# Appendix for Model 03060101

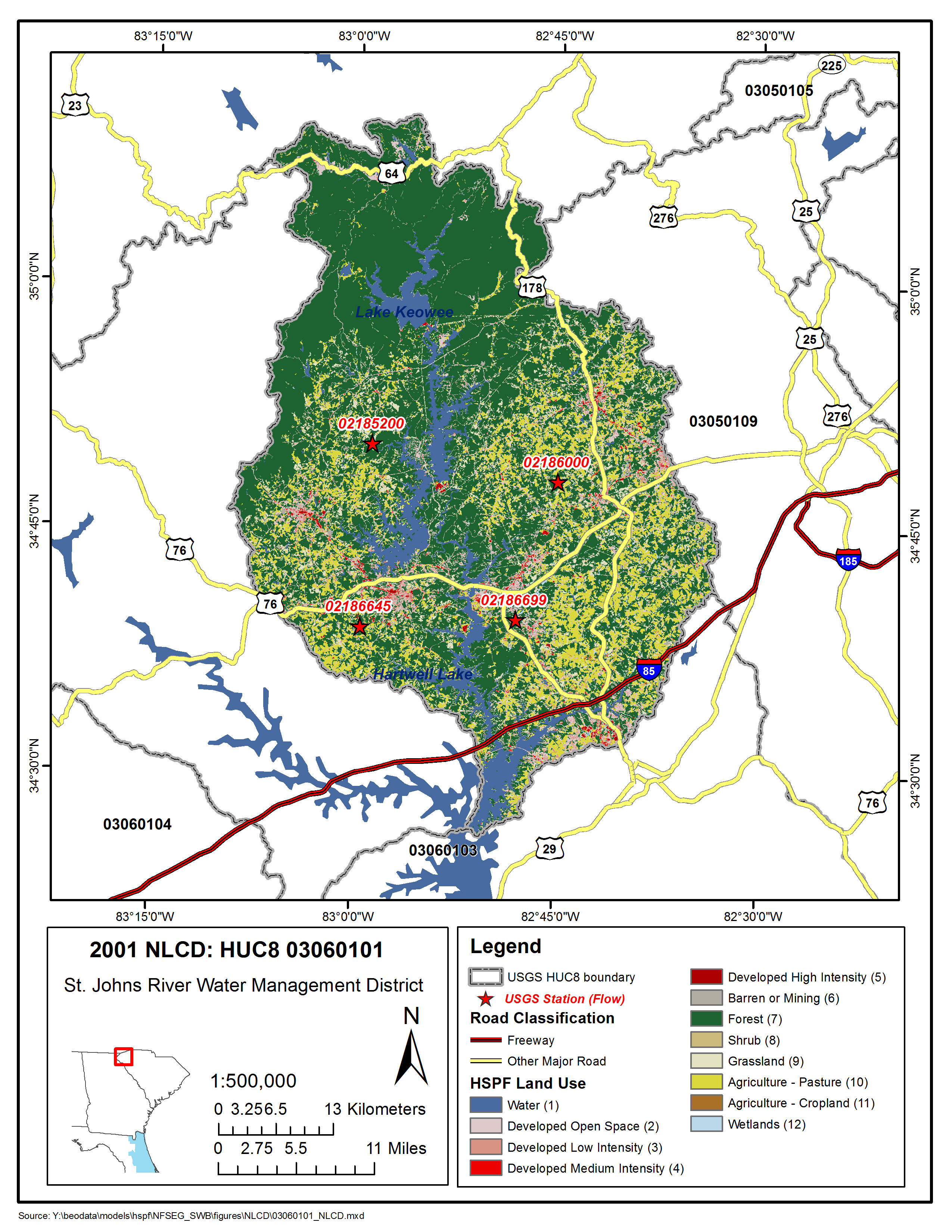


Figure 03060101-1: Land Cover from the National Land Cover Database.

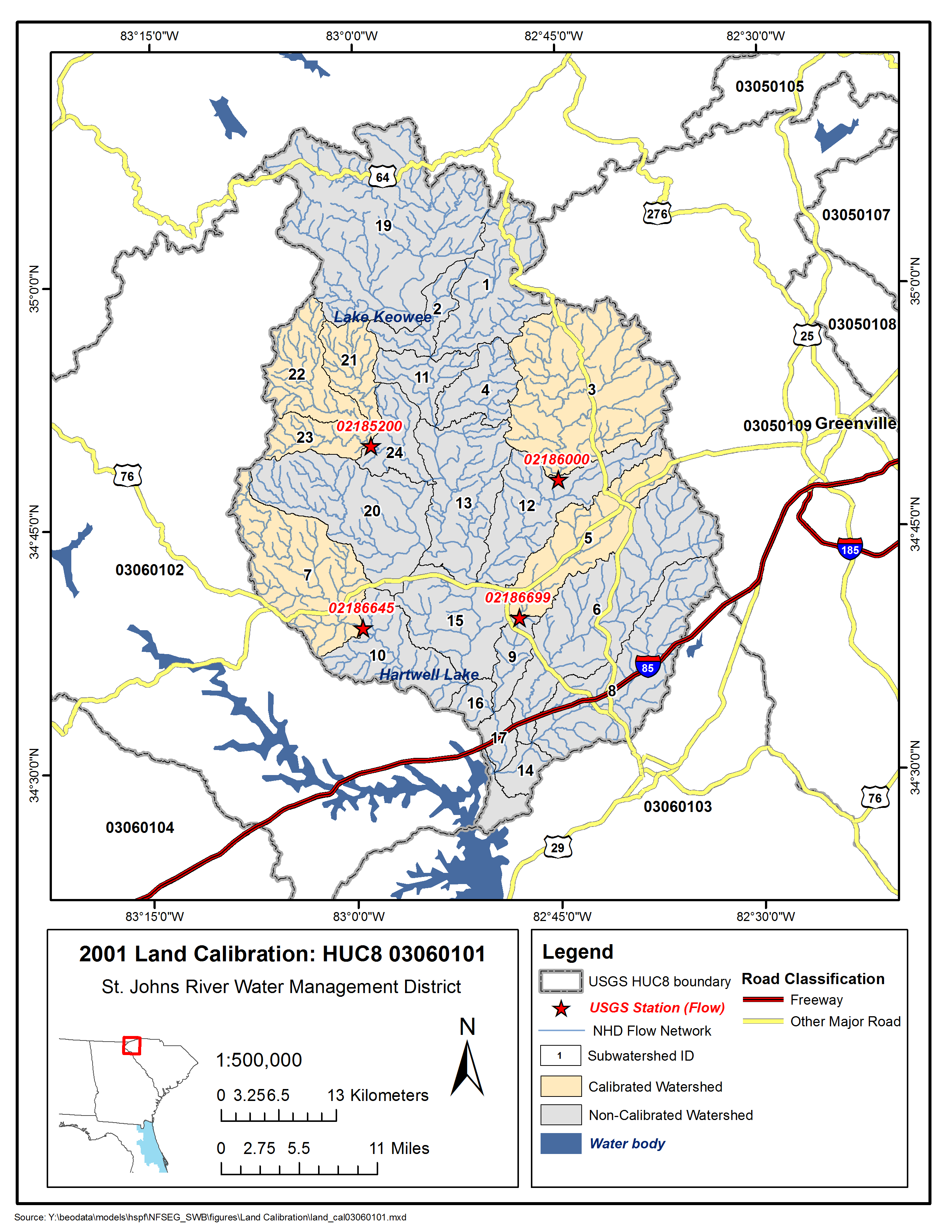


Figure 03060101-2: Calibrated sub-watersheds.

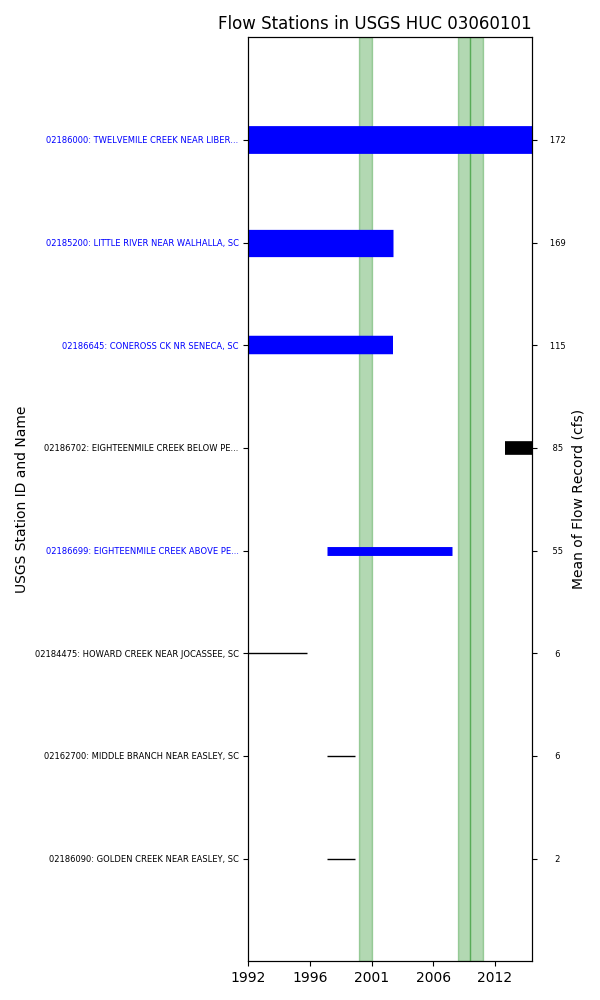


Figure 03060101-3: Station period of record. Blue color identifies gauges used for calibration.

## HSPF Reach 03, USGS Gauge 02186000

Table 03060101-1: Comparison Statistics Between HSPF Reach 03 and USGS Gauge 02186000.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -8.22 |
| Standard error | 41.69 |
| Relative bias | -0.05 |
| Relative standard error | 0.38 |
| Nash-Sutcliffe coefficient | 0.85 |
| Coefficient of efficiency | 0.67 |
| Index of agreement | 0.83 |

Table 03060101-2: Hydrologic Indices Between USGS Gauge 02186000 and HSPF Reach 03.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02186000 | Simulated Reach 03 | Percent Difference |
| MA1: Mean, all daily flows | 171.87 | 162.30 | -5.57 |
| MA2: Median, all daily flows | 125.00 | 121.27 | -2.98 |
| MA3: CV, all daily flows | 95.70 | 87.84 | -8.21 |
| MA4: CV, log of all daily flows | 63.59 | 60.93 | -4.18 |
| MA5: Mean daily flow / median daily flow | 1.37 | 1.34 | -2.67 |
| MA9: (Q10 - Q90) / median daily flow | 1.95 | 1.89 | -3.39 |
| MA10: (Q20 - Q80) / median daily flow | 1.13 | 1.09 | -3.40 |
| MA11: (Q25 - Q75) / median daily flow | 0.87 | 0.91 | 4.20 |
| MA12: Mean monthly flow, January | 212.86 | 216.68 | 1.80 |
| MA13: Mean monthly flow, February | 200.07 | 189.19 | -5.44 |
| MA14: Mean monthly flow, March | 225.21 | 208.93 | -7.23 |
| MA15: Mean monthly flow, April | 182.96 | 170.74 | -6.68 |
| MA16: Mean monthly flow, May | 138.04 | 123.83 | -10.29 |
| MA17: Mean monthly flow, June | 124.18 | 109.84 | -11.55 |
| MA18: Mean monthly flow, July | 90.67 | 85.99 | -5.16 |
| MA19: Mean monthly flow, August | 119.73 | 89.99 | -24.84 |
| MA20: Mean monthly flow, September | 79.69 | 82.04 | 2.95 |
| MA21: Mean monthly flow, October | 93.18 | 98.16 | 5.35 |
| MA22: Mean monthly flow, November | 118.10 | 117.78 | -0.27 |
| MA23: Mean monthly flow, December | 158.45 | 152.22 | -3.93 |
| ML1: Mean minimum monthly flow, January | 123.17 | 120.92 | -1.82 |
| ML2: Mean minimum monthly flow, February | 139.17 | 135.90 | -2.34 |
| ML3: Mean minimum monthly flow, March | 149.56 | 136.69 | -8.60 |
| ML4: Mean minimum monthly flow, April | 144.17 | 127.55 | -11.52 |
| ML5: Mean minimum monthly flow, May | 113.50 | 100.63 | -11.34 |
| ML6: Mean minimum monthly flow, June | 90.61 | 88.00 | -2.88 |
| ML7: Mean minimum monthly flow, July | 67.11 | 72.11 | 7.45 |
| ML8: Mean minimum monthly flow, August | 65.11 | 68.92 | 5.85 |
| ML9: Mean minimum monthly flow, September | 60.61 | 70.82 | 16.85 |
| ML10: Mean minimum monthly flow, October | 73.35 | 79.22 | 7.99 |
| ML11: Mean minimum monthly flow, November | 88.35 | 89.75 | 1.58 |
| ML12: Mean minimum monthly flow, December | 104.06 | 109.48 | 5.21 |
| ML13: CV of minimum monthly flows | 53.05 | 47.86 | -9.79 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.31 | 0.38 | 22.34 |
| ML15: Mean minimum annual flow / mean annual flow | 0.24 | 0.30 | 24.84 |
| ML16: Median minimum annual flow / median annual flow | 0.31 | 0.40 | 30.56 |
| ML20: Ratio of baseflow volume to total flow volume | 0.66 | 0.69 | 4.36 |
| ML22: Mean annual minimum flow divided by catchment area | 14286.16 | 14286.21 | 0.00 |
| RA1: Mean of positive changes from one day to next (rise rate) | 99.47 | 92.95 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 292.14 | 317.94 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 39.74 | 29.56 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 391.04 | 447.50 |  |
| RA5: Ratio of days that are higher than previous day | 0.27 | 0.24 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.13 | 0.06 |  |
| 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 | 94.33 | 81.95 |  |
| RA9: CV, number of flow reversals from one day to the next | 42.57 | 43.66 |  |

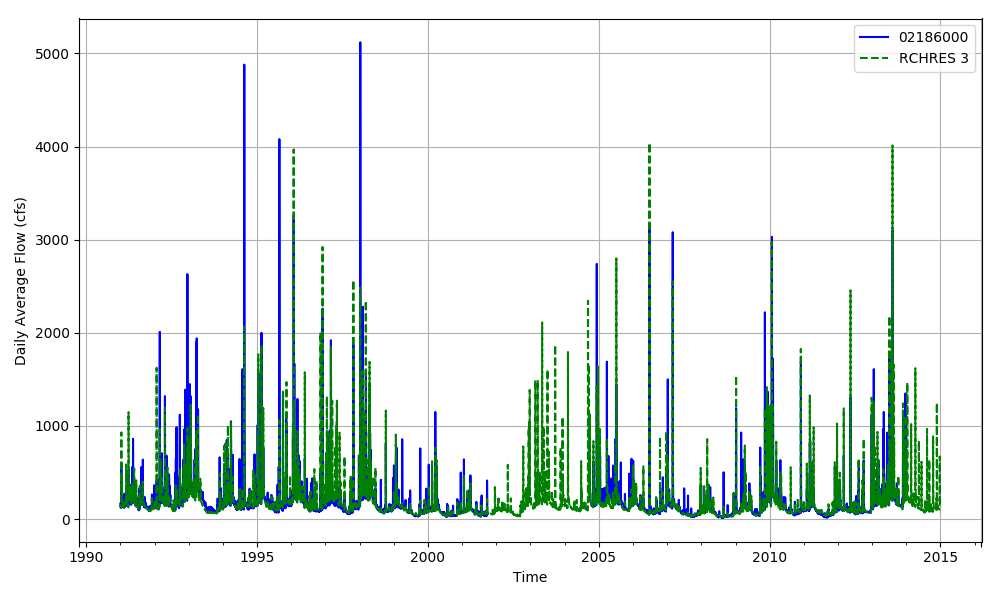


Figure 03060101-4: Daily flow for HSFP reach 03 and USGS station 02186000.

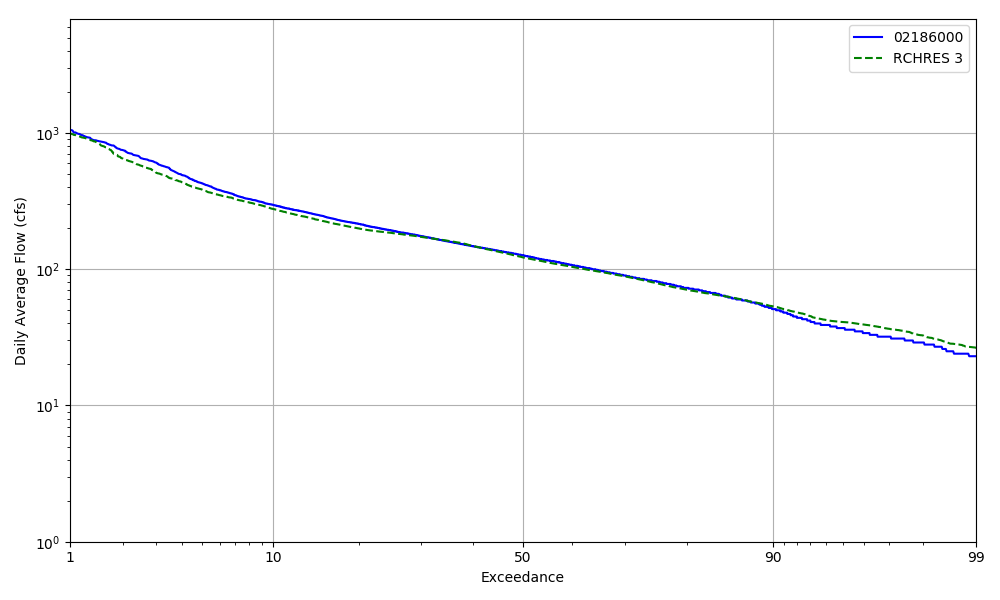


Figure 03060101-5: Daily exceedance for HSFP reach 03 and USGS station 02186000.

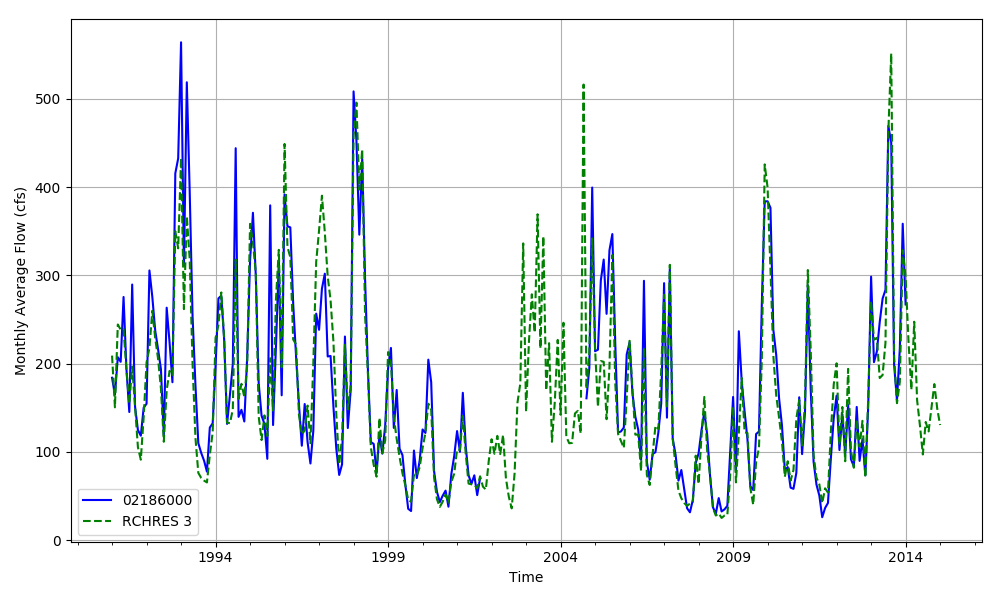


Figure 03060101-6: Monthly flow for HSFP reach 03 and USGS station 02186000.

## HSPF Reach 05, USGS Gauge 02186699

Table 03060101-3: Comparison Statistics Between HSPF Reach 05 and USGS Gauge 02186699.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -2.76 |
| Standard error | 14.12 |
| Relative bias | -0.05 |
| Relative standard error | 0.40 |
| Nash-Sutcliffe coefficient | 0.84 |
| Coefficient of efficiency | 0.62 |
| Index of agreement | 0.82 |

Table 03060101-4: Hydrologic Indices Between USGS Gauge 02186699 and HSPF Reach 05.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02186699 | Simulated Reach 05 | Percent Difference |
| MA1: Mean, all daily flows | 55.47 | 52.61 | -5.15 |
| MA2: Median, all daily flows | 42.00 | 38.28 | -8.86 |
| MA3: CV, all daily flows | 123.24 | 114.61 | -7.00 |
| MA4: CV, log of all daily flows | 53.47 | 64.51 | 20.65 |
| MA5: Mean daily flow / median daily flow | 1.32 | 1.37 | 4.07 |
| MA9: (Q10 - Q90) / median daily flow | 1.60 | 1.93 | 21.05 |
| MA10: (Q20 - Q80) / median daily flow | 0.98 | 1.21 | 23.57 |
| MA11: (Q25 - Q75) / median daily flow | 0.76 | 0.96 | 26.00 |
| MA12: Mean monthly flow, January | 57.01 | 56.56 | -0.79 |
| MA13: Mean monthly flow, February | 63.40 | 60.14 | -5.15 |
| MA14: Mean monthly flow, March | 79.06 | 66.60 | -15.77 |
| MA15: Mean monthly flow, April | 52.12 | 49.49 | -5.05 |
| MA16: Mean monthly flow, May | 53.31 | 49.18 | -7.74 |
| MA17: Mean monthly flow, June | 52.35 | 47.23 | -9.78 |
| MA18: Mean monthly flow, July | 44.05 | 43.58 | -1.07 |
| MA19: Mean monthly flow, August | 31.13 | 30.36 | -2.49 |
| MA20: Mean monthly flow, September | 46.10 | 44.88 | -2.66 |
| MA21: Mean monthly flow, October | 35.48 | 37.76 | 6.43 |
| MA22: Mean monthly flow, November | 40.52 | 39.89 | -1.57 |
| MA23: Mean monthly flow, December | 62.85 | 60.88 | -3.13 |
| ML1: Mean minimum monthly flow, January | 39.80 | 38.10 | -4.28 |
| ML2: Mean minimum monthly flow, February | 45.00 | 40.96 | -8.97 |
| ML3: Mean minimum monthly flow, March | 44.20 | 40.33 | -8.77 |
| ML4: Mean minimum monthly flow, April | 40.80 | 35.90 | -12.02 |
| ML5: Mean minimum monthly flow, May | 35.82 | 30.79 | -14.03 |
| ML6: Mean minimum monthly flow, June | 29.97 | 25.77 | -14.04 |
| ML7: Mean minimum monthly flow, July | 25.22 | 25.34 | 0.47 |
| ML8: Mean minimum monthly flow, August | 21.66 | 23.91 | 10.38 |
| ML9: Mean minimum monthly flow, September | 20.85 | 21.59 | 3.57 |
| ML10: Mean minimum monthly flow, October | 24.16 | 25.22 | 4.41 |
| ML11: Mean minimum monthly flow, November | 28.80 | 27.79 | -3.50 |
| ML12: Mean minimum monthly flow, December | 35.30 | 34.10 | -3.39 |
| ML13: CV of minimum monthly flows | 49.93 | 52.54 | 5.24 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.32 | 0.42 | 28.65 |
| ML15: Mean minimum annual flow / mean annual flow | 0.27 | 0.31 | 15.39 |
| ML16: Median minimum annual flow / median annual flow | 0.32 | 0.35 | 9.55 |
| ML20: Ratio of baseflow volume to total flow volume | 0.66 | 0.65 | -0.29 |
| ML22: Mean annual minimum flow divided by catchment area | 0.15 | 0.17 | 15.43 |
| RA1: Mean of positive changes from one day to next (rise rate) | 36.67 | 33.46 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 396.07 | 342.66 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 19.03 | 11.98 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 530.02 | 453.52 |  |
| RA5: Ratio of days that are higher than previous day | 0.29 | 0.26 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.14 | 0.07 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.08 | 0.05 |  |
| RA8: Number of flow reversals from one day to the next | 114.00 | 105.64 |  |
| RA9: CV, number of flow reversals from one day to the next | 22.52 | 22.58 |  |

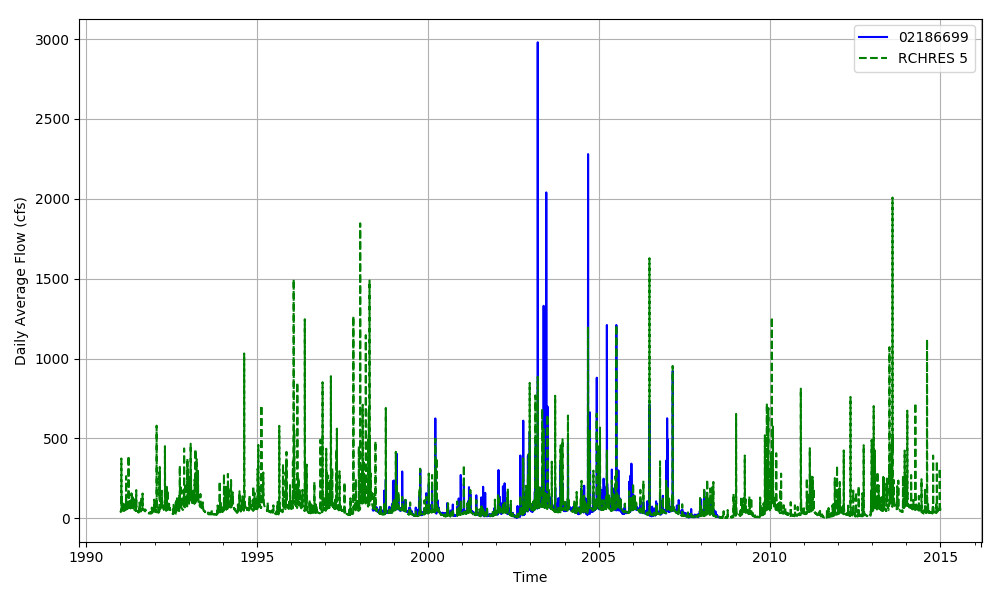


Figure 03060101-7: Daily flow for HSFP reach 05 and USGS station 02186699.

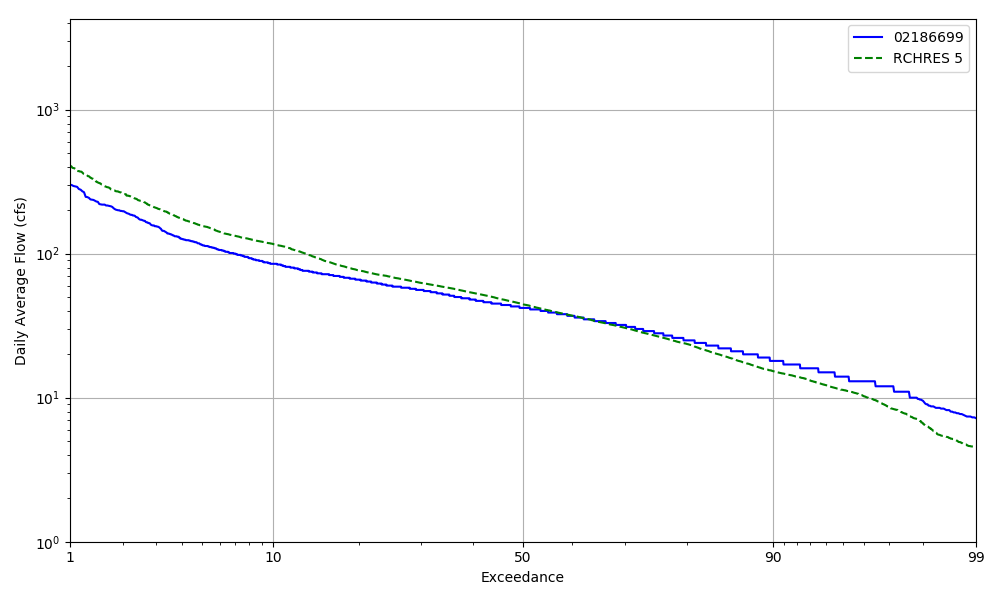


Figure 03060101-8: Daily exceedance for HSFP reach 05 and USGS station 02186699.

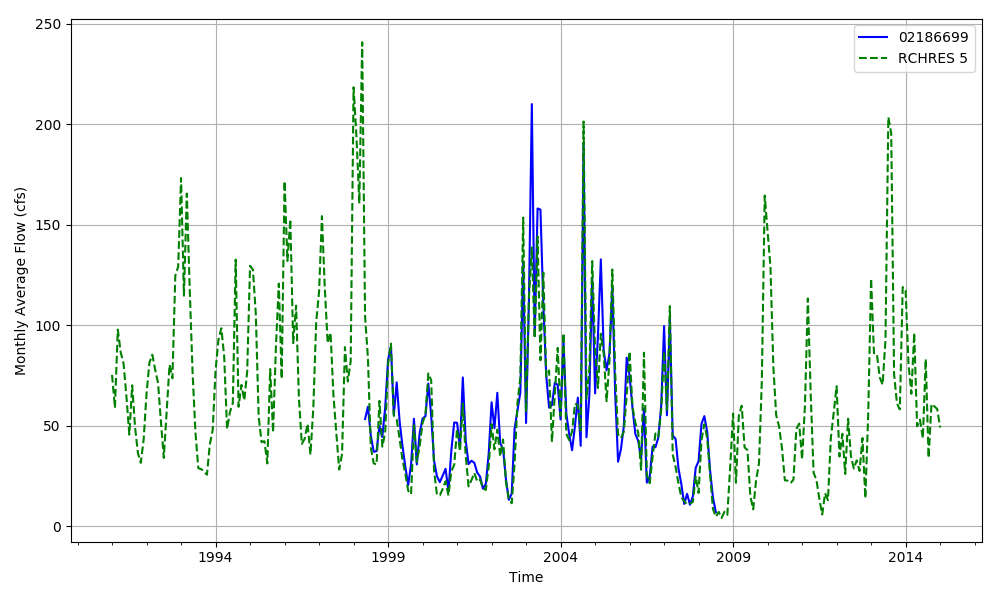


Figure 03060101-9: Monthly flow for HSFP reach 05 and USGS station 02186699.

## HSPF Reach 07, USGS Gauge 02186645

Table 03060101-5: Comparison Statistics Between HSPF Reach 07 and USGS Gauge 02186645.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -1.16 |
| Standard error | 19.33 |
| Relative bias | -0.01 |
| Relative standard error | 0.27 |
| Nash-Sutcliffe coefficient | 0.93 |
| Coefficient of efficiency | 0.75 |
| Index of agreement | 0.87 |

Table 03060101-6: Hydrologic Indices Between USGS Gauge 02186645 and HSPF Reach 07.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02186645 | Simulated Reach 07 | Percent Difference |
| MA1: Mean, all daily flows | 114.90 | 113.76 | -1.00 |
| MA2: Median, all daily flows | 81.00 | 84.09 | 3.82 |
| MA3: CV, all daily flows | 111.03 | 104.70 | -5.70 |
| MA4: CV, log of all daily flows | 70.04 | 62.51 | -10.76 |
| MA5: Mean daily flow / median daily flow | 1.42 | 1.35 | -4.64 |
| MA9: (Q10 - Q90) / median daily flow | 2.05 | 1.94 | -5.43 |
| MA10: (Q20 - Q80) / median daily flow | 1.07 | 1.12 | 4.39 |
| MA11: (Q25 - Q75) / median daily flow | 0.80 | 0.92 | 14.33 |
| MA12: Mean monthly flow, January | 150.16 | 154.92 | 3.17 |
| MA13: Mean monthly flow, February | 166.56 | 160.15 | -3.85 |
| MA14: Mean monthly flow, March | 171.07 | 165.04 | -3.53 |
| MA15: Mean monthly flow, April | 135.04 | 137.13 | 1.55 |
| MA16: Mean monthly flow, May | 109.59 | 108.78 | -0.74 |
| MA17: Mean monthly flow, June | 86.21 | 84.37 | -2.14 |
| MA18: Mean monthly flow, July | 70.83 | 71.50 | 0.95 |
| MA19: Mean monthly flow, August | 104.15 | 91.13 | -12.50 |
| MA20: Mean monthly flow, September | 71.97 | 74.22 | 3.12 |
| MA21: Mean monthly flow, October | 92.35 | 91.68 | -0.72 |
| MA22: Mean monthly flow, November | 91.74 | 94.21 | 2.69 |
| MA23: Mean monthly flow, December | 105.11 | 108.05 | 2.79 |
| ML1: Mean minimum monthly flow, January | 72.85 | 77.81 | 6.81 |
| ML2: Mean minimum monthly flow, February | 85.31 | 90.88 | 6.53 |
| ML3: Mean minimum monthly flow, March | 91.62 | 91.37 | -0.27 |
| ML4: Mean minimum monthly flow, April | 84.62 | 83.13 | -1.75 |
| ML5: Mean minimum monthly flow, May | 67.92 | 68.38 | 0.67 |
| ML6: Mean minimum monthly flow, June | 55.15 | 57.61 | 4.44 |
| ML7: Mean minimum monthly flow, July | 44.22 | 46.23 | 4.54 |
| ML8: Mean minimum monthly flow, August | 38.78 | 44.42 | 14.56 |
| ML9: Mean minimum monthly flow, September | 41.69 | 47.59 | 14.14 |
| ML10: Mean minimum monthly flow, October | 46.50 | 51.30 | 10.32 |
| ML11: Mean minimum monthly flow, November | 56.75 | 60.71 | 6.97 |
| ML12: Mean minimum monthly flow, December | 64.17 | 72.37 | 12.78 |
| ML13: CV of minimum monthly flows | 48.77 | 47.84 | -1.91 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.37 | 0.42 | 13.44 |
| ML15: Mean minimum annual flow / mean annual flow | 0.27 | 0.32 | 17.83 |
| ML16: Median minimum annual flow / median annual flow | 0.39 | 0.41 | 4.25 |
| ML20: Ratio of baseflow volume to total flow volume | 0.61 | 0.65 | 7.20 |
| ML22: Mean annual minimum flow divided by catchment area | 0.32 | 0.36 | 12.45 |
| RA1: Mean of positive changes from one day to next (rise rate) | 79.50 | 75.27 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 243.16 | 280.26 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 28.27 | 23.32 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 345.24 | 396.67 |  |
| RA5: Ratio of days that are higher than previous day | 0.24 | 0.24 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.18 | 0.08 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.07 | 0.04 |  |
| RA8: Number of flow reversals from one day to the next | 108.00 | 96.85 |  |
| RA9: CV, number of flow reversals from one day to the next | 7.25 | 12.84 |  |

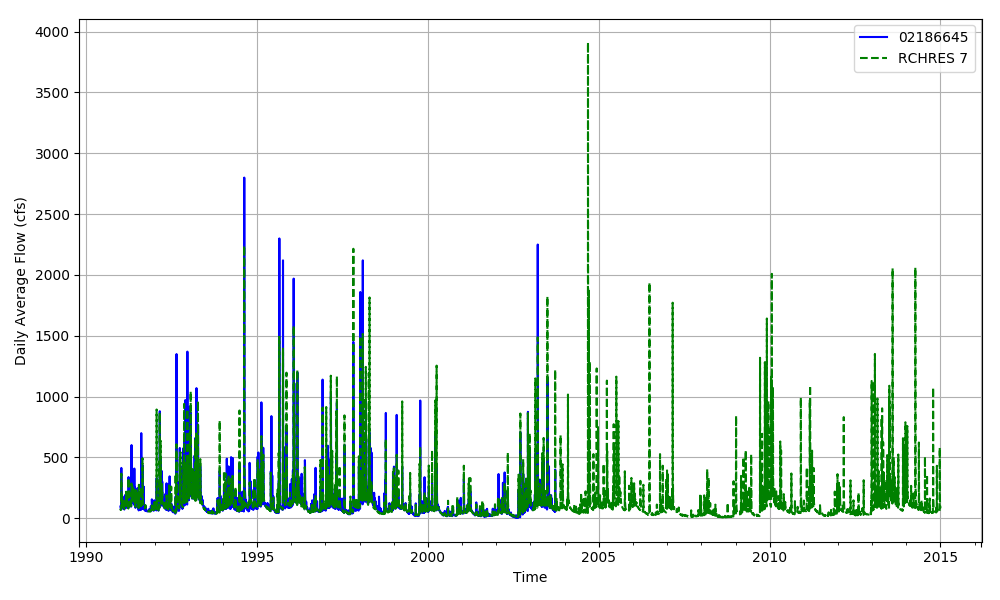


Figure 03060101-10: Daily flow for HSFP reach 07 and USGS station 02186645.

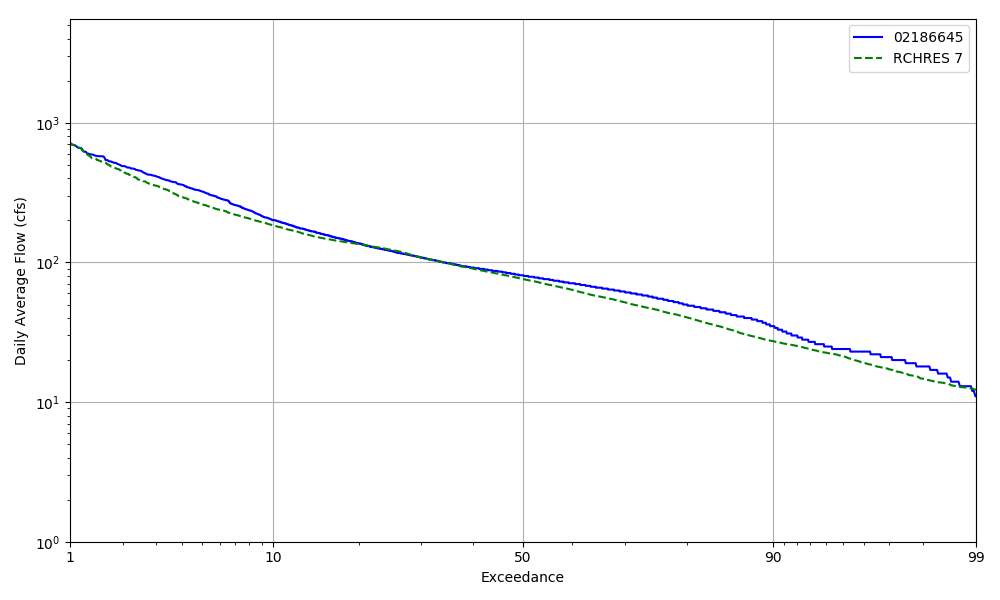


Figure 03060101-11: Daily exceedance for HSFP reach 07 and USGS station 02186645.

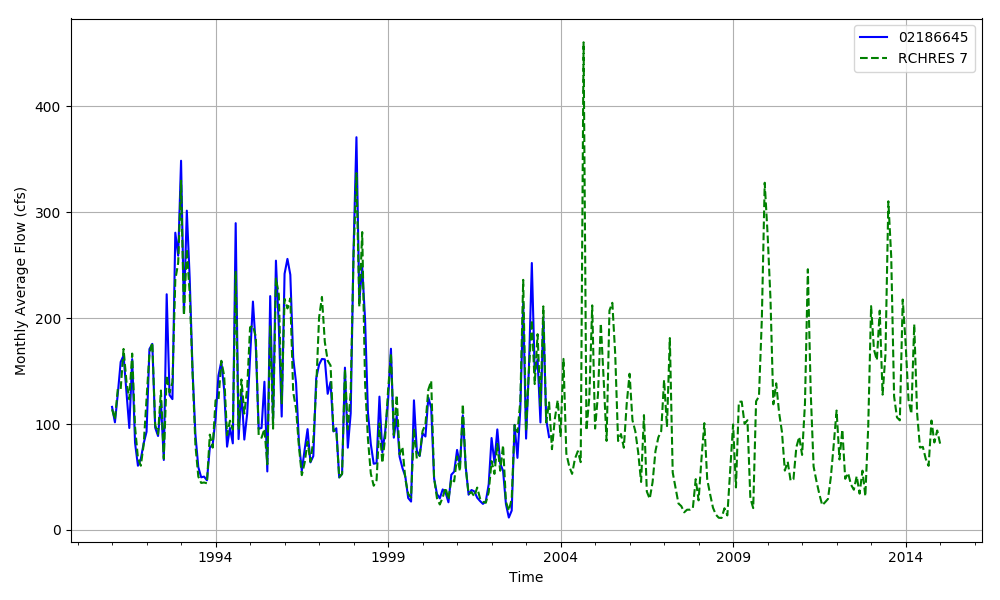


Figure 03060101-12: Monthly flow for HSFP reach 07 and USGS station 02186645.

## HSPF Reach 23, USGS Gauge 02185200

Table 03060101-7: Comparison Statistics Between HSPF Reach 23 and USGS Gauge 02185200.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 8.78 |
| Standard error | 38.58 |
| Relative bias | 0.05 |
| Relative standard error | 0.41 |
| Nash-Sutcliffe coefficient | 0.83 |
| Coefficient of efficiency | 0.62 |
| Index of agreement | 0.82 |

Table 03060101-8: Hydrologic Indices Between USGS Gauge 02185200 and HSPF Reach 23.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02185200 | Simulated Reach 23 | Percent Difference |
| MA1: Mean, all daily flows | 170.68 | 179.35 | 5.08 |
| MA2: Median, all daily flows | 137.00 | 139.24 | 1.63 |
| MA3: CV, all daily flows | 84.67 | 91.08 | 7.58 |
| MA4: CV, log of all daily flows | 56.15 | 59.39 | 5.77 |
| MA5: Mean daily flow / median daily flow | 1.25 | 1.29 | 3.39 |
| MA9: (Q10 - Q90) / median daily flow | 1.69 | 1.74 | 2.95 |
| MA10: (Q20 - Q80) / median daily flow | 1.06 | 1.07 | 1.01 |
| MA11: (Q25 - Q75) / median daily flow | 0.85 | 0.81 | -4.48 |
| MA12: Mean monthly flow, January | 223.48 | 251.39 | 12.49 |
| MA13: Mean monthly flow, February | 218.88 | 239.92 | 9.61 |
| MA14: Mean monthly flow, March | 237.74 | 247.97 | 4.31 |
| MA15: Mean monthly flow, April | 214.94 | 211.88 | -1.42 |
| MA16: Mean monthly flow, May | 177.72 | 170.59 | -4.01 |
| MA17: Mean monthly flow, June | 146.82 | 140.20 | -4.51 |
| MA18: Mean monthly flow, July | 120.93 | 117.27 | -3.03 |
| MA19: Mean monthly flow, August | 146.78 | 136.15 | -7.24 |
| MA20: Mean monthly flow, September | 110.65 | 125.42 | 13.35 |
| MA21: Mean monthly flow, October | 121.13 | 135.64 | 11.98 |
| MA22: Mean monthly flow, November | 135.36 | 161.77 | 19.51 |
| MA23: Mean monthly flow, December | 156.62 | 176.10 | 12.44 |
| ML1: Mean minimum monthly flow, January | 125.23 | 127.15 | 1.53 |
| ML2: Mean minimum monthly flow, February | 135.15 | 139.35 | 3.11 |
| ML3: Mean minimum monthly flow, March | 154.15 | 140.89 | -8.61 |
| ML4: Mean minimum monthly flow, April | 155.85 | 133.68 | -14.22 |
| ML5: Mean minimum monthly flow, May | 124.92 | 106.58 | -14.69 |
| ML6: Mean minimum monthly flow, June | 99.92 | 97.87 | -2.06 |
| ML7: Mean minimum monthly flow, July | 82.46 | 82.42 | -0.05 |
| ML8: Mean minimum monthly flow, August | 74.08 | 80.06 | 8.07 |
| ML9: Mean minimum monthly flow, September | 75.46 | 86.31 | 14.38 |
| ML10: Mean minimum monthly flow, October | 75.75 | 85.19 | 12.47 |
| ML11: Mean minimum monthly flow, November | 85.92 | 96.67 | 12.51 |
| ML12: Mean minimum monthly flow, December | 111.00 | 117.90 | 6.22 |
| ML13: CV of minimum monthly flows | 50.74 | 41.82 | -17.58 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.37 | 0.46 | 25.87 |
| ML15: Mean minimum annual flow / mean annual flow | 0.31 | 0.37 | 20.21 |
| ML16: Median minimum annual flow / median annual flow | 0.36 | 0.40 | 13.27 |
| ML20: Ratio of baseflow volume to total flow volume | 0.72 | 0.67 | -6.14 |
| ML22: Mean annual minimum flow divided by catchment area | 0.54 | 0.65 | 20.43 |
| RA1: Mean of positive changes from one day to next (rise rate) | 80.53 | 108.33 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 264.75 | 259.59 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 28.80 | 32.98 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 390.45 | 370.70 |  |
| RA5: Ratio of days that are higher than previous day | 0.25 | 0.23 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.12 | 0.07 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.05 | 0.04 |  |
| RA8: Number of flow reversals from one day to the next | 107.46 | 101.31 |  |
| RA9: CV, number of flow reversals from one day to the next | 11.25 | 11.46 |  |

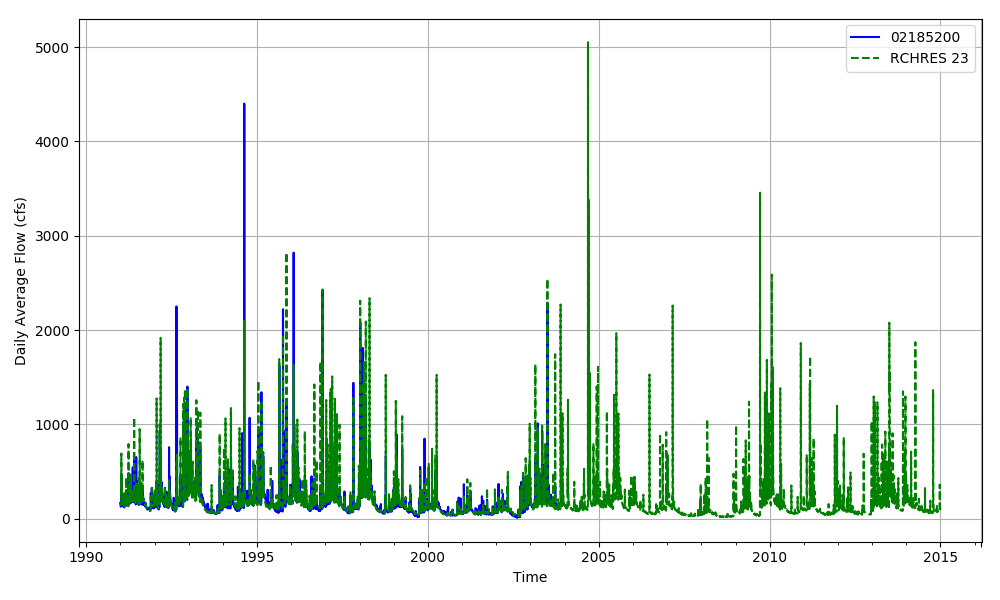


Figure 03060101-13: Daily flow for HSFP reach 23 and USGS station 02185200.

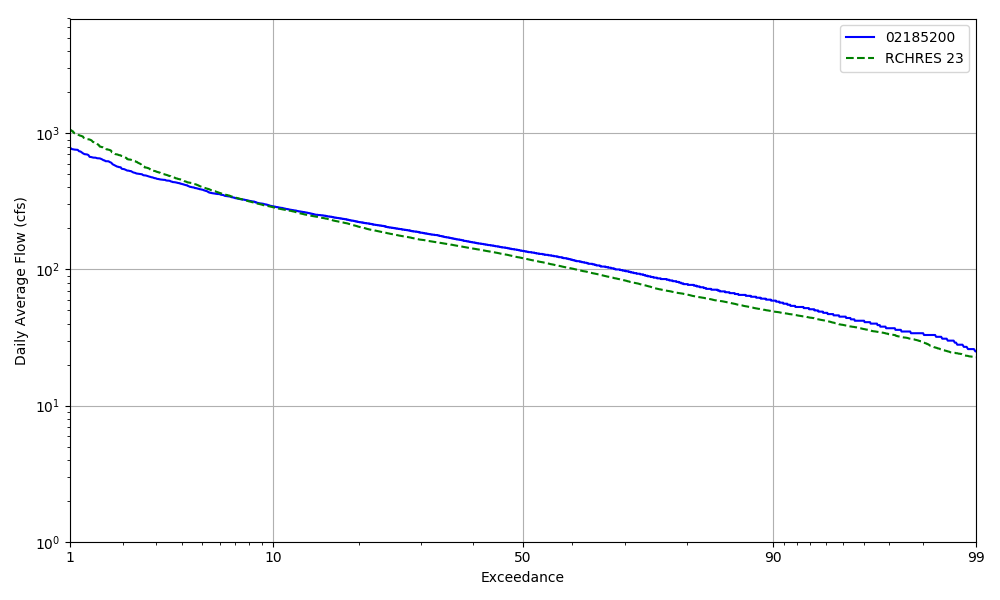


Figure 03060101-14: Daily exceedance for HSFP reach 23 and USGS station 02185200.

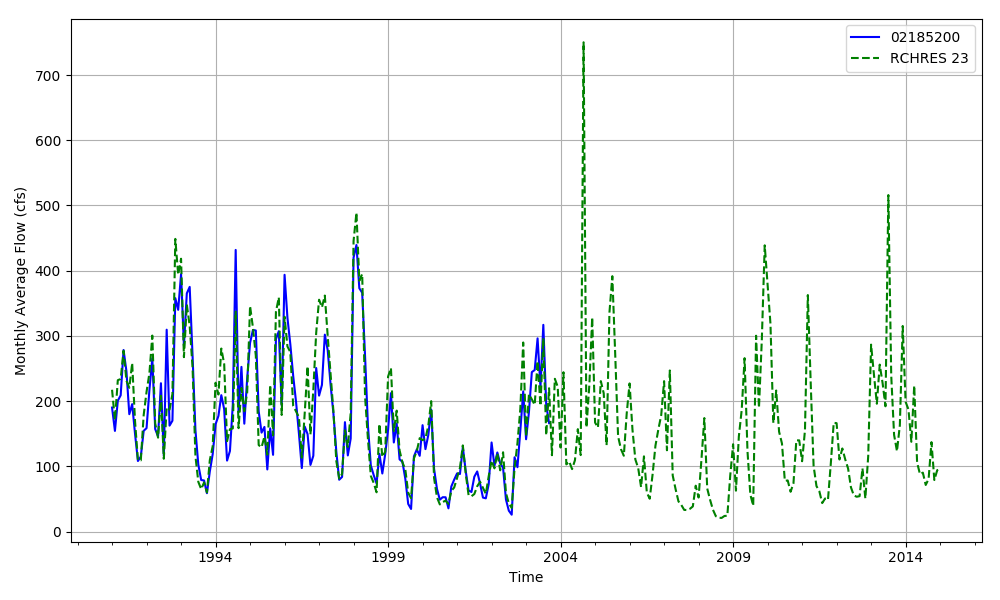


Figure 03060101-15: Monthly flow for HSFP reach 23 and USGS station 02185200.