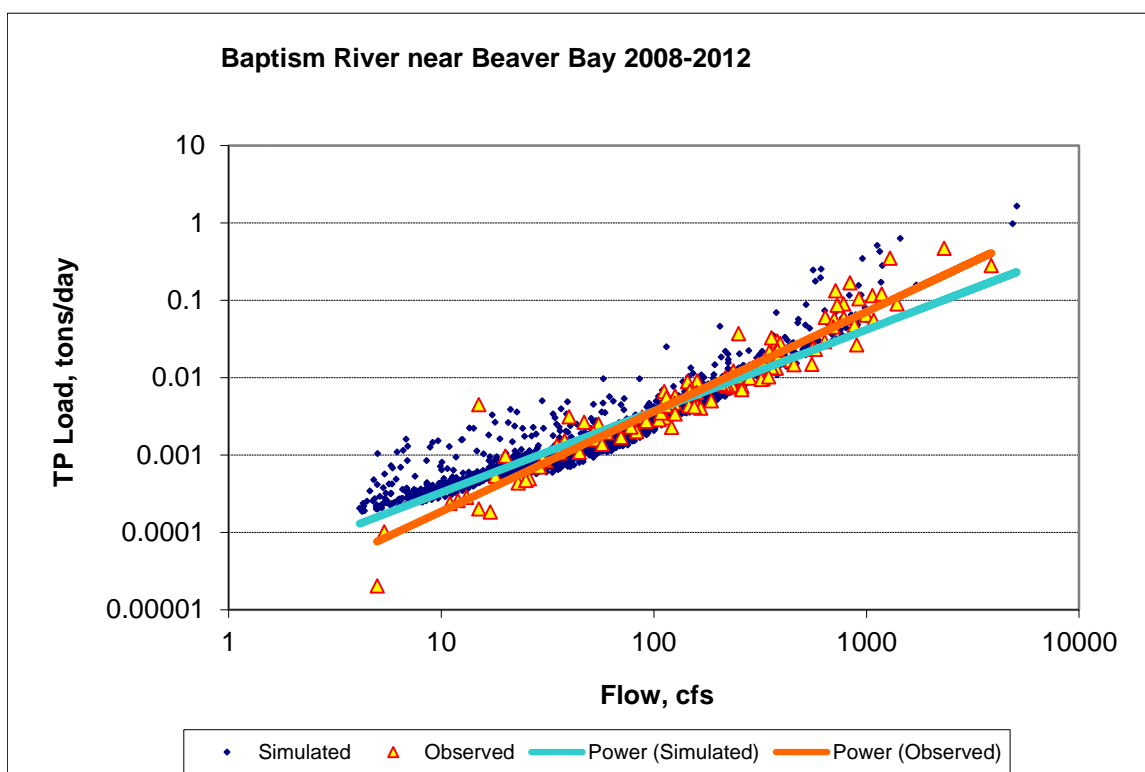


**Figure 252. Residual (Simulated - Observed) vs. Flow Organic Phosphorus (OrgP) at Baptism River near Beaver Bay**

## Total Phosphorus (TP)

**Table 49. Total Phosphorus (TP) statistics**

Count	106
Concentration Average Error	8.86%
Concentration Median Error	1.37%
Load Ave Error	3.25%
Load Median Error	-2.30%
Paired t concentration	0.85
Paired t load	0.76



**Figure 253. Power plot of simulated and observed Total Phosphorus (TP) load vs flow at Baptism River near Beaver Bay**

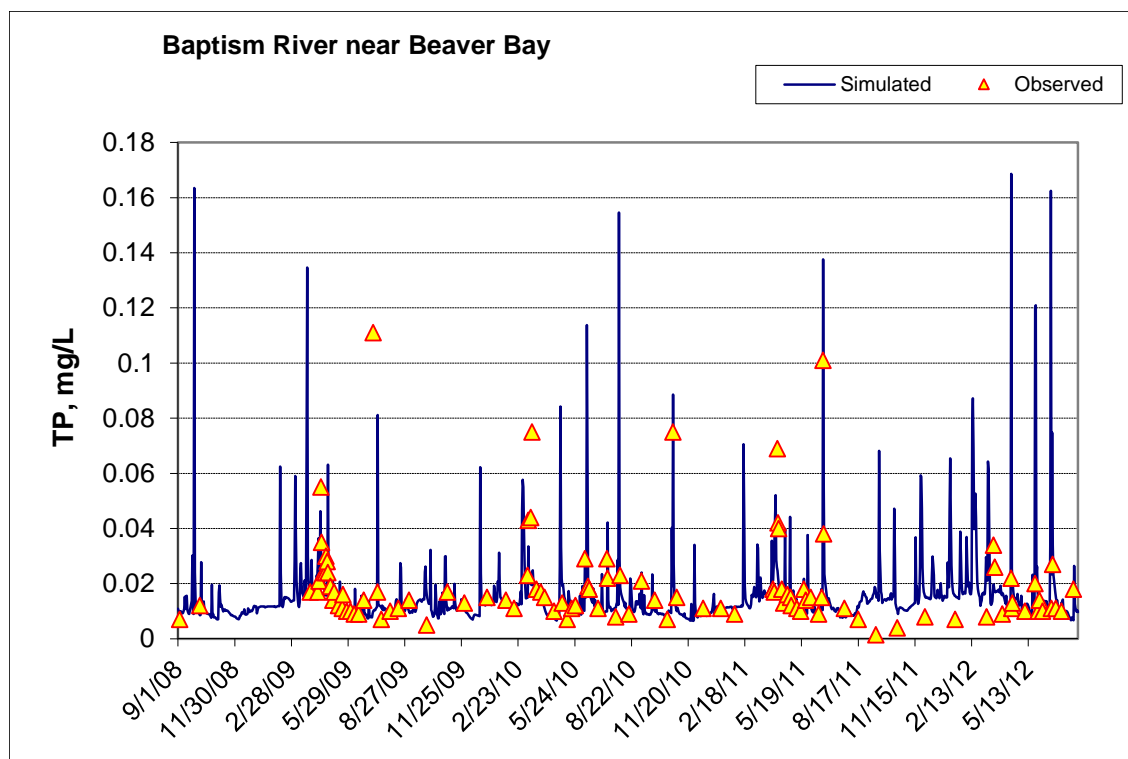


Figure 254. Time series of observed and simulated Total Phosphorus (TP) concentration at Baptism River near Beaver Bay

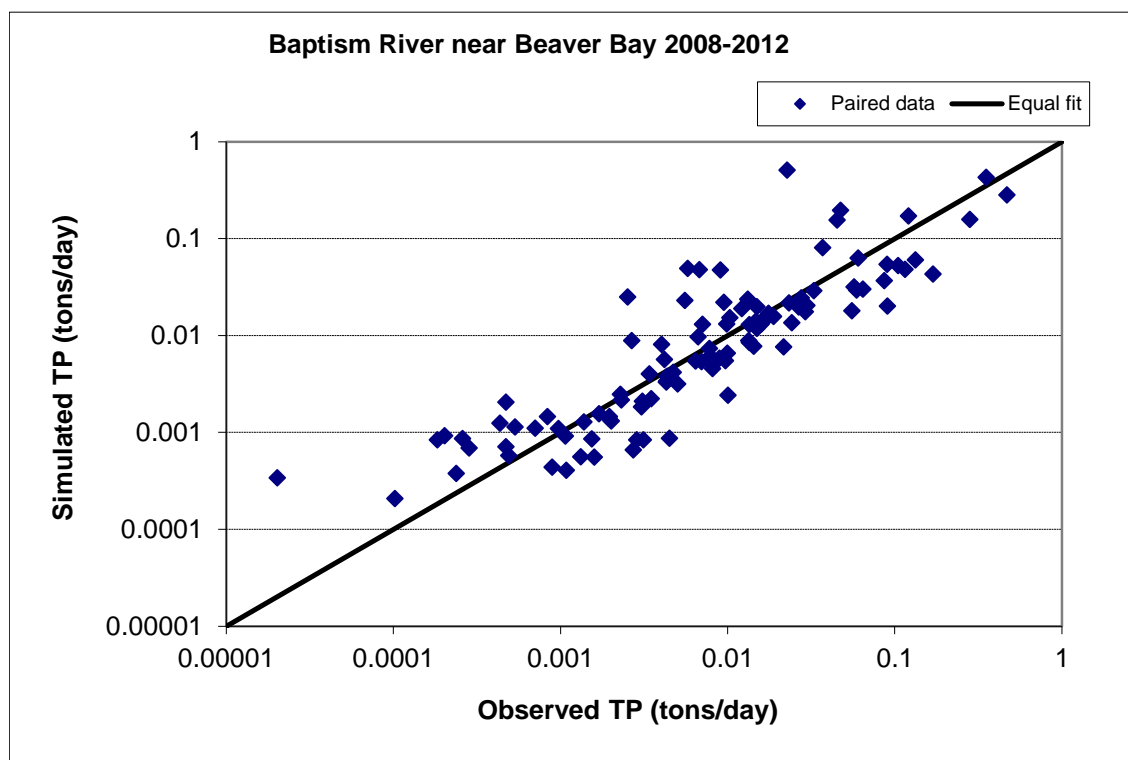


Figure 255. Paired simulated vs. observed Total Phosphorus (TP) load at Baptism River near Beaver Bay





Figure 256. Residual (Simulated - Observed) vs. Month Total Phosphorus (TP) at Baptism River near Beaver Bay

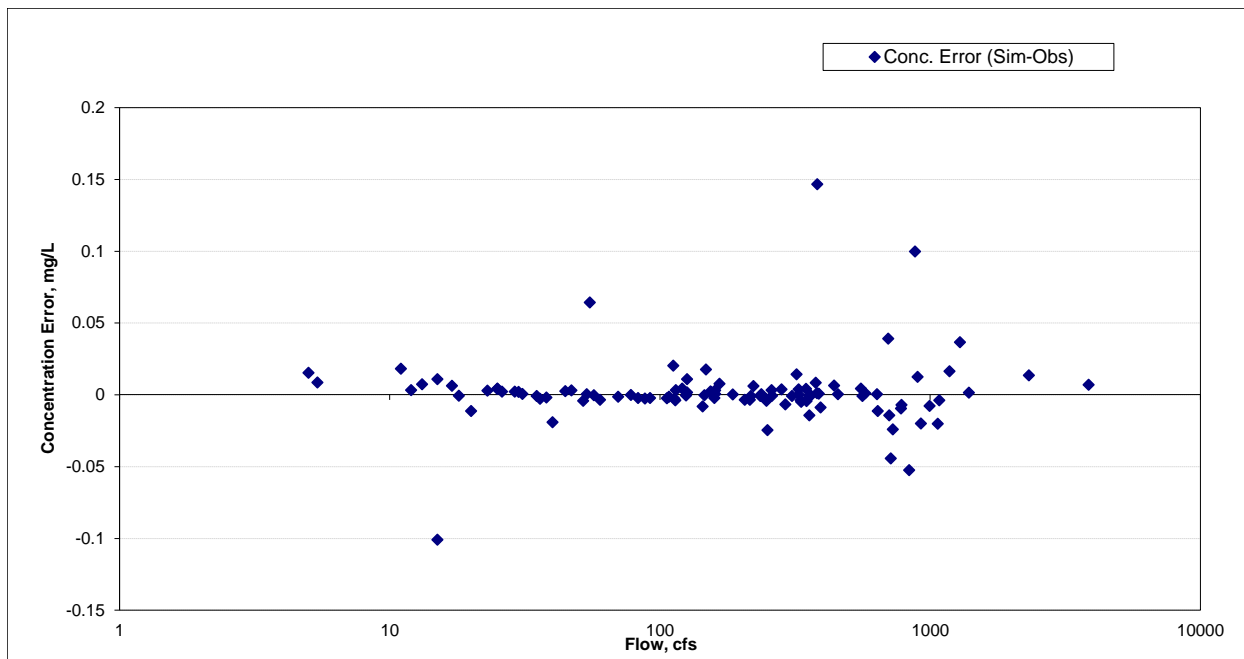


Figure 257. Residual (Simulated - Observed) vs. Flow Total Phosphorus (TP) at Baptism River near Beaver Bay

## Poplar River near Lutsen (HYDSTRA 01063003)

### Total Suspended Solids (TSS)

Table 50. Total Suspended Solids (TSS) statistics

Count	116
Concentration Average Error	2.18%
Concentration Median Error	8.18%
Load Ave Error	37.85%
Load Median Error	1.40%
Paired t concentration	0.90
Paired t load	0.29

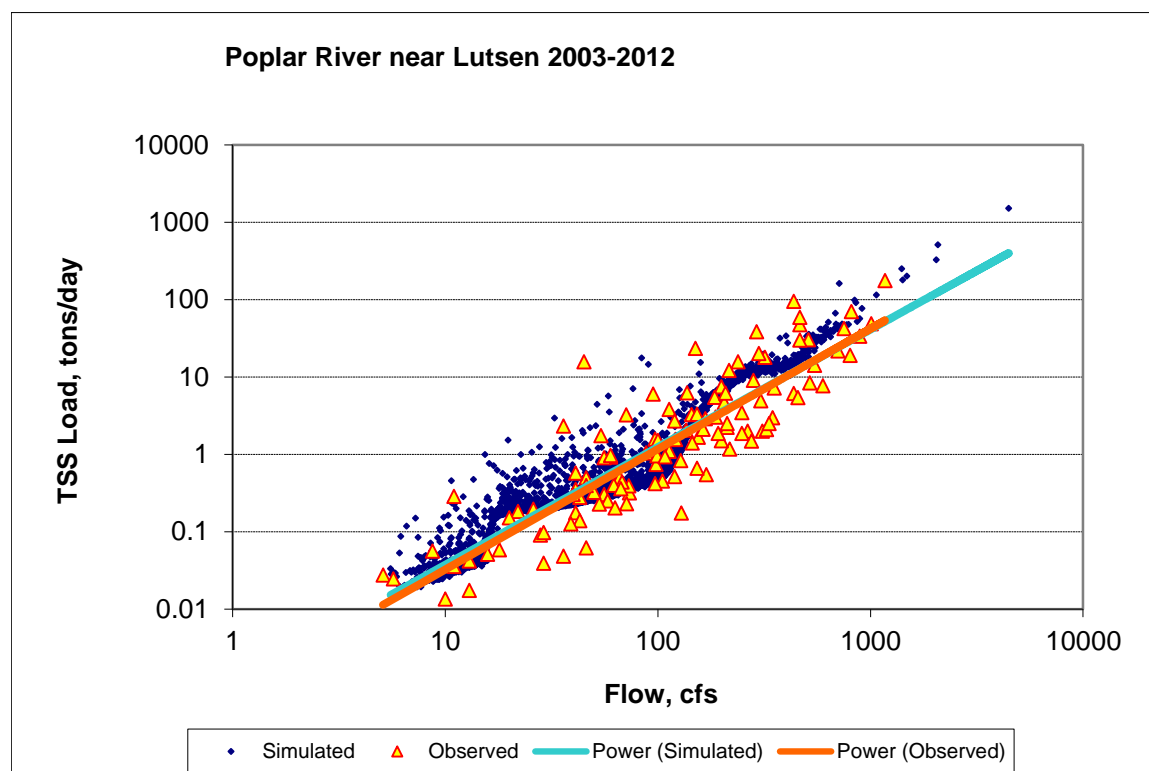


Figure 258. Power plot of simulated and observed Total Suspended Solids (TSS) load vs flow at Poplar River near Lutsen

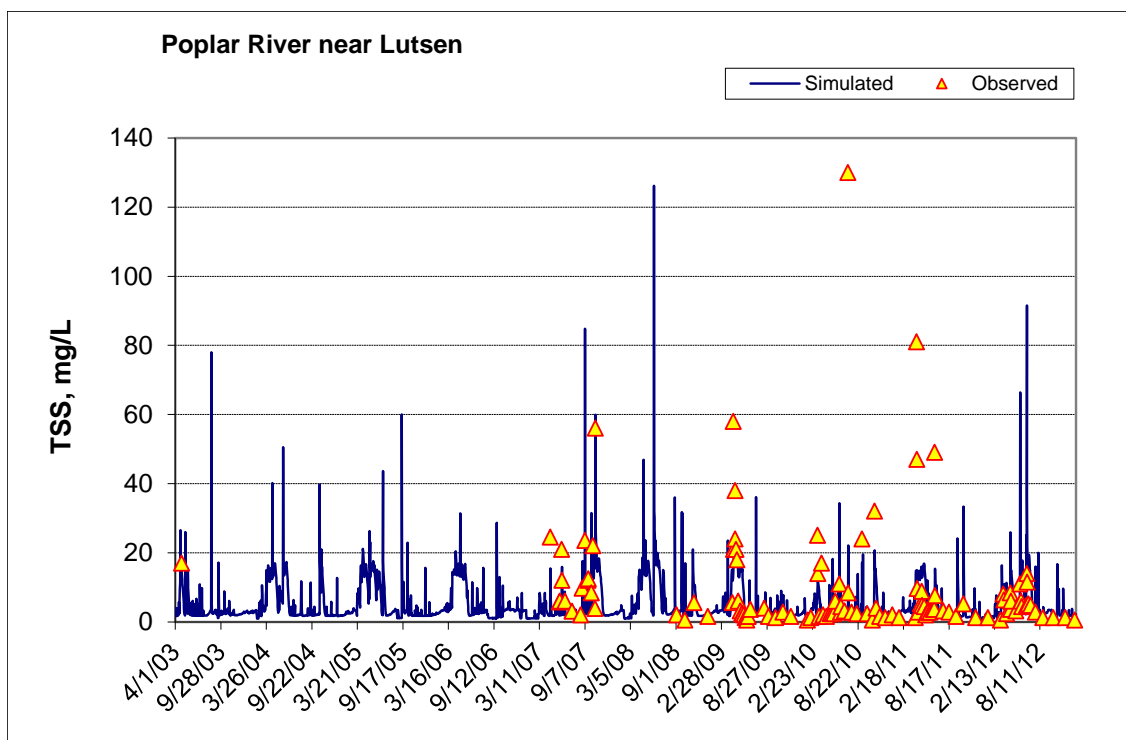


Figure 259. Time series of observed and simulated Total Suspended Solids (TSS) concentration at Poplar River near Lutsen

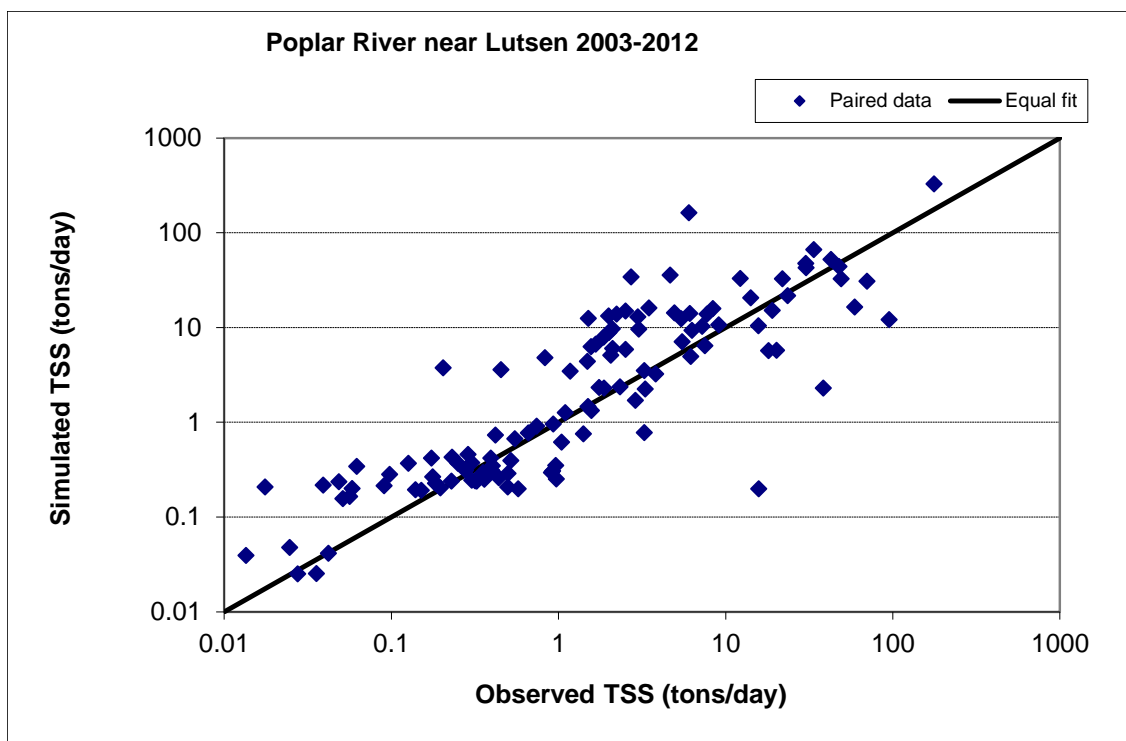
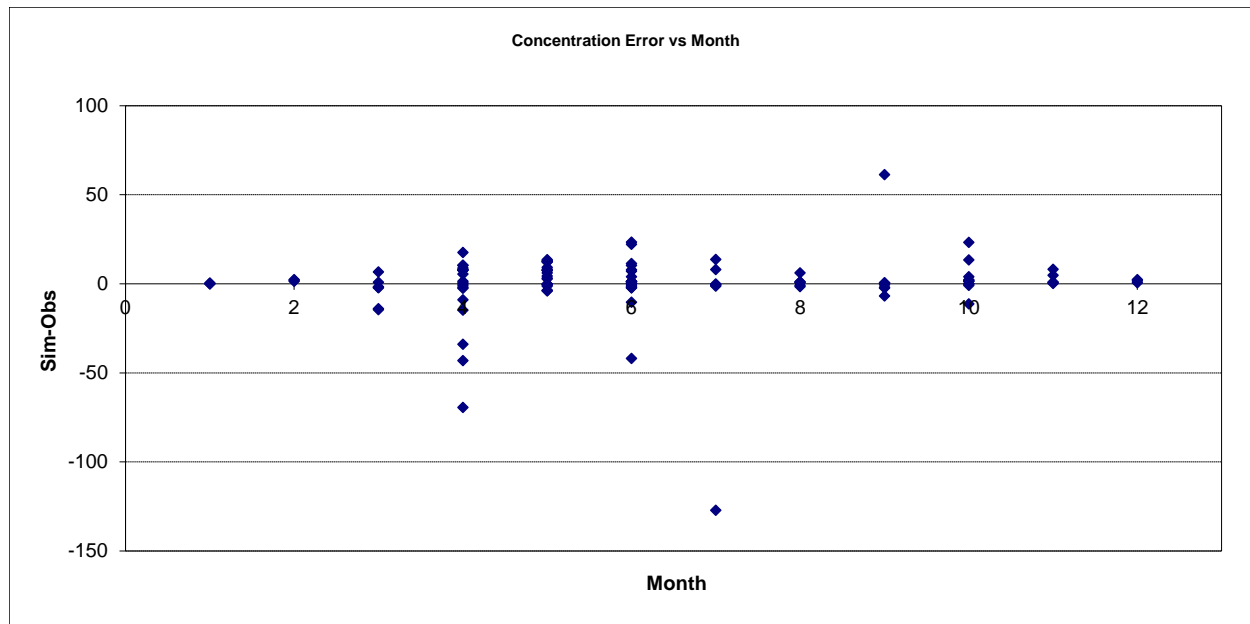
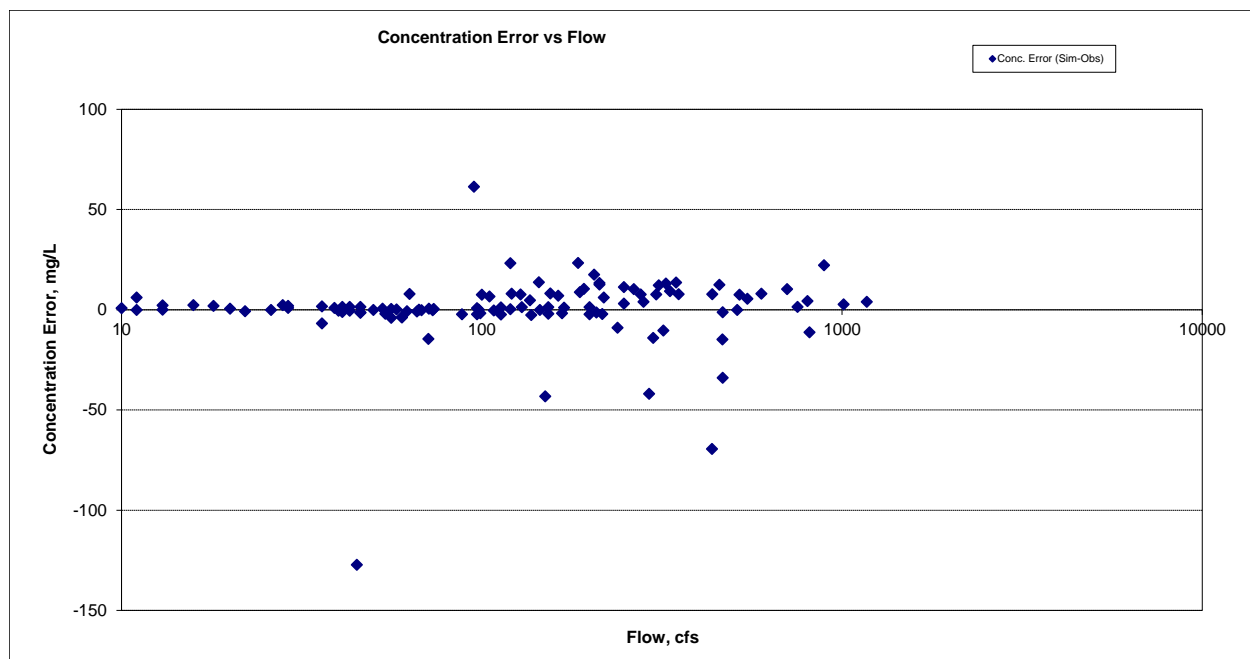


Figure 260. Paired simulated vs. observed Total Suspended Solids (TSS) load at Poplar River near Lutsen



**Figure 261. Residual (Simulated - Observed) vs. Month Total Suspended Solids (TSS) at Poplar River near Lutsen**

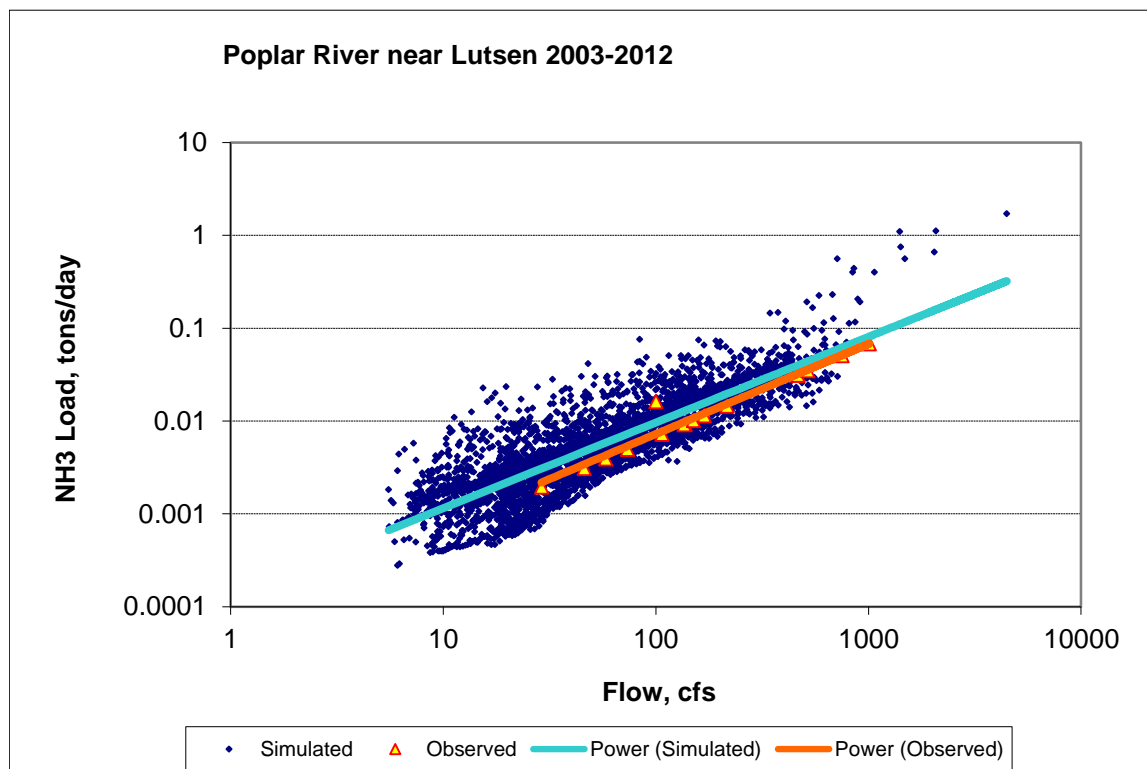


**Figure 262. Residual (Simulated - Observed) vs. Flow Total Suspended Solids (TSS) at Poplar River near Lutsen**

## Ammonia Nitrogen (NH<sub>3</sub>)

**Table 51. Ammonia Nitrogen (NH<sub>3</sub>) statistics**

Count	16
Concentration Average Error	-1.59%
Concentration Median Error	-3.02%
Load Ave Error	46.98%
Load Median Error	22.16%
Paired t concentration	0.97
Paired t load	0.21



**Figure 263. Power plot of simulated and observed Ammonia Nitrogen (NH<sub>3</sub>) load vs flow at Poplar River near Lutsen**

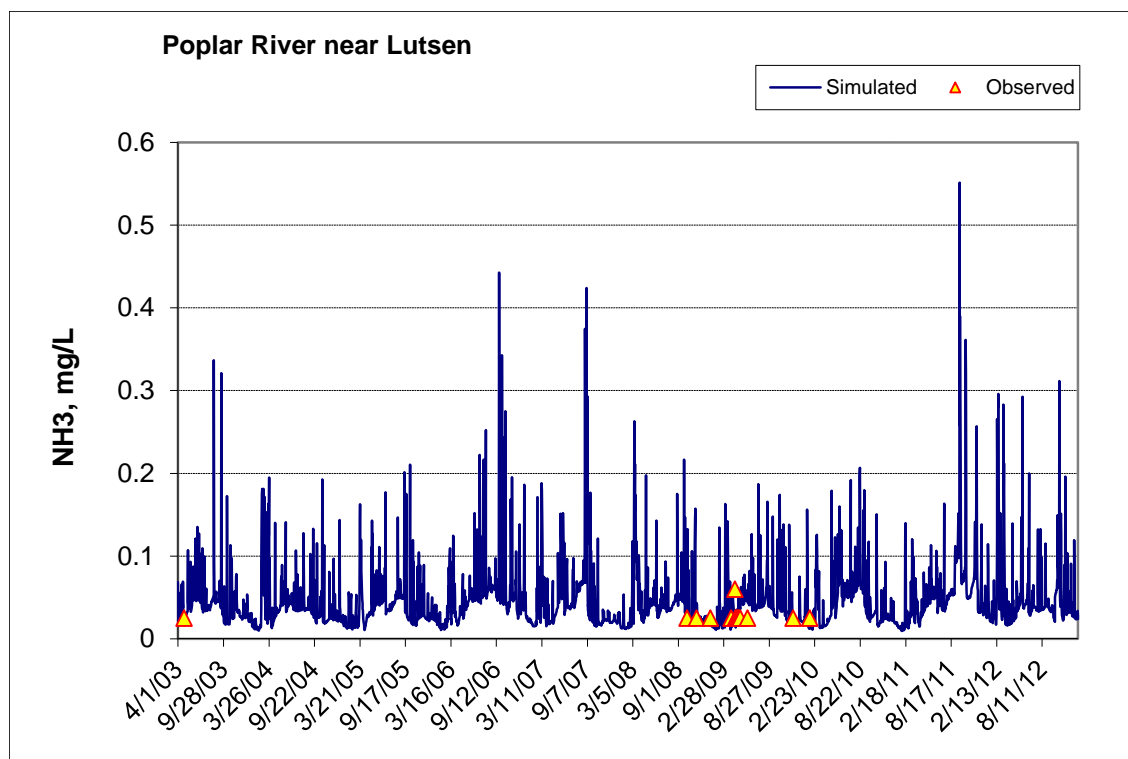


Figure 264. Time series of observed and simulated Ammonia Nitrogen (NH<sub>3</sub>) concentration at Poplar River near Lutsen

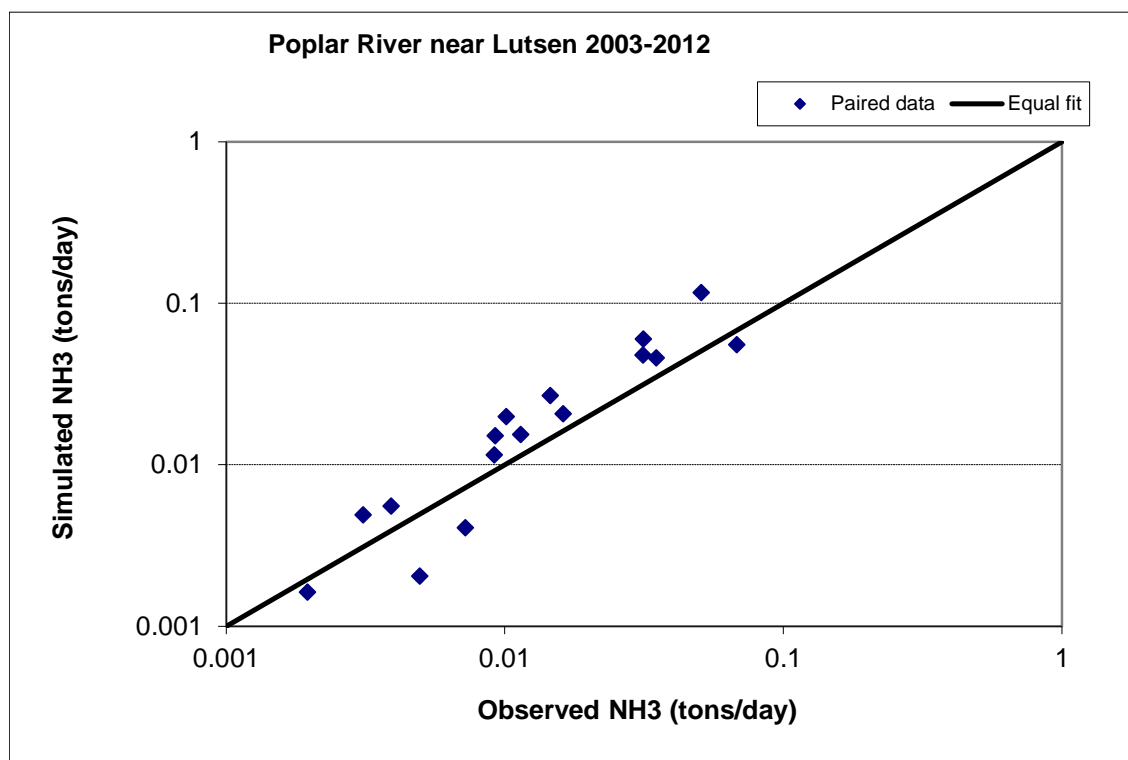


Figure 265. Paired simulated vs. observed Ammonia Nitrogen (NH<sub>3</sub>) load at Poplar River near Lutsen

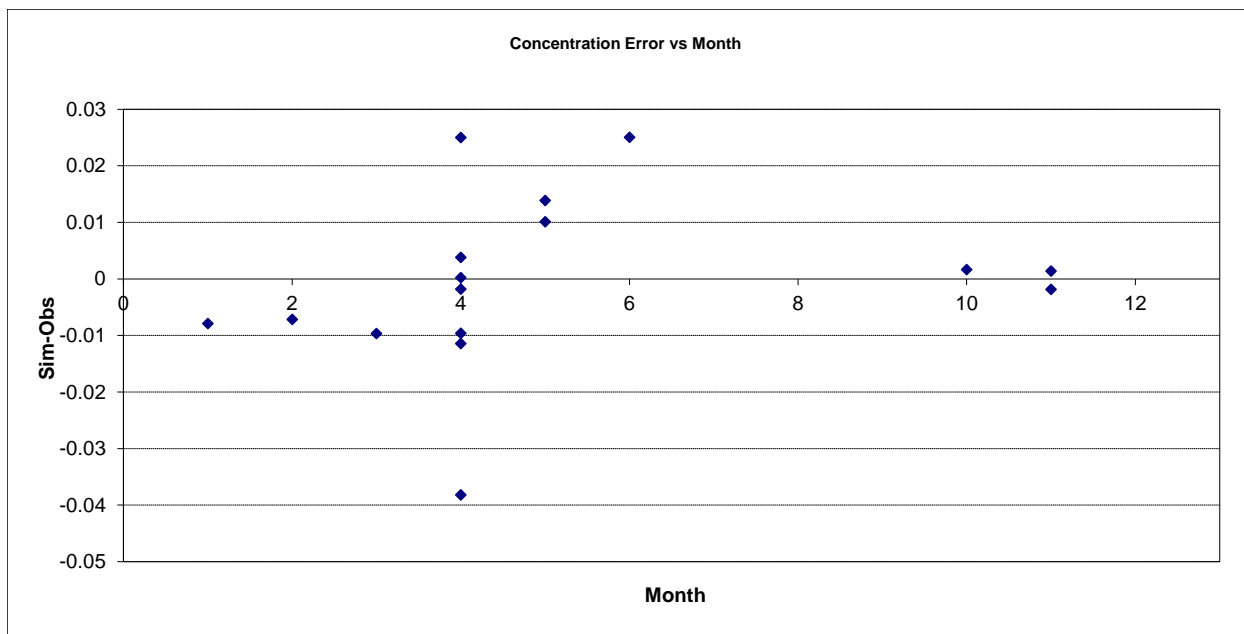


Figure 266. Residual (Simulated - Observed) vs. Month Ammonia Nitrogen (NH3) at Poplar River near Lutsen

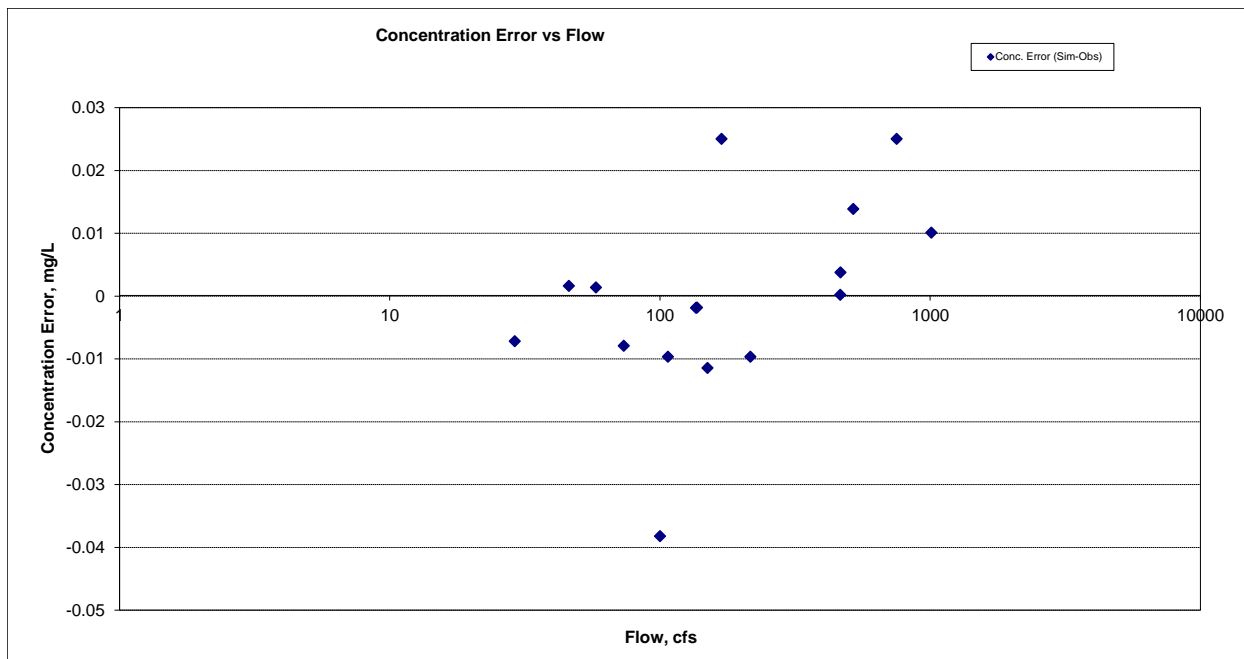


Figure 267. Residual (Simulated - Observed) vs. Flow Ammonia Nitrogen (NH3) at Poplar River near Lutsen

## Organic Nitrogen (OrgN)

Table 52. Organic Nitrogen (OrgN) statistics

Count	16
Concentration Average Error	2.70%
Concentration Median Error	-3.43%
Load Ave Error	59.76%
Load Median Error	3.69%
Paired t concentration	0.98
Paired t load	0.13

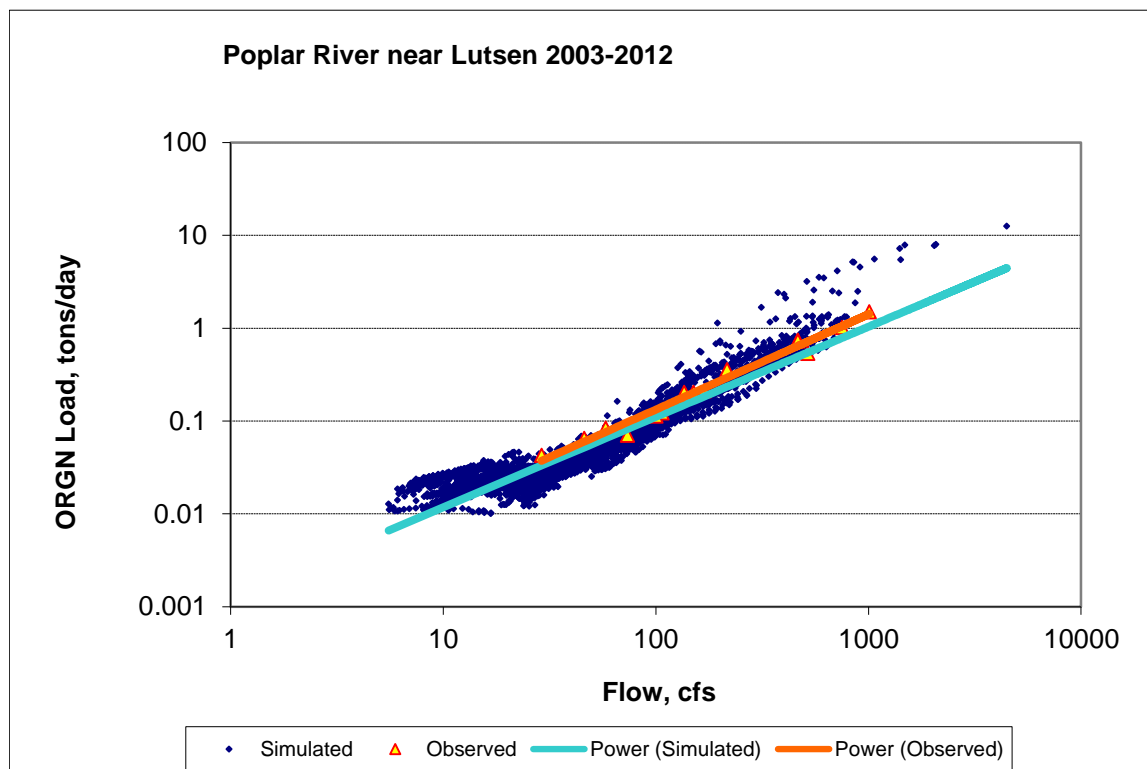


Figure 268. Power plot of simulated and observed Organic Nitrogen (OrgN) load vs flow at Poplar River near Lutsen



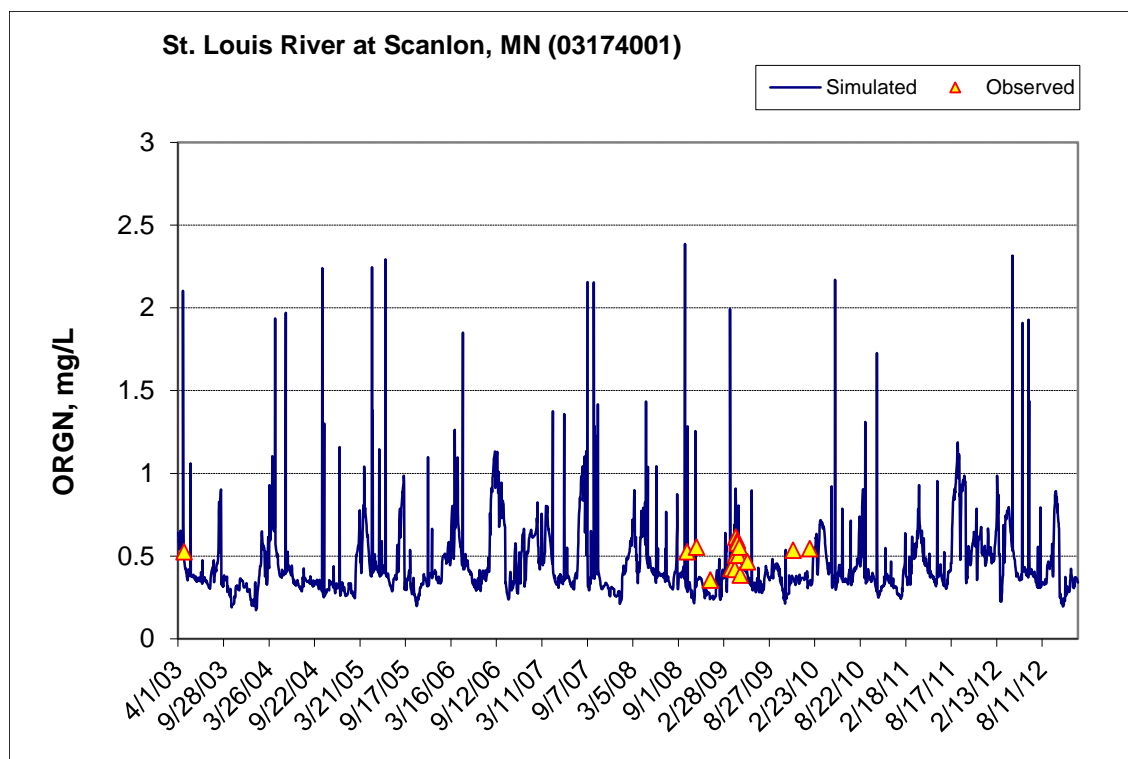


Figure 269. Time series of observed and simulated Organic Nitrogen (OrgN) concentration at Poplar River near Lutsen

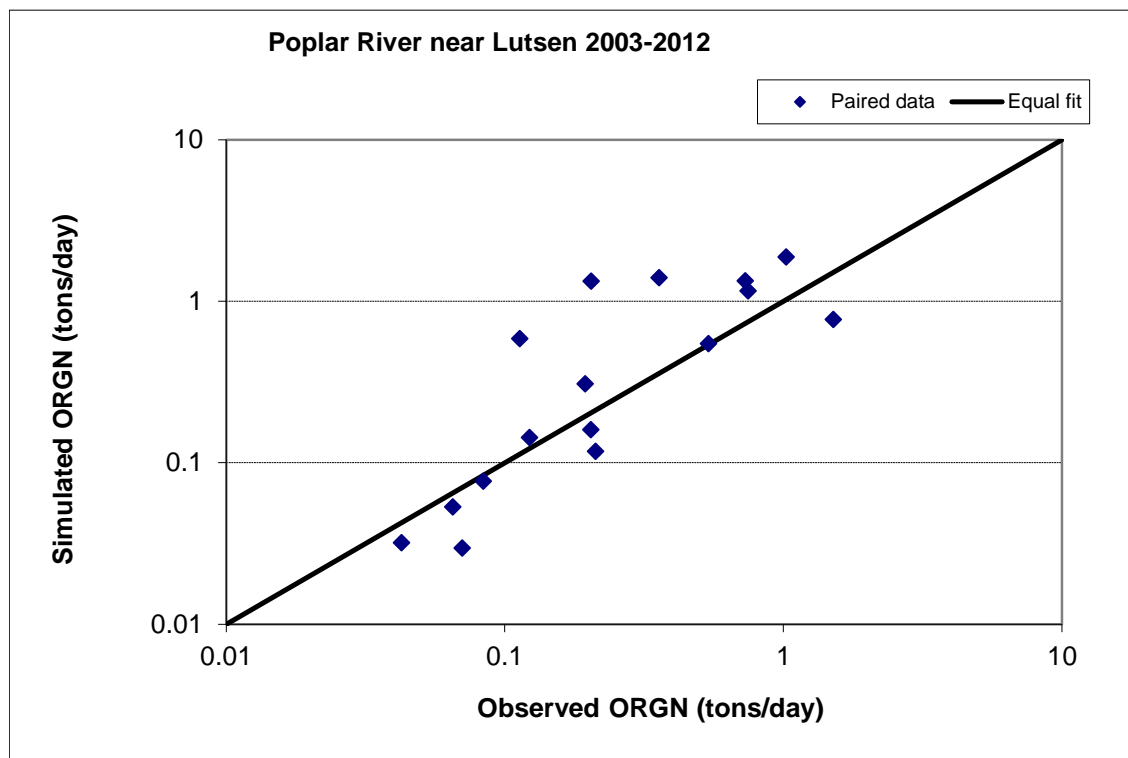
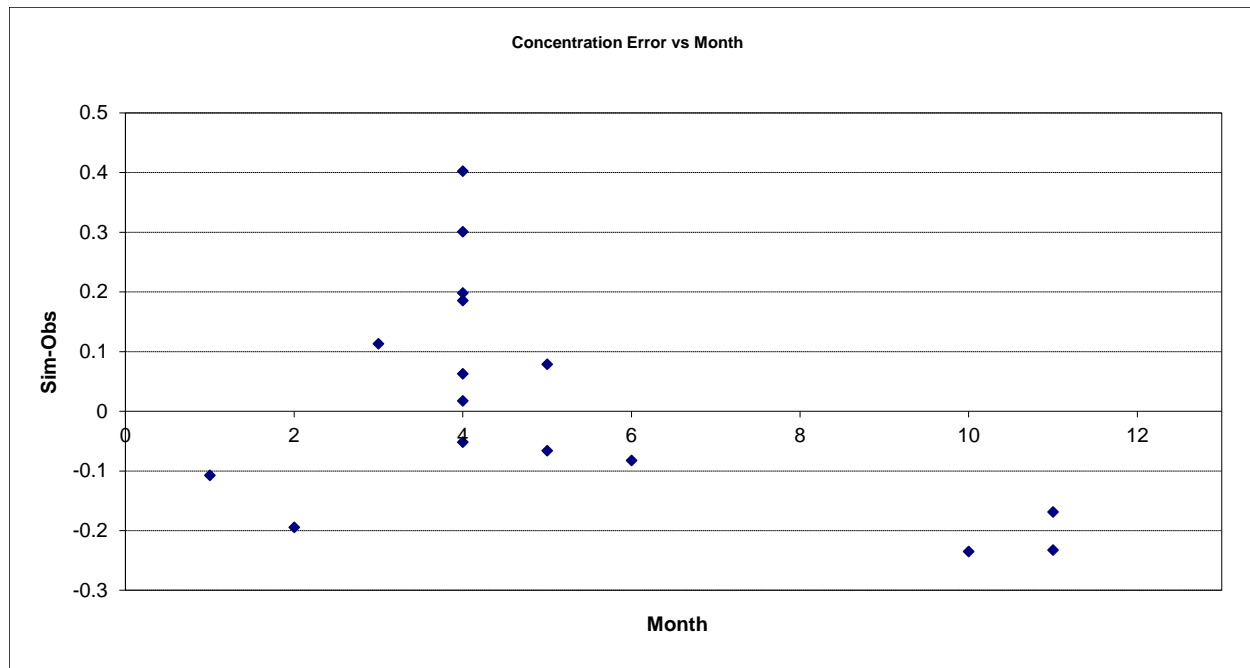
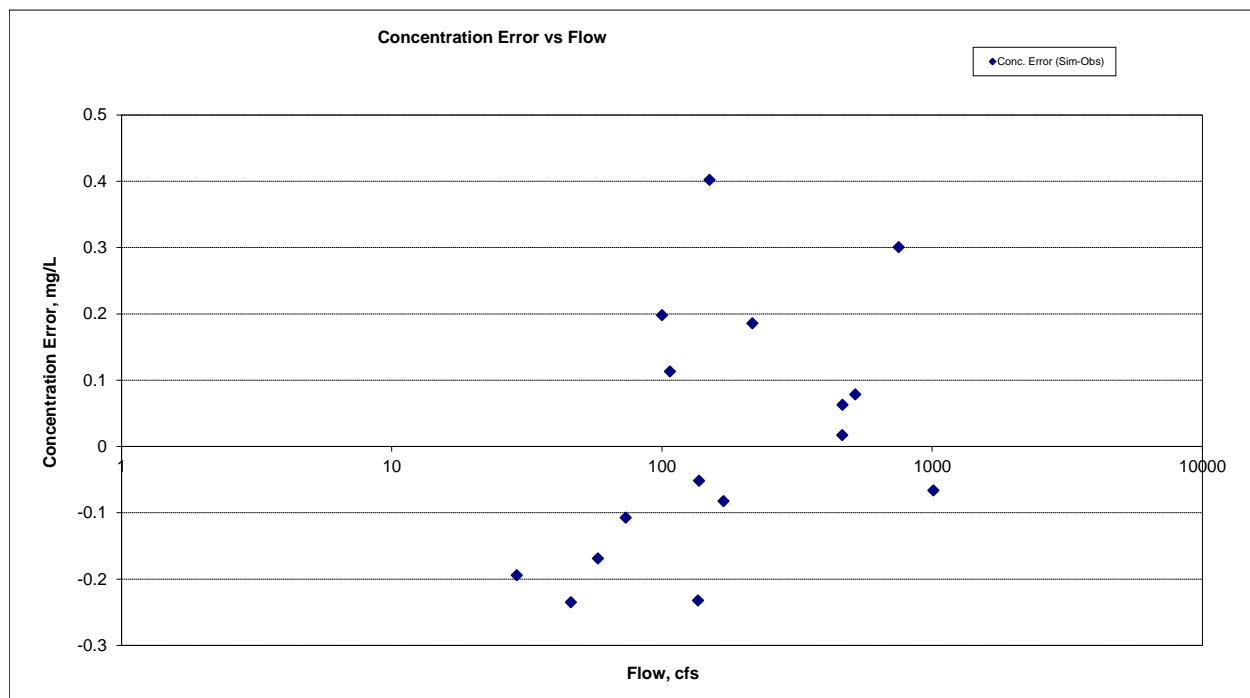


Figure 270. Paired simulated vs. observed Organic Nitrogen (OrgN) load at Poplar River near Lutsen



**Figure 271. Residual (Simulated - Observed) vs. Month Organic Nitrogen (OrgN) at Poplar River near Lutsen**



**Figure 272. Residual (Simulated - Observed) vs. Flow Organic Nitrogen (OrgN) at Poplar River near Lutsen**

## Total Kjeldahl Nitrogen (TKN)

Table 53. Total Kjeldahl Nitrogen (TKN) statistics

Count	102
Concentration Average Error	-6.85%
Concentration Median Error	-8.83%
Load Ave Error	-0.46%
Load Median Error	-6.43%
Paired t concentration	1.00
Paired t load	0.92

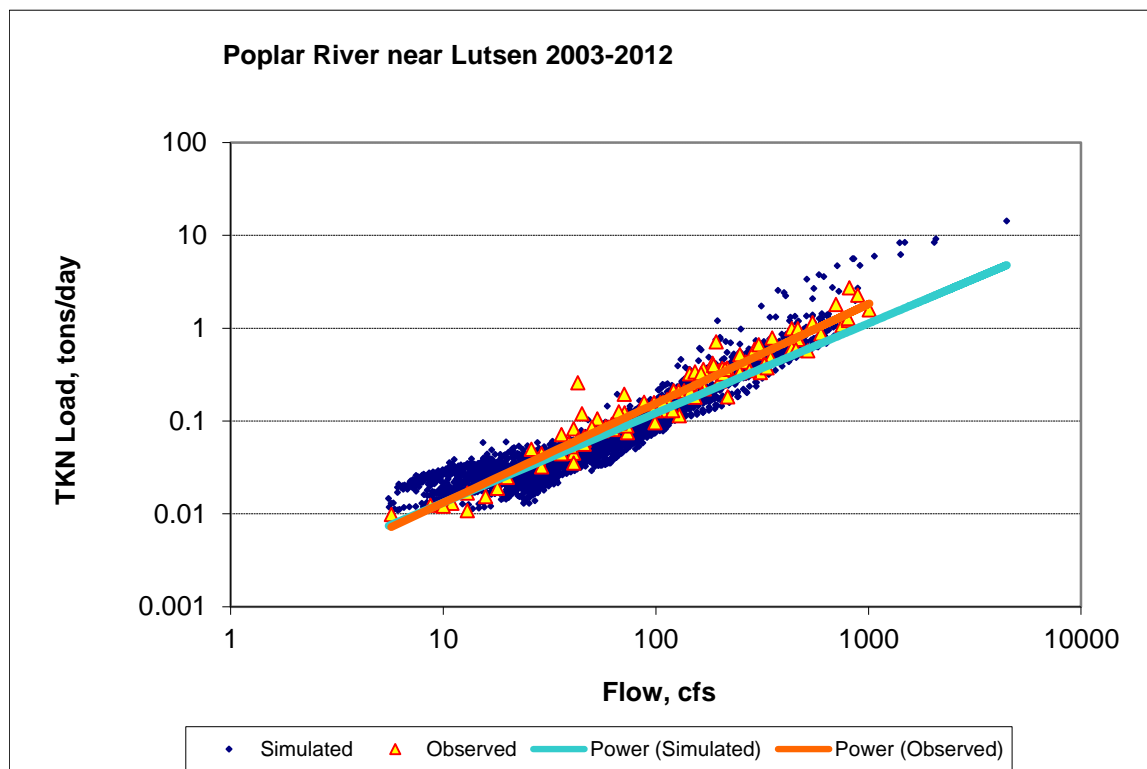


Figure 273. Power plot of simulated and observed Total Kjeldahl Nitrogen (TKN) load vs flow at Poplar River near Lutsen

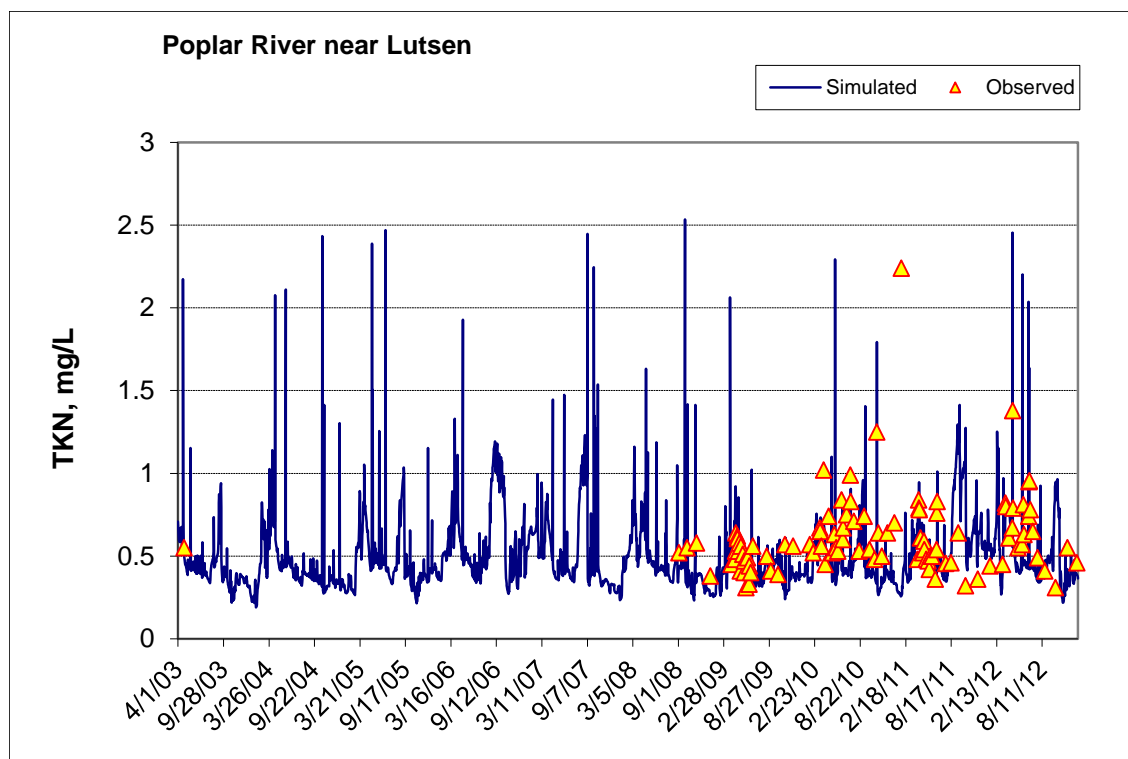


Figure 274. Time series of observed and simulated Total Kjeldahl Nitrogen (TKN) concentration at Poplar River near Lutsen

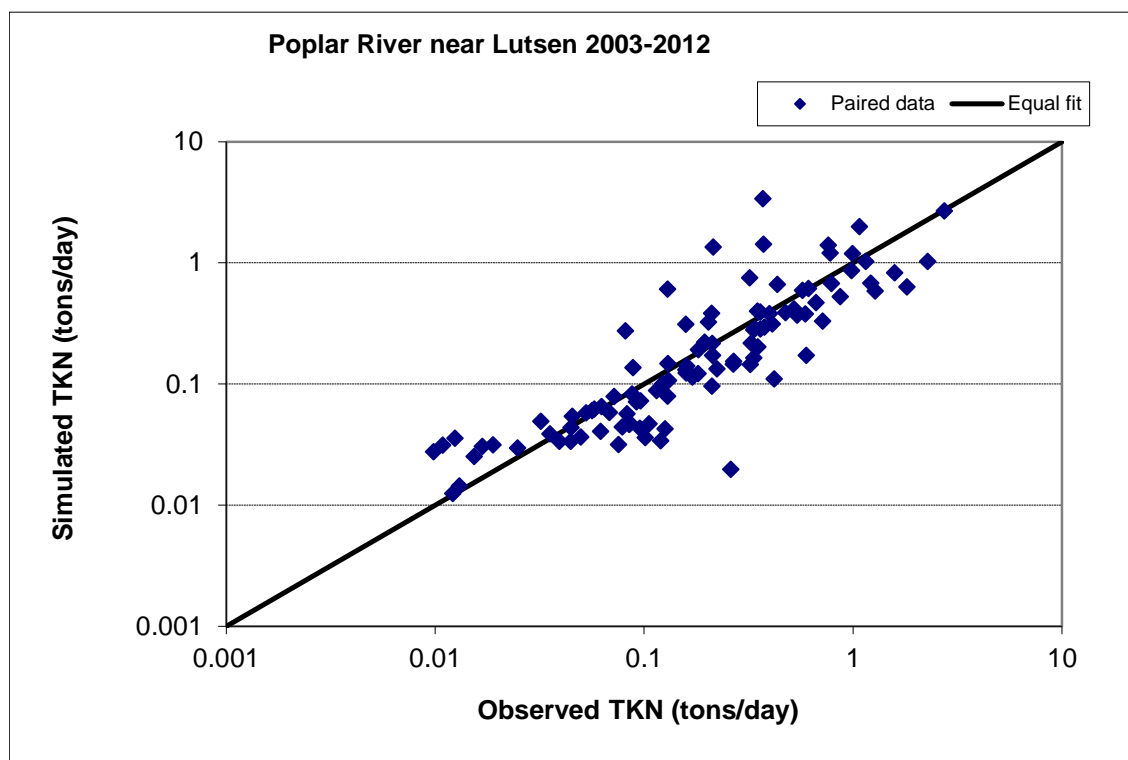


Figure 275. Paired simulated vs. observed Total Kjeldahl Nitrogen (TKN) load at Poplar River near Lutsen

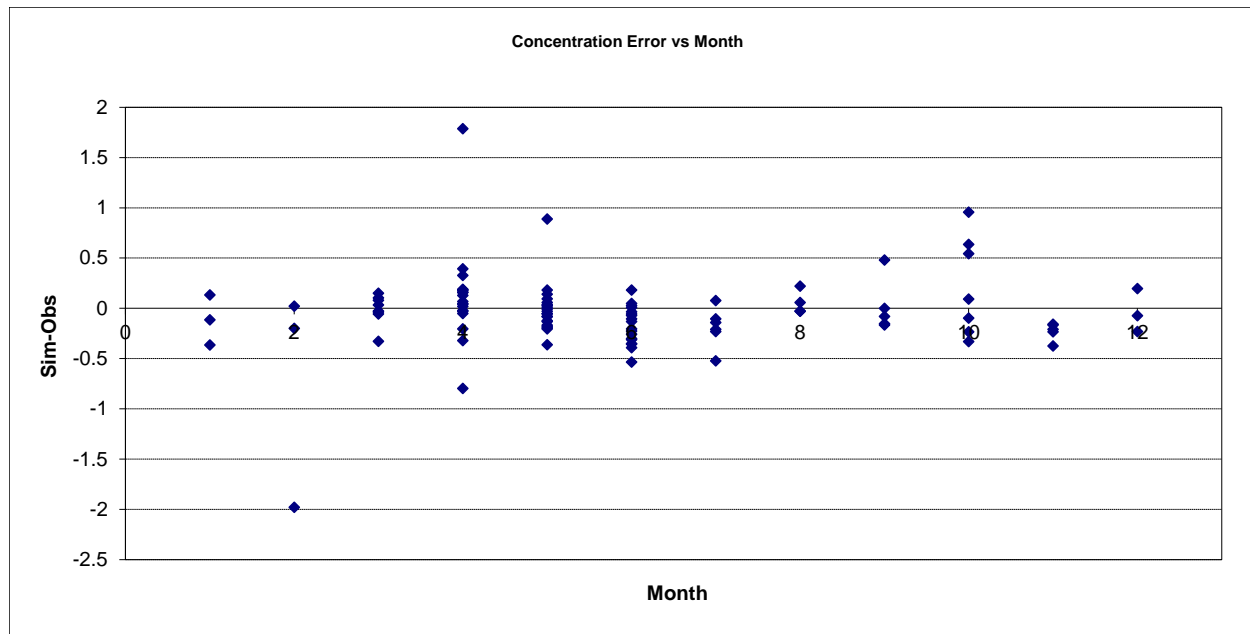


Figure 276. Residual (Simulated - Observed) vs. Month Total Kjeldahl Nitrogen (TKN) at Poplar River near Lutsen

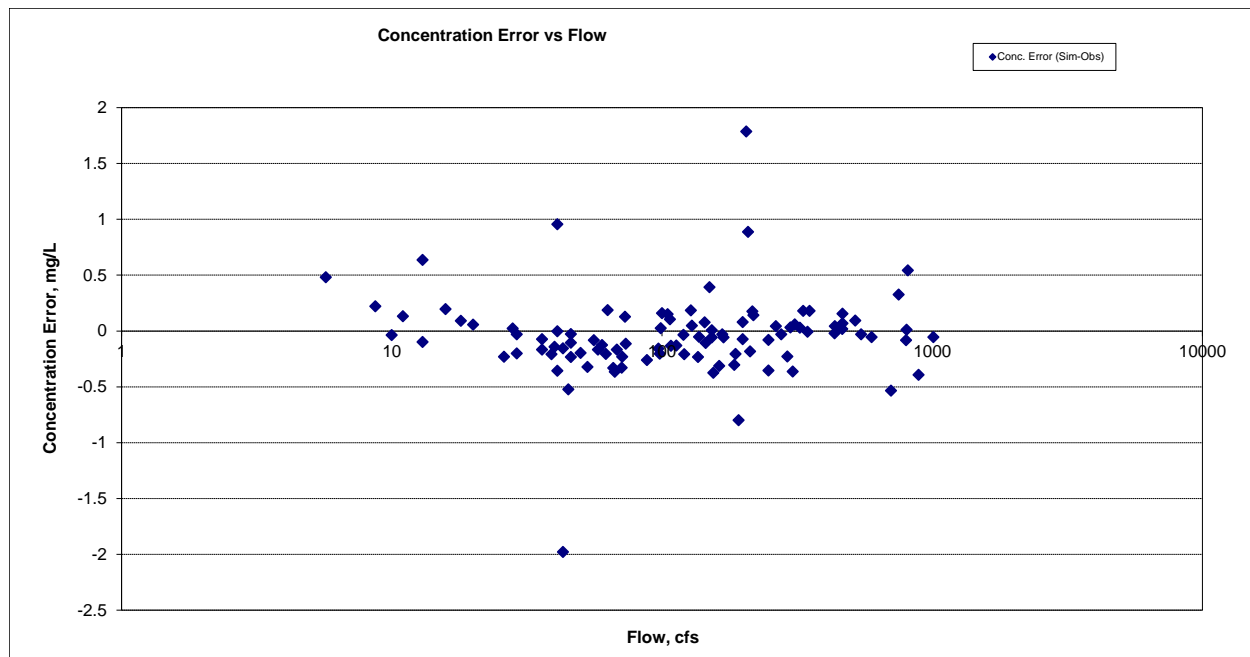
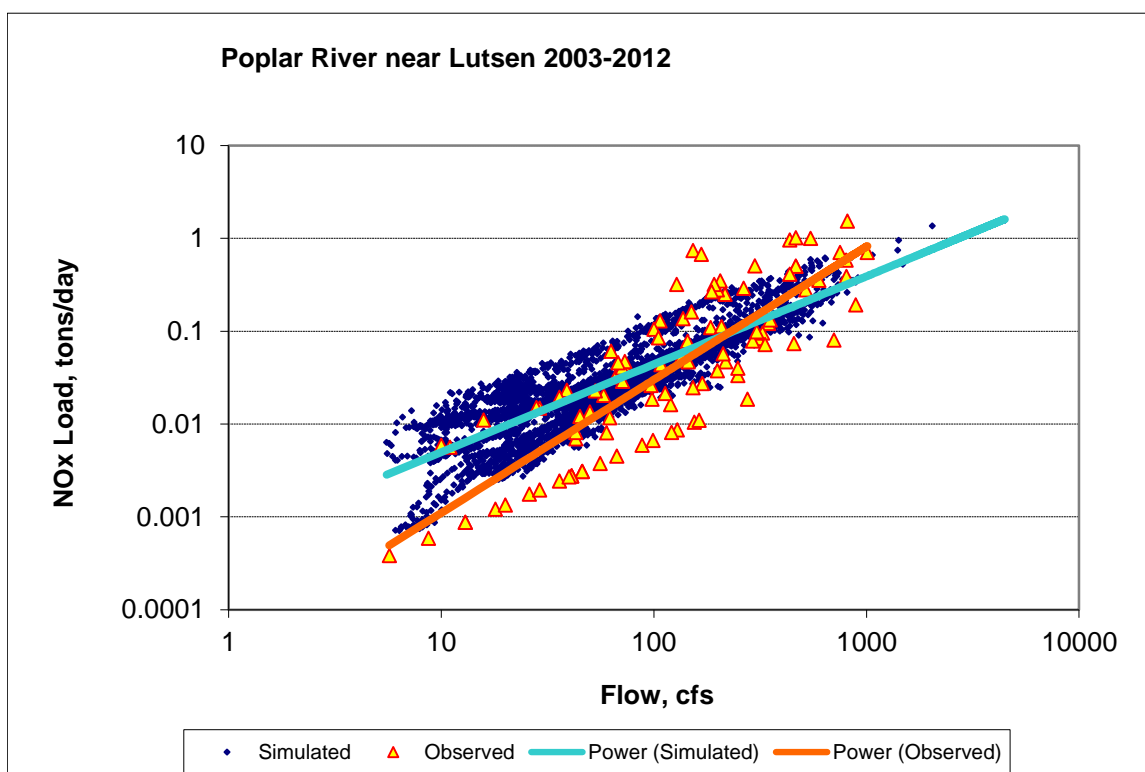


Figure 277. Residual (Simulated - Observed) vs. Flow Total Kjeldahl Nitrogen (TKN) at Poplar River near Lutsen

## Nitrite+ Nitrate Nitrogen (NOx)

**Table 54. Nitrite+ Nitrate Nitrogen (NOx) statistics**

Count	102
Concentration Average Error	-11.06%
Concentration Median Error	12.98%
Load Ave Error	-34.50%
Load Median Error	3.17%
Paired t concentration	0.82
Paired t load	0.14



**Figure 278. Power plot of simulated and observed Nitrite+ Nitrate Nitrogen (NOx) load vs flow at Poplar River near Lutsen**

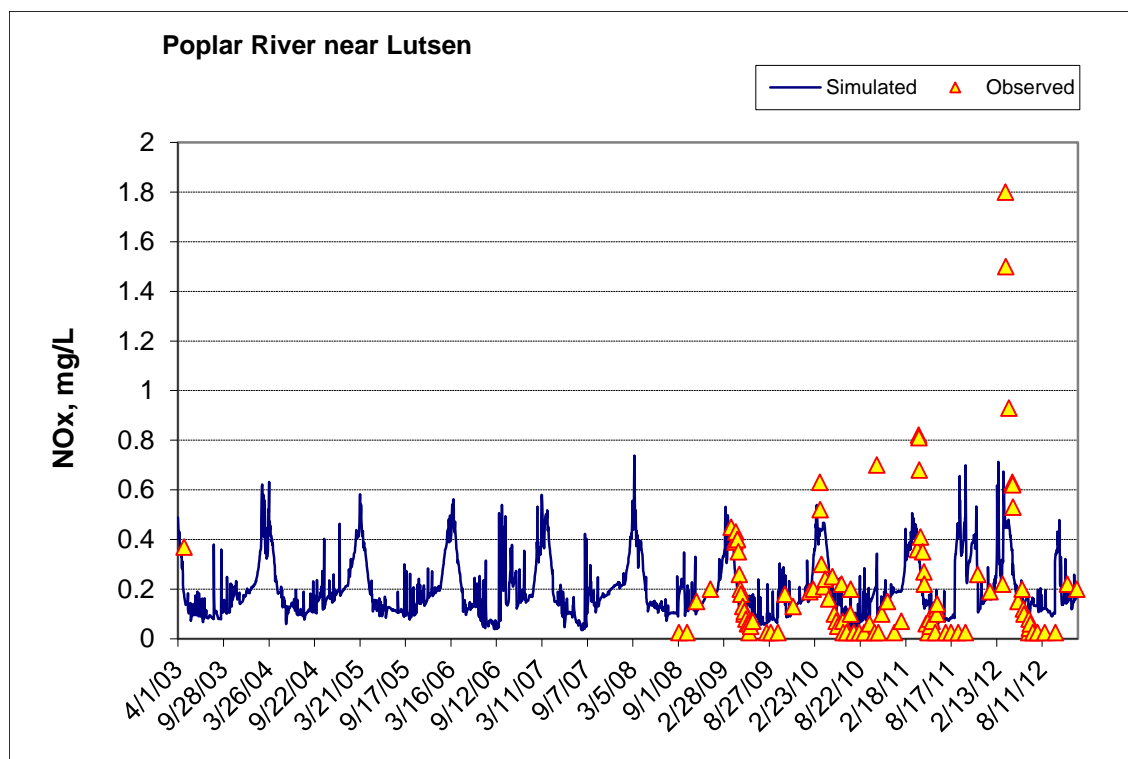


Figure 279. Time series of observed and simulated Nitrite+ Nitrate Nitrogen (NOx) concentration at Poplar River near Lutsen

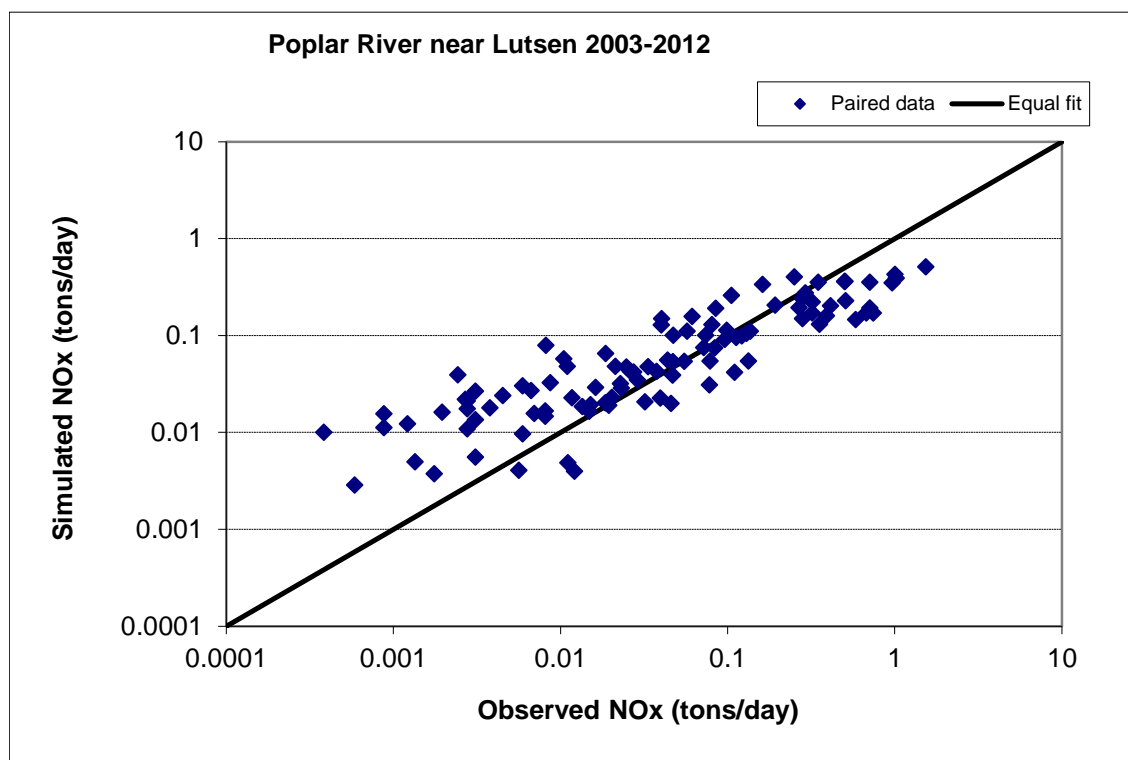


Figure 280. Paired simulated vs. observed Nitrite+ Nitrate Nitrogen (NOx) load at Poplar River near Lutsen

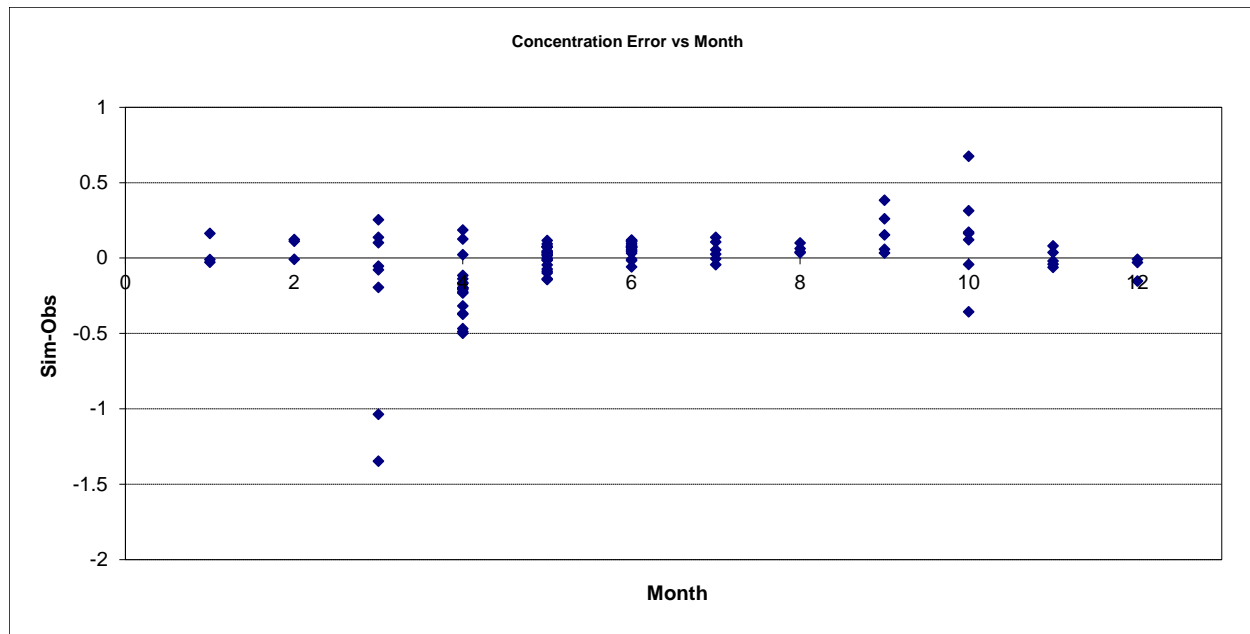


Figure 281. Residual (Simulated - Observed) vs. Month Nitrite+ Nitrate Nitrogen (NOx) at Poplar River near Lutsen

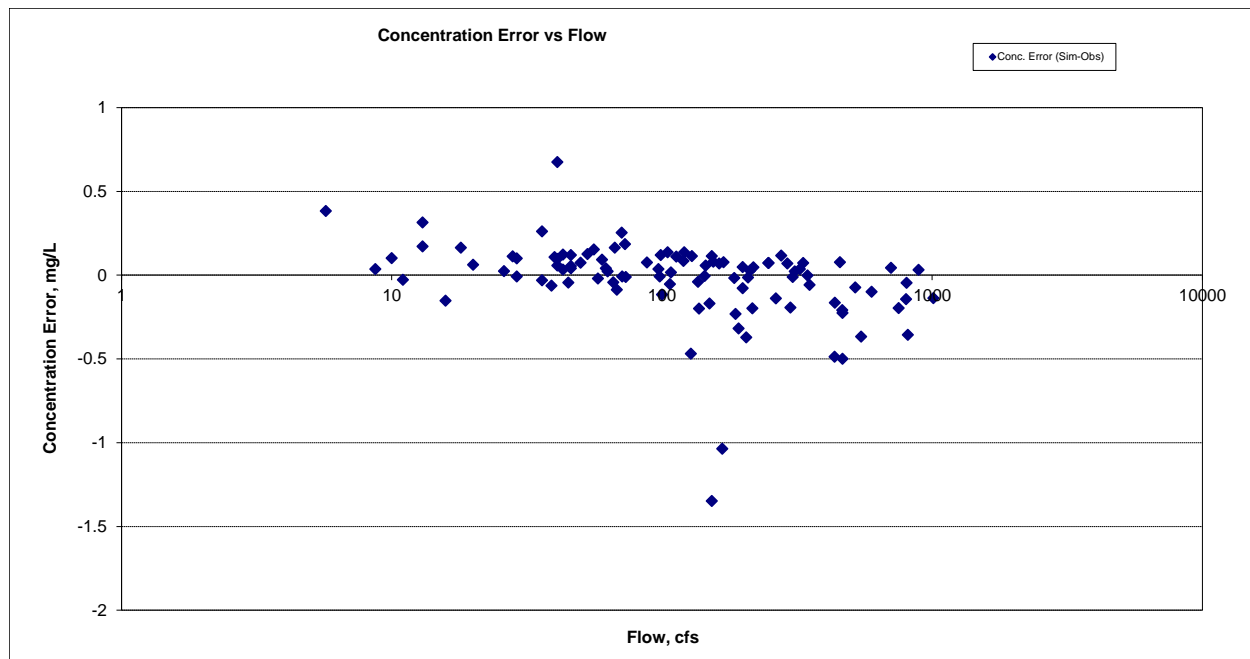


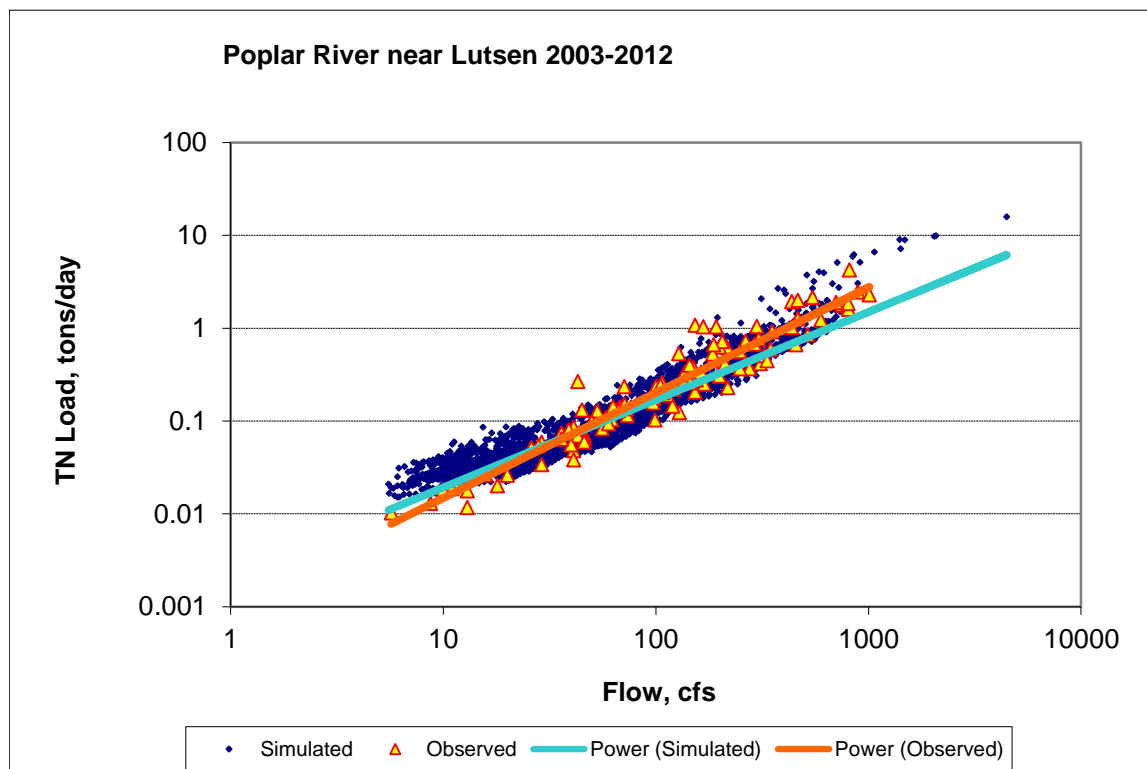
Figure 282. Residual (Simulated - Observed) vs. Flow Nitrite+ Nitrate Nitrogen (NOx) at Poplar River near Lutsen



## Total Nitrogen (TN)

**Table 55. Total Nitrogen (TN) statistics**

Count	102
Concentration Average Error	-7.97%
Concentration Median Error	-7.53%
Load Ave Error	-10.85%
Load Median Error	-3.19%
Paired t concentration	0.99
Paired t load	0.76



**Figure 283. Power plot of simulated and observed Total Nitrogen (TN) load vs flow at Poplar River near Lutsen**

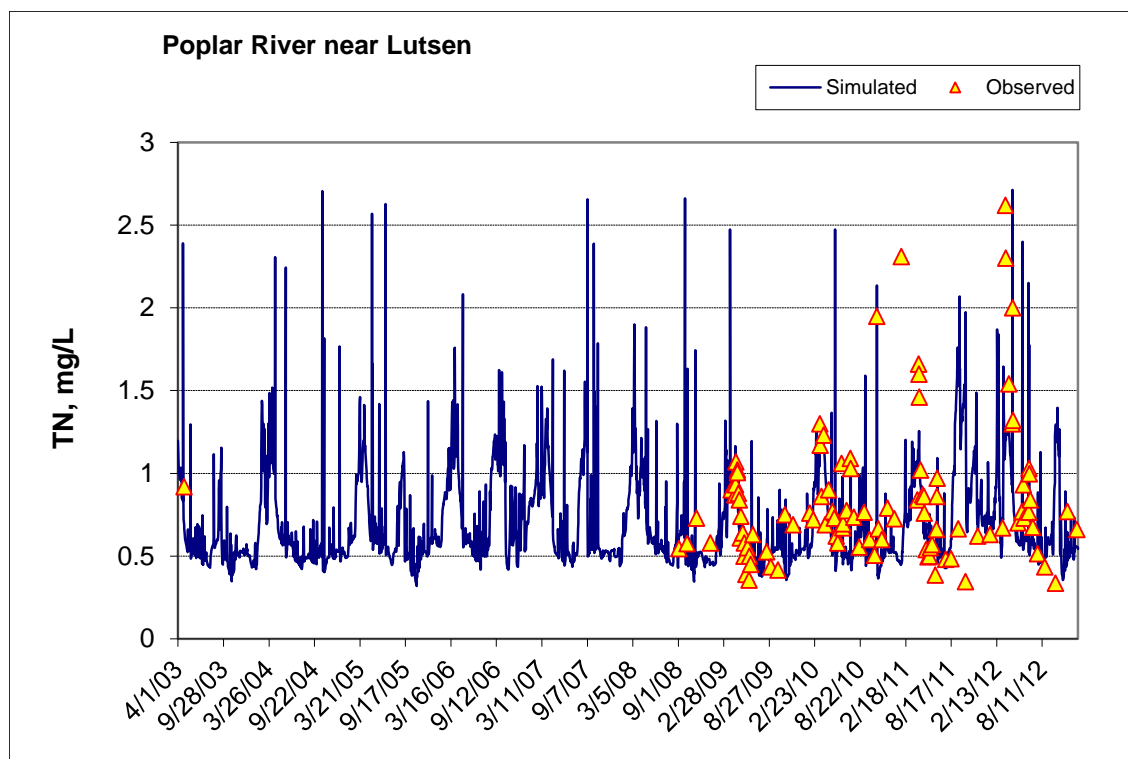


Figure 284. Time series of observed and simulated Total Nitrogen (TN) concentration at Poplar River near Lutsen

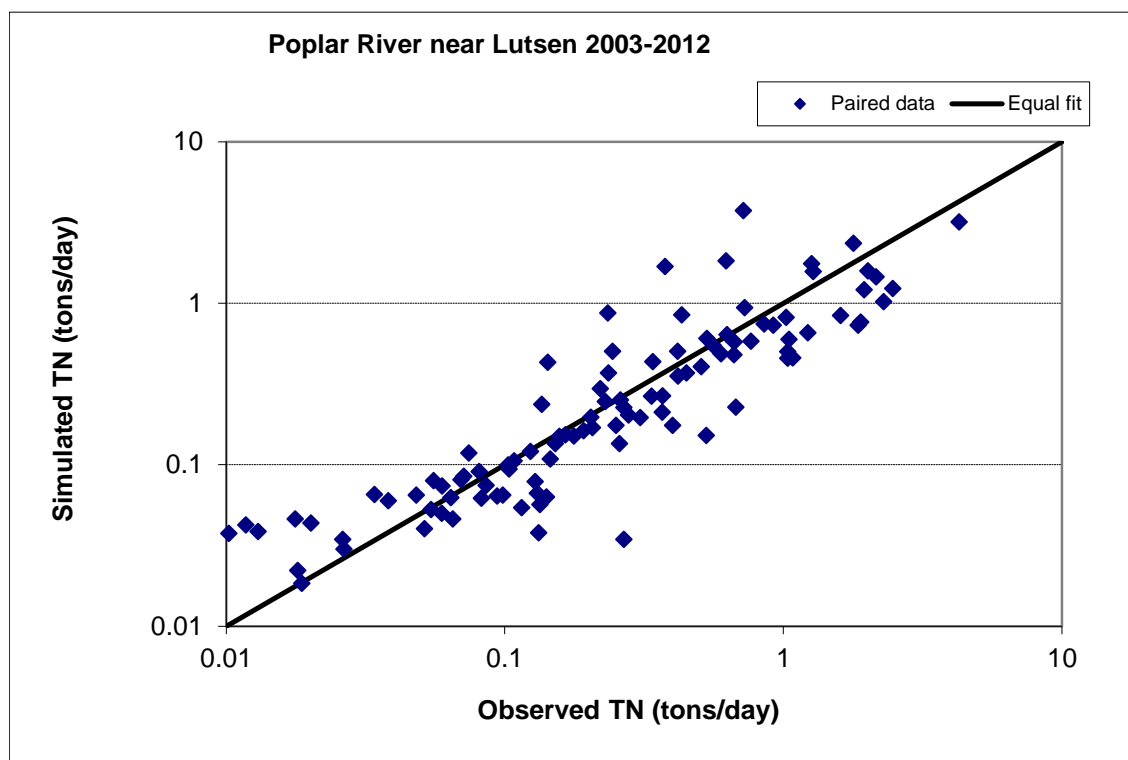


Figure 285. Paired simulated vs. observed Total Nitrogen (TN) load at Poplar River near Lutsen

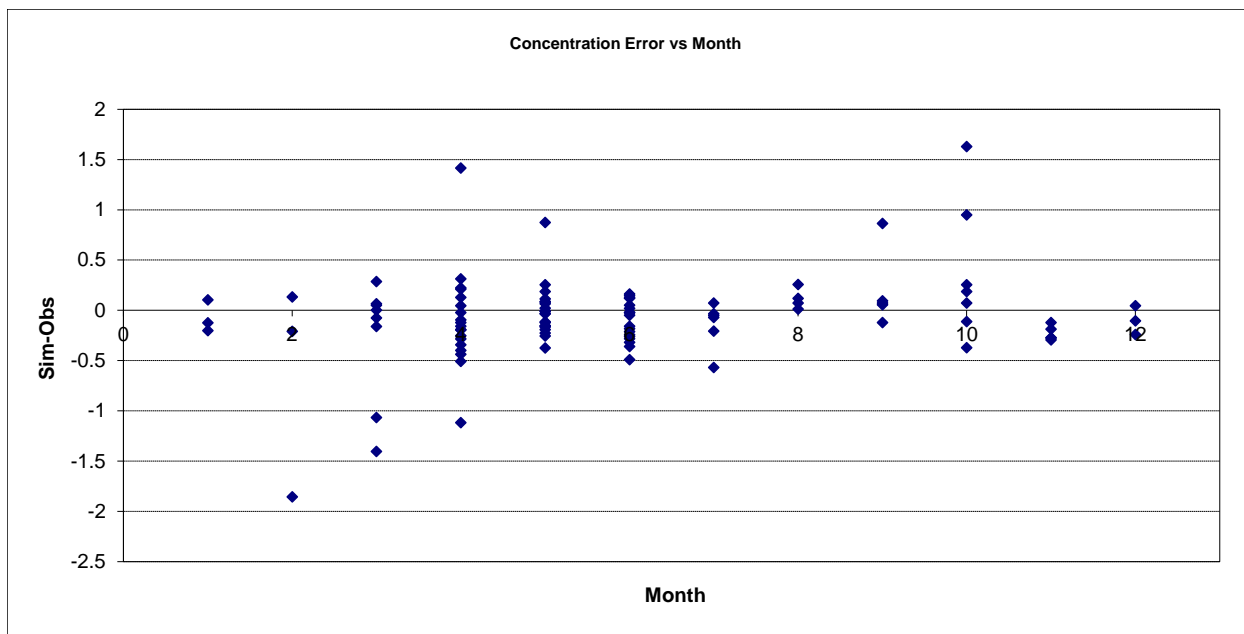


Figure 286. Residual (Simulated - Observed) vs. Month Total Nitrogen (TN) at Poplar River near Lutsen

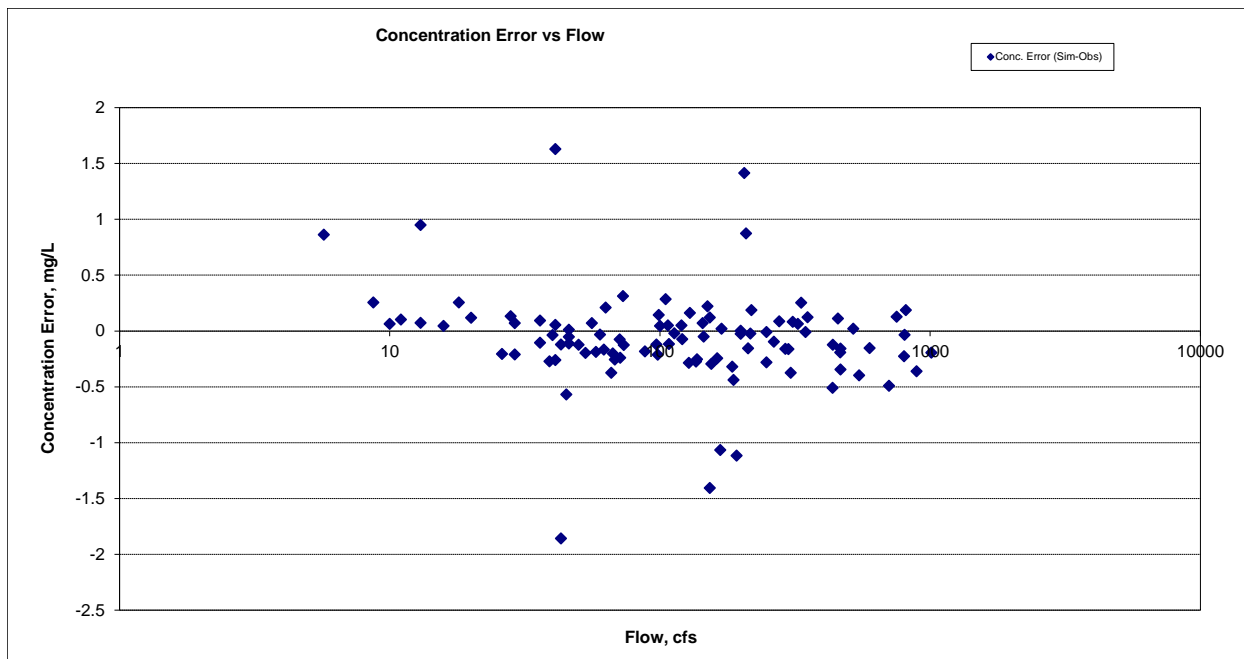
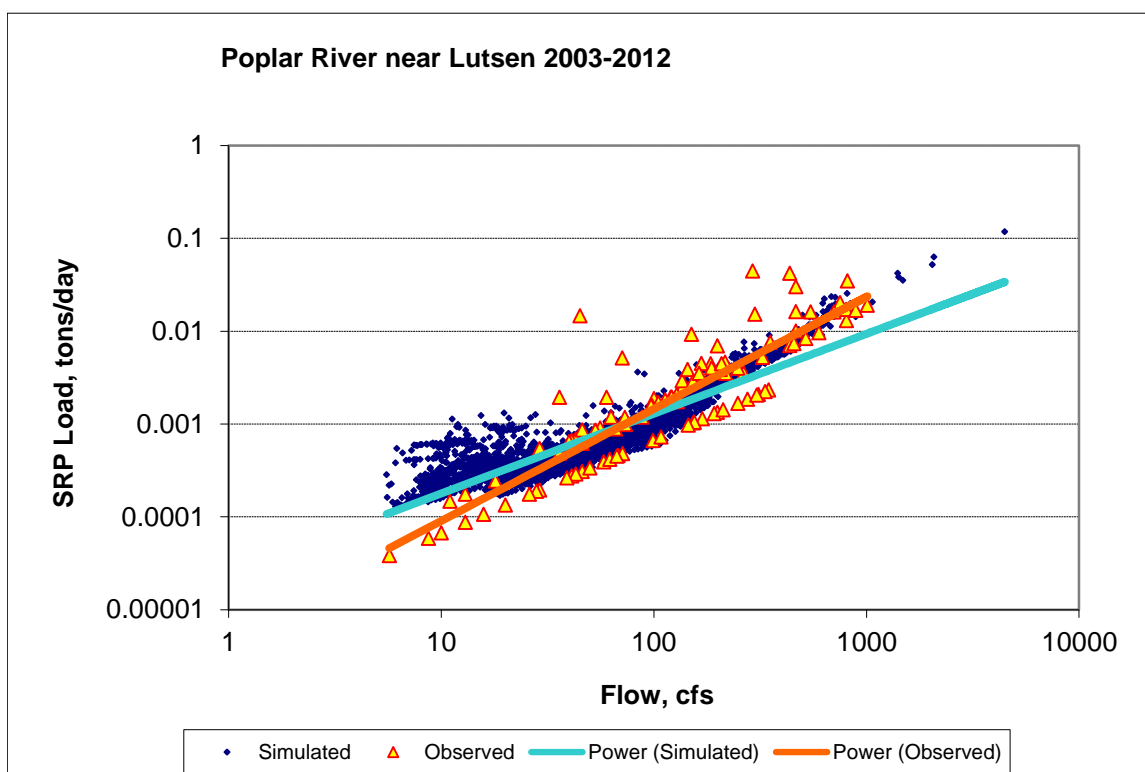


Figure 287. Residual (Simulated - Observed) vs. Flow Total Nitrogen (TN) at Poplar River near Lutsen

## Soluble Reactive Phosphorus (SRP)

**Table 56. Soluble Reactive Phosphorus (SRP) statistics**

Count	101
Concentration Average Error	-27.43%
Concentration Median Error	-5.15%
Load Ave Error	-33.39%
Load Median Error	0.49%
Paired t concentration	0.27
Paired t load	0.16



**Figure 288. Power plot of simulated and observed Soluble Reactive Phosphorus (SRP) load vs flow at Poplar River near Lutsen**

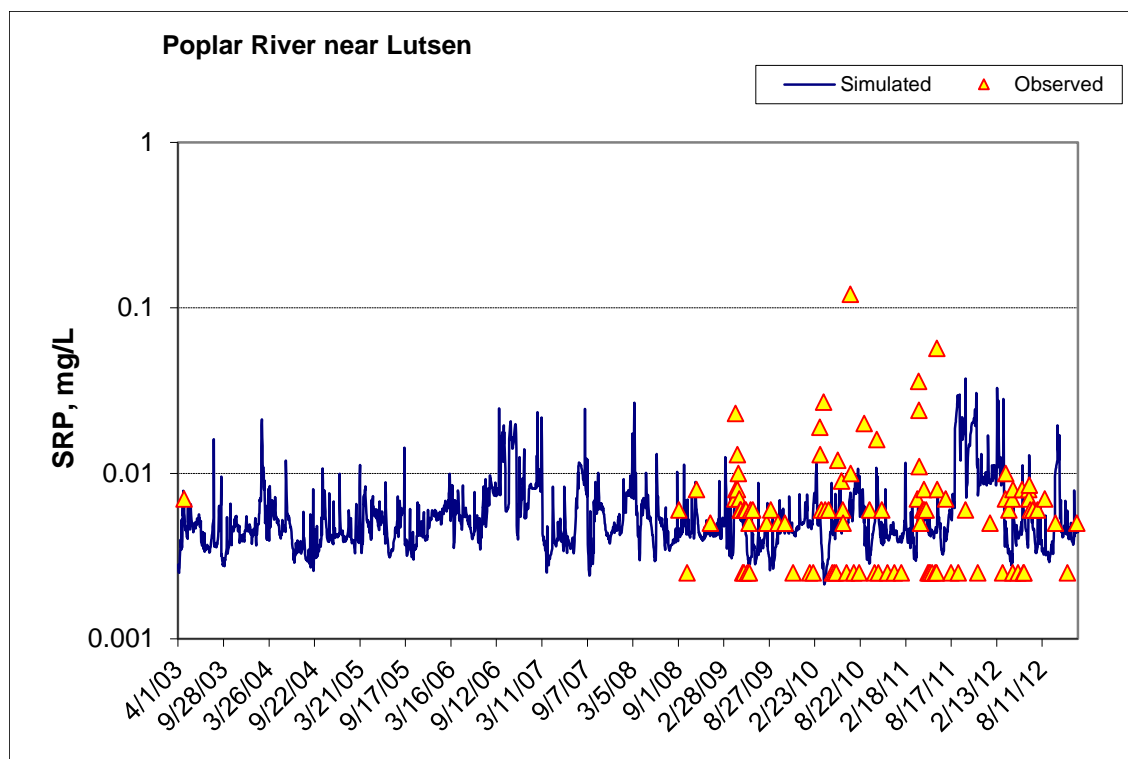


Figure 289. Time series of observed and simulated Soluble Reactive Phosphorus (SRP) concentration at Poplar River near Lutsen

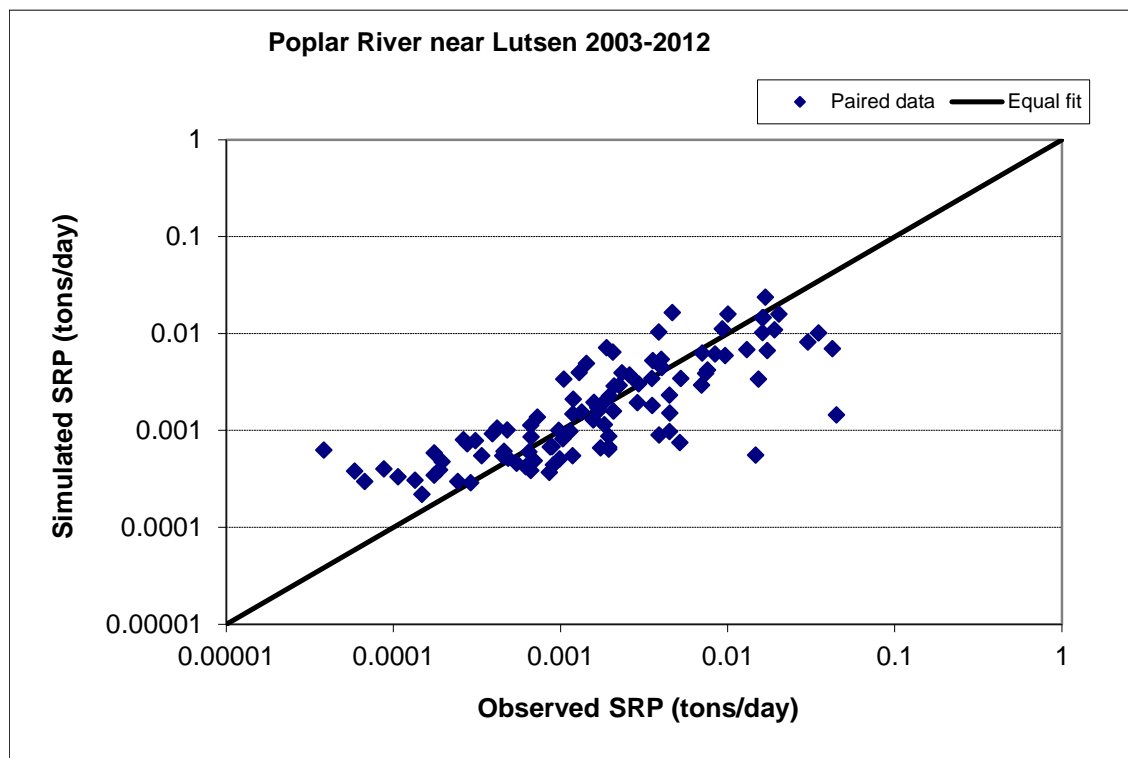
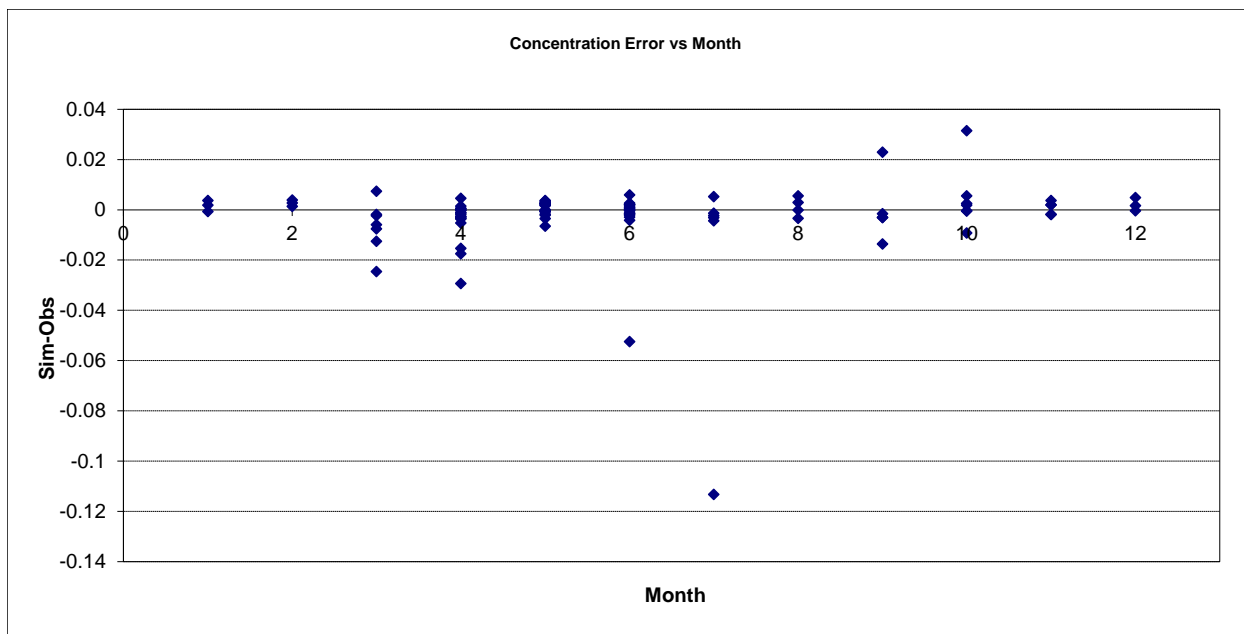
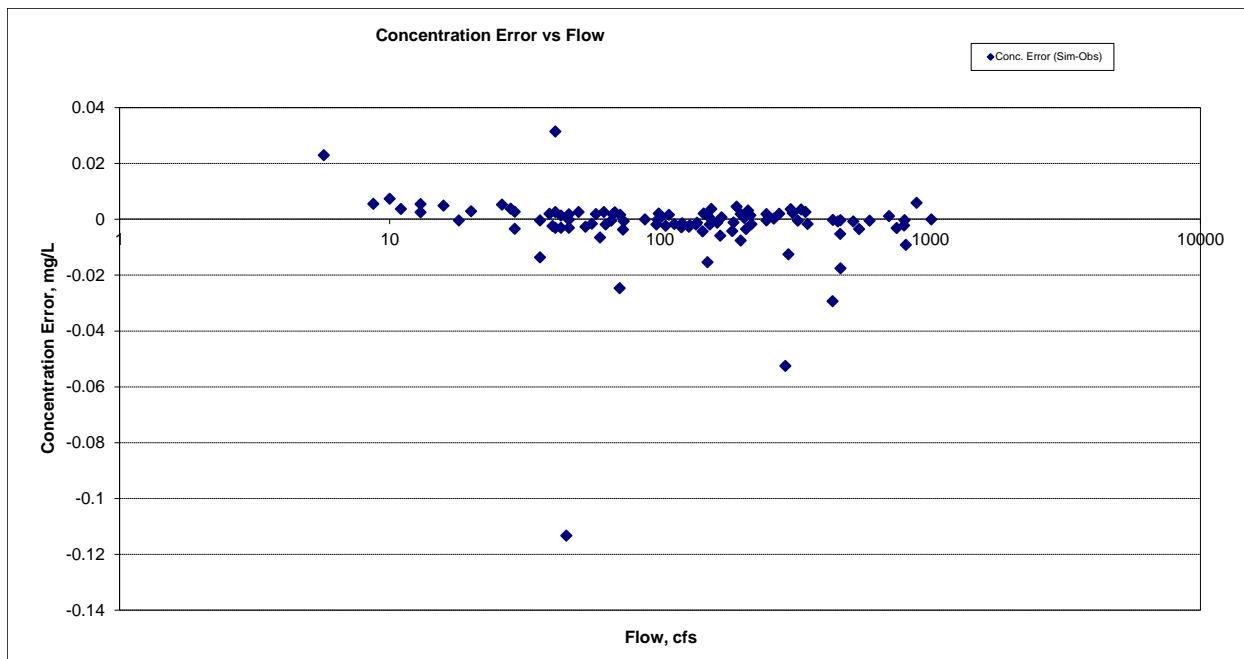


Figure 290. Paired simulated vs. observed Soluble Reactive Phosphorus (SRP) load at Poplar River near Lutsen



**Figure 291. Residual (Simulated - Observed) vs. Month Soluble Reactive Phosphorus (SRP) at Poplar River near Lutsen**

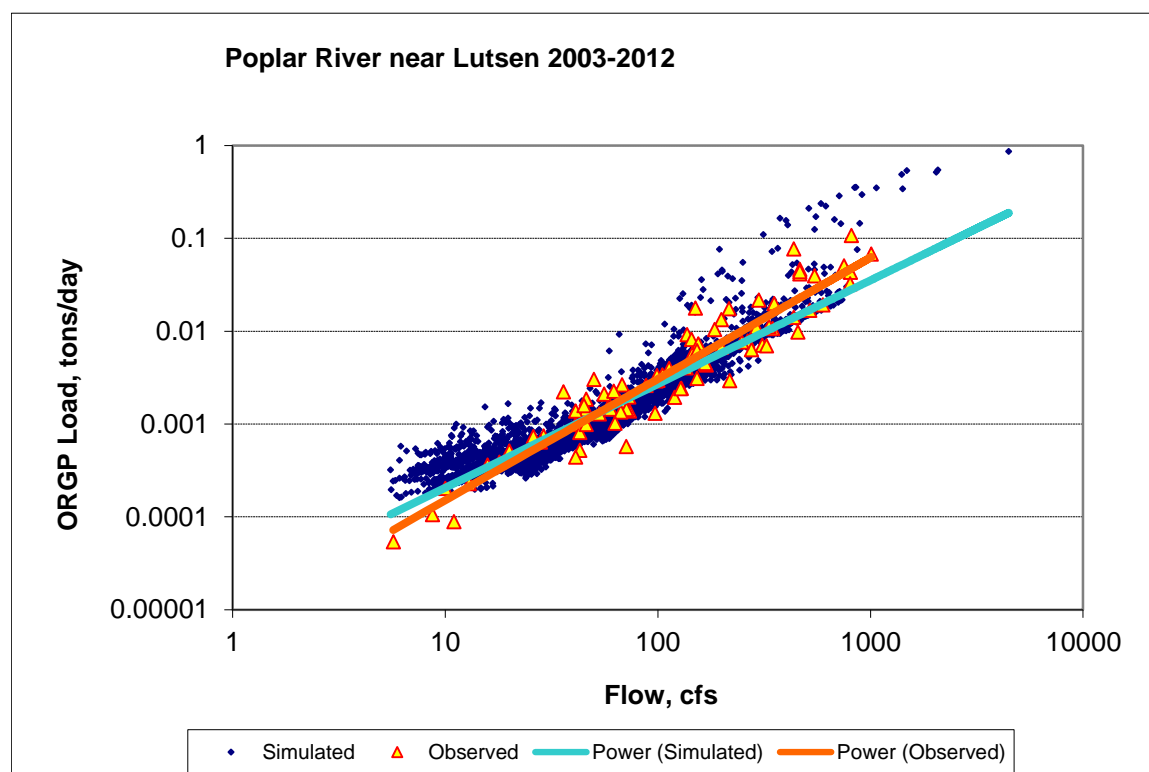


**Figure 292. Residual (Simulated - Observed) vs. Flow Soluble Reactive Phosphorus (SRP) at Poplar River near Lutsen**

## Organic Phosphorus (OrgP)

**Table 57. Organic Phosphorus (OrgP) statistics**

Count	84
Concentration Average Error	-4.22%
Concentration Median Error	-10.27%
Load Ave Error	-9.98%
Load Median Error	-3.08%
Paired t concentration	0.95
Paired t load	0.69



**Figure 293. Power plot of simulated and observed Organic Phosphorus (OrgP) load vs flow at Poplar River near Lutsen**

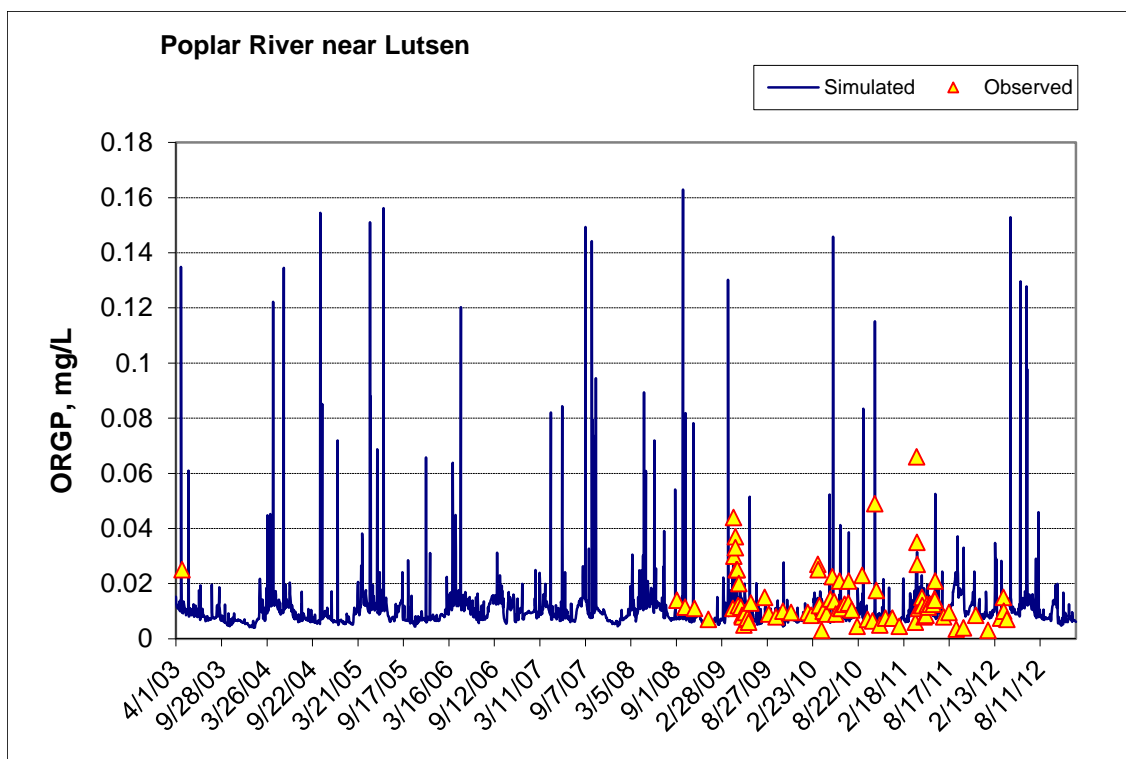


Figure 294. Time series of observed and simulated Organic Phosphorus (OrgP) concentration at Poplar River near Lutsen

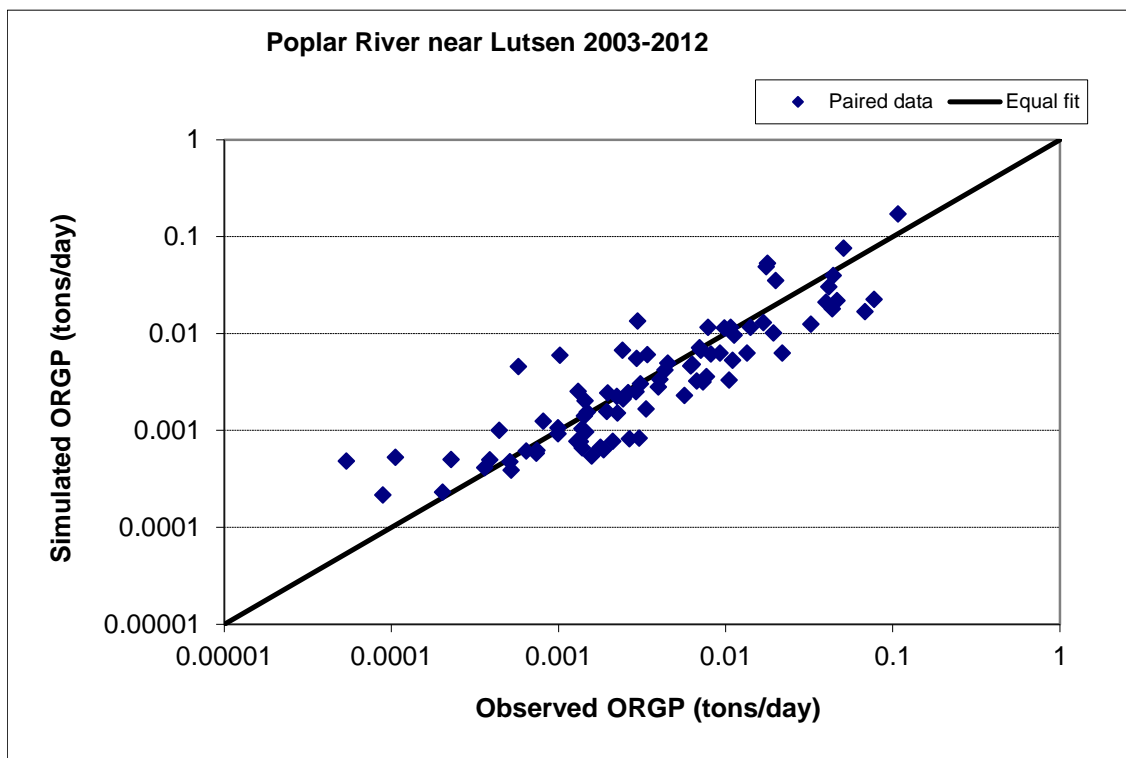
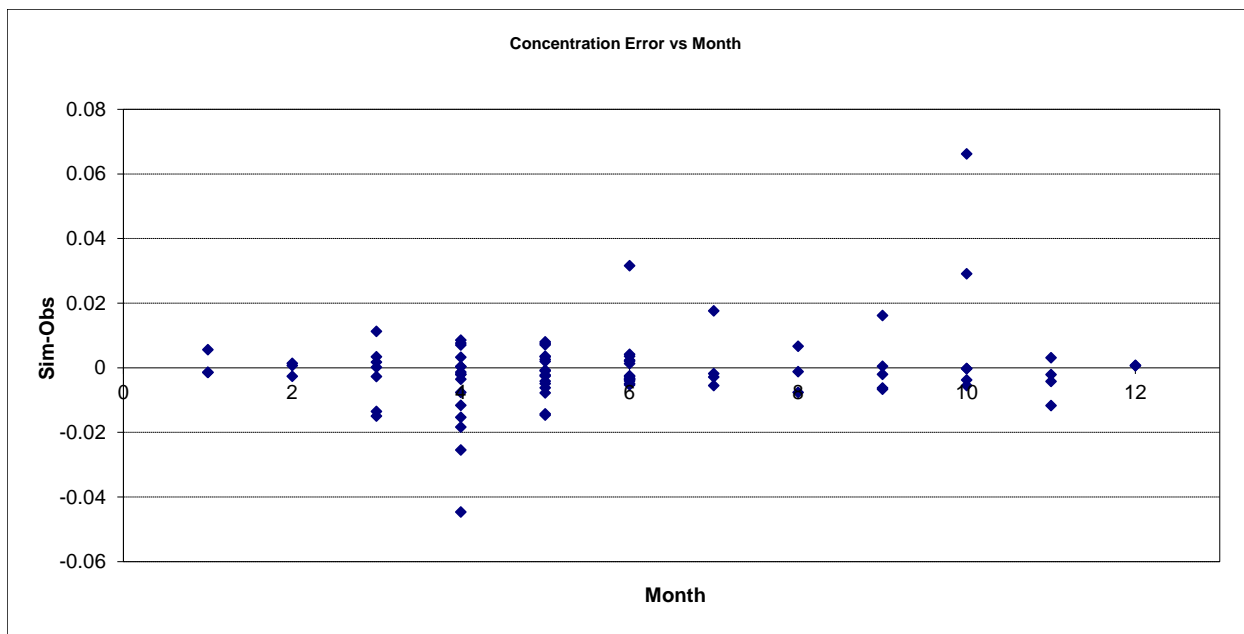
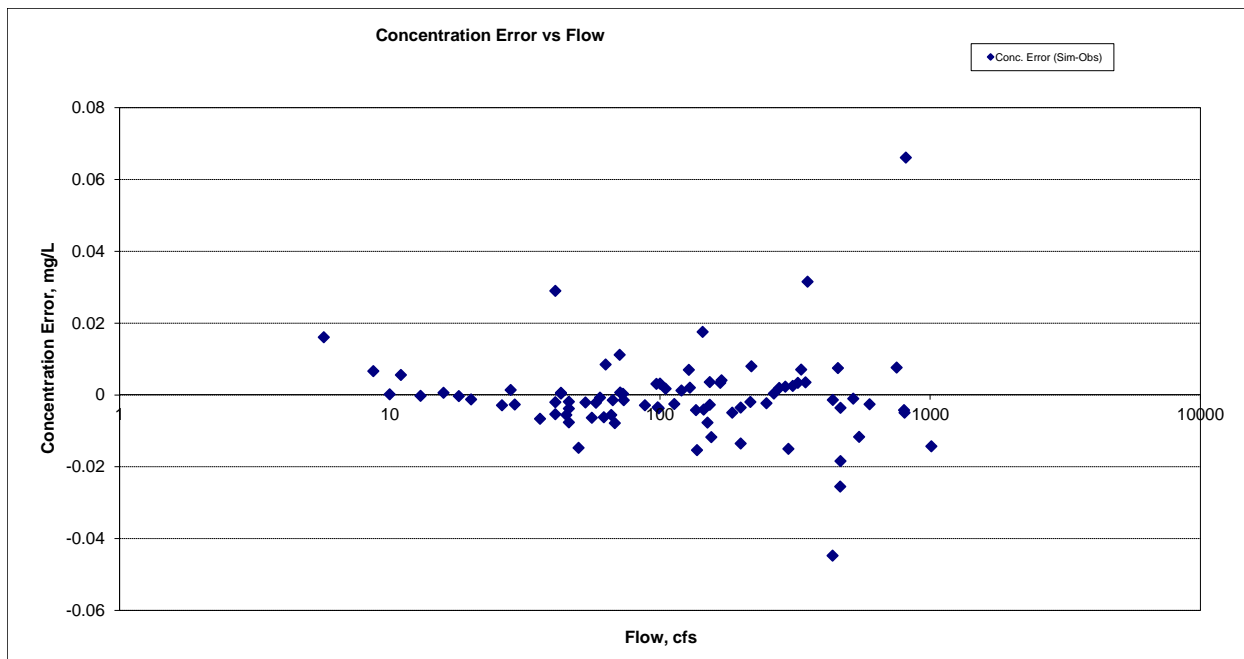


Figure 295. Paired simulated vs. observed Organic Phosphorus (OrgP) load at Poplar River near Lutsen





**Figure 296. Residual (Simulated - Observed) vs. Month Organic Phosphorus (OrgP) at Poplar River near Lutsen**

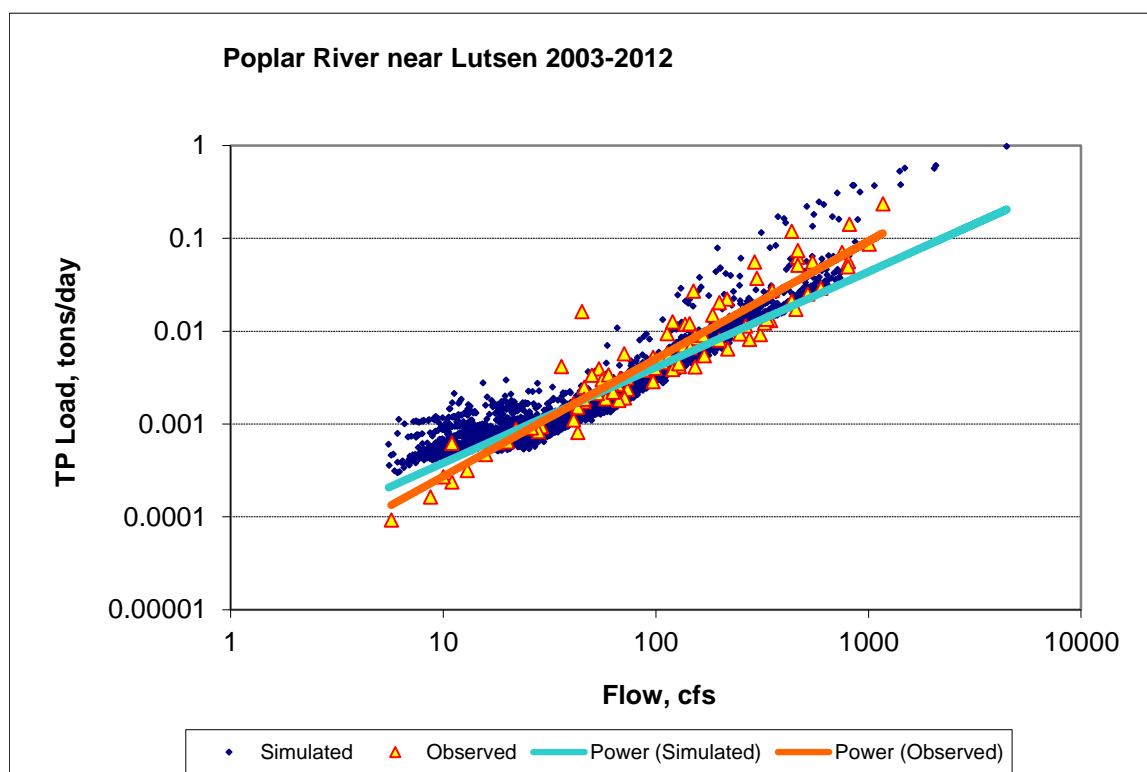


**Figure 297. Residual (Simulated - Observed) vs. Flow Organic Phosphorus (OrgP) at Poplar River near Lutsen**

## Total Phosphorus (TP)

**Table 58. Total Phosphorus (TP) statistics**

Count	92
Concentration Average Error	-6.16%
Concentration Median Error	-7.10%
Load Ave Error	12.57%
Load Median Error	-1.83%
Paired t concentration	0.93
Paired t load	0.60



**Figure 298. Power plot of simulated and observed Total Phosphorus (TP) load vs flow at Poplar River near Lutsen**

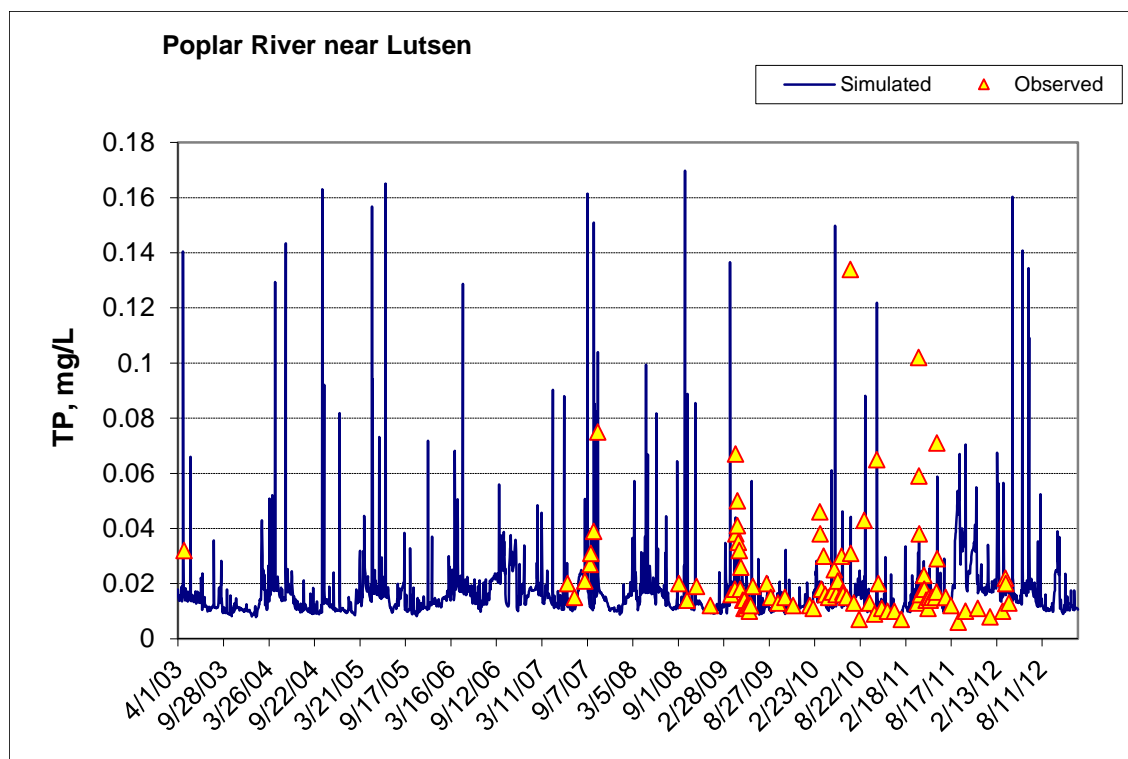


Figure 299. Time series of observed and simulated Total Phosphorus (TP) concentration at Poplar River near Lutsen

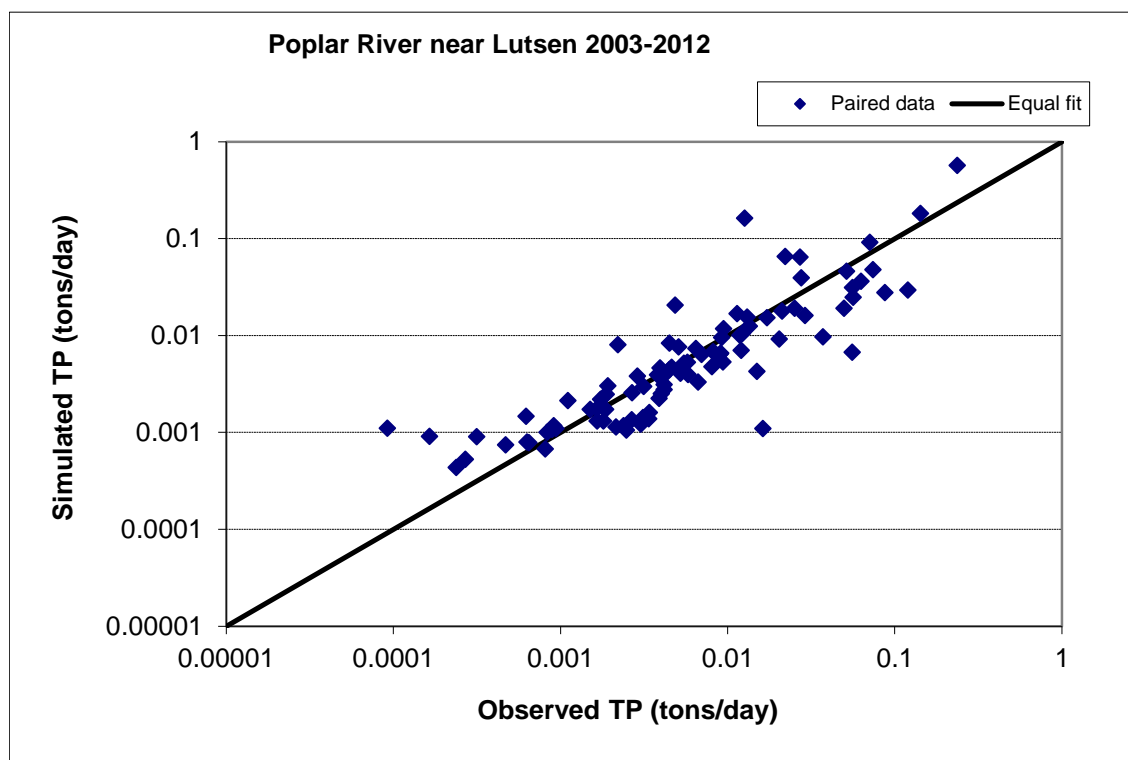
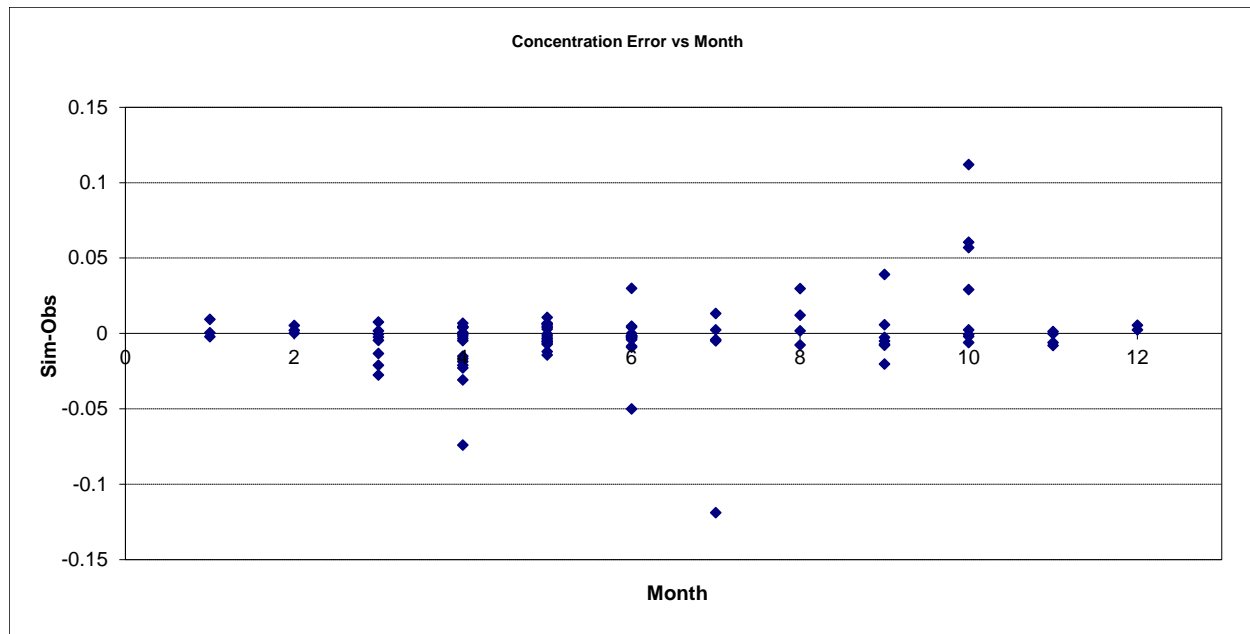
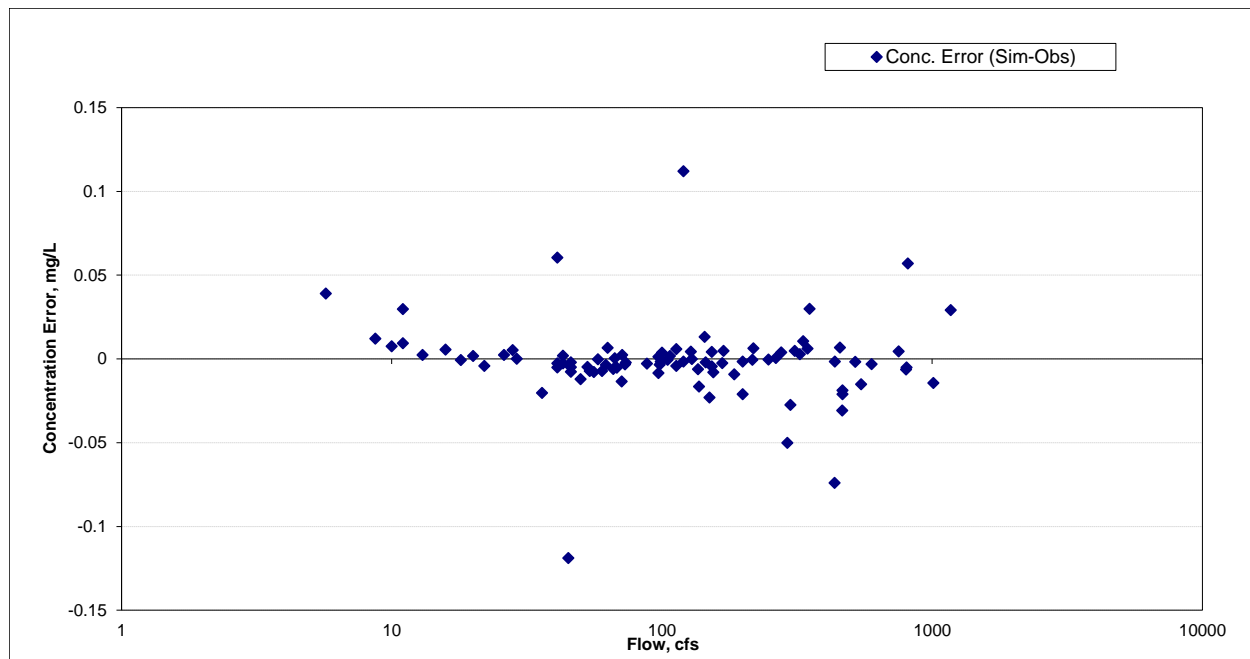


Figure 300. Paired simulated vs. observed Total Phosphorus (TP) load at Poplar River near Lutsen



**Figure 301. Residual (Simulated - Observed) vs. Month Total Phosphorus (TP) at Poplar River near Lutsen**



**Figure 302. Residual (Simulated - Observed) vs. Flow Total Phosphorus (TP) at Poplar River near Lutsen**

## Brule River near Hovland (HYDSTRA 01022001)

### Total Suspended Solids (TSS)

Table 59. Total Suspended Solids (TSS) statistics

Count	128
Concentration Average Error	-3.20%
Concentration Median Error	11.34%
Load Ave Error	-2.51%
Load Median Error	1.14%
Paired t concentration	0.92
Paired t load	0.74

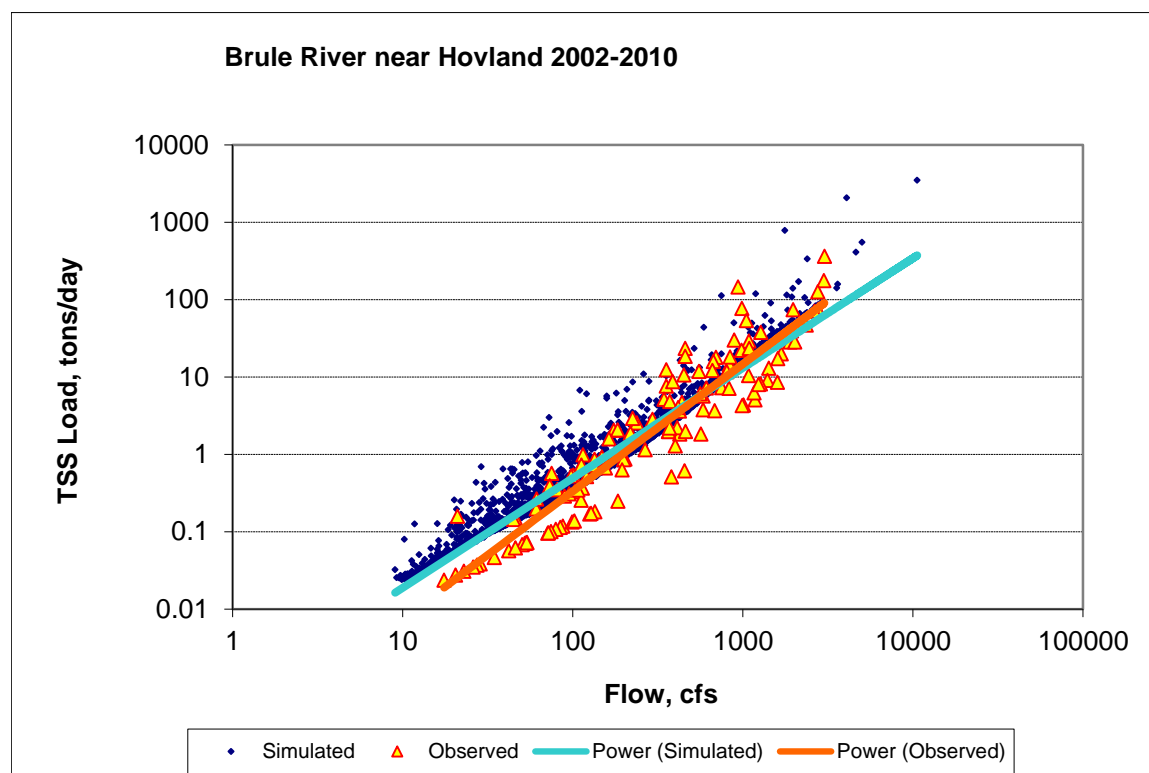


Figure 303. Power plot of simulated and observed Total Suspended Solids (TSS) load vs flow at Brule River near Hovland (validation period)

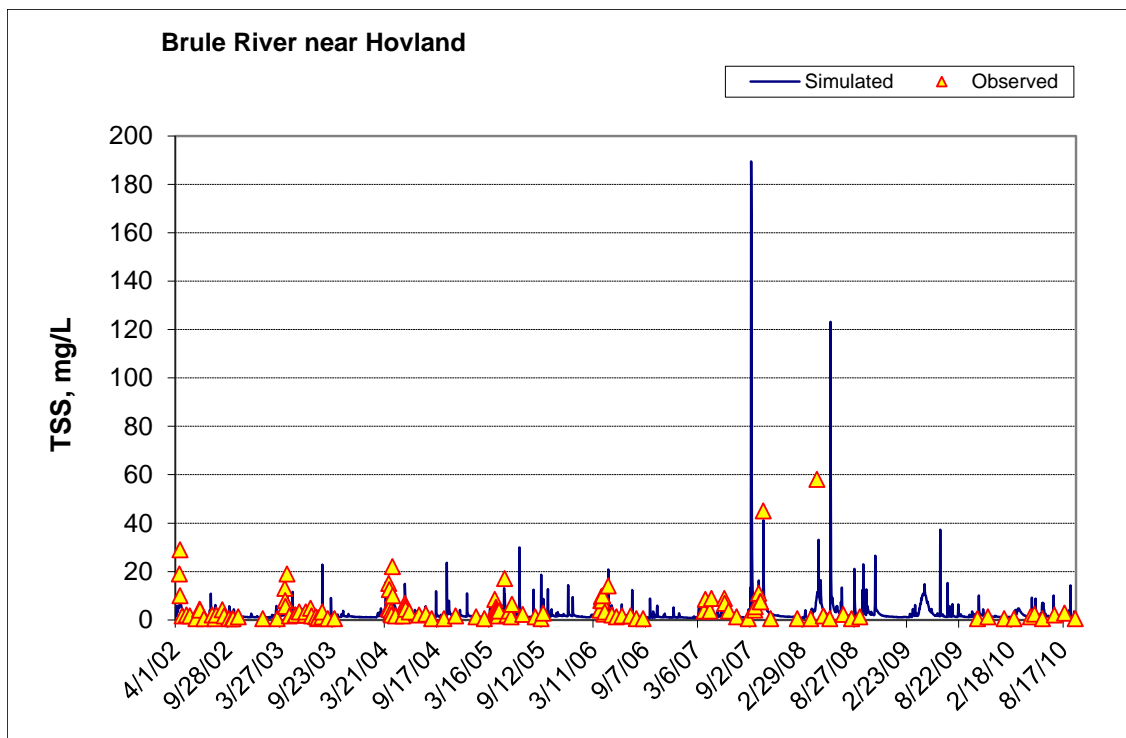


Figure 304. Time series of observed and simulated Total Suspended Solids (TSS) concentration at Brule River near Hovland

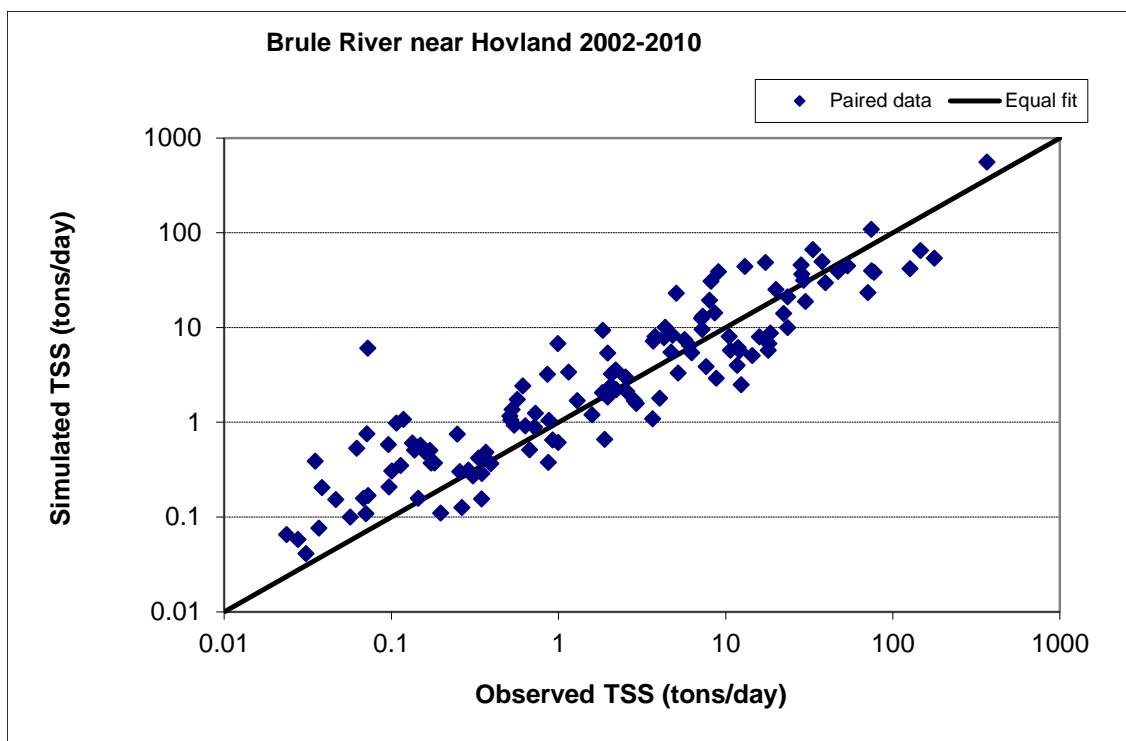
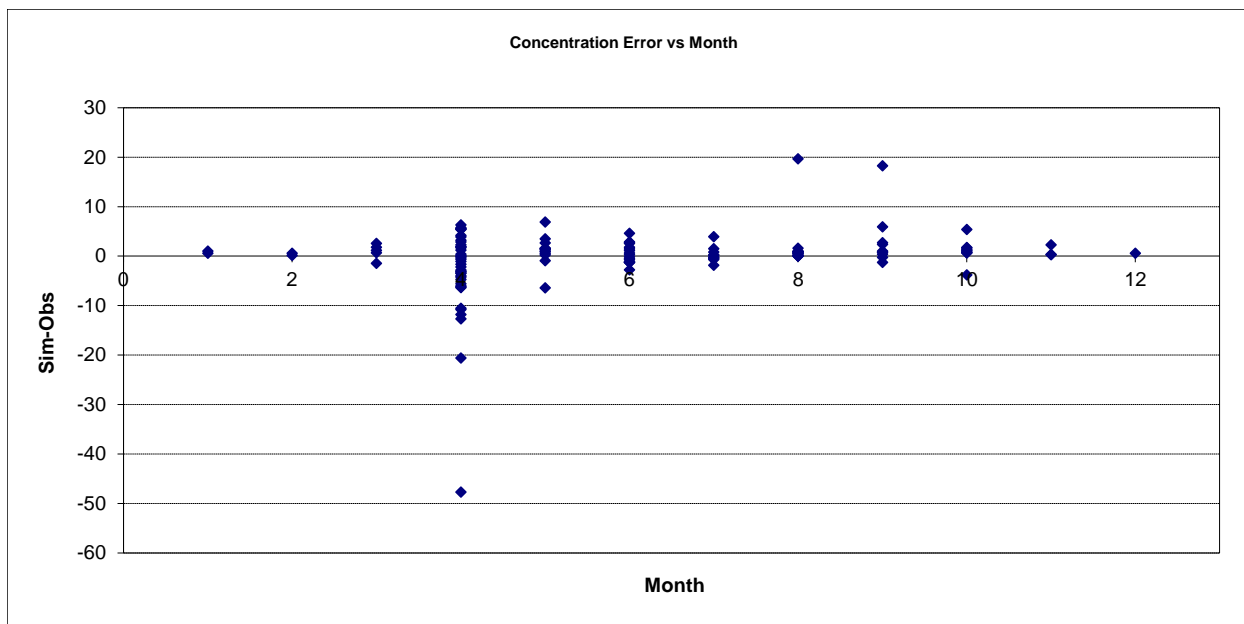
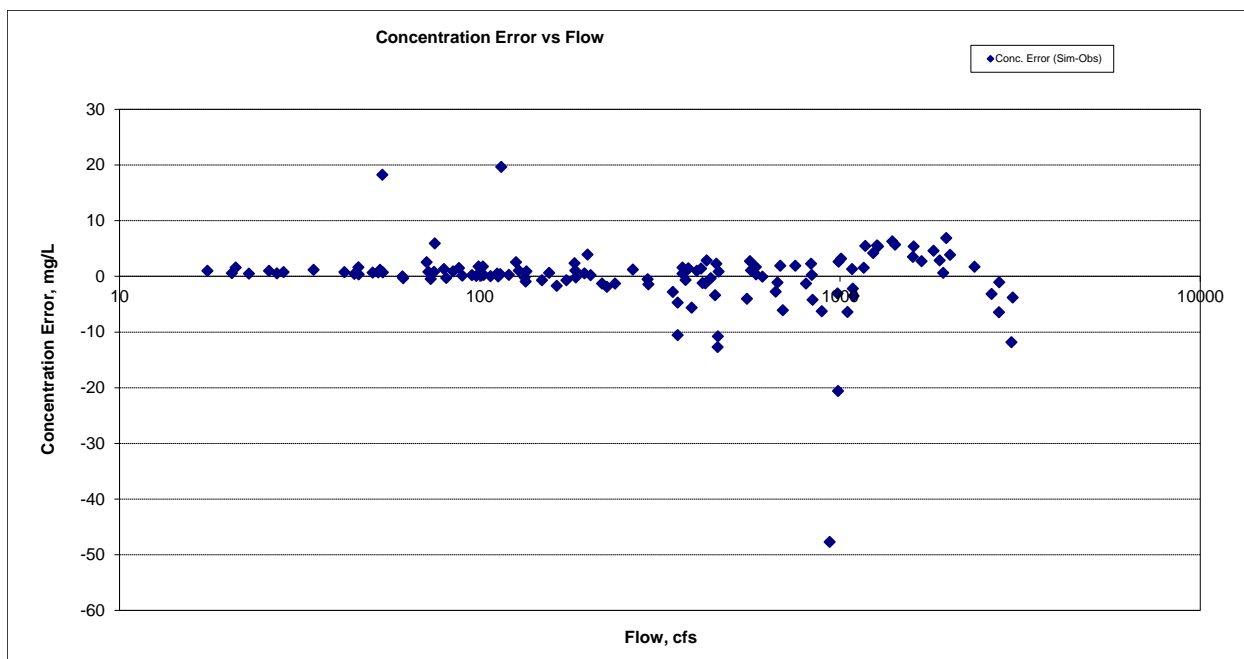


Figure 305. Paired simulated vs. observed Total Suspended Solids (TSS) load at Brule River near Hovland (validation period)



**Figure 306. Residual (Simulated - Observed) vs. Month Total Suspended Solids (TSS) at Brule River near Hovland**



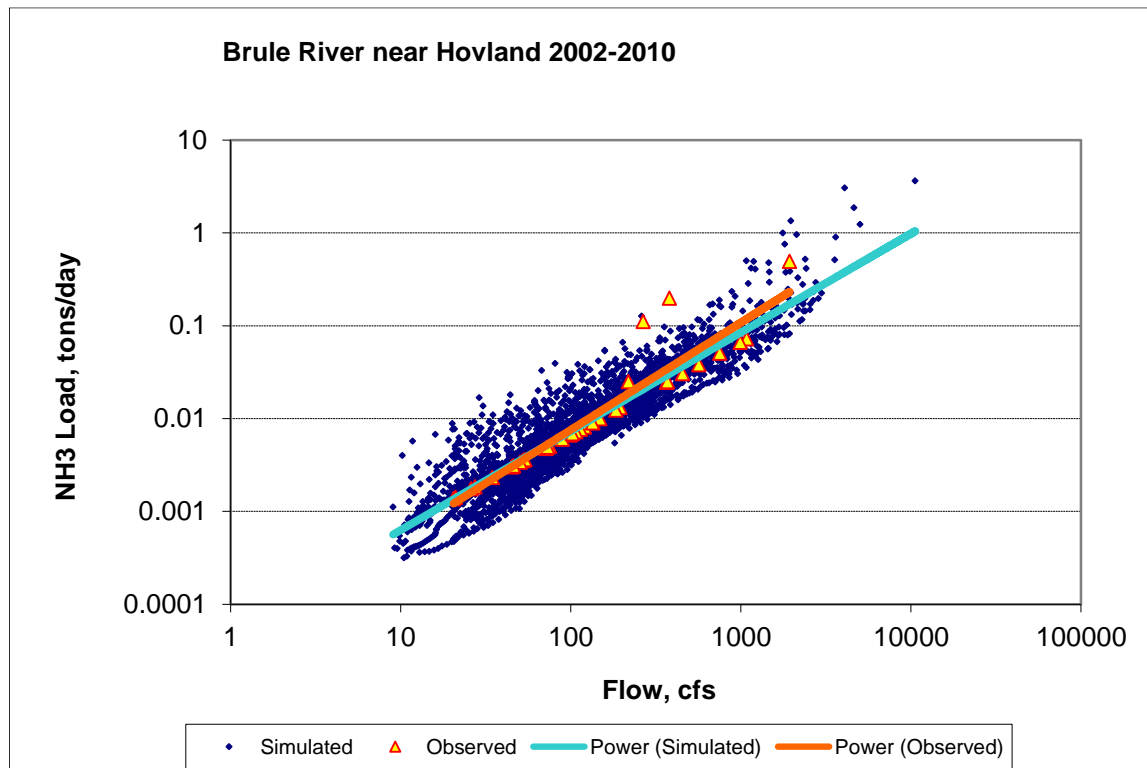
**Figure 307. Residual (Simulated - Observed) vs. Flow Total Suspended Solids (TSS) at Brule River near Hovland**

## Ammonia Nitrogen (NH<sub>3</sub>)

**Table 60. Ammonia Nitrogen (NH<sub>3</sub>) statistics**

Count	39
-------	----

Concentration Average Error	-5.50%
Concentration Median Error	4.82%
Load Ave Error	-35.62%
Load Median Error	2.47%
Paired t concentration	0.86
Paired t load	0.30



**Figure 308. Power plot of simulated and observed Ammonia Nitrogen (NH<sub>3</sub>) load vs flow at Brule River near Hovland (validation period)**



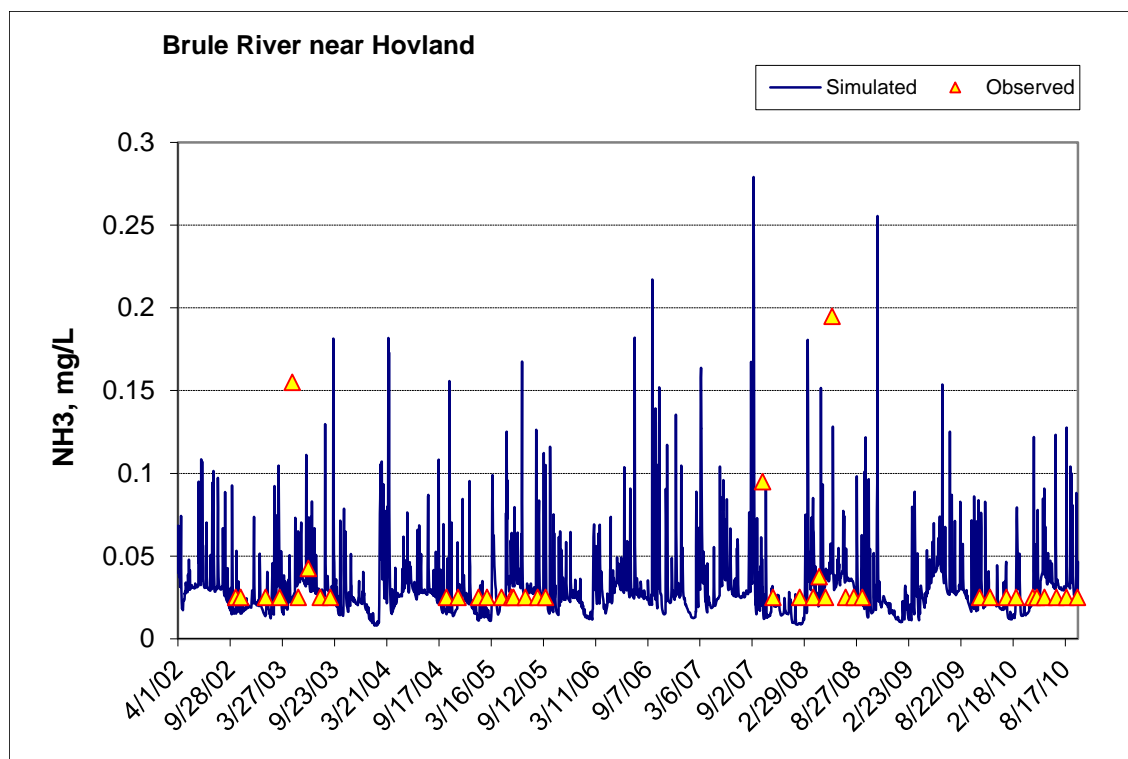


Figure 309. Time series of observed and simulated Ammonia Nitrogen (NH<sub>3</sub>) concentration at Brule River near Hovland

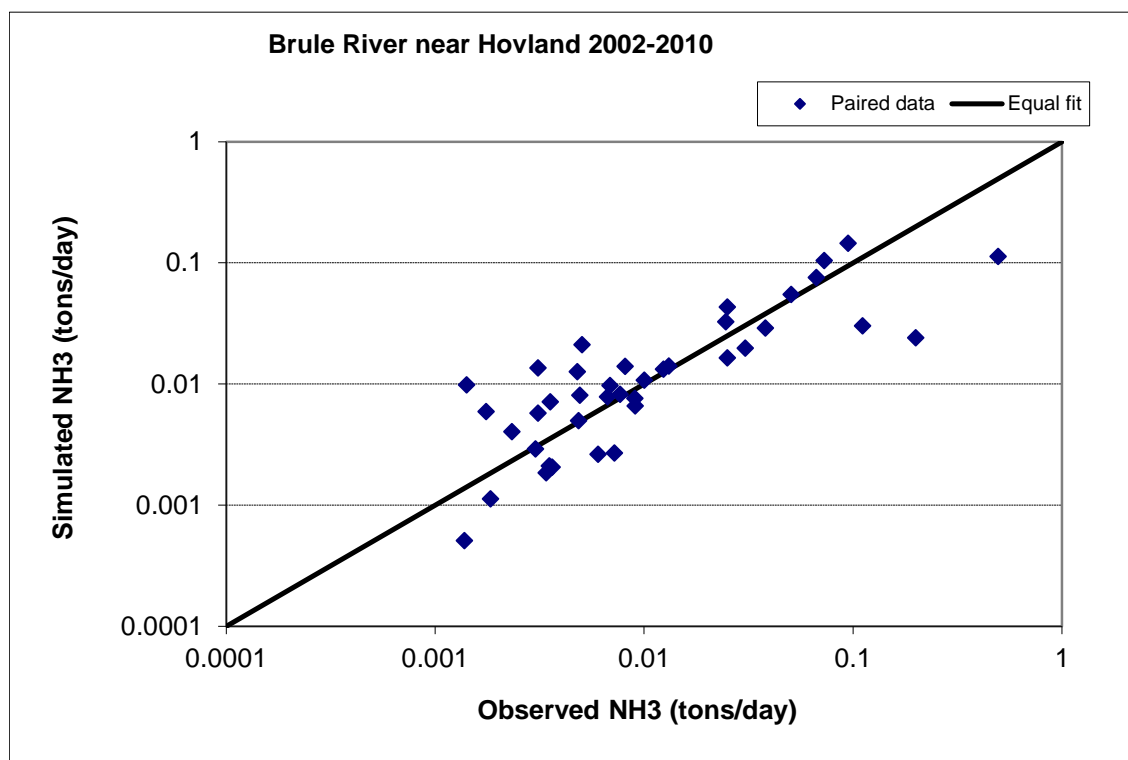


Figure 310. Paired simulated vs. observed Ammonia Nitrogen (NH<sub>3</sub>) load at Brule River near Hovland (validation period)

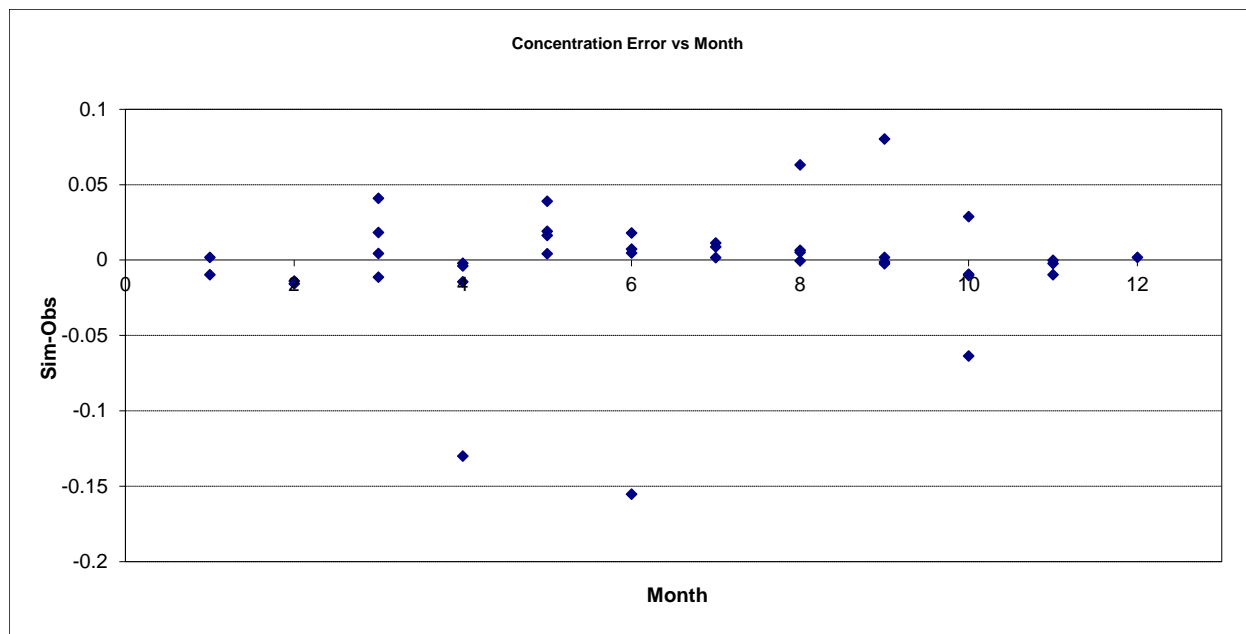


Figure 311. Residual (Simulated - Observed) vs. Month Ammonia Nitrogen (NH3) at Brule River near Hovland

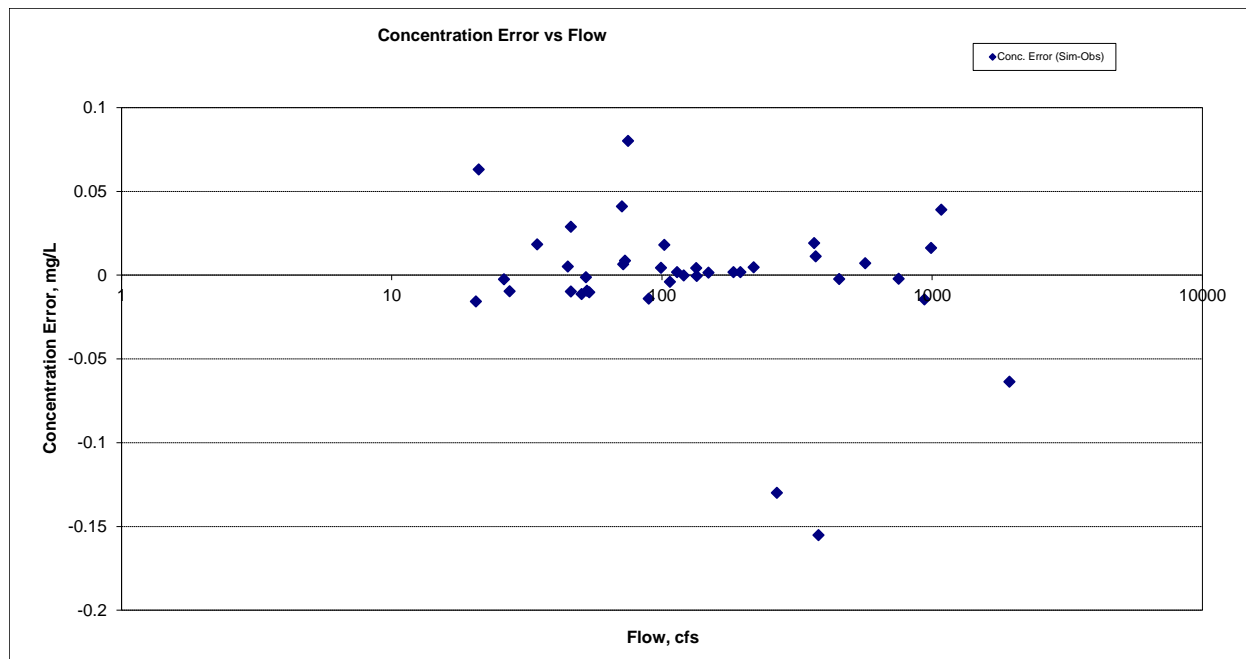


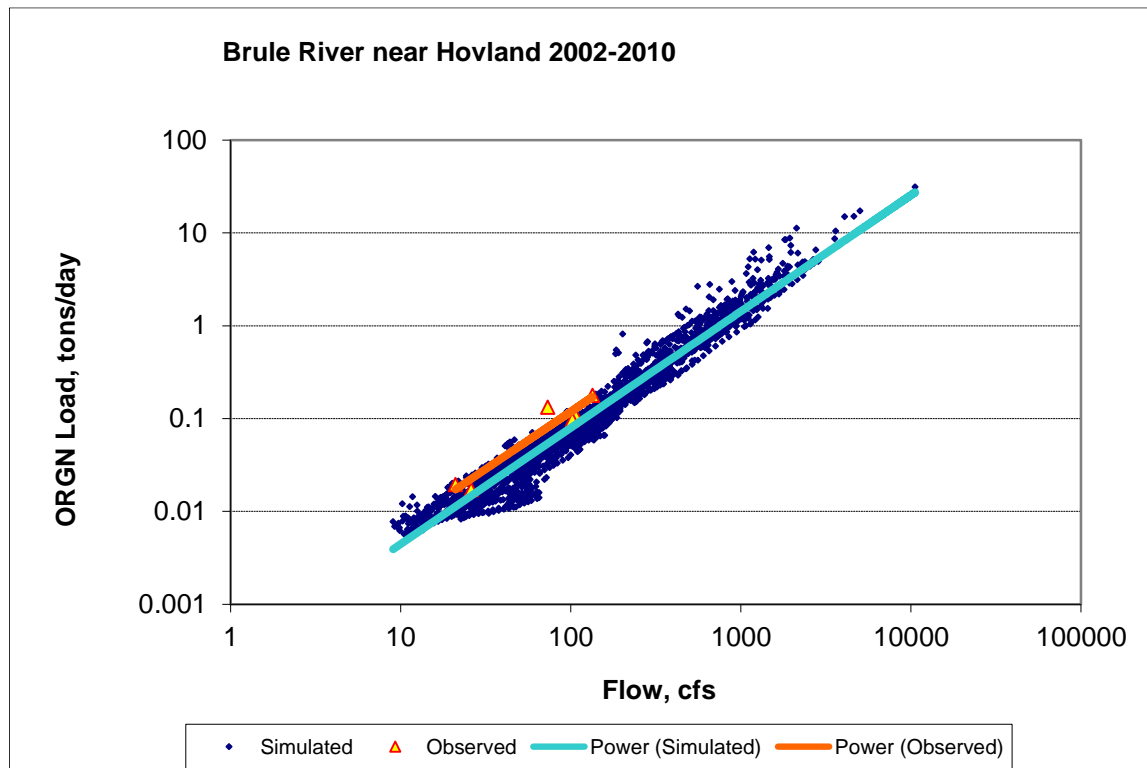
Figure 312. Residual (Simulated - Observed) vs. Flow Ammonia Nitrogen (NH3) at Brule River near Hovland

## Organic Nitrogen (OrgN)

Table 61. Organic Nitrogen (OrgN) statistics

Count	6
-------	---

Concentration Average Error	-25.56%
Concentration Median Error	-11.05%
Load Ave Error	-31.98%
Load Median Error	-50.66%
Paired t concentration	0.31
Paired t load	0.30



**Figure 313. Power plot of simulated and observed Organic Nitrogen (OrgN) load vs flow at Brule River near Hovland (validation period)**

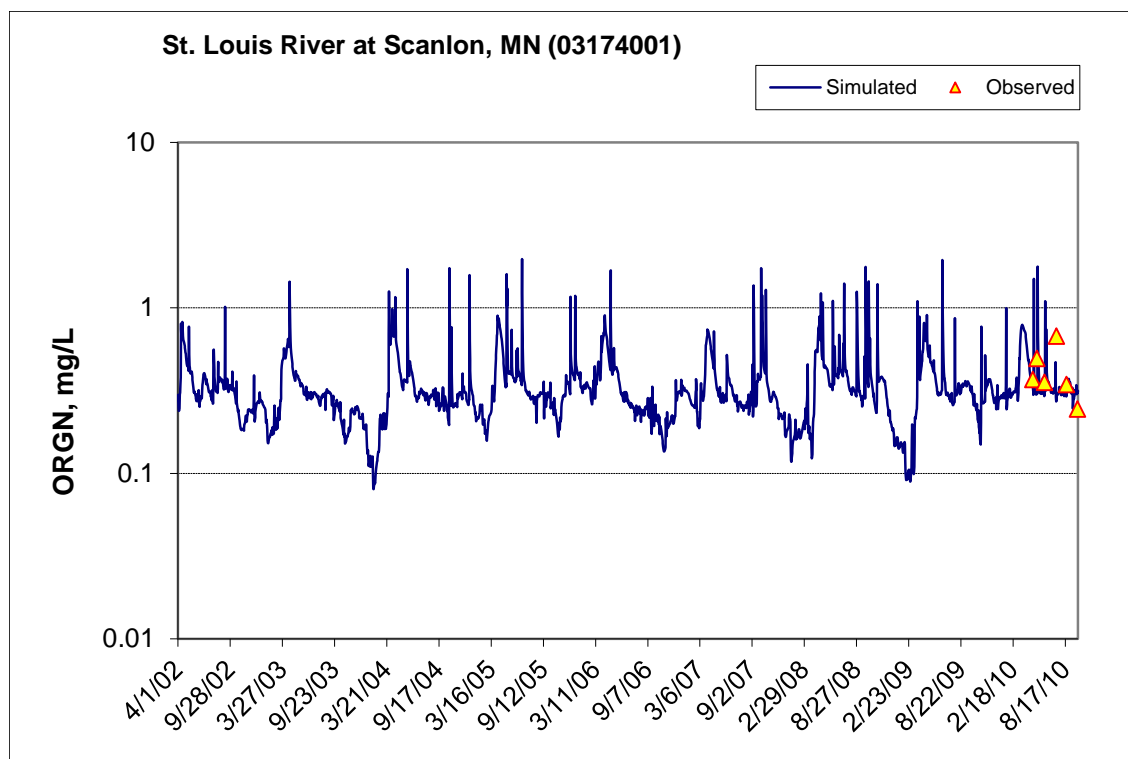


Figure 314. Time series of observed and simulated Organic Nitrogen (OrgN) concentration at Brule River near Hovland

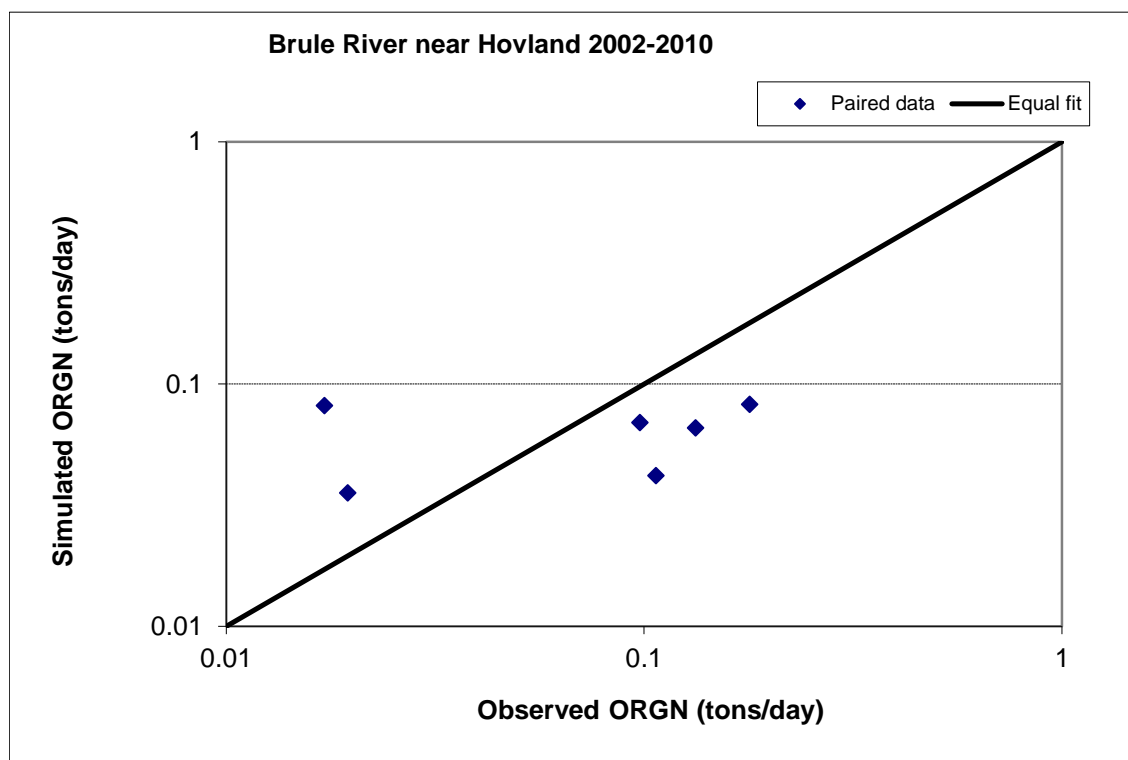


Figure 315. Paired simulated vs. observed Organic Nitrogen (OrgN) load at Brule River near Hovland (validation period)

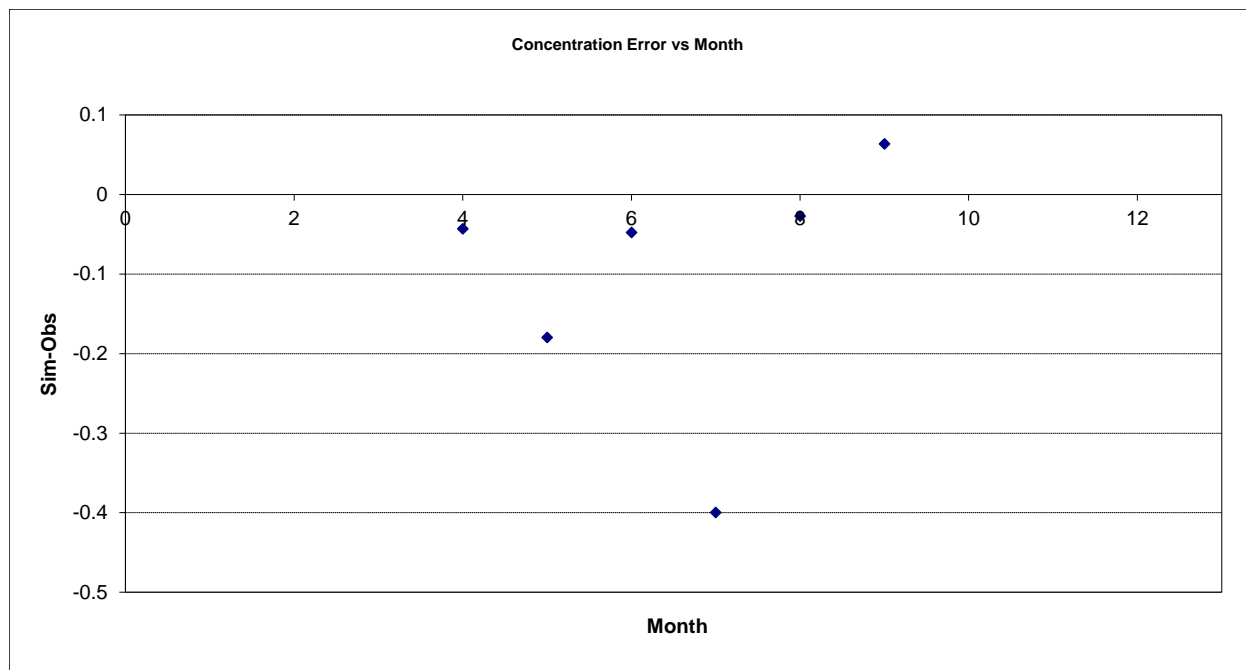


Figure 316. Residual (Simulated - Observed) vs. Month Organic Nitrogen (OrgN) at Brule River near Hovland

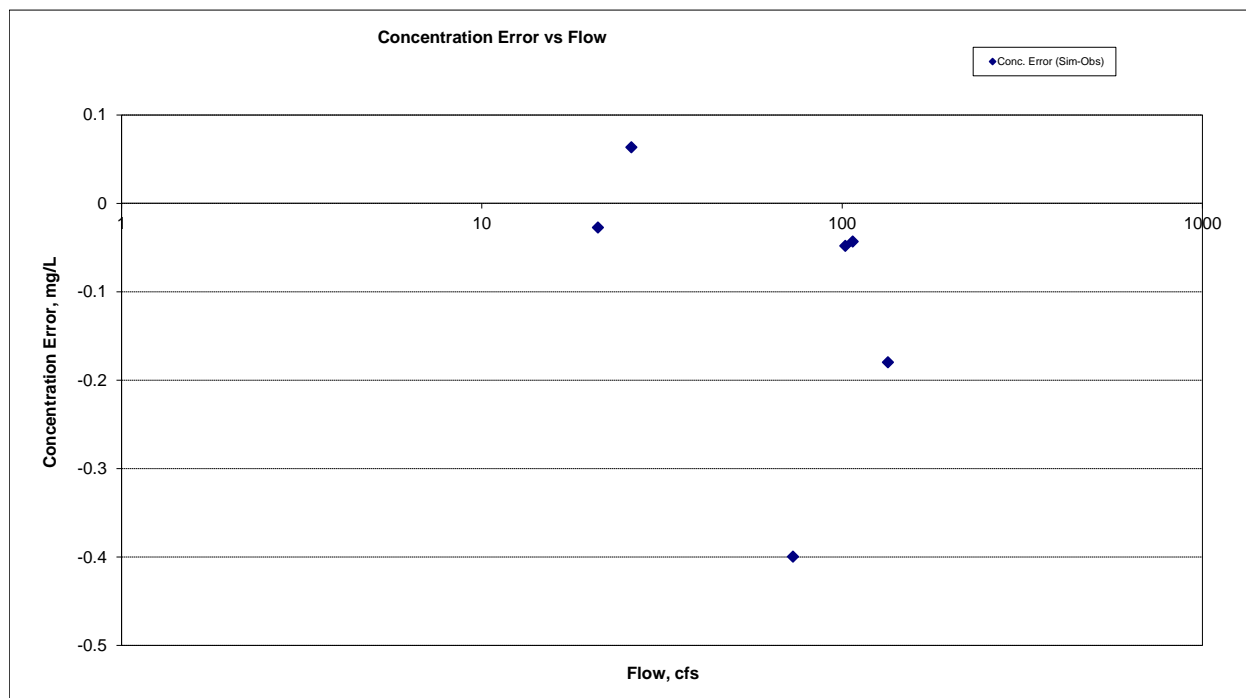
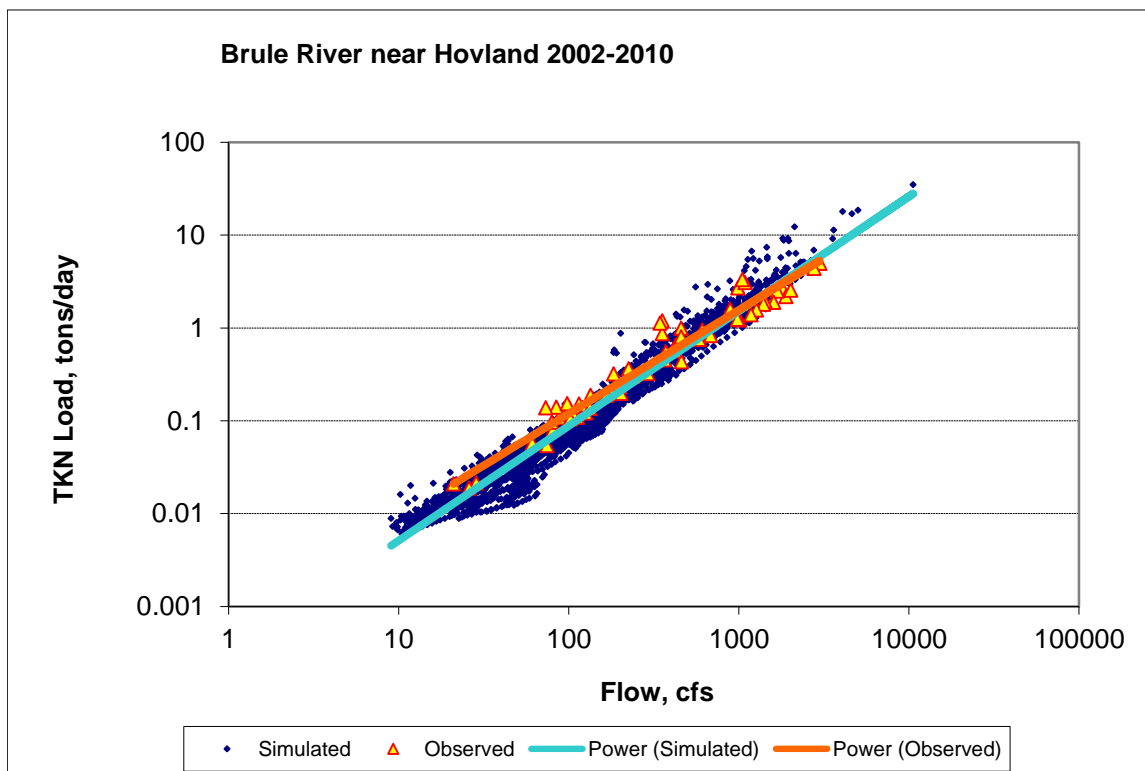


Figure 317. Residual (Simulated - Observed) vs. Flow Organic Nitrogen (OrgN) at Brule River near Hovland

## Total Kjeldahl Nitrogen (TKN)

Table 62. Total Kjeldahl Nitrogen (TKN) statistics

Count	62
Concentration Average Error	6.54%
Concentration Median Error	5.26%
Load Ave Error	43.82%
Load Median Error	3.99%
Paired t concentration	0.99
Paired t load	0.11



**Figure 318. Power plot of simulated and observed Total Kjeldahl Nitrogen (TKN) load vs flow at Brule River near Hovland (validation period)**

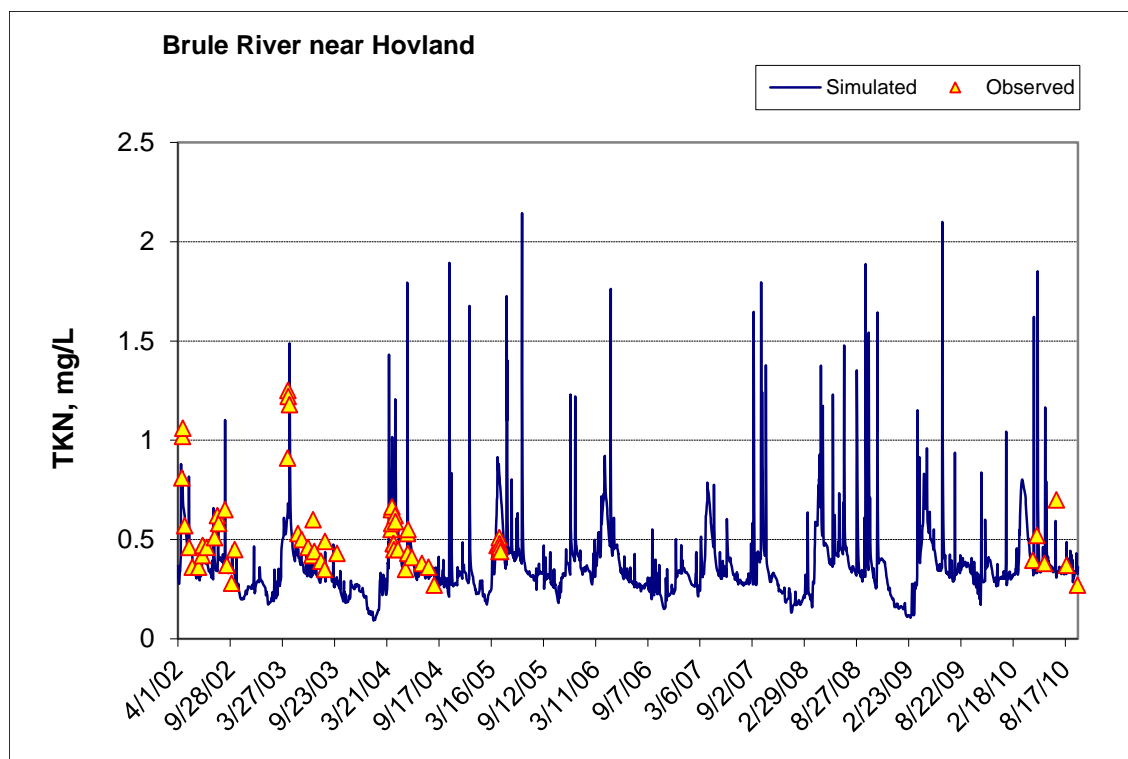


Figure 319. Time series of observed and simulated Total Kjeldahl Nitrogen (TKN) concentration at Brule River near Hovland

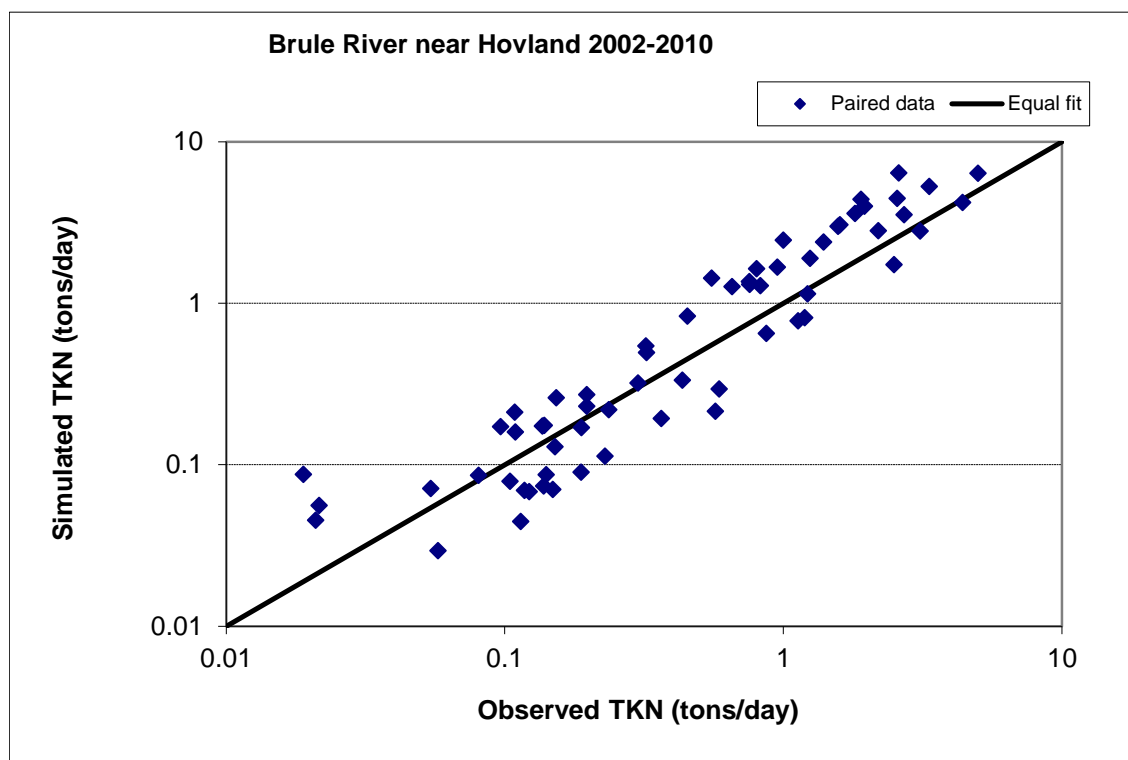


Figure 320. Paired simulated vs. observed Total Kjeldahl Nitrogen (TKN) load at Brule River near Hovland (validation period)

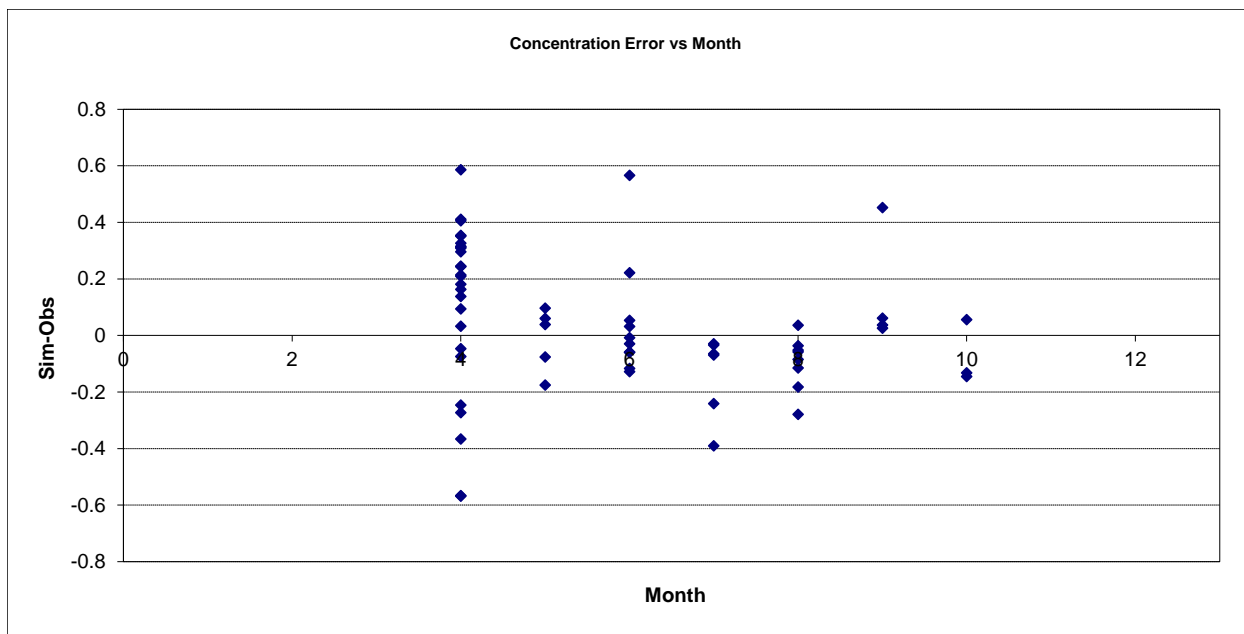


Figure 321. Residual (Simulated - Observed) vs. Month Total Kjeldahl Nitrogen (TKN) at Brule River near Hovland

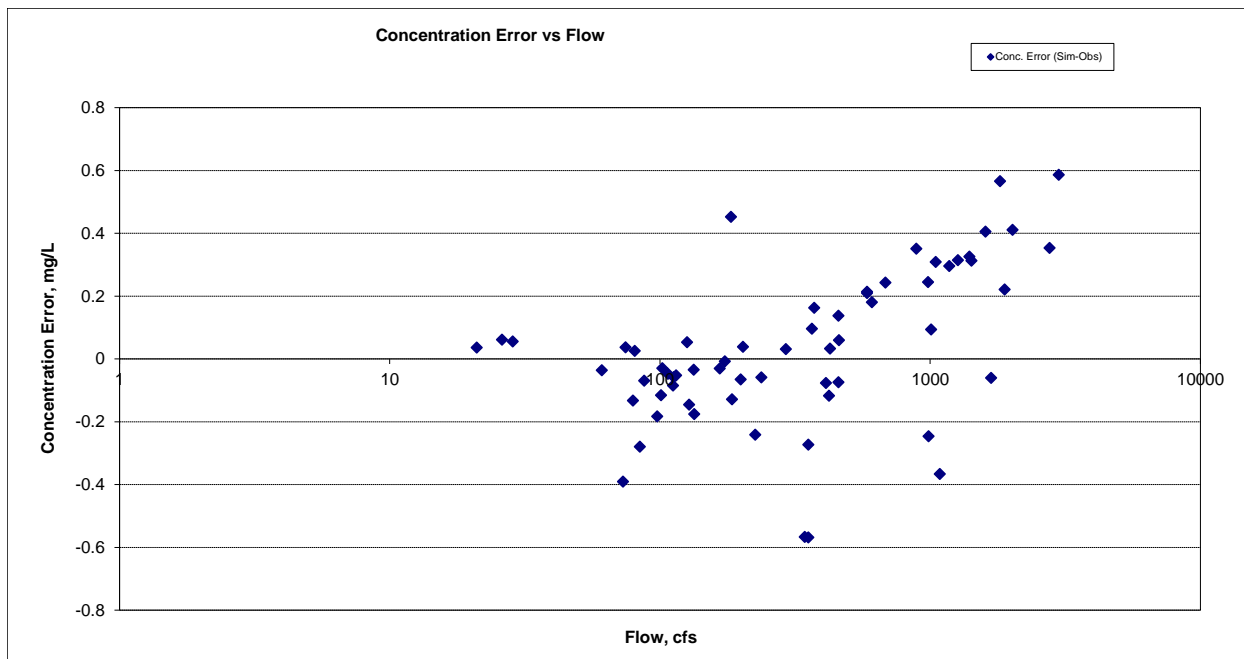


Figure 322. Residual (Simulated - Observed) vs. Flow Total Kjeldahl Nitrogen (TKN) at Brule River near Hovland

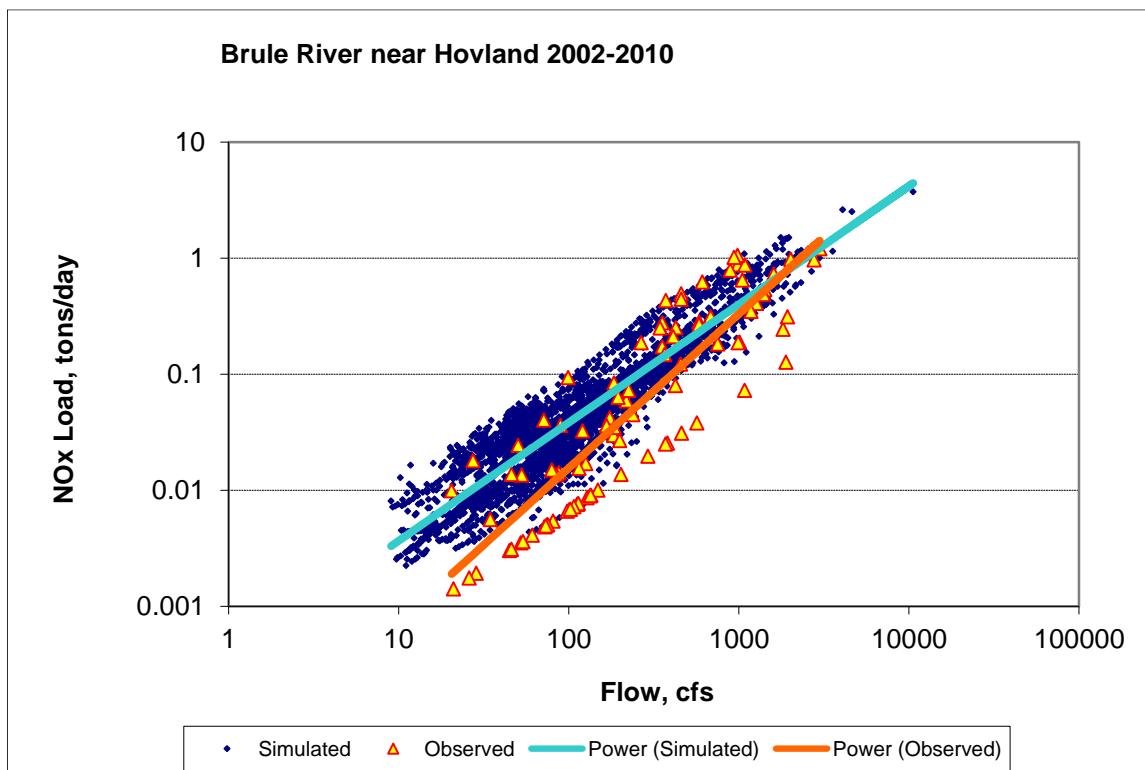
## Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>)

Table 63. Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) statistics

Count	94
-------	----



Concentration Average Error	39.58%
Concentration Median Error	54.38%
Load Ave Error	43.89%
Load Median Error	18.13%
Paired t concentration	0.01
Paired t load	0.09



**Figure 323. Power plot of simulated and observed Nitrite+ Nitrate Nitrogen (NOx) load vs flow at Brule River near Hovland (validation period)**

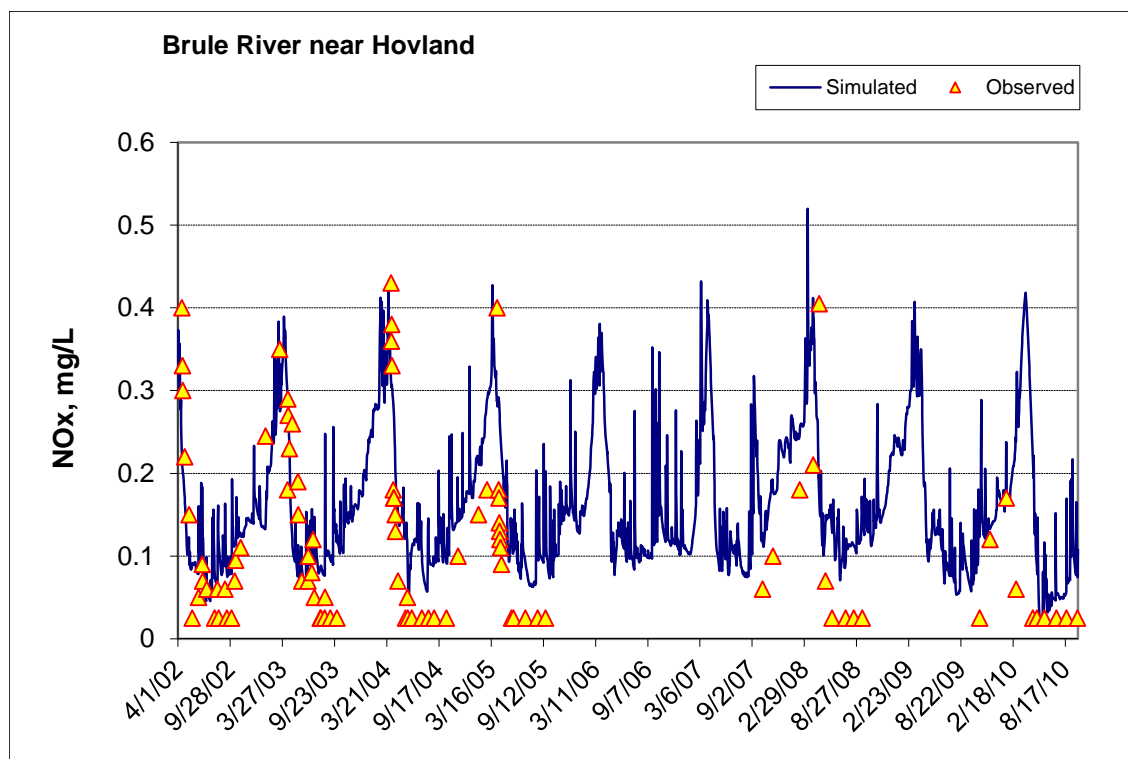


Figure 324. Time series of observed and simulated Nitrite+ Nitrate Nitrogen (NOx) concentration at Brule River near Hovland

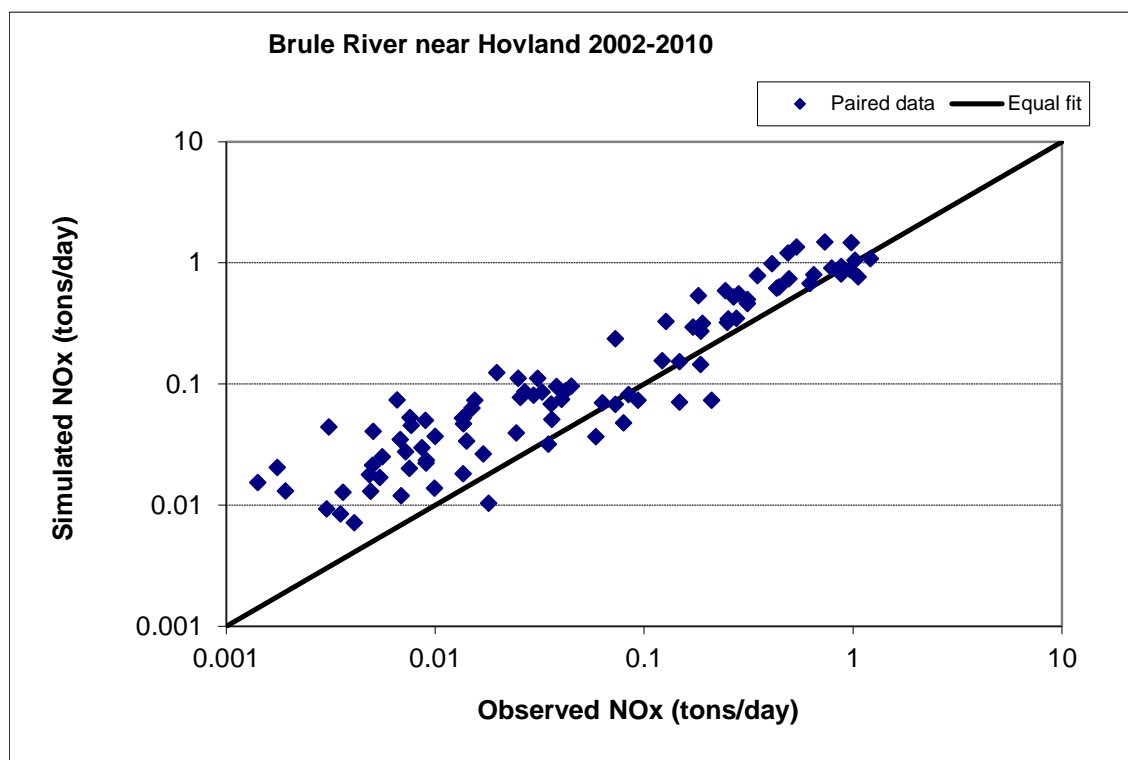


Figure 325. Paired simulated vs. observed Nitrite+ Nitrate Nitrogen (NOx) load at Brule River near Hovland (validation period)

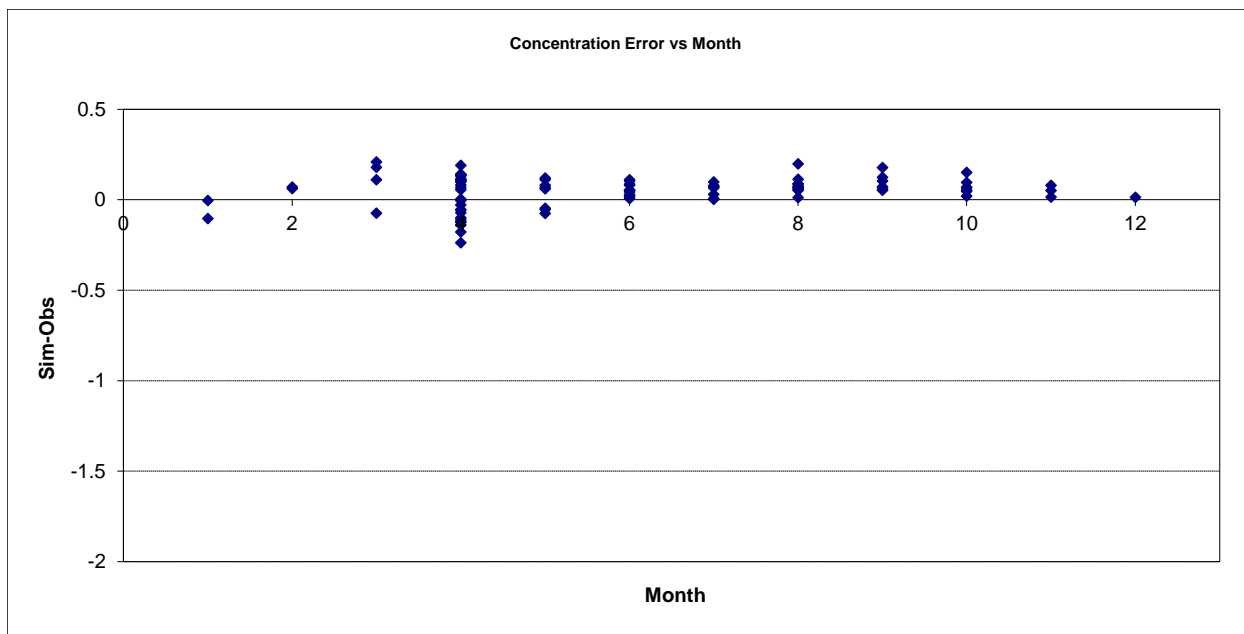


Figure 326. Residual (Simulated - Observed) vs. Month Nitrite+ Nitrate Nitrogen (NOx) at Brule River near Hovland

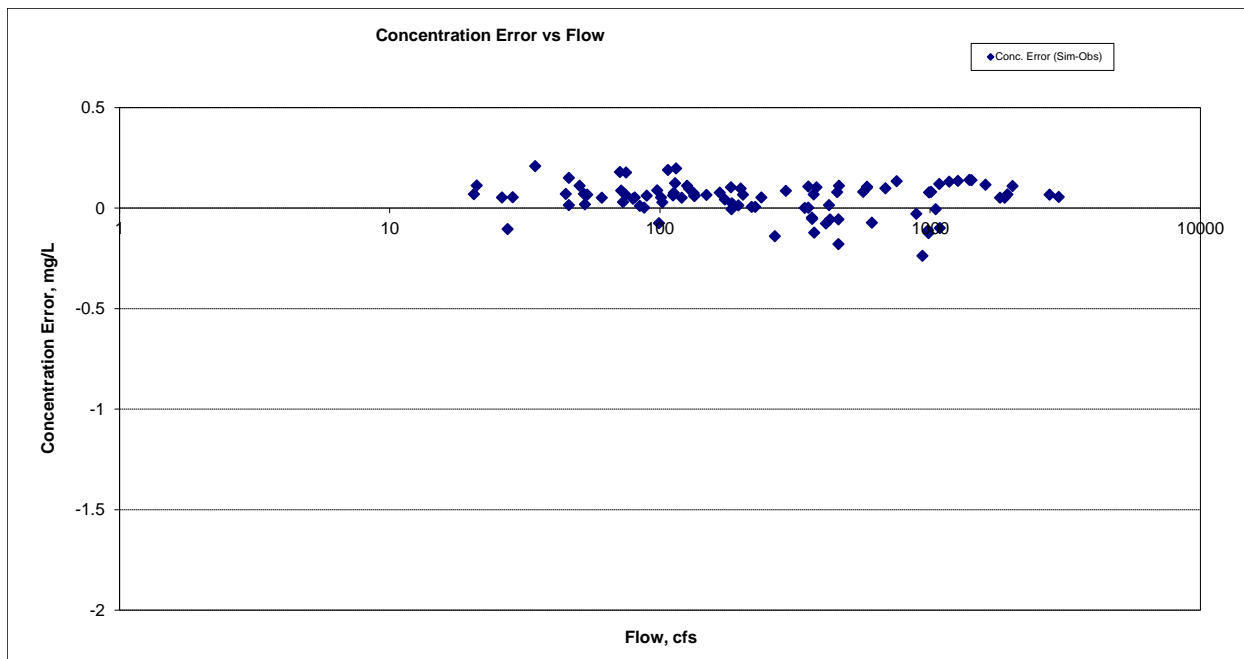


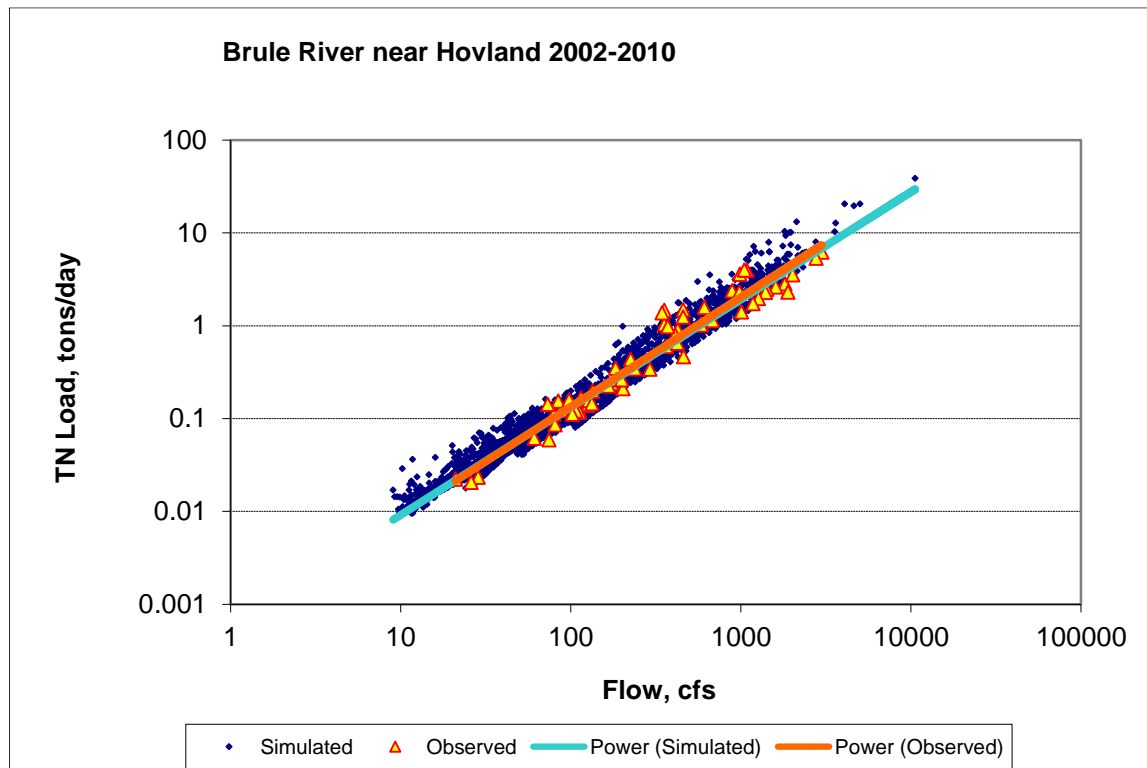
Figure 327. Residual (Simulated - Observed) vs. Flow Nitrite+ Nitrate Nitrogen (NOx) at Brule River near Hovland

## Total Nitrogen (TN)

Table 64. Total Nitrogen (TN) statistics

Count	61
-------	----

Concentration Average Error	12.23%
Concentration Median Error	11.80%
Load Ave Error	46.50%
Load Median Error	6.81%
Paired t concentration	0.90
Paired t load	0.09



**Figure 328. Power plot of simulated and observed Total Nitrogen (TN) load vs flow at Brule River near Hovland (validation period)**

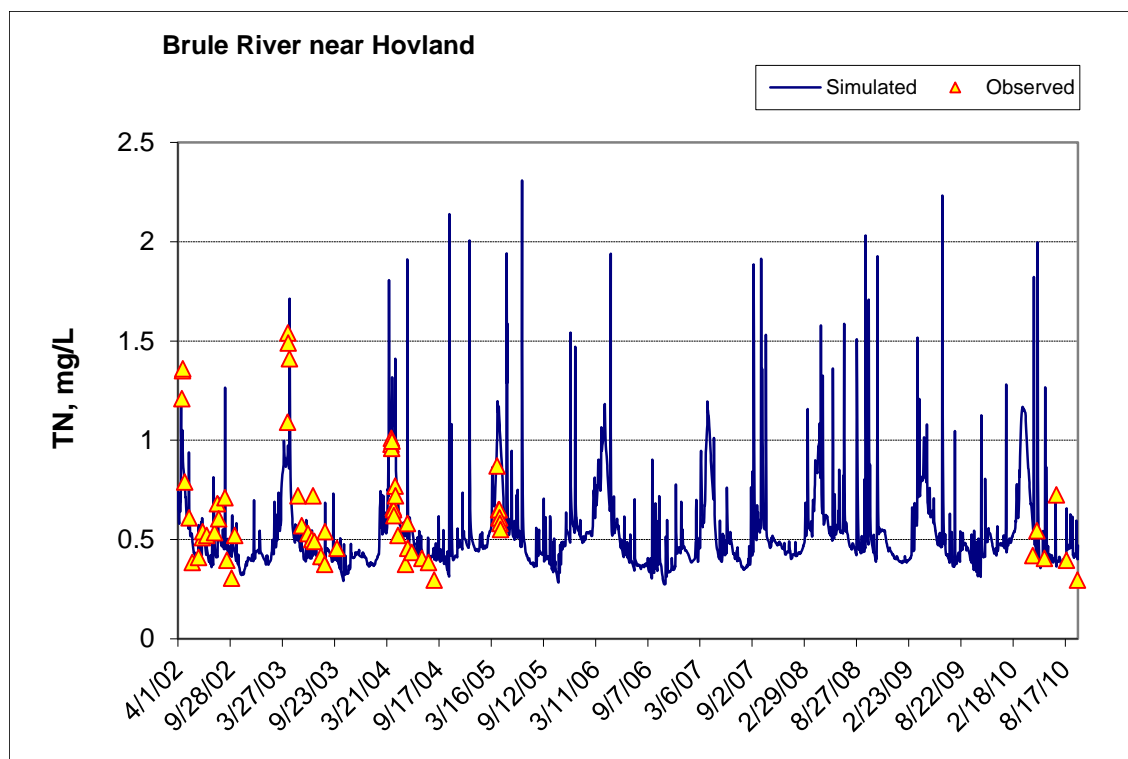


Figure 329. Time series of observed and simulated Total Nitrogen (TN) concentration at Brule River near Hovland

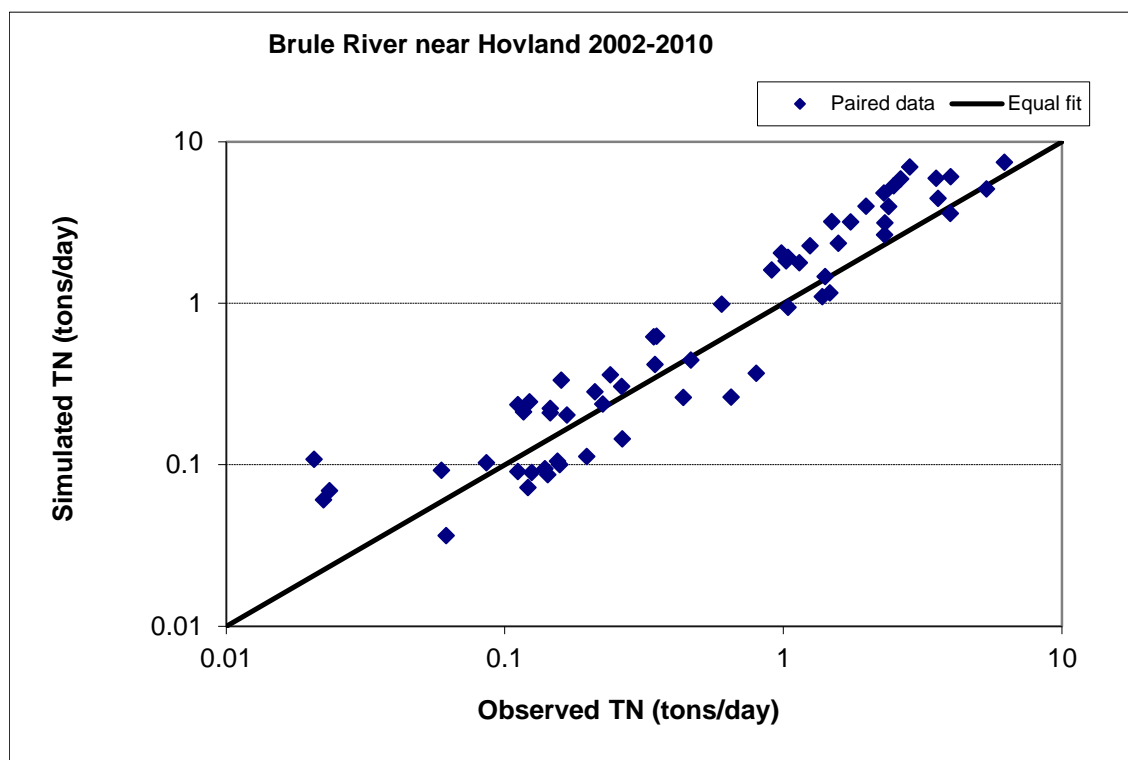


Figure 330. Paired simulated vs. observed Total Nitrogen (TN) load at Brule River near Hovland (validation period)

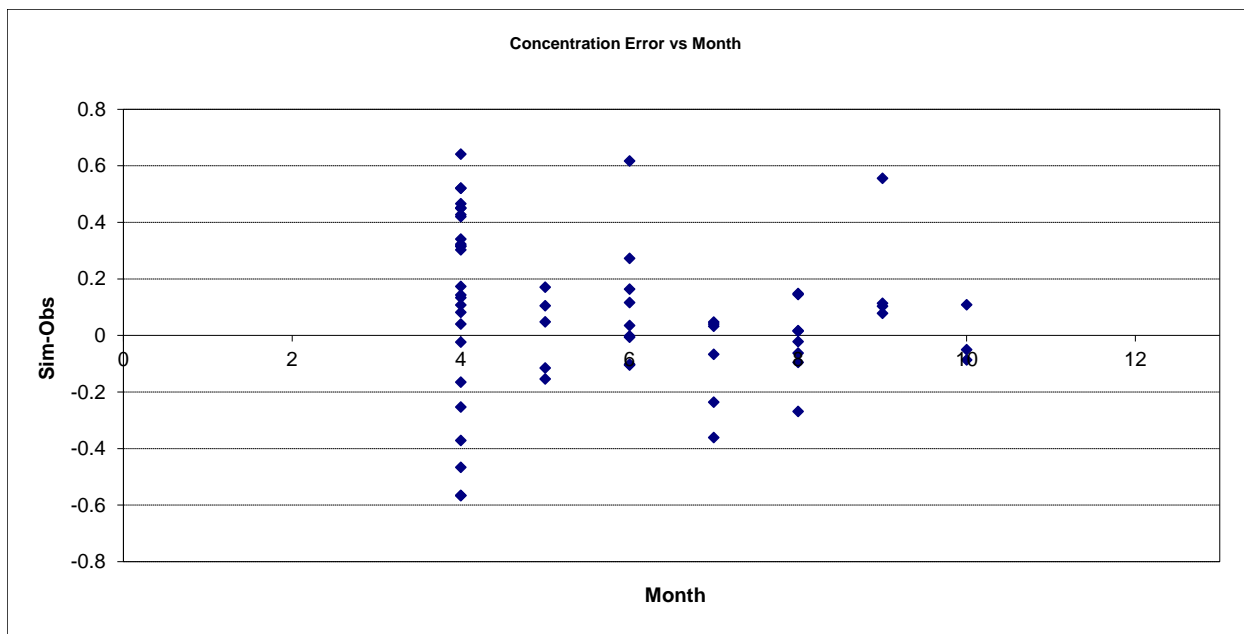


Figure 331. Residual (Simulated - Observed) vs. Month Total Nitrogen (TN) at Brule River near Hovland

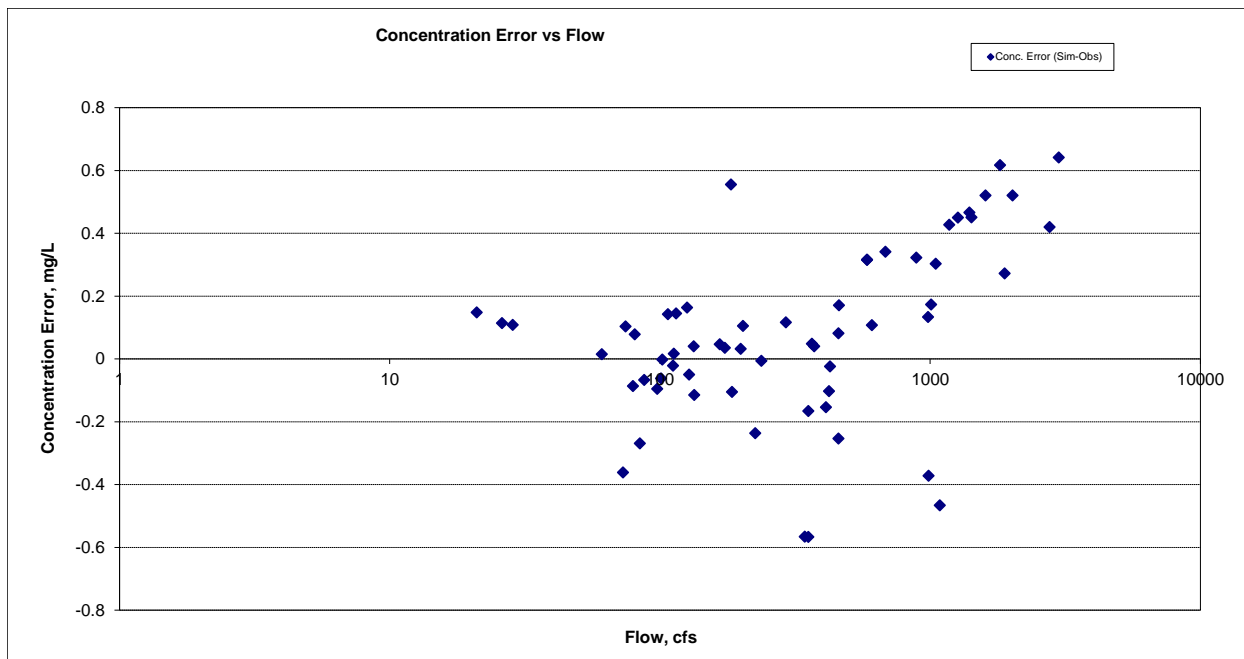


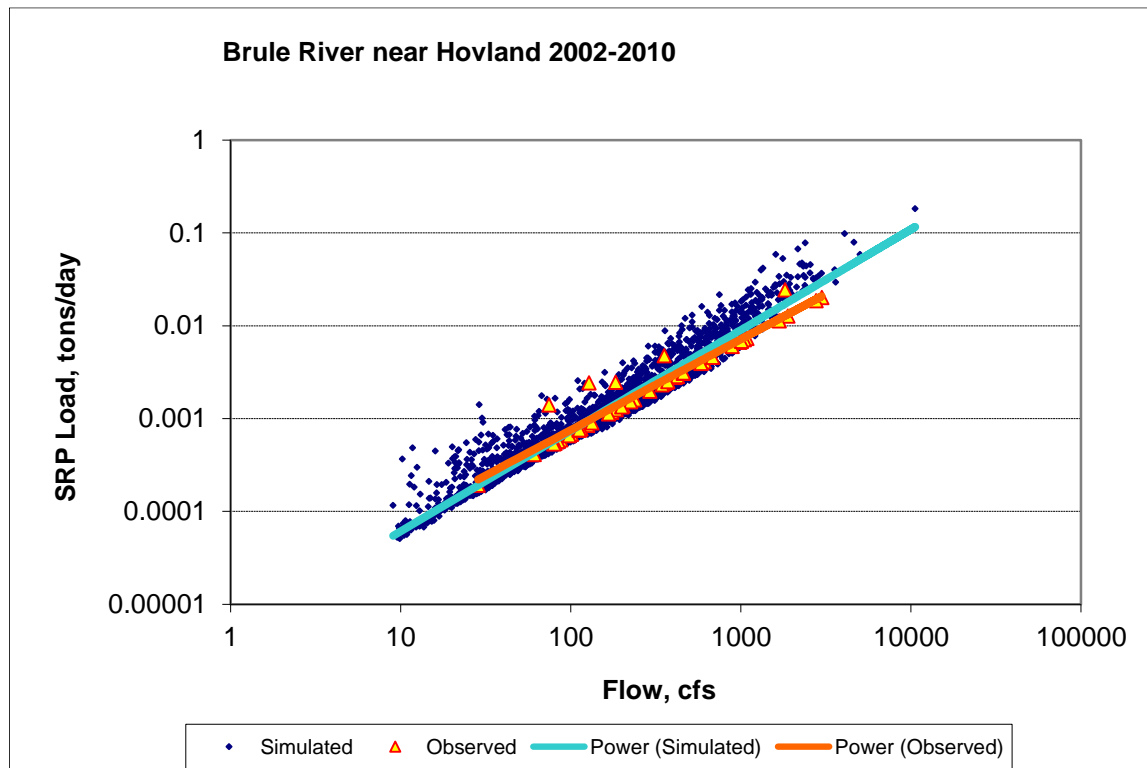
Figure 332. Residual (Simulated - Observed) vs. Flow Total Nitrogen (TN) at Brule River near Hovland

## Soluble Reactive Phosphorus (SRP)

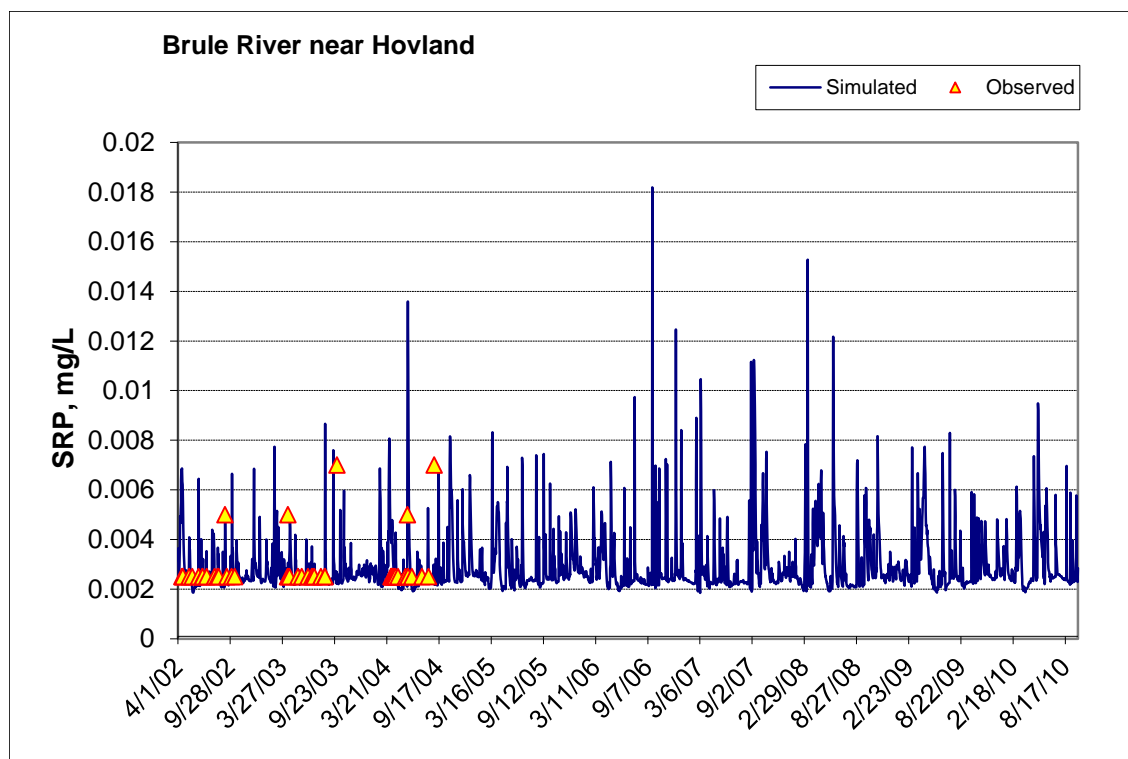
Table 65. Soluble Reactive Phosphorus (SRP) statistics

Count	48
-------	----

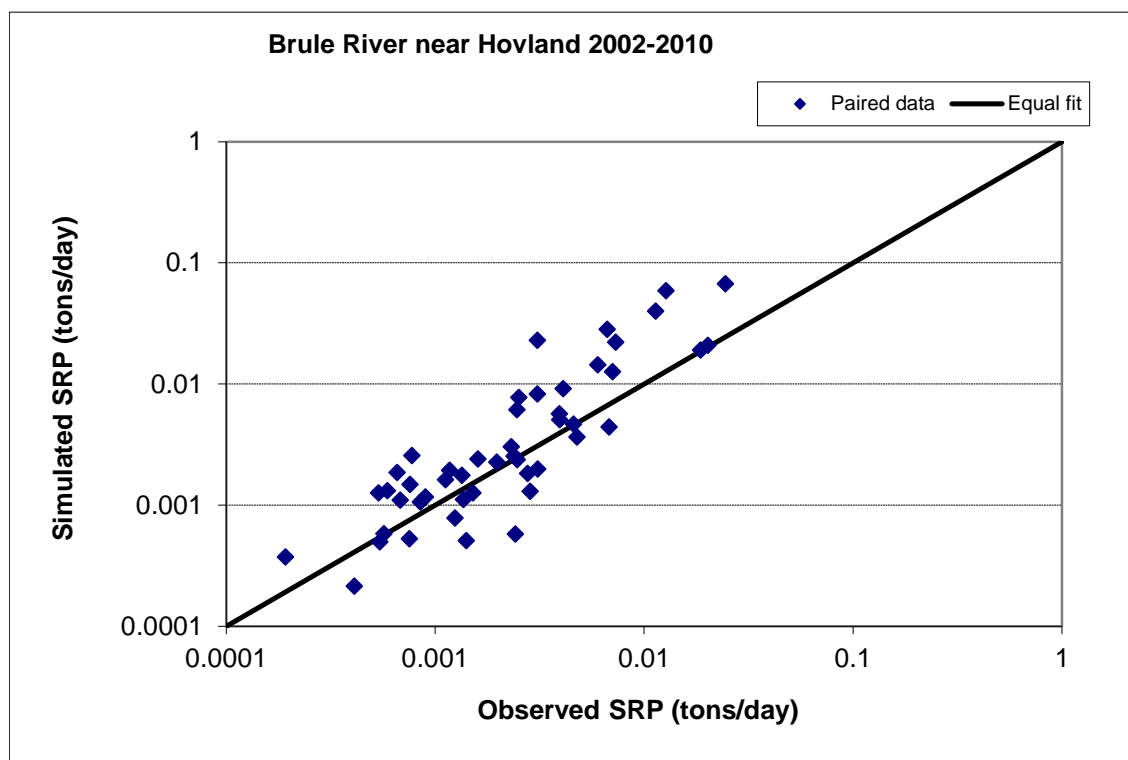
Concentration Average Error	36.07%
Concentration Median Error	8.41%
Load Ave Error	108.66%
Load Median Error	12.17%
Paired t concentration	0.06
Paired t load	0.01



**Figure 333. Power plot of simulated and observed Soluble Reactive Phosphorus (SRP) load vs flow at Brule River near Hovland (validation period)**



**Figure 334. Time series of observed and simulated Soluble Reactive Phosphorus (SRP) concentration at Brule River near Hovland**



**Figure 335. Paired simulated vs. observed Soluble Reactive Phosphorus (SRP) load at Brule River near Hovland (validation period)**



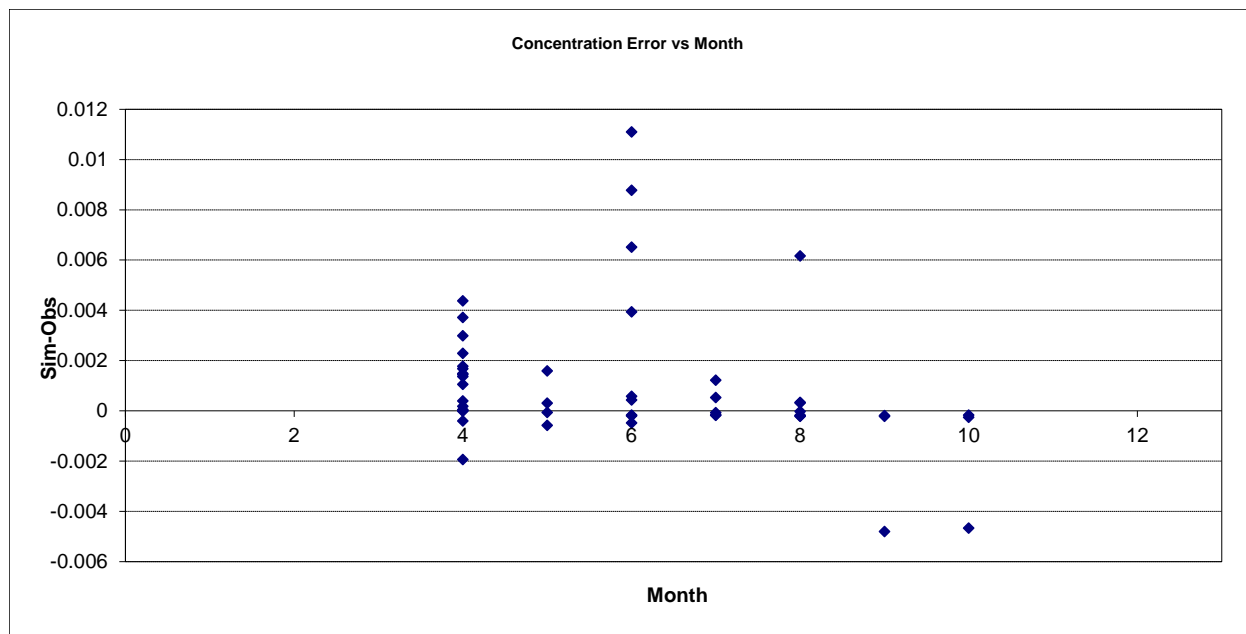


Figure 336. Residual (Simulated - Observed) vs. Month Soluble Reactive Phosphorus (SRP) at Brule River near Hovland

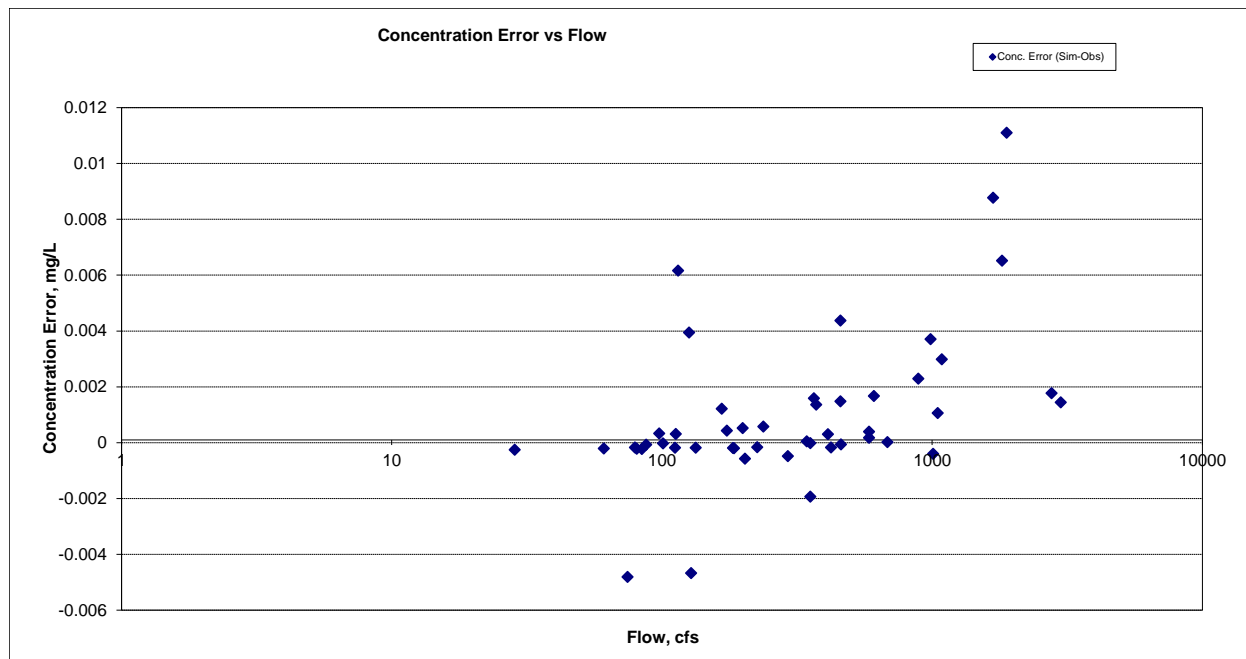


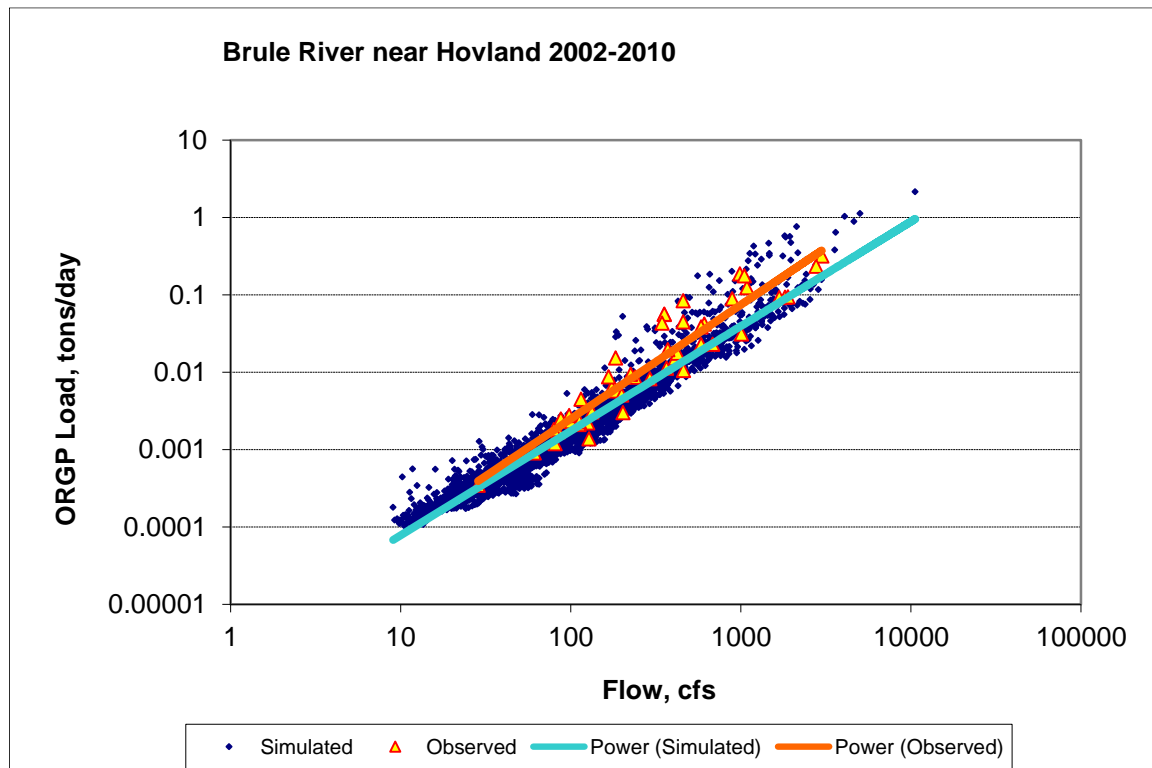
Figure 337. Residual (Simulated - Observed) vs. Flow Soluble Reactive Phosphorus (SRP) at Brule River near Hovland

## Organic Phosphorus (OrgP)

Table 66. Organic Phosphorus (OrgP) statistics

Count	47
-------	----

Concentration Average Error	-25.14%
Concentration Median Error	-10.09%
Load Ave Error	-4.02%
Load Median Error	-1.74%
Paired t concentration	0.33
Paired t load	0.74



**Figure 338. Power plot of simulated and observed Organic Phosphorus (OrgP) load vs flow at Brule River near Hovland (validation period)**

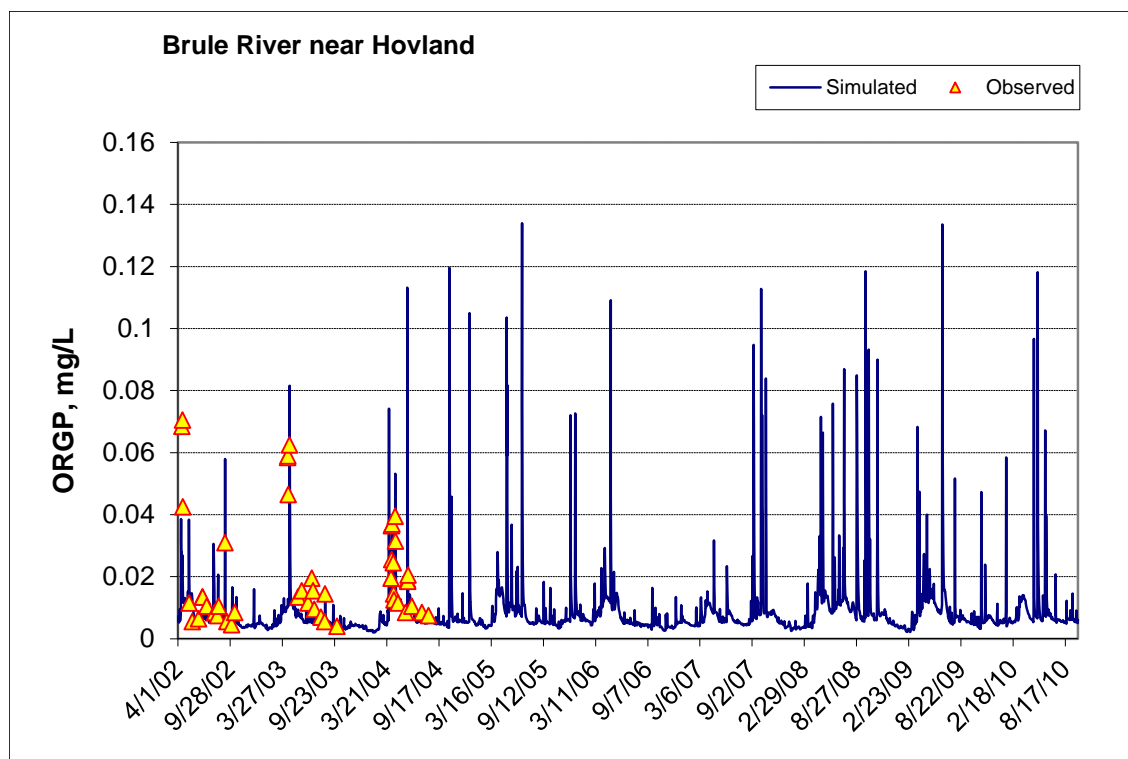


Figure 339. Time series of observed and simulated Organic Phosphorus (OrgP) concentration at Brule River near Hovland

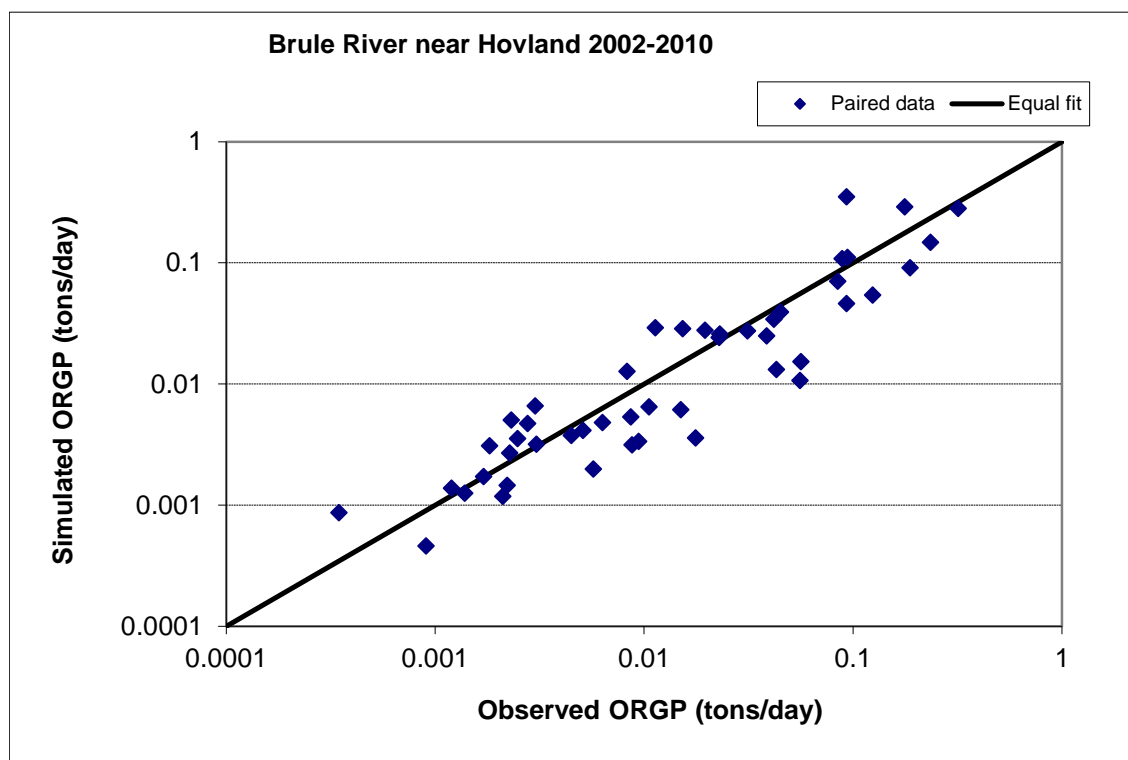


Figure 340. Paired simulated vs. observed Organic Phosphorus (OrgP) load at Brule River near Hovland (validation period)

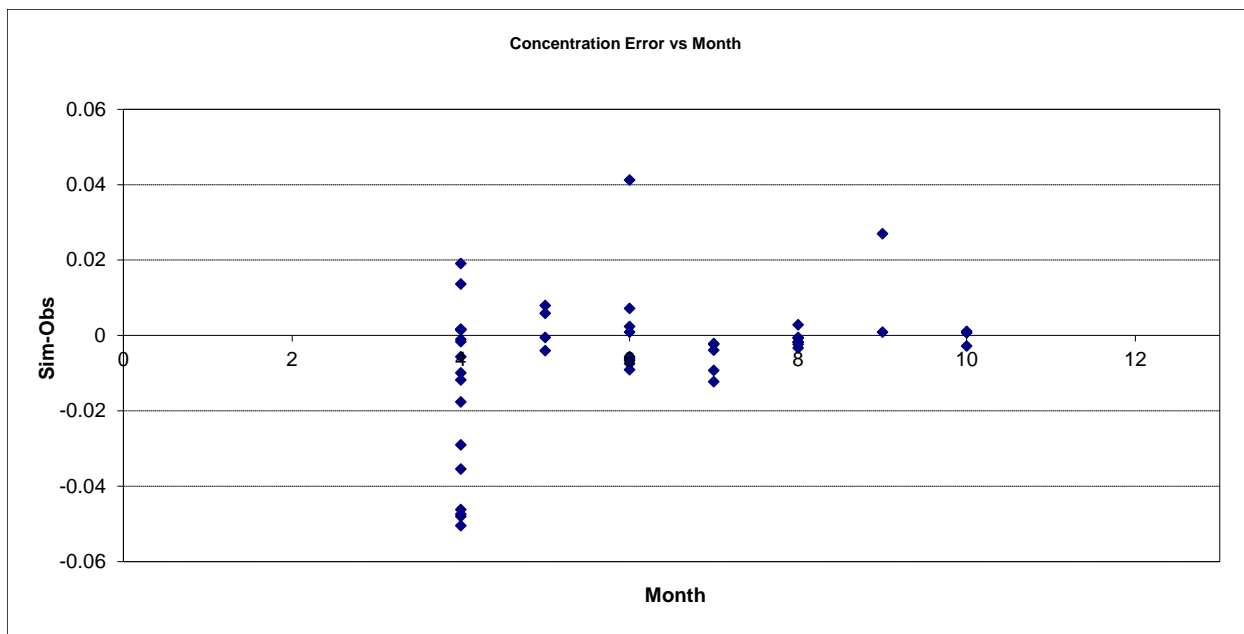


Figure 341. Residual (Simulated - Observed) vs. Month Organic Phosphorus (OrgP) at Brule River near Hovland

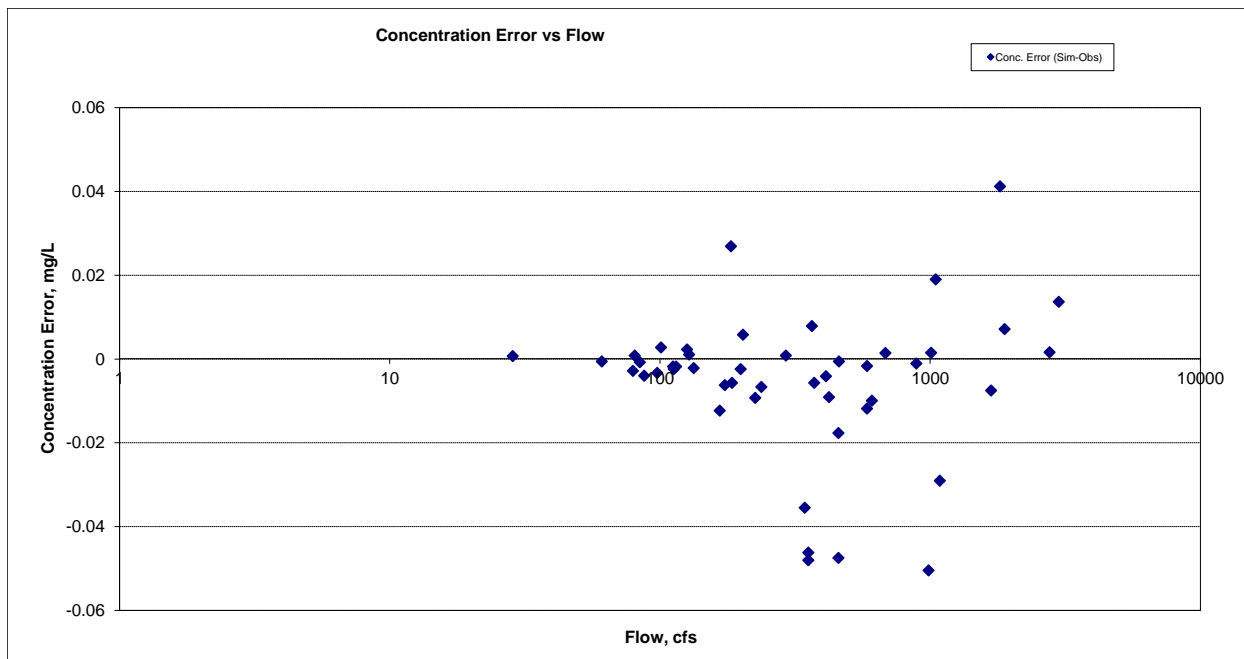


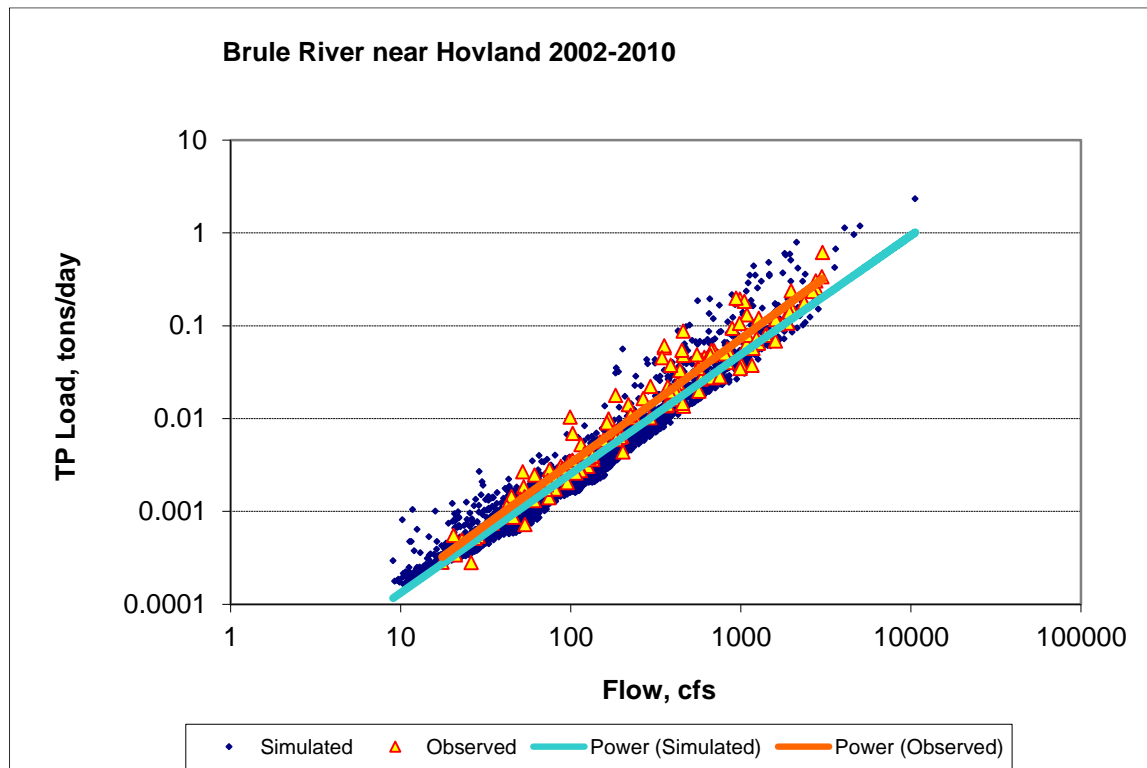
Figure 342. Residual (Simulated - Observed) vs. Flow Organic Phosphorus (OrgP) at Brule River near Hovland

## Total Phosphorus (TP)

Table 67. Total Phosphorus (TP) statistics

Count	131
-------	-----

Concentration Average Error	-11.45%
Concentration Median Error	-12.24%
Load Ave Error	10.40%
Load Median Error	-2.37%
Paired t concentration	0.88
Paired t load	0.68



**Figure 343. Power plot of simulated and observed Total Phosphorus (TP) load vs flow at Brule River near Hovland (validation period)**

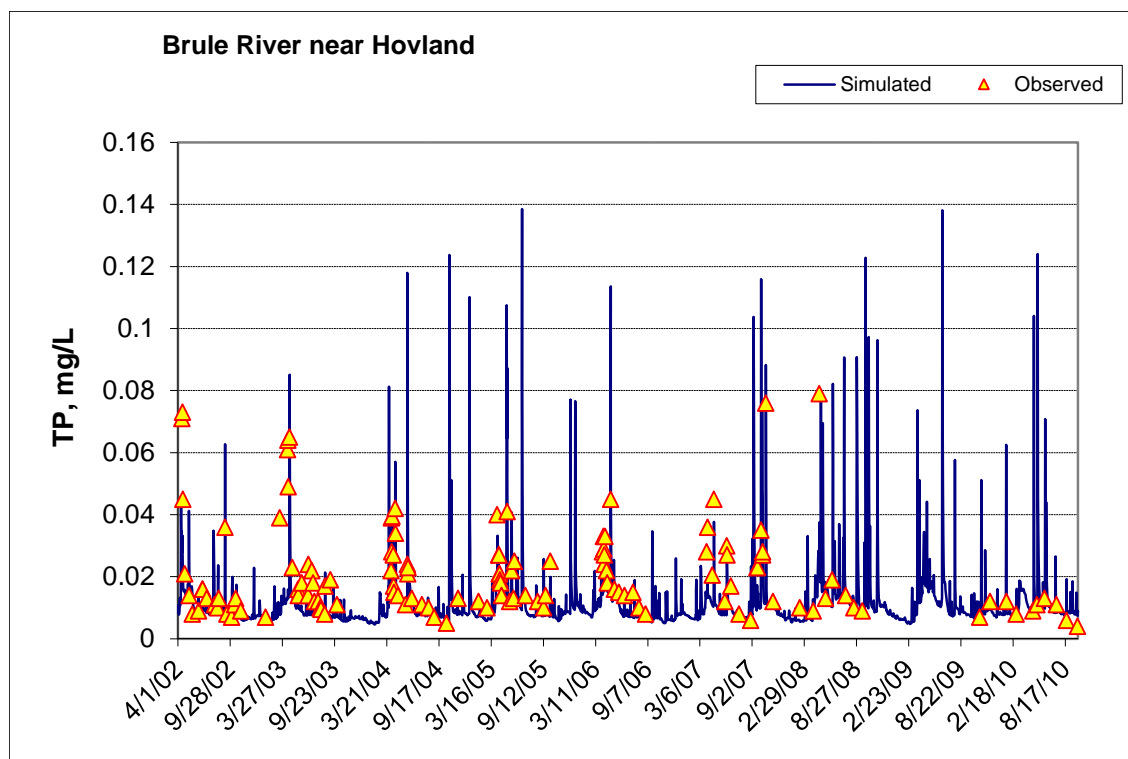


Figure 344. Time series of observed and simulated Total Phosphorus (TP) concentration at Brule River near Hovland

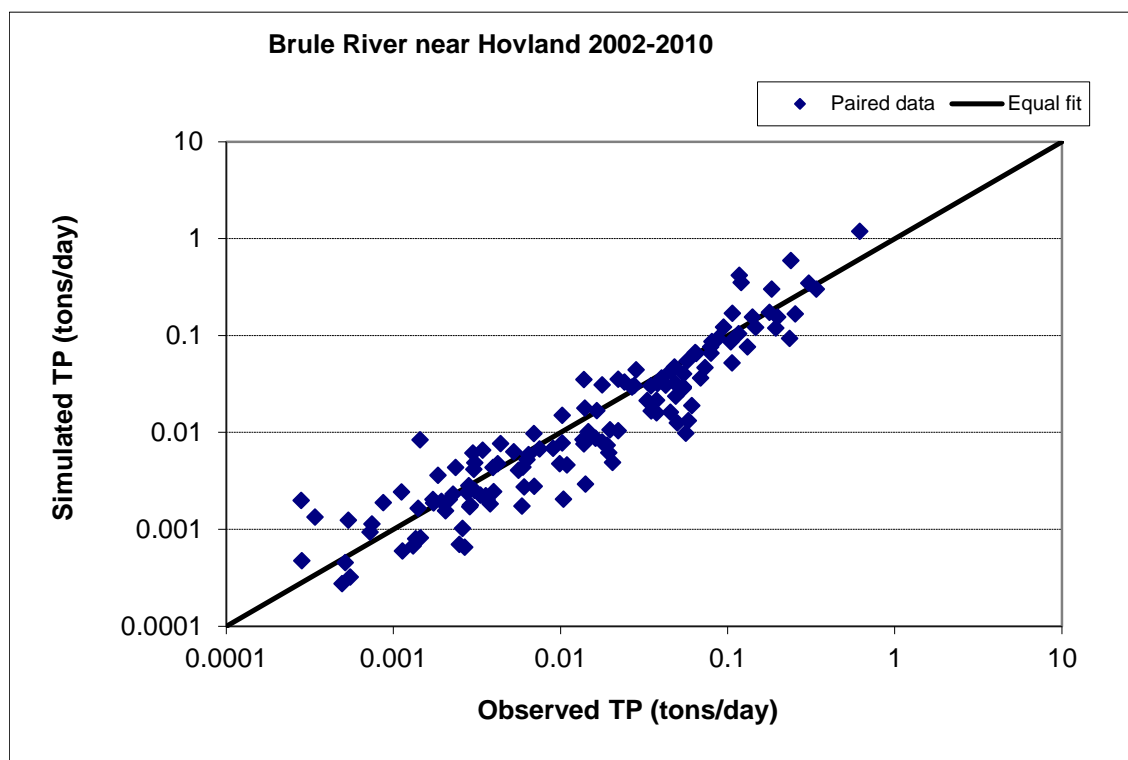
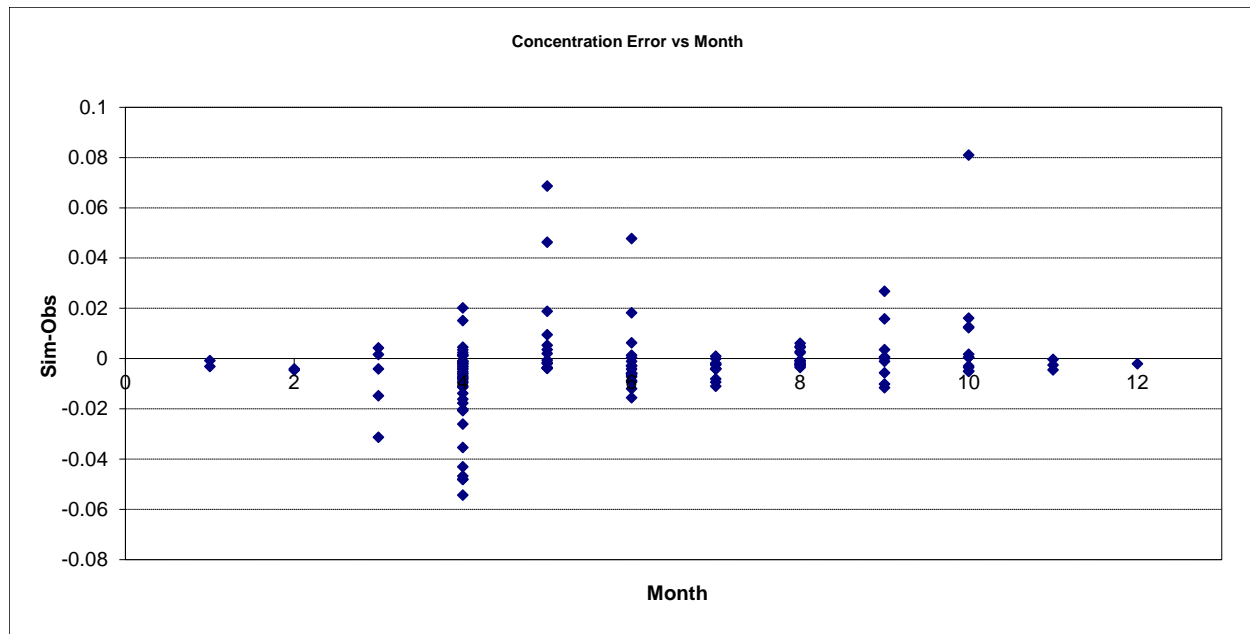
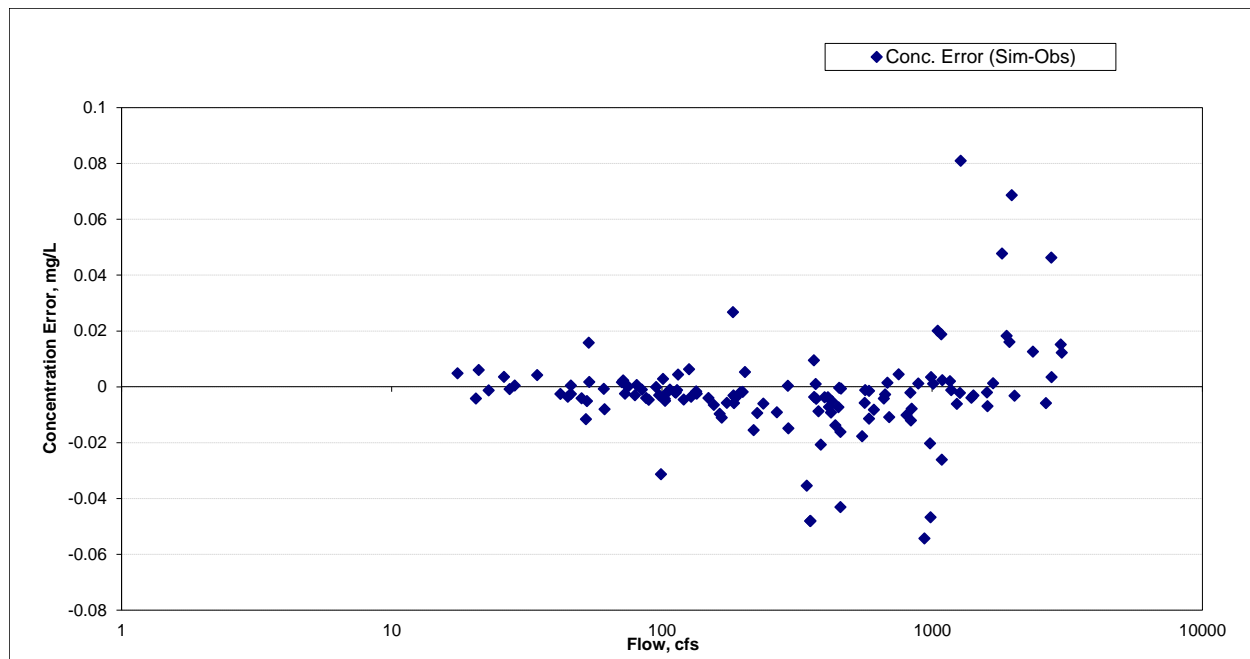


Figure 345. Paired simulated vs. observed Total Phosphorus (TP) load at Brule River near Hovland (validation period)



**Figure 346. Residual (Simulated - Observed) vs. Month Total Phosphorus (TP) at Brule River near Hovland**



**Figure 347. Residual (Simulated - Observed) vs. Flow Total Phosphorus (TP) at Brule River near Hovland**

## Caribou River (EQUIS S004-954)

### Total Suspended Solids (TSS)

Table 68. Total Suspended Solids (TSS) statistics

Count	20
Concentration Average Error	-80.05%
Concentration Median Error	-24.21%
Load Ave Error	-77.45%
Load Median Error	-1.46%
Paired t concentration	0.04
Paired t load	0.18

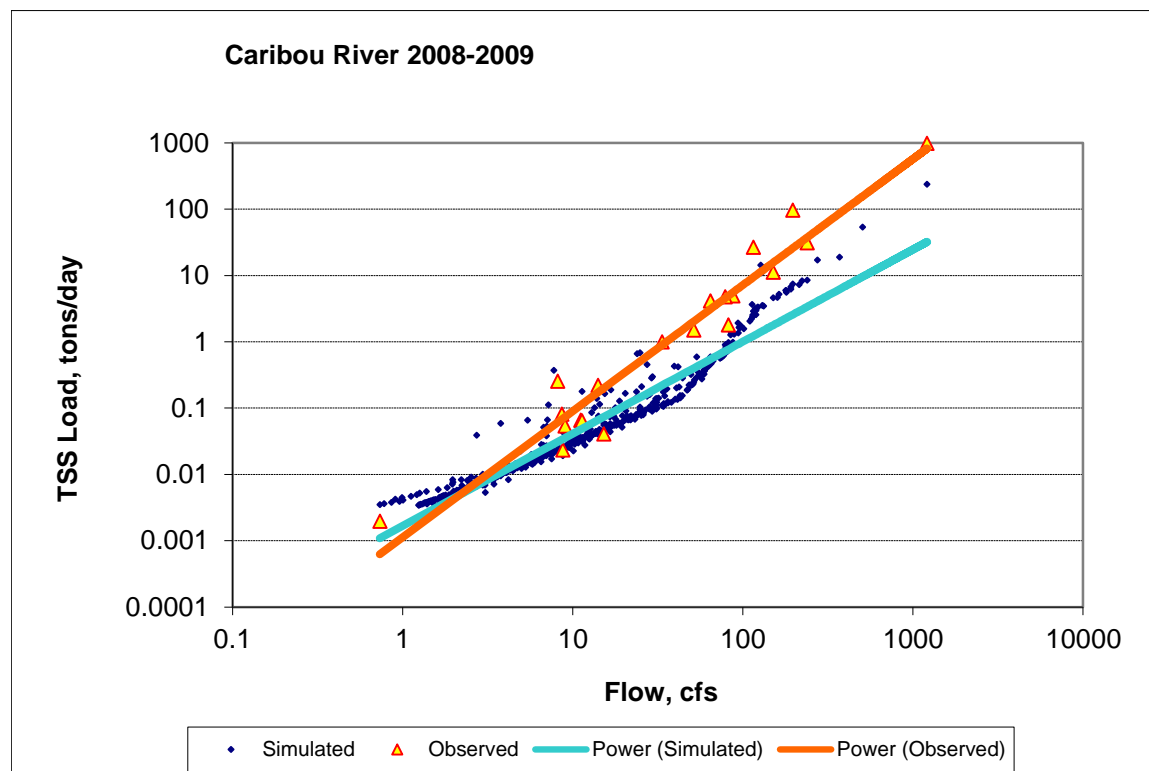
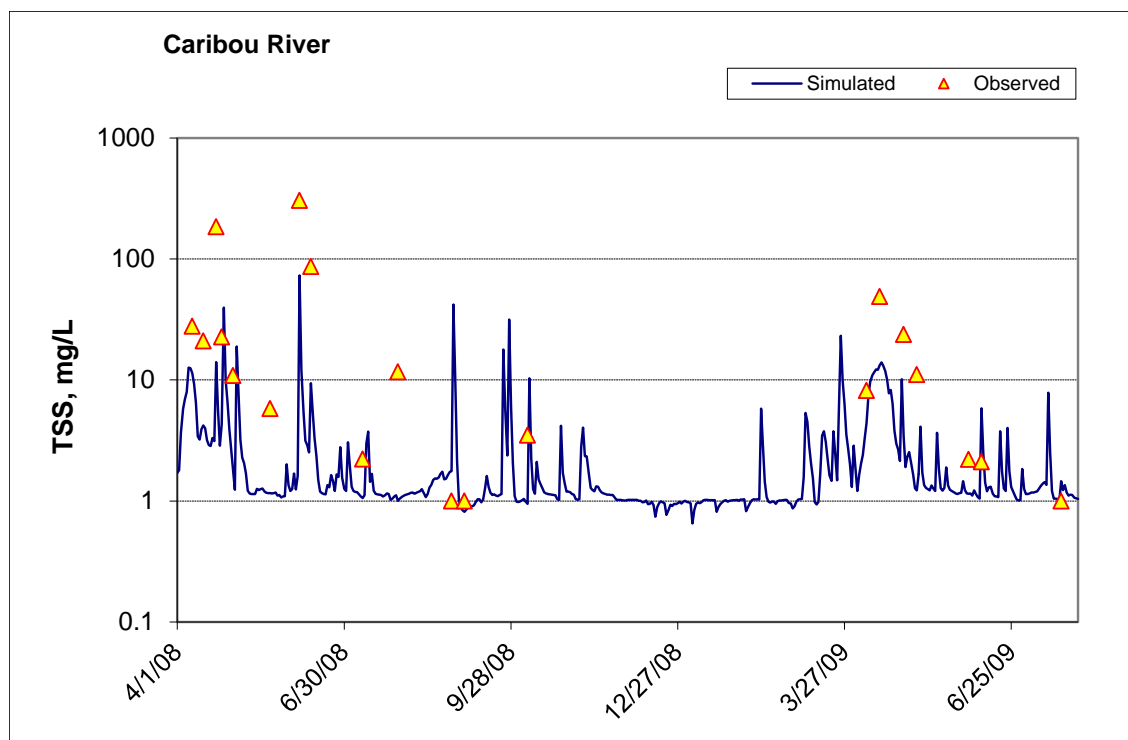
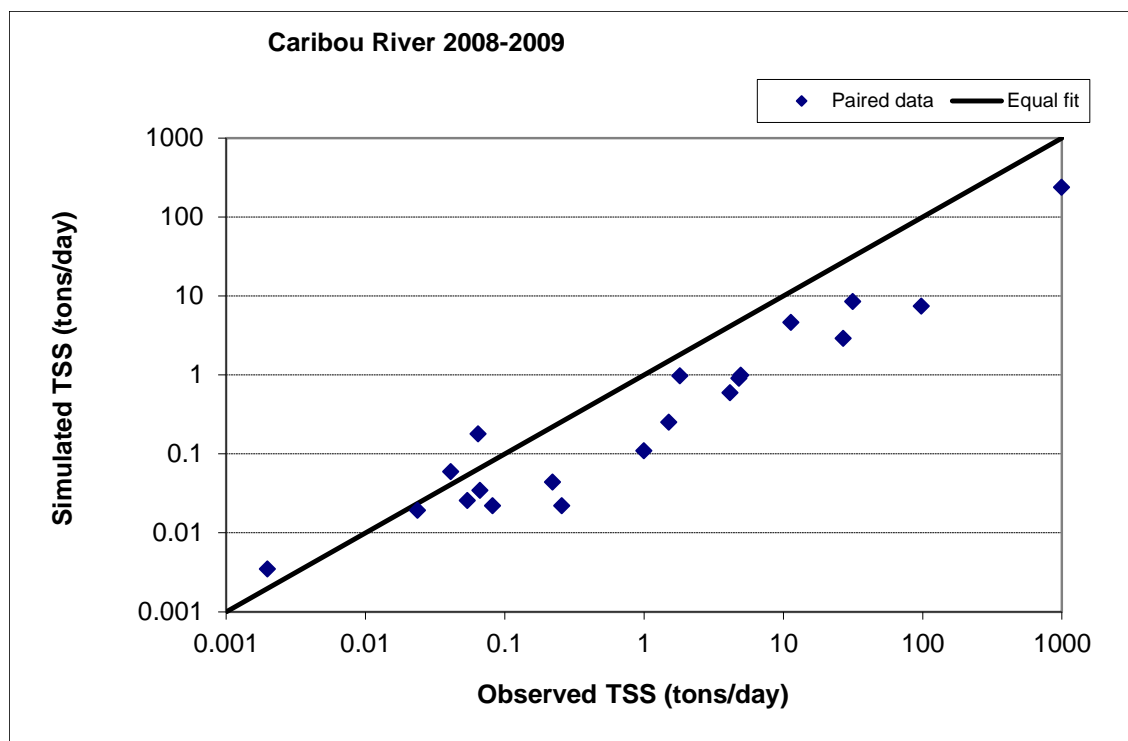


Figure 348. Power plot of simulated and observed Total Suspended Solids (TSS) load vs flow at Caribou River (validation period)

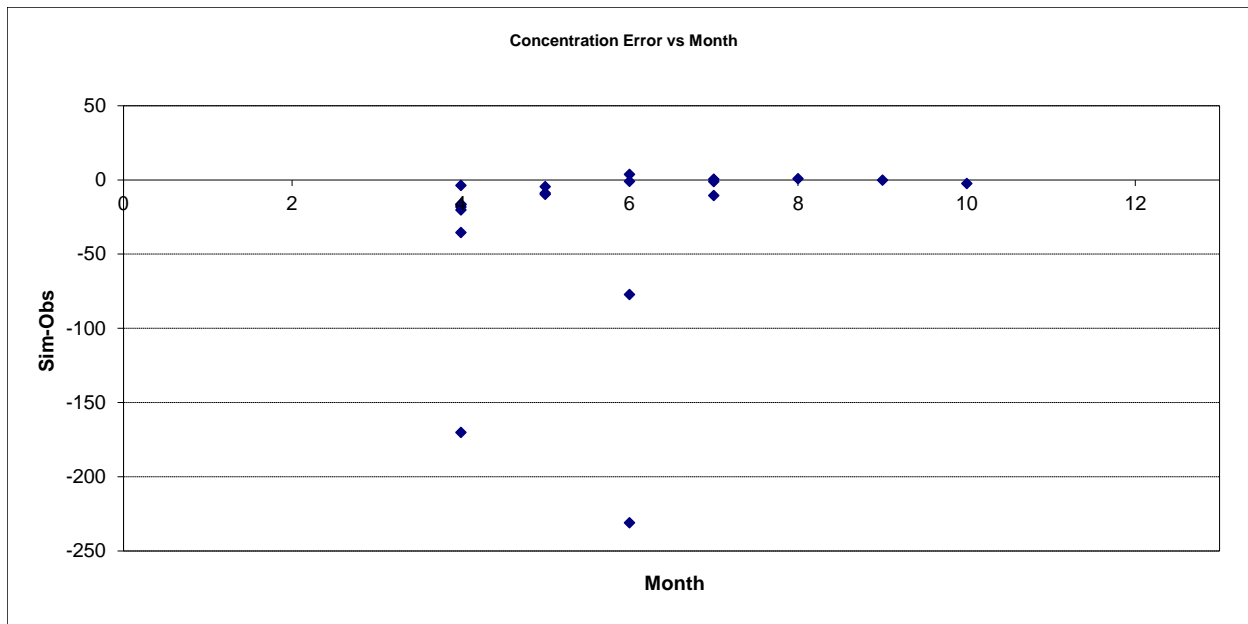




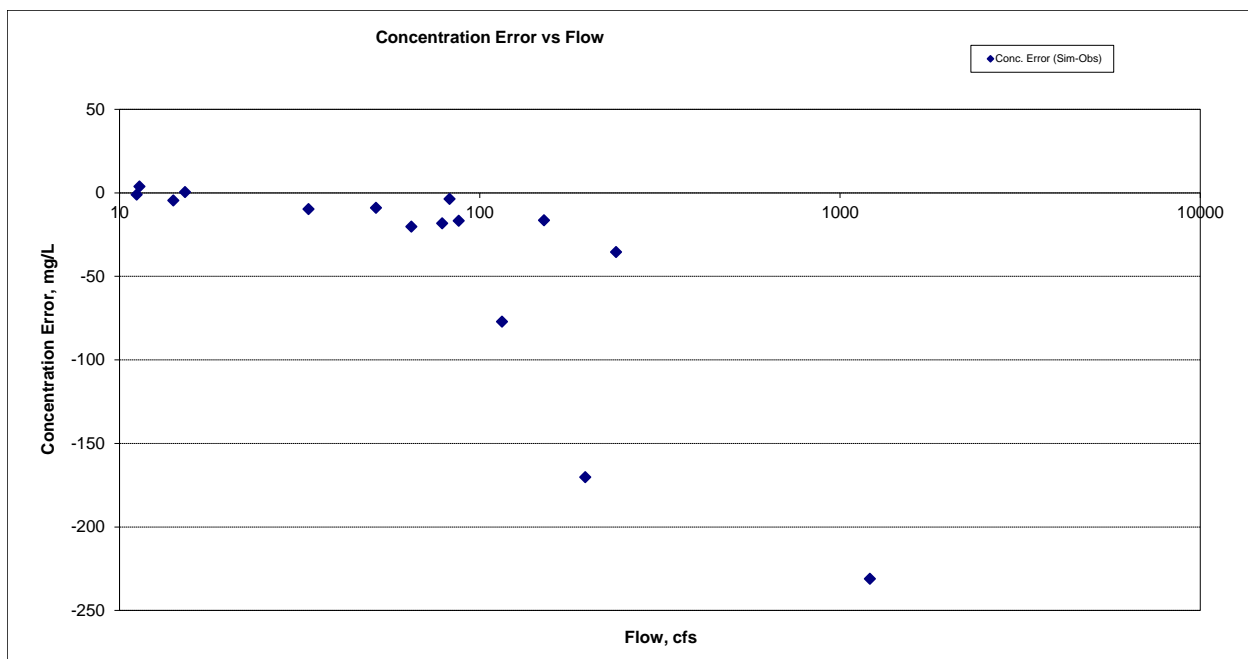
**Figure 349. Time series of observed and simulated Total Suspended Solids (TSS) concentration at Caribou River**



**Figure 350. Paired simulated vs. observed Total Suspended Solids (TSS) load at Caribou River (validation period)**



**Figure 351. Residual (Simulated - Observed) vs. Month Total Suspended Solids (TSS) at Caribou River**

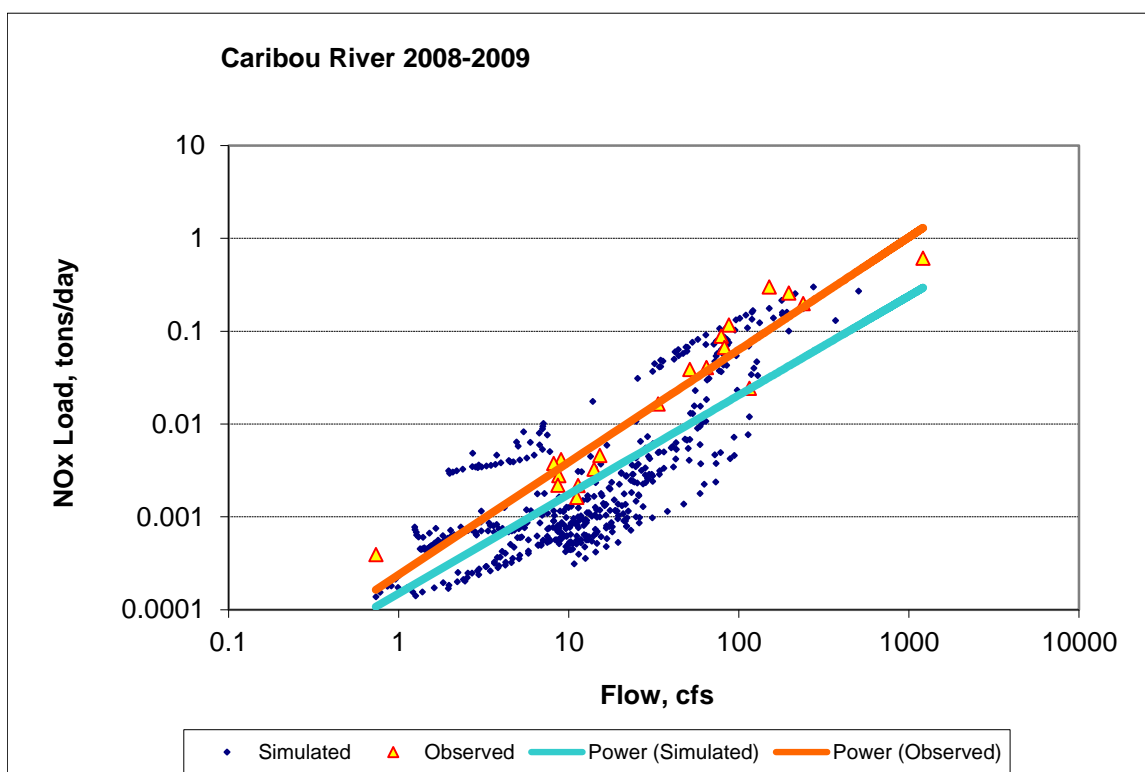


**Figure 352. Residual (Simulated - Observed) vs. Flow Total Suspended Solids (TSS) at Caribou River**

## Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>)

**Table 69. Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) statistics**

Count	20
Concentration Average Error	-47.39%
Concentration Median Error	-46.71%
Load Ave Error	-44.10%
Load Median Error	-8.35%
Paired t concentration	0.04
Paired t load	0.22



**Figure 353. Power plot of simulated and observed Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) load vs flow at Caribou River (validation period)**

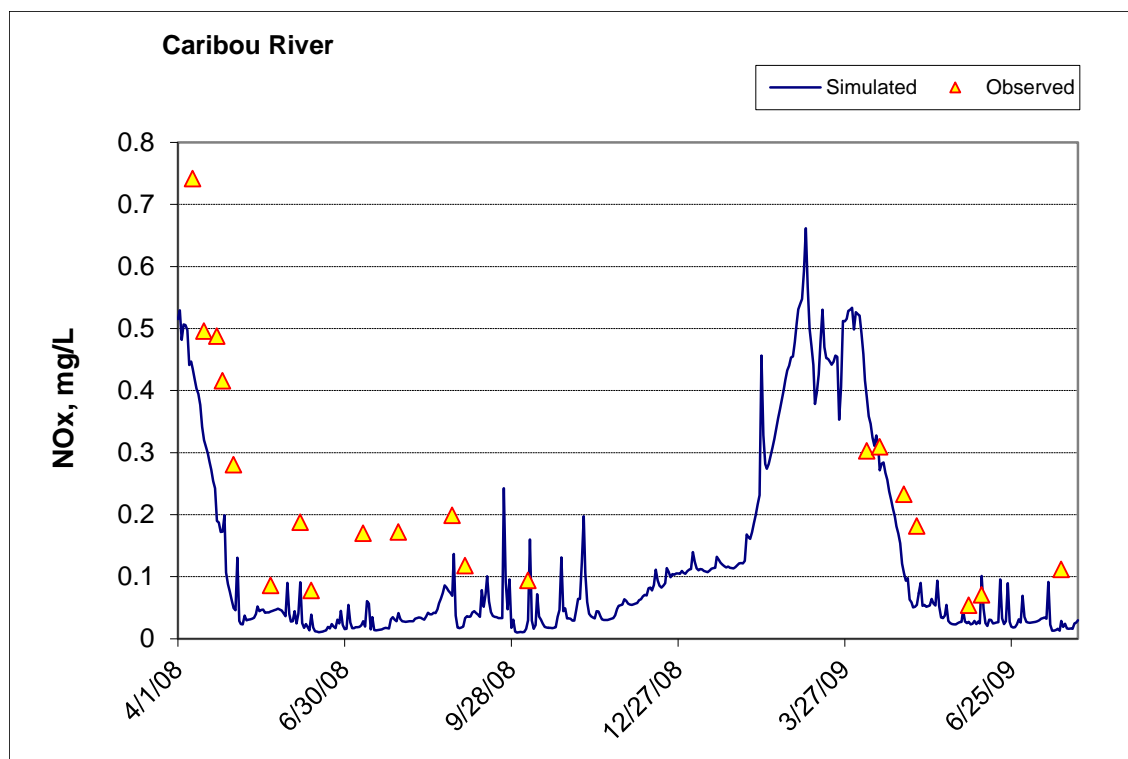


Figure 354. Time series of observed and simulated Nitrite+ Nitrate Nitrogen (NOx) concentration at Caribou River

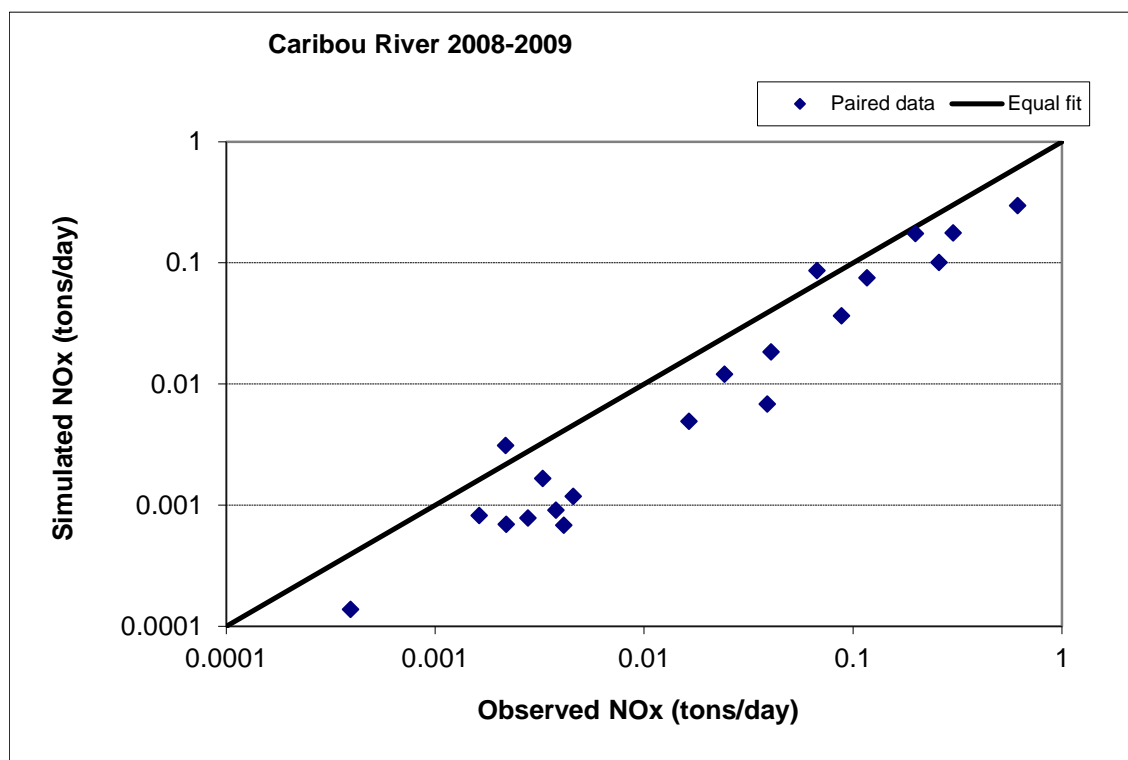


Figure 355. Paired simulated vs. observed Nitrite+ Nitrate Nitrogen (NOx) load at Caribou River (validation period)

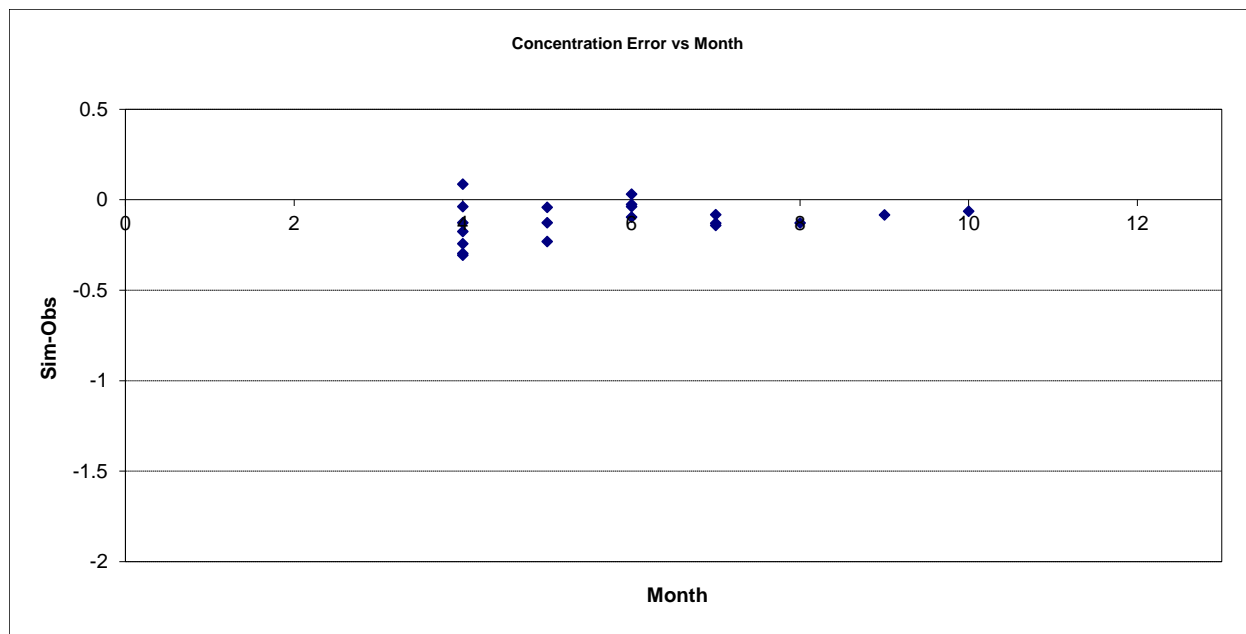


Figure 356. Residual (Simulated - Observed) vs. Month Nitrite+ Nitrate Nitrogen (NOx) at Caribou River

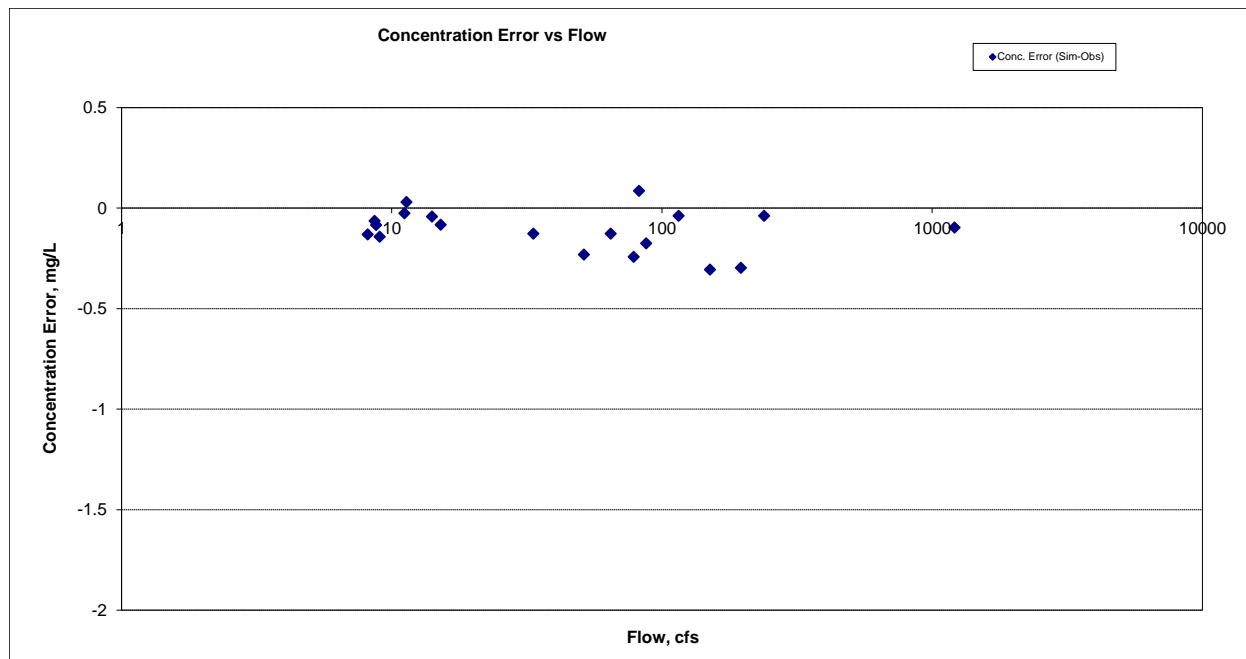
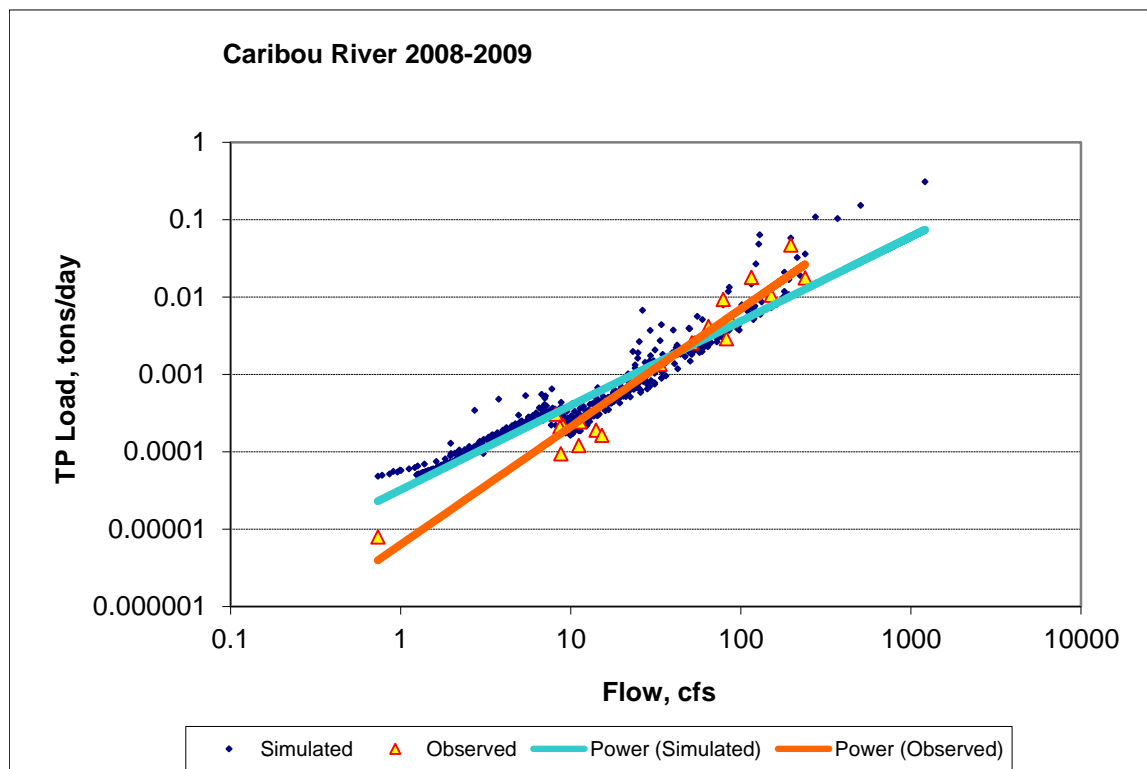


Figure 357. Residual (Simulated - Observed) vs. Flow Nitrite+ Nitrate Nitrogen (NOx) at Caribou River

## Total Phosphorus (TP)

Table 70. Total Phosphorus (TP) statistics

Count	19
Concentration Average Error	21.76%
Concentration Median Error	18.77%
Load Ave Error	18.94%
Load Median Error	1.20%
Paired t concentration	0.47
Paired t load	0.51



**Figure 358. Power plot of simulated and observed Total Phosphorus (TP) load vs flow at Caribou River (validation period)**

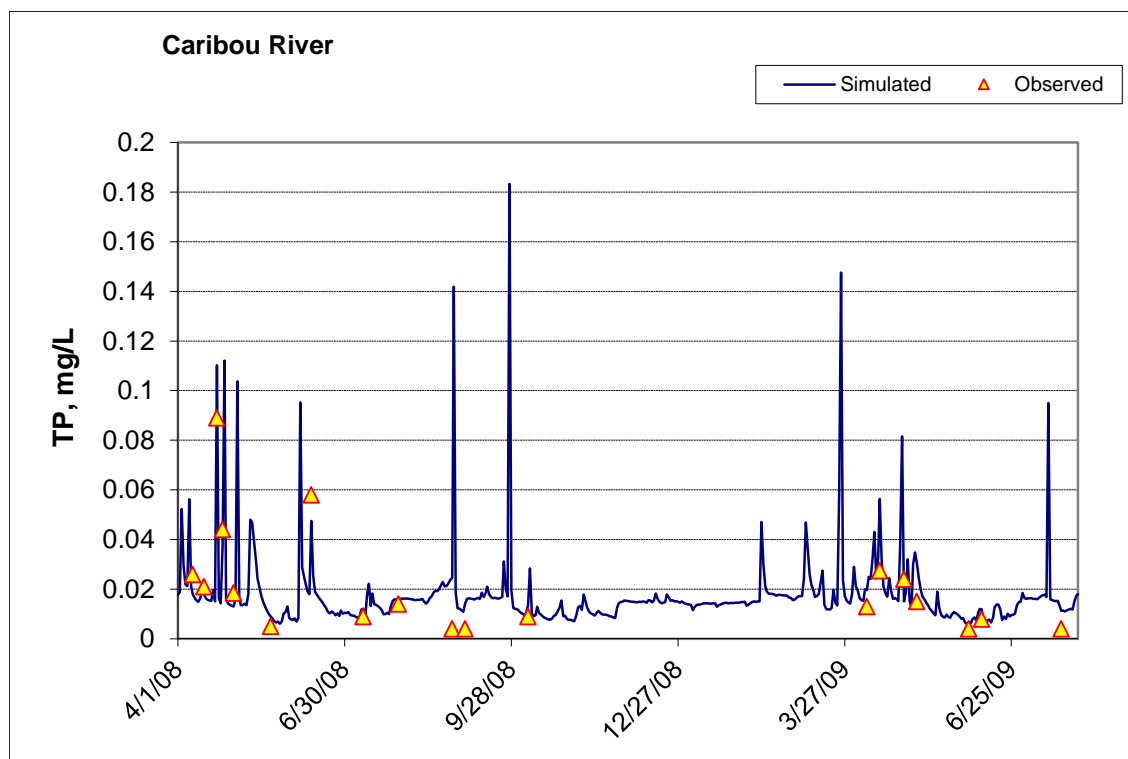


Figure 359. Time series of observed and simulated Total Phosphorus (TP) concentration at Caribou River

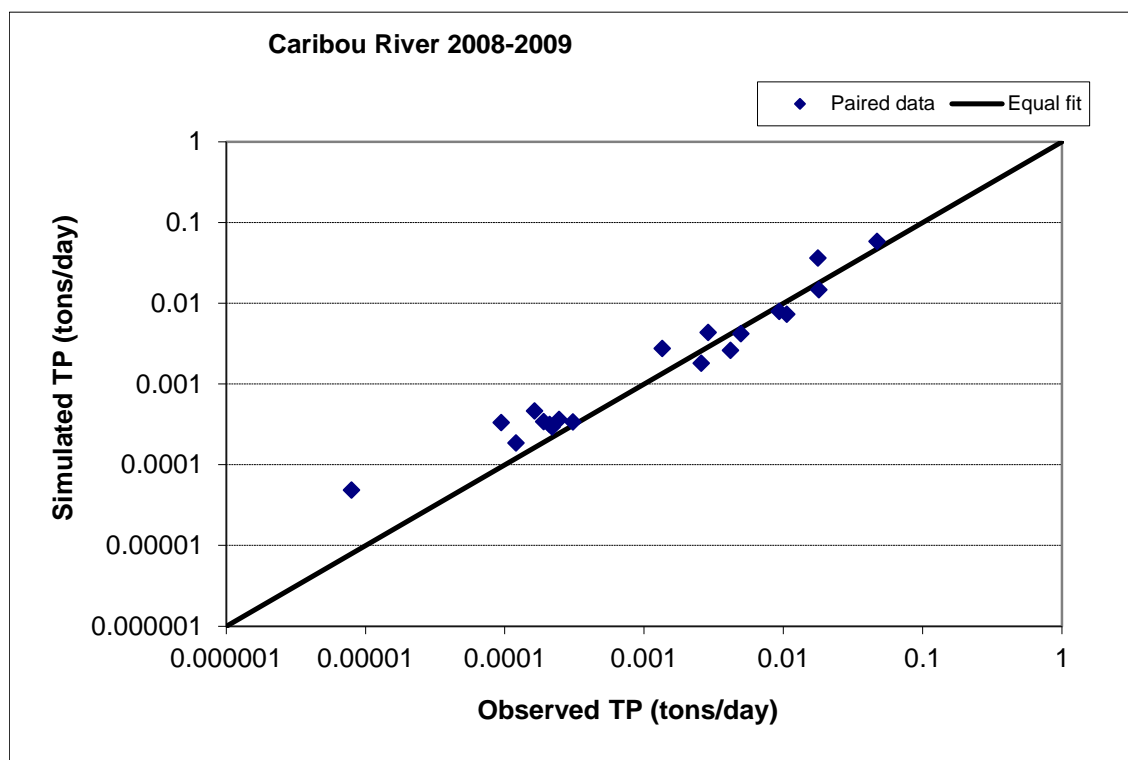


Figure 360. Paired simulated vs. observed Total Phosphorus (TP) load at Caribou River (validation period)

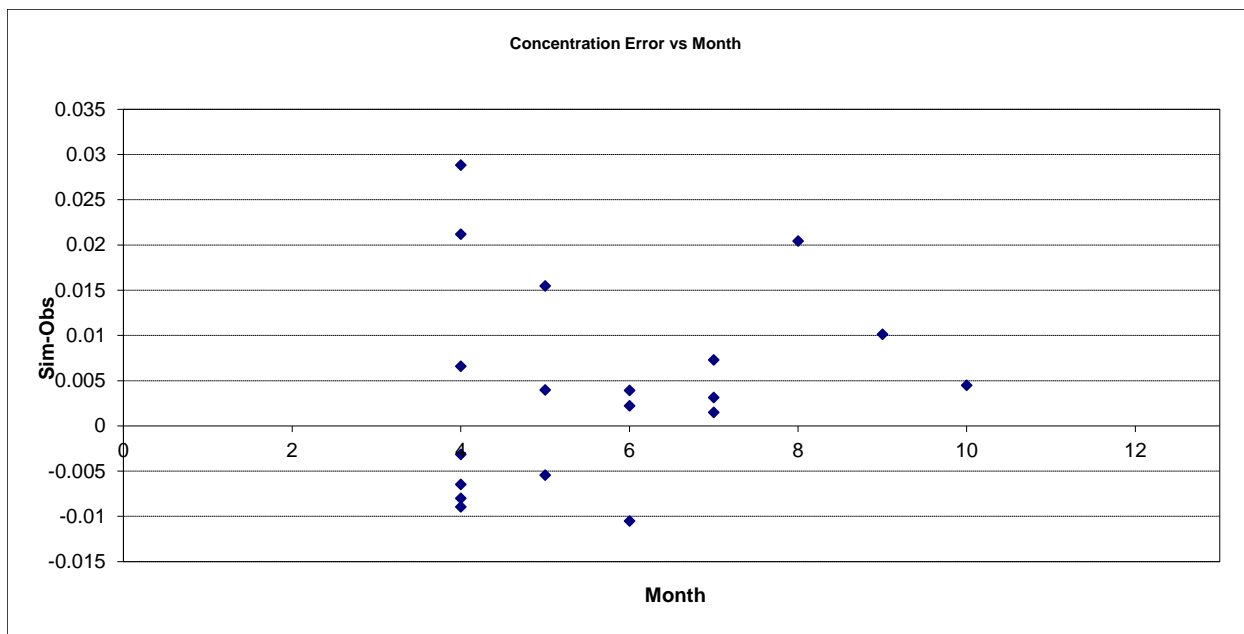


Figure 361. Residual (Simulated - Observed) vs. Month Total Phosphorus (TP) at Caribou River

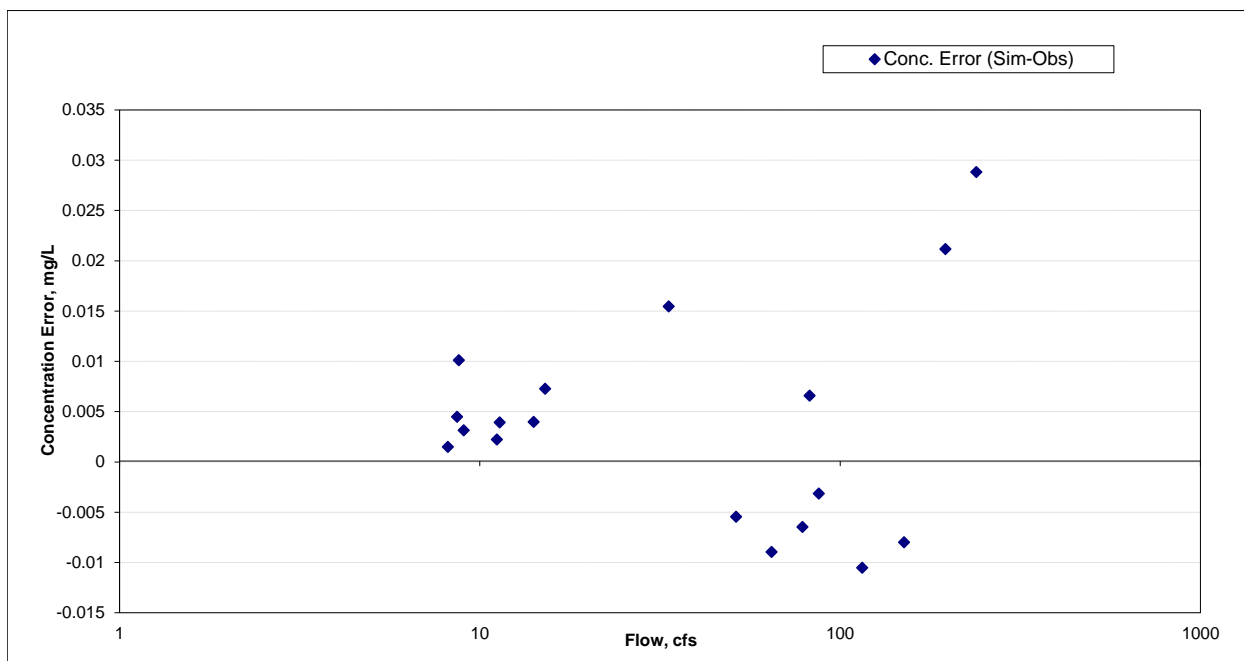


Figure 362. Residual (Simulated - Observed) vs. Flow Total Phosphorus (TP) at Caribou River



## Cascade River (EQUIS S000-253)

### Total Suspended Solids (TSS)

Table 71. Total Suspended Solids (TSS) statistics

Count	20
Concentration Average Error	-32.78%
Concentration Median Error	1.09%
Load Ave Error	-11.64%
Load Median Error	0.04%
Paired t concentration	0.38
Paired t load	0.54

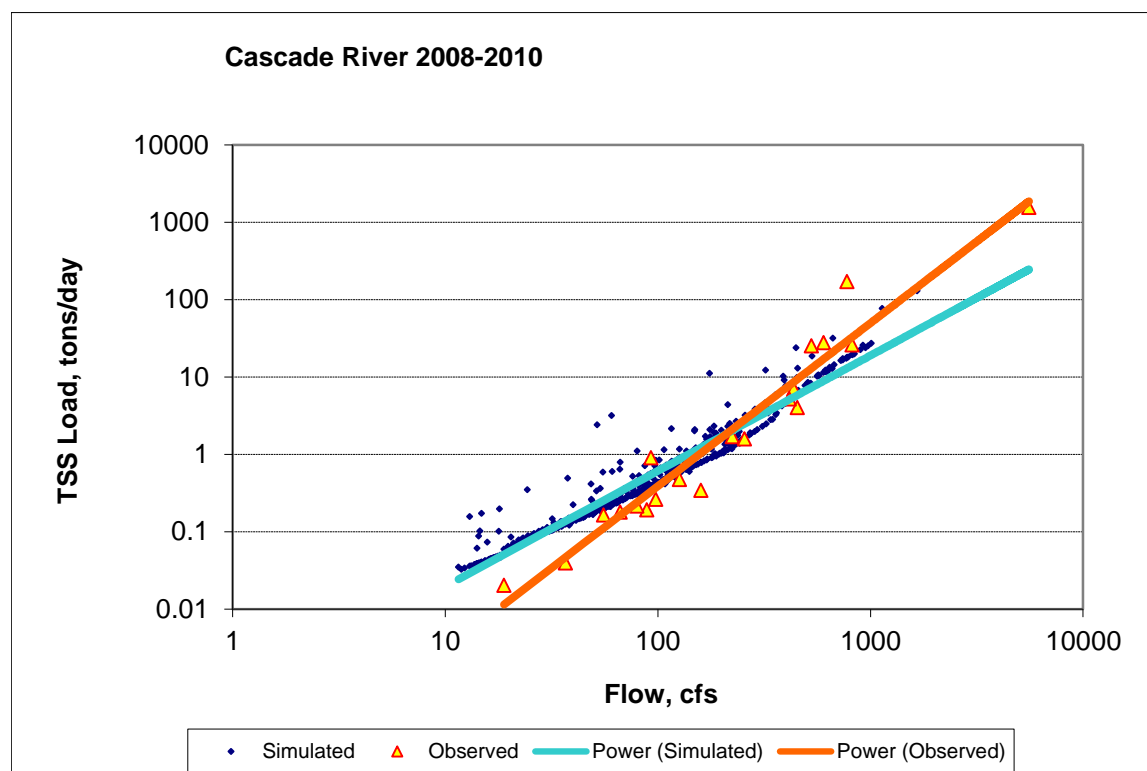


Figure 363. Power plot of simulated and observed Total Suspended Solids (TSS) load vs flow at Cascade River (validation period)

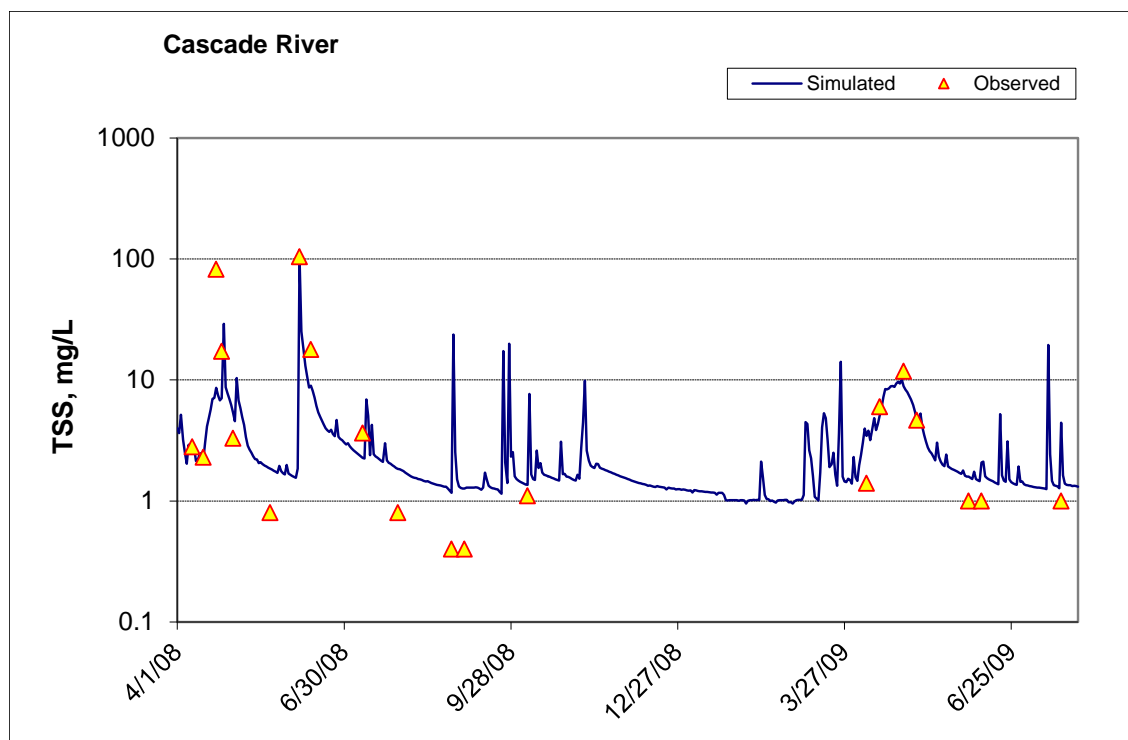


Figure 364. Time series of observed and simulated Total Suspended Solids (TSS) concentration at Cascade River

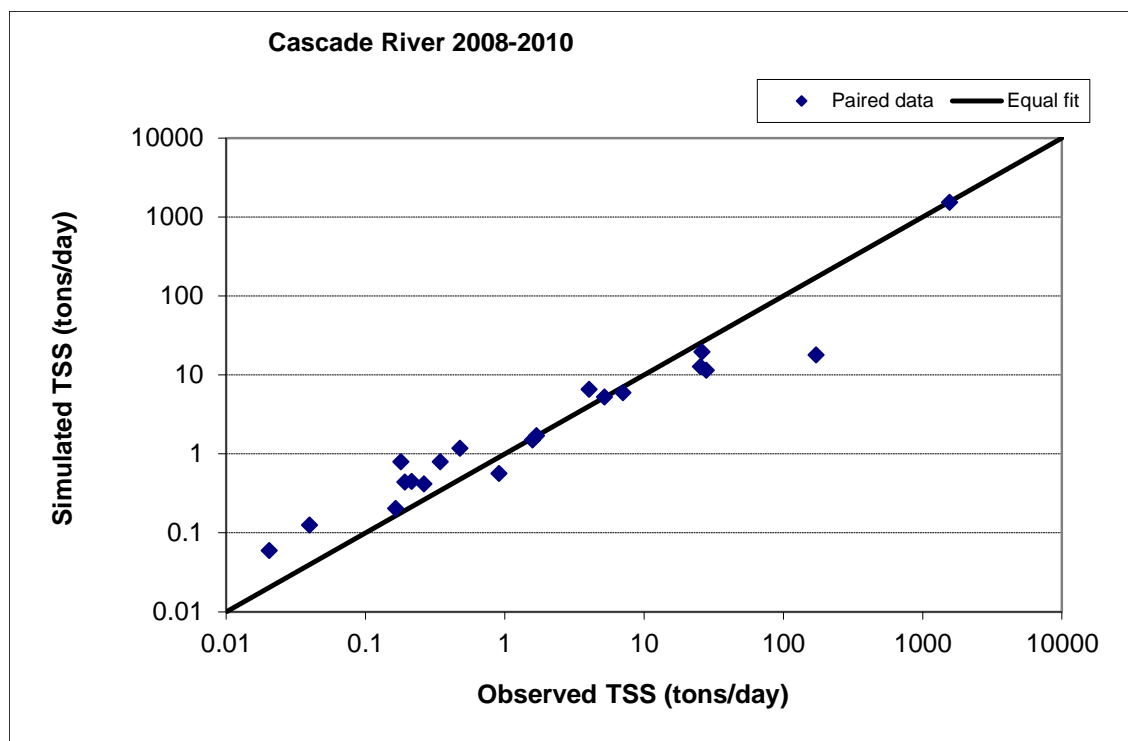
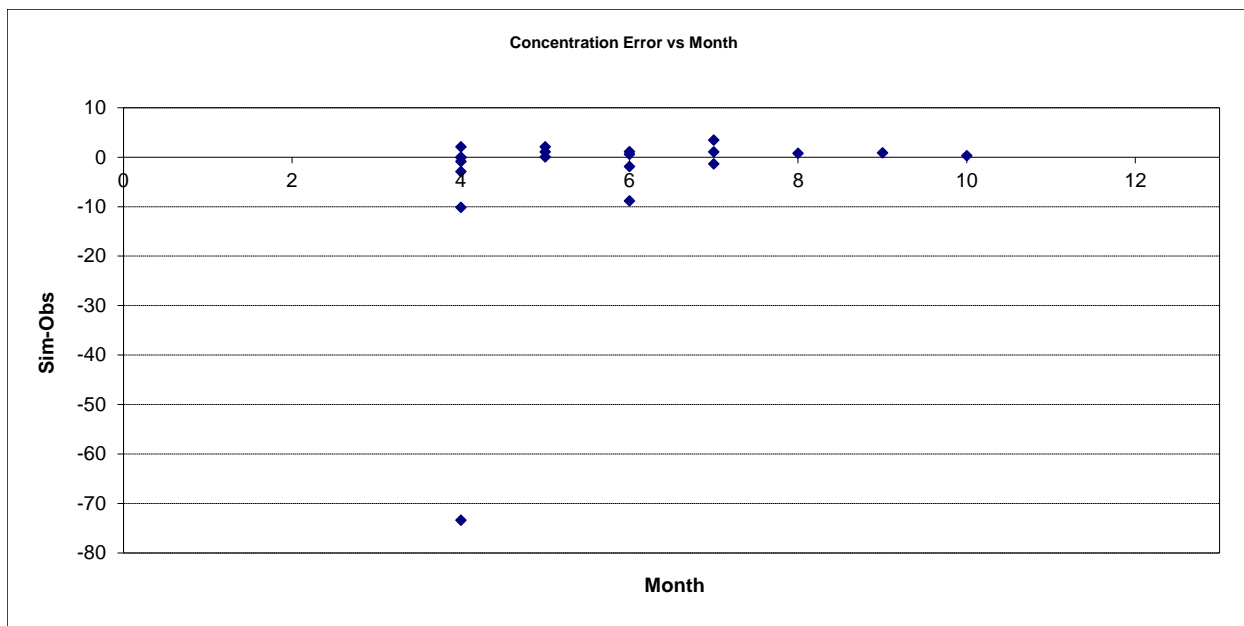
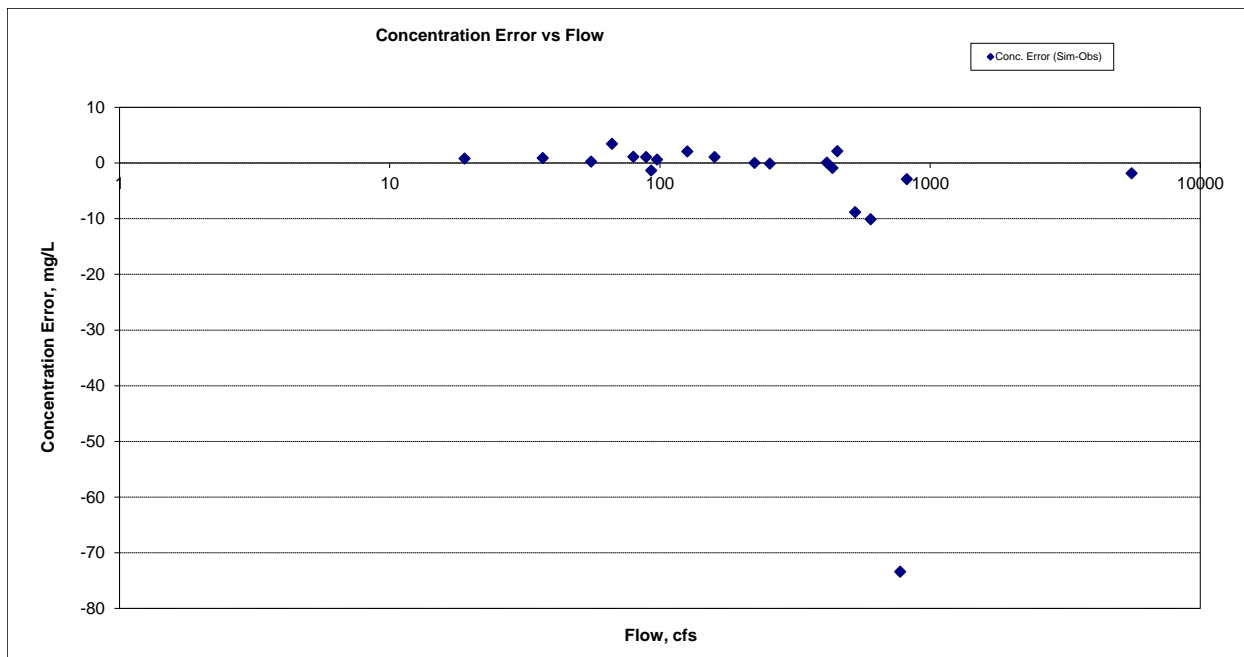


Figure 365. Paired simulated vs. observed Total Suspended Solids (TSS) load at Cascade River (validation period)



**Figure 366. Residual (Simulated - Observed) vs. Month Total Suspended Solids (TSS) at Cascade River**

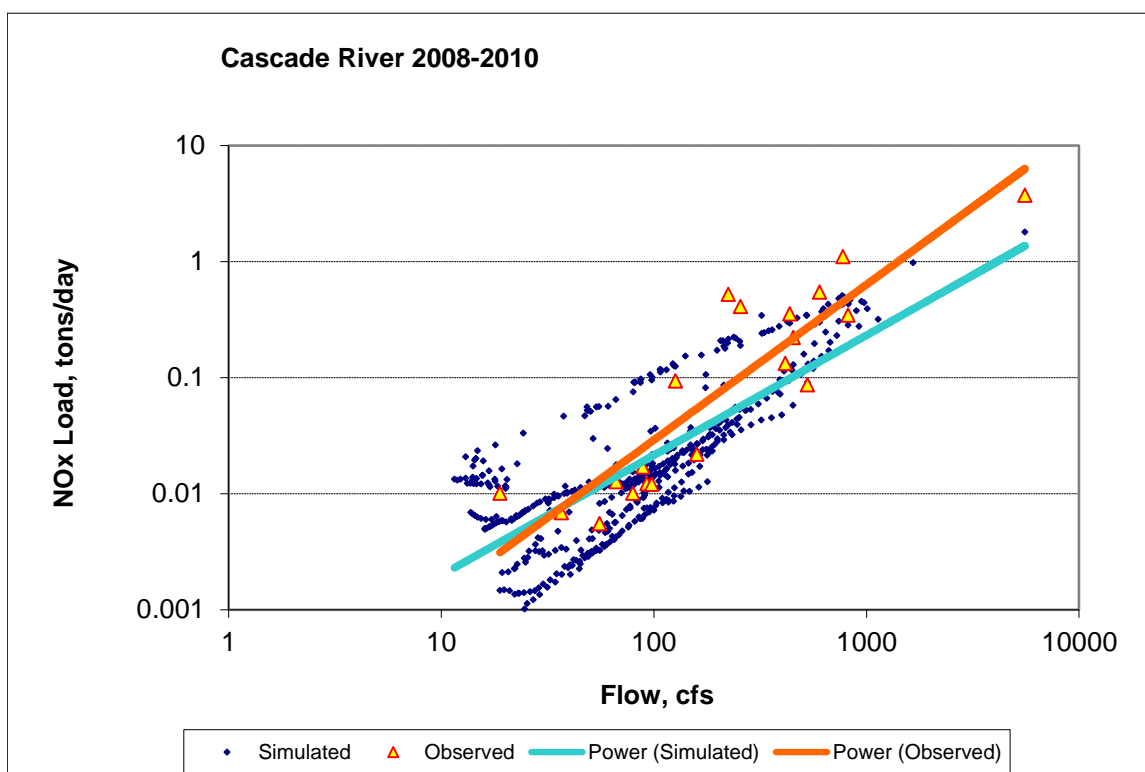


**Figure 367. Residual (Simulated - Observed) vs. Flow Total Suspended Solids (TSS) at Cascade River**

## Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>)

**Table 72. Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) statistics**

Count	20
Concentration Average Error	-39.72%
Concentration Median Error	-16.42%
Load Ave Error	-47.10%
Load Median Error	-2.52%
Paired t concentration	0.14
Paired t load	0.24



**Figure 368. Power plot of simulated and observed Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) load vs flow at Cascade River (validation period)**

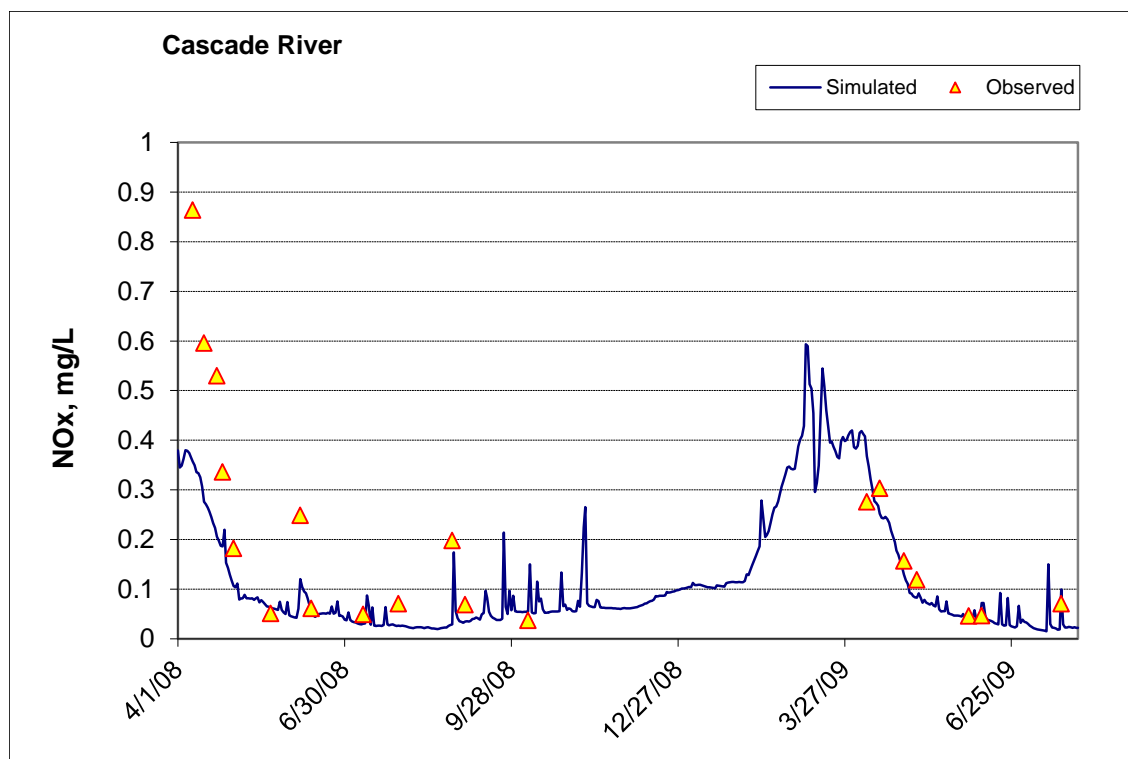


Figure 369. Time series of observed and simulated Nitrite+ Nitrate Nitrogen (NOx) concentration at Cascade River

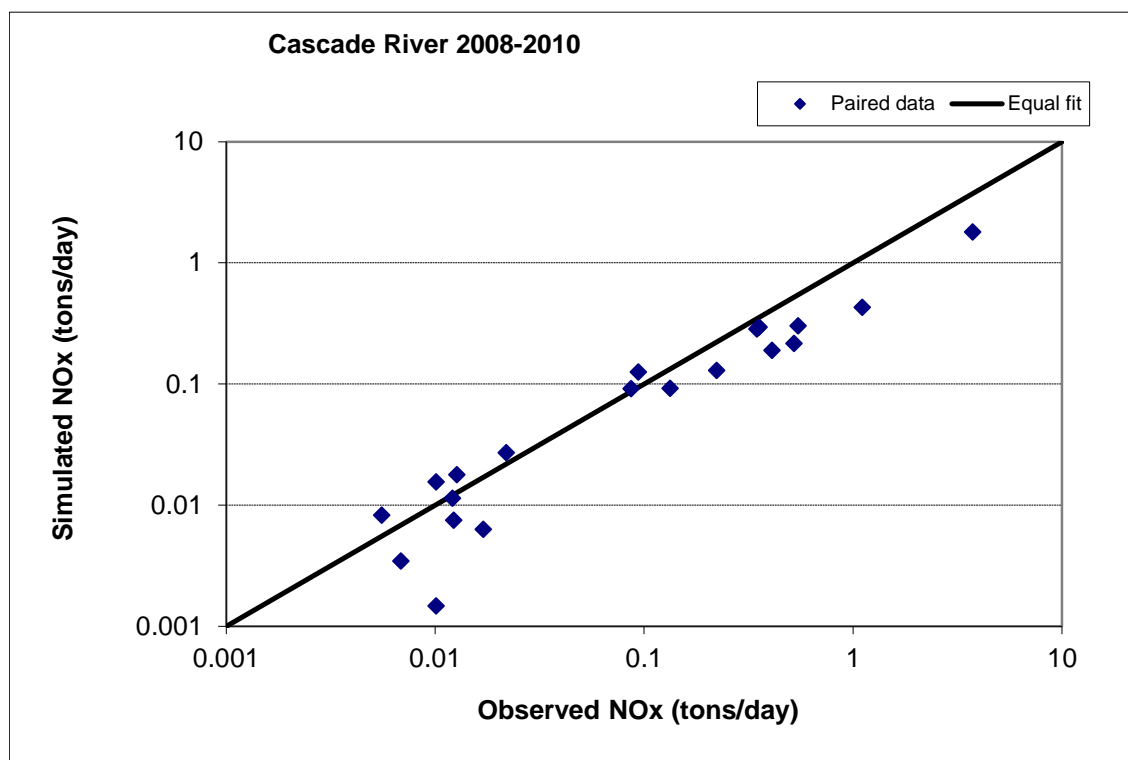


Figure 370. Paired simulated vs. observed Nitrite+ Nitrate Nitrogen (NOx) load at Cascade River (validation period)



Figure 371. Residual (Simulated - Observed) vs. Month Nitrite+ Nitrate Nitrogen (NOx) at Cascade River

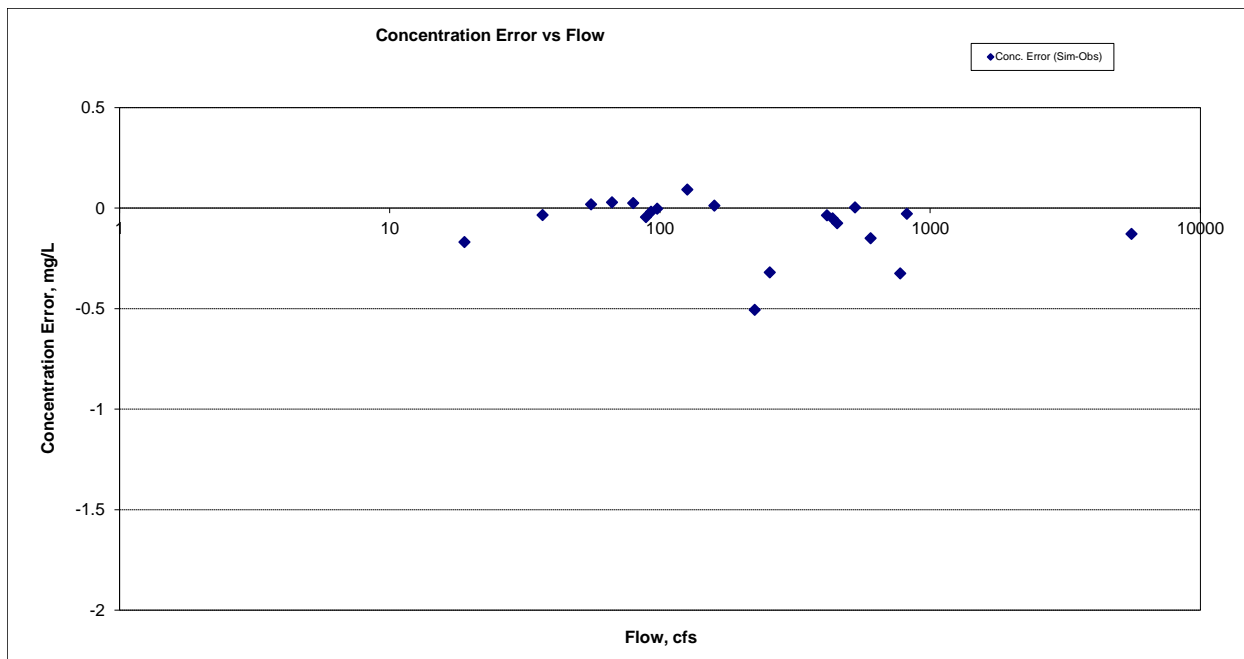
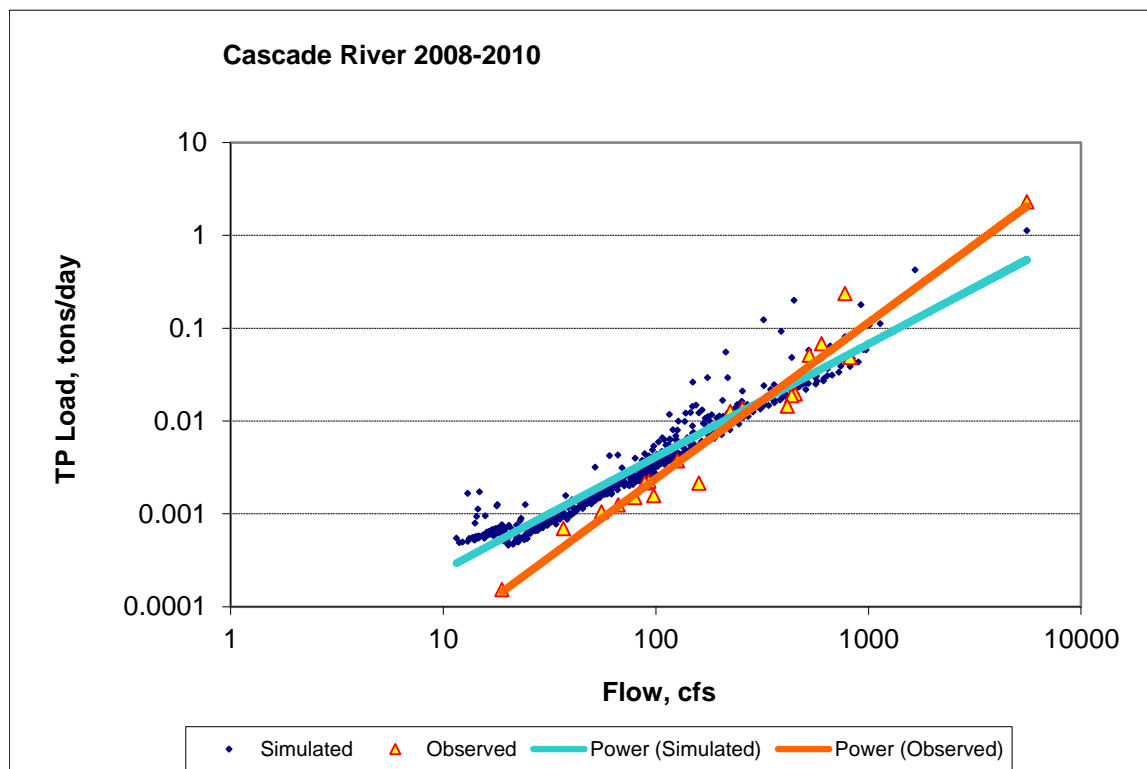


Figure 372. Residual (Simulated - Observed) vs. Flow Nitrite+ Nitrate Nitrogen (NOx) at Cascade River

## Total Phosphorus (TP)

**Table 73. Total Phosphorus (TP) statistics**

Count	20
Concentration Average Error	-8.16%
Concentration Median Error	17.89%
Load Ave Error	-46.12%
Load Median Error	0.93%
Paired t concentration	0.68
Paired t load	0.34



**Figure 373. Power plot of simulated and observed Total Phosphorus (TP) load vs flow at Cascade River (validation period)**

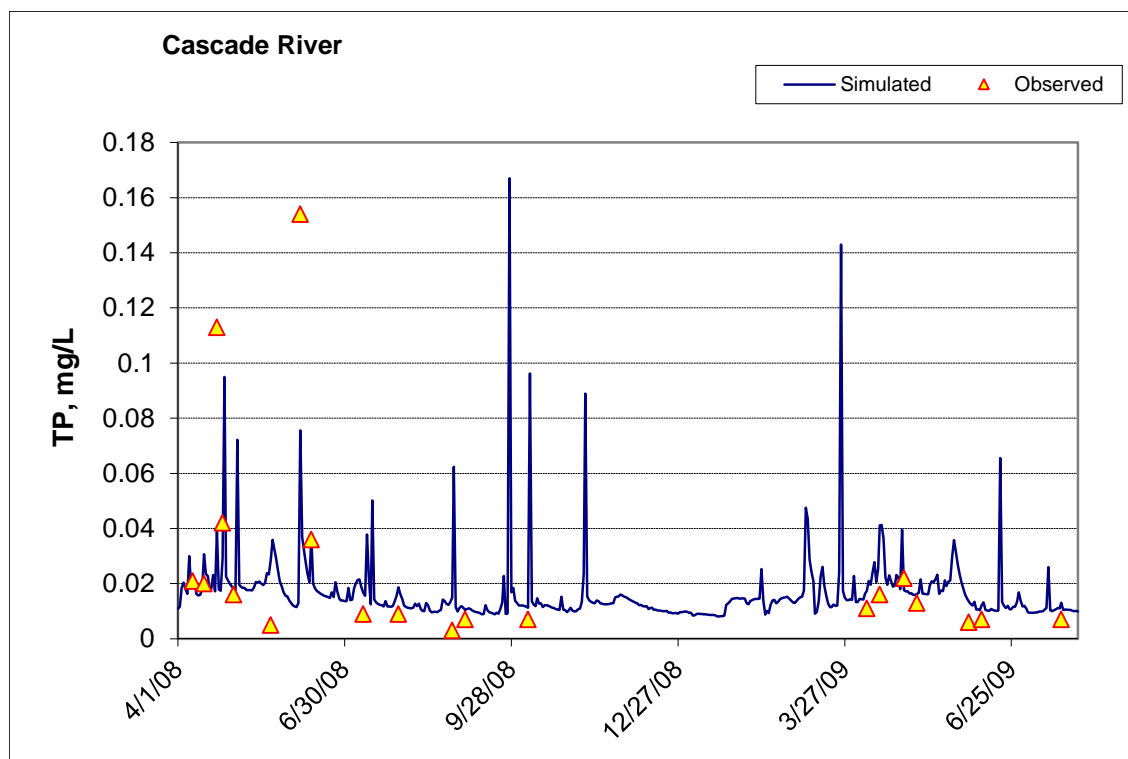


Figure 374. Time series of observed and simulated Total Phosphorus (TP) concentration at Cascade River

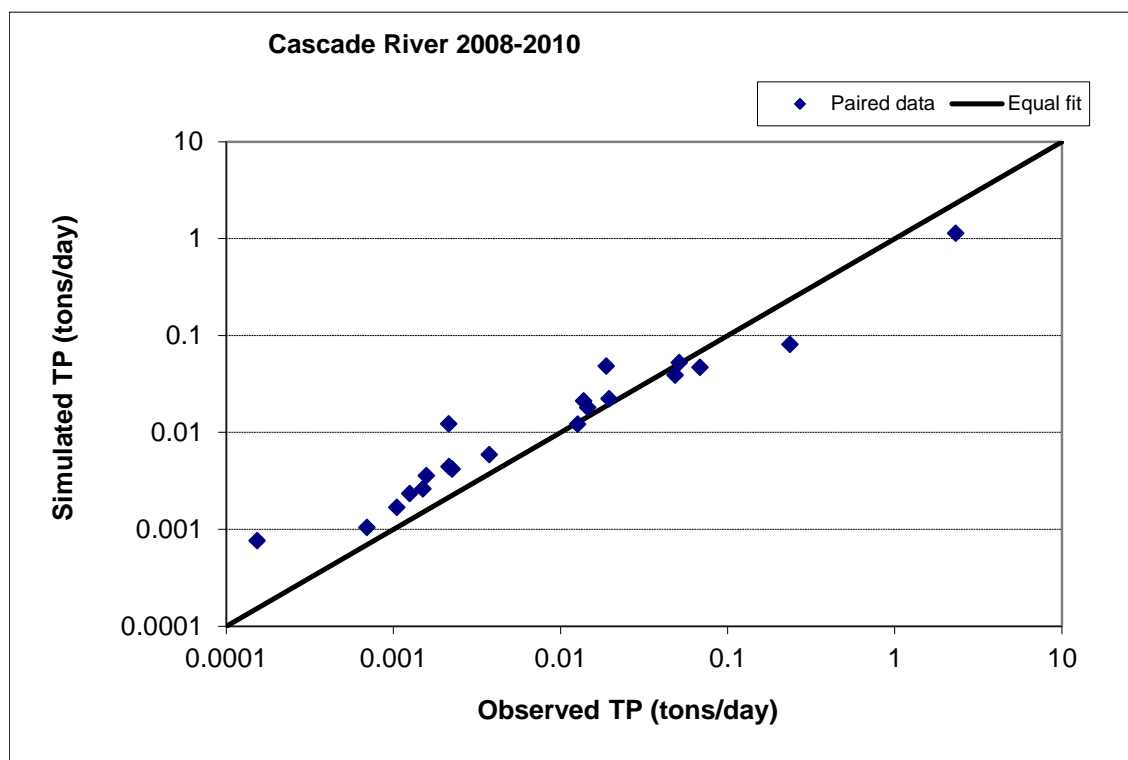


Figure 375. Paired simulated vs. observed Total Phosphorus (TP) load at Cascade River (validation period)



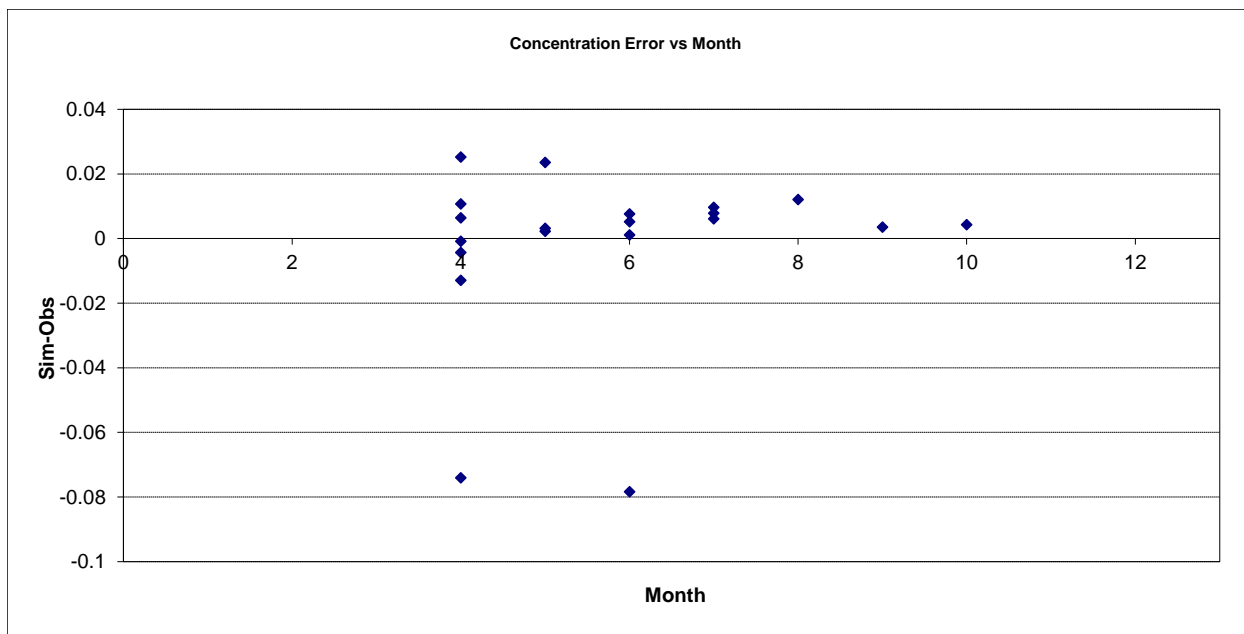


Figure 376. Residual (Simulated - Observed) vs. Month Total Phosphorus (TP) at Cascade River

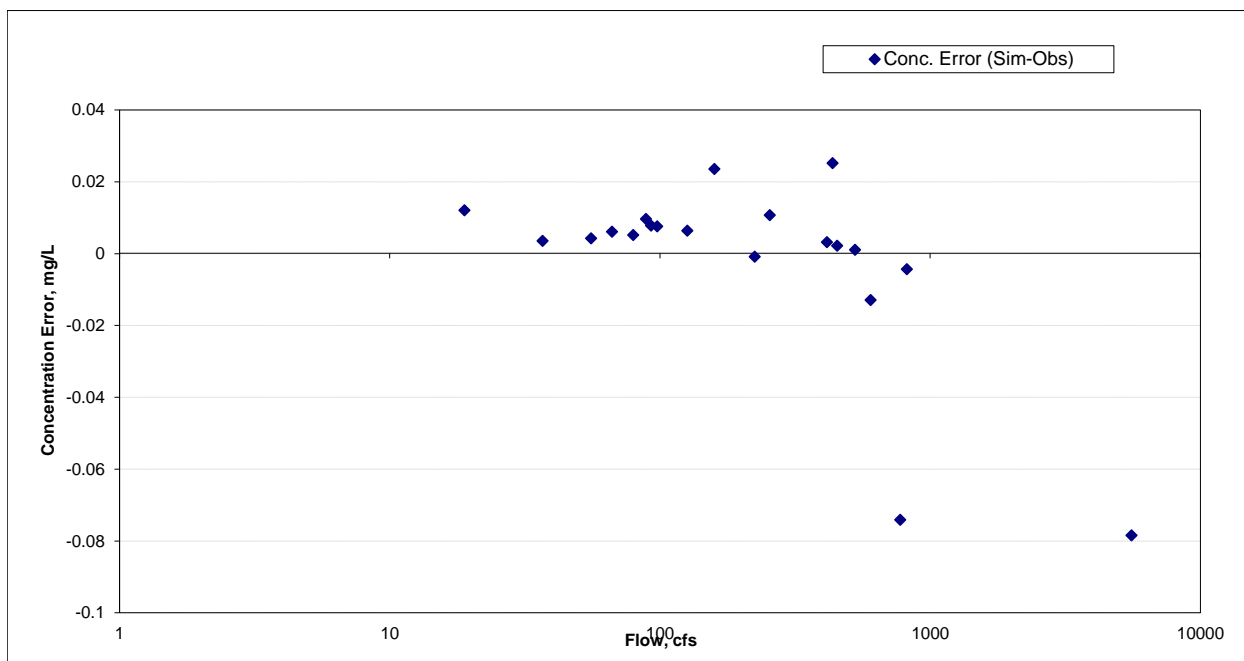


Figure 377. Residual (Simulated - Observed) vs. Flow Total Phosphorus (TP) at Cascade River

## Flute Reed River (EQUIS S004-283)

### Total Suspended Solids (TSS)

Table 74. Total Suspended Solids (TSS) statistics

Count	34
Concentration Average Error	-75.06%
Concentration Median Error	-16.10%
Load Ave Error	-85.35%
Load Median Error	-1.10%
Paired t concentration	0.03
Paired t load	0.04

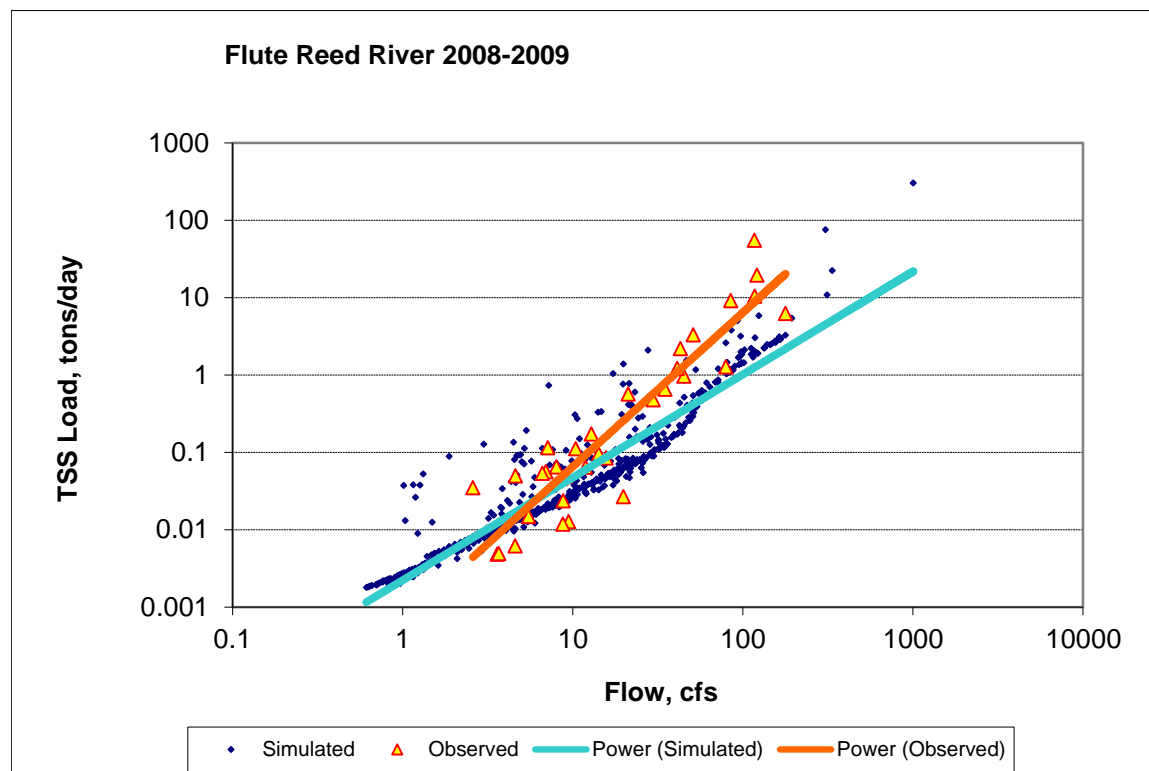
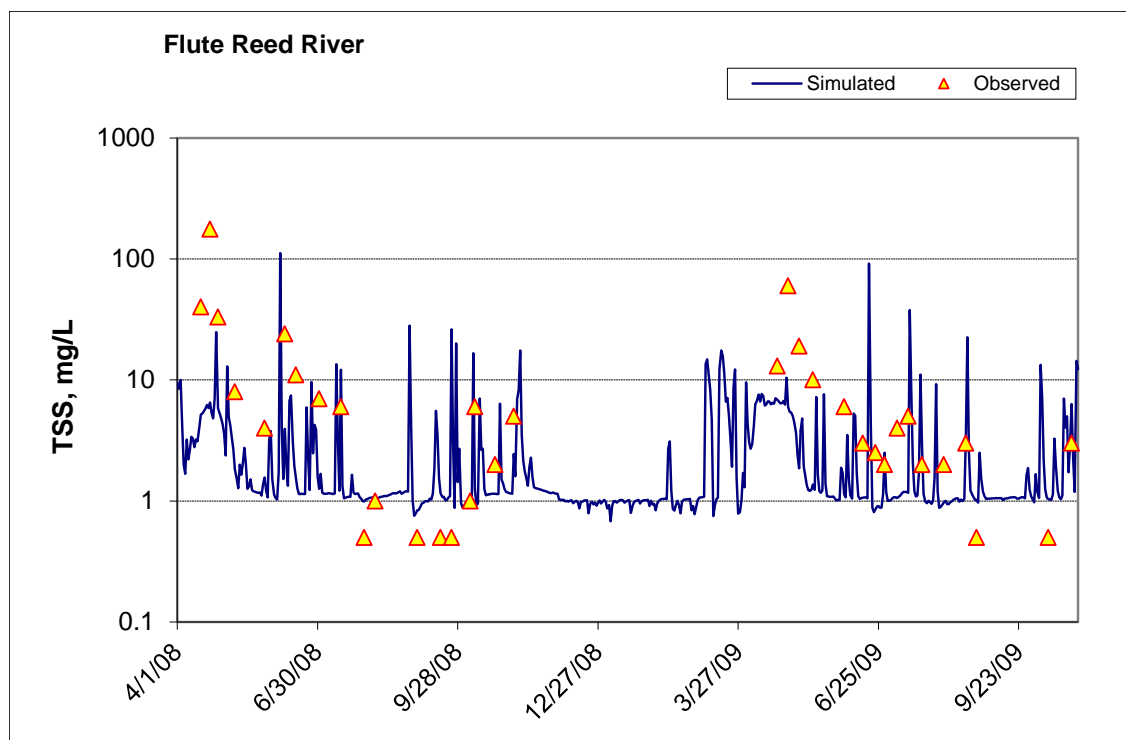
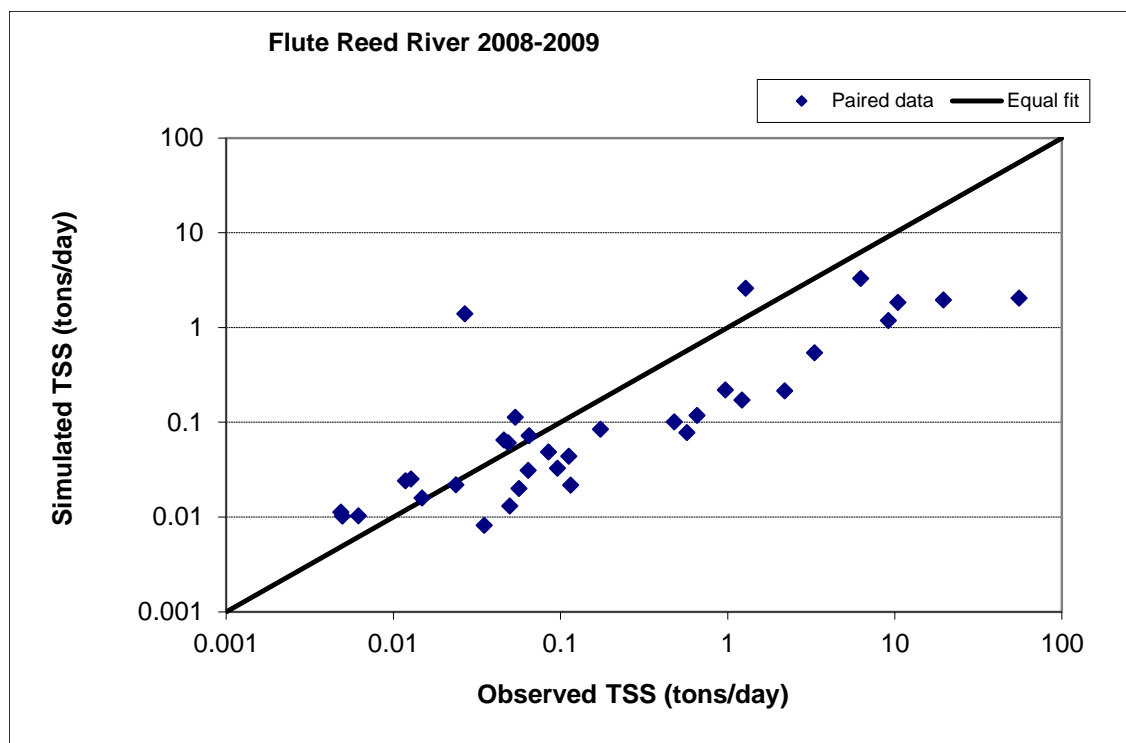


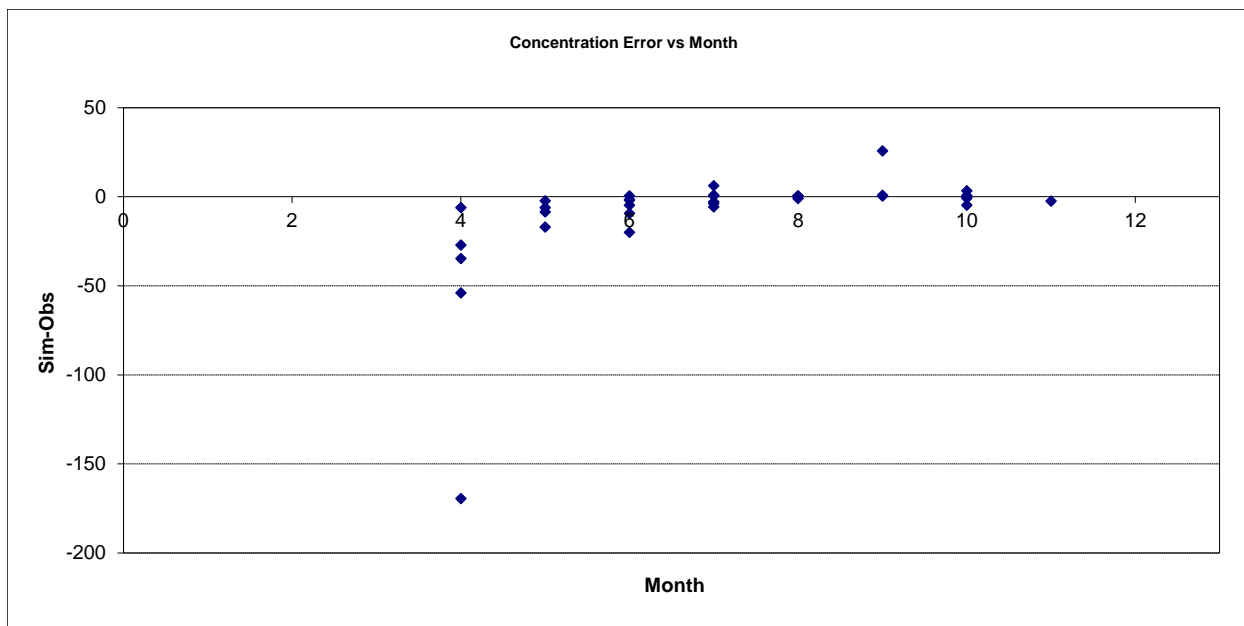
Figure 378. Power plot of simulated and observed Total Suspended Solids (TSS) load vs flow at Flute Reed River (validation period)



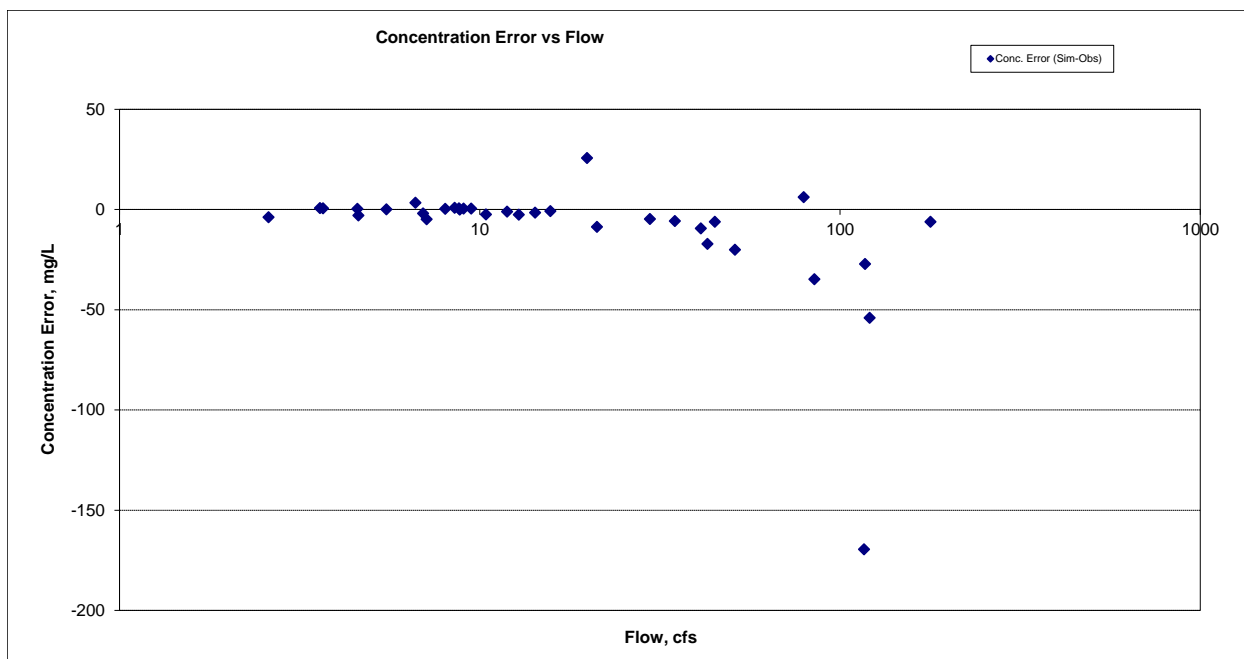
**Figure 379. Time series of observed and simulated Total Suspended Solids (TSS) concentration at Flute Reed River**



**Figure 380. Paired simulated vs. observed Total Suspended Solids (TSS) load at Flute Reed River (validation period)**



**Figure 381. Residual (Simulated - Observed) vs. Month Total Suspended Solids (TSS) at Flute Reed River**

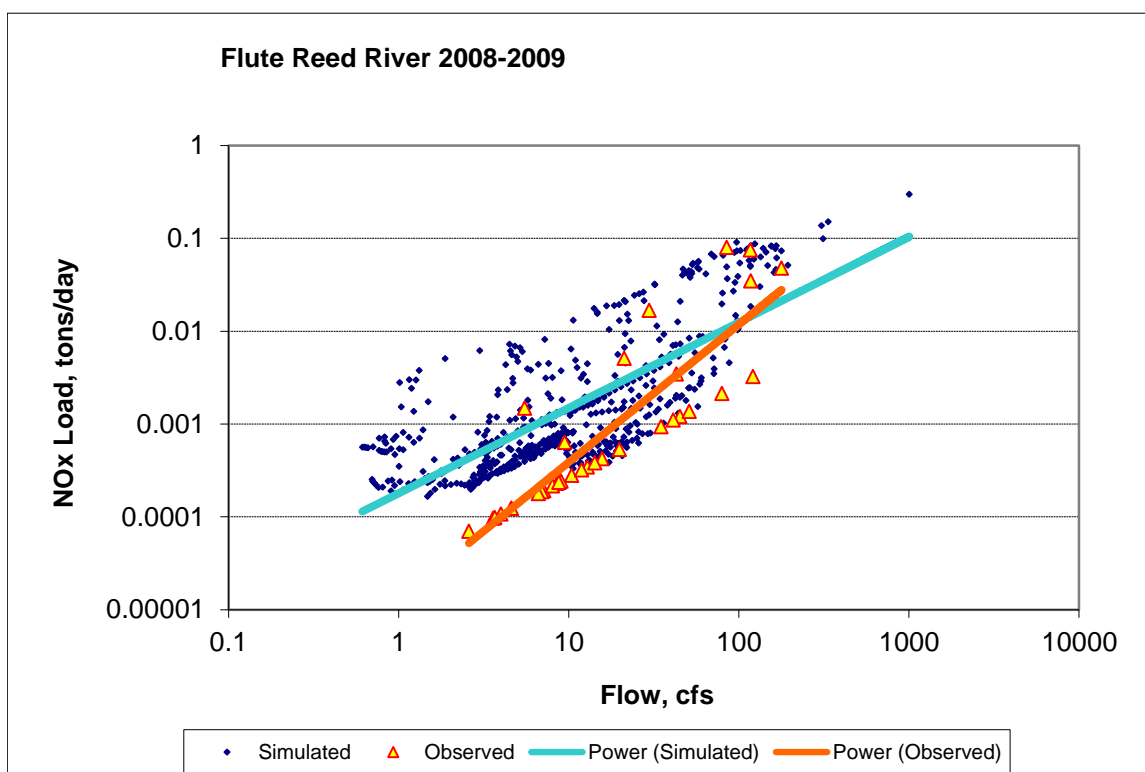


**Figure 382. Residual (Simulated - Observed) vs. Flow Total Suspended Solids (TSS) at Flute Reed River**

## Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>)

**Table 75. Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) statistics**

Count	35
Concentration Average Error	56.51%
Concentration Median Error	48.38%
Load Ave Error	1.84%
Load Median Error	4.10%
Paired t concentration	0.10
Paired t load	0.68



**Figure 383. Power plot of simulated and observed Nitrite+ Nitrate Nitrogen (NO<sub>x</sub>) load vs flow at Flute Reed River (validation period)**

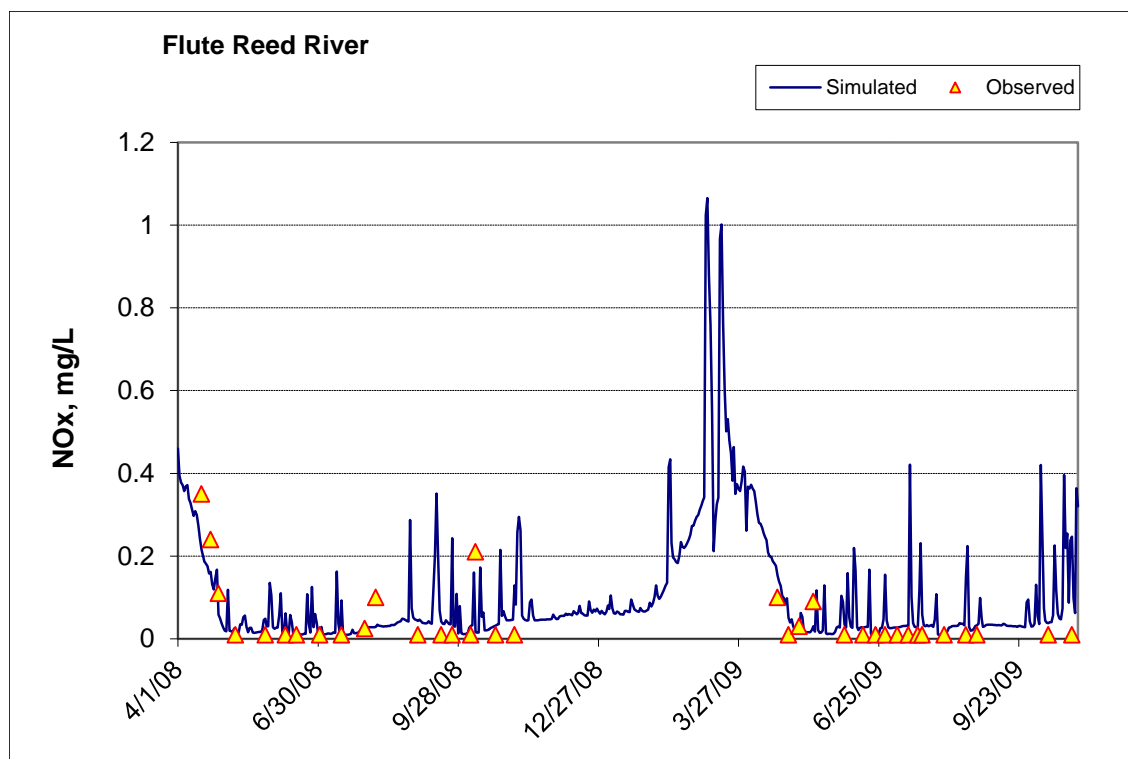


Figure 384. Time series of observed and simulated Nitrite+ Nitrate Nitrogen (NOx) concentration at Flute Reed River

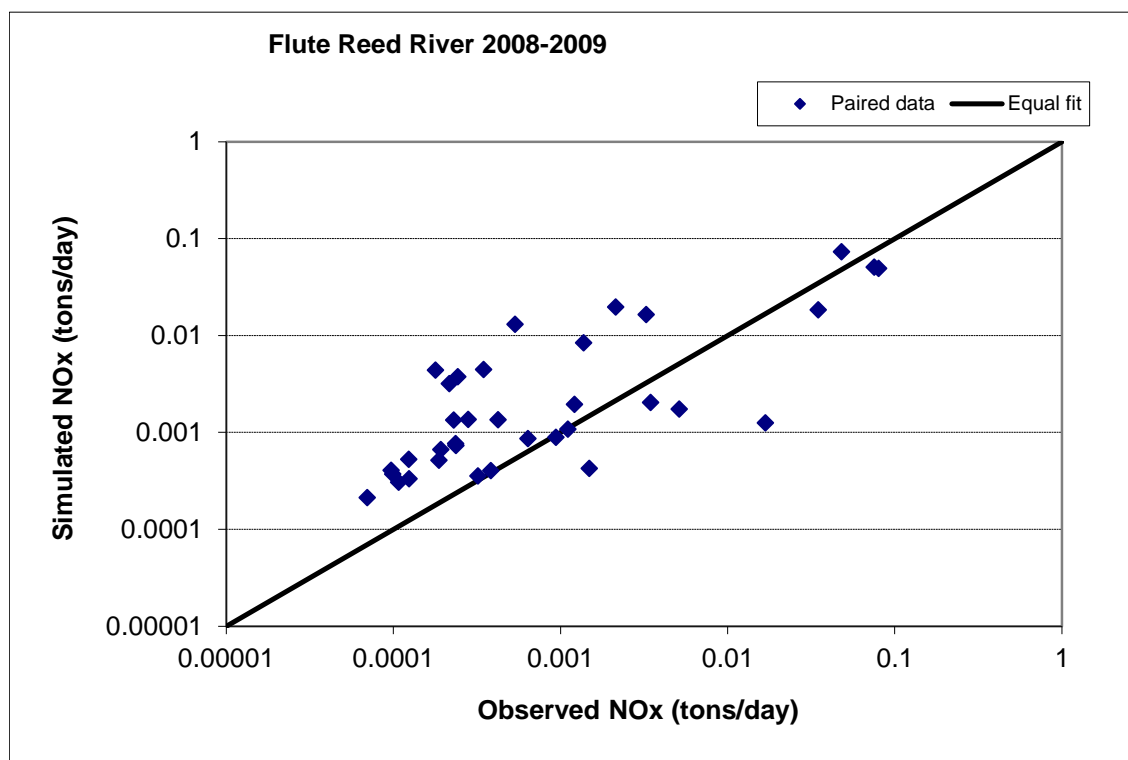


Figure 385. Paired simulated vs. observed Nitrite+ Nitrate Nitrogen (NOx) load at Flute Reed River (validation period)

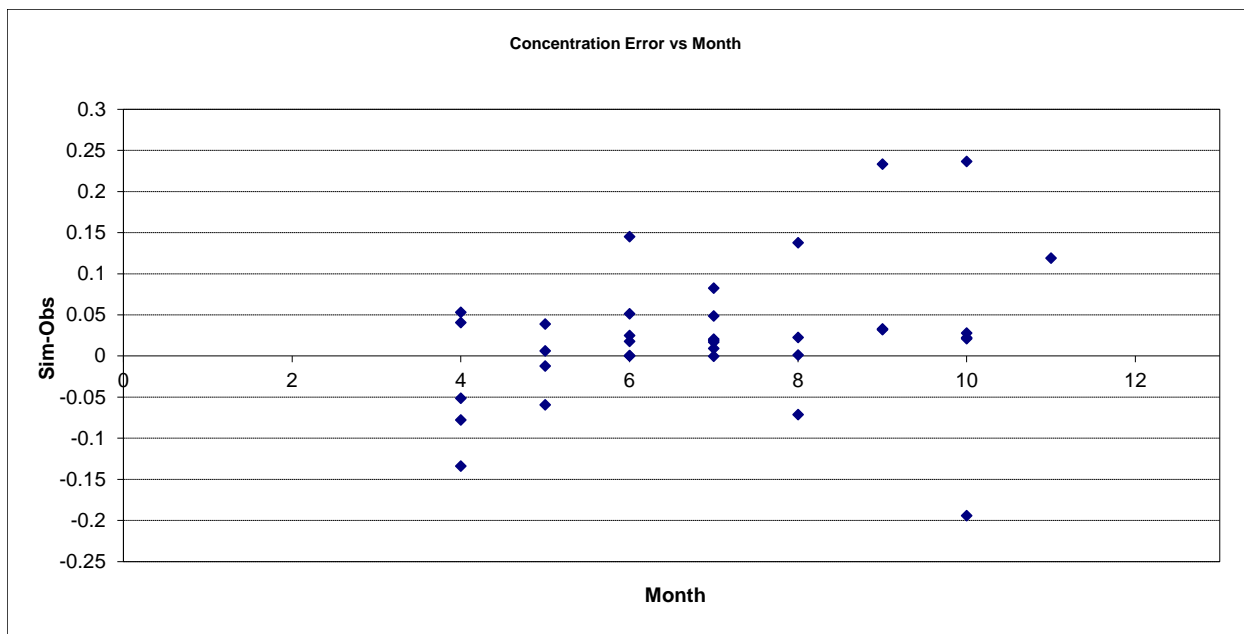


Figure 386. Residual (Simulated - Observed) vs. Month Nitrite+ Nitrate Nitrogen (NOx) at Flute Reed River

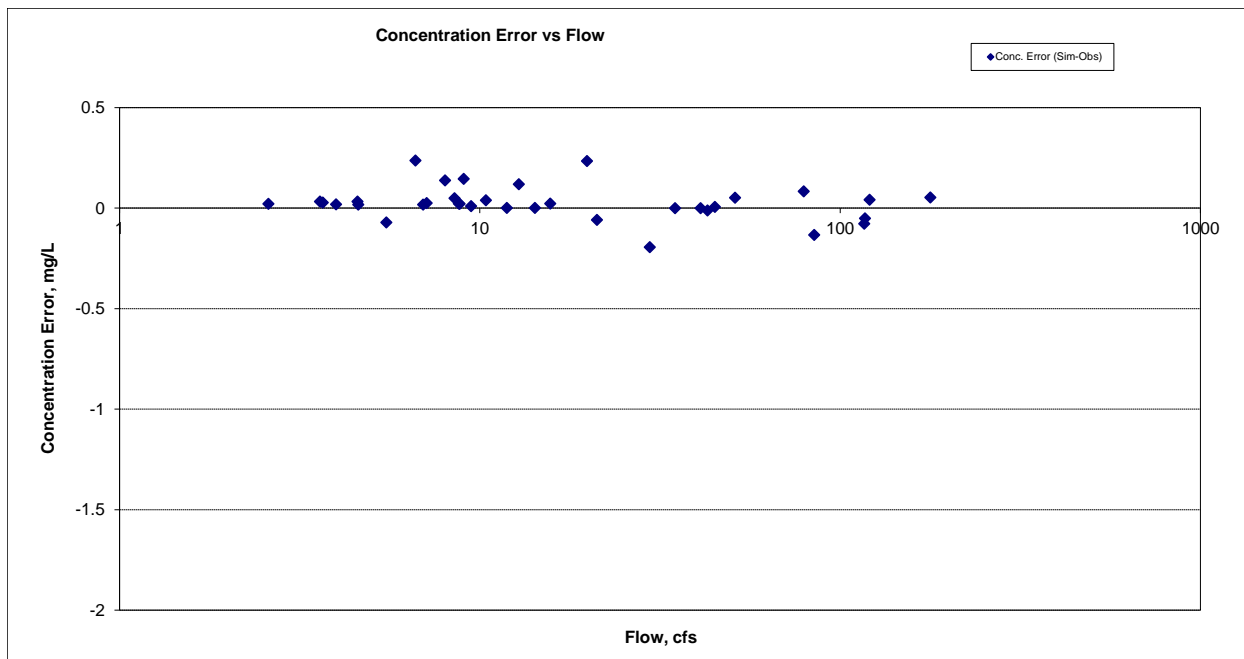
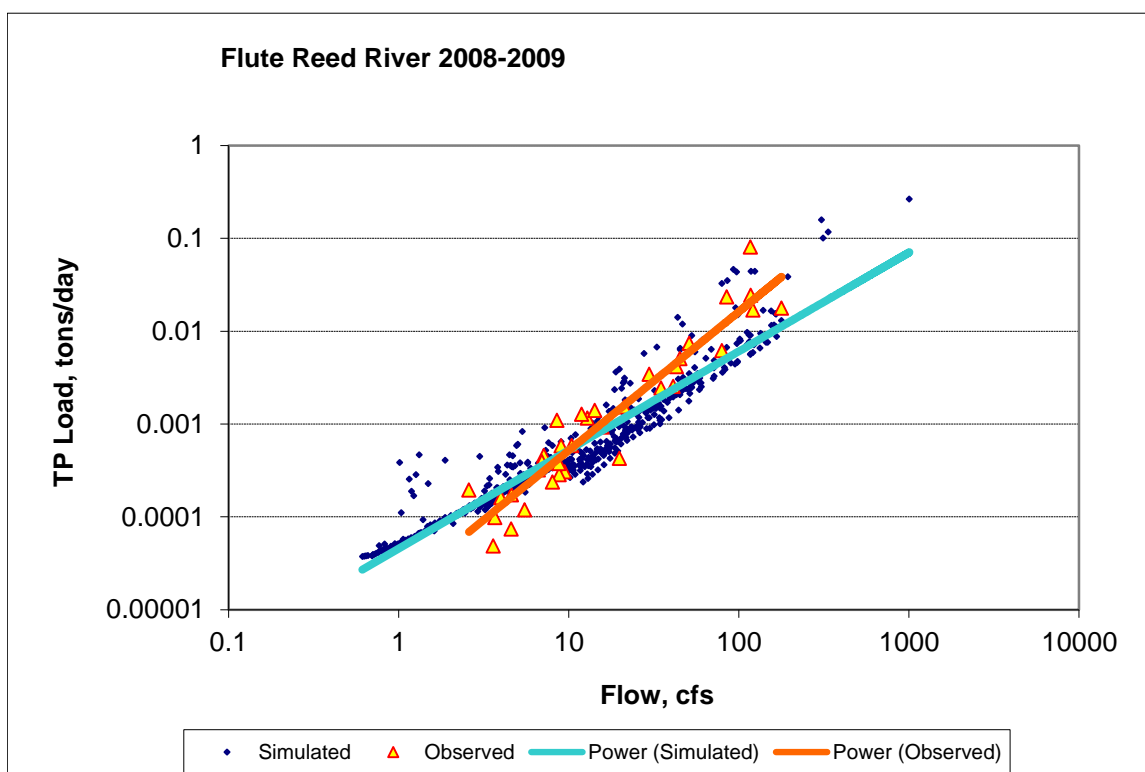


Figure 387. Residual (Simulated - Observed) vs. Flow Nitrite+ Nitrate Nitrogen (NOx) at Flute Reed River

## Total Phosphorus (TP)

**Table 76. Total Phosphorus (TP) statistics**

Count	35
Concentration Average Error	-30.20%
Concentration Median Error	-17.42%
Load Ave Error	-51.91%
Load Median Error	-2.55%
Paired t concentration	0.28
Paired t load	0.16



**Figure 388. Power plot of simulated and observed Total Phosphorus (TP) load vs flow at Flute Reed River (validation period)**



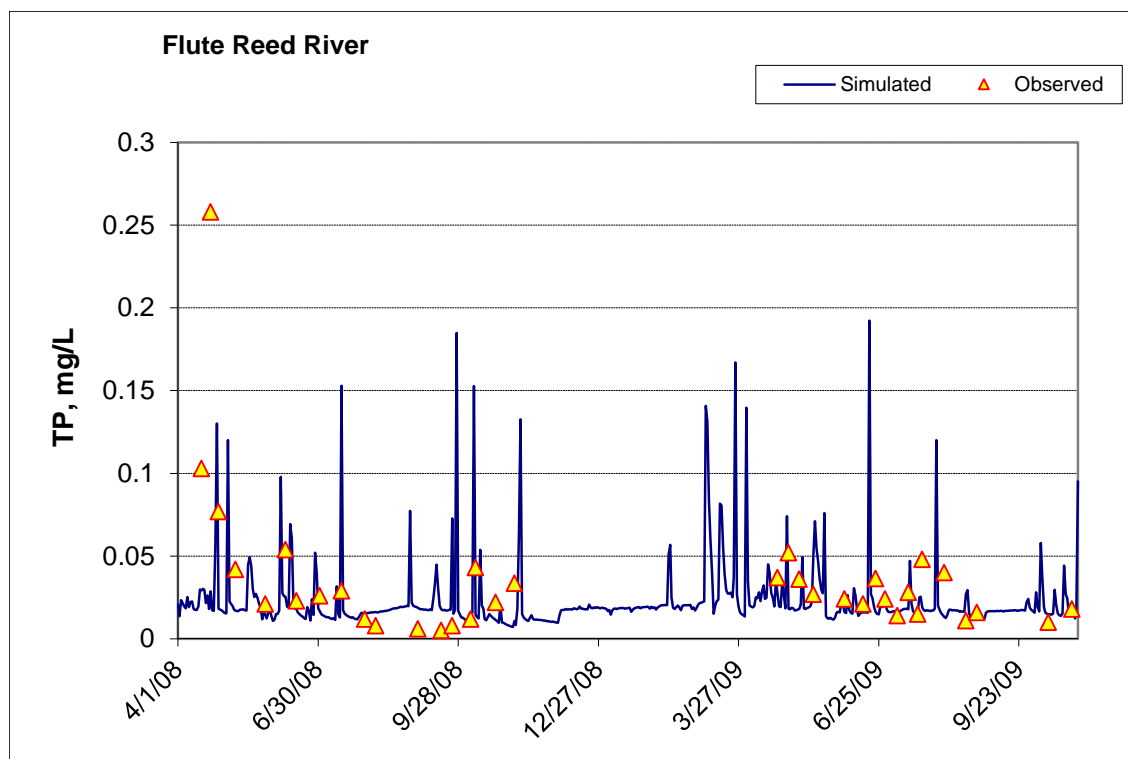


Figure 389. Time series of observed and simulated Total Phosphorus (TP) concentration at Flute Reed River

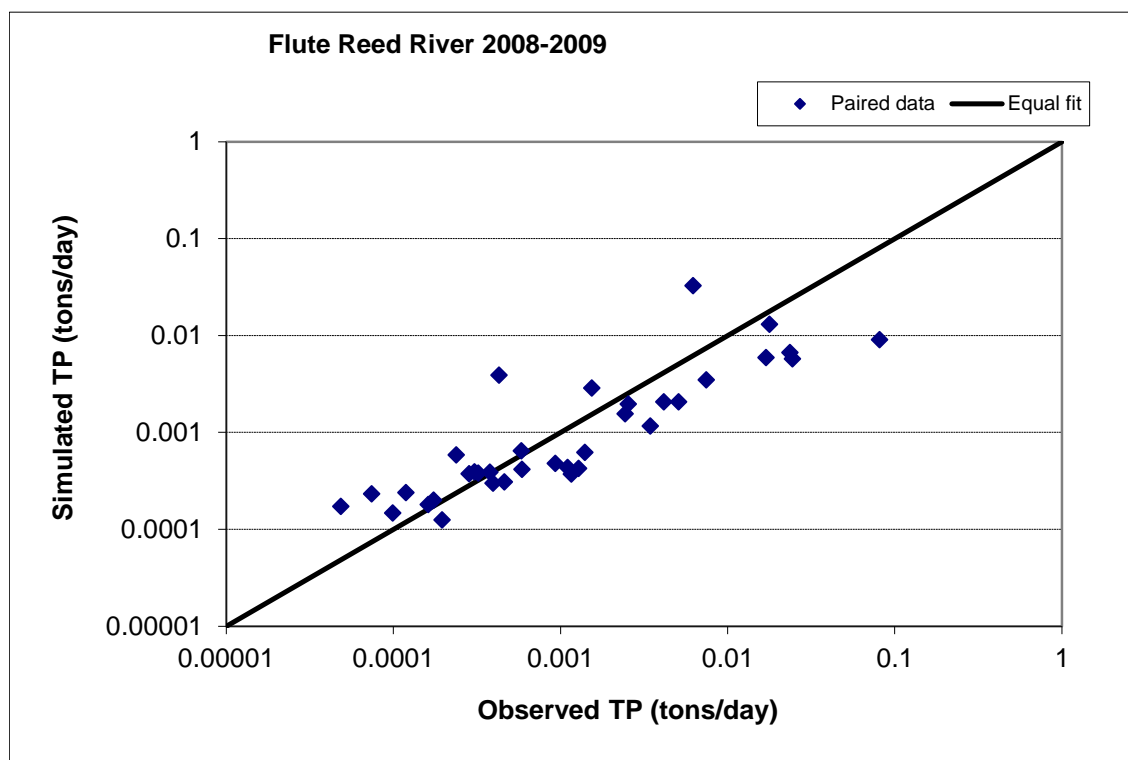


Figure 390. Paired simulated vs. observed Total Phosphorus (TP) load at Flute Reed River (validation period)

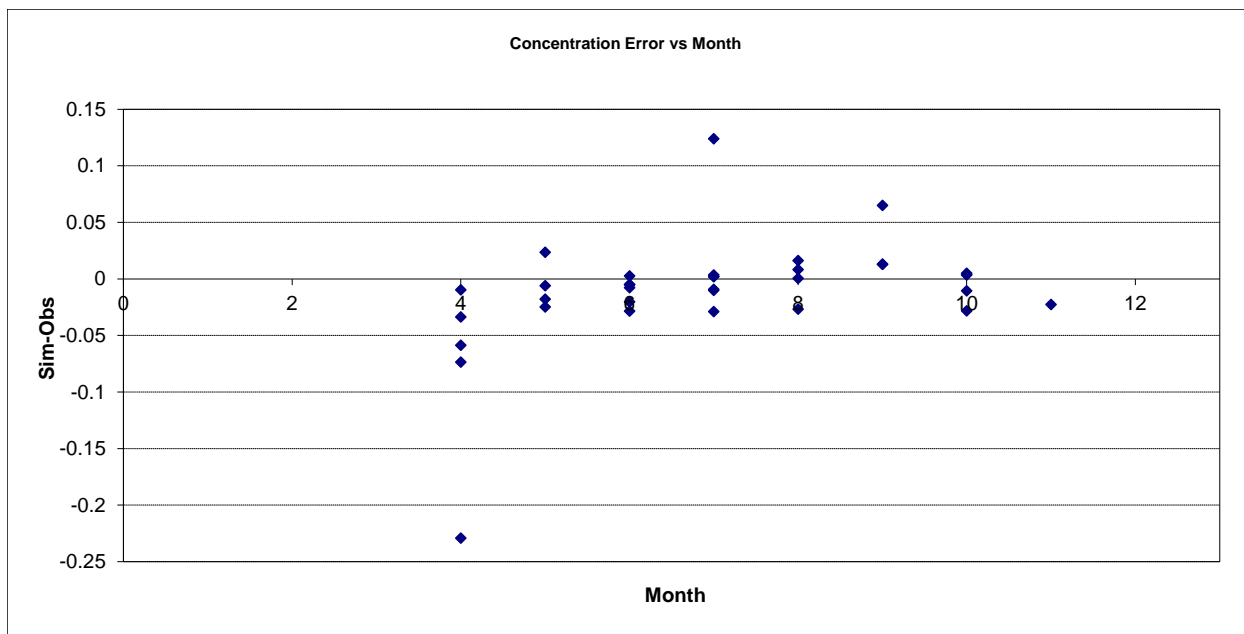


Figure 391. Residual (Simulated - Observed) vs. Month Total Phosphorus (TP) at Flute Reed River

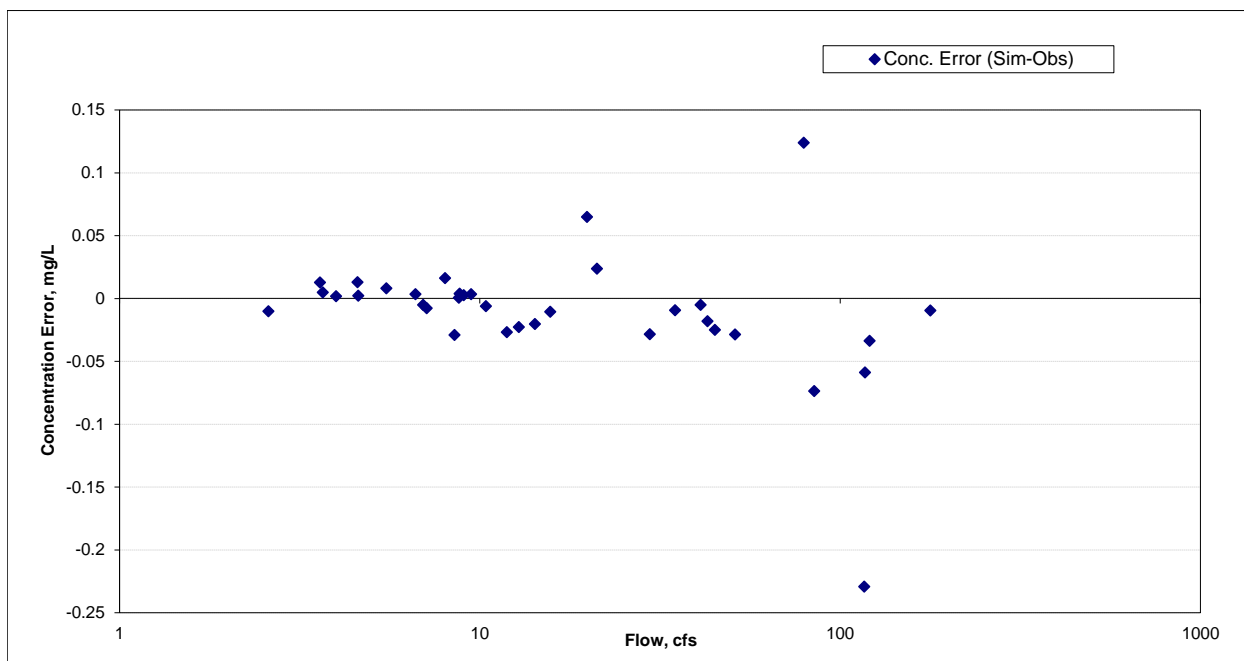


Figure 392. Residual (Simulated - Observed) vs. Flow Total Phosphorus (TP) at Flute Reed River