# Appendix for Model 03120003

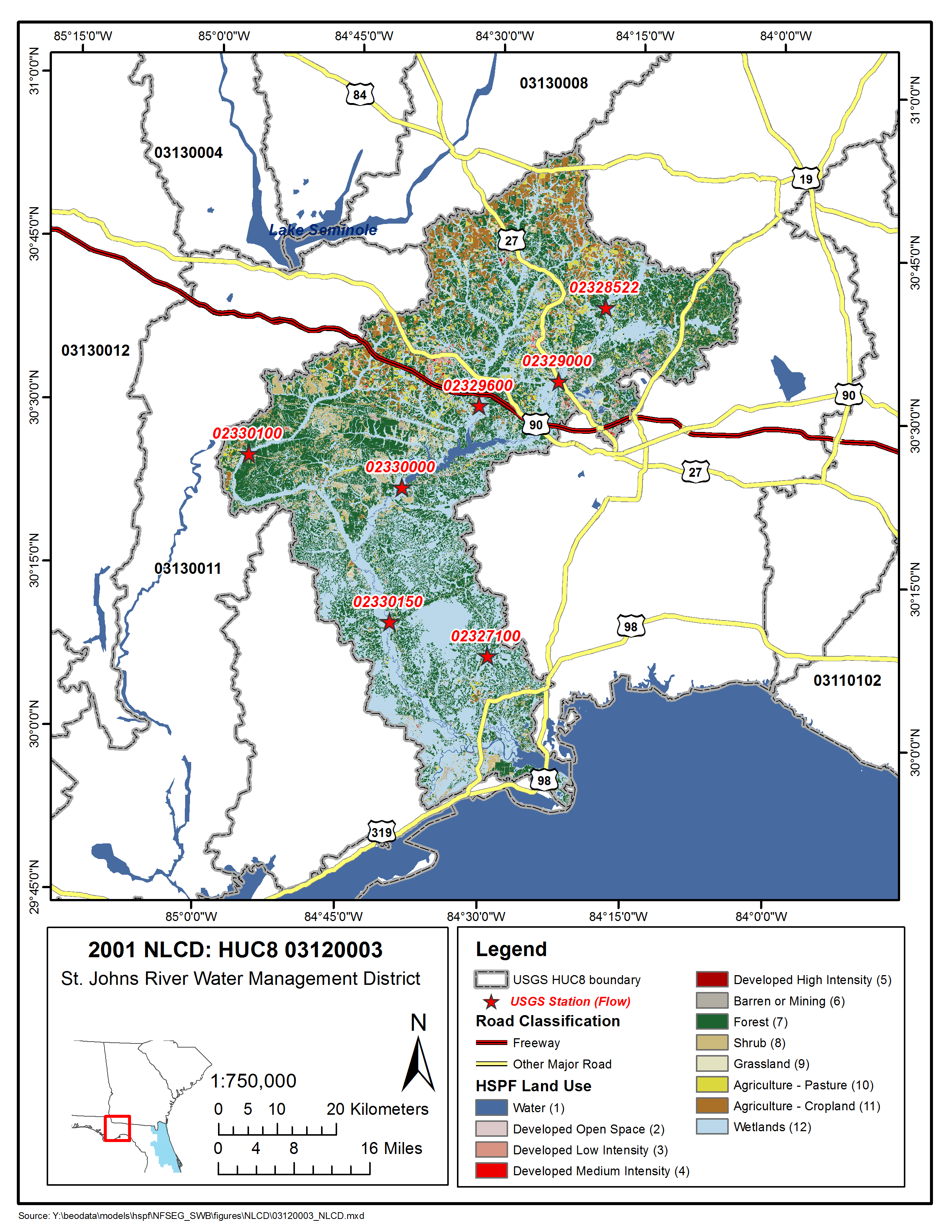


Figure 03120003-1: Land Cover from the National Land Cover Database.

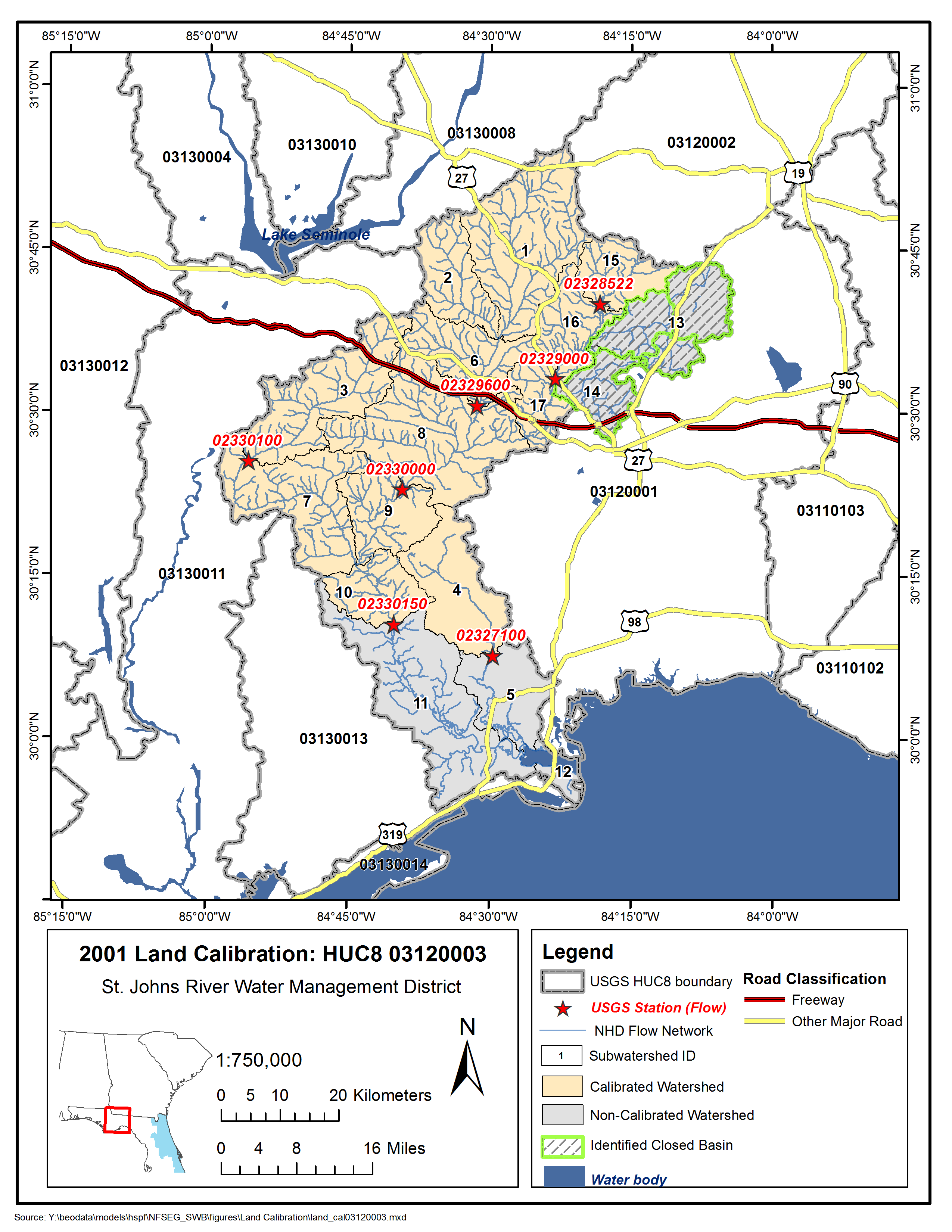


Figure 03120003-2: Calibrated sub-watersheds.

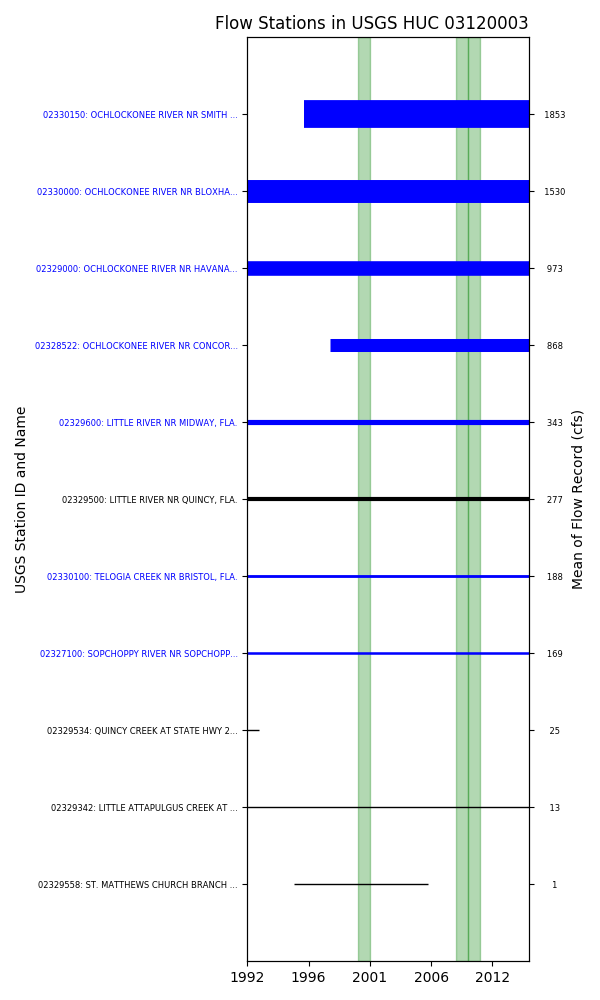


Figure 03120003-3: Station period of record. Blue color identifies gauges used for calibration.

## HSPF Reach 03, USGS Gauge 02330100

Table 03120003-1: Comparison Statistics Between HSPF Reach 03 and USGS Gauge 02330100.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -42.09 |
| Standard error | 86.86 |
| Relative bias | -0.22 |
| Relative standard error | 0.52 |
| Nash-Sutcliffe coefficient | 0.73 |
| Coefficient of efficiency | 0.50 |
| Index of agreement | 0.76 |

Table 03120003-2: Hydrologic Indices Between USGS Gauge 02330100 and HSPF Reach 03.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02330100 | Simulated Reach 03 | Percent Difference |
| MA1: Mean, all daily flows | 193.64 | 151.70 | -21.66 |
| MA2: Median, all daily flows | 107.00 | 82.66 | -22.75 |
| MA3: CV, all daily flows | 151.41 | 122.22 | -19.28 |
| MA4: CV, log of all daily flows | 92.93 | 98.19 | 5.67 |
| MA5: Mean daily flow / median daily flow | 1.81 | 1.84 | 1.41 |
| MA9: (Q10 - Q90) / median daily flow | 3.21 | 3.85 | 20.15 |
| MA10: (Q20 - Q80) / median daily flow | 1.40 | 2.19 | 56.38 |
| MA11: (Q25 - Q75) / median daily flow | 1.04 | 1.74 | 68.12 |
| MA12: Mean monthly flow, January | 224.79 | 192.22 | -14.49 |
| MA13: Mean monthly flow, February | 252.83 | 233.96 | -7.46 |
| MA14: Mean monthly flow, March | 298.44 | 271.76 | -8.94 |
| MA15: Mean monthly flow, April | 204.44 | 177.75 | -13.05 |
| MA16: Mean monthly flow, May | 142.48 | 105.28 | -26.11 |
| MA17: Mean monthly flow, June | 133.93 | 92.32 | -31.07 |
| MA18: Mean monthly flow, July | 171.98 | 114.37 | -33.50 |
| MA19: Mean monthly flow, August | 220.28 | 139.27 | -36.77 |
| MA20: Mean monthly flow, September | 145.83 | 103.67 | -28.91 |
| MA21: Mean monthly flow, October | 148.02 | 114.43 | -22.69 |
| MA22: Mean monthly flow, November | 135.78 | 95.99 | -29.31 |
| MA23: Mean monthly flow, December | 162.64 | 114.57 | -29.56 |
| ML1: Mean minimum monthly flow, January | 101.96 | 67.99 | -33.32 |
| ML2: Mean minimum monthly flow, February | 104.91 | 97.81 | -6.77 |
| ML3: Mean minimum monthly flow, March | 106.74 | 114.13 | 6.92 |
| ML4: Mean minimum monthly flow, April | 82.04 | 77.91 | -5.04 |
| ML5: Mean minimum monthly flow, May | 59.87 | 39.22 | -34.49 |
| ML6: Mean minimum monthly flow, June | 56.17 | 38.31 | -31.80 |
| ML7: Mean minimum monthly flow, July | 69.91 | 54.73 | -21.71 |
| ML8: Mean minimum monthly flow, August | 74.74 | 64.02 | -14.35 |
| ML9: Mean minimum monthly flow, September | 63.61 | 44.92 | -29.38 |
| ML10: Mean minimum monthly flow, October | 64.39 | 40.31 | -37.39 |
| ML11: Mean minimum monthly flow, November | 76.22 | 45.54 | -40.25 |
| ML12: Mean minimum monthly flow, December | 89.17 | 51.74 | -41.98 |
| ML13: CV of minimum monthly flows | 53.85 | 92.05 | 70.93 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.38 | 0.13 | -64.88 |
| ML15: Mean minimum annual flow / mean annual flow | 0.24 | 0.09 | -62.10 |
| ML16: Median minimum annual flow / median annual flow | 0.36 | 0.09 | -75.88 |
| ML20: Ratio of baseflow volume to total flow volume | 0.47 | 0.53 | 13.94 |
| ML22: Mean annual minimum flow divided by catchment area | 0.43 | 0.14 | -68.00 |
| RA1: Mean of positive changes from one day to next (rise rate) | 105.52 | 51.97 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 359.01 | 459.53 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 53.29 | 23.02 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 414.87 | 444.64 |  |
| RA5: Ratio of days that are higher than previous day | 0.32 | 0.31 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.18 | 0.11 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.08 | 0.07 |  |
| RA8: Number of flow reversals from one day to the next | 87.88 | 97.50 |  |
| RA9: CV, number of flow reversals from one day to the next | 18.12 | 25.79 |  |

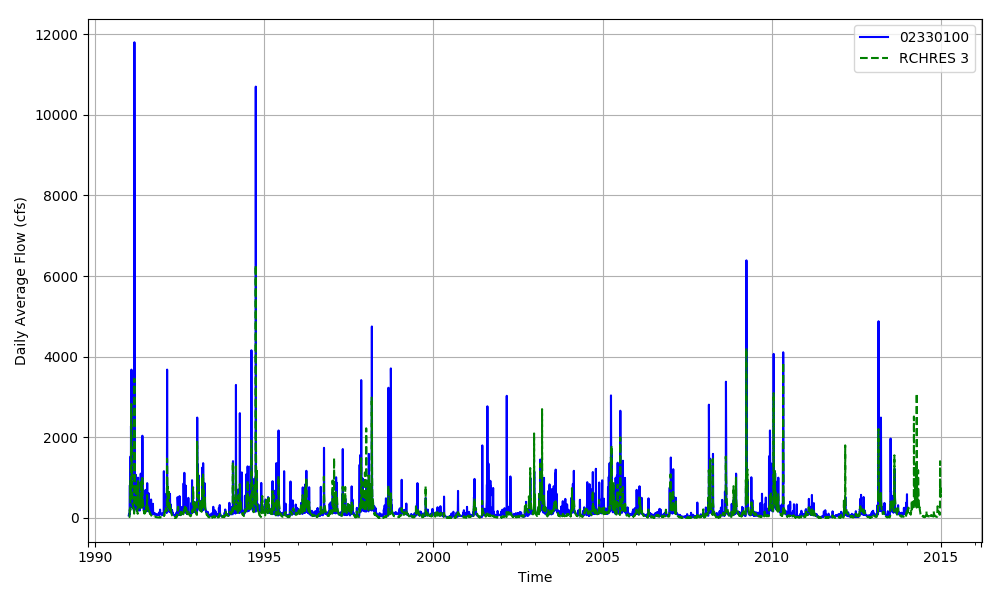


Figure 03120003-4: Daily flow for HSFP reach 03 and USGS station 02330100.

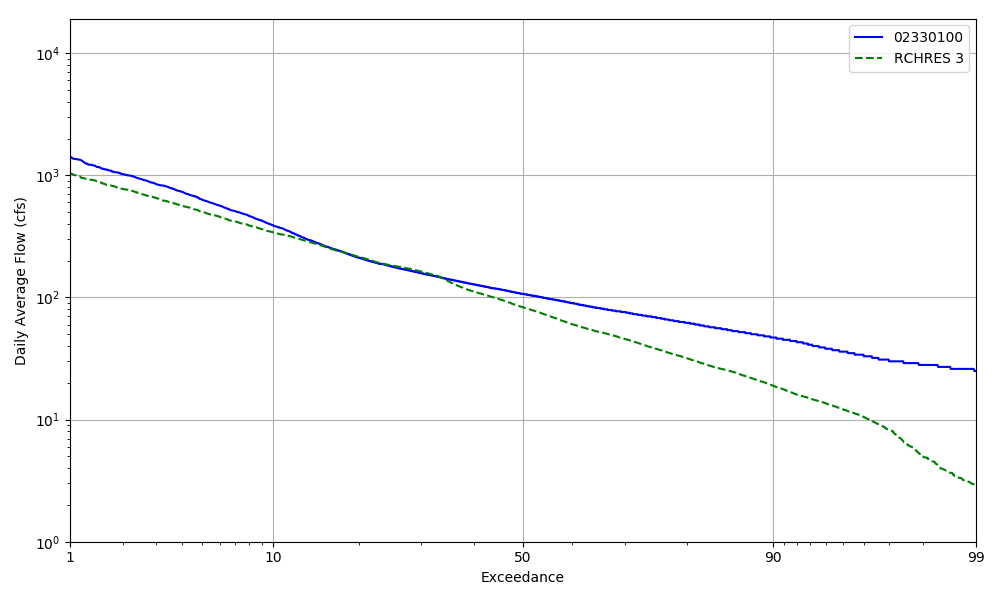


Figure 03120003-5: Daily exceedance for HSFP reach 03 and USGS station 02330100.

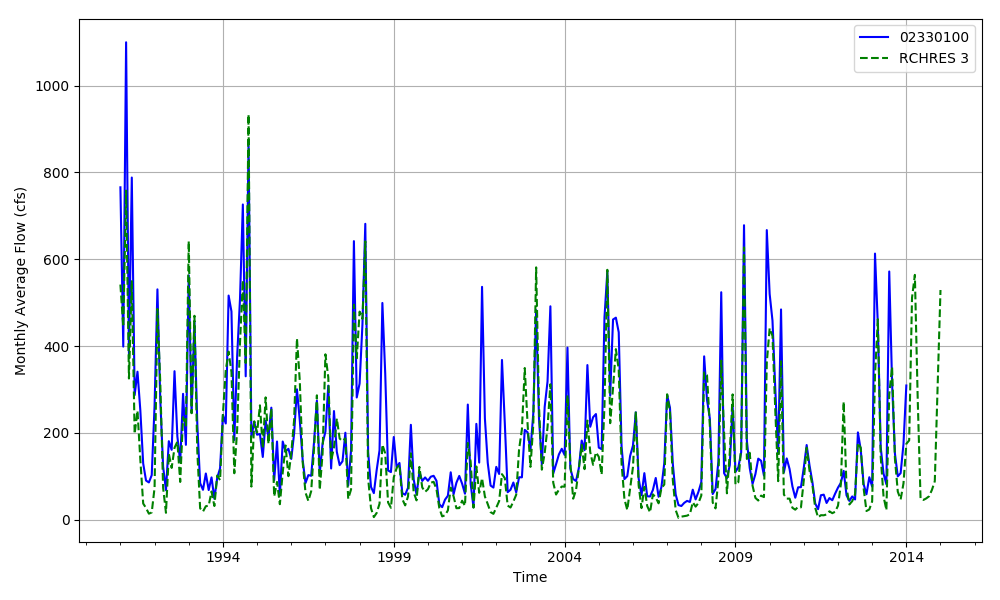


Figure 03120003-6: Monthly flow for HSFP reach 03 and USGS station 02330100.

## HSPF Reach 04, USGS Gauge 02327100

Table 03120003-3: Comparison Statistics Between HSPF Reach 04 and USGS Gauge 02327100.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -66.06 |
| Standard error | 186.52 |
| Relative bias | -0.38 |
| Relative standard error | 0.81 |
| Nash-Sutcliffe coefficient | 0.34 |
| Coefficient of efficiency | 0.46 |
| Index of agreement | 0.71 |

Table 03120003-4: Hydrologic Indices Between USGS Gauge 02327100 and HSPF Reach 04.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02327100 | Simulated Reach 04 | Percent Difference |
| MA1: Mean, all daily flows | 173.18 | 108.00 | -37.64 |
| MA2: Median, all daily flows | 40.00 | 37.73 | -5.67 |
| MA3: CV, all daily flows | 205.16 | 166.70 | -18.75 |
| MA4: CV, log of all daily flows | 152.08 | 138.66 | -8.82 |
| MA5: Mean daily flow / median daily flow | 4.33 | 2.86 | -33.89 |
| MA9: (Q10 - Q90) / median daily flow | 10.94 | 5.31 | -51.50 |
| MA10: (Q20 - Q80) / median daily flow | 5.67 | 2.25 | -60.30 |
| MA11: (Q25 - Q75) / median daily flow | 4.12 | 1.81 | -56.16 |
| MA12: Mean monthly flow, January | 217.25 | 147.73 | -32.00 |
| MA13: Mean monthly flow, February | 227.64 | 172.84 | -24.08 |
| MA14: Mean monthly flow, March | 307.12 | 186.21 | -39.37 |
| MA15: Mean monthly flow, April | 109.29 | 116.55 | 6.65 |
| MA16: Mean monthly flow, May | 53.05 | 56.36 | 6.25 |
| MA17: Mean monthly flow, June | 157.05 | 52.17 | -66.78 |
| MA18: Mean monthly flow, July | 203.90 | 95.28 | -53.27 |
| MA19: Mean monthly flow, August | 286.28 | 117.02 | -59.12 |
| MA20: Mean monthly flow, September | 197.02 | 63.52 | -67.76 |
| MA21: Mean monthly flow, October | 97.65 | 73.15 | -25.09 |
| MA22: Mean monthly flow, November | 40.96 | 60.93 | 48.78 |
| MA23: Mean monthly flow, December | 113.78 | 106.75 | -6.17 |
| ML1: Mean minimum monthly flow, January | 50.81 | 33.08 | -34.89 |
| ML2: Mean minimum monthly flow, February | 53.19 | 44.22 | -16.86 |
| ML3: Mean minimum monthly flow, March | 49.27 | 50.12 | 1.73 |
| ML4: Mean minimum monthly flow, April | 11.72 | 34.09 | 190.91 |
| ML5: Mean minimum monthly flow, May | 6.84 | 21.89 | 220.12 |
| ML6: Mean minimum monthly flow, June | 4.33 | 21.02 | 385.67 |
| ML7: Mean minimum monthly flow, July | 42.16 | 31.85 | -24.46 |
| ML8: Mean minimum monthly flow, August | 52.14 | 40.05 | -23.18 |
| ML9: Mean minimum monthly flow, September | 21.56 | 28.12 | 30.43 |
| ML10: Mean minimum monthly flow, October | 10.40 | 23.37 | 124.79 |
| ML11: Mean minimum monthly flow, November | 8.01 | 23.08 | 188.32 |
| ML12: Mean minimum monthly flow, December | 19.54 | 28.27 | 44.72 |
| ML13: CV of minimum monthly flows | 175.02 | 72.57 | -58.54 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.08 | 0.34 | 339.41 |
| ML15: Mean minimum annual flow / mean annual flow | 0.01 | 0.19 | 1204.14 |
| ML16: Median minimum annual flow / median annual flow | 0.05 | 0.31 | 541.18 |
| ML20: Ratio of baseflow volume to total flow volume | 0.30 | 0.40 | 33.68 |
| ML22: Mean annual minimum flow divided by catchment area | 0.02 | 0.13 | 601.98 |
| RA1: Mean of positive changes from one day to next (rise rate) | 87.90 | 65.74 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 378.80 | 346.06 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 35.05 | 21.53 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 353.35 | 362.05 |  |
| RA5: Ratio of days that are higher than previous day | 0.27 | 0.25 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.22 | 0.07 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.14 | 0.04 |  |
| RA8: Number of flow reversals from one day to the next | 69.54 | 61.92 |  |
| RA9: CV, number of flow reversals from one day to the next | 21.56 | 19.24 |  |

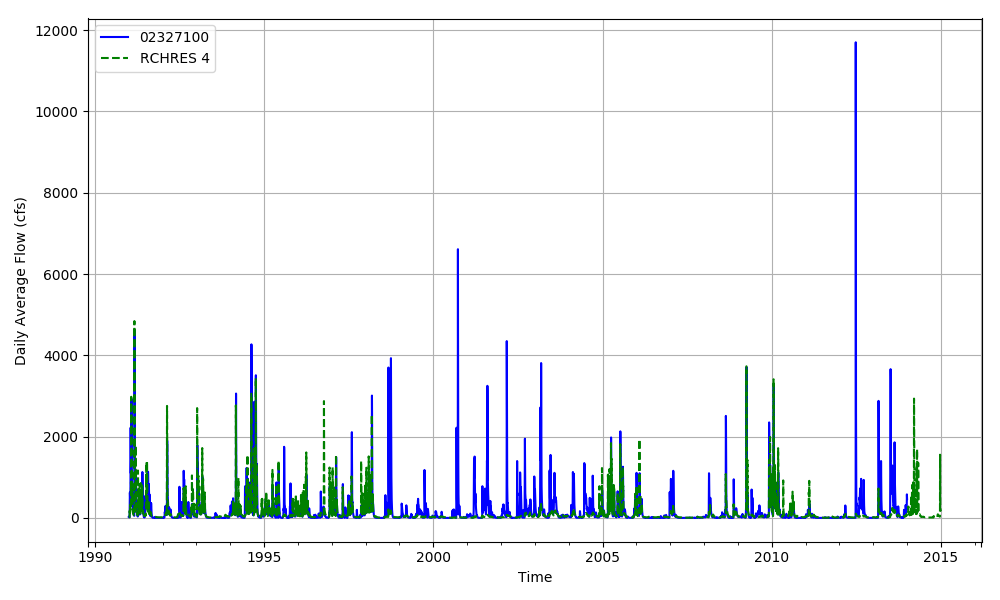


Figure 03120003-7: Daily flow for HSFP reach 04 and USGS station 02327100.

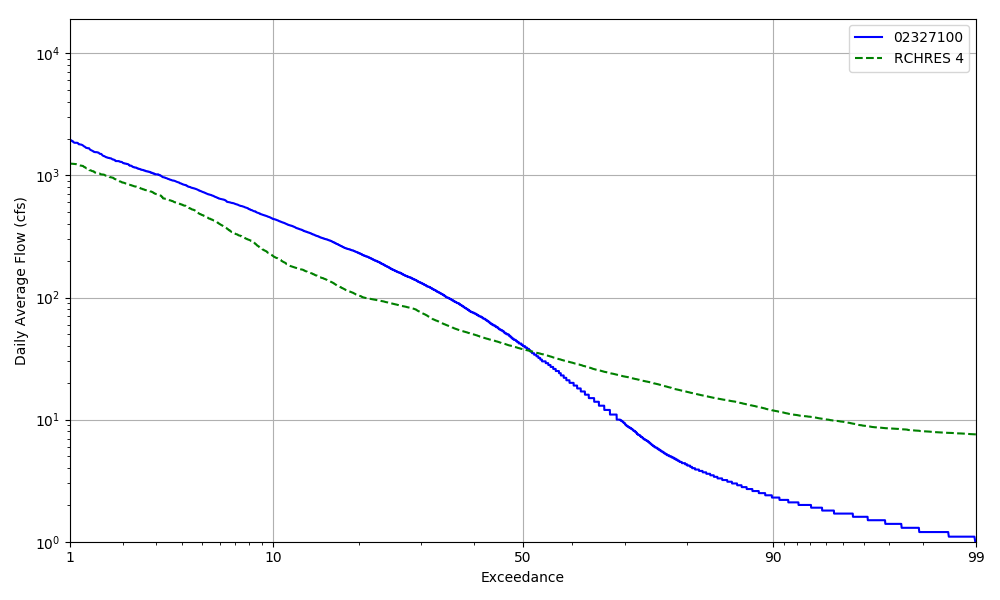


Figure 03120003-8: Daily exceedance for HSFP reach 04 and USGS station 02327100.

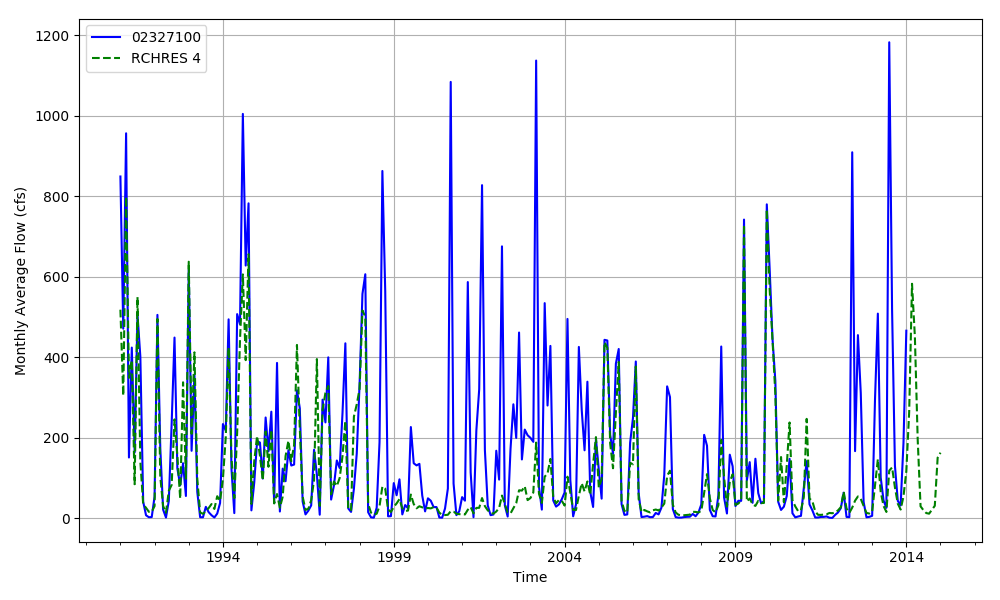


Figure 03120003-9: Monthly flow for HSFP reach 04 and USGS station 02327100.

## HSPF Reach 06, USGS Gauge 02329600

Table 03120003-5: Comparison Statistics Between HSPF Reach 06 and USGS Gauge 02329600.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -20.38 |
| Standard error | 165.19 |
| Relative bias | -0.06 |
| Relative standard error | 0.42 |
| Nash-Sutcliffe coefficient | 0.82 |
| Coefficient of efficiency | 0.63 |
| Index of agreement | 0.81 |

Table 03120003-6: Hydrologic Indices Between USGS Gauge 02329600 and HSPF Reach 06.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02329600 | Simulated Reach 06 | Percent Difference |
| MA1: Mean, all daily flows | 351.88 | 331.70 | -5.73 |
| MA2: Median, all daily flows | 162.00 | 175.05 | 8.05 |
| MA3: CV, all daily flows | 182.96 | 126.74 | -30.73 |
| MA4: CV, log of all daily flows | 115.87 | 101.89 | -12.07 |
| MA5: Mean daily flow / median daily flow | 2.17 | 1.89 | -12.76 |
| MA9: (Q10 - Q90) / median daily flow | 4.35 | 3.88 | -10.85 |
| MA10: (Q20 - Q80) / median daily flow | 2.01 | 2.08 | 3.16 |
| MA11: (Q25 - Q75) / median daily flow | 1.48 | 1.63 | 10.21 |
| MA12: Mean monthly flow, January | 429.82 | 430.54 | 0.17 |
| MA13: Mean monthly flow, February | 525.24 | 540.77 | 2.96 |
| MA14: Mean monthly flow, March | 687.41 | 645.22 | -6.14 |
| MA15: Mean monthly flow, April | 392.53 | 369.50 | -5.87 |
| MA16: Mean monthly flow, May | 208.93 | 206.20 | -1.31 |
| MA17: Mean monthly flow, June | 204.84 | 194.49 | -5.05 |
| MA18: Mean monthly flow, July | 261.61 | 268.19 | 2.52 |
| MA19: Mean monthly flow, August | 392.17 | 319.95 | -18.41 |
| MA20: Mean monthly flow, September | 221.59 | 196.63 | -11.27 |
| MA21: Mean monthly flow, October | 265.31 | 215.85 | -18.64 |
| MA22: Mean monthly flow, November | 219.33 | 200.68 | -8.50 |
| MA23: Mean monthly flow, December | 266.78 | 252.32 | -5.42 |
| ML1: Mean minimum monthly flow, January | 160.42 | 157.61 | -1.75 |
| ML2: Mean minimum monthly flow, February | 175.13 | 214.91 | 22.71 |
| ML3: Mean minimum monthly flow, March | 192.48 | 259.68 | 34.92 |
| ML4: Mean minimum monthly flow, April | 115.57 | 166.93 | 44.45 |
| ML5: Mean minimum monthly flow, May | 64.67 | 88.93 | 37.53 |
| ML6: Mean minimum monthly flow, June | 53.33 | 86.57 | 62.32 |
| ML7: Mean minimum monthly flow, July | 74.30 | 136.50 | 83.73 |
| ML8: Mean minimum monthly flow, August | 96.00 | 151.63 | 57.94 |
| ML9: Mean minimum monthly flow, September | 64.51 | 100.30 | 55.48 |
| ML10: Mean minimum monthly flow, October | 73.13 | 84.71 | 15.83 |
| ML11: Mean minimum monthly flow, November | 84.43 | 101.60 | 20.34 |
| ML12: Mean minimum monthly flow, December | 121.74 | 122.90 | 0.96 |
| ML13: CV of minimum monthly flows | 86.60 | 83.89 | -3.12 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.19 | 0.20 | 2.61 |
| ML15: Mean minimum annual flow / mean annual flow | 0.11 | 0.13 | 22.59 |
| ML16: Median minimum annual flow / median annual flow | 0.18 | 0.20 | 9.63 |
| ML20: Ratio of baseflow volume to total flow volume | 0.38 | 0.55 | 44.22 |
| ML22: Mean annual minimum flow divided by catchment area | 0.35 | 0.38 | 7.40 |
| RA1: Mean of positive changes from one day to next (rise rate) | 172.00 | 120.59 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 461.08 | 410.82 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 101.12 | 46.81 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 431.54 | 388.81 |  |
| RA5: Ratio of days that are higher than previous day | 0.35 | 0.28 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.15 | 0.07 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.11 | 0.05 |  |
| RA8: Number of flow reversals from one day to the next | 90.88 | 78.04 |  |
| RA9: CV, number of flow reversals from one day to the next | 20.01 | 21.97 |  |

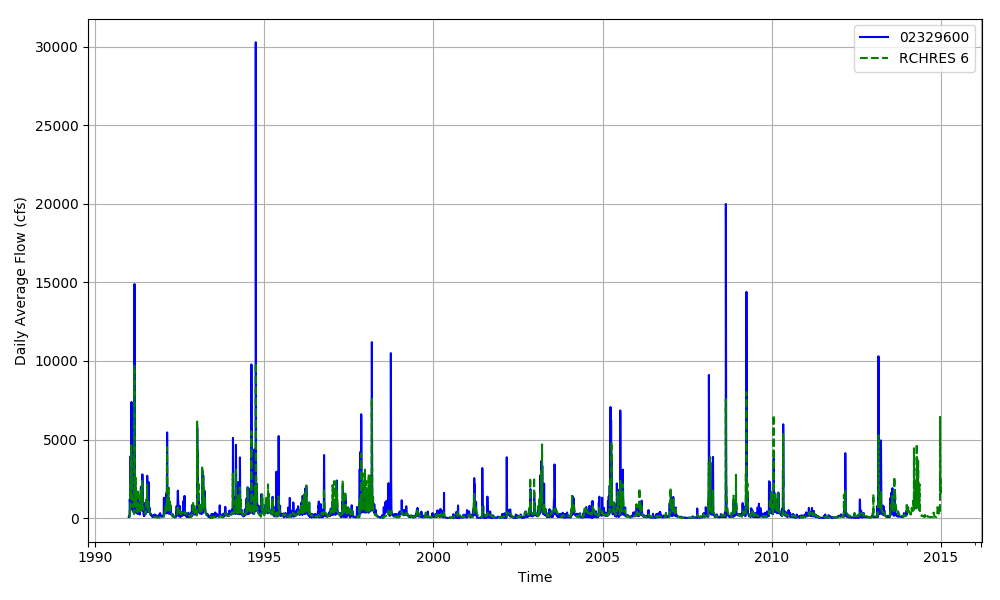


Figure 03120003-10: Daily flow for HSFP reach 06 and USGS station 02329600.

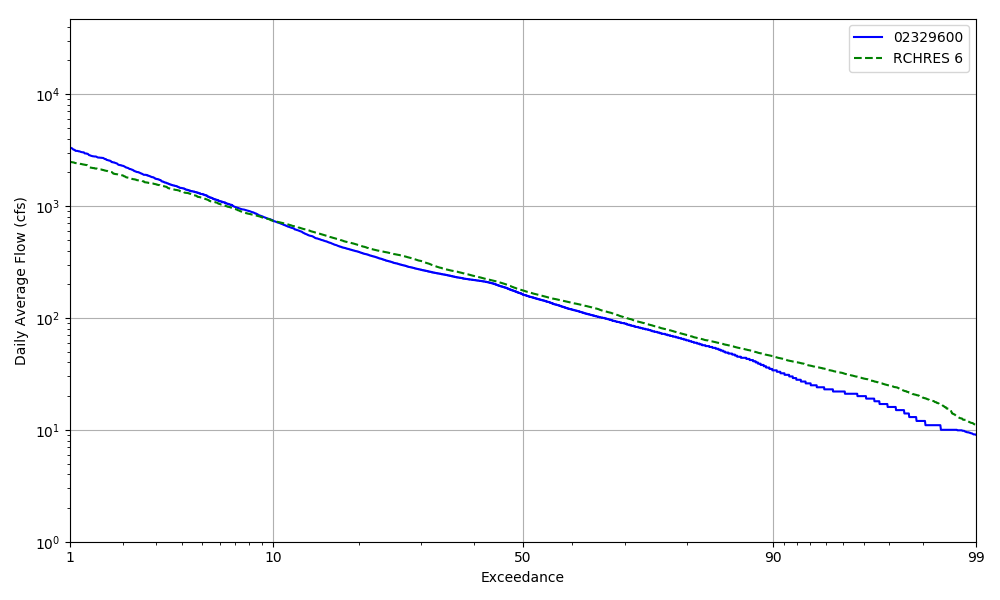


Figure 03120003-11: Daily exceedance for HSFP reach 06 and USGS station 02329600.

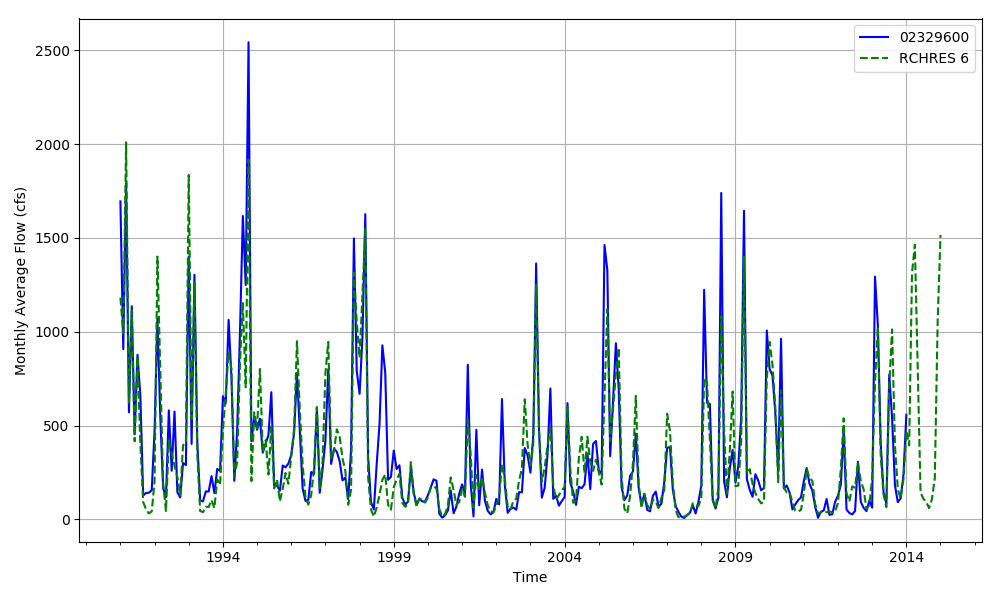


Figure 03120003-12: Monthly flow for HSFP reach 06 and USGS station 02329600.

## HSPF Reach 08, USGS Gauge 02330000

Table 03120003-7: Comparison Statistics Between HSPF Reach 08 and USGS Gauge 02330000.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 130.46 |
| Standard error | 734.83 |
| Relative bias | 0.08 |
| Relative standard error | 0.41 |
| Nash-Sutcliffe coefficient | 0.83 |
| Coefficient of efficiency | 0.67 |
| Index of agreement | 0.85 |

Table 03120003-8: Hydrologic Indices Between USGS Gauge 02330000 and HSPF Reach 08.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02330000 | Simulated Reach 08 | Percent Difference |
| MA1: Mean, all daily flows | 1567.17 | 1695.21 | 8.17 |
| MA2: Median, all daily flows | 759.00 | 730.56 | -3.75 |
| MA3: CV, all daily flows | 129.22 | 147.58 | 14.21 |
| MA4: CV, log of all daily flows | 109.48 | 118.60 | 8.33 |
| MA5: Mean daily flow / median daily flow | 2.06 | 2.32 | 12.38 |
| MA9: (Q10 - Q90) / median daily flow | 4.70 | 5.31 | 13.11 |
| MA10: (Q20 - Q80) / median daily flow | 2.93 | 2.82 | -3.94 |
| MA11: (Q25 - Q75) / median daily flow | 2.24 | 2.13 | -4.97 |
| MA12: Mean monthly flow, January | 1733.26 | 2471.53 | 42.59 |
| MA13: Mean monthly flow, February | 2681.66 | 3148.30 | 17.40 |
| MA14: Mean monthly flow, March | 3256.50 | 3633.39 | 11.57 |
| MA15: Mean monthly flow, April | 2092.50 | 1871.37 | -10.57 |
| MA16: Mean monthly flow, May | 901.02 | 796.08 | -11.65 |
| MA17: Mean monthly flow, June | 853.98 | 796.54 | -6.73 |
| MA18: Mean monthly flow, July | 1195.89 | 1259.43 | 5.31 |
| MA19: Mean monthly flow, August | 1676.03 | 1530.78 | -8.67 |
| MA20: Mean monthly flow, September | 877.90 | 890.53 | 1.44 |
| MA21: Mean monthly flow, October | 1055.63 | 1016.64 | -3.69 |
| MA22: Mean monthly flow, November | 740.31 | 910.19 | 22.95 |
| MA23: Mean monthly flow, December | 1091.35 | 1336.92 | 22.50 |
| ML1: Mean minimum monthly flow, January | 657.79 | 812.72 | 23.55 |
| ML2: Mean minimum monthly flow, February | 1107.83 | 1113.49 | 0.51 |
| ML3: Mean minimum monthly flow, March | 1201.04 | 1118.70 | -6.86 |
| ML4: Mean minimum monthly flow, April | 713.30 | 608.60 | -14.68 |
| ML5: Mean minimum monthly flow, May | 254.91 | 285.53 | 12.01 |
| ML6: Mean minimum monthly flow, June | 235.13 | 273.71 | 16.41 |
| ML7: Mean minimum monthly flow, July | 435.35 | 563.45 | 29.43 |
| ML8: Mean minimum monthly flow, August | 472.48 | 573.31 | 21.34 |
| ML9: Mean minimum monthly flow, September | 264.43 | 319.11 | 20.67 |
| ML10: Mean minimum monthly flow, October | 289.61 | 315.89 | 9.07 |
| ML11: Mean minimum monthly flow, November | 262.70 | 403.27 | 53.51 |
| ML12: Mean minimum monthly flow, December | 524.96 | 553.06 | 5.35 |
| ML13: CV of minimum monthly flows | 118.91 | 101.73 | -14.45 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.18 | 0.16 | -8.23 |
| ML15: Mean minimum annual flow / mean annual flow | 0.09 | 0.08 | -9.34 |
| ML16: Median minimum annual flow / median annual flow | 0.15 | 0.15 | -0.57 |
| ML20: Ratio of baseflow volume to total flow volume | 0.49 | 0.47 | -4.08 |
| ML22: Mean annual minimum flow divided by catchment area | 1.17 | 1.17 | -0.48 |
| RA1: Mean of positive changes from one day to next (rise rate) | 370.72 | 564.47 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 305.29 | 375.97 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 277.53 | 249.27 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 241.13 | 360.14 |  |
| RA5: Ratio of days that are higher than previous day | 0.40 | 0.31 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.11 | 0.07 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.10 | 0.06 |  |
| RA8: Number of flow reversals from one day to the next | 113.17 | 59.54 |  |
| RA9: CV, number of flow reversals from one day to the next | 23.46 | 21.05 |  |

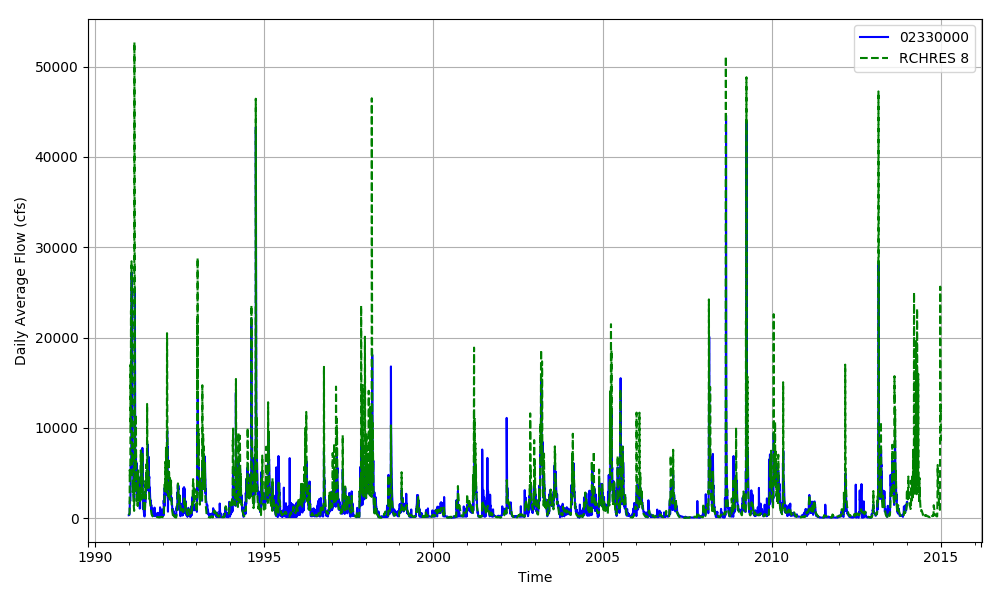


Figure 03120003-13: Daily flow for HSFP reach 08 and USGS station 02330000.

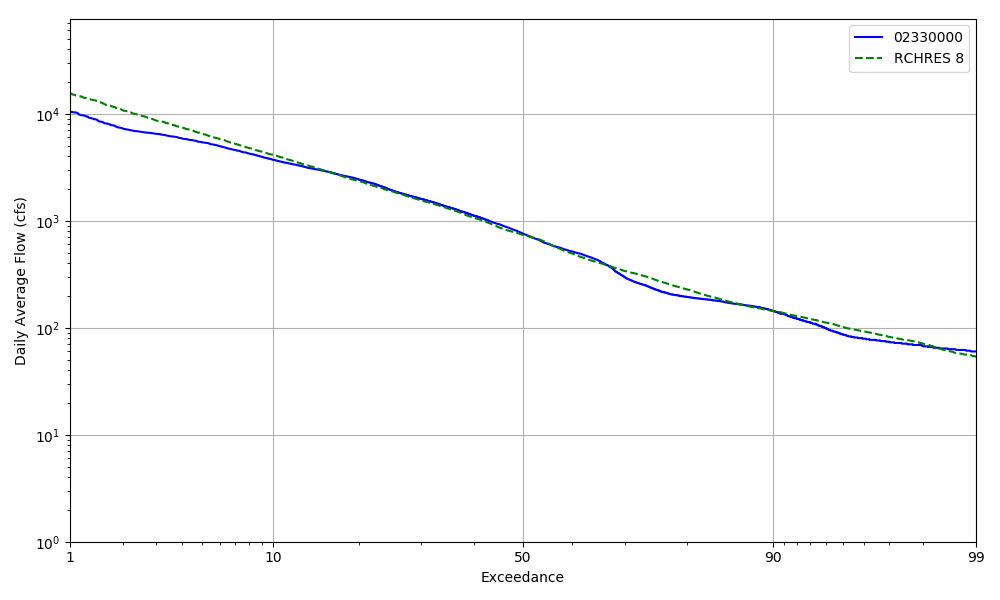


Figure 03120003-14: Daily exceedance for HSFP reach 08 and USGS station 02330000.

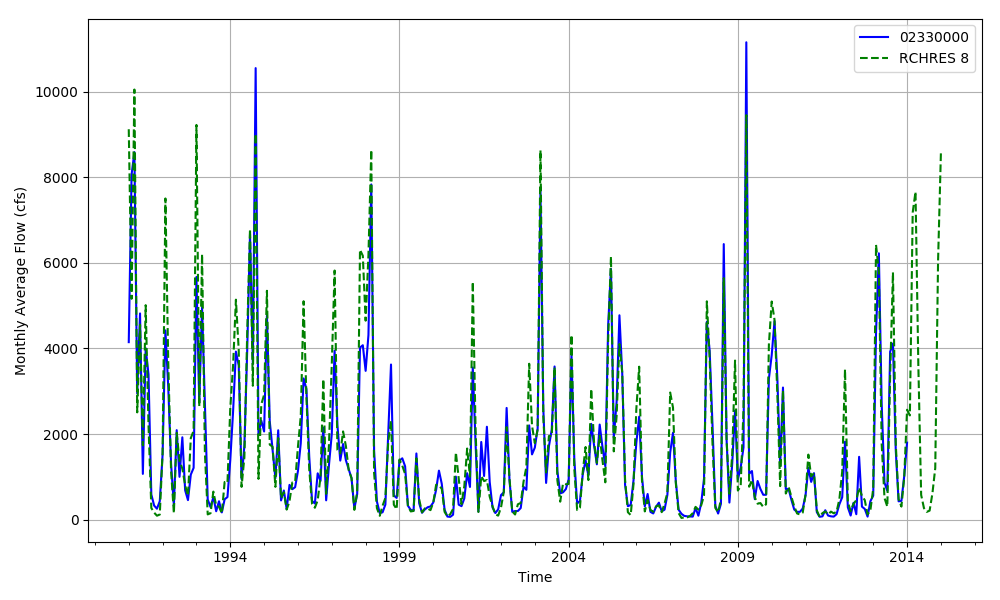


Figure 03120003-15: Monthly flow for HSFP reach 08 and USGS station 02330000.

## HSPF Reach 10, USGS Gauge 02330150

Table 03120003-9: Comparison Statistics Between HSPF Reach 10 and USGS Gauge 02330150.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 57.11 |
| Standard error | 906.37 |
| Relative bias | 0.03 |
| Relative standard error | 0.45 |
| Nash-Sutcliffe coefficient | 0.80 |
| Coefficient of efficiency | 0.63 |
| Index of agreement | 0.83 |

Table 03120003-10: Hydrologic Indices Between USGS Gauge 02330150 and HSPF Reach 10.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02330150 | Simulated Reach 10 | Percent Difference |
| MA1: Mean, all daily flows | 1791.03 | 1842.35 | 2.87 |
| MA2: Median, all daily flows | 848.00 | 840.94 | -0.83 |
| MA3: CV, all daily flows | 121.42 | 133.08 | 9.60 |
| MA4: CV, log of all daily flows | 103.16 | 114.57 | 11.06 |
| MA5: Mean daily flow / median daily flow | 2.11 | 2.19 | 3.73 |
| MA9: (Q10 - Q90) / median daily flow | 4.67 | 4.77 | 2.22 |
| MA10: (Q20 - Q80) / median daily flow | 2.72 | 2.47 | -9.04 |
| MA11: (Q25 - Q75) / median daily flow | 2.12 | 1.90 | -10.22 |
| MA12: Mean monthly flow, January | 1719.76 | 2132.97 | 24.03 |
| MA13: Mean monthly flow, February | 2491.79 | 3125.13 | 25.42 |
| MA14: Mean monthly flow, March | 3482.99 | 3514.72 | 0.91 |
| MA15: Mean monthly flow, April | 2271.79 | 2075.14 | -8.66 |
| MA16: Mean monthly flow, May | 870.62 | 841.08 | -3.39 |
| MA17: Mean monthly flow, June | 995.47 | 788.48 | -20.79 |
| MA18: Mean monthly flow, July | 1471.74 | 1247.95 | -15.21 |
| MA19: Mean monthly flow, August | 2024.00 | 1733.42 | -14.36 |
| MA20: Mean monthly flow, September | 1182.72 | 1148.85 | -2.86 |
| MA21: Mean monthly flow, October | 972.68 | 990.97 | 1.88 |
| MA22: Mean monthly flow, November | 925.48 | 1175.81 | 27.05 |
| MA23: Mean monthly flow, December | 1447.26 | 1713.01 | 18.36 |
| ML1: Mean minimum monthly flow, January | 1034.72 | 1051.52 | 1.62 |
| ML2: Mean minimum monthly flow, February | 1287.88 | 1227.15 | -4.72 |
| ML3: Mean minimum monthly flow, March | 1462.71 | 1215.84 | -16.88 |
| ML4: Mean minimum monthly flow, April | 900.94 | 736.61 | -18.24 |
| ML5: Mean minimum monthly flow, May | 341.35 | 324.35 | -4.98 |
| ML6: Mean minimum monthly flow, June | 331.29 | 356.37 | 7.57 |
| ML7: Mean minimum monthly flow, July | 596.59 | 567.25 | -4.92 |
| ML8: Mean minimum monthly flow, August | 803.22 | 708.07 | -11.85 |
| ML9: Mean minimum monthly flow, September | 393.00 | 441.35 | 12.30 |
| ML10: Mean minimum monthly flow, October | 381.72 | 447.81 | 17.31 |
| ML11: Mean minimum monthly flow, November | 476.44 | 575.13 | 20.71 |
| ML12: Mean minimum monthly flow, December | 722.22 | 688.85 | -4.62 |
| ML13: CV of minimum monthly flows | 114.98 | 96.26 | -16.28 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.28 | 0.22 | -19.81 |
| ML15: Mean minimum annual flow / mean annual flow | 0.16 | 0.14 | -17.00 |
| ML16: Median minimum annual flow / median annual flow | 0.24 | 0.20 | -18.07 |
| ML20: Ratio of baseflow volume to total flow volume | 0.50 | 0.51 | 2.27 |
| ML22: Mean annual minimum flow divided by catchment area | 2.32 | 2.04 | -11.95 |
| RA1: Mean of positive changes from one day to next (rise rate) | 356.04 | 595.67 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 315.92 | 407.49 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 216.58 | 258.45 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 292.90 | 388.28 |  |
| RA5: Ratio of days that are higher than previous day | 0.37 | 0.30 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.08 | 0.06 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.06 | 0.05 |  |
| RA8: Number of flow reversals from one day to the next | 70.26 | 46.53 |  |
| RA9: CV, number of flow reversals from one day to the next | 30.66 | 32.53 |  |

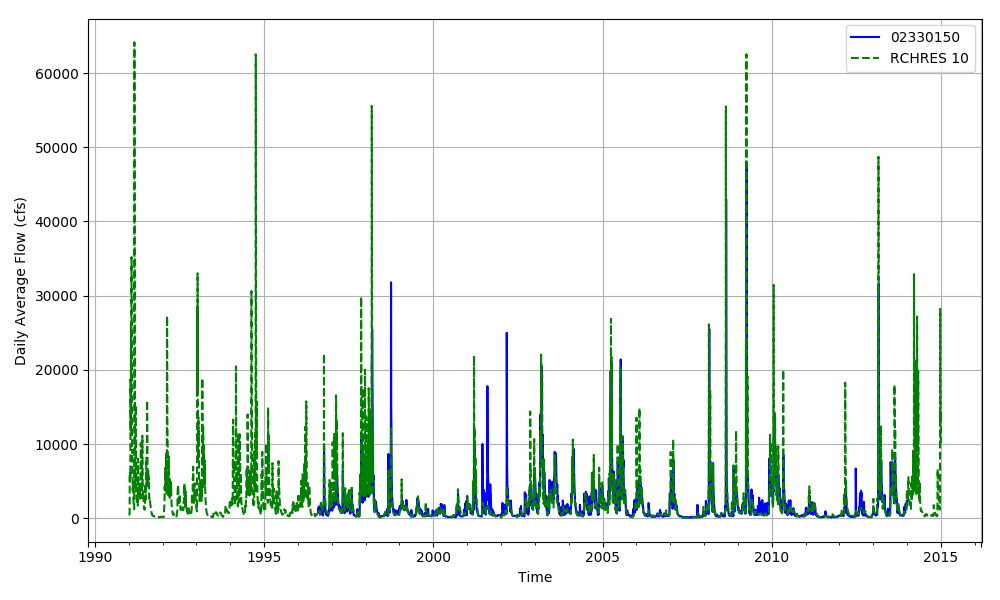


Figure 03120003-16: Daily flow for HSFP reach 10 and USGS station 02330150.

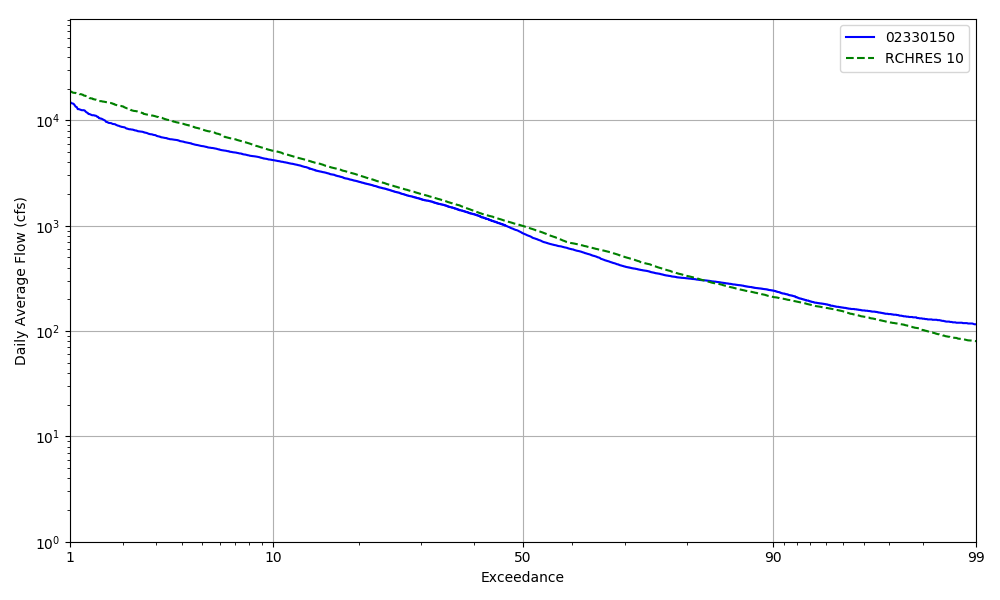


Figure 03120003-17: Daily exceedance for HSFP reach 10 and USGS station 02330150.

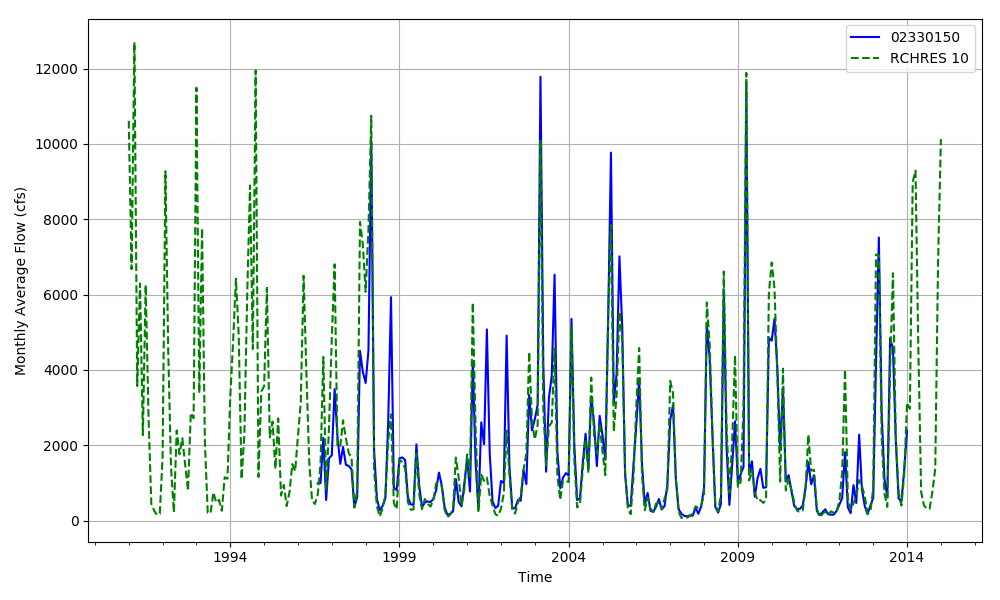


Figure 03120003-18: Monthly flow for HSFP reach 10 and USGS station 02330150.

## HSPF Reach 15, USGS Gauge 02328522

Table 03120003-11: Comparison Statistics Between HSPF Reach 15 and USGS Gauge 02328522.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 15.20 |
| Standard error | 441.78 |
| Relative bias | 0.02 |
| Relative standard error | 0.36 |
| Nash-Sutcliffe coefficient | 0.87 |
| Coefficient of efficiency | 0.69 |
| Index of agreement | 0.85 |

Table 03120003-12: Hydrologic Indices Between USGS Gauge 02328522 and HSPF Reach 15.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02328522 | Simulated Reach 15 | Percent Difference |
| MA1: Mean, all daily flows | 823.04 | 833.64 | 1.29 |
| MA2: Median, all daily flows | 265.00 | 259.70 | -2.00 |
| MA3: CV, all daily flows | 172.96 | 175.48 | 1.46 |
| MA4: CV, log of all daily flows | 130.27 | 133.36 | 2.37 |
| MA5: Mean daily flow / median daily flow | 3.11 | 3.21 | 3.35 |
| MA9: (Q10 - Q90) / median daily flow | 6.68 | 7.18 | 7.51 |
| MA10: (Q20 - Q80) / median daily flow | 3.75 | 3.93 | 4.83 |
| MA11: (Q25 - Q75) / median daily flow | 2.85 | 2.97 | 4.00 |
| MA12: Mean monthly flow, January | 801.58 | 993.36 | 23.93 |
| MA13: Mean monthly flow, February | 1329.78 | 1619.99 | 21.82 |
| MA14: Mean monthly flow, March | 1859.87 | 1971.88 | 6.02 |
| MA15: Mean monthly flow, April | 1398.95 | 1129.67 | -19.25 |
| MA16: Mean monthly flow, May | 348.83 | 262.12 | -24.86 |
| MA17: Mean monthly flow, June | 385.54 | 313.33 | -18.73 |
| MA18: Mean monthly flow, July | 785.73 | 584.78 | -25.57 |
| MA19: Mean monthly flow, August | 959.35 | 876.41 | -8.65 |
| MA20: Mean monthly flow, September | 412.09 | 495.57 | 20.26 |
| MA21: Mean monthly flow, October | 361.15 | 369.98 | 2.44 |
| MA22: Mean monthly flow, November | 291.95 | 368.59 | 26.25 |
| MA23: Mean monthly flow, December | 569.44 | 693.43 | 21.77 |
| ML1: Mean minimum monthly flow, January | 398.94 | 436.44 | 9.40 |
| ML2: Mean minimum monthly flow, February | 521.27 | 477.48 | -8.40 |
| ML3: Mean minimum monthly flow, March | 583.07 | 456.28 | -21.75 |
| ML4: Mean minimum monthly flow, April | 333.67 | 190.92 | -42.78 |
| ML5: Mean minimum monthly flow, May | 109.47 | 42.11 | -61.53 |
| ML6: Mean minimum monthly flow, June | 81.60 | 57.37 | -29.69 |
| ML7: Mean minimum monthly flow, July | 233.67 | 186.06 | -20.37 |
| ML8: Mean minimum monthly flow, August | 249.73 | 209.88 | -15.96 |
| ML9: Mean minimum monthly flow, September | 114.87 | 88.05 | -23.35 |
| ML10: Mean minimum monthly flow, October | 111.17 | 112.27 | 0.98 |
| ML11: Mean minimum monthly flow, November | 132.75 | 154.33 | 16.26 |
| ML12: Mean minimum monthly flow, December | 242.44 | 223.19 | -7.94 |
| ML13: CV of minimum monthly flows | 127.97 | 135.05 | 5.53 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.17 | 0.08 | -52.73 |
| ML15: Mean minimum annual flow / mean annual flow | 0.08 | 0.03 | -58.83 |
| ML16: Median minimum annual flow / median annual flow | 0.15 | 0.06 | -61.16 |
| ML20: Ratio of baseflow volume to total flow volume | 0.42 | 0.44 | 2.96 |
| ML22: Mean annual minimum flow divided by catchment area | 0.51 | 0.24 | -53.32 |
| RA1: Mean of positive changes from one day to next (rise rate) | 228.05 | 309.64 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 516.85 | 441.55 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 114.02 | 139.98 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 536.12 | 447.31 |  |
| RA5: Ratio of days that are higher than previous day | 0.32 | 0.31 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.11 | 0.11 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.07 | 0.08 |  |
| RA8: Number of flow reversals from one day to the next | 54.56 | 58.88 |  |
| RA9: CV, number of flow reversals from one day to the next | 20.79 | 20.72 |  |

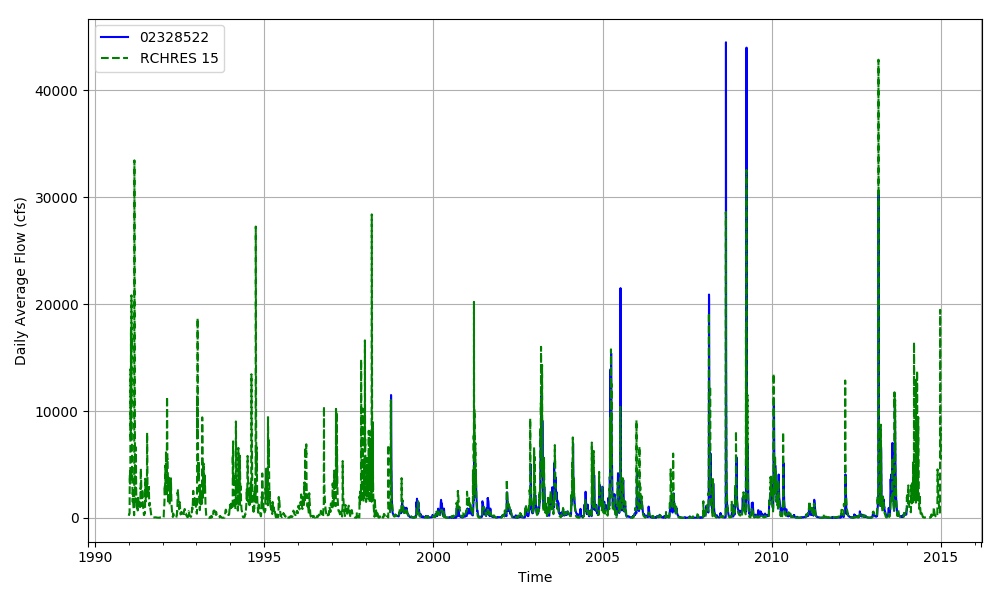


Figure 03120003-19: Daily flow for HSFP reach 15 and USGS station 02328522.

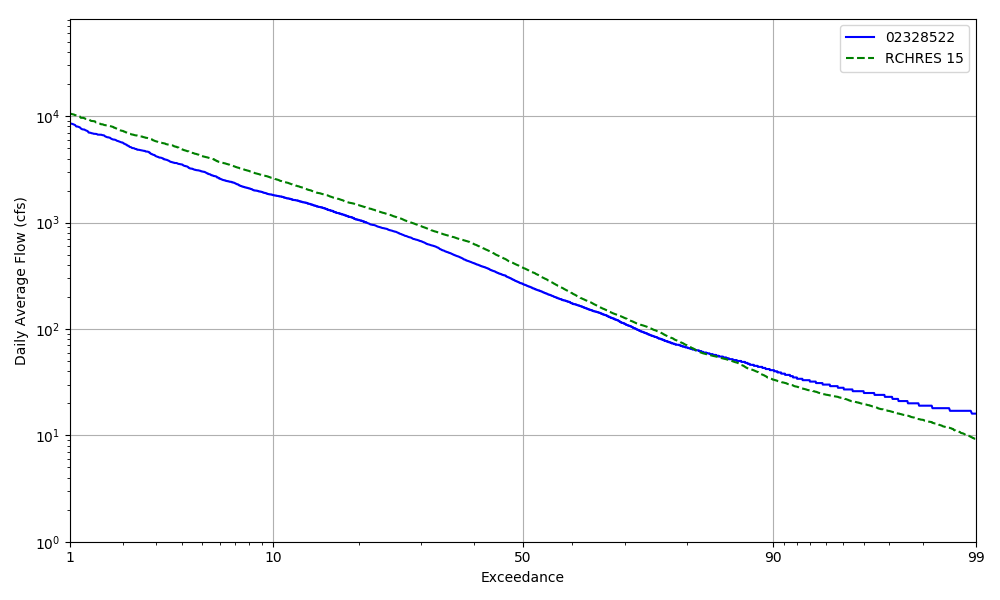


Figure 03120003-20: Daily exceedance for HSFP reach 15 and USGS station 02328522.

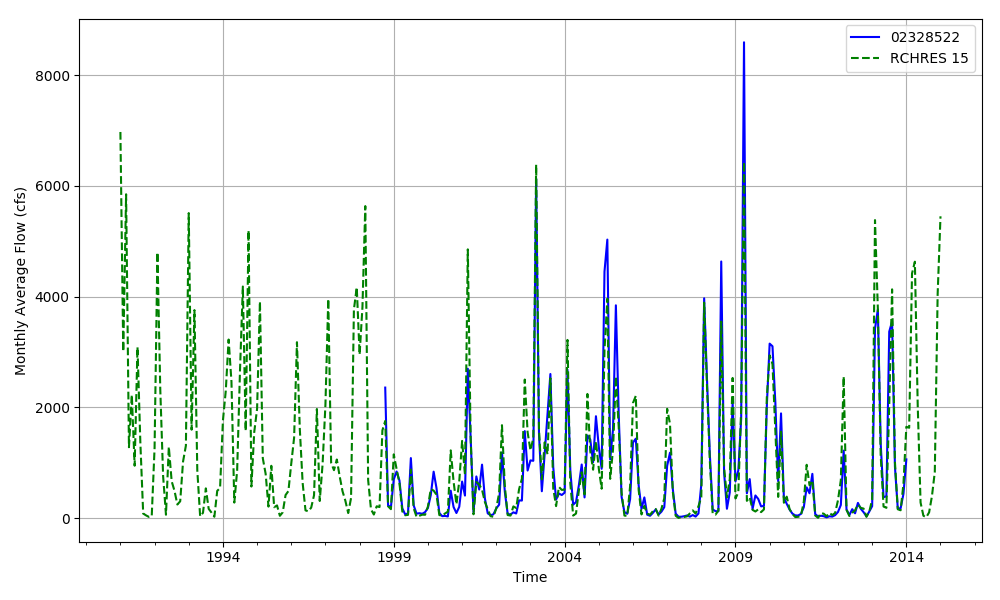


Figure 03120003-21: Monthly flow for HSFP reach 15 and USGS station 02328522.

## HSPF Reach 16, USGS Gauge 02329000

Table 03120003-13: Comparison Statistics Between HSPF Reach 16 and USGS Gauge 02329000.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 109.68 |
| Standard error | 559.18 |
| Relative bias | 0.11 |
| Relative standard error | 0.43 |
| Nash-Sutcliffe coefficient | 0.82 |
| Coefficient of efficiency | 0.66 |
| Index of agreement | 0.84 |

Table 03120003-14: Hydrologic Indices Between USGS Gauge 02329000 and HSPF Reach 16.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02329000 | Simulated Reach 16 | Percent Difference |
| MA1: Mean, all daily flows | 999.26 | 1105.03 | 10.58 |
| MA2: Median, all daily flows | 390.00 | 404.54 | 3.73 |
| MA3: CV, all daily flows | 146.07 | 163.65 | 12.04 |
| MA4: CV, log of all daily flows | 121.36 | 128.92 | 6.23 |
| MA5: Mean daily flow / median daily flow | 2.56 | 2.73 | 6.61 |
| MA9: (Q10 - Q90) / median daily flow | 6.02 | 6.46 | 7.23 |
| MA10: (Q20 - Q80) / median daily flow | 3.43 | 3.46 | 0.84 |
| MA11: (Q25 - Q75) / median daily flow | 2.53 | 2.71 | 6.96 |
| MA12: Mean monthly flow, January | 1118.83 | 1711.00 | 52.93 |
| MA13: Mean monthly flow, February | 1768.30 | 2215.49 | 25.29 |
| MA14: Mean monthly flow, March | 2277.04 | 2515.80 | 10.49 |
| MA15: Mean monthly flow, April | 1498.33 | 1214.99 | -18.91 |
| MA16: Mean monthly flow, May | 514.09 | 407.20 | -20.79 |
| MA17: Mean monthly flow, June | 484.83 | 452.72 | -6.62 |
| MA18: Mean monthly flow, July | 812.65 | 770.66 | -5.17 |
| MA19: Mean monthly flow, August | 994.16 | 942.52 | -5.19 |
| MA20: Mean monthly flow, September | 465.36 | 540.26 | 16.10 |
| MA21: Mean monthly flow, October | 621.78 | 625.01 | 0.52 |
| MA22: Mean monthly flow, November | 399.89 | 553.08 | 38.31 |
| MA23: Mean monthly flow, December | 611.01 | 883.42 | 44.58 |
| ML1: Mean minimum monthly flow, January | 478.29 | 525.71 | 9.91 |
| ML2: Mean minimum monthly flow, February | 823.39 | 719.85 | -12.58 |
| ML3: Mean minimum monthly flow, March | 878.43 | 629.48 | -28.34 |
| ML4: Mean minimum monthly flow, April | 536.30 | 295.92 | -44.82 |
| ML5: Mean minimum monthly flow, May | 205.13 | 111.63 | -45.58 |
| ML6: Mean minimum monthly flow, June | 155.48 | 109.52 | -29.56 |
| ML7: Mean minimum monthly flow, July | 345.65 | 312.54 | -9.58 |
| ML8: Mean minimum monthly flow, August | 347.17 | 271.86 | -21.69 |
| ML9: Mean minimum monthly flow, September | 165.96 | 126.28 | -23.91 |
| ML10: Mean minimum monthly flow, October | 178.93 | 148.48 | -17.02 |
| ML11: Mean minimum monthly flow, November | 203.09 | 218.99 | 7.83 |
| ML12: Mean minimum monthly flow, December | 335.87 | 338.07 | 0.66 |
| ML13: CV of minimum monthly flows | 122.05 | 124.92 | 2.36 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.16 | 0.09 | -40.97 |
| ML15: Mean minimum annual flow / mean annual flow | 0.08 | 0.04 | -52.19 |
| ML16: Median minimum annual flow / median annual flow | 0.14 | 0.08 | -42.78 |
| ML20: Ratio of baseflow volume to total flow volume | 0.54 | 0.43 | -19.54 |
| ML22: Mean annual minimum flow divided by catchment area | 0.64 | 0.35 | -45.50 |
| RA1: Mean of positive changes from one day to next (rise rate) | 196.54 | 392.87 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 443.86 | 389.55 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 106.85 | 181.66 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 376.72 | 373.91 |  |
| RA5: Ratio of days that are higher than previous day | 0.34 | 0.32 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.09 | 0.10 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.06 | 0.08 |  |
| RA8: Number of flow reversals from one day to the next | 56.12 | 53.71 |  |
| RA9: CV, number of flow reversals from one day to the next | 25.17 | 19.15 |  |

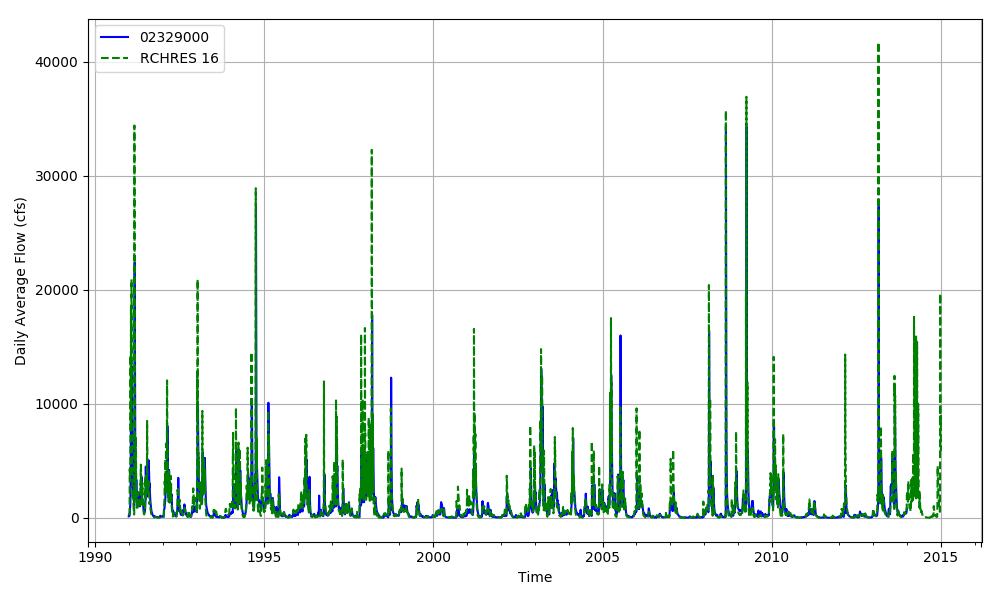


Figure 03120003-22: Daily flow for HSFP reach 16 and USGS station 02329000.

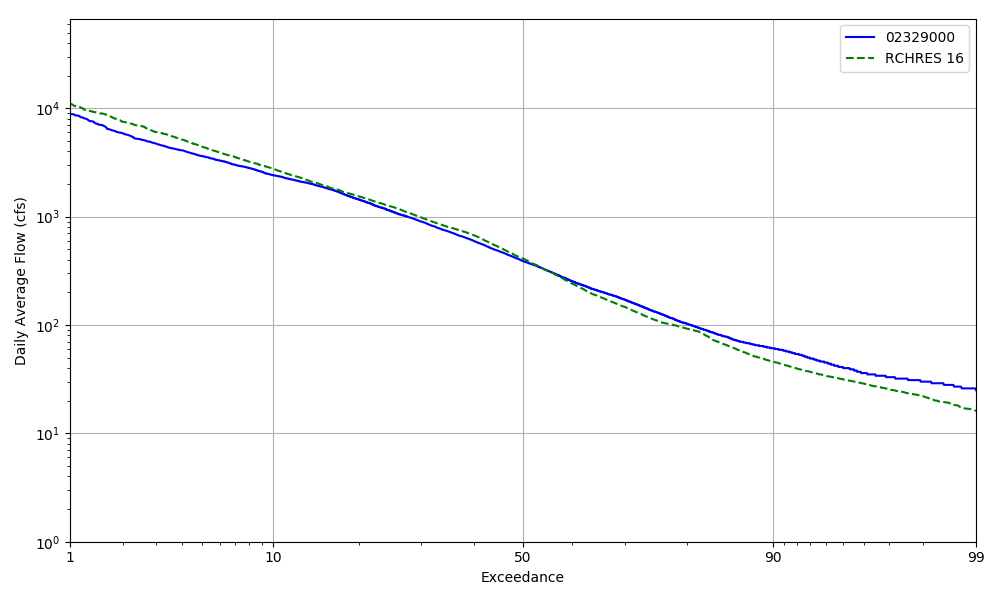


Figure 03120003-23: Daily exceedance for HSFP reach 16 and USGS station 02329000.

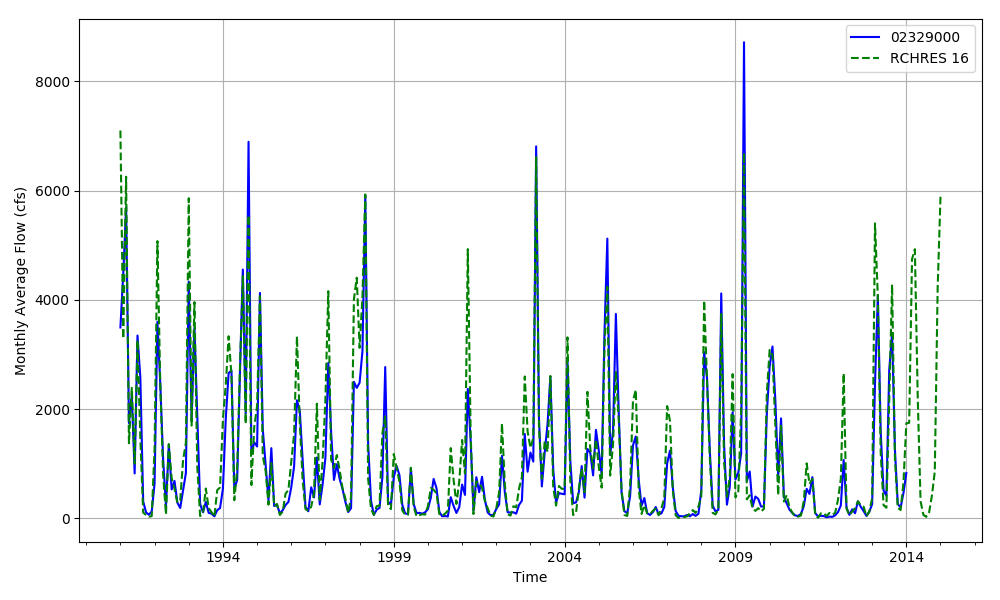


Figure 03120003-24: Monthly flow for HSFP reach 16 and USGS station 02329000.