# Appendix for Model 03080102

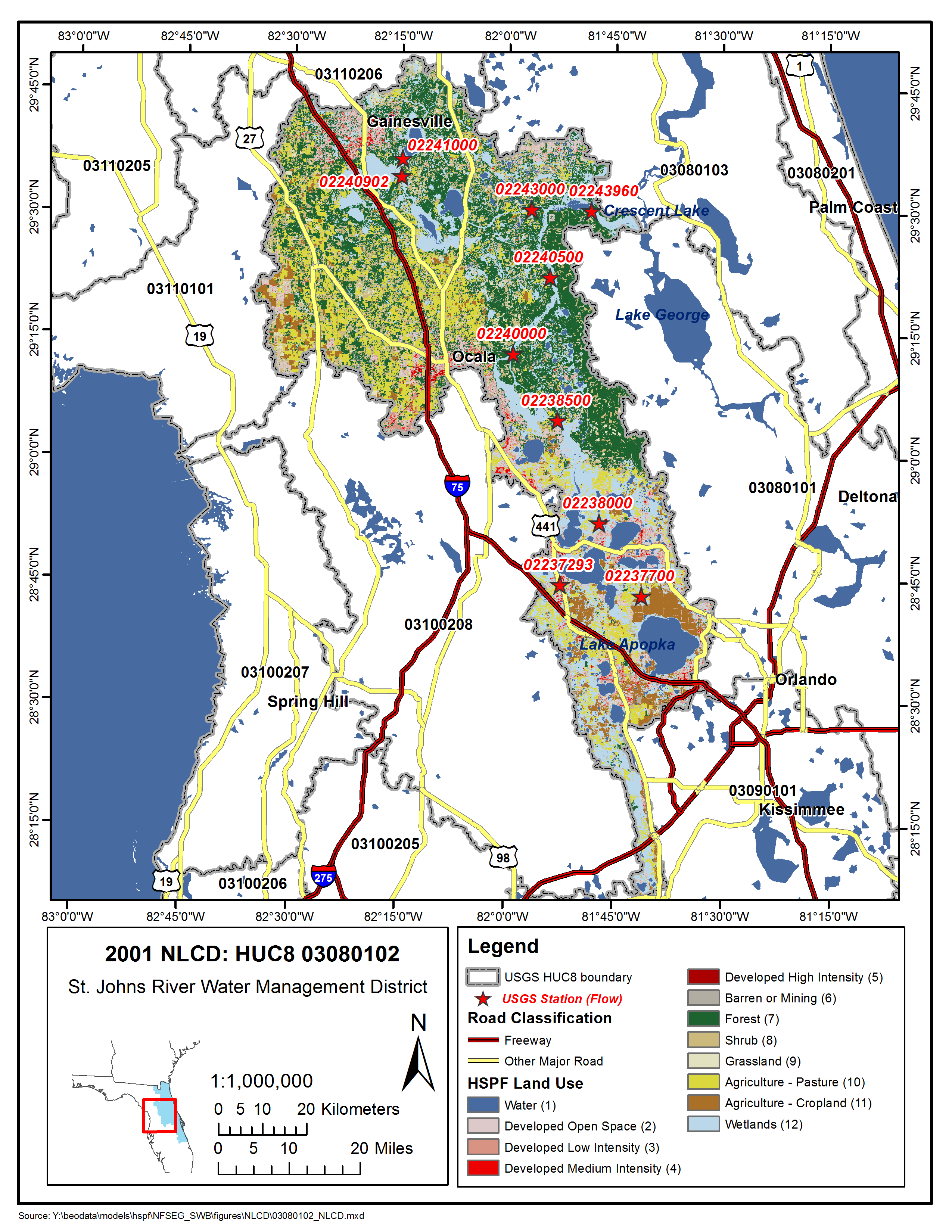


Figure 03080102-1: Land Cover from the National Land Cover Database.

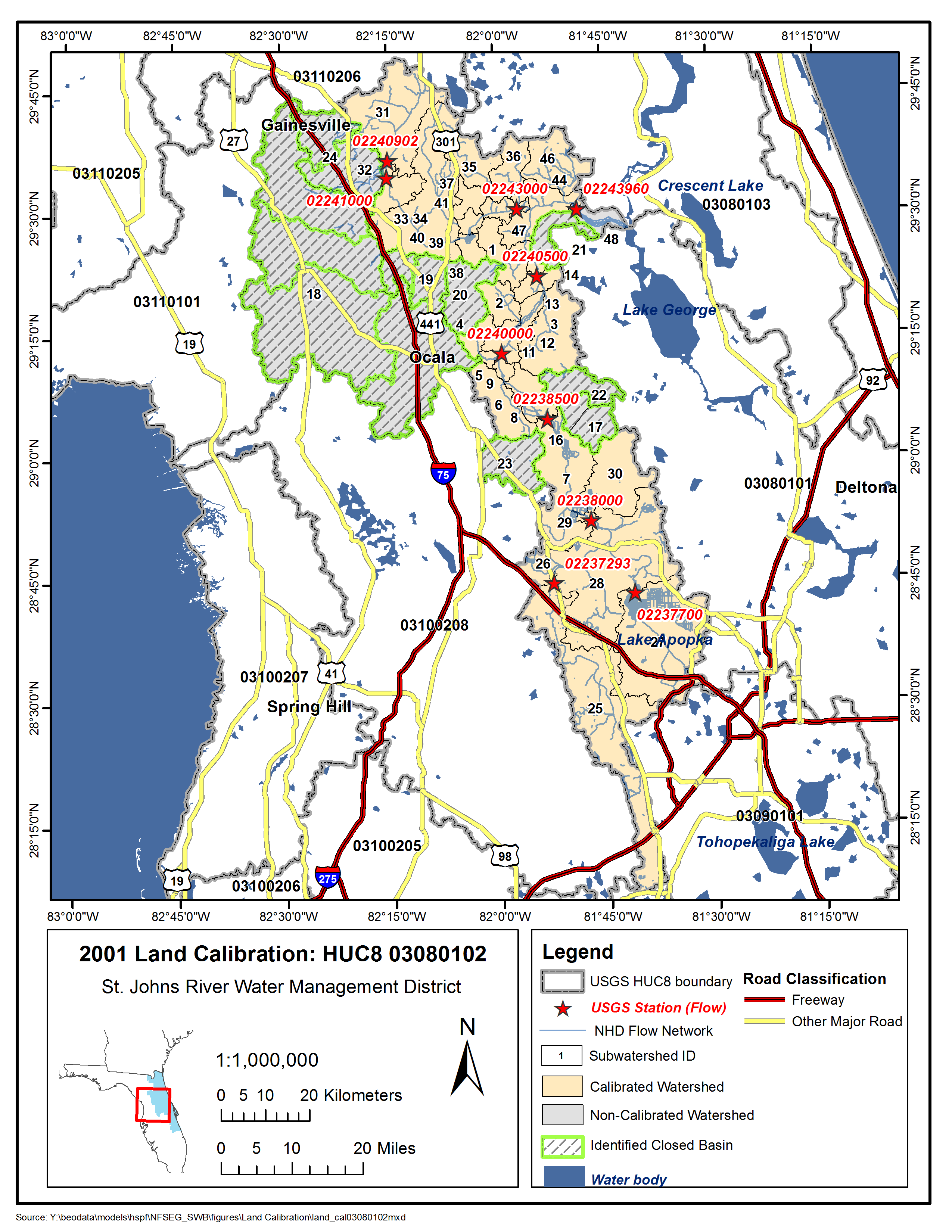


Figure 03080102-2: Calibrated sub-watersheds.

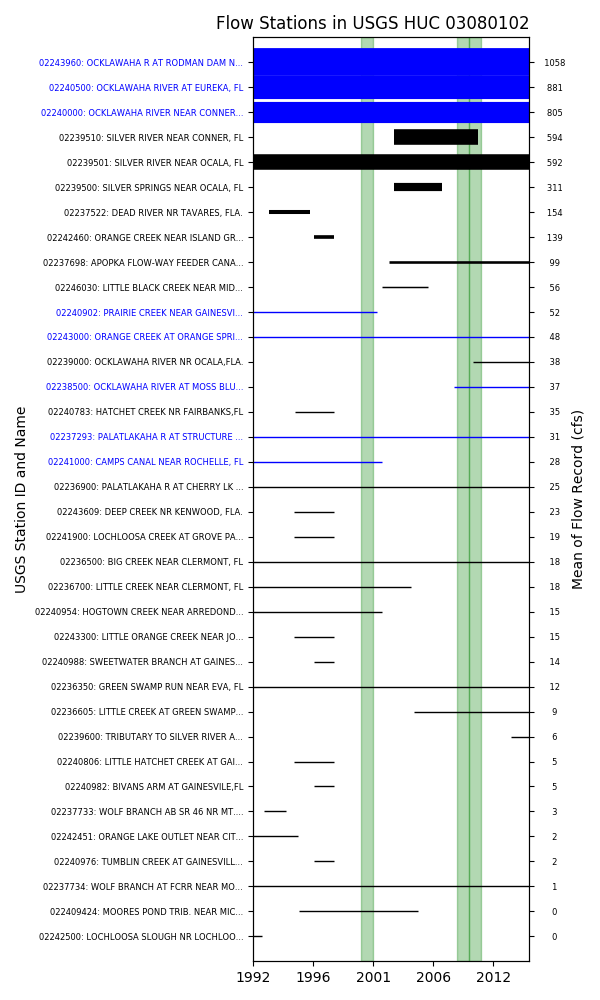


Figure 03080102-3: Station period of record. Blue color identifies gauges used for calibration.

## HSPF Reach 04, USGS Gauge 02239501

Table 03080102-1: Comparison Statistics Between HSPF Reach 04 and USGS Gauge 02239501.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 2.60 |
| Standard error | 118.43 |
| Relative bias | 0.00 |
| Relative standard error | 0.82 |
| Nash-Sutcliffe coefficient | 0.33 |
| Kling-Gupta coefficient | 0.67 |
| Coefficient of efficiency | 0.15 |
| Index of agreement | 0.58 |

Table 03080102-2: Hydrologic Indices Between USGS Gauge 02239501 and HSPF Reach 04.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02239501 | Simulated Reach 04 | Percent Difference |
| MA1: Mean, all daily flows | 591.24 | 593.69 | 0.41 |
| MA2: Median, all daily flows | 582.00 | 575.11 | -1.18 |
| MA3: CV, all daily flows | 10.59 | 12.20 | 15.25 |
| MA4: CV, log of all daily flows | 21.93 | 22.96 | 4.72 |
| MA5: Mean daily flow / median daily flow | 1.02 | 1.03 | 1.62 |
| MA9: (Q10 - Q90) / median daily flow | 0.62 | 0.70 | 12.74 |
| MA10: (Q20 - Q80) / median daily flow | 0.40 | 0.41 | 0.69 |
| MA11: (Q25 - Q75) / median daily flow | 0.31 | 0.33 | 6.02 |
| MA12: Mean monthly flow, January | 596.01 | 586.90 | -1.53 |
| MA13: Mean monthly flow, February | 572.10 | 565.14 | -1.22 |
| MA14: Mean monthly flow, March | 569.82 | 571.44 | 0.28 |
| MA15: Mean monthly flow, April | 567.56 | 558.52 | -1.59 |
| MA16: Mean monthly flow, May | 543.18 | 527.76 | -2.84 |
| MA17: Mean monthly flow, June | 526.85 | 524.39 | -0.47 |
| MA18: Mean monthly flow, July | 538.97 | 551.98 | 2.41 |
| MA19: Mean monthly flow, August | 553.04 | 580.10 | 4.89 |
| MA20: Mean monthly flow, September | 579.70 | 603.47 | 4.10 |
| MA21: Mean monthly flow, October | 602.41 | 616.69 | 2.37 |
| MA22: Mean monthly flow, November | 593.42 | 591.57 | -0.31 |
| MA23: Mean monthly flow, December | 578.89 | 574.01 | -0.84 |
| ML1: Mean minimum monthly flow, January | 579.96 | 566.53 | -2.32 |
| ML2: Mean minimum monthly flow, February | 572.35 | 561.15 | -1.96 |
| ML3: Mean minimum monthly flow, March | 570.43 | 571.51 | 0.19 |
| ML4: Mean minimum monthly flow, April | 575.39 | 561.46 | -2.42 |
| ML5: Mean minimum monthly flow, May | 546.87 | 527.20 | -3.60 |
| ML6: Mean minimum monthly flow, June | 530.17 | 524.50 | -1.07 |
| ML7: Mean minimum monthly flow, July | 544.22 | 553.06 | 1.62 |
| ML8: Mean minimum monthly flow, August | 555.35 | 577.30 | 3.95 |
| ML9: Mean minimum monthly flow, September | 572.57 | 593.24 | 3.61 |
| ML10: Mean minimum monthly flow, October | 603.22 | 612.11 | 1.47 |
| ML11: Mean minimum monthly flow, November | 605.48 | 596.57 | -1.47 |
| ML12: Mean minimum monthly flow, December | 589.70 | 572.54 | -2.91 |
| ML13: CV of minimum monthly flows | 25.61 | 25.16 | -1.77 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.80 | 0.81 | 1.58 |
| ML15: Mean minimum annual flow / mean annual flow | 0.80 | 0.80 | 0.59 |
| ML16: Median minimum annual flow / median annual flow | 0.80 | 0.80 | -0.24 |
| ML20: Ratio of baseflow volume to total flow volume | 0.99 | 0.99 | -0.35 |
| ML22: Mean annual minimum flow divided by catchment area | 4.73 | 4.76 | 0.60 |
| RA1: Mean of positive changes from one day to next (rise rate) | 3.50 | 9.46 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 123.98 | 208.27 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 3.44 | 2.39 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 133.71 | 124.17 |  |
| RA5: Ratio of days that are higher than previous day | 0.42 | 0.20 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.00 | 0.01 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.00 | 0.00 |  |
| RA8: Number of flow reversals from one day to the next | 111.17 | 64.46 |  |
| RA9: CV, number of flow reversals from one day to the next | 20.14 | 21.88 |  |

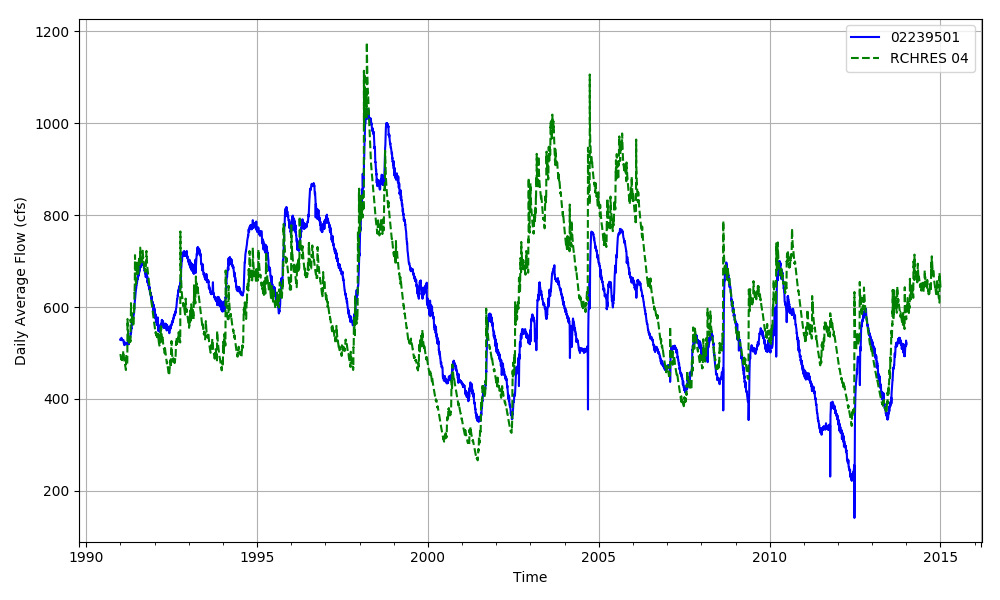


Figure 03080102-4: Daily flow for HSFP reach 04 and USGS station 02239501.

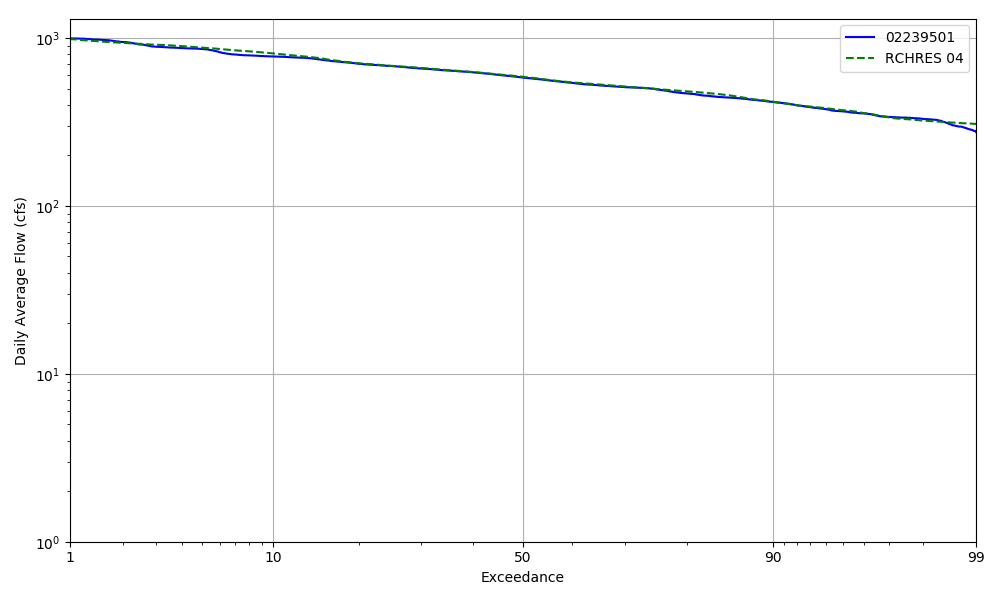


Figure 03080102-5: Daily exceedance for HSFP reach 04 and USGS station 02239501.

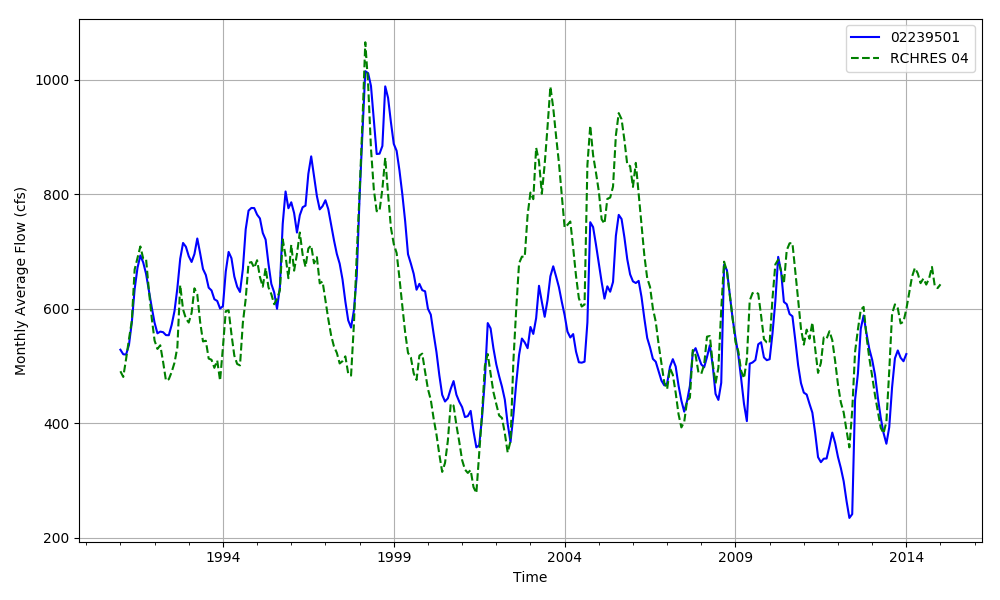


Figure 03080102-6: Monthly flow for HSFP reach 04 and USGS station 02239501.

## HSPF Reach 07, USGS Gauge 02238500

Table 03080102-3: Comparison Statistics Between HSPF Reach 07 and USGS Gauge 02238500.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 5.45 |
| Standard error | 170.24 |
| Relative bias | 0.04 |
| Relative standard error | 0.60 |
| Nash-Sutcliffe coefficient | 0.63 |
| Kling-Gupta coefficient | 0.74 |
| Coefficient of efficiency | 0.48 |
| Index of agreement | 0.71 |

Table 03080102-4: Hydrologic Indices Between USGS Gauge 02238500 and HSPF Reach 07.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02238500 | Simulated Reach 07 | Percent Difference |
| MA1: Mean, all daily flows | 151.95 | 157.49 | 3.65 |
| MA2: Median, all daily flows | 34.00 | 57.34 | 68.64 |
| MA3: CV, all daily flows | 131.31 | 112.03 | -14.68 |
| MA4: CV, log of all daily flows | 214.17 | 138.05 | -35.54 |
| MA5: Mean daily flow / median daily flow | 4.47 | 2.75 | -38.54 |
| MA9: (Q10 - Q90) / median daily flow | 15.43 | 6.78 | -56.06 |
| MA10: (Q20 - Q80) / median daily flow | 1.32 | 2.40 | 81.44 |
| MA11: (Q25 - Q75) / median daily flow | 0.88 | 1.78 | 102.01 |
| MA12: Mean monthly flow, January | 148.88 | 179.33 | 20.45 |
| MA13: Mean monthly flow, February | 166.56 | 145.82 | -12.46 |
| MA14: Mean monthly flow, March | 269.93 | 193.15 | -28.45 |
| MA15: Mean monthly flow, April | 196.52 | 131.27 | -33.20 |
| MA16: Mean monthly flow, May | 57.72 | 53.51 | -7.29 |
| MA17: Mean monthly flow, June | 141.93 | 83.26 | -41.33 |
| MA18: Mean monthly flow, July | 174.04 | 151.47 | -12.96 |
| MA19: Mean monthly flow, August | 172.95 | 158.76 | -8.21 |
| MA20: Mean monthly flow, September | 162.88 | 200.44 | 23.06 |
| MA21: Mean monthly flow, October | 111.97 | 209.76 | 87.34 |
| MA22: Mean monthly flow, November | 62.56 | 150.16 | 140.03 |
| MA23: Mean monthly flow, December | 83.75 | 155.72 | 85.94 |
| ML1: Mean minimum monthly flow, January | 52.25 | 101.27 | 93.81 |
| ML2: Mean minimum monthly flow, February | 85.25 | 97.24 | 14.07 |
| ML3: Mean minimum monthly flow, March | 96.95 | 107.07 | 10.44 |
| ML4: Mean minimum monthly flow, April | 51.36 | 61.86 | 20.45 |
| ML5: Mean minimum monthly flow, May | 33.98 | 39.35 | 15.80 |
| ML6: Mean minimum monthly flow, June | 49.18 | 39.93 | -18.81 |
| ML7: Mean minimum monthly flow, July | 50.17 | 86.83 | 73.07 |
| ML8: Mean minimum monthly flow, August | 63.04 | 96.27 | 52.70 |
| ML9: Mean minimum monthly flow, September | 39.91 | 84.69 | 112.18 |
| ML10: Mean minimum monthly flow, October | 51.87 | 99.40 | 91.63 |
| ML11: Mean minimum monthly flow, November | 33.13 | 78.85 | 138.01 |
| ML12: Mean minimum monthly flow, December | 33.20 | 78.86 | 137.56 |
| ML13: CV of minimum monthly flows | 271.44 | 135.07 | -50.24 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.29 | 0.58 | 97.71 |
| ML15: Mean minimum annual flow / mean annual flow | 0.18 | 0.37 | 108.63 |
| ML16: Median minimum annual flow / median annual flow | 0.23 | 0.56 | 145.63 |
| ML20: Ratio of baseflow volume to total flow volume | 0.56 | 0.69 | 22.39 |
| ML22: Mean annual minimum flow divided by catchment area | 0.12 | 0.34 | 186.93 |
| RA1: Mean of positive changes from one day to next (rise rate) | 27.16 | 22.85 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 341.15 | 275.99 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 27.01 | 10.97 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 278.91 | 207.19 |  |
| RA5: Ratio of days that are higher than previous day | 0.39 | 0.24 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.13 | 0.03 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.14 | 0.02 |  |
| RA8: Number of flow reversals from one day to the next | 157.75 | 28.88 |  |
| RA9: CV, number of flow reversals from one day to the next | 20.84 | 61.38 |  |

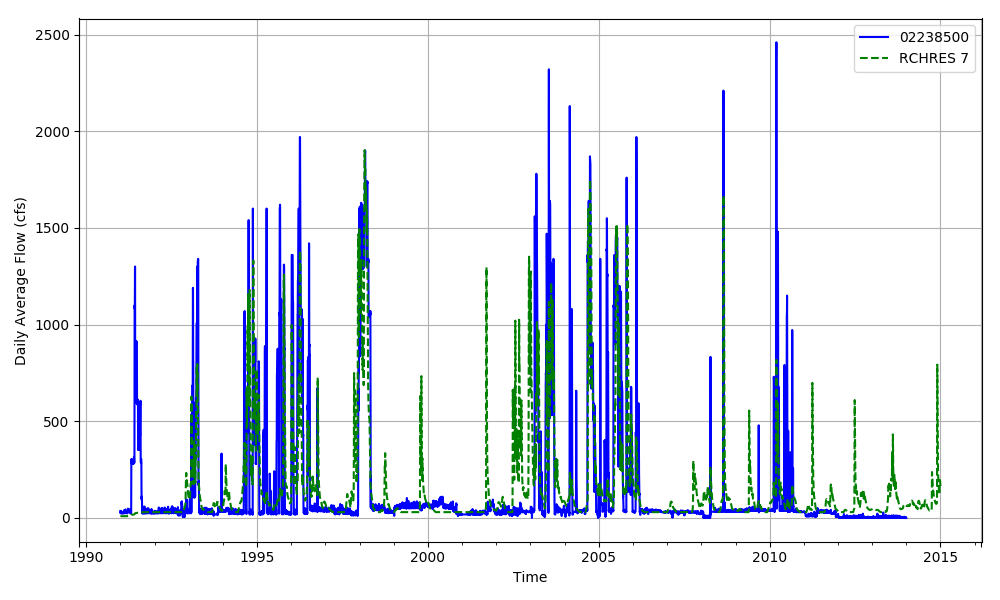


Figure 03080102-7: Daily flow for HSFP reach 07 and USGS station 02238500.

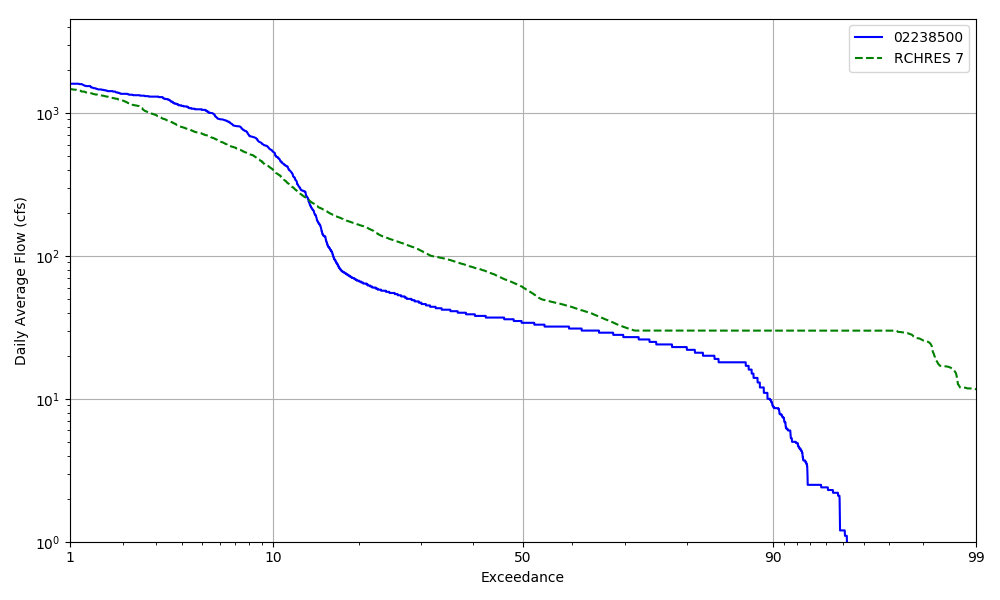


Figure 03080102-8: Daily exceedance for HSFP reach 07 and USGS station 02238500.

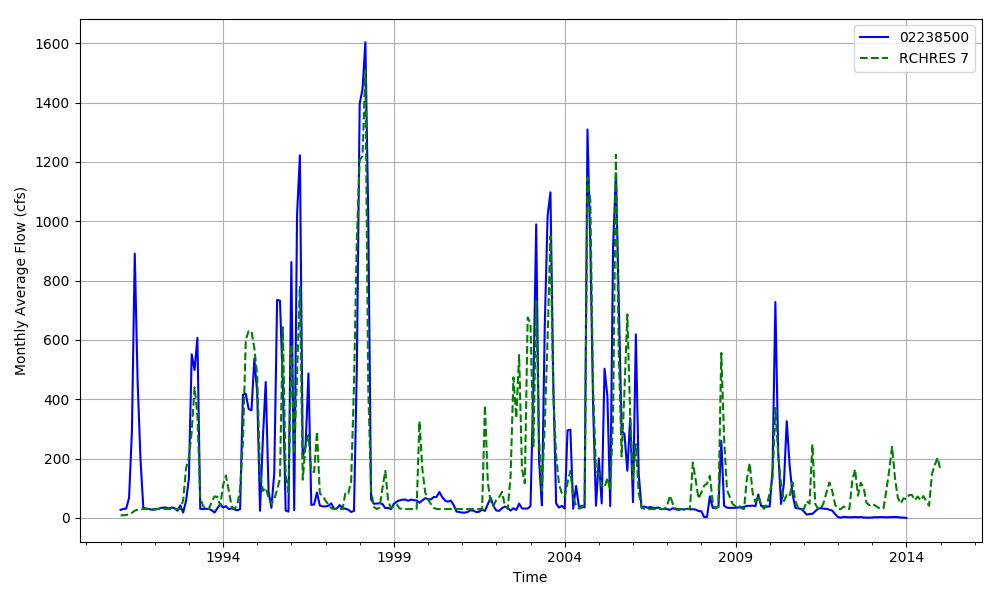


Figure 03080102-9: Monthly flow for HSFP reach 07 and USGS station 02238500.

## HSPF Reach 10, USGS Gauge 02240000

Table 03080102-5: Comparison Statistics Between HSPF Reach 10 and USGS Gauge 02240000.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -27.45 |
| Standard error | 211.80 |
| Relative bias | -0.03 |
| Relative standard error | 0.49 |
| Nash-Sutcliffe coefficient | 0.76 |
| Kling-Gupta coefficient | 0.82 |
| Coefficient of efficiency | 0.51 |
| Index of agreement | 0.74 |

Table 03080102-6: Hydrologic Indices Between USGS Gauge 02240000 and HSPF Reach 10.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02240000 | Simulated Reach 10 | Percent Difference |
| MA1: Mean, all daily flows | 812.55 | 784.88 | -3.41 |
| MA2: Median, all daily flows | 669.00 | 668.71 | -0.04 |
| MA3: CV, all daily flows | 32.24 | 33.55 | 4.06 |
| MA4: CV, log of all daily flows | 45.92 | 40.14 | -12.59 |
| MA5: Mean daily flow / median daily flow | 1.21 | 1.17 | -3.36 |
| MA9: (Q10 - Q90) / median daily flow | 1.31 | 1.16 | -11.21 |
| MA10: (Q20 - Q80) / median daily flow | 0.61 | 0.58 | -4.99 |
| MA11: (Q25 - Q75) / median daily flow | 0.49 | 0.46 | -6.68 |
| MA12: Mean monthly flow, January | 803.12 | 797.16 | -0.74 |
| MA13: Mean monthly flow, February | 804.18 | 750.78 | -6.64 |
| MA14: Mean monthly flow, March | 915.05 | 799.55 | -12.62 |
| MA15: Mean monthly flow, April | 822.75 | 710.60 | -13.63 |
| MA16: Mean monthly flow, May | 642.78 | 592.15 | -7.88 |
| MA17: Mean monthly flow, June | 712.01 | 638.49 | -10.33 |
| MA18: Mean monthly flow, July | 776.34 | 749.52 | -3.45 |
| MA19: Mean monthly flow, August | 810.12 | 789.21 | -2.58 |
| MA20: Mean monthly flow, September | 855.95 | 850.27 | -0.66 |
| MA21: Mean monthly flow, October | 810.13 | 861.84 | 6.38 |
| MA22: Mean monthly flow, November | 706.67 | 758.45 | 7.33 |
| MA23: Mean monthly flow, December | 710.55 | 754.84 | 6.23 |
| ML1: Mean minimum monthly flow, January | 696.17 | 683.60 | -1.81 |
| ML2: Mean minimum monthly flow, February | 726.52 | 671.28 | -7.60 |
| ML3: Mean minimum monthly flow, March | 774.04 | 694.77 | -10.24 |
| ML4: Mean minimum monthly flow, April | 715.35 | 627.77 | -12.24 |
| ML5: Mean minimum monthly flow, May | 617.87 | 569.24 | -7.87 |
| ML6: Mean minimum monthly flow, June | 627.96 | 573.97 | -8.60 |
| ML7: Mean minimum monthly flow, July | 662.43 | 658.78 | -0.55 |
| ML8: Mean minimum monthly flow, August | 707.43 | 699.08 | -1.18 |
| ML9: Mean minimum monthly flow, September | 680.57 | 691.17 | 1.56 |
| ML10: Mean minimum monthly flow, October | 727.78 | 722.53 | -0.72 |
| ML11: Mean minimum monthly flow, November | 684.91 | 683.78 | -0.17 |
| ML12: Mean minimum monthly flow, December | 667.13 | 661.68 | -0.82 |
| ML13: CV of minimum monthly flows | 42.36 | 35.28 | -16.72 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.78 | 0.76 | -1.70 |
| ML15: Mean minimum annual flow / mean annual flow | 0.70 | 0.69 | -2.11 |
| ML16: Median minimum annual flow / median annual flow | 0.78 | 0.76 | -2.96 |
| ML20: Ratio of baseflow volume to total flow volume | 0.92 | 0.92 | -0.88 |
| ML22: Mean annual minimum flow divided by catchment area | 5.43 | 5.22 | -3.87 |
| RA1: Mean of positive changes from one day to next (rise rate) | 30.91 | 40.91 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 259.83 | 264.03 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 18.34 | 12.49 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 225.03 | 193.48 |  |
| RA5: Ratio of days that are higher than previous day | 0.34 | 0.23 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.01 | 0.02 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.01 | 0.01 |  |
| RA8: Number of flow reversals from one day to the next | 110.54 | 64.62 |  |
| RA9: CV, number of flow reversals from one day to the next | 39.85 | 20.50 |  |

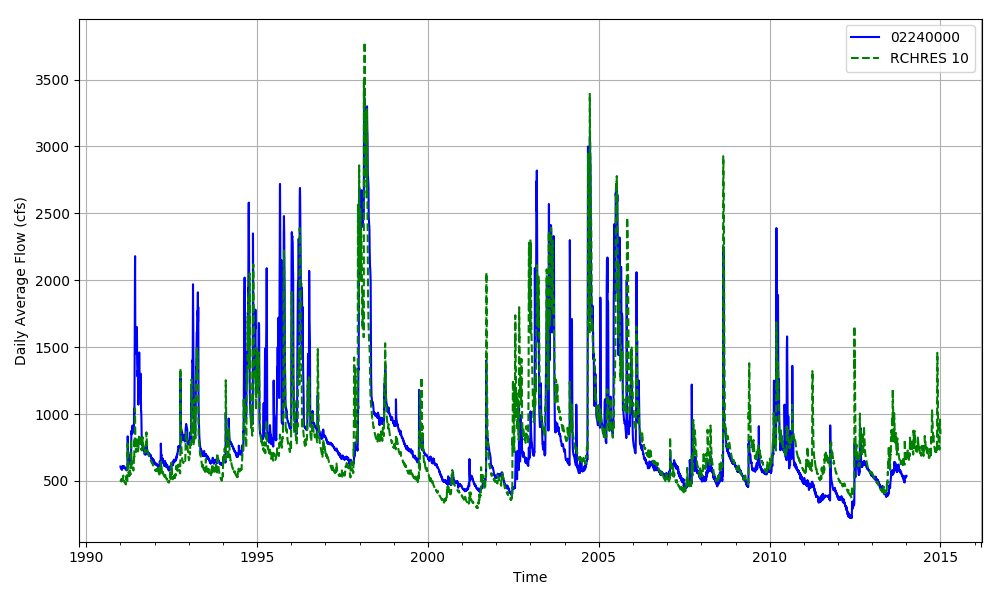


Figure 03080102-10: Daily flow for HSFP reach 10 and USGS station 02240000.

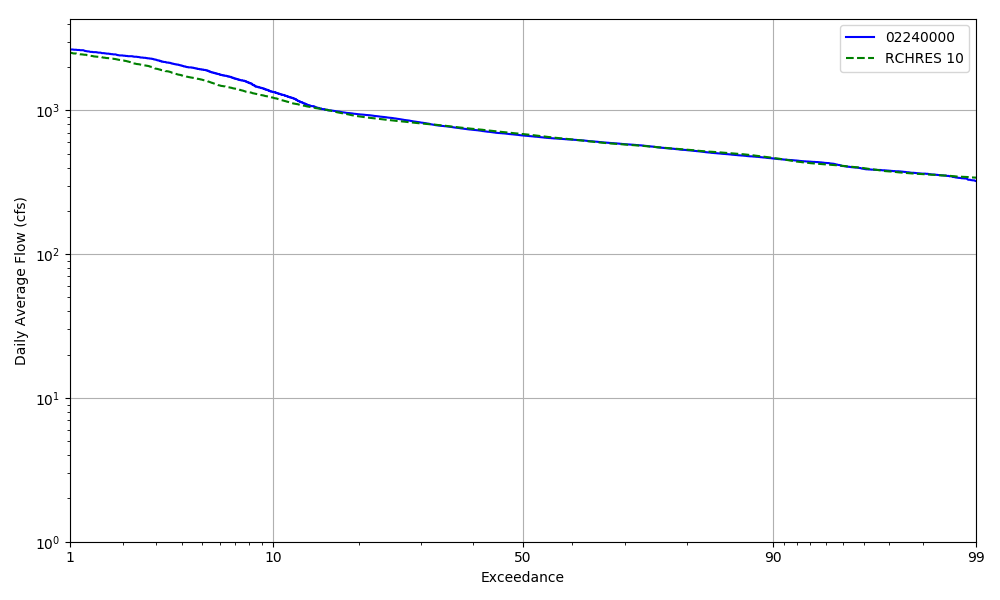


Figure 03080102-11: Daily exceedance for HSFP reach 10 and USGS station 02240000.

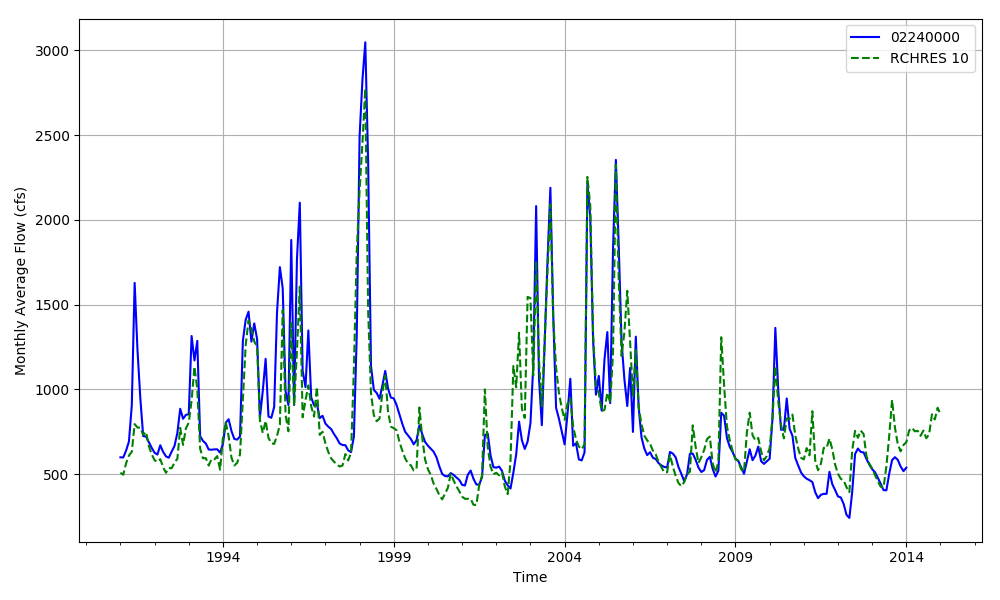


Figure 03080102-12: Monthly flow for HSFP reach 10 and USGS station 02240000.

## HSPF Reach 13, USGS Gauge 02240500

Table 03080102-7: Comparison Statistics Between HSPF Reach 13 and USGS Gauge 02240500.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -42.92 |
| Standard error | 209.15 |
| Relative bias | -0.05 |
| Relative standard error | 0.46 |
| Nash-Sutcliffe coefficient | 0.79 |
| Kling-Gupta coefficient | 0.87 |
| Coefficient of efficiency | 0.56 |
| Index of agreement | 0.78 |

Table 03080102-8: Hydrologic Indices Between USGS Gauge 02240500 and HSPF Reach 13.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02240500 | Simulated Reach 13 | Percent Difference |
| MA1: Mean, all daily flows | 885.76 | 842.65 | -4.87 |
| MA2: Median, all daily flows | 720.00 | 698.31 | -3.01 |
| MA3: CV, all daily flows | 35.87 | 39.49 | 10.10 |
| MA4: CV, log of all daily flows | 44.47 | 43.67 | -1.80 |
| MA5: Mean daily flow / median daily flow | 1.23 | 1.21 | -1.91 |
| MA9: (Q10 - Q90) / median daily flow | 1.33 | 1.29 | -2.94 |
| MA10: (Q20 - Q80) / median daily flow | 0.68 | 0.65 | -4.20 |
| MA11: (Q25 - Q75) / median daily flow | 0.53 | 0.50 | -5.84 |
| MA12: Mean monthly flow, January | 855.92 | 850.58 | -0.62 |
| MA13: Mean monthly flow, February | 853.65 | 819.43 | -4.01 |
| MA14: Mean monthly flow, March | 976.55 | 862.42 | -11.69 |
| MA15: Mean monthly flow, April | 881.62 | 740.55 | -16.00 |
| MA16: Mean monthly flow, May | 681.70 | 612.73 | -10.12 |
| MA17: Mean monthly flow, June | 760.66 | 684.43 | -10.02 |
| MA18: Mean monthly flow, July | 852.72 | 815.11 | -4.41 |
| MA19: Mean monthly flow, August | 885.25 | 863.41 | -2.47 |
| MA20: Mean monthly flow, September | 973.30 | 938.77 | -3.55 |
| MA21: Mean monthly flow, October | 919.79 | 938.87 | 2.07 |
| MA22: Mean monthly flow, November | 795.30 | 790.57 | -0.60 |
| MA23: Mean monthly flow, December | 778.25 | 802.42 | 3.11 |
| ML1: Mean minimum monthly flow, January | 754.96 | 698.30 | -7.50 |
| ML2: Mean minimum monthly flow, February | 736.83 | 689.63 | -6.41 |
| ML3: Mean minimum monthly flow, March | 817.13 | 717.89 | -12.14 |
| ML4: Mean minimum monthly flow, April | 745.22 | 633.90 | -14.94 |
| ML5: Mean minimum monthly flow, May | 623.04 | 573.00 | -8.03 |
| ML6: Mean minimum monthly flow, June | 661.13 | 585.52 | -11.44 |
| ML7: Mean minimum monthly flow, July | 730.83 | 680.27 | -6.92 |
| ML8: Mean minimum monthly flow, August | 760.87 | 724.47 | -4.78 |
| ML9: Mean minimum monthly flow, September | 742.22 | 710.66 | -4.25 |
| ML10: Mean minimum monthly flow, October | 805.52 | 741.11 | -8.00 |
| ML11: Mean minimum monthly flow, November | 752.96 | 694.22 | -7.80 |
| ML12: Mean minimum monthly flow, December | 711.48 | 673.80 | -5.30 |
| ML13: CV of minimum monthly flows | 42.31 | 36.46 | -13.81 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.73 | 0.74 | 1.20 |
| ML15: Mean minimum annual flow / mean annual flow | 0.66 | 0.65 | -0.71 |
| ML16: Median minimum annual flow / median annual flow | 0.73 | 0.74 | 2.09 |
| ML20: Ratio of baseflow volume to total flow volume | 0.91 | 0.88 | -2.93 |
| ML22: Mean annual minimum flow divided by catchment area | 5.52 | 5.27 | -4.53 |
| RA1: Mean of positive changes from one day to next (rise rate) | 37.57 | 54.90 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 260.34 | 284.91 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 22.63 | 18.80 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 185.88 | 183.08 |  |
| RA5: Ratio of days that are higher than previous day | 0.35 | 0.26 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.01 | 0.02 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.01 | 0.01 |  |
| RA8: Number of flow reversals from one day to the next | 88.54 | 56.21 |  |
| RA9: CV, number of flow reversals from one day to the next | 42.31 | 19.03 |  |

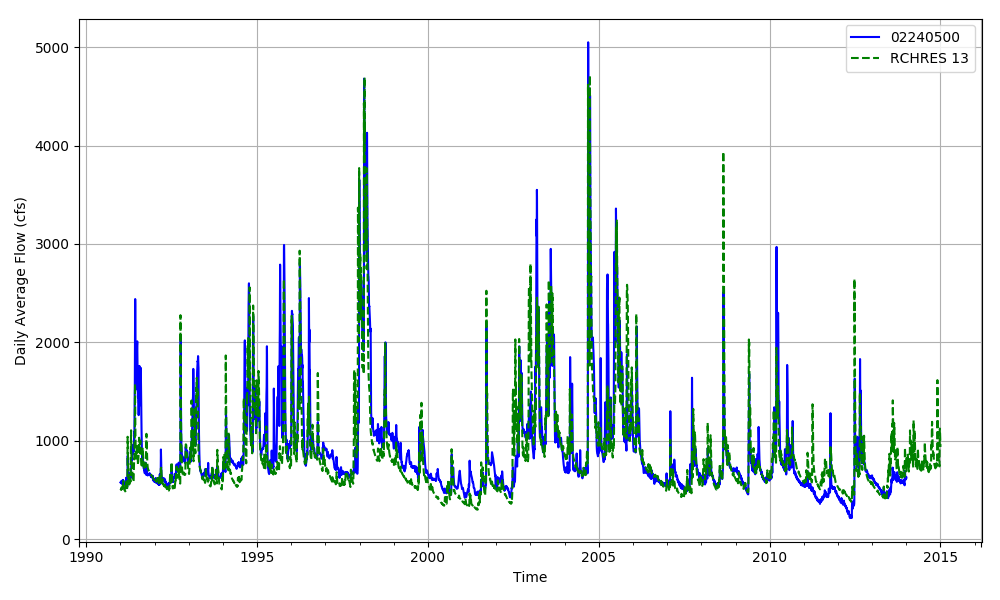


Figure 03080102-13: Daily flow for HSFP reach 13 and USGS station 02240500.

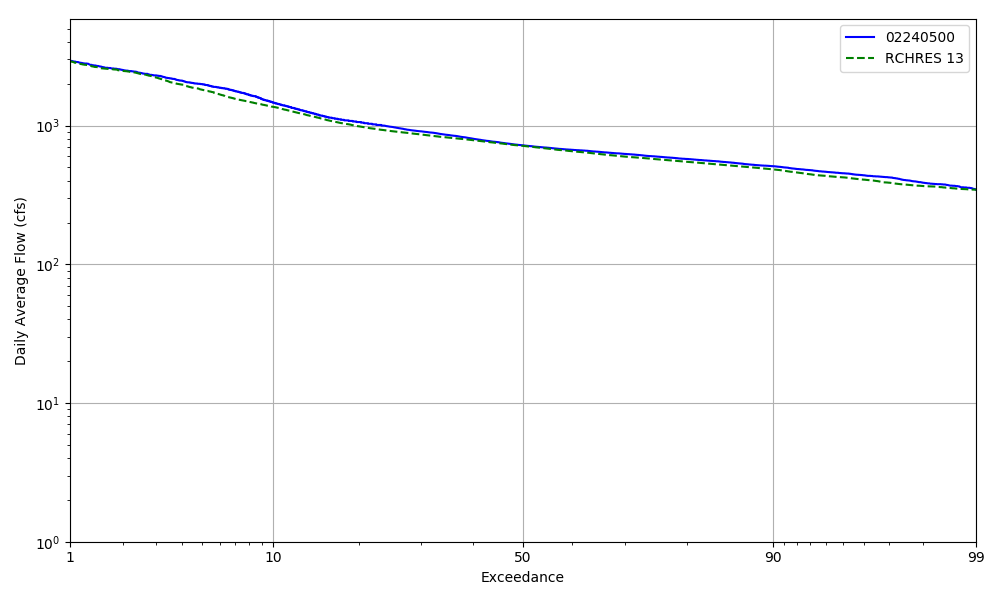


Figure 03080102-14: Daily exceedance for HSFP reach 13 and USGS station 02240500.

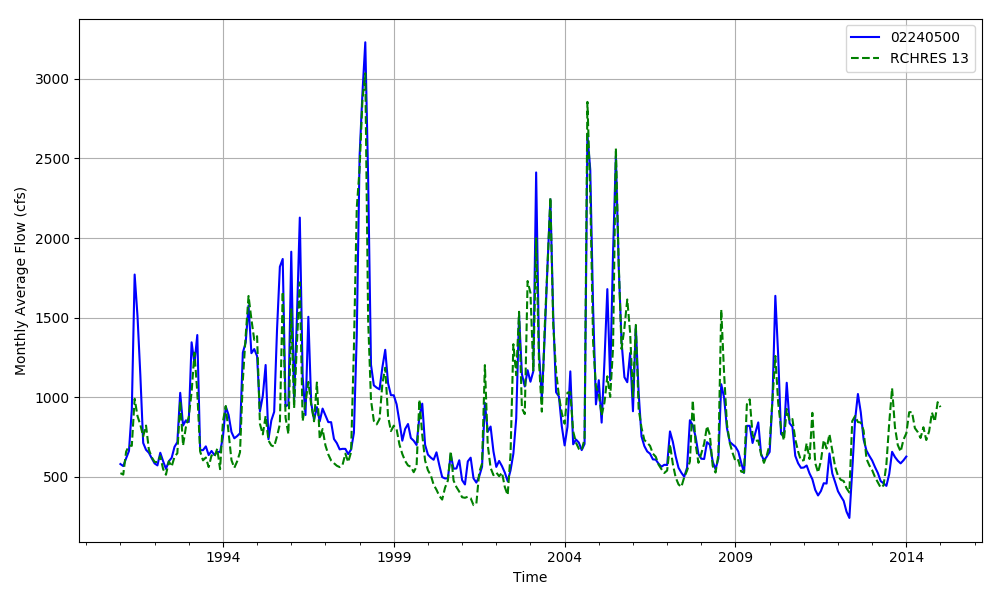


Figure 03080102-15: Monthly flow for HSFP reach 13 and USGS station 02240500.

## HSPF Reach 25, USGS Gauge 02237293

Table 03080102-9: Comparison Statistics Between HSPF Reach 25 and USGS Gauge 02237293.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 17.79 |
| Standard error | 59.47 |
| Relative bias | 0.57 |
| Relative standard error | 0.63 |
| Nash-Sutcliffe coefficient | 0.60 |
| Kling-Gupta coefficient | 0.33 |
| Coefficient of efficiency | 0.23 |
| Index of agreement | 0.56 |

Table 03080102-10: Hydrologic Indices Between USGS Gauge 02237293 and HSPF Reach 25.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02237293 | Simulated Reach 25 | Percent Difference |
| MA1: Mean, all daily flows | 31.41 | 49.29 | 56.91 |
| MA2: Median, all daily flows | 1.20 | 27.25 | 2170.56 |
| MA3: CV, all daily flows | 133.34 | 72.61 | -45.55 |
| MA4: CV, log of all daily flows | 306.31 | 108.99 | -64.42 |
| MA5: Mean daily flow / median daily flow | 26.17 | 1.81 | -93.09 |
| MA9: (Q10 - Q90) / median daily flow | 66.67 | 4.46 | -93.31 |
| MA10: (Q20 - Q80) / median daily flow | 4.08 | 2.35 | -42.45 |
| MA11: (Q25 - Q75) / median daily flow | 2.92 | 1.68 | -42.38 |
| MA12: Mean monthly flow, January | 34.63 | 41.39 | 19.51 |
| MA13: Mean monthly flow, February | 34.93 | 41.58 | 19.03 |
| MA14: Mean monthly flow, March | 44.05 | 46.06 | 4.55 |
| MA15: Mean monthly flow, April | 31.22 | 49.16 | 57.46 |
| MA16: Mean monthly flow, May | 3.15 | 29.24 | 827.77 |
| MA17: Mean monthly flow, June | 7.01 | 27.55 | 293.20 |
| MA18: Mean monthly flow, July | 33.48 | 47.28 | 41.24 |
| MA19: Mean monthly flow, August | 36.36 | 55.59 | 52.89 |
| MA20: Mean monthly flow, September | 53.15 | 70.14 | 31.97 |
| MA21: Mean monthly flow, October | 50.31 | 70.16 | 39.46 |
| MA22: Mean monthly flow, November | 20.33 | 49.22 | 142.14 |
| MA23: Mean monthly flow, December | 12.89 | 39.46 | 206.20 |
| ML1: Mean minimum monthly flow, January | 15.14 | 34.23 | 126.12 |
| ML2: Mean minimum monthly flow, February | 22.21 | 34.11 | 53.60 |
| ML3: Mean minimum monthly flow, March | 33.68 | 40.66 | 20.73 |
| ML4: Mean minimum monthly flow, April | 4.90 | 37.19 | 659.10 |
| ML5: Mean minimum monthly flow, May | 1.16 | 22.20 | 1814.21 |
| ML6: Mean minimum monthly flow, June | 1.00 | 18.69 | 1765.39 |
| ML7: Mean minimum monthly flow, July | 14.86 | 38.67 | 160.17 |
| ML8: Mean minimum monthly flow, August | 22.40 | 46.37 | 107.02 |
| ML9: Mean minimum monthly flow, September | 31.41 | 49.98 | 59.12 |
| ML10: Mean minimum monthly flow, October | 30.98 | 53.13 | 71.49 |
| ML11: Mean minimum monthly flow, November | 6.40 | 39.37 | 515.14 |
| ML12: Mean minimum monthly flow, December | 1.89 | 29.49 | 1464.17 |
| ML13: CV of minimum monthly flows | 427.41 | 138.28 | -67.65 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.05 | 0.28 | 466.65 |
| ML15: Mean minimum annual flow / mean annual flow | 0.02 | 0.20 | 972.54 |
| ML16: Median minimum annual flow / median annual flow | 0.00 | 0.29 |  |
| ML20: Ratio of baseflow volume to total flow volume | 0.74 | 0.95 | 27.53 |
| ML22: Mean annual minimum flow divided by catchment area | 0.00 | 0.11 | 2064.51 |
| RA1: Mean of positive changes from one day to next (rise rate) | 5.59 | 1.89 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 319.00 | 346.55 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 2.79 | 0.79 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 364.84 | 199.17 |  |
| RA5: Ratio of days that are higher than previous day | 0.20 | 0.27 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.09 | 0.02 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.06 | 0.02 |  |
| RA8: Number of flow reversals from one day to the next | 54.88 | 33.08 |  |
| RA9: CV, number of flow reversals from one day to the next | 39.95 | 43.15 |  |

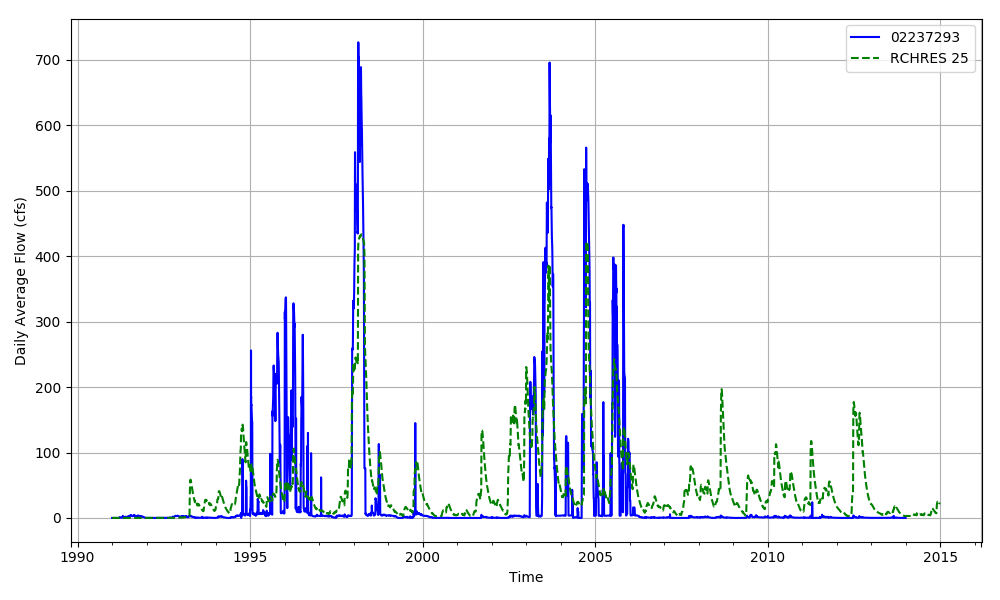


Figure 03080102-16: Daily flow for HSFP reach 25 and USGS station 02237293.

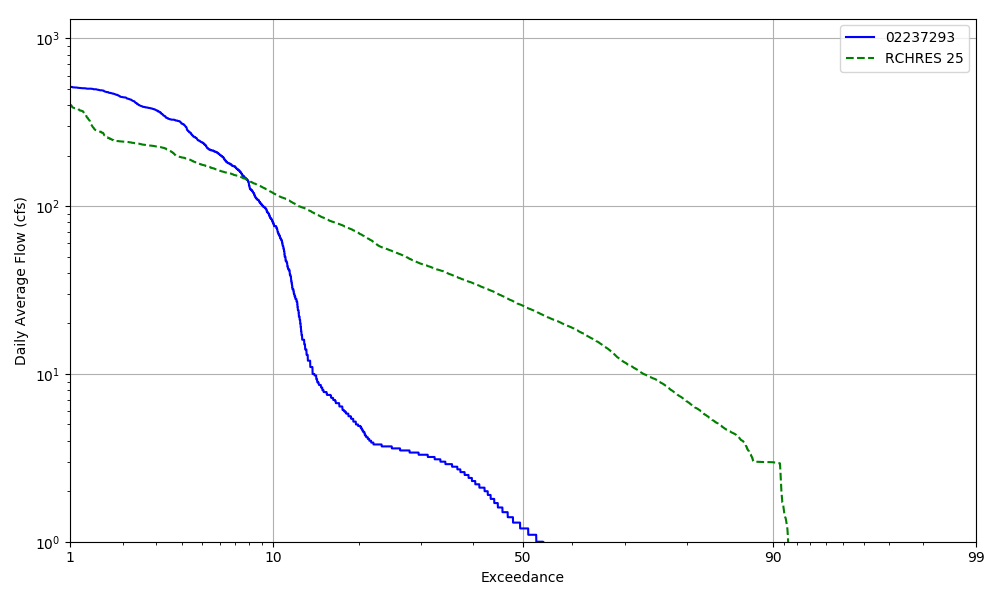


Figure 03080102-17: Daily exceedance for HSFP reach 25 and USGS station 02237293.

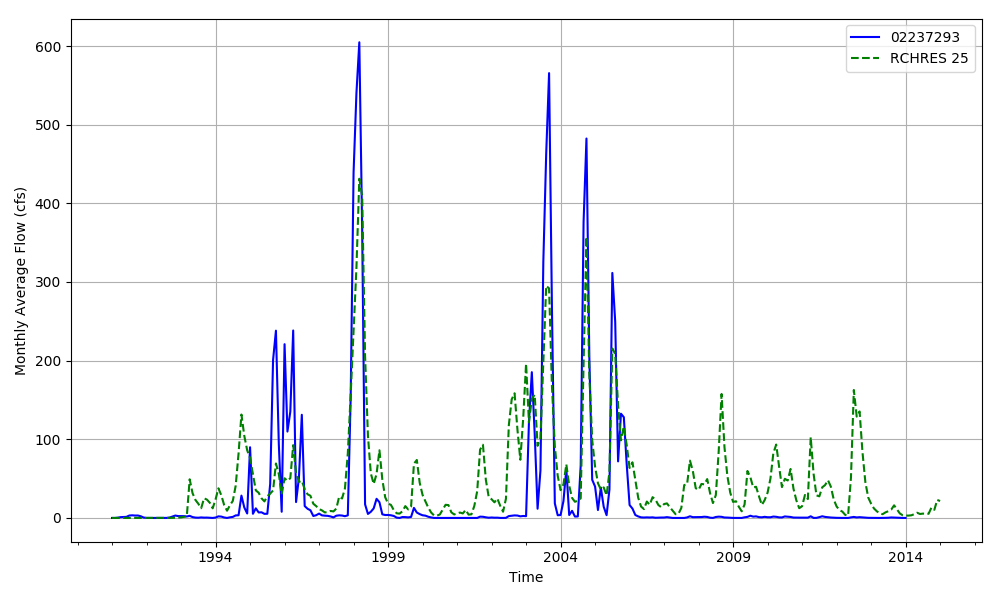


Figure 03080102-18: Monthly flow for HSFP reach 25 and USGS station 02237293.

## HSPF Reach 27, USGS Gauge 02237700

Table 03080102-11: Comparison Statistics Between HSPF Reach 27 and USGS Gauge 02237700.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 5.11 |
| Standard error | 73.83 |
| Relative bias | 0.10 |
| Relative standard error | 0.79 |
| Nash-Sutcliffe coefficient | 0.38 |
| Kling-Gupta coefficient | 0.68 |
| Coefficient of efficiency | 0.39 |
| Index of agreement | 0.71 |

Table 03080102-12: Hydrologic Indices Between USGS Gauge 02237700 and HSPF Reach 27.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02237700 | Simulated Reach 27 | Percent Difference |
| MA1: Mean, all daily flows | 52.79 | 57.86 | 9.60 |
| MA2: Median, all daily flows | 15.00 | 13.75 | -8.34 |
| MA3: CV, all daily flows | 119.13 | 102.94 | -13.59 |
| MA4: CV, log of all daily flows | 206.22 | 188.14 | -8.77 |
| MA5: Mean daily flow / median daily flow | 3.52 | 4.21 | 19.58 |
| MA9: (Q10 - Q90) / median daily flow | 10.37 | 11.07 | 6.71 |
| MA10: (Q20 - Q80) / median daily flow | 1.51 | 2.25 | 49.51 |
| MA11: (Q25 - Q75) / median daily flow | 1.27 | 1.11 | -13.06 |
| MA12: Mean monthly flow, January | 55.42 | 72.60 | 31.00 |
| MA13: Mean monthly flow, February | 44.11 | 50.51 | 14.50 |
| MA14: Mean monthly flow, March | 62.38 | 69.62 | 11.60 |
| MA15: Mean monthly flow, April | 53.46 | 57.73 | 7.99 |
| MA16: Mean monthly flow, May | 17.08 | 15.54 | -9.01 |
| MA17: Mean monthly flow, June | 41.85 | 29.49 | -29.53 |
| MA18: Mean monthly flow, July | 65.81 | 49.01 | -25.54 |
| MA19: Mean monthly flow, August | 86.58 | 46.69 | -46.08 |
| MA20: Mean monthly flow, September | 62.61 | 69.01 | 10.22 |
| MA21: Mean monthly flow, October | 45.72 | 75.37 | 64.86 |
| MA22: Mean monthly flow, November | 26.18 | 61.12 | 133.48 |
| MA23: Mean monthly flow, December | 40.60 | 63.49 | 56.41 |
| ML1: Mean minimum monthly flow, January | 32.70 | 52.19 | 59.57 |
| ML2: Mean minimum monthly flow, February | 36.26 | 40.91 | 12.81 |
| ML3: Mean minimum monthly flow, March | 37.15 | 47.12 | 26.84 |
| ML4: Mean minimum monthly flow, April | 15.61 | 21.07 | 35.00 |
| ML5: Mean minimum monthly flow, May | 11.79 | 12.40 | 5.19 |
| ML6: Mean minimum monthly flow, June | 12.48 | 12.47 | -0.07 |
| ML7: Mean minimum monthly flow, July | 19.32 | 34.08 | 76.37 |
| ML8: Mean minimum monthly flow, August | 25.98 | 32.83 | 26.34 |
| ML9: Mean minimum monthly flow, September | 28.47 | 27.99 | -1.72 |
| ML10: Mean minimum monthly flow, October | 27.86 | 49.49 | 77.62 |
| ML11: Mean minimum monthly flow, November | 14.24 | 32.96 | 131.55 |
| ML12: Mean minimum monthly flow, December | 18.00 | 32.96 | 83.08 |
| ML13: CV of minimum monthly flows | 224.58 | 226.15 | 0.70 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.48 | 0.67 | 39.64 |
| ML15: Mean minimum annual flow / mean annual flow | 0.22 | 0.49 | 119.42 |
| ML16: Median minimum annual flow / median annual flow | 0.49 | 0.88 | 81.33 |
| ML20: Ratio of baseflow volume to total flow volume | 0.70 | 0.80 | 14.01 |
| ML22: Mean annual minimum flow divided by catchment area | 0.08 | 0.12 | 46.67 |
| RA1: Mean of positive changes from one day to next (rise rate) | 10.48 | 5.57 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 303.99 | 402.89 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 9.33 | 2.17 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 295.74 | 269.13 |  |
| RA5: Ratio of days that are higher than previous day | 0.21 | 0.27 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.06 | 0.00 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.06 | 0.00 |  |
| RA8: Number of flow reversals from one day to the next | 84.50 | 66.79 |  |
| RA9: CV, number of flow reversals from one day to the next | 47.21 | 29.31 |  |

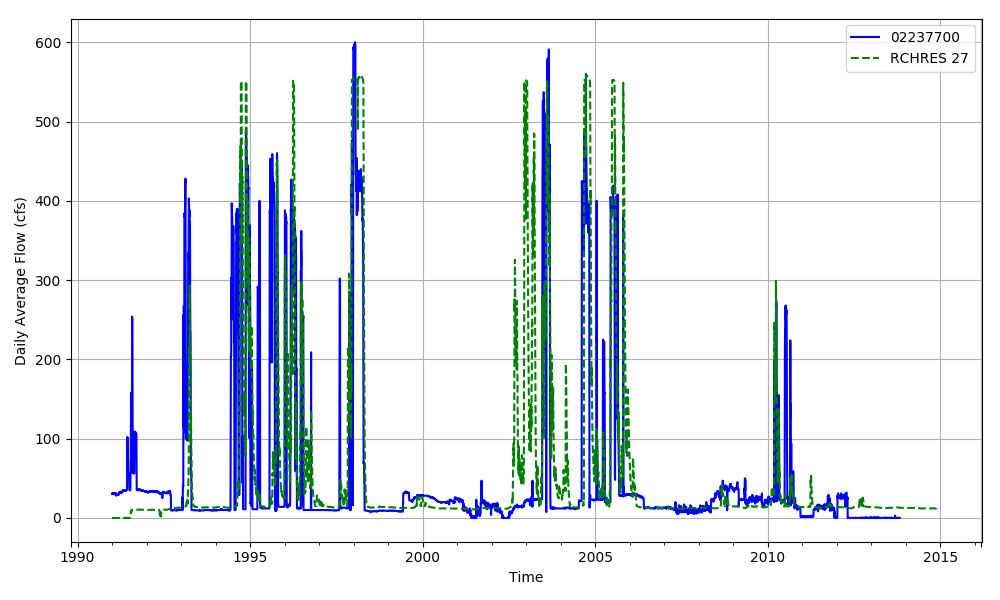


Figure 03080102-19: Daily flow for HSFP reach 27 and USGS station 02237700.

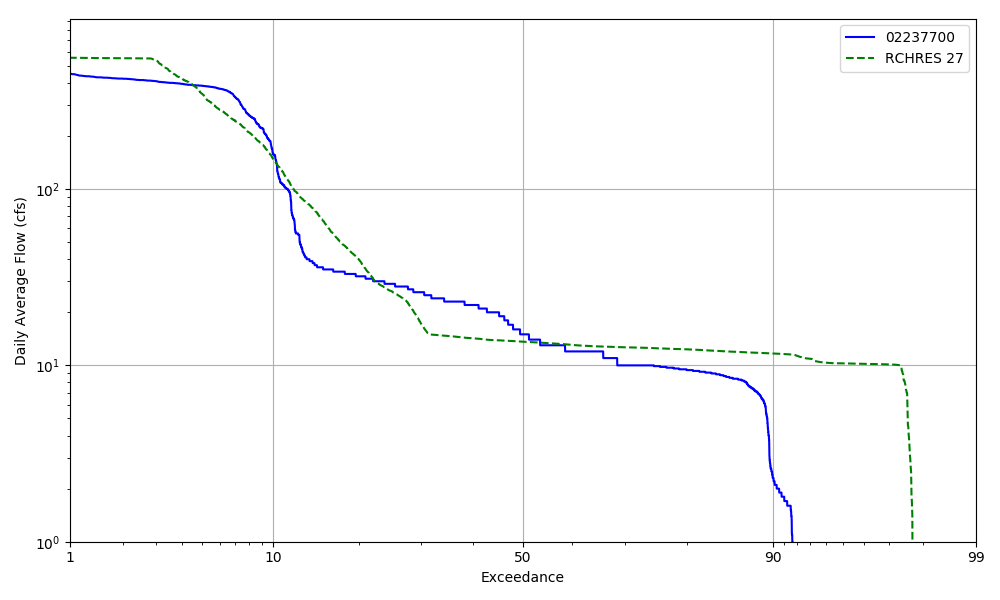


Figure 03080102-20: Daily exceedance for HSFP reach 27 and USGS station 02237700.

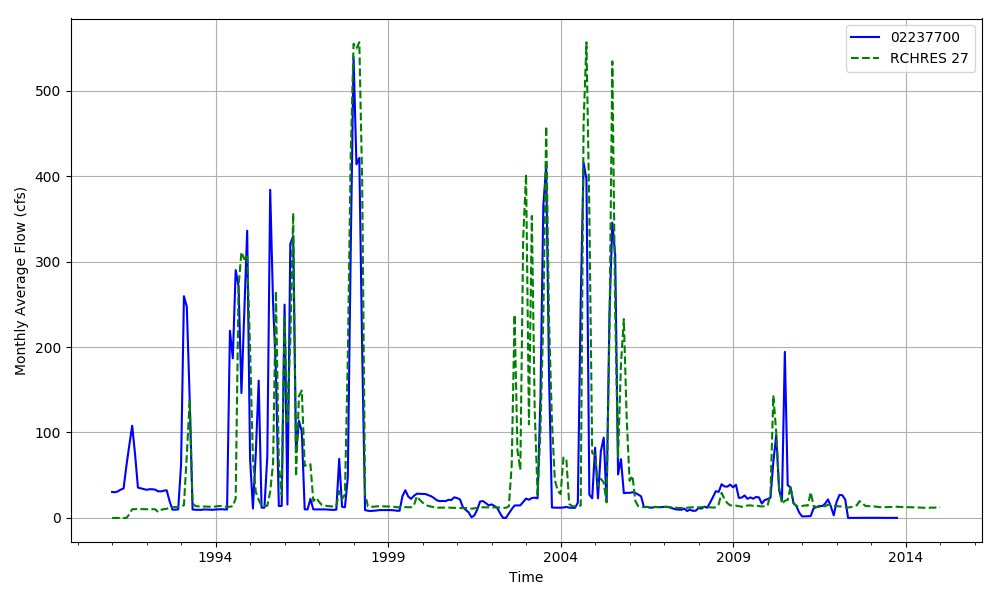


Figure 03080102-21: Monthly flow for HSFP reach 27 and USGS station 02237700.

## HSPF Reach 28, USGS Gauge 02238000

Table 03080102-13: Comparison Statistics Between HSPF Reach 28 and USGS Gauge 02238000.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -5.65 |
| Standard error | 150.30 |
| Relative bias | -0.04 |
| Relative standard error | 0.59 |
| Nash-Sutcliffe coefficient | 0.66 |
| Kling-Gupta coefficient | 0.73 |
| Coefficient of efficiency | 0.45 |
| Index of agreement | 0.70 |

Table 03080102-14: Hydrologic Indices Between USGS Gauge 02238000 and HSPF Reach 28.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02238000 | Simulated Reach 28 | Percent Difference |
| MA1: Mean, all daily flows | 142.07 | 136.62 | -3.84 |
| MA2: Median, all daily flows | 38.00 | 57.51 | 51.34 |
| MA3: CV, all daily flows | 118.80 | 127.68 | 7.47 |
| MA4: CV, log of all daily flows | 195.47 | 145.88 | -25.37 |
| MA5: Mean daily flow / median daily flow | 3.74 | 2.38 | -36.46 |
| MA9: (Q10 - Q90) / median daily flow | 12.03 | 5.42 | -54.93 |
| MA10: (Q20 - Q80) / median daily flow | 1.87 | 2.39 | 27.93 |
| MA11: (Q25 - Q75) / median daily flow | 1.26 | 1.77 | 40.49 |
| MA12: Mean monthly flow, January | 150.05 | 159.91 | 6.57 |
| MA13: Mean monthly flow, February | 160.84 | 119.95 | -25.43 |
| MA14: Mean monthly flow, March | 218.80 | 165.10 | -24.55 |
| MA15: Mean monthly flow, April | 183.38 | 101.82 | -44.48 |
| MA16: Mean monthly flow, May | 41.66 | 36.19 | -13.14 |
| MA17: Mean monthly flow, June | 131.42 | 76.74 | -41.60 |
| MA18: Mean monthly flow, July | 172.89 | 121.06 | -29.98 |
| MA19: Mean monthly flow, August | 158.65 | 141.51 | -10.81 |
| MA20: Mean monthly flow, September | 144.33 | 182.94 | 26.75 |
| MA21: Mean monthly flow, October | 106.68 | 202.27 | 89.60 |
| MA22: Mean monthly flow, November | 79.22 | 126.03 | 59.08 |
| MA23: Mean monthly flow, December | 88.93 | 138.15 | 55.34 |
| ML1: Mean minimum monthly flow, January | 82.44 | 82.84 | 0.49 |
| ML2: Mean minimum monthly flow, February | 97.71 | 76.54 | -21.67 |
| ML3: Mean minimum monthly flow, March | 98.40 | 72.73 | -26.08 |
| ML4: Mean minimum monthly flow, April | 56.41 | 42.67 | -24.36 |
| ML5: Mean minimum monthly flow, May | 27.11 | 19.01 | -29.88 |
| ML6: Mean minimum monthly flow, June | 44.10 | 24.27 | -44.98 |
| ML7: Mean minimum monthly flow, July | 64.00 | 60.93 | -4.80 |
| ML8: Mean minimum monthly flow, August | 83.91 | 74.15 | -11.64 |
| ML9: Mean minimum monthly flow, September | 52.99 | 69.68 | 31.50 |
| ML10: Mean minimum monthly flow, October | 57.00 | 89.03 | 56.20 |
| ML11: Mean minimum monthly flow, November | 38.33 | 59.23 | 54.51 |
| ML12: Mean minimum monthly flow, December | 33.88 | 57.80 | 70.63 |
| ML13: CV of minimum monthly flows | 267.63 | 153.74 | -42.56 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.36 | 0.40 | 12.05 |
| ML15: Mean minimum annual flow / mean annual flow | 0.22 | 0.19 | -10.35 |
| ML16: Median minimum annual flow / median annual flow | 0.27 | 0.31 | 15.44 |
| ML20: Ratio of baseflow volume to total flow volume | 0.63 | 0.63 | 0.05 |
| ML22: Mean annual minimum flow divided by catchment area | 0.17 | 0.16 | -6.93 |
| RA1: Mean of positive changes from one day to next (rise rate) | 17.50 | 48.33 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 356.22 | 263.24 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 16.25 | 17.37 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 316.83 | 282.66 |  |
| RA5: Ratio of days that are higher than previous day | 0.39 | 0.19 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.07 | 0.09 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.06 | 0.04 |  |
| RA8: Number of flow reversals from one day to the next | 138.17 | 52.08 |  |
| RA9: CV, number of flow reversals from one day to the next | 23.29 | 44.77 |  |

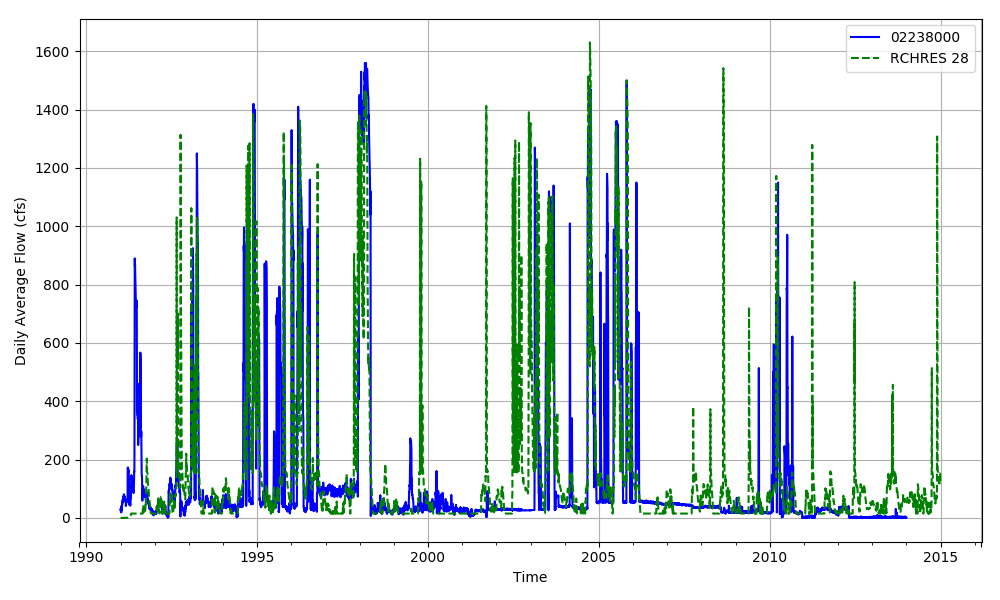


Figure 03080102-22: Daily flow for HSFP reach 28 and USGS station 02238000.

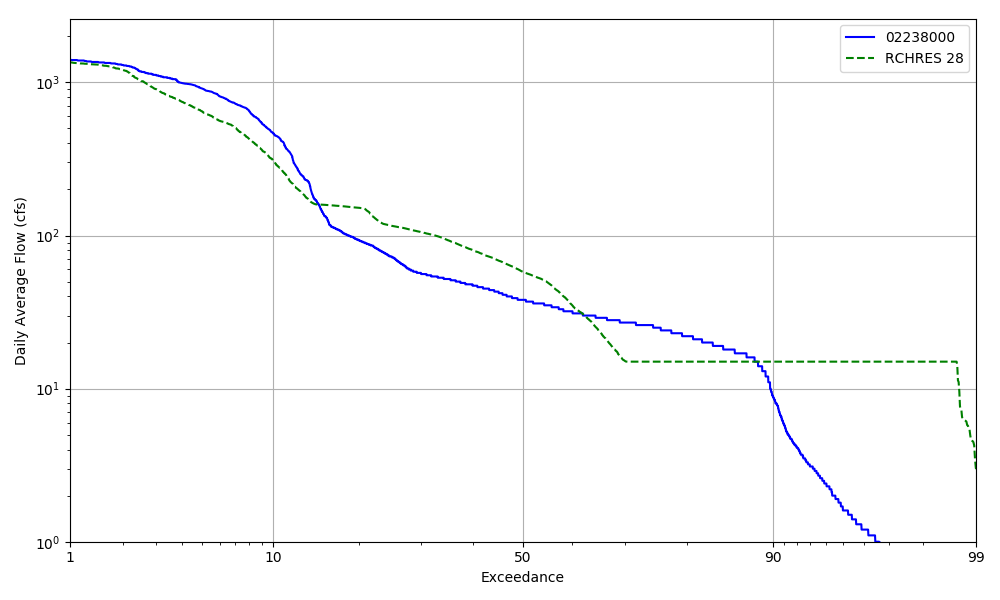


Figure 03080102-23: Daily exceedance for HSFP reach 28 and USGS station 02238000.

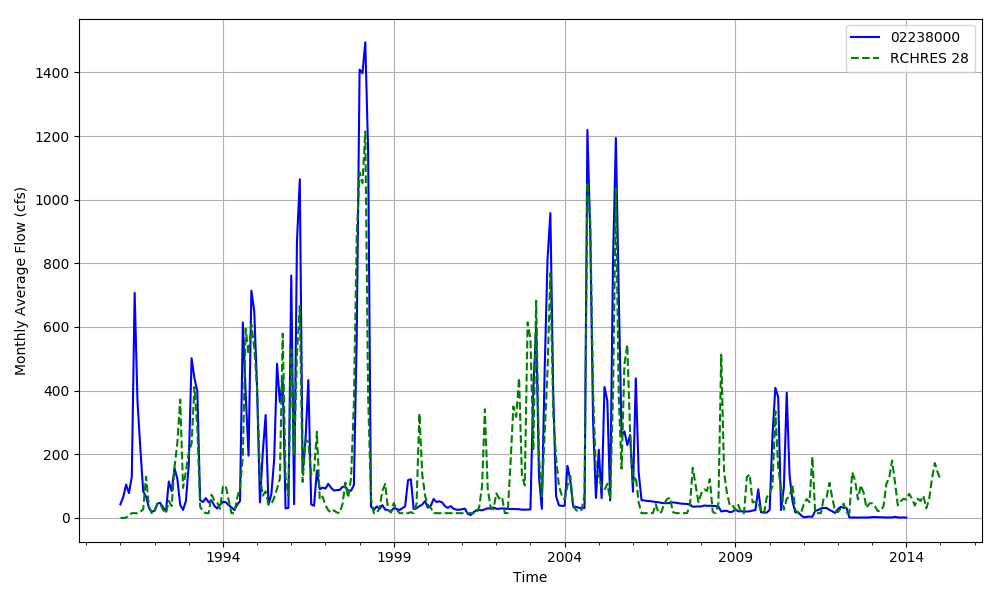


Figure 03080102-24: Monthly flow for HSFP reach 28 and USGS station 02238000.

## HSPF Reach 31, USGS Gauge 02240902

Table 03080102-15: Comparison Statistics Between HSPF Reach 31 and USGS Gauge 02240902.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -21.95 |
| Standard error | 49.11 |
| Relative bias | -0.43 |
| Relative standard error | 0.64 |
| Nash-Sutcliffe coefficient | 0.59 |
| Kling-Gupta coefficient | 0.37 |
| Coefficient of efficiency | 0.42 |
| Index of agreement | 0.68 |

Table 03080102-16: Hydrologic Indices Between USGS Gauge 02240902 and HSPF Reach 31.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02240902 | Simulated Reach 31 | Percent Difference |
| MA1: Mean, all daily flows | 50.51 | 28.29 | -43.99 |
| MA2: Median, all daily flows | 32.00 | 17.98 | -43.81 |
| MA3: CV, all daily flows | 92.16 | 81.15 | -11.94 |
| MA4: CV, log of all daily flows | 101.97 | 102.22 | 0.25 |
| MA5: Mean daily flow / median daily flow | 1.58 | 1.57 | -0.32 |
| MA9: (Q10 - Q90) / median daily flow | 3.34 | 3.53 | 5.74 |
| MA10: (Q20 - Q80) / median daily flow | 2.29 | 2.18 | -4.81 |
| MA11: (Q25 - Q75) / median daily flow | 1.87 | 1.81 | -3.04 |
| MA12: Mean monthly flow, January | 40.75 | 25.69 | -36.96 |
| MA13: Mean monthly flow, February | 59.28 | 40.17 | -32.24 |
| MA14: Mean monthly flow, March | 66.66 | 47.58 | -28.62 |
| MA15: Mean monthly flow, April | 55.37 | 33.21 | -40.01 |
| MA16: Mean monthly flow, May | 36.39 | 19.50 | -46.42 |
| MA17: Mean monthly flow, June | 29.73 | 15.39 | -48.24 |
| MA18: Mean monthly flow, July | 36.61 | 18.24 | -50.17 |
| MA19: Mean monthly flow, August | 39.00 | 20.05 | -48.60 |
| MA20: Mean monthly flow, September | 64.29 | 26.98 | -58.04 |
| MA21: Mean monthly flow, October | 66.55 | 30.75 | -53.79 |
| MA22: Mean monthly flow, November | 36.21 | 21.18 | -41.50 |
| MA23: Mean monthly flow, December | 32.06 | 19.87 | -38.03 |
| ML1: Mean minimum monthly flow, January | 35.01 | 22.63 | -35.36 |
| ML2: Mean minimum monthly flow, February | 39.92 | 29.14 | -27.00 |
| ML3: Mean minimum monthly flow, March | 44.12 | 34.04 | -22.84 |
| ML4: Mean minimum monthly flow, April | 40.40 | 24.39 | -39.61 |
| ML5: Mean minimum monthly flow, May | 28.35 | 14.67 | -48.26 |
| ML6: Mean minimum monthly flow, June | 26.28 | 13.06 | -50.29 |
| ML7: Mean minimum monthly flow, July | 29.28 | 15.79 | -46.08 |
| ML8: Mean minimum monthly flow, August | 33.86 | 17.41 | -48.60 |
| ML9: Mean minimum monthly flow, September | 37.01 | 17.98 | -51.43 |
| ML10: Mean minimum monthly flow, October | 42.72 | 23.63 | -44.68 |
| ML11: Mean minimum monthly flow, November | 30.24 | 18.97 | -37.25 |
| ML12: Mean minimum monthly flow, December | 24.20 | 15.62 | -35.46 |
| ML13: CV of minimum monthly flows | 128.29 | 135.50 | 5.62 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.18 | 0.20 | 10.00 |
| ML15: Mean minimum annual flow / mean annual flow | 0.14 | 0.17 | 22.57 |
| ML16: Median minimum annual flow / median annual flow | 0.09 | 0.07 | -21.08 |
| ML20: Ratio of baseflow volume to total flow volume | 0.89 | 0.93 | 4.55 |
| ML22: Mean annual minimum flow divided by catchment area | 0.10 | 0.07 | -25.46 |
| RA1: Mean of positive changes from one day to next (rise rate) | 3.55 | 1.73 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 380.66 | 380.96 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 1.85 | 0.69 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 242.23 | 246.27 |  |
| RA5: Ratio of days that are higher than previous day | 0.25 | 0.24 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.04 | 0.03 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.03 | 0.02 |  |
| RA8: Number of flow reversals from one day to the next | 69.09 | 50.22 |  |
| RA9: CV, number of flow reversals from one day to the next | 48.36 | 44.63 |  |

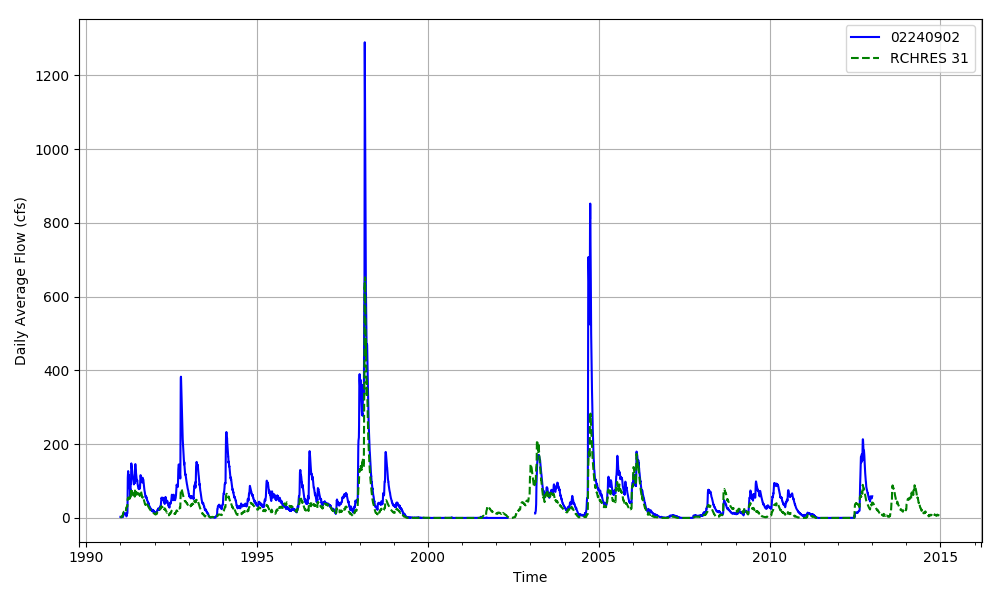


Figure 03080102-25: Daily flow for HSFP reach 31 and USGS station 02240902.

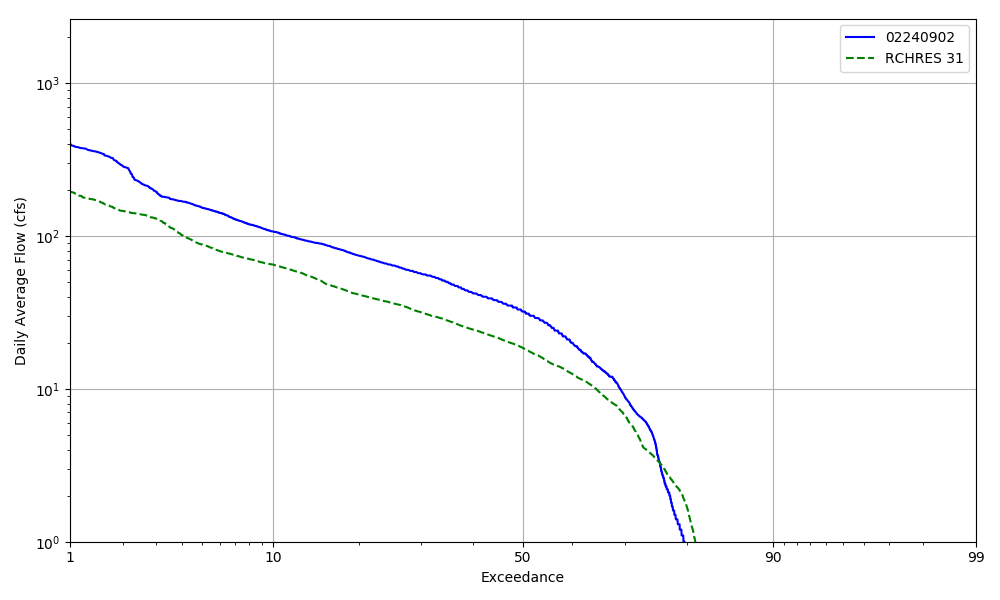


Figure 03080102-26: Daily exceedance for HSFP reach 31 and USGS station 02240902.

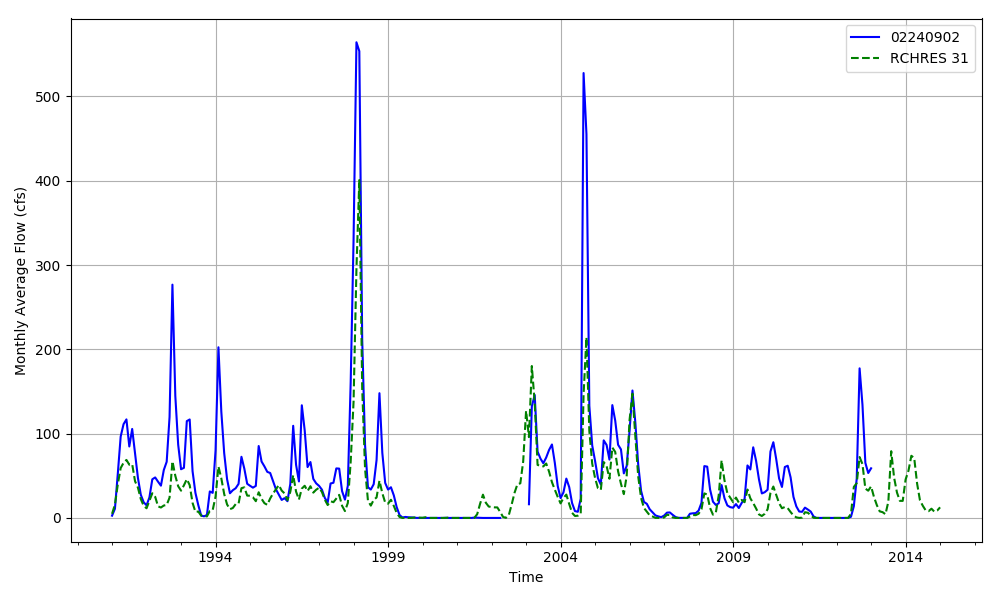


Figure 03080102-27: Monthly flow for HSFP reach 31 and USGS station 02240902.

## HSPF Reach 32, USGS Gauge 02241000

Table 03080102-17: Comparison Statistics Between HSPF Reach 32 and USGS Gauge 02241000.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 6.60 |
| Standard error | 28.27 |
| Relative bias | 0.29 |
| Relative standard error | 0.69 |
| Nash-Sutcliffe coefficient | 0.52 |
| Kling-Gupta coefficient | 0.63 |
| Coefficient of efficiency | 0.29 |
| Index of agreement | 0.66 |

Table 03080102-18: Hydrologic Indices Between USGS Gauge 02241000 and HSPF Reach 32.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02241000 | Simulated Reach 32 | Percent Difference |
| MA1: Mean, all daily flows | 22.61 | 28.83 | 27.51 |
| MA2: Median, all daily flows | 11.39 | 18.13 | 59.13 |
| MA3: CV, all daily flows | 99.67 | 82.95 | -16.78 |
| MA4: CV, log of all daily flows | 120.35 | 102.28 | -15.02 |
| MA5: Mean daily flow / median daily flow | 1.98 | 1.59 | -19.87 |
| MA9: (Q10 - Q90) / median daily flow | 3.86 | 3.55 | -8.13 |
| MA10: (Q20 - Q80) / median daily flow | 2.54 | 2.18 | -14.37 |
| MA11: (Q25 - Q75) / median daily flow | 2.04 | 1.82 | -10.39 |
| MA12: Mean monthly flow, January | 15.09 | 26.59 | 76.15 |
| MA13: Mean monthly flow, February | 25.07 | 42.03 | 67.65 |
| MA14: Mean monthly flow, March | 30.73 | 48.89 | 59.07 |
| MA15: Mean monthly flow, April | 22.70 | 33.85 | 49.11 |
| MA16: Mean monthly flow, May | 18.62 | 19.81 | 6.40 |
| MA17: Mean monthly flow, June | 15.89 | 16.05 | 1.03 |
| MA18: Mean monthly flow, July | 19.79 | 19.07 | -3.65 |
| MA19: Mean monthly flow, August | 20.14 | 21.54 | 6.95 |
| MA20: Mean monthly flow, September | 28.14 | 29.54 | 5.00 |
| MA21: Mean monthly flow, October | 30.67 | 31.65 | 3.20 |
| MA22: Mean monthly flow, November | 16.53 | 21.54 | 30.32 |
| MA23: Mean monthly flow, December | 12.88 | 20.63 | 60.08 |
| ML1: Mean minimum monthly flow, January | 13.20 | 23.17 | 75.56 |
| ML2: Mean minimum monthly flow, February | 14.90 | 29.83 | 100.24 |
| ML3: Mean minimum monthly flow, March | 23.63 | 34.69 | 46.81 |
| ML4: Mean minimum monthly flow, April | 16.61 | 24.65 | 48.41 |
| ML5: Mean minimum monthly flow, May | 15.22 | 14.03 | -7.76 |
| ML6: Mean minimum monthly flow, June | 13.39 | 12.61 | -5.85 |
| ML7: Mean minimum monthly flow, July | 13.92 | 15.78 | 13.30 |
| ML8: Mean minimum monthly flow, August | 15.37 | 17.49 | 13.81 |
| ML9: Mean minimum monthly flow, September | 14.59 | 18.50 | 26.83 |
| ML10: Mean minimum monthly flow, October | 18.06 | 23.93 | 32.50 |
| ML11: Mean minimum monthly flow, November | 11.63 | 19.28 | 65.86 |
| ML12: Mean minimum monthly flow, December | 10.75 | 15.87 | 47.60 |
| ML13: CV of minimum monthly flows | 163.00 | 135.94 | -16.60 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.23 | 0.18 | -18.44 |
| ML15: Mean minimum annual flow / mean annual flow | 0.17 | 0.16 | -4.60 |
| ML16: Median minimum annual flow / median annual flow | 0.20 | 0.06 | -71.53 |
| ML20: Ratio of baseflow volume to total flow volume | 0.84 | 0.91 | 8.41 |
| ML22: Mean annual minimum flow divided by catchment area | 0.04 | 0.07 | 71.73 |
| RA1: Mean of positive changes from one day to next (rise rate) | 2.47 | 1.70 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 356.28 | 399.62 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 1.18 | 0.67 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 312.05 | 250.40 |  |
| RA5: Ratio of days that are higher than previous day | 0.20 | 0.28 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.04 | 0.05 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.03 | 0.02 |  |
| RA8: Number of flow reversals from one day to the next | 52.00 | 89.61 |  |
| RA9: CV, number of flow reversals from one day to the next | 52.91 | 39.28 |  |

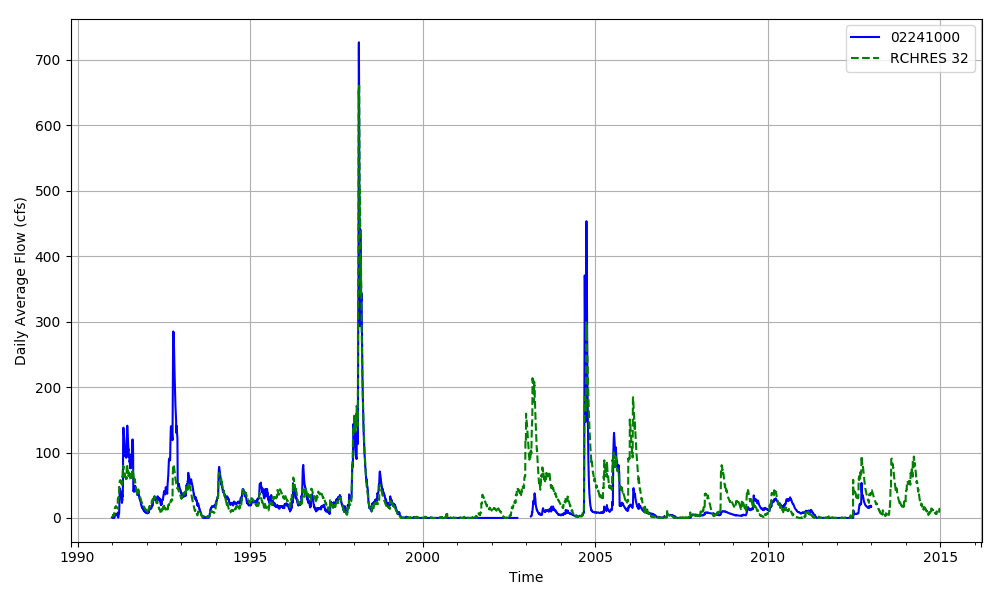


Figure 03080102-28: Daily flow for HSFP reach 32 and USGS station 02241000.

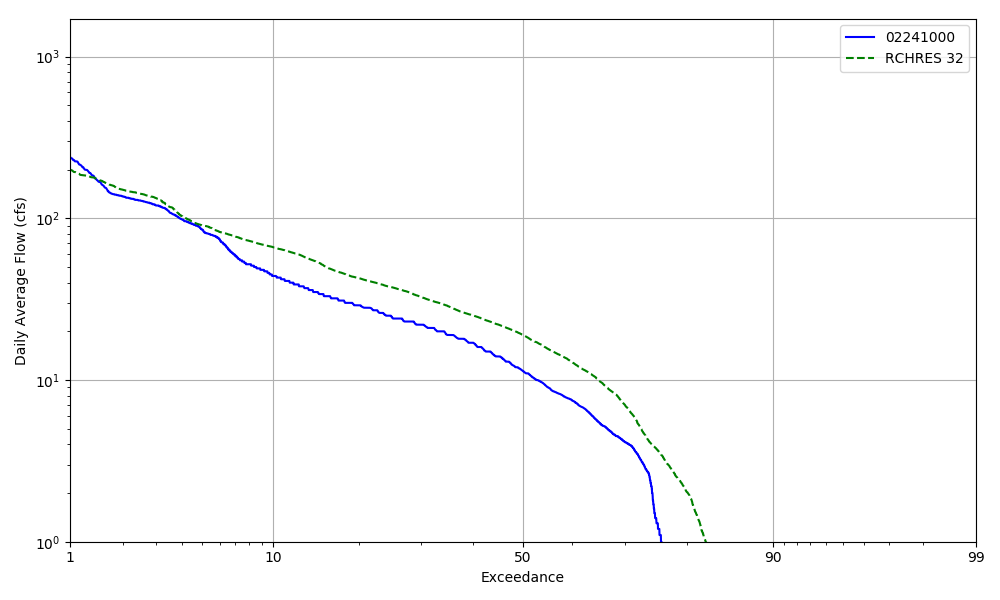


Figure 03080102-29: Daily exceedance for HSFP reach 32 and USGS station 02241000.

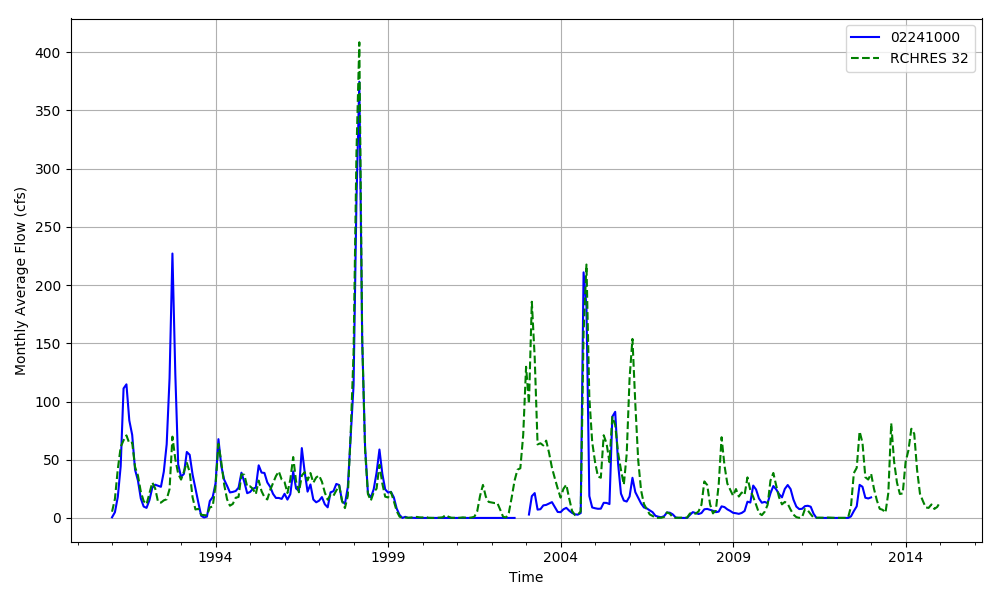


Figure 03080102-30: Monthly flow for HSFP reach 32 and USGS station 02241000.

## HSPF Reach 41, USGS Gauge 02243000

Table 03080102-19: Comparison Statistics Between HSPF Reach 41 and USGS Gauge 02243000.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 6.77 |
| Standard error | 50.27 |
| Relative bias | 0.15 |
| Relative standard error | 0.44 |
| Nash-Sutcliffe coefficient | 0.80 |
| Kling-Gupta coefficient | 0.82 |
| Coefficient of efficiency | 0.51 |
| Index of agreement | 0.76 |

Table 03080102-20: Hydrologic Indices Between USGS Gauge 02243000 and HSPF Reach 41.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02243000 | Simulated Reach 41 | Percent Difference |
| MA1: Mean, all daily flows | 45.68 | 52.41 | 14.74 |
| MA2: Median, all daily flows | 12.00 | 13.47 | 12.25 |
| MA3: CV, all daily flows | 119.81 | 136.22 | 13.70 |
| MA4: CV, log of all daily flows | 144.37 | 149.78 | 3.75 |
| MA5: Mean daily flow / median daily flow | 3.81 | 3.89 | 2.21 |
| MA9: (Q10 - Q90) / median daily flow | 7.52 | 8.58 | 14.20 |
| MA10: (Q20 - Q80) / median daily flow | 3.57 | 3.94 | 10.48 |
| MA11: (Q25 - Q75) / median daily flow | 2.51 | 2.81 | 11.90 |
| MA12: Mean monthly flow, January | 48.40 | 70.60 | 45.85 |
| MA13: Mean monthly flow, February | 64.21 | 85.24 | 32.75 |
| MA14: Mean monthly flow, March | 76.54 | 86.82 | 13.43 |
| MA15: Mean monthly flow, April | 44.20 | 47.35 | 7.13 |
| MA16: Mean monthly flow, May | 20.65 | 22.65 | 9.69 |
| MA17: Mean monthly flow, June | 23.78 | 33.15 | 39.39 |
| MA18: Mean monthly flow, July | 35.17 | 38.95 | 10.76 |
| MA19: Mean monthly flow, August | 37.10 | 41.39 | 11.57 |
| MA20: Mean monthly flow, September | 44.52 | 53.34 | 19.80 |
| MA21: Mean monthly flow, October | 68.39 | 56.38 | -17.56 |
| MA22: Mean monthly flow, November | 30.08 | 23.55 | -21.70 |
| MA23: Mean monthly flow, December | 35.58 | 47.33 | 33.02 |
| ML1: Mean minimum monthly flow, January | 33.37 | 38.47 | 15.29 |
| ML2: Mean minimum monthly flow, February | 30.37 | 34.74 | 14.41 |
| ML3: Mean minimum monthly flow, March | 53.78 | 42.76 | -20.49 |
| ML4: Mean minimum monthly flow, April | 24.08 | 20.21 | -16.09 |
| ML5: Mean minimum monthly flow, May | 9.83 | 6.63 | -32.50 |
| ML6: Mean minimum monthly flow, June | 8.11 | 7.79 | -3.98 |
| ML7: Mean minimum monthly flow, July | 18.29 | 14.93 | -18.37 |
| ML8: Mean minimum monthly flow, August | 16.68 | 15.21 | -8.81 |
| ML9: Mean minimum monthly flow, September | 13.41 | 8.35 | -37.78 |
| ML10: Mean minimum monthly flow, October | 32.00 | 19.51 | -39.02 |
| ML11: Mean minimum monthly flow, November | 19.90 | 11.07 | -44.35 |
| ML12: Mean minimum monthly flow, December | 18.94 | 11.18 | -40.97 |
| ML13: CV of minimum monthly flows | 313.24 | 316.91 | 1.17 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.23 | 0.14 | -37.41 |
| ML15: Mean minimum annual flow / mean annual flow | 0.13 | 0.07 | -49.71 |
| ML16: Median minimum annual flow / median annual flow | 0.19 | 0.13 | -32.48 |
| ML20: Ratio of baseflow volume to total flow volume | 0.72 | 0.62 | -13.80 |
| ML22: Mean annual minimum flow divided by catchment area | 0.04 | 0.03 | -28.90 |
| RA1: Mean of positive changes from one day to next (rise rate) | 11.74 | 16.39 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 315.44 | 315.80 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 4.48 | 6.64 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 264.06 | 263.29 |  |
| RA5: Ratio of days that are higher than previous day | 0.25 | 0.29 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.15 | 0.20 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.08 | 0.11 |  |
| RA8: Number of flow reversals from one day to the next | 86.50 | 78.25 |  |
| RA9: CV, number of flow reversals from one day to the next | 24.81 | 21.82 |  |

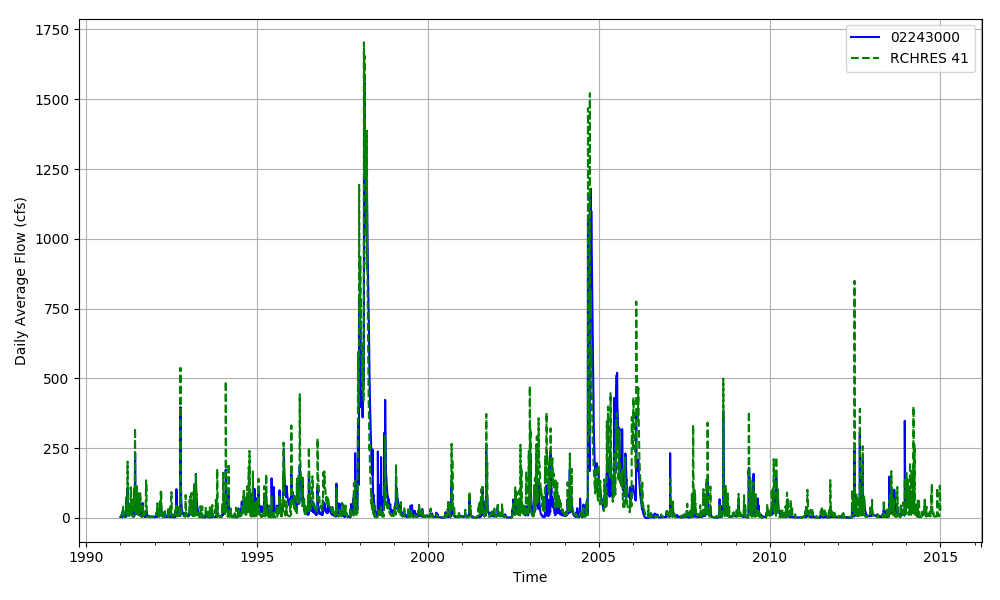


Figure 03080102-31: Daily flow for HSFP reach 41 and USGS station 02243000.

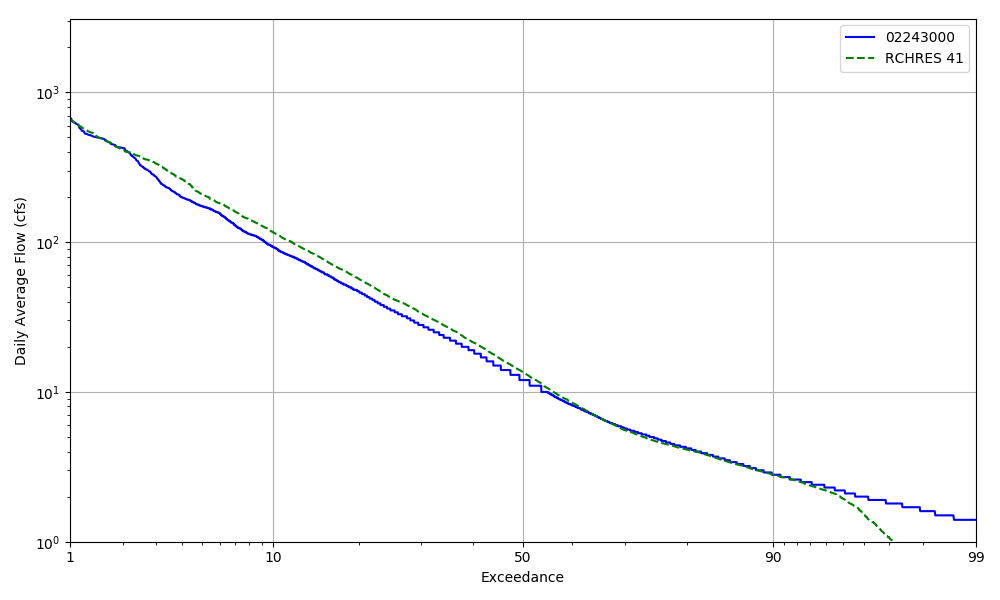


Figure 03080102-32: Daily exceedance for HSFP reach 41 and USGS station 02243000.

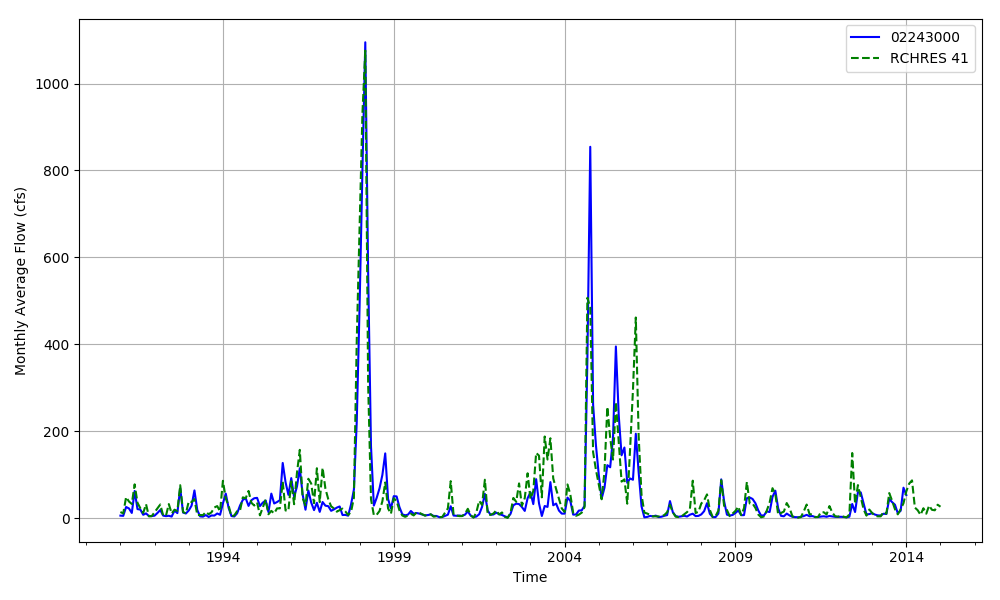


Figure 03080102-33: Monthly flow for HSFP reach 41 and USGS station 02243000.

## HSPF Reach 47, USGS Gauge 02243960

Table 03080102-21: Comparison Statistics Between HSPF Reach 47 and USGS Gauge 02243960.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -51.08 |
| Standard error | 352.32 |
| Relative bias | -0.05 |
| Relative standard error | 0.48 |
| Nash-Sutcliffe coefficient | 0.77 |
| Kling-Gupta coefficient | 0.81 |
| Coefficient of efficiency | 0.51 |
| Index of agreement | 0.74 |

Table 03080102-22: Hydrologic Indices Between USGS Gauge 02243960 and HSPF Reach 47.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02243960 | Simulated Reach 47 | Percent Difference |
| MA1: Mean, all daily flows | 1049.25 | 1000.39 | -4.66 |
| MA2: Median, all daily flows | 811.50 | 772.20 | -4.84 |
| MA3: CV, all daily flows | 58.23 | 51.28 | -11.94 |
| MA4: CV, log of all daily flows | 64.03 | 51.23 | -19.98 |
| MA5: Mean daily flow / median daily flow | 1.29 | 1.30 | 0.20 |
| MA9: (Q10 - Q90) / median daily flow | 2.00 | 1.55 | -22.62 |
| MA10: (Q20 - Q80) / median daily flow | 1.18 | 0.82 | -30.00 |
| MA11: (Q25 - Q75) / median daily flow | 0.89 | 0.62 | -30.83 |
| MA12: Mean monthly flow, January | 1205.61 | 1023.41 | -15.11 |
| MA13: Mean monthly flow, February | 1127.56 | 1035.89 | -8.13 |
| MA14: Mean monthly flow, March | 1046.04 | 1067.01 | 2.00 |
| MA15: Mean monthly flow, April | 891.78 | 850.04 | -4.68 |
| MA16: Mean monthly flow, May | 658.44 | 680.04 | 3.28 |
| MA17: Mean monthly flow, June | 789.88 | 804.99 | 1.91 |
| MA18: Mean monthly flow, July | 955.69 | 966.80 | 1.16 |
| MA19: Mean monthly flow, August | 1058.89 | 1024.98 | -3.20 |
| MA20: Mean monthly flow, September | 1152.23 | 1146.31 | -0.51 |
| MA21: Mean monthly flow, October | 1082.49 | 1135.75 | 4.92 |
| MA22: Mean monthly flow, November | 1012.46 | 869.95 | -14.08 |
| MA23: Mean monthly flow, December | 1152.15 | 938.49 | -18.54 |
| ML1: Mean minimum monthly flow, January | 798.04 | 773.36 | -3.09 |
| ML2: Mean minimum monthly flow, February | 729.70 | 759.56 | 4.09 |
| ML3: Mean minimum monthly flow, March | 663.17 | 803.29 | 21.13 |
| ML4: Mean minimum monthly flow, April | 560.00 | 669.81 | 19.61 |
| ML5: Mean minimum monthly flow, May | 427.26 | 590.72 | 38.26 |
| ML6: Mean minimum monthly flow, June | 490.13 | 618.19 | 26.13 |
| ML7: Mean minimum monthly flow, July | 629.22 | 738.38 | 17.35 |
| ML8: Mean minimum monthly flow, August | 698.87 | 776.18 | 11.06 |
| ML9: Mean minimum monthly flow, September | 601.35 | 762.69 | 26.83 |
| ML10: Mean minimum monthly flow, October | 668.61 | 802.24 | 19.99 |
| ML11: Mean minimum monthly flow, November | 689.39 | 726.97 | 5.45 |
| ML12: Mean minimum monthly flow, December | 662.96 | 711.72 | 7.36 |
| ML13: CV of minimum monthly flows | 70.52 | 43.56 | -38.23 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.40 | 0.68 | 68.72 |
| ML15: Mean minimum annual flow / mean annual flow | 0.34 | 0.58 | 70.24 |
| ML16: Median minimum annual flow / median annual flow | 0.38 | 0.68 | 79.26 |
| ML20: Ratio of baseflow volume to total flow volume | 0.72 | 0.82 | 12.97 |
| ML22: Mean annual minimum flow divided by catchment area | 3.13 | 5.44 | 73.77 |
| RA1: Mean of positive changes from one day to next (rise rate) | 114.03 | 99.20 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 216.03 | 305.94 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 118.86 | 36.21 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 197.01 | 199.99 |  |
| RA5: Ratio of days that are higher than previous day | 0.39 | 0.27 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.01 | 0.03 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.02 | 0.02 |  |
| RA8: Number of flow reversals from one day to the next | 80.04 | 61.33 |  |
| RA9: CV, number of flow reversals from one day to the next | 22.74 | 18.60 |  |

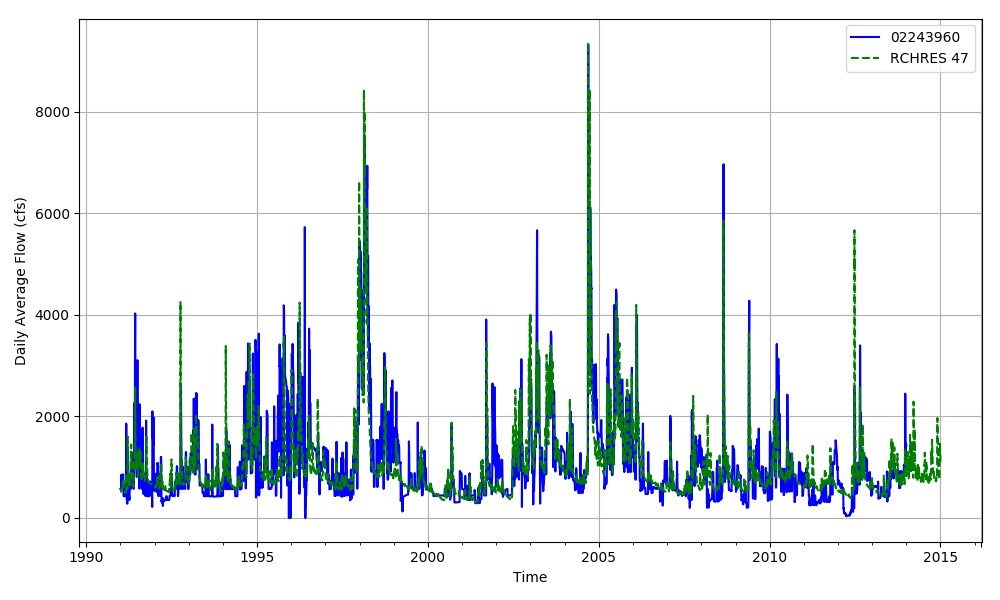


Figure 03080102-34: Daily flow for HSFP reach 47 and USGS station 02243960.

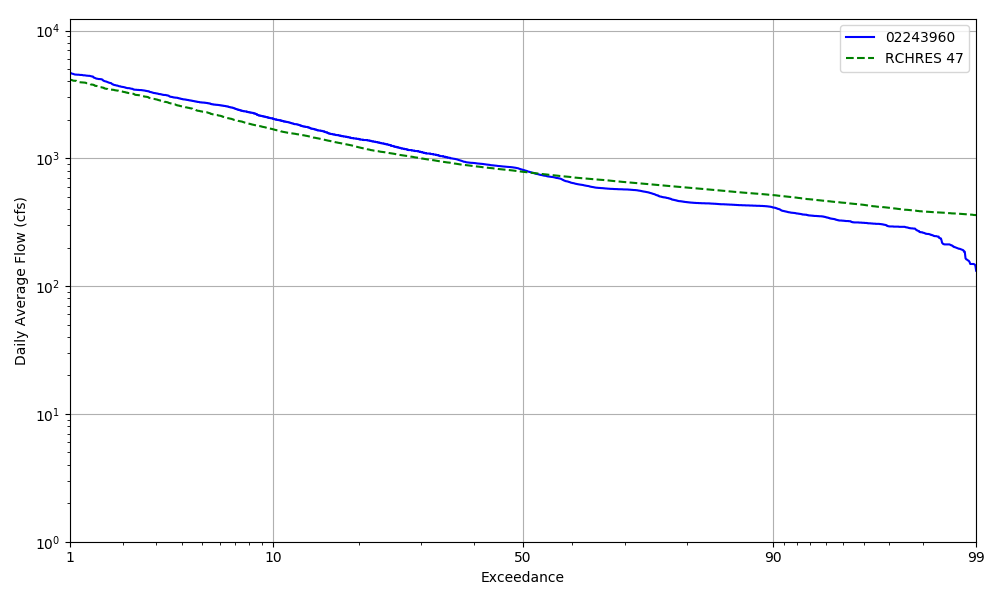


Figure 03080102-35: Daily exceedance for HSFP reach 47 and USGS station 02243960.

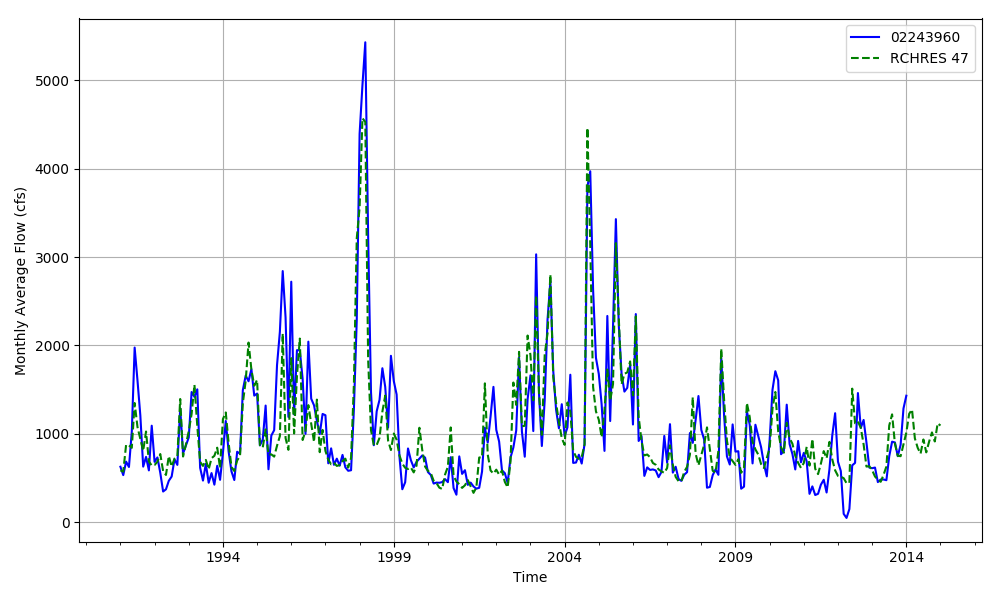


Figure 03080102-36: Monthly flow for HSFP reach 47 and USGS station 02243960.