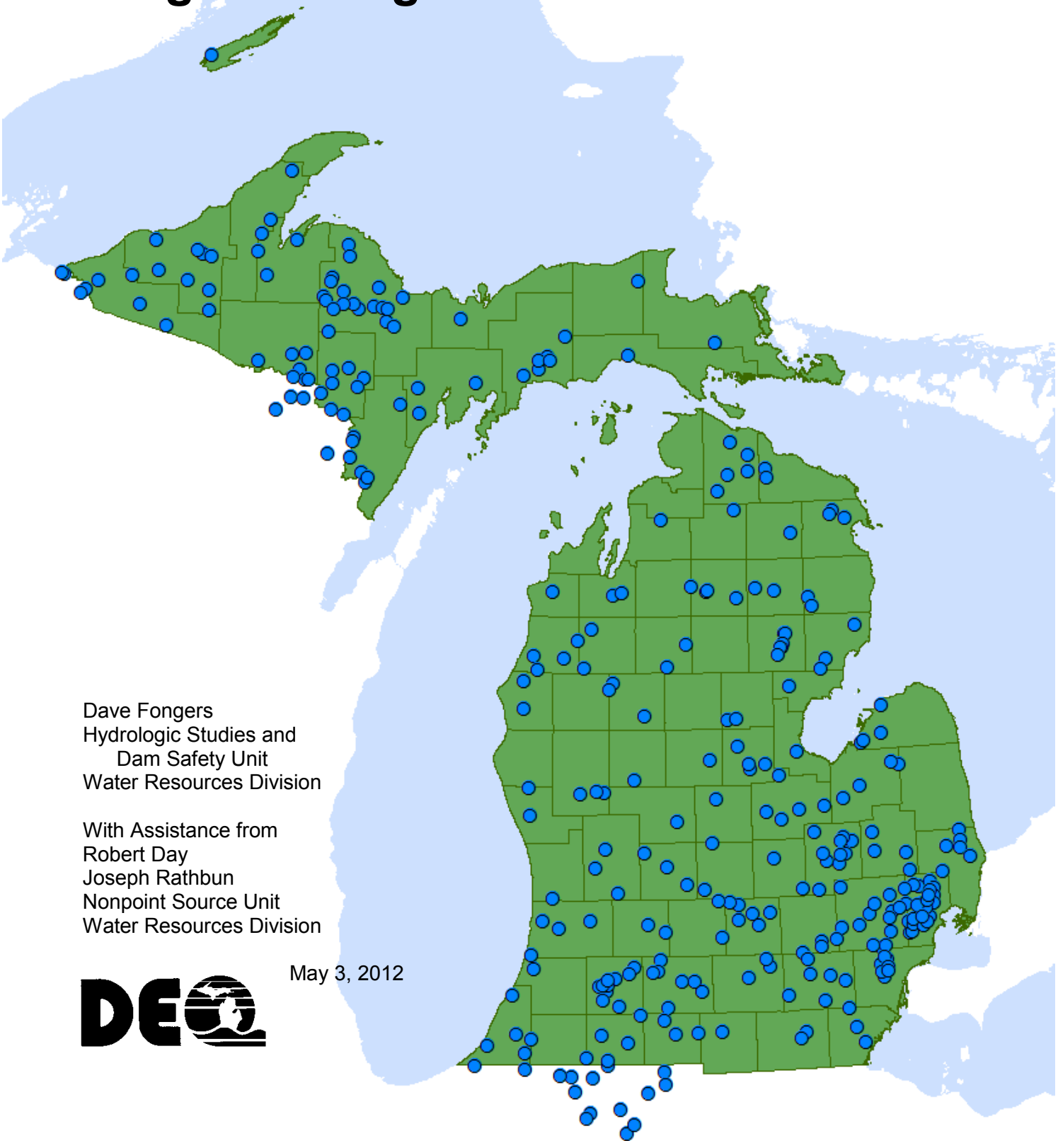
MI/DEQ/WRD-12/028

Application of the Richards-Baker Flashiness Index to Gaged Michigan Rivers and Streams



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The cover depicts the United States Geological Survey gages analyzed using the Richards-Baker Flashiness Index method.

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Summary

Stream flashiness is a stream flow response to storms. Streams that rise and fall quickly are considered flashier than those that maintain a steadier flow. An increase in flashiness, often due to changing land use, is a common cause of stream channel instability. The Richards-Baker Flashiness Index (R-B Index) uses data from United States Geological Survey (USGS) gaging stations to quantify the frequency and rapidity of short-term changes in stream flow. The Michigan Department of Environmental Quality (MDEQ) Nonpoint Source (NPS) Program staff calculated R-B Index values and assessed trends for 308 USGS gages in Michigan watersheds that had at least five years of data through the end of water year 2011.

The NPS Program encourages grant recipients to incorporate this information in their stream stability assessments and watershed management plans. Watershed stakeholders should also find it useful as an aid to Best Management Practices (BMPs) selection and design. The NPS Program may also use the information to guide future grant goals. The information should also be useful to those interpreting other data, such as watershed development trends, stream bank erosion rates, or biological survey data.

The characteristic R-B Index values for Michigan watersheds are unitless and range from 0.005 to 1.009. Fluctuations over time are apparent in a stream's R-B Index values. Some fluctuations in the R-B Index values are expected from year to year simply because of natural weather variations. Longer term trends result from hydrologic alterations within the watershed. Trends identified at gages in operation during the past 25 years should be influencing the streams' morphology today. For the 204 gages in operation during the past 25 years, 31 have decreasing trends and 39 have increasing trends. For gages included in the 2007 report that have updated trend analyses, 10 gages have morphologically destabilizing flashiness trend changes and 33 have morphologically stabilizing or stable trend changes.

An increase in flashiness, due to higher peak flows or more frequent bankfull flows, may result in measurable changes to the channel shape – width, depth, sinuosity, and slope. These changes occur by erosion. Reducing excessive erosion is a common NPS project objective. A frequent dilemma in selecting and siting NPS BMPs is assessing the scale of the stream channel stability problem versus the scale of the problem's cause. The R-B Index is one tool for diagnosing the scale of a particular stream channel problem.

This report is intended to describe the flashiness analysis methodology and results. It does not attempt to fully explain changes in R-B Index values at specific sites. Further analysis of a specific site or sites within a watershed would be more efficiently and practically performed by local watershed groups and other stakeholders who can often apply watershed-specific and other local information to the interpretation.

The R-B Index values and trends apply only to the stream in the vicinity of the gage. Conditions throughout the watershed may vary. For example, flashy flows in a stream above the gage may be masked by the combined flows of other streams at the gage. Similarly, streams that are increasingly flashy at one gaged location may become stable downstream due to attenuation of flashy flows by tributary flows downstream of the gage.

Introduction

The term flashiness reflects the frequency and rapidity of short-term changes in stream flow (Baker et al., 2004). A stream described as flashy responds to rainfall by rising and falling quickly. Conversely, a stream that is not flashy would rise and fall less for an equivalent rainfall and would typically derive more of its overall flow from groundwater.

One approach to quantifying flashiness was proposed by Baker et al (2004). The method measures the path length of flow oscillations for data from gaged streams. Longer paths correlate with flashier streams, while more constant flows have shorter path lengths. Values for the R-B Index could theoretically range from zero to two. The R-B Index value would have a value of zero if the stream flow were absolutely constant. The R-B Index value increases as the path length, and flashiness, increase. An example of R-B Index values for two Michigan streams with similar drainage areas is shown in Figure 1. The Au Sable River and Lower River Rouge gaged drainage areas are 97 and 84 square miles, respectively. For water year 1991, both gages recorded similar total flows; 900 and 790 billion cubic feet for the Au Sable River and Lower Rouge River, respectively. Despite similar drainage areas and total discharges, the Lower Rouge River exhibited much flashier flows than the Au Sable River, with R-B Index values of 0.56 and 0.05, respectively. This is presumably due primarily to three factors: vegetation, soils, and imperviousness. The Au Sable River watershed has more vegetation and sandier, more permeable soils. The Lower Rouge River watershed has more impervious surface cover.

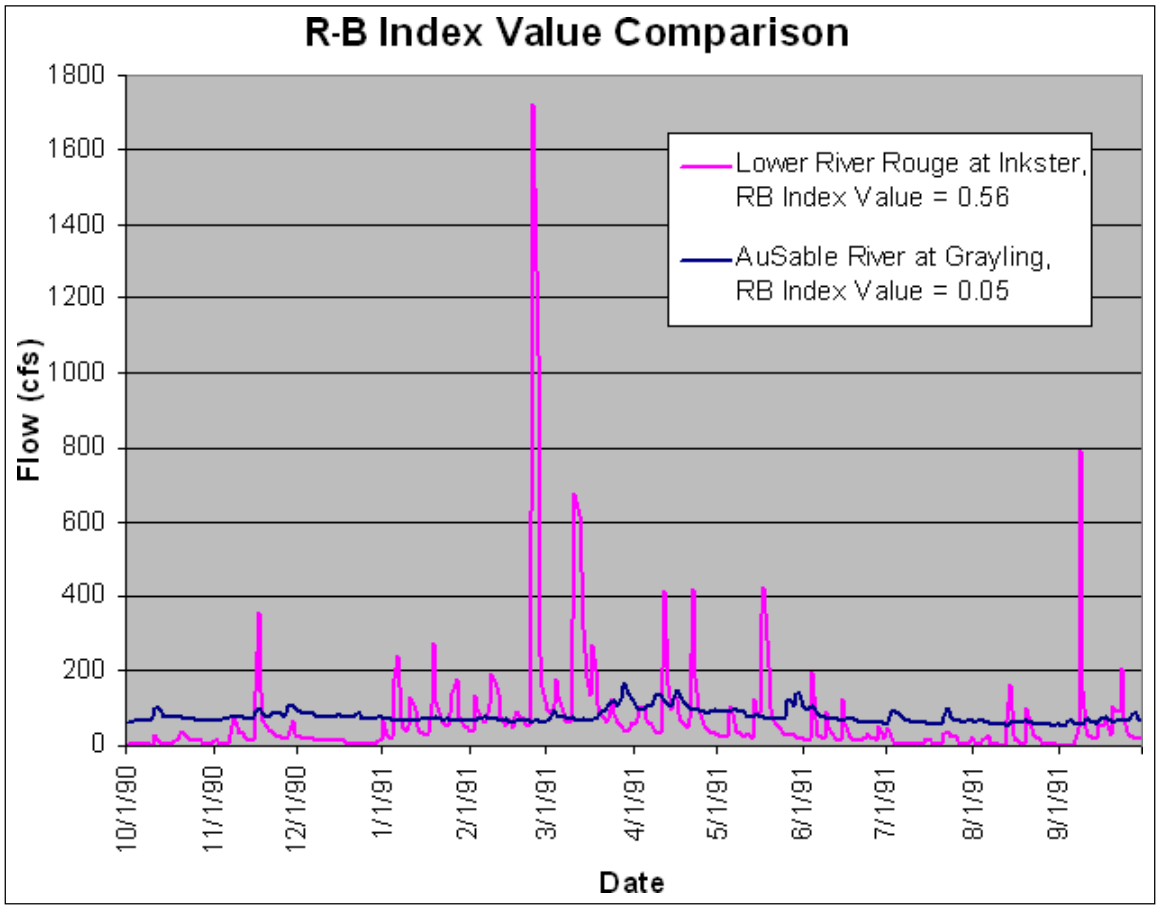


Figure 1 – Hydrographs for Two Michigan Streams.

One complication in interpreting R-B Index values is the effect of watershed size. Specifically, smaller watersheds naturally tend to have flashier flows. There is a natural tendency for flashiness

to decrease as the drainage area increases because varied timing of tributary flows helps attenuate main channel peak flows, and because soils and land uses tend to become more varied as the watershed size increases. This is reflected in the Baker et al (2004) results, as summarized in Figure 2, which shows that maximum R-B Index values decrease as watershed size increases.

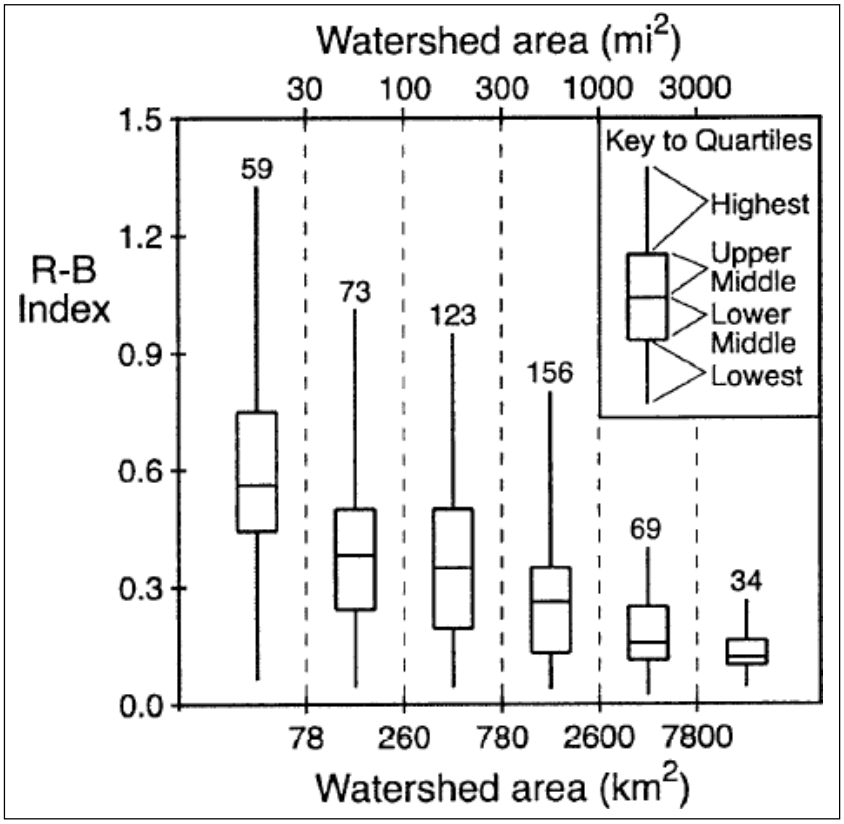


Figure 2 – Summary of the Richards-Baker Data for 515 Gages in Six Midwestern States, including Michigan.

Methodology

Gage Selection

This flashiness analysis for Michigan watersheds uses average daily flow data from 308 USGS gages (Figure 3). The selection criteria was that each gage had at least five years of daily data (P. Richards, personal communication, 2005) and that the flow data be available for at least 90 percent of the water year. For this report, data was available through the end of water year 2011, which was September 30, 2011.

We did not limit the age of the data, preferring that watershed groups and other users of the results draw their own conclusions with regard to the validity and usefulness of the results, particularly with regard to discontinued gages, for their watershed. Of the 308 gages, 104 were discontinued over 25 years ago. Another 61 were discontinued 2 to 25 years ago. Refer also to Figure 3. Flashiness rankings for discontinued gages may not reflect current conditions.

Occasionally, a gage is moved and assigned a new number. If the gages are considered equivalent, the discontinued gage's flow record is included in the new gage's record. Only the newer gage, with the complete record, is included in this analysis. These gages are noted in the "Information by Gage Site" section.

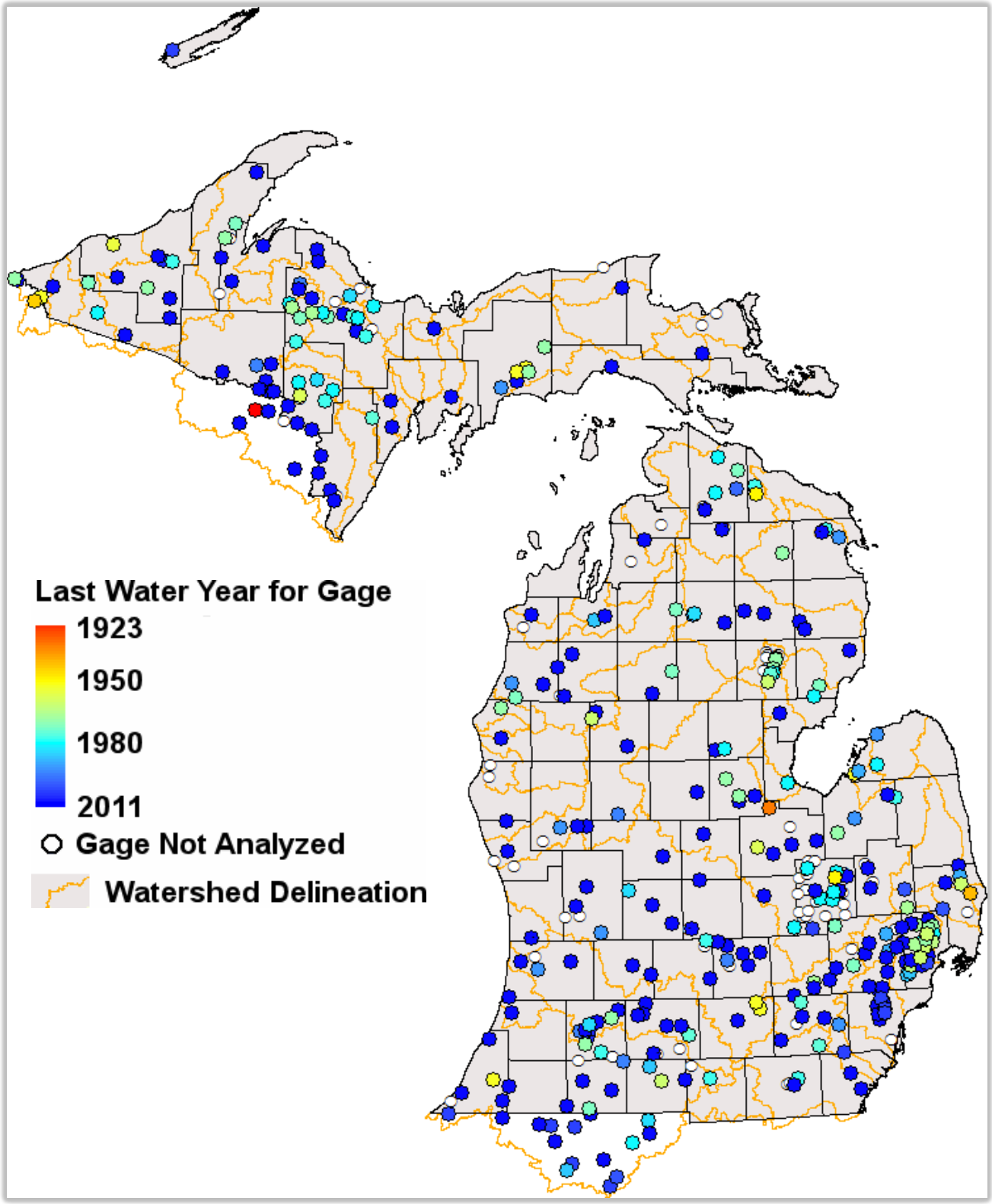
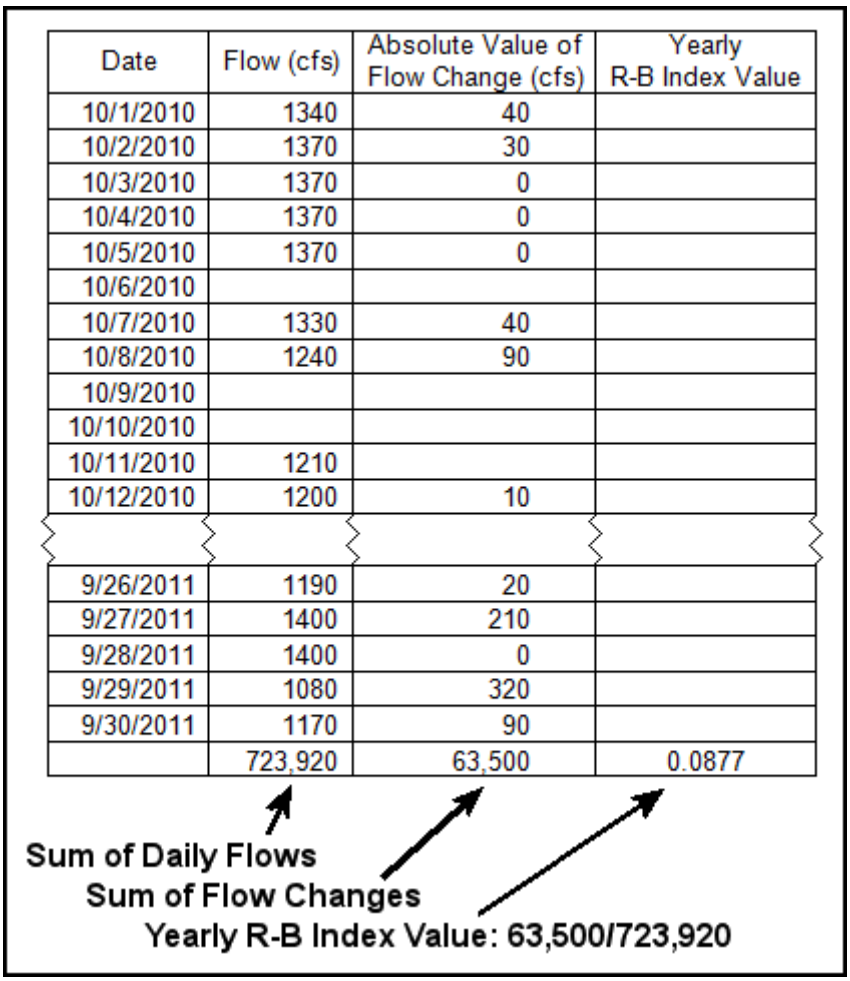


Figure 3 – USGS Gage Status for Michigan Watersheds.

Calculation of Yearly and Characteristic R-B Index Values

Yearly R-B Index values are calculated by summing the absolute values of daily flow differences and dividing by the sum of the daily flows for each year, as shown in Figure 4. If flow data is not available for one day, the difference equation spans the one day gap. For gaps of two days or more, the difference equation is reset at the beginning of the gap. Days reported as "ICE" are excluded from this analysis and are the most common reason for a data gap. More detail can be obtained from the journal article by Baker et al (2004).



Date	Flow (cfs)	Absolute Value of Flow Change (cfs)	Yearly R-B Index Value
10/1/2010	1340	40	
10/2/2010	1370	30	
10/3/2010	1370	0	
10/4/2010	1370	0	
10/5/2010	1370	0	
10/6/2010			
10/7/2010	1330	40	
10/8/2010	1240	90	
10/9/2010			
10/10/2010			
10/11/2010	1210		
10/12/2010	1200	10	
9/26/2011	1190	20	
9/27/2011	1400	210	
9/28/2011	1400	0	
9/29/2011	1080	320	
9/30/2011	1170	90	
	723,920	63,500	0.0877

Figure 4 – Calculation of Yearly R-B Index Values.

A characteristic R-B Index value for each gage is calculated from that gage's yearly values. Refer also to Figure 5.

- Linear regression is used to estimate the characteristic R-B Index value at the last year when data were collected when there is a statistically significant trend. For this report, statistical significance means linear regression p value is less than or equal to 0.05. In other words, the characteristic R-B Index value is the point on the trend line at the last year of data collection. This point is highlighted on the graphs in "Information by Gage Site" section.
- If there is not a trend, the characteristic R-B Index value is the average of yearly R-B Index values.

The F-Test Two-Sample for Variances analysis was applied to gages with large yearly data gaps. If P(F<=f) one-tail is less than 0.05, the variances are different and only the more recent data is analyzed for linear regression. If greater than 0.05, all data are used.

Visual examination of the data plots for each gage indicates that some gages have experienced trend changes. A statistical technique, termed cusum, was then applied to the data, and then the first derivative of the five-year moving average cusum data was plotted. Extremes in the first derivative plots were used to identify possible trend breaks. Where a possible trend change was identified, an additional regression analysis was performed on the gage's more recent yearly R-B Index values. This technique is further explained in Appendix A. If a statistically significant change occurred, only the more recent data were used for the trend analysis and to calculate the characteristic R-B Index value.

Serially correlated data and data with heterogeneous variance were excluded from the linear regression analysis. The linear trend lines shown in the "Information by Gage Site" section do not guarantee a linear relationship between flashiness and time for those streams, nor can they be used to predict future flashiness trends for those streams. The physical processes causing the changes are undoubtedly complex. The trends identified are only intended to objectively identify streams experiencing flow changes that may be physically altering the stream's channel morphology today.

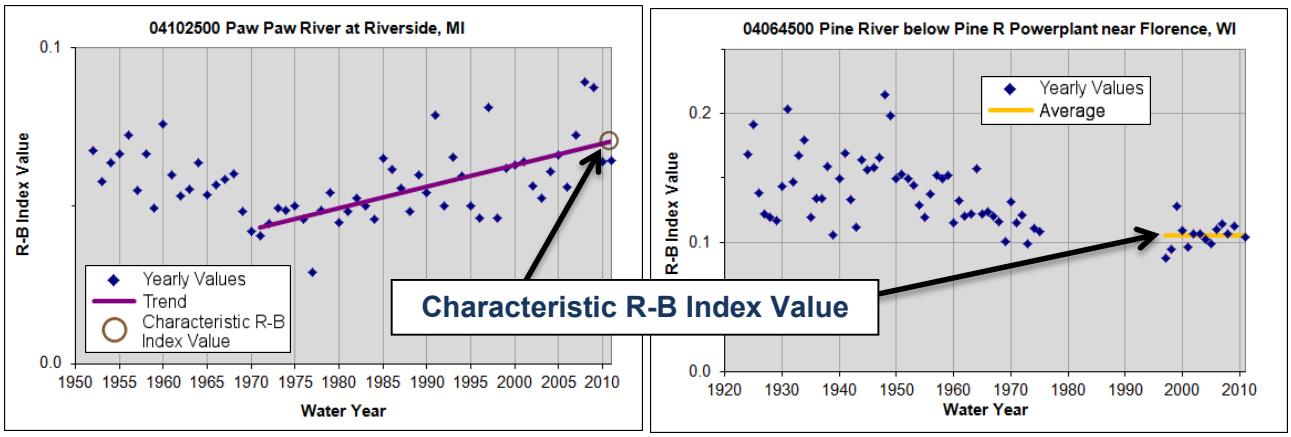


Figure 5 – Examples of Characteristic R-B Index Values.

General Changes in Methodology since the 2007 Report

Data through water year 2011 were added. Gages outside the state of Michigan were added if they are in a watershed that includes Michigan. A few new gages within Michigan were also added. The term "Average R-B Index Value" was replaced with "Characteristic R-B Index Value" because averages are no longer used when there is a statistically significant trend.

Other statistical criteria were revised as described below:

1. The yearly analyses were restricted to only include water years that have flow data for at least 90 percent of the water year, or at least 329 days. Ice days are excluded. This revision was applied to all data, resulting in the deletion of some previously reported R-B Index yearly values and the elimination of one gage from the analysis.
2. The F-Test Two-Sample for Variances analysis was applied to gages with significant data gaps.
3. Statistical significance is reported only if the p value is less than or equal to 0.05. In the 2007 report, we included p values of 0.05 to 0.10.

4. Where there is a statistically significant trend, linear regression is used to estimate the characteristic R-B Index value at the last year when data were collected. Previously, the average of the yearly R-B Index values for the years spanned by the trend line was used for what is termed the characteristic R-B Index value in this report.

Gage-Specific Changes in Methodology since the 2007 Report

Gage 04065000 (Menominee River near Iron Mountain), included in the first report, is no longer included because the data does not meet criterion number 1 listed under "General Changes."

Thirty gages were added (Figure 6). Most are in Indiana or Wisconsin, but located in a watershed that includes Michigan. A few new gages in Michigan that now have enough data to be analyzed have been added. Four of the added gages have statistically significant increasing trends. Four have statistically significant decreasing trends. This information will be useful to someone considering BMPs for a site in Michigan, but upstream or downstream of one of the added gages. See also the "Application to NPS BMP Selection" section.

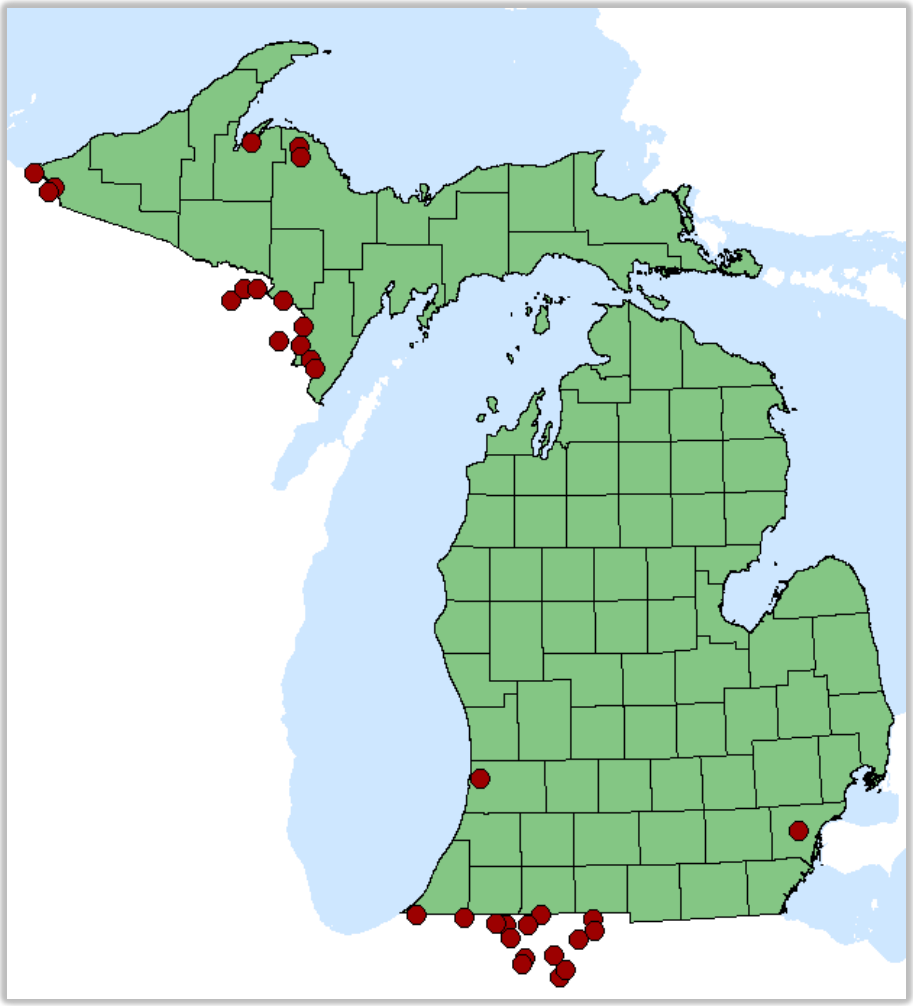


Figure 6 – Gages Added to the Analysis Since the 2007 Report.

List of Added Gages:

- Streams Tributary to Lake Superior

    - 04028000, Montreal River at Ironwood, Michigan
    - 04029000, West Branch Montreal River at Gile, Wisconsin
    - 04029990, Montreal River at Saxon Falls near Saxon, Wisconsin
    - 04043150, Silver River near L'Anse, Michigan
    - 04043244, East Branch Salmon Trout River near Dodge City, Michigan
    - 04043275, Yellow Dog River near Big Bay, Michigan

- Streams Tributary to Lake Michigan, Upper Peninsula

    - 04063700, Popple River near Fence, Wisconsin
    - 04064000, Pine River near Florence, Wisconsin
    - 04064500, Pine River below Pine River Powerplant near Florence, Wisconsin
    - 04065106, Menominee River at Niagara, Wisconsin (decreasing trend)
    - 04066030, Menominee River at White Rapids Dam near Banat, Michigan
    - 04066500, Pike River at Amberg, Wisconsin
    - 04067500, Menominee River near McAllister, Wisconsin (decreasing trend)

- Streams Tributary to Lake Michigan, Southern Lower Peninsula

    - 04096100, Galena River near Laporte, Indiana
    - 04097970, Lime Lake Outlet at Panama, Indiana
    - 04099510, Pigeon Creek near Angola, Indiana (decreasing trend)
    - 04099610, Pretty Lake Inlet near Stroh, Indiana
    - 04099750, Pigeon River near Scott, Indiana (increasing trend)
    - 04099808, Little Elkhart River at Middlebury, Indiana
    - 04099850, Pine Creek near Elkhart, Indiana
    - 04100222, North Branch Elkhart River at Cosperville, Indiana (decreasing trend)
    - 04100252, Forker Creek near Burr Oak, Indiana (increasing trend)
    - 04100295, Rimmell Branch near Albion, Indiana
    - 04100377, Solomon Creek near Syracuse, Indiana (increasing trend)
    - 04100465, Turkey Creek at Syracuse, Indiana
    - 04100500, Elkhart River at Goshen, Indiana
    - 04101000, St. Joseph River at Elkhart, Indiana (increasing trend)
    - 04101370, Juday Creek near South Bend, Indiana
    - 04108670, Kalamazoo River near New Richmond, Michigan

- Streams Tributary to Detroit River

    - 04168580, Ecorse River at Dearborn Heights, Michigan

R-B Index Value Analysis

The R-B Index values for Michigan watersheds range from 0.005 to 1.009, as shown in Table 1. For comparison, the R-B Index values for the Richards-Baker six-state study of 515 midwestern gages ranged from 0.030 to 1.323. The Richards-Baker six-state study used data from 1975 through 2001.

Results of this R-B flashiness analysis are summarized in Figures 7 and 8. Figure 7 is similar to Figure 2, which summarizes the six-state Richards-Baker data. The 3,000-square mile drainage

area break point used in that study was omitted in this study because only eight gages in this study exceed that size.

Figure 8 illustrates the quartile rankings. Most of the flashiest steams are in the southeastern portion of the Lower Peninsula or the western end of the Upper Peninsula. This is likely a combination of developed land uses and heavier soils. The cluster of less flashy streams in the northern portion of the Lower Peninsula is likely the result of extensive natural land uses and sandy soils. In itself, a high or low ranking is not necessarily good or bad. The rankings may be used to identify areas where methods to reduce flashiness can be employed, or to identify areas where extra effort is warranted to protect our most sensitive and exceptional streams. This is discussed further in the "Flashiness Changes and Hydrologic Alterations, Land Use" section.

Detailed information for each gage is provided in the "Gage-Specific Flashiness Information" section.

Table 1 – Summary of R-B Flashiness Analysis Statistics.

MDEQ Analysis for Michigan	**Drainage Area (sq. miles)**				
	0-30	**30-100**	**100-300**	**300-1000**	**1000+**
Number of Gages	49	80	75	65	39
Mean	0.356	0.222	0.138	0.129	0.092
Minimum	0.005	0.046	0.026	0.029	0.047
25th Percentile	0.156	0.101	0.076	0.067	0.060
Median/50th Percentile	0.294	0.173	0.104	0.105	0.077
75th Percentile	0.489	0.289	0.172	0.149	0.100
Maximum	0.957	1.009	0.492	0.429	0.229

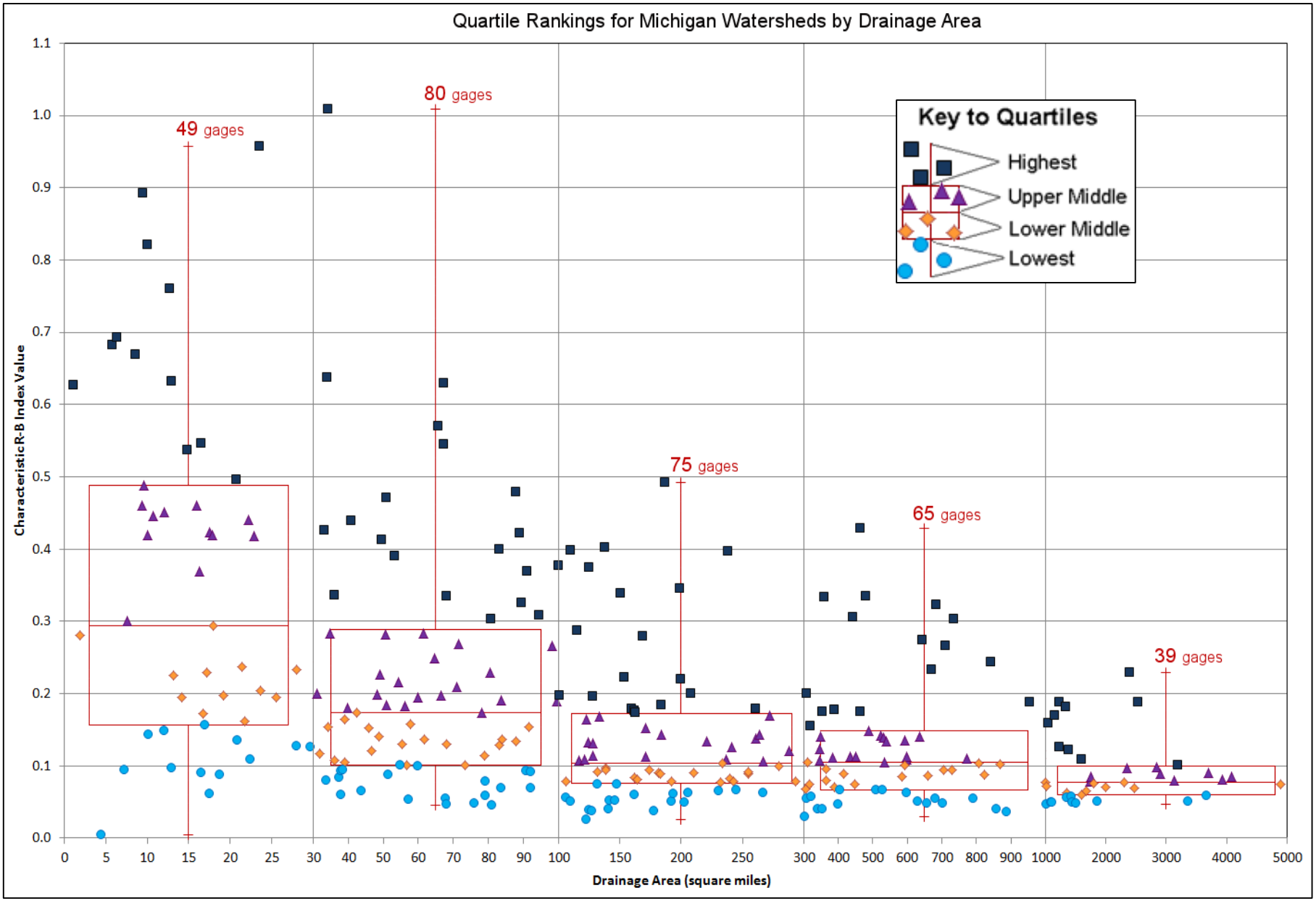


Figure 7 – Summary of Michigan R-B Index values.

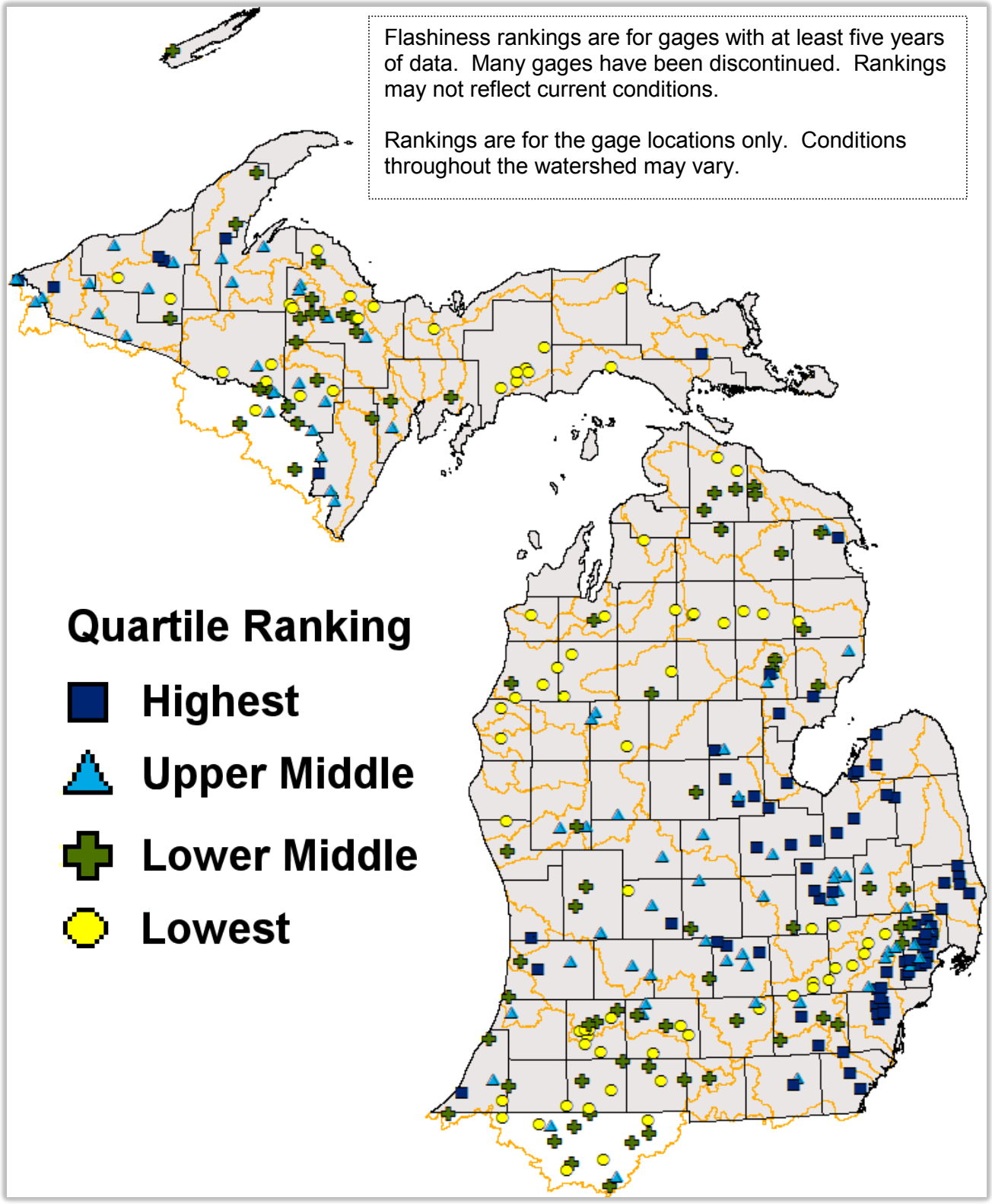


Figure 8 – Quartile Ranking of Michigan R-B Index Values.

Trend Analysis

Fluctuations over time are common in a stream's R-B Index values. Some fluctuations in the R-B Index values are expected from year to year simply because of natural weather variations. Longer-term trends result from hydrologic alterations, such as a change in land use or removal or change in operation of a dam. Figure 9 illustrates two examples. An increase in flashiness, due to higher peak flows or more frequent bankfull flows, can result in changes to the channel shape: width, depth, sinuosity, and slope. This is especially true for stream channels that are steep and composed of noncohesive materials (Rhoads and Miller, 1991). Changes in stream channel shape, in turn, can have significant impacts on aquatic organism populations (Richards et al., 1997; Van Steeter and Pitlick, 1998). Because a stream can take 50 years or more to adapt to flow changes (Caraco, 2000), we restricted the trend analysis to gages in operation during the past 25 years. The identified trends, which may span part or all of the gage record, should therefore be influencing each stream's morphology today and provide a comparative reference of the present condition of Michigan's streams.

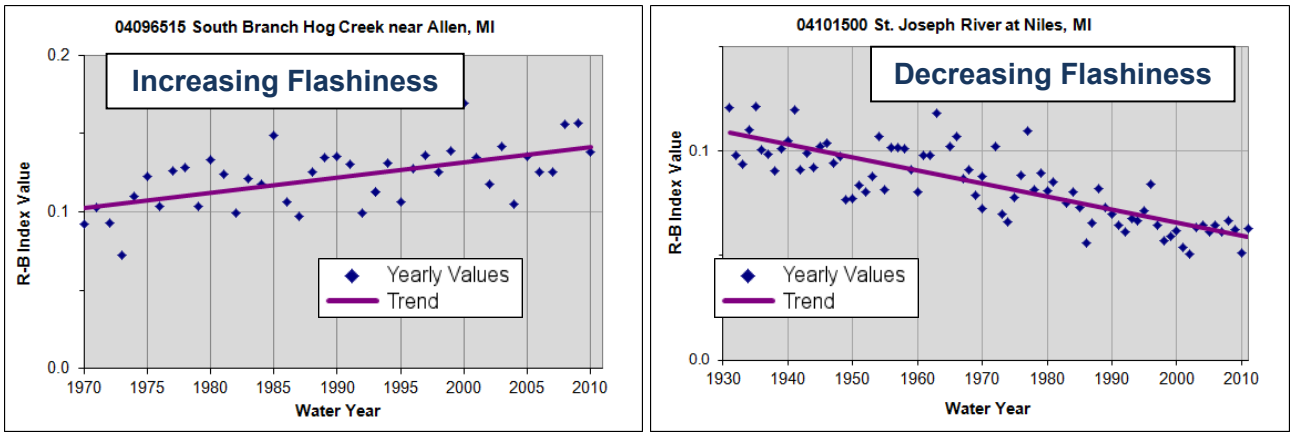


Figure 9 – Examples of Changing Stream Flashiness over Time.

As noted earlier, R-B Index values tend to decrease as the watershed sizes increase, which is accounted for in the quartile rankings. With regard to the trend analysis, smaller watersheds are also more likely to register an increase in flashiness, as shown in Figure 10. For example, 41 percent of the gages with an increasing trend have watersheds smaller than 100 square miles, compared to only 19 percent of the gages with decreasing trends.

The results of the trend analysis are shown in Figure 11 and Tables 2 and 3. Statistically significant trends in the R-B Index values are identified for 70 of the 204 gages in operation during the past 25 years. Thirty-one of the gages have decreasing trends. Thirty-nine of the gages have increasing trends. Detailed information for each gage is provided in the "Gage-Specific Flashiness Information" section.

Trends are for the gage location only. Streams that are increasingly flashy at one location may become stable downstream due to attenuation of flashy flows by tributary flows downstream of the gage. Similarly, flashy flows in a stream above the gage may be masked by the combined flows of other streams at the gage.

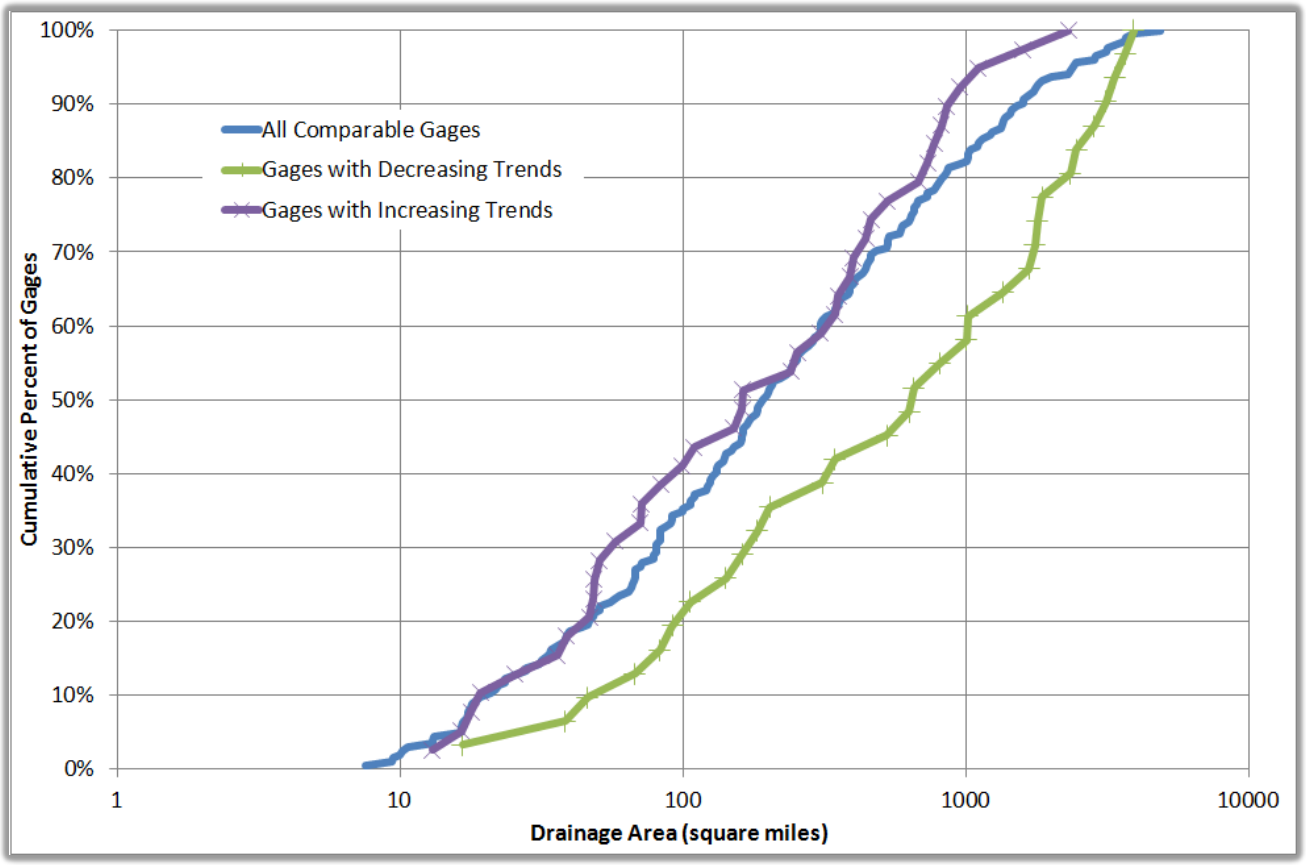


Figure 10 – Scaling Comparison of Gages with Increasing and Decreasing R-B Index Trends.

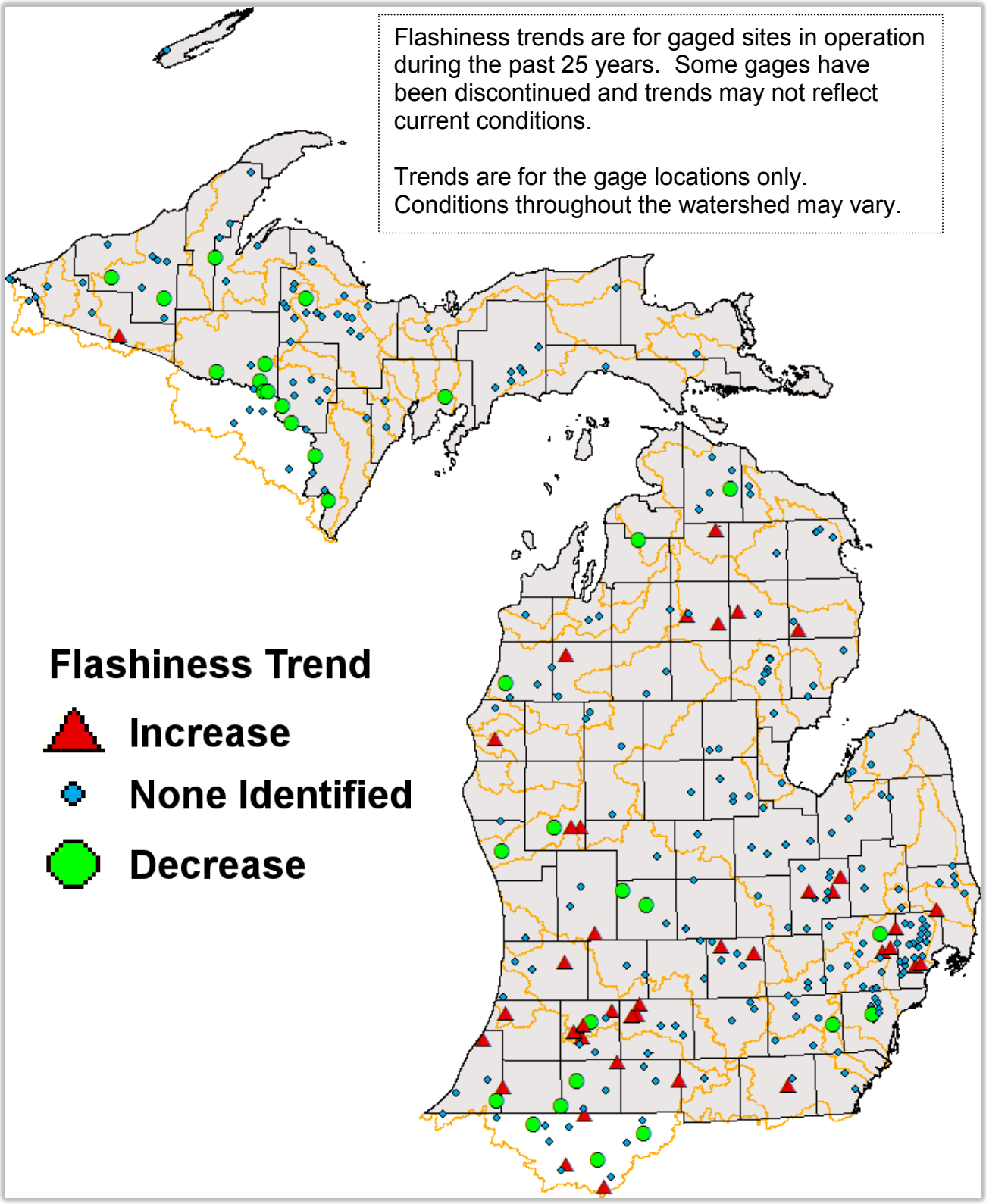


Figure 11 – Flashiness Trend by Gage.

Table 2 – Summary of Less Flashy Gages.

Gage Number	Gage Description	Drainage Area (sq. mi.)	Major Watershed	Ending Water Year
Less Flashy Gages in the Upper Peninsula – Total 14				
04034500	Middle Branch Ontonagon River near Trout Creek, MI	203	Ontonagon, 53	2011
04036000	West Branch Ontonagon River near Bergland, MI	162	Ontonagon, 53	2011
04041500	Sturgeon River near Alston, MI	346	Portage, 55	2011
04057510	Sturgeon River near Nahma Junction, MI	183	Sturgeon, 58	2009
04057800	Middle Branch Escanaba River at Humboldt, MI	46	Escanaba, 46	2009
04060500	Iron River at Highway 424 at Caspian, MI	92	Menominee, 50	2009
04062000	Paint River near Alpha, MI	631	Menominee, 50	2011
04062011	Brule River near Commonwealth, WI	1020	Menominee, 50	2011
04062500	Michigamme River near Crystal Falls, MI	656	Menominee, 50	2011
04063000	Menominee River near Florence, WI	1760	Menominee, 50	2011
04063500	Menominee River at Twin Falls near Iron Mountain, MI	1800	Menominee, 50	2011
04065106	Menominee River at Niagara, WI	2470	Menominee, 50	2011
04066003	Menominee River below Pemene Creek near Pembine, WI	3140	Menominee, 50	2011
04067500	Menominee River near McAllister, WI	3930	Menominee, 50	2011
Less Flashy Gages in the Lower Peninsula – Total 17				
04097500	St. Joseph River at Three Rivers, MI	1350	St. Joseph, 34	2011
04099000	St. Joseph River at Mottville, MI	1866	St. Joseph, 34	2011
04099510	Pigeon Creek near Angola, IN	106	St. Joseph, 34	2011
04100222	North Branch Elkhart River at Cosperville, IN	142	St. Joseph, 34	2011
04101000	St. Joseph River at Elkhart, IN	3370	St. Joseph, 34	2011
04101500	St. Joseph River at Niles, MI	3666	St. Joseph, 34	2011
04106000	Kalamazoo River at Comstock, MI	1010	Kalamazoo, 17	2011
04116000	Grand River at Ionia, MI	2840	Grand, 14	2011
04116500	Flat River at Smyrna, MI	528	Grand, 14	1986
04122000	Muskegon River at Newaygo, MI	2350	Muskegon, 22	1993
04122100	Bear Creek near Muskegon, MI	17	Muskegon, 22	2011
04126000	Manistee River near Manistee, MI	1677	Manistee, 20	1993
04127800	Jordan River near East Jordan, MI	68	Pine, 10	2011
04130500	Black River near Tower, MI	311	Cheboygan, 11	2000
04161500	Paint Creek near Lake Orion, MI	39	Clinton, 12	1991
04168000	Lower River Rouge at Inkster, MI	83	Rouge, 31	2011
04174800	Huron River at Ypsilanti, MI	807	Huron, 15	1994

Table 3 – Summary of More Flashy Gages.

Gage Number	Gage Description	Drainage Area (sq. mi.)	Major Watershed	Ending Water Year
More Flashy Gages in the Upper Peninsula – Total 1				
04037500	Cisco Branch Ontonagon River at Cisco Lake Outlet, MI	51	Ontonagon, 53	2011
More Flashy Gages in the Lower Peninsula – Total 38				
04096515	South Branch Hog Creek near Allen, MI	49	St. Joseph, 34	2010
04096900	Nottawa Creek near Athens, MI	162	St. Joseph, 34	1997
04099750	Pigeon River near Scott, IN	307	St. Joseph, 34	2011
04100252	Forker Creek near Burr Oak, IN	19	St. Joseph, 34	2003
04100377	Solomon Creek near Syracuse, IN	36	St. Joseph, 34	2003
04101800	Dowagiac River at Sumnerville, MI	255	St. Joseph, 34	2011
04102500	Paw Paw River at Riverside, MI	390	St. Joseph, 34	2011
04102700	South Branch Black River near Bangor, MI	84	Black, 7	2011
04104945	Wanadoga Creek near Battle Creek, MI	48	Kalamazoo, 17	2011
04105000	Battle Creek at Battle Creek, MI	241	Kalamazoo, 17	2011
04105500	Kalamazoo River near Battle Creek, MI	824	Kalamazoo, 17	2011
04105700	Augusta Creek near Augusta, MI	39	Kalamazoo, 17	2011
04106180	Portage Creek at Portage, MI	17	Kalamazoo, 17	2006
04106320	West Fork Portage Creek near Oshtemo, MI	13	Kalamazoo, 17	1996
04106500	Portage Creek at Kalamazoo, MI	47	Kalamazoo, 17	1986
04108600	Rabbit River near Hopkins, MI	71	Kalamazoo, 17	2011
04111379	Red Cedar River near Williamston, MI	163	Grand, 14	2011
04112500	Red Cedar River at East Lansing, MI	355	Grand 14	2011
04118000	Thornapple River near Caledonia, MI	773	Grand 14	1994
04121944	Little Muskegon River near Oak Grove, MI	345	Muskegon, 22	2011
04121970	Muskegon River near Croton, MI	2313	Muskegon, 22	2011
04122500	Pere Marquette River at Scottville, MI	681	Pere Marquette, 25	2011
04124000	Manistee River near Sherman, MI	857	Manistee, 20	2011
04128990	Pigeon River at Sturgeon Valley Road near Vanderbilt, MI	58	Cheboygan, 11	2011
04135500	Au Sable River at Grayling, MI	110	Au Sable, 2	1993
04135700	South Branch Au Sable River near Luzerne, MI	401	Au Sable, 2	2011
04136000	Au Sable River near Red Oak, MI	1108	Au Sable, 2	2011
04137005	Au Sable River near Curtisville, MI	1598	Au Sable, 2	2011
04147500	Flint River near Otisville, MI	530	Saginaw, 32	2011
04148140	Kearsley Creek near Davison, MI	99	Saginaw, 32	2011
04148500	Flint River near Flint, MI	956	Saginaw, 32	2011
04160600	Belle River at Memphis, MI	151	Belle, 3	2011
04161100	Galloway Creek near Auburn Heights, MI	18	Clinton, 12	1991
04161540	Paint Creek at Rochester, MI	71	Clinton, 12	2011
04161580	Stony Creek near Romeo, MI	26	Clinton, 12	2011
04164000	Clinton River near Fraser, MI	444	Clinton, 12	2011
04165500	Clinton River at Moravian Drive at Mount Clemens, MI	734	Clinton, 12	2004
04176000	River Raisin near Adrian, MI	463	Raisin, 29	2011

Changes in Results since the 2007 Report

Many of the characteristic R-B Index values were recalculated as trend line endpoints at the last year of data collection instead of as averages. Data with large gaps were also reevaluated using F-Test Two-Sample for Variances analysis. Some gages therefore have revised characteristic R-B Index values due only to refinements in the methodology, not because of a change in the stream's flashiness. Further, one gage was dropped and 30 gages were added, mostly in neighboring states, but located in a watershed that includes Michigan. Because of these revisions, the summary statistics, Table 1, and trend counts, Table 2, should not be directly compared to the 2007 report.

Seventy-two of the gages with trends can be reviewed for changes from the 2007 report to this report. These 72 gages are summarized in Table 4 and on Figure 12 with the results grouped as follows:

- Destabilizing – unnatural steambank erosion is possible
    - Decreasing trend updated to increasing trend
    - No trend updated to increasing trend
    - Continued increasing trend
- Stabilizing – unnatural steambank erosion rate is not worsening and may be improving
    - Increasing trend updated to no trend
    - Increasing trend updated to decreasing trend
- Stable – unnatural steambank erosion rate is not expected
    - Decreasing trend updated to no trend
    - No trend updated to decreasing trend
    - Continued decreasing trend

Table 4 – Summary of Trend Comparison from 2007 to 2012 Report.

Morphologic Impact	Trend Changed	Trend Continuing Unchanged	Total
Destabilizing	11	18	29
Stabilizing	14	*	14
Stable	19	10	29

*As defined above, all gages classified as stabilizing must have a trend change from the 2007 report.

Twenty-eight gages were excluded from the comparison as described in Table 5.

Table 6 provides details for each of the gages as compared to the 2007 report. Forty-four gages with additional data had revised trend analysis. Twenty-eight gages have additional data analyzed for this report, but the reported trend did not change.

Table 5 – Gages Excluded from Comparison, Sorted by Gage Number.

Gage	Comment
04065106, Menominee River at Niagara, WI	Not in 2007 report, neighboring state, decreasing trend
04065393, East Branch Sturgeon River below Skunk Creek near Felch, MI	Data now over 25 years old, was decreasing trend
04067500, Menominee River near McAllister, WI	Not in 2007 report, neighboring state, decreasing trend
04096900, Nottawa Creek Near Athens, MI	Static Analysis, Increasing Trend, but gage was discontinued and had no additional data to analyze
04099510, Pigeon Creek near Angola, IN	Not in 2007 report, neighboring state, decreasing trend
04099750, Pigeon River near Scott, IN	Not in 2007 report, neighboring state, increasing trend
04100222, North Branch Elkhart River at Cosperville, IN	Not in 2007 report, neighboring state, decreasing trend
04100252, Forker Creek near Burr Oak, IN	Not in 2007 report, neighboring state, increasing trend
04100377, Solomon Creek near Syracuse, IN	Not in 2007 report, neighboring state, increasing trend
04101000, St. Joseph River at Elkhart, IN	Not in 2007 report, neighboring state, increasing trend
04106320, West Fork Portage Creek Near Oshtemo, MI	Static Analysis, Increasing Trend, but gage was discontinued and had no additional data to analyze
04106500, Portage Creek At Kalamazoo, MI	Static Analysis, Increasing Trend, but gage was discontinued and had no additional data to analyze
04116500, Flat River At Smyrna, MI	Static Analysis, Decreasing Trend, but gage was discontinued and had no additional data to analyze
04118000, Thornapple River Near Caledonia, MI	Static Analysis, Increasing Trend, but gage was discontinued and had no additional data to analyze
04122000, Muskegon River At Newaygo, MI	Static Analysis, Decreasing Trend, but gage was discontinued and had no additional data to analyze
04126000, Manistee River Near Manistee, MI	Static Analysis, Decreasing Trend, but gage was discontinued and had no additional data to analyze
04135500, Au Sable River At Grayling, MI	Static Analysis, Increasing Trend, but gage was discontinued and had no additional data to analyze
04135600, East Branch Au Sable River at Grayling, MI	Data now over 25 years old, was increasing trend
04140500, Rifle River at State Road at Selkirk, MI	Data now over 25 years old, was decreasing trend
04143500, North Branch Kawkawlin River near Kawkawlin, MI	Data now over 25 years old, was decreasing trend
04144000, Shiawassee River at Byron, MI	Data now over 25 years old, was decreasing trend
04152500, Tobacco River at Glidden Road at Beaverton, MI	Data now over 25 years old, was decreasing trend
04161100, Galloway Creek Near Auburn Heights, MI	Static Analysis, Increasing Trend, but gage was discontinued and had no additional data to analyze
04161500, Paint Creek near Lake Orion, MI	No trend changed to decreasing trend based on revised analysis, no new data
04162900, Big Beaver Creek near Warren, MI	Increasing trend changed to no trend based on revised analysis, no new data
04165500, Clinton River At Mount Clemens, MI	Static Analysis, Increasing Trend, but gage was discontinued and had no additional data to analyze
04174800, Huron River At Ypsilanti, MI	Static Analysis, Decreasing Trend, but gage was discontinued and had no additional data to analyze
04175700, River Raisin near Tecumseh, MI	Data now over 25 years old, was decreasing trend

Table 6 – Gages with Updated Trend Analysis Compared to 2007 Report, Sorted by Gage Number.

	Gage	Trend Change	Morphologic Impact
UP, Lake Superior	04033000, Middle Branch Ontonagon River near Paulding, MI	Increasing Trend to No Trend	Stabilizing
	04034500, Middle Branch Ontonagon River near Trout Creek, MI	Increasing Trend to Decreasing Trend	Stabilizing
	04036000, West Branch Ontonagon River Near Bergland, MI	Decreasing Trend Continuing	Stable
	04037500, Cisco Branch Ontonagon River At Cisco Lake Outlet, MI	Increasing Trend Continuing	Destabilizing
	04041500, Sturgeon River near Alston, MI	No Trend to Decreasing Trend	Stable
	04044724, AuTrain River at Forest Lake, MI	Increasing Trend to No Trend	Stabilizing
UP, Lake Michigan	04057510, Sturgeon River near Nahma Junction, MI	No Trend to Decreasing Trend	Stable
	04057800, Middle Branch Escanaba River at Humboldt, MI	No Trend to Decreasing Trend	Stable
	04058100, Middle Branch Escanaba River near Princeton, MI	Decreasing Trend to No Trend	Stable
	04059000, Escanaba River at Cornell, MI	Decreasing Trend to No Trend	Stable
	04060500, Iron River at Highway 424 at Caspian, MI	No Trend to Decreasing Trend	Stable
	04062000, Paint River near Alpha, MI	No Trend to Decreasing Trend	Stable
	04062011, Brule River Near Commonwealth, WI	Decreasing Trend Continuing	Stable
	04062500, Michigamme River Near Crystal Falls, MI	Decreasing Trend Continuing	Stable
	04063000, Menominee River near Florence, WI	No Trend to Decreasing Trend	Stable
	04063500, Menominee River at Twin Falls near Iron Mountain, MI	No Trend to Decreasing Trend	Stable
	04066003, Menominee River Below Pemene Creek Near Pembine, WI	Decreasing Trend Continuing	Stable
LP, Southern Lake Michigan	04096015, Galien River near Sawyer, MI	Decreasing Trend to No Trend	Stable
	04096515, South Branch Hog Creek Near Allen, MI	Increasing Trend Continuing	Destabilizing
	04097500, St. Joseph River At Three Rivers, MI	Decreasing Trend Continuing	Stable
	04099000, St. Joseph River At Mottville, MI	Decreasing Trend Continuing	Stable
	04101500, St. Joseph River At Niles, MI	Decreasing Trend Continuing	Stable
	04101800,Dowagiac River At Sumnerville, MI	Increasing Trend Continuing	Destabilizing
	04102500,Paw Paw River At Riverside, MI	Increasing Trend Continuing	Destabilizing
	04102700, South Branch Black River near Bangor, MI	No Trend to Increasing Trend	Destabilizing
	04104945, Wanadoga Creek near Battle Creek, MI	No Trend to Increasing Trend	Destabilizing
	04105000,Battle Creek At Battle Creek, MI	Increasing Trend Continuing	Destabilizing
	04105500, Kalamazoo River near Battle Creek, MI	Decreasing Trend to Increasing Trend	Destabilizing
	04105700,Augusta Creek Near Augusta, MI	Increasing Trend Continuing	Destabilizing
	04106000, Kalamazoo River at Comstock, MI	No Trend to Decreasing Trend	Stable
	04106180,Portage Creek At Portage, MI	Increasing Trend Continuing	Destabilizing
	04106400, West Fork Portage Creek at Kalamazoo, MI	Increasing Trend to No Trend	Stabilizing
	04108600,Rabbit River Near Hopkins, MI	Increasing Trend Continuing	Destabilizing
	04109000, Grand River at Jackson, MI	Decreasing Trend to No Trend	Stable
	04111000, Grand River at Eaton Rapids, MI	Decreasing Trend to No Trend	Stable
	04111379, Red Cedar River near Williamston, MI	No Trend to Increasing Trend	Destabilizing
	04112500,Red Cedar River At East Lansing, MI	Increasing Trend Continuing	Destabilizing

	Gage	Trend Change	Morphologic Impact
	04116000, Grand River at Ionia, MI	No Trend to Decreasing Trend	Stable
LP, Northern L. Michigan	04121900, Little Muskegon River near Morley, MI	Increasing Trend to No Trend	Stabilizing
	04121944, Little Muskegon River near Oak Grove, MI	No Trend to Increasing Trend	Destabilizing
	04121970, Muskegon River near Croton, MI	No Trend to Increasing Trend	Destabilizing
	04122100, Bear Creek Near Muskegon, MI	Decreasing Trend Continuing	Stable
	04122500,Pere Marquette River At Scottville, MI	Increasing Trend Continuing	Destabilizing
	04124000, Manistee River near Sherman, MI	No Trend to Increasing Trend	Destabilizing
	04127800, Jordan River Near East Jordan, MI	Decreasing Trend Continuing	Stable
LP, Lake Huron	04128990,Pigeon River Near Vanderbilt, MI	Increasing Trend Continuing	Destabilizing
	04130500, Black River near Tower, MI	No Trend to Decreasing Trend	Stable
	04135700, South Branch Au Sable River near Luzerne, MI	No Trend to Increasing Trend	Destabilizing
	04136000, Au Sable River near Red Oak, MI	No Trend to Increasing Trend	Destabilizing
	04137005, Au Sable River near Curtisville, MI	No Trend to Increasing Trend	Destabilizing
	04137500, Au Sable River near Au Sable, MI	Decreasing Trend to No Trend	Stable
	04147500,Flint River Near Otisville, MI	Increasing Trend Continuing	Destabilizing
	04148140, Kearsley Creek near Davison, MI	No Trend to Increasing Trend	Destabilizing
	04148500,Flint River Near Flint, MI	Increasing Trend Continuing	Destabilizing
	04149000, Flint River near Fosters, MI	Decreasing Trend to No Trend	Stable
St. Clair R.	04159492, Black River near Jeddo, MI	Increasing Trend to No Trend	Stabilizing
	04160600,Belle River At Memphis, MI	Increasing Trend Continuing	Destabilizing
L. St, Clair	04161000, Clinton River at Auburn Heights, MI	Increasing Trend to No Trend	Stabilizing
	04161540,Paint Creek At Rochester, MI	Increasing Trend Continuing	Destabilizing
	04161580,Stony Creek Near Romeo, MI	Increasing Trend Continuing	Destabilizing
	04164000,Clinton River Near Fraser, MI	Increasing Trend Continuing	Destabilizing
	04164500, North Branch Clinton River near Mount Clemens, MI	Increasing Trend to No Trend	Stabilizing
Detroit River	04166000, River Rouge at Birmingham, MI	Increasing Trend to No Trend	Stabilizing
	04166100, River Rouge at Southfield, MI	Increasing Trend to No Trend	Stabilizing
	04166200, Evans Ditch at Southfield, MI	Increasing Trend to No Trend	Stabilizing
	04166300, Upper River Rouge at Farmington, MI	Increasing Trend to No Trend	Stabilizing
	04166500, River Rouge at Detroit, MI	Increasing Trend to No Trend	Stabilizing
	04167000, Middle River Rouge near Garden City, MI	Increasing Trend to No Trend	Stabilizing
	04168000, Lower River Rouge At Inkster, MI	Decreasing Trend Continuing	Stable
L. Erie	04173500, Mill Creek near Dexter, MI	Decreasing Trend to No Trend	Stable
	04174500, Huron River at Ann Arbor, MI	Decreasing Trend to No Trend	Stable
	04176000,River Raisin Near Adrian, MI	Increasing Trend Continuing	Destabilizing

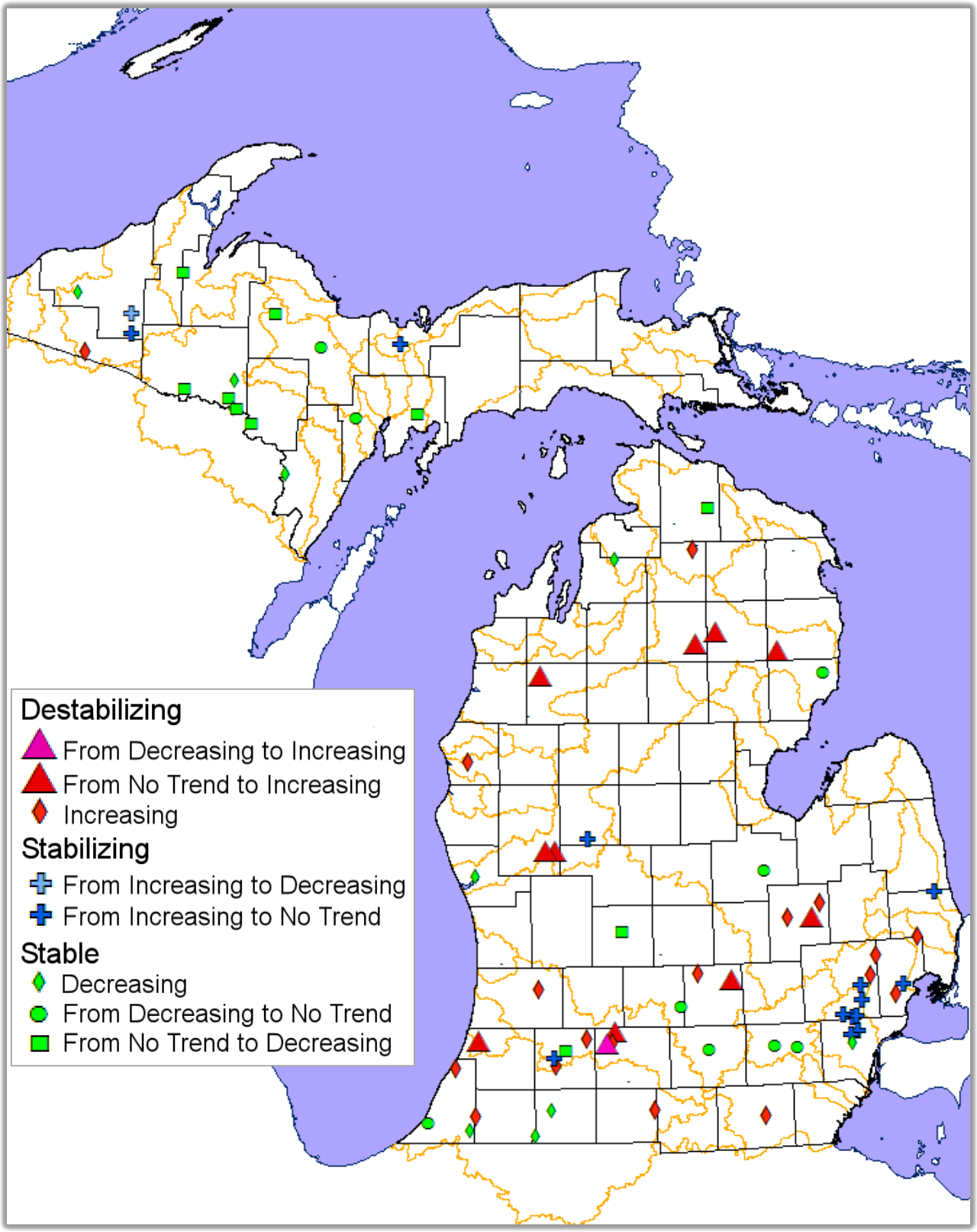


Figure 12 – Gages with Flashiness Trend Changes from the 2007 Report.

Understanding the Flashiness Results

Application to NPS BMP Selection

An increase in flashiness, due to higher or more frequent flows, results in changes to the channel shape: width, depth, sinuosity, and slope. These changes occur by erosion. Reducing excessive erosion is a component of many NPS projects. A frequent dilemma in selecting and siting NPS BMPs is assessing the scale of the stream channel stability problem versus the scale of the problem's cause. A bank erosion problem with a local, small-scale cause (e.g., cattle access) can be addressed by a local BMP (e.g., fencing), while a bank erosion problem with a large-scale cause (e.g., a watershed-wide increase in impervious area) can only be addressed with a similarly large-scale solution (e.g., regional storm water management practices).

The R-B Index is one tool for diagnosing the scale of a particular stream channel problem. If the R-B Index values are steady over time, channel erosion problems in the vicinity of the USGS gage may have local causes that can be addressed with a local BMP. Conversely, if an R-B Index trend indicates that flashiness is increasing over time, channel erosion problems in the vicinity of the gage station may have large-scale causes and will require a large-scale solution. Note that "in the vicinity of the gage" is not well defined. Streams that are increasingly flashy at one location may become stable downstream due to attenuation of flashy flows by tributary flows downstream of the gage. Similarly, flashy flows in a stream above the gage may be masked by the combined flows of other streams at the gage.

Flashiness Changes and Hydrologic Alterations

In general, flashiness changes result from hydrologic alterations. Some factors that can alter flashiness include:

- In-Stream Changes
  - Removal or change in operation of a dam
  - Expansion or straightening of the drainage network
- Watershed Land Use Changes
  - Urbanization
  - Forest regrowth
  - Soil compaction
  - Change in paved or other impervious areas
  - Use of low impact development techniques
  - Change in forestry practices
  - Change in agricultural practices
  - Change in runoff storage capacity

This report does not attempt to fully explain R-B Index value changes at specific sites. Thorough analysis of a specific site or sites within a watershed would be more efficiently and practically performed by local watershed groups and other stakeholders who can often apply watershed-specific and other local information to the interpretation. However, an overview of the results does generally illustrate the effect of some hydrologic alterations. These are discussed in more detail in the following sections.

Dams

The influence of water control structures, especially dams, is one of many complicating factors when interpreting stream flashiness data. The MDEQ tracks over 2,500 dams in a statewide dam safety database. There are undoubtedly many more small dams present on the state's rivers and streams. Dams, especially hydropower dams, can influence stream flow and therefore stream flashiness in both the short term (oscillations over hours or days) and the long term (trends over many years). This report does not try to identify all locations where a dam may influence the results of the R-B Index calculations. However, the "Information by Gage Site" section notes gages that may be affected by dam operations. This information is from the MDEQ's Surface Water Assessment Section (Suppnick, personal communication, 2006) and from yearly USGS Water Resources Data books. This information should be considered a partial, provisional list.

Gage 04170000 is an example of dam operation affecting R-B Index values, as shown in Figure 13. The USGS notes that prior to May 29, 1957, the flow was regulated by a power plant. Since then, there has been only occasional regulation for lake level control. R-B Index values are consistently lower after 1957.

The installation or removal of a dam, or a change in the operation of the dam, can affect the R-B Index values. However, if a dam is operated to manage only lower flows, it is possible that the effect on stream morphology will be negligible.

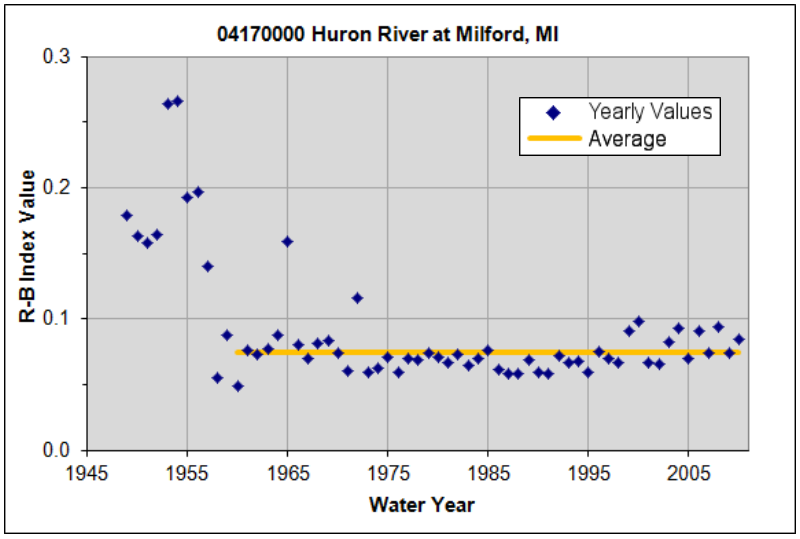


Figure 13 – Changes in the R-B Index Following Changes in 1957 in the Operation of a Dam Upstream of USGS Gage 04170000.

Land Use, Soil, and Imperviousness

It is almost axiomatic that urban areas have flashy streams and undeveloped areas do not. Figures 14 and 15 illustrate the land use throughout the state as of 2001, along with the flashiness rankings and trends. Although the figures suggest that there is some correlation of flashiness with developed land uses, land use does not completely predict flashiness rankings or trends. Certainly many of the flashier gages are in urban areas. However, some are also in areas with extensive natural areas, and some of the gages in the lower quartiles are in or near urban areas. Soils, Figure 16, are also a factor in the quartile rankings. Flashiness rankings and trends represent the stream's response to many factors in a complex system - the watershed. When wise storm water management is employed, adverse stream impacts can be minimized.

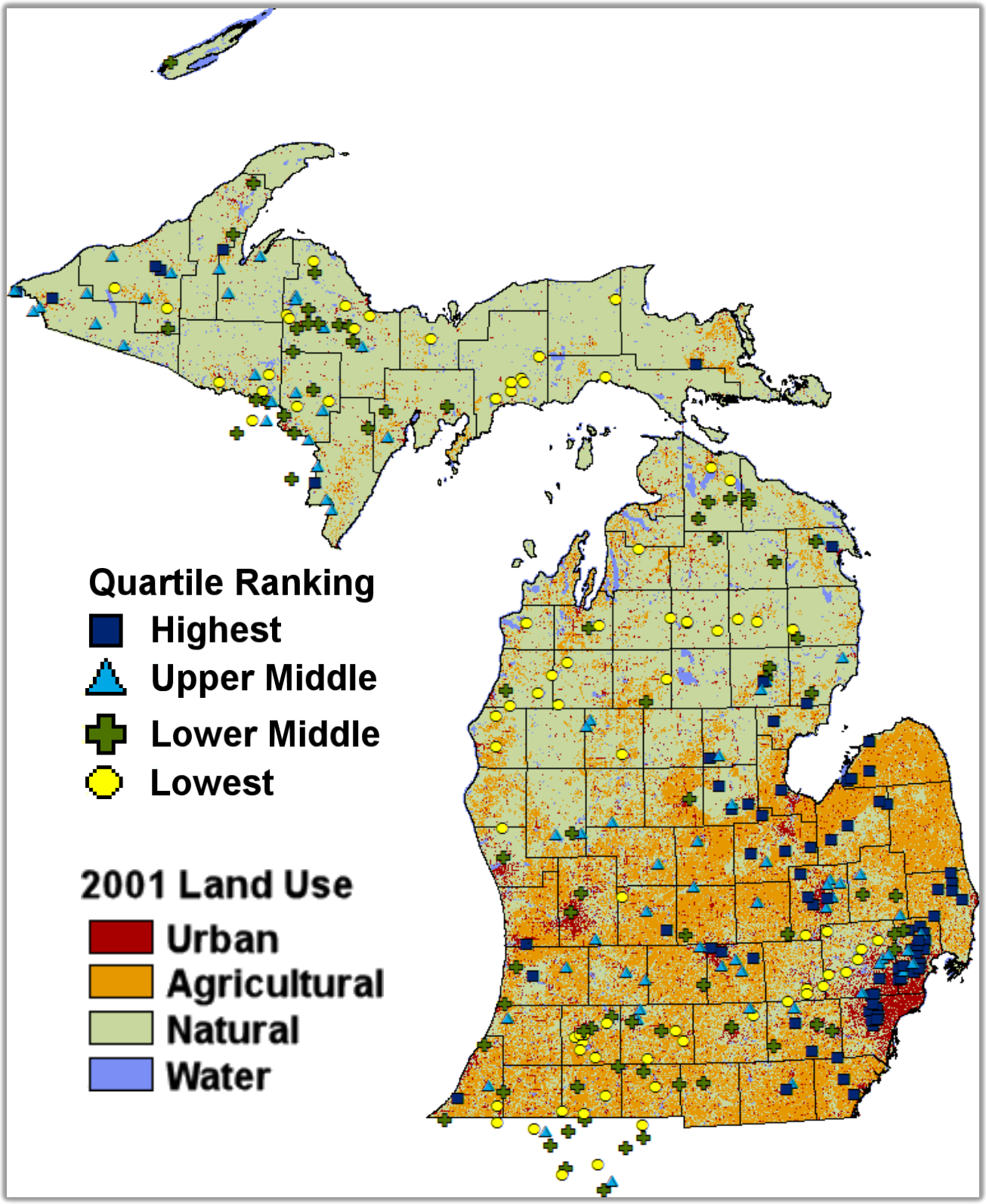


Figure 14 – General 2001 Land Use Classifications with R-B Index Quartile Rankings.

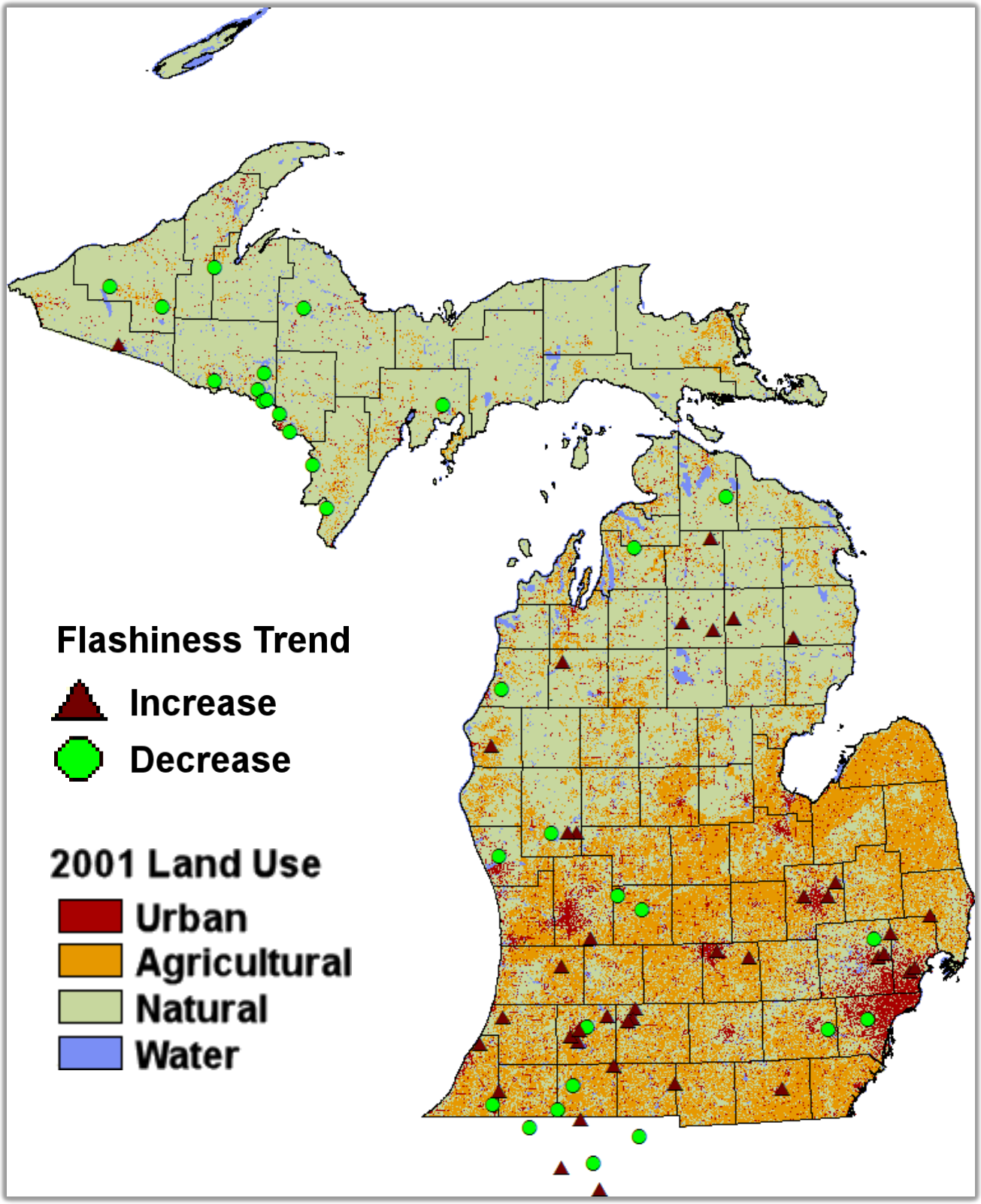


Figure 15 – General 2001 Land Use Classifications with R-B Index Flashiness Trends.

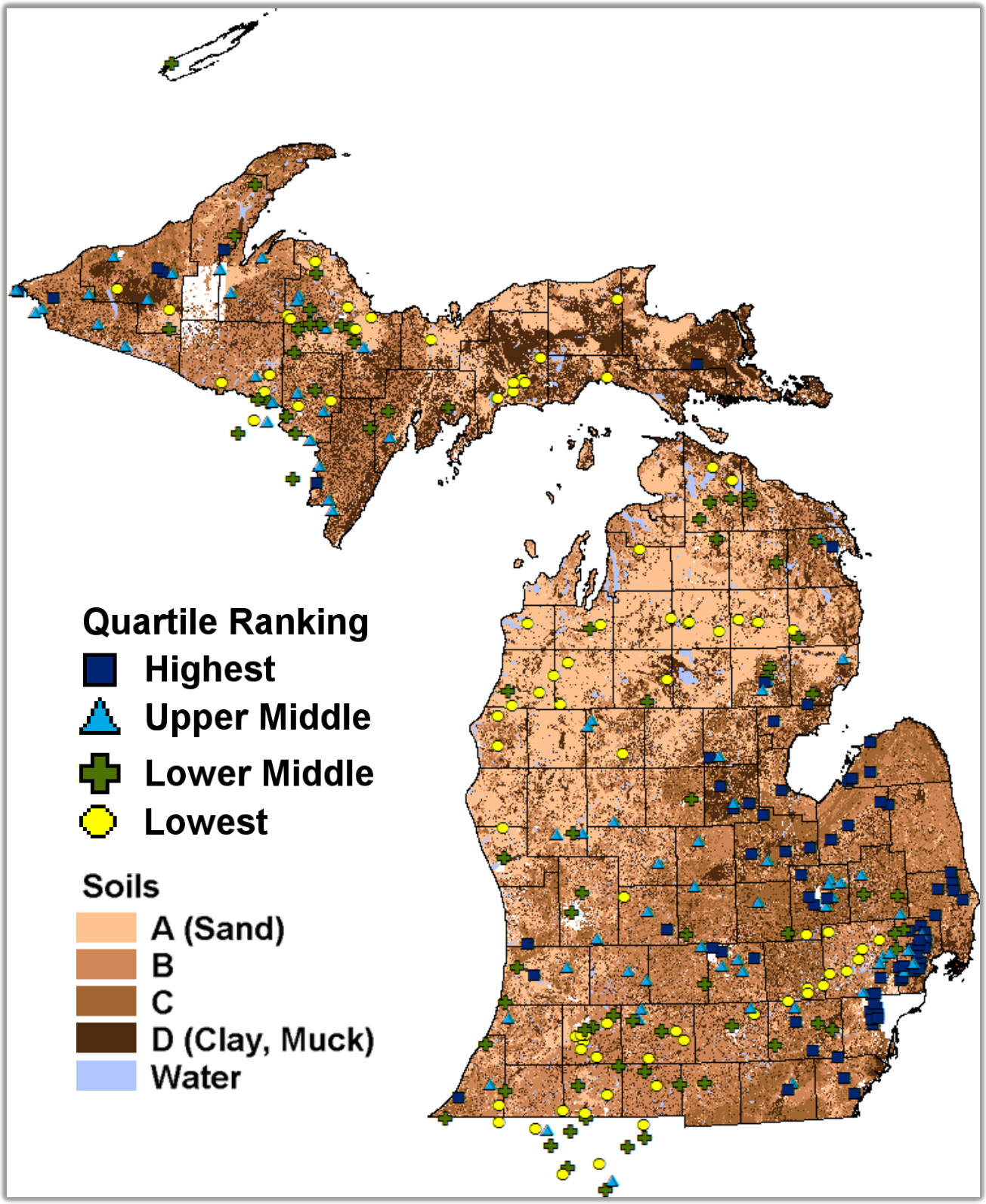


Figure 16 – Soil Hydrogroups from the United States Department of Agriculture-Natural Resources Conservation Service's (USDA-NRCS) Soil Survey Geographic Database, Dual Classified Soil Resolved using 1978 Land Use Data, with R-B Index Quartile Rankings.

Imperviousness within the watershed has received particular attention as an indicator of stream quality. The Center for Watershed Protection developed the Impervious Cover Model (ICM) for urban headwater streams, excerpted in Table 7 and detailed in *The Importance of Imperviousness, The Practice of Watershed Protection* (Schueler, 2000). In May 2008, three ICM refinements were presented by Tom Schueler, Chesapeake Stormwater Network, and Lisa Fraley-McNeal, Center for Watershed Protection, at the 2nd Symposium on Urbanization and Stream Ecology. Figure 17 shows the revised figure, adapted with permission.

The three refinements as described by Fraley-McNeal (personal communication, 2008) are:

1. The imperviousness/stream quality relationship is now a cone rather than a line. The cone represents the observed variability in stream quality and also the typical range in expected improvement that could be attributed to subwatershed treatment. The cone illustrates that most regions show a generally continuous but variable gradient of stream degradation as impervious cover increases.

2. The cone width is greatest for impervious cover values less than ten percent, which reflects the wide variability in stream quality observed for these streams. This prevents the misperception that streams with low impervious cover will automatically possess good or excellent quality. The expected quality of streams in this range of impervious cover is generally influenced more by other watershed characteristics such as forest cover, road density, riparian continuity, and cropping practices.

3. The transition between stream quality classifications is now a band rather than a fixed line. If specific values are used to separate stream categories, the values should be based on actual monitoring data for the ecoregion, the stream indicators of greatest concern, and the predominant predevelopment regional land cover (e.g., crops or forest).

To properly apply and interpret the ICM in a watershed context:

- Watershed scale matters. The use of the ICM should generally be restricted to first to third order alluvial streams.
- The ICM may not work well in subwatersheds with major pollutant point sources, or extensive impoundments or dams within the stream network.
- The ICM is best applied to subwatersheds located within the same physiographic region. In particular, stream slopes, as measured from the top to the bottom of subwatersheds, should be in the same general range.
- The ICM is unreliable when management practices are poor, particularly when impervious cover levels are low (e.g., deforestation, acid mine drainage, intensive row crops, denudation of riparian cover).

When these caveats are applied, the available science generally reinforces the validity of the ICM as a watershed planning tool to forecast the general response of freshwater and tidal streams as a result of future land development.

Percent imperviousness was analyzed using 1978 land cover data, 1995 Topologically Integrated Geographic Encoding and Referencing population density data, and the Impervious Surface Analysis Tool (ISAT) Geographic Information Systems extension. The population data is from the Michigan Geographic Data Library, http://gis-michigan.opendata.arcgis.com/. The population data was converted to 50 meter grids. The ISAT was provided by the National Oceanic and Atmospheric Administration. Percent imperviousness was

estimated using ISAT according to Table 8. The imperviousness values for residential, commercial, and industrial are from the USDA-NRCS (1986).

Figure 18 illustrates the percent imperviousness and flashiness trends results. Compared to the 2007 report, fewer of the gages that are exhibiting increasing flashiness are in or near urban areas with over 25 percent imperviousness. This is probably due to slower development and improved storm water management. Refer also to the "Changes in Results since the 2007 Report" section.

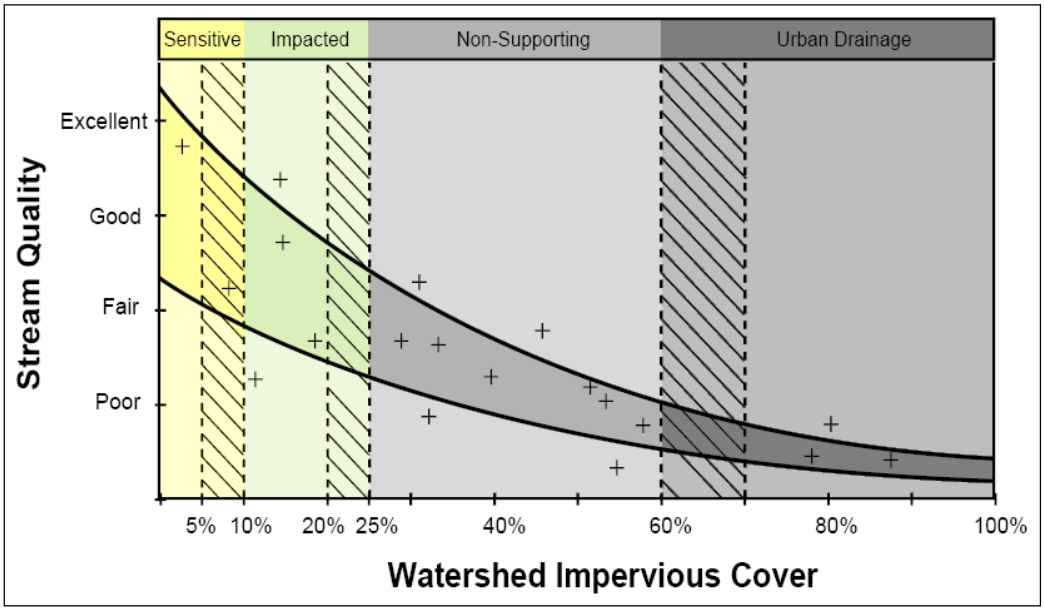


Figure 17 - Impervious Cover Model, Adapted with Permission (Fraley-McNeal 2008).

Table 7 - Classification of Urban Headwater Streams.

Urban Stream Classification	**Sensitive**	**Impacted**	**Nonsupporting**
Channel Stability	Stable	Unstable	Highly unstable
Water Quality	Good	Fair	Fair-Poor
Stream Biodiversity	Good-Excellent	Fair-Good	Poor
Resource Objective	Protect biodiversity and channel stability	Maintain critical elements of stream quality	Minimize downstream pollutant loads

Excerpted from "The Practice of Watershed Protection" (Schueler, 2000, p. 15).

Table 8 - Imperviousness Table for ISAT Analysis.

Class	Description	Assigned Imperviousness (percent) by Population Density (people per square mile)		
		Less than 250	250-1000	Over 1000
1	Residential	25	38	65
2	Commercial	85	85	85
3	Industrial	72	72	72
4	Road, Utilities	95	95	95
7, 8, 9	Agriculture	1	1	1
5, 6, 10-14	Natural land covers	0	0	0

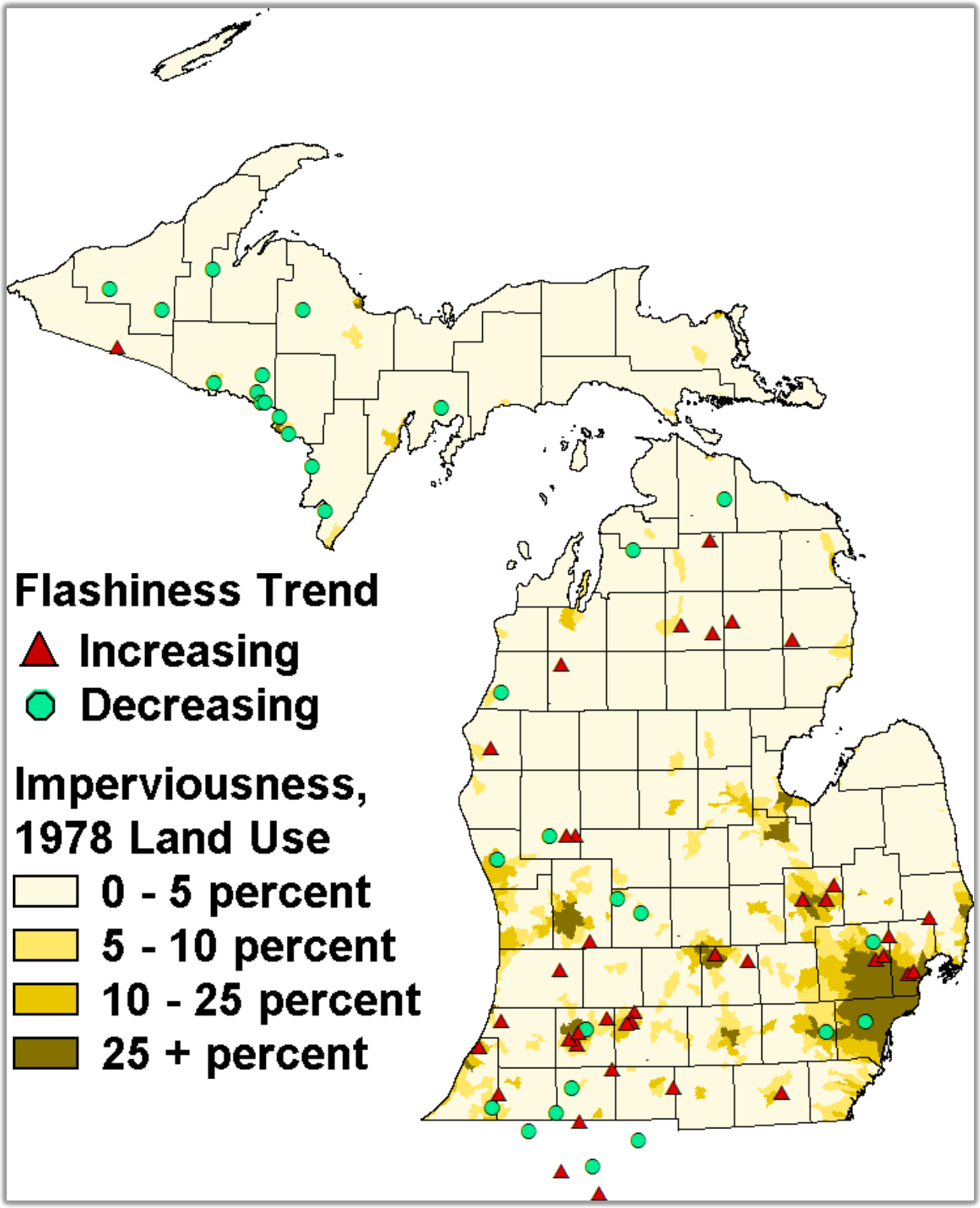


Figure 18 – Statewide Imperviousness with Updated Flashiness Trends, 1978 Land Use.

Gage-Specific Flashiness Information

Information by Gage Site

Graphs of the R-B Index values are shown for each site. The x-axis always ends at 2011, so that the comparative age of the data is more readily apparent. The y-axis is constrained to show gridlines for every 0.1 increment, allowing a sense of rank relative to other gages - more gridlines equate to higher values. The graphs for all gages with data encompassing at least part of the past 25 years have a soft blue border.

The characteristic R-B Index values are either:

- The average of the yearly R-B Index values and is shown as a horizontal gold line spanning the years used to calculate the value.
- The endpoint of a statistically significant (i.e., $p < 0.05$) trend. If the trend encompasses at least part of the past 25 years, it is represented by a sloped purple line. If the trend is older, it is represented by a sloped gold line with soft edges. Where there is an identified trend, the characteristic R-B Index value is based on the point on the trend line at the last year of data collection and is represented by a brown circle.

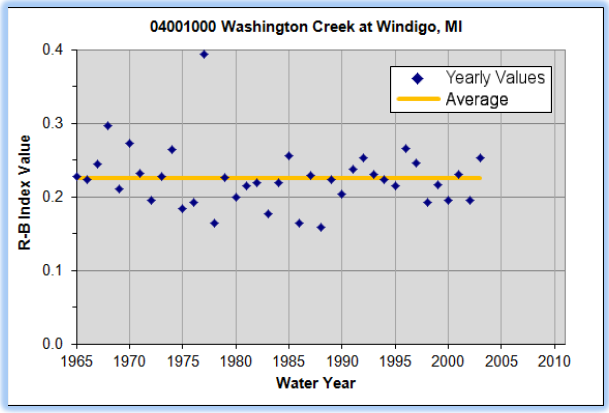
Gage-specific information is included under each graph. Some, though likely not all, of the gages that may be affected by dam operations are noted. In a few cases, equivalent gages are noted. This is where a gage is moved and assigned a new number, but considered equivalent. In these cases, the flow record for the discontinued gage is included in the new gage. Only the newer gage, with the complete record, is included in this analysis.

The graphs in this section are arranged in numerical order. In general, they are arranged by Great Lake (or connecting channel) watershed, in the following order:

- Streams tributary to Lake Superior (04001000-04045500), pages 30-37
- Streams tributary to Lake Michigan
    - Upper Peninsula (04046000-04067500), pages 37-53
    - Southern Lower Peninsula (04096015-04119000), pages 53-76
    - Northern Lower Peninsula (04121000-04127800), pages 77-84
- Streams tributary to Lake Huron
    - Upper Peninsula (04127918), page 84
    - Lower Peninsula (04127997-04159010), pages 85-104
- Streams tributary to St. Clair River (04159492-04160600), pages 104-106
- Streams tributary to Lake St. Clair (04160800-04165500), pages 106-115
- Streams tributary to Detroit River (04166000-04168580), pages 115-119
- Streams tributary to Lake Erie (04169500-04176605), pages 119-124

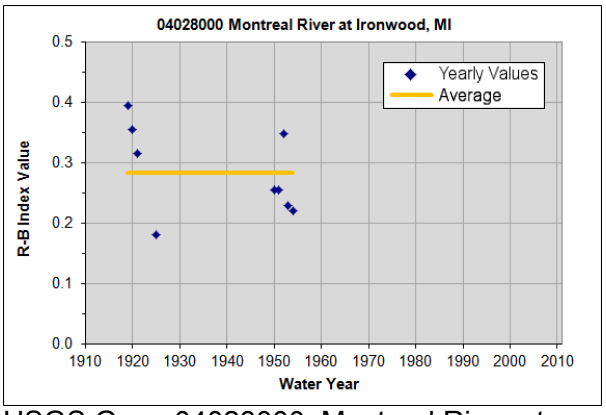
As noted on the USGS Web site, http://pubs.usgs.gov/wdr/WDR-WA-03-1/pdf/ADR_F.pdf, "Since October 1, 1950, hydrologic-station records in USGS reports have been listed in order of downstream direction along the main stream. All stations on a tributary entering upstream from a main-stream station are listed before that station. A station on a tributary entering between two mainstream stations is listed between those stations."

Streams Tributary to Lake Superior



USGS Gage 04001000, Washington Creek at Windigo, MI

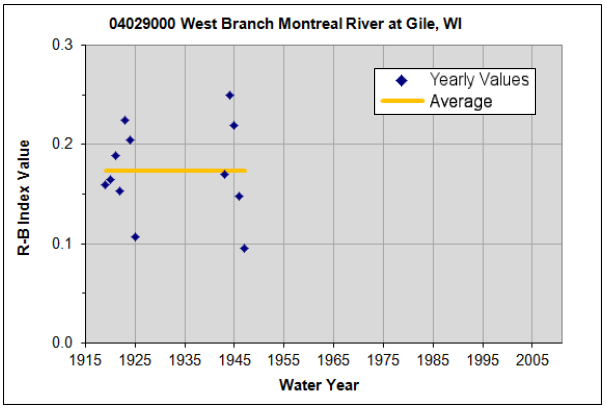
- Drainage Area (square miles): 13.2
- Basin Number: 55
- Characteristic R-B Index Value: 0.225
- Rank: Lower Middle
- First Water Year: 1965
- Last Water Year: 2003
- Number of Water Years Analyzed: 39



USGS Gage 04028000, Montreal River at Ironwood, MI

- Drainage Area (square miles): 61.4
- Basin Number: 51
- Characteristic R-B Index Value: 0.284
- Rank: Upper Middle
- First Water Year: 1919
- Last Water Year: 1954
- Number of Water Years Analyzed: 9

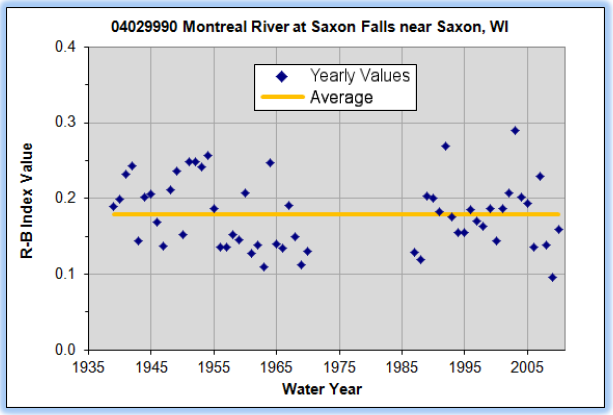
Comments: Gage added for this report update.



USGS Gage 04029000, West Branch Montreal River at Gile, WI

- Drainage Area (square miles): 78
- Basin Number: 51
- Characteristic R-B Index Value: 0.174
- Rank: Upper Middle
- First Water Year: 1919
- Last Water Year: 1947
- Number of Water Years Analyzed: 12

Comments: Gage added for this report update.

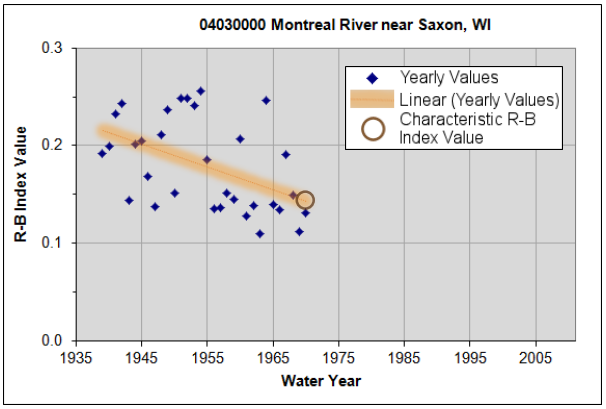


USGS Gage 04029990, Montreal River at Saxon Falls near Saxon, WI

- Drainage Area (square miles): 261
- Basin Number: 51
- Characteristic R-B Index Value: 0.179
- Rank: Highest
- First Water Year: 1939
- Last Water Year: 2010
- Number of Water Years Analyzed: 56

Comments: Gage added for this report update.

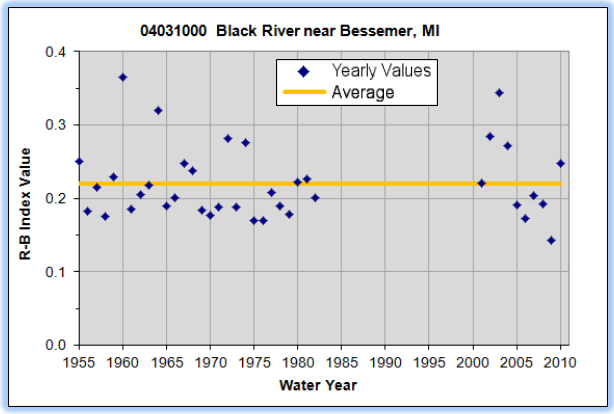
Streams Tributary to Lake Superior (cont.)



USGS Gage 04030000, Montreal River near Saxon, WI

- Drainage Area (square miles): 264
- Basin Number: 51
- Characteristic R-B Index Value: 0.144
- Rank: Upper Middle
- p value: 0.01
- First Water Year: 1939
- Last Water Year: 1970
- Number of Water Years Analyzed: 32

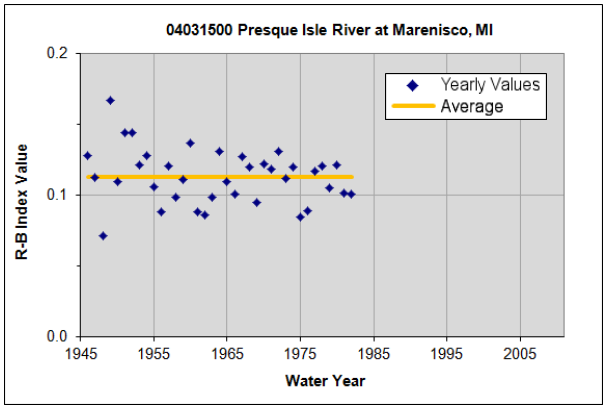
Comments: Diurnal fluctuation caused by Saxon Falls power plant 1.5 miles upstream. Flow regulated by Gile reservoir on West Branch Montreal River since April 1941.



USGS Gage 04031000, Black River near Bessemer, MI

- Drainage Area (square miles): 200
- Basin Number: 56
- Characteristic R-B Index Value: 0.220
- Rank: Highest
- First Water Year: 1955
- Last Water Year: 2010
- Number of Water Years Analyzed: 38

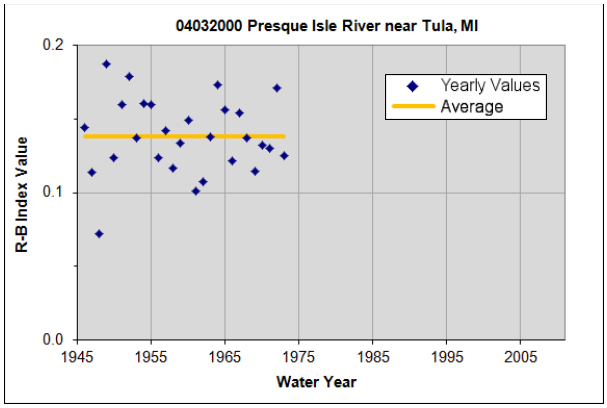
Comments: Flow included some ground water pumped from mines at Bessemer.



USGS Gage 04031500, Presque Isle River at Marenisco, MI

- Drainage Area (square miles): 171
- Basin Number: 56
- Characteristic R-B Index Value: 0.113
- Rank: Upper Middle
- First Water Year: 1946
- Last Water Year: 1982
- Number of Water Years Analyzed: 37

Comments: Since 1959, occasional regulation by Presque Isle Flooding Reservoir 2.5 miles upstream.

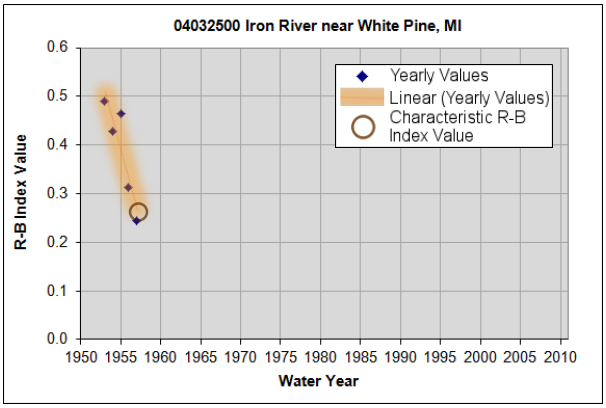


USGS Gage 04032000, Presque Isle River near Tula, MI

- Drainage Area (square miles): 261
- Basin Number: 56
- Characteristic R-B Index Value: 0.138
- Rank: Upper Middle
- First Water Year: 1946
- Last Water Year: 1973
- Number of Water Years Analyzed: 28

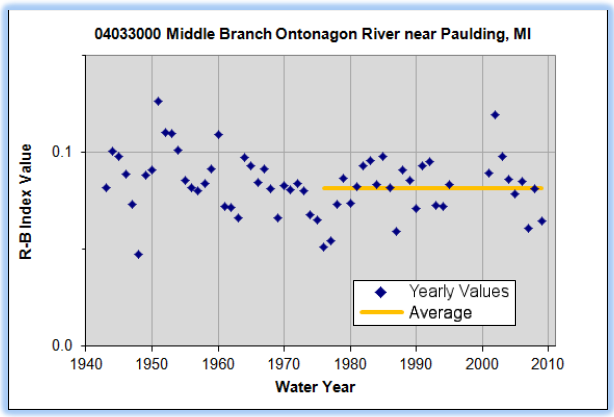
Comments: Occasional regulation for lake or pond level control at several places above station at Marenisco.

Streams Tributary to Lake Superior (cont.)



USGS Gage 04032500, Iron River near White Pine, MI

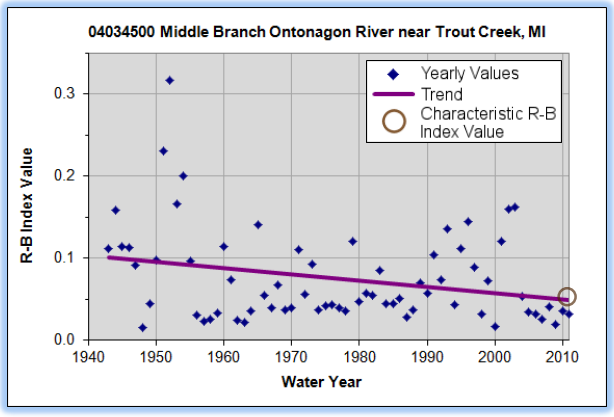
- Drainage Area (square miles): 98.1
- Basin Number: 56
- Characteristic R-B Index Value: 0.266
- Rank: Upper Middle
- p value: 0.03
- First Water Year: 1953
- Last Water Year: 1957
- Number of Water Years Analyzed: 5



USGS Gage 04033000, Middle Branch Ontonagon River near Paulding, MI

- Drainage Area (square miles): 164
- Basin Number: 53
- Characteristic R-B Index Value: 0.081
- Rank: Lower Middle
- First Water Year: 1943
- First Water Year Analyzed, if different: 1976
- Last Water Year: 2009
- Number of Water Years Analyzed: 29

Comments: Initially published an increasing trend for this gage. Additional data revises the analysis to no trend for this report update.

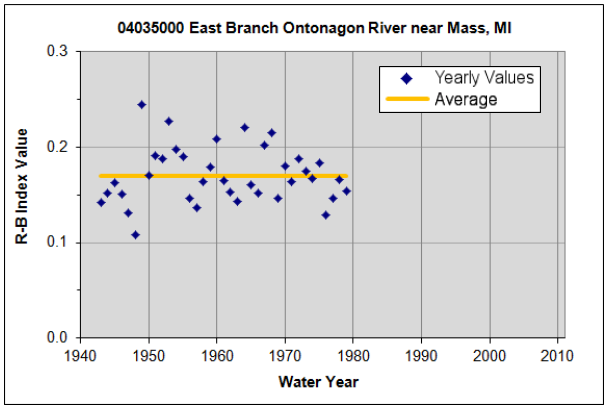


USGS Gage 04034500, Middle Branch Ontonagon River near Trout Creek, MI

- Drainage Area (square miles): 203
- Basin Number: 53
- Characteristic R-B Index Value: 0.049
- Rank: Lowest
- Trend: decrease, p value: 0.02
- First Water Year: 1943
- Last Water Year: 2011
- Number of Water Years Analyzed: 69

Comments:

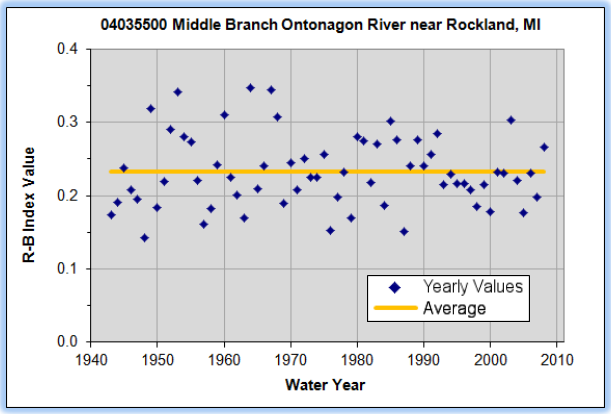
- Regulation by Bond Falls Reservoir 7.5 miles upstream.
- Initially published an increasing trend for this gage. Additional data revises the analysis to decreasing trend for this report update.



USGS Gage 04035000, East Branch Ontonagon River near Mass, MI

- Drainage Area (square miles): 272
- Basin Number: 53
- Characteristic R-B Index Value: 0.170
- Rank: Upper Middle
- First Water Year: 1943
- Last Water Year: 1979
- Number of Water Years Analyzed: 37

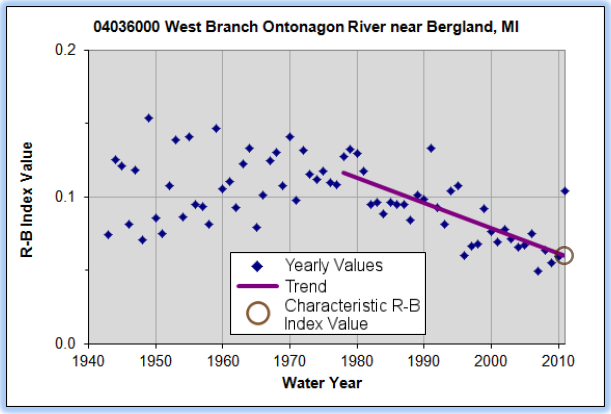
Streams Tributary to Lake Superior (cont.)



USGS Gage 04035500, Middle Branch Ontonagon River near Rockland, MI

- Drainage Area (square miles): 671
- Basin Number: 53
- Characteristic R-B Index Value: 0.233
- Rank: Highest
- First Water Year: 1943
- Last Water Year: 2008
- Number of Water Years Analyzed: 66

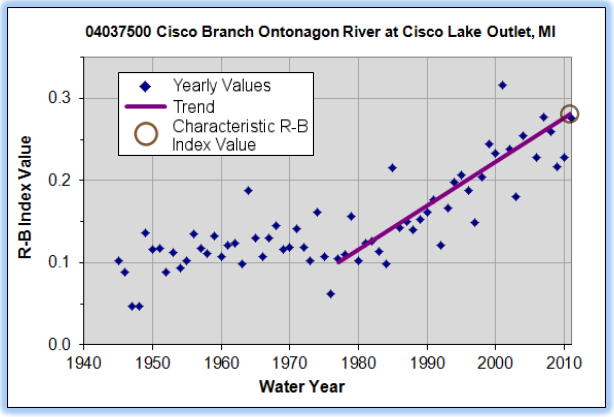
Comments: Regulation by Bond Falls Reservoir 30 miles upstream.



USGS Gage 04036000, West Branch Ontonagon River near Bergland, MI

- Drainage Area (square miles): 162
- Basin Number: 53
- Characteristic R-B Index Value: 0.060
- Rank: Lowest
- Trend: decrease, p value: 0.00
- First Water Year: 1943
- First Water Year Analyzed, if different: 1978
- Last Water Year: 2011
- Number of Water Years Analyzed: 34

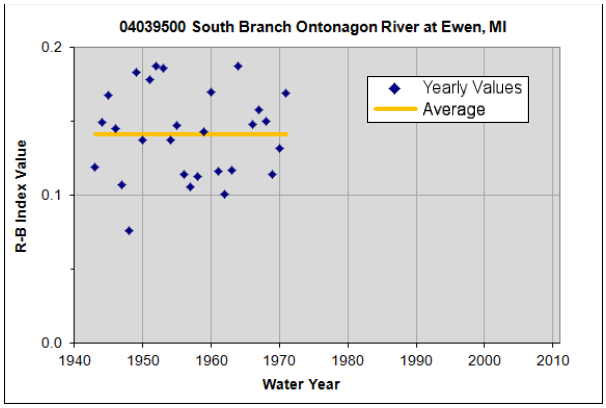
Comments: Flow regulated by Lake Gogebic.



USGS Gage 04037500, Cisco Branch Ontonagon River at Cisco Lake Outlet, MI

- Drainage Area (square miles): 50.7
- Basin Number: 53
- Characteristic R-B Index Value: 0.281
- Rank: Upper Middle
- Trend: increase, p value: 0.00
- First Water Year: 1945
- First Water Year Analyzed, if different: 1977
- Last Water Year: 2011
- Number of Water Years Analyzed: 35

Comments: Flow regulated by Cisco Lake.

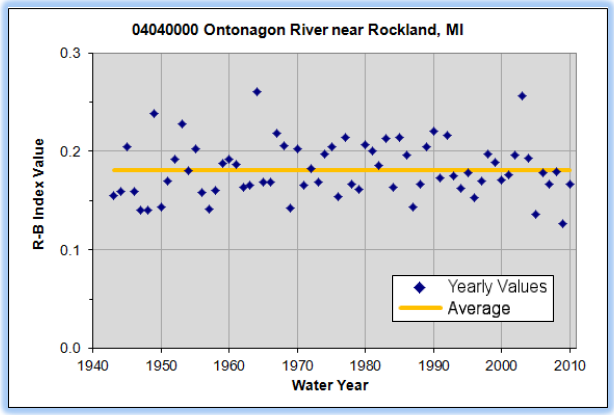


USGS Gage 04039500, South Branch Ontonagon River at Ewen, MI

- Drainage Area (square miles): 348
- Basin Number: 53
- Characteristic R-B Index Value: 0.141
- Rank: Upper Middle
- First Water Year: 1943
- Last Water Year: 1971
- Number of Water Years Analyzed: 28

Comments: Some diversions from middle branch Ontonagon River by Bond Falls Canal. Some regulation at medium and low flows by Cisco Lake.

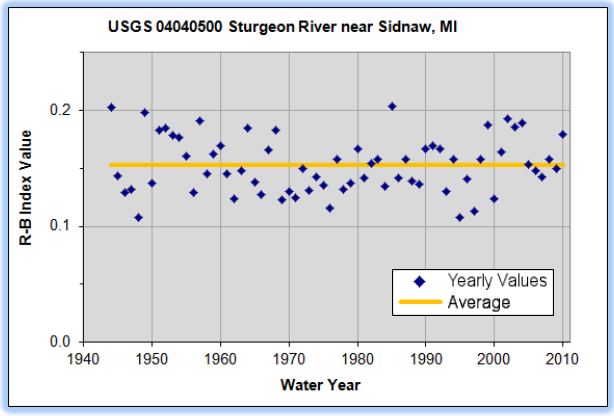
Streams Tributary to Lake Superior (cont.)



USGS Gage 04040000, Ontonagon River near Rockland, MI

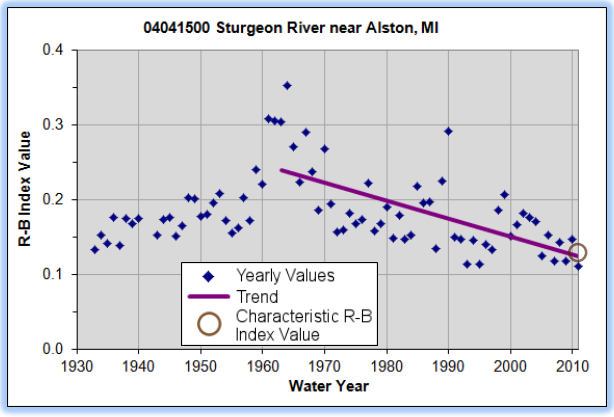
- Drainage Area (square miles): 1340
- Basin Number: 53
- Characteristic R-B Index Value: 0.181
- Rank: Highest
- First Water Year: 1943
- Last Water Year: 2010
- Number of Water Years Analyzed: 68

Comments: Regulated by Lake Victoria power plant on west branch five miles upstream. Bonds Falls reservoir 24 miles upstream.



USGS Gage 04040500, Sturgeon River near Sidnaw, MI

- Drainage Area (square miles): 171
- Basin Number: 55
- Characteristic R-B Index Value: 0.153
- Rank: Upper Middle
- First Water Year: 1944
- Last Water Year: 2010
- Number of Water Years Analyzed: 67



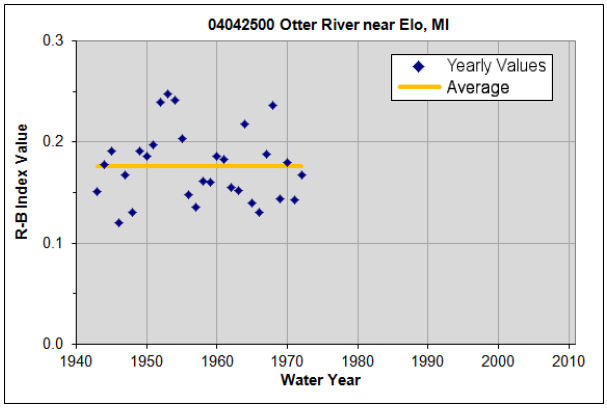
USGS Gage 04041500, Sturgeon River near Alston, MI

Drainage Area (square miles): 346

- Basin Number: 55
- Characteristic R-B Index Value: 0.123
- Rank: Upper Middle
- Trend: decrease, p value: 0.00
- First Water Year: 1933
- First Water Year Analyzed, if different: 1963
- Last Water Year: 2011
- Number of Water Years Analyzed: 49

Comments:

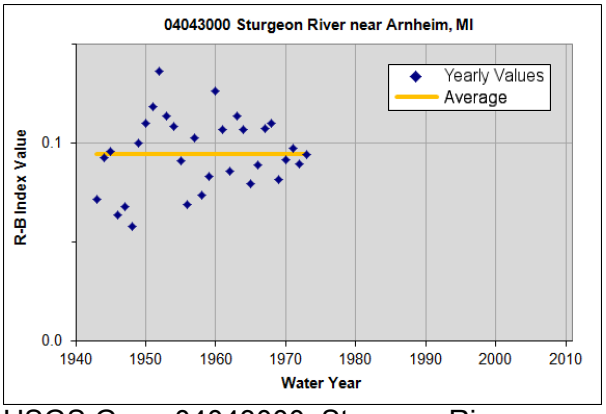
- Flow regulated by power plant at gage station.
- Initially published no trend for this gage. Additional data revises the analysis to decreasing trend for this report update.



USGS Gage 04042500, Otter River near Elo, MI

- Drainage Area (square miles): 162
- Basin Number: 55
- Characteristic R-B Index Value: 0.176
- Rank: Highest
- First Water Year: 1943
- Last Water Year: 1972
- Number of Water Years Analyzed: 30

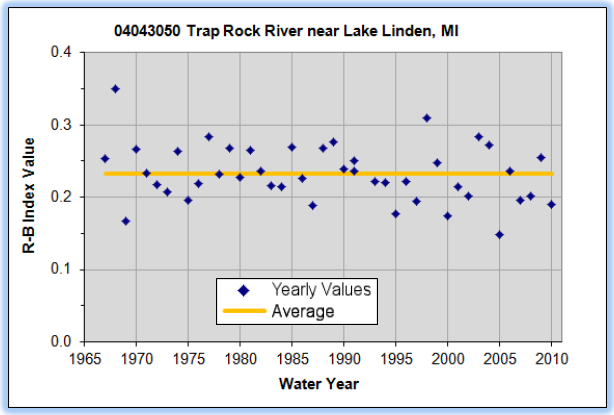
Streams Tributary to Lake Superior (cont.)



USGS Gage 04043000, Sturgeon River near Arnheim, MI

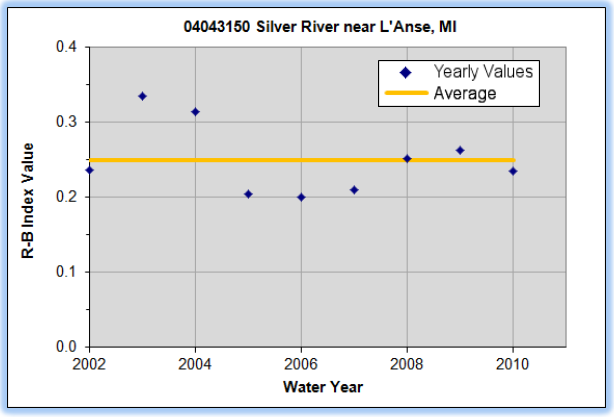
- Drainage Area (square miles): 705
- Basin Number: 55
- Characteristic R-B Index Value: 0.095
- Rank: Lower Middle
- First Water Year: 1943
- Last Water Year: 1973
- Number of Water Years Analyzed: 31

Comments: Occasional slight regulation caused by Prickett Dam at mile 45.



USGS Gage 04043050, Trap Rock River near Lake Linden, MI

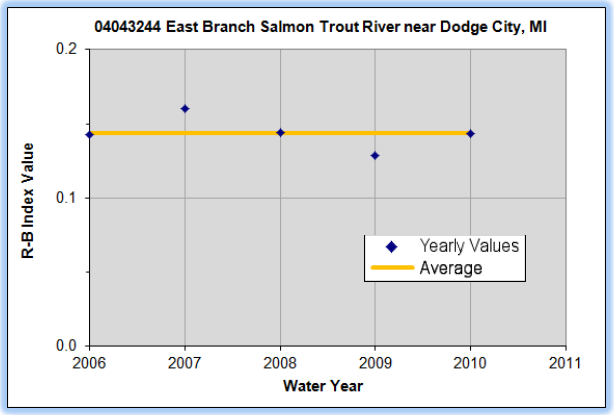
- Drainage Area (square miles): 28
- Basin Number: 55
- Characteristic R-B Index Value: 0.233
- Rank: Lower Middle
- First Water Year: 1967
- Last Water Year: 2010
- Number of Water Years Analyzed: 44



USGS Gage 04043150, Silver River near L'Anse, MI

- Drainage Area (square miles): 64.7
- Basin Number: 48
- Characteristic R-B Index Value: 0.250
- Rank: Upper Middle
- First Water Year: 2002
- Last Water Year: 2010
- Number of Water Years Analyzed: 9

Comments: Gage added for this report update.

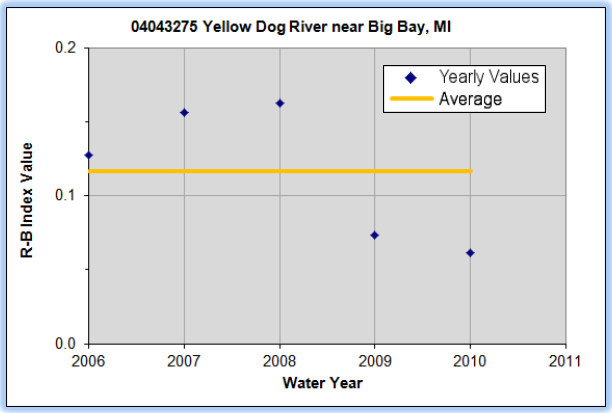


USGS Gage 04043244, East Branch Salmon Trout River near Dodge City, MI

- Drainage Area (square miles): 10.2
- Basin Number: 48
- Characteristic R-B Index Value: 0.144
- Rank: Lowest
- First Water Year: 2006
- Last Water Year: 2010
- Number of Water Years Analyzed: 5

Comments: Gage added for this report update.

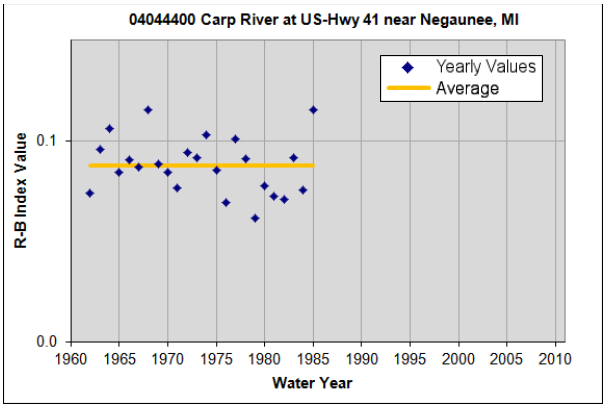
Streams Tributary to Lake Superior (cont.)



USGS Gage 04043275, Yellow Dog River near Big Bay, MI

- Drainage Area (square miles): 31.8
- Basin Number: 48
- Characteristic R-B Index Value: 0.117
- Rank: Lower Middle
- First Water Year: 2006
- Last Water Year: 2010
- Number of Water Years Analyzed: 5

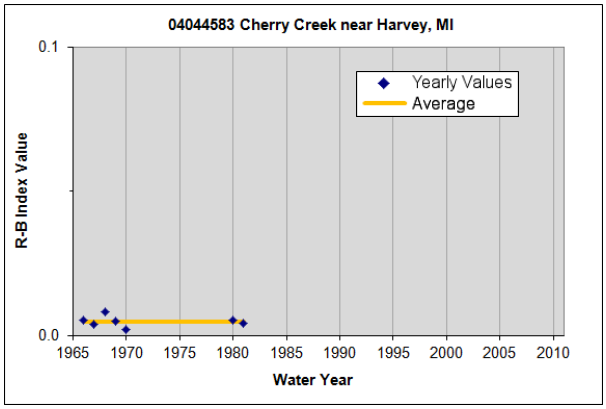
Comments: Gage added for this report update.



USGS Gage 04044400, Carp River at US-Highway 41 near Negaunee, MI

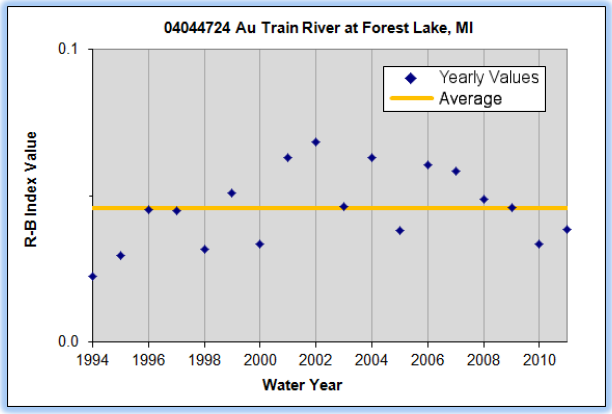
- Drainage Area (square miles): 51.4
- Basin Number: 45
- Characteristic R-B Index Value: 0.088
- Rank: Lowest
- First Water Year: 1962
- Last Water Year: 1985
- Number of Water Years Analyzed: 24

Comments: Flow regulated by Deer Lake storage reservoir five miles upstream.



USGS Gage 04044583, Cherry Creek near Harvey, MI

- Drainage Area (square miles): 4.53
- Basin Number: 43
- Characteristic R-B Index Value: 0.005
- Rank: Lowest
- First Water Year: 1966
- Last Water Year: 1981
- Number of Water Years Analyzed: 7



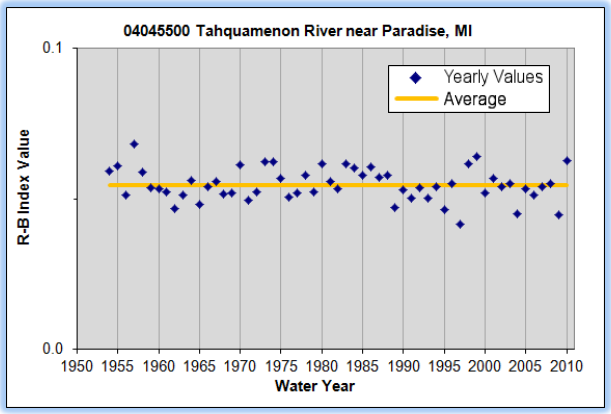
USGS Gage 04044724, AuTrain River at Forest Lake, MI

- Drainage Area (square miles): 81
- Basin Number: 39
- Characteristic R-B Index Value: 0.046
- Rank: Lowest
- First Water Year: 1994
- Last Water Year: 2011
- Number of Water Years Analyzed: 18

Comments:

- Flow regulated by a power plant 800 feet upstream and by the Au-Train Basin 0.6 miles upstream.
- Initially published an increasing trend for this gage. Additional data revises the analysis to no trend for this report update.

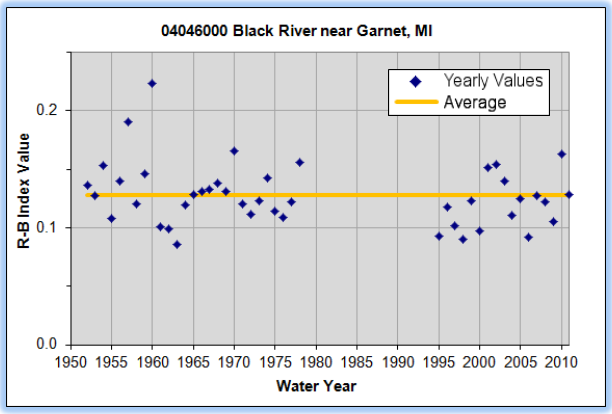
Streams Tributary to Lake Superior (cont.)



USGS Gage 04045500, Tahquamenon River near Paradise, MI

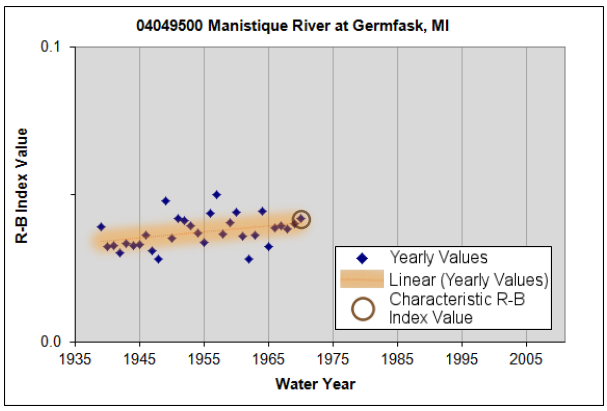
- Drainage Area (square miles): 790
- Basin Number: 60
- Characteristic R-B Index Value: 0.055
- Rank: Lowest
- First Water Year: 1954
- Last Water Year: 2010
- Number of Water Years Analyzed: 57

Streams Tributary to Lake Michigan, Upper Peninsula



USGS Gage 04046000, Black River near Garnet, MI

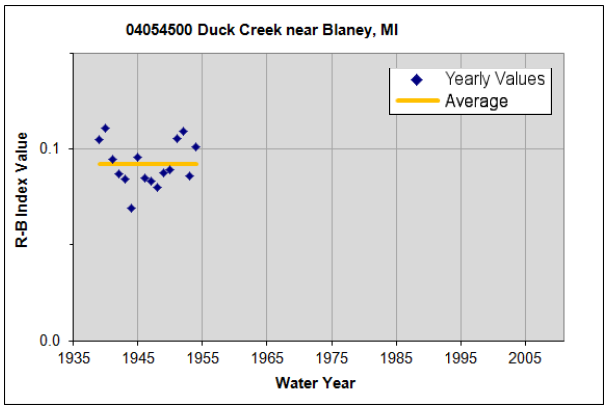
- Drainage Area (square miles): 28
- Basin Number: 41
- Characteristic R-B Index Value: 0.128
- Rank: Lowest
- First Water Year: 1952
- Last Water Year: 2011
- Number of Water Years Analyzed: 44



USGS Gage 04049500, Manistique River at Germfask, MI

- Drainage Area (square miles): 341
- Basin Number: 49
- Characteristic R-B Index Value: 0.040
- Rank: Lowest
- p value: 0.05
- First Water Year: 1939
- Last Water Year: 1970
- Number of Water Years Analyzed: 32

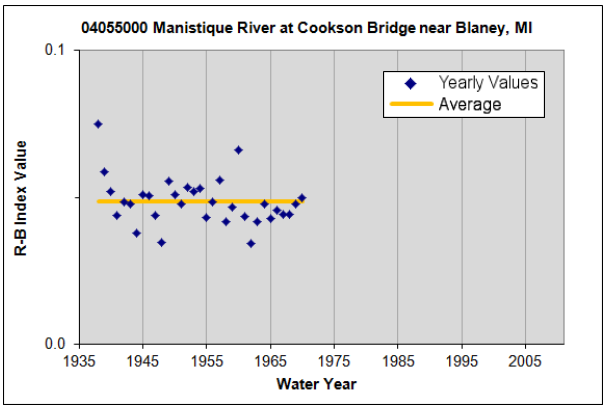
Comments: Slight regulation on outlet of Manistique Lake about seven miles upstream beginning July 1948.



USGS Gage 04054500, Duck Creek near Blaney, MI

- Drainage Area (square miles): 92
- Basin Number: 49
- Characteristic R-B Index Value: 0.092
- Rank: Lowest
- First Water Year: 1939
- Last Water Year: 1954
- Number of Water Years Analyzed: 16

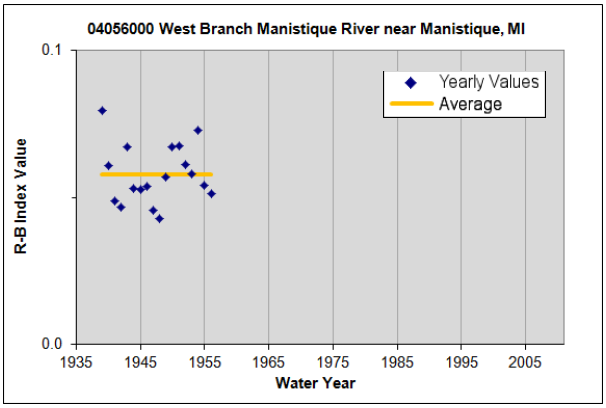
Streams Tributary to Lake Michigan, Upper Peninsula (cont.)



USGS Gage 04055000, Manistique River at Cookson Bridge near Blaney, MI

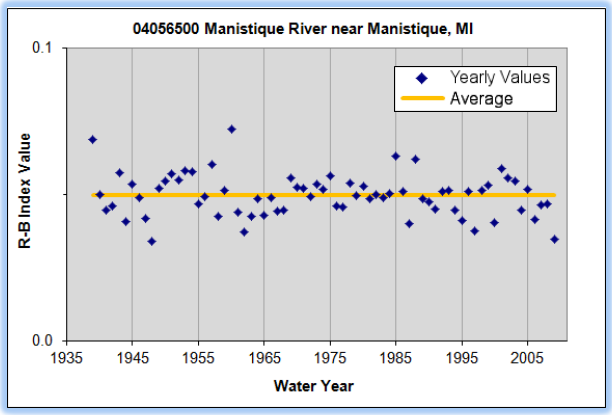
- Drainage Area (square miles): 704
- Basin Number: 49
- Characteristic R-B Index Value: 0.048
- Rank: Lowest
- First Water Year: 1938
- Last Water Year: 1970
- Number of Water Years Analyzed: 33

Comments: Since July 1948 slight regulation on outlet at Manistique Lake about 25 miles upstream.



USGS Gage 04056000, West Branch Manistique River near Manistique, MI

- Drainage Area (square miles): 322
- Basin Number: 49
- Characteristic R-B Index Value: 0.058
- Rank: Lowest
- First Water Year: 1939
- Last Water Year: 1956
- Number of Water Years Analyzed: 18

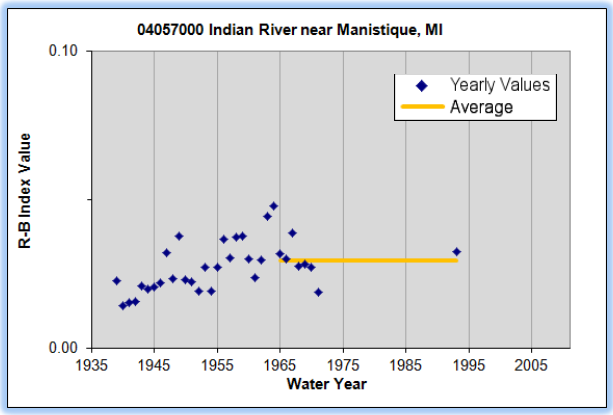


USGS Gage 04056500, Manistique River near Manistique, MI

Drainage Area (square miles): 1100

- Basin Number: 49
- Characteristic R-B Index Value: 0.050
- Rank: Lowest
- First Water Year: 1939
- Last Water Year: 2009
- Number of Water Years Analyzed: 71

Comments: Slight regulation by dam on outlet of Manistee Lake since July 1948.

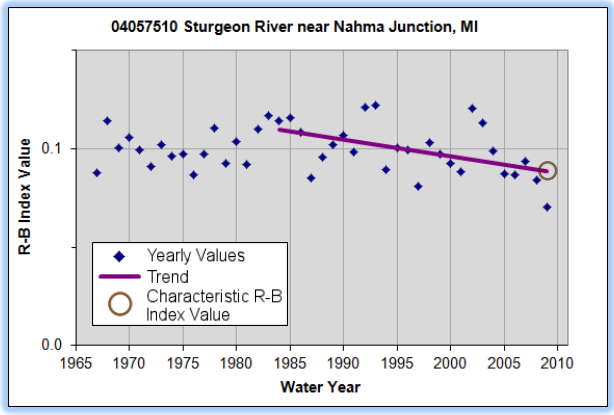


USGS Gage 04057000, Indian River near Manistique, MI

- Drainage Area (square miles): 302
- Basin Number: 49
- Characteristic R-B Index Value: 0.029
- Rank: Lowest
- First Water Year: 1939
- First Water Year Analyzed, if different: 1965
- Last Water Year: 1993
- Number of Water Years Analyzed: 8

Comments: Indian Lake regulated 1.5 miles below base gage.

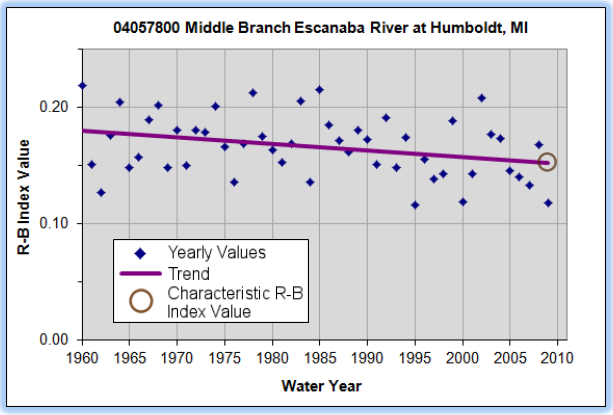
Streams Tributary to Lake Michigan, Upper Peninsula (cont.)



USGS Gage 04057510, Sturgeon River near Nahma Junction, MI

- Drainage Area (square miles): 183
- Basin Number: 58
- Characteristic R-B Index Value: 0.089
- Rank: Lower Middle
- Trend: decrease, p value: 0.01
- First Water Year: 1967
- First Water Year Analyzed, if different: 1984
- Last Water Year: 2009
- Number of Water Years Analyzed: 26

Comments: Initially published no trend for this gage. Additional data revises the analysis to decreasing trend for this report update.



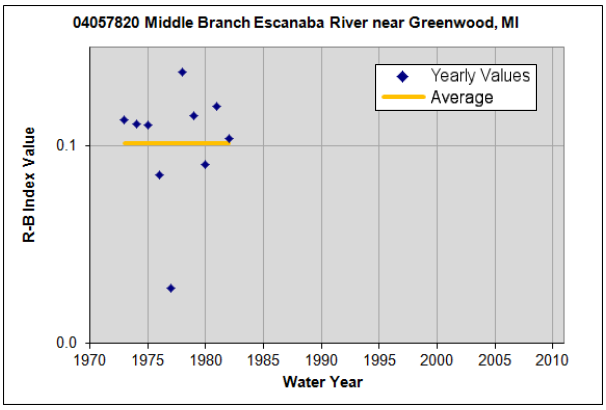
USGS Gage 04057800, Middle Branch Escanaba River at Humboldt, MI

- Drainage Area (square miles): 46
- Basin Number: 46
- Characteristic R-B Index Value: 0.153
- Rank: Lower Middle
- Trend: decrease, p value: 0.03
- First Water Year: 1960
- Last Water Year: 2009
- Number of Water Years Analyzed: 50

Comments:

- From July 1960 to June 1972 some diversions 100 feet upstream by industry for iron ore processing.
- Initially published no trend for this gage. Additional data revises the analysis to decreasing trend for this report update.

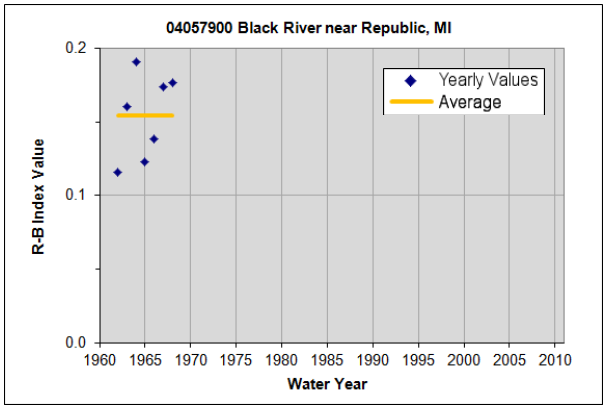
Streams Tributary to Lake Michigan, Upper Peninsula (cont.)



USGS Gage 04057820, Middle Branch Escanaba River near Greenwood, MI

- Drainage Area (square miles): 73.3
- Basin Number: 46
- Characteristic R-B Index Value: 0.101
- Rank: Lower Middle
- First Water Year: 1973
- Last Water Year: 1982
- Number of Water Years Analyzed: 10

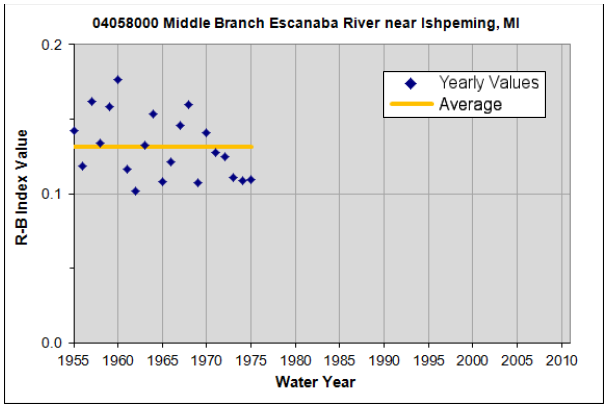
Comments: Since January 1973 flow diverted 2.3 miles upstream at Greenwood after Bay, to Green Creek for iron ore processing, some returned to middle branch Escanaba River 24 miles downstream via another Green Creek and some returned to East Branch Escanaba River via Goose Lake Outlet.



USGS Gage 04057900, Black River near Republic, MI

- Drainage Area (square miles): 34.4
- Basin Number: 46
- Characteristic R-B Index Value: 0.154
- Rank: Lower Middle
- First Water Year: 1962
- Last Water Year: 1968
- Number of Water Years Analyzed: 7

Comments: Records include effluent from industrial plant diverted into basin from Middle Branch Escanaba River.

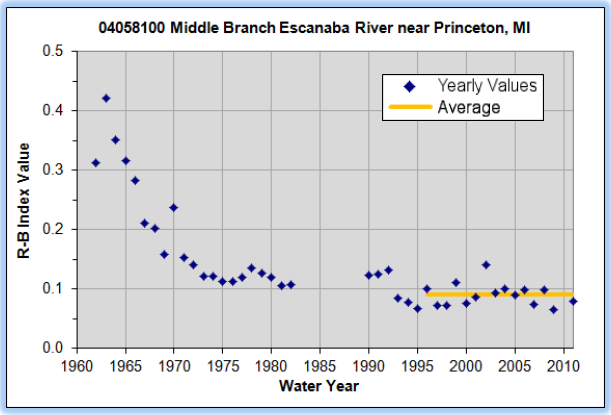


USGS Gage 04058000, Middle Branch Escanaba River near Ishpeming, MI

- Drainage Area (square miles): 128
- Basin Number: 46
- Characteristic R-B Index Value: 0.131
- Rank: Upper Middle
- First Water Year: 1955
- Last Water Year: 1975
- Number of Water Years Analyzed: 21

Comments: Some flow diverted and returned above station by iron ore processing plant.

Streams Tributary to Lake Michigan, Upper Peninsula (cont.)

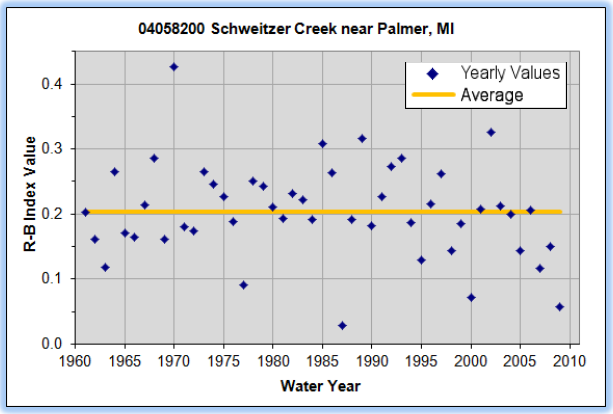


USGS Gage 04058100, Middle Branch Escanaba River near Princeton, MI

- Drainage Area (square miles): 210
- Basin Number: 46
- Characteristic R-B Index Value: 0.090
- Rank: Lower Middle
- First Water Year: 1962
- First Water Year Analyzed, if different: 1996
- Last Water Year: 2011
- Number of Water Years Analyzed: 15

Comments:

- Flow regulated by power plant 400 feet upstream from station. Since December 1972 additional regulation 27 miles upstream by Greenwood release. Since January 1973 some flow diverted to Green Creek via Greenwood Diversion 27 miles upstream. October 1979 some of the diversion returned five miles downstream via Goose Lake Outlet and East Branch Escanaba River. 1973 to 1991 discharges and runoff figures were adjusted for diversion and change in contents in Greenwood reservoir.
- Initially published decreasing trend for this gage. Additional data revises the analysis to no trend for this report update.

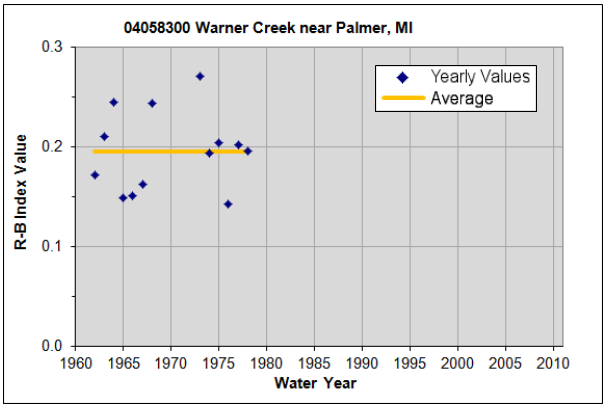


USGS Gage 04058200, Schweitzer Creek near Palmer, MI

- Drainage Area (square miles): 23.6
- Basin Number: 46
- Characteristic R-B Index Value: 0.204
- Rank: Lower Middle
- First Water Year: 1961
- Last Water Year: 2009
- Number of Water Years Analyzed: 49

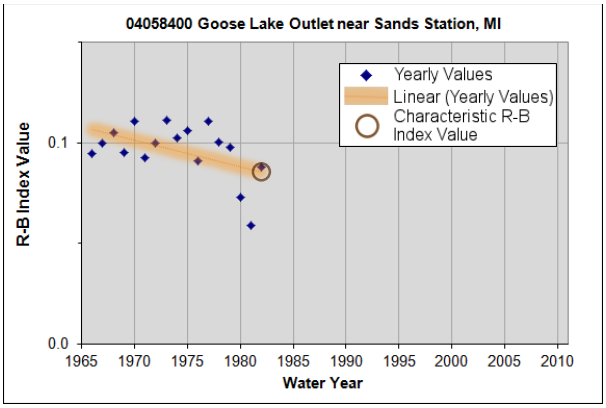
Comments: Since August 1962 flow completely regulated by Schweitzer Reservoirs one mile upstream. Prior to June 1994 some diversions from headwaters of basin for municipal supply and effluent discharge to the Carp River basin. An average of 46 cubic feet per second was diverted from Schweitzer reservoirs by industry iron ore processing, some returned via Goose Lake Outlet and East Branch Escanaba River. Diversions into Schweitzer Reservoir from Greenwood Reservoir via Greenwood diversion.

Streams Tributary to Lake Michigan, Upper Peninsula (cont.)



USGS Gage 04058300, Warner Creek near Palmer, MI

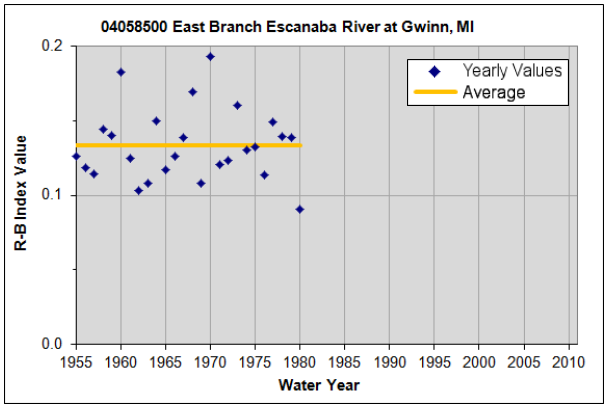
- Drainage Area (square miles): 14.2
- Basin Number: 46
- Characteristic R-B Index Value: 0.195
- Rank: Lower Middle
- First Water Year: 1962
- Last Water Year: 1978
- Number of Water Years Analyzed: 13



USGS Gage 04058400, Goose Lake Outlet near Sands Station, MI

- Drainage Area (square miles): 37.5
- Basin Number: 46
- Characteristic R-B Index Value: 0.084
- Rank: Lowest
- p value: 0.05
- First Water Year: 1966
- Last Water Year: 1982
- Number of Water Years Analyzed: 17

Comments: Flow includes an average of 9.6 cubic feet per second discharge into basin from mine tailings pond three miles upstream, the greater part diverted from Schweitzer Reservoir station. Diversion began October 1979.

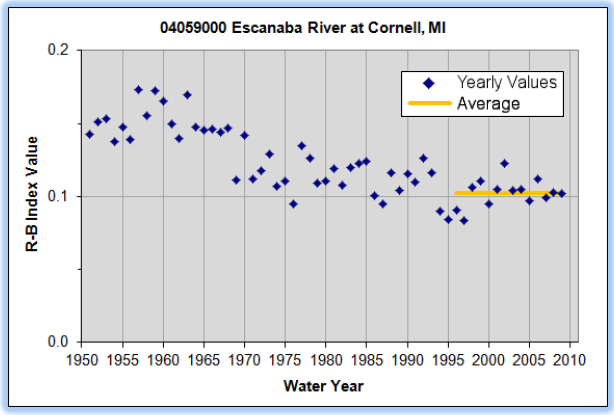


USGS Gage 04058500, East Branch Escanaba River at Gwinn, MI

- Drainage Area (square miles): 124
- Basin Number: 46
- Characteristic R-B Index Value: 0.133
- Rank: Upper Middle
- First Water Year: 1955
- Last Water Year: 1980
- Number of Water Years Analyzed: 26

Comments: Since August 1962 some regulation by Schweitzer Reservoir about 16 miles upstream. An average of 2.2 cubic feet per second was diverted from headwaters of basin by the City of Ishpeming for municipal supply and effluent discharge to the Carp River Basin. An average of 34 cubic feet per second was diverted from Schweitzer reservoir by industry for iron ore processing, some returned to the Middle Branch Escanaba River via Green Creek and some returned to the East Branch Escanaba River via the Goose Lake Outlet. Diversion into Schweitzer Reservoir from Greenwood Reservoir via Greenwood Diversion.

Streams Tributary to Lake Michigan, Upper Peninsula (cont.)

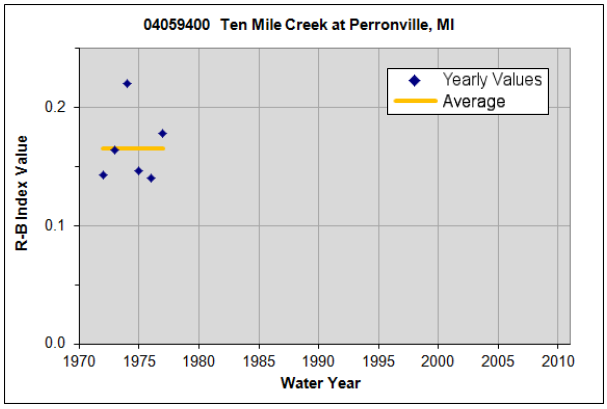


USGS Gage 04059000, Escanaba River at Cornell, MI

- Drainage Area (square miles): 870
- Basin Number: 46
- Characteristic R-B Index Value: 0.103
- Rank: Lower Middle
- First Water Year: 1951
- First Water Year Analyzed, if different: 1996
- Last Water Year: 2009
- Number of Water Years Analyzed: 14

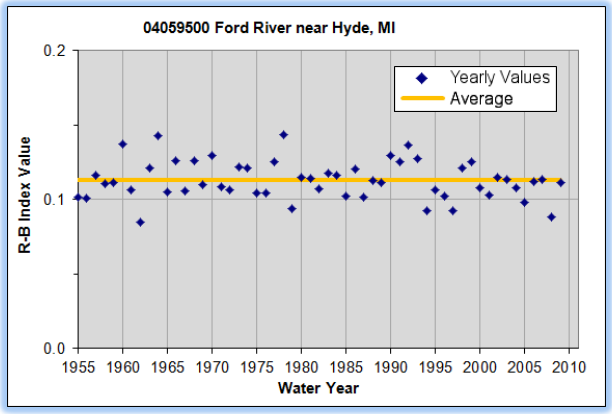
Comments:

- Diurnal fluctuation and occasional slight regulation caused by Boney Falls power plant seven miles above station since 1950. Since August 1962 some regulation by Schweitzer reservoir at headwaters.
- Initially published decreasing trend for this gage. Additional data revises the analysis to no trend for this report update.



USGS Gage 04059400, Ten Mile Creek at Perronville, MI

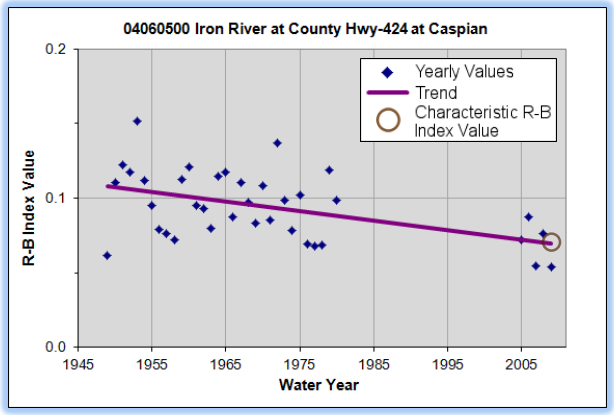
- Drainage Area (square miles): 39
- Basin Number: 47
- Characteristic R-B Index Value: 0.165
- Rank: Lower Middle
- First Water Year: 1972
- Last Water Year: 1977
- Number of Water Years Analyzed: 6



USGS Gage 04059500, Ford River near Hyde, MI

- Drainage Area (square miles): 450
- Basin Number: 47
- Characteristic R-B Index Value: 0.113
- Rank: Upper Middle
- First Water Year: 1955
- Last Water Year: 2009
- Number of Water Years Analyzed: 55

Streams Tributary to Lake Michigan, Upper Peninsula (cont.)

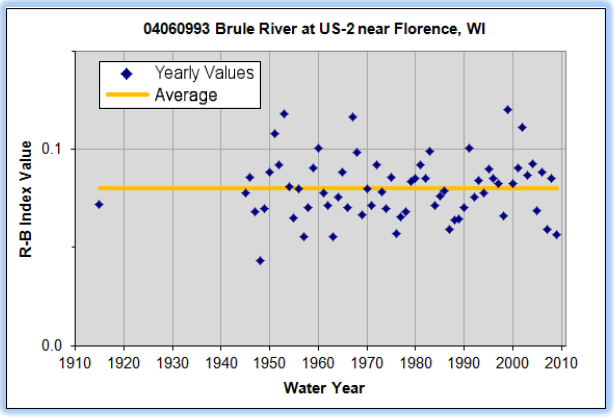


USGS Gage 04060500, Iron River at Highway 424 at Caspian, MI

- Drainage Area (square miles): 92.1
- Basin Number: 50
- Characteristic R-B Index Value: 0.069
- Rank: Lowest
- Trend: decrease, p value: 0.00
- First Water Year: 1949
- Last Water Year: 2009
- Number of Water Years Analyzed: 37

Comments:

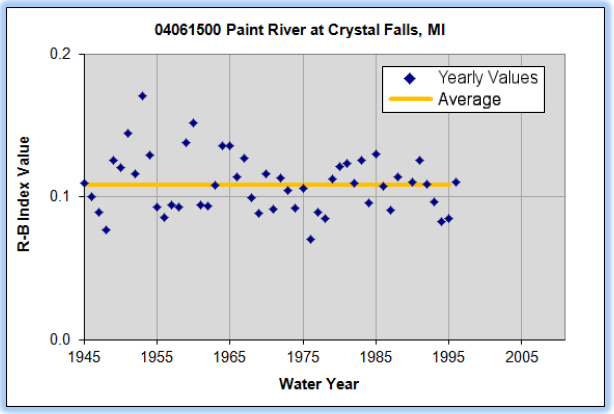
- Prior to August 1978 the average flow includes mine pumpage and sewage effluent. Since August 1978 average flow includes about one foot per second sewage effluent.
- Initially published no trend for this gage. Additional data revises the analysis to decreasing trend for this report update.



USGS Gage 04060993, Brule River at US-2 near Florence, WI

- Drainage Area (square miles): 366
- Basin Number: 50
- Characteristic R-B Index Value: 0.080
- Rank: Lower Middle
- First Water Year: 1915
- Last Water Year: 2009
- Number of Water Years Analyzed: 66

Comments: Discharge includes some mine pumpage prior to August 1977, discontinued gage 04061000 considered equivalent.

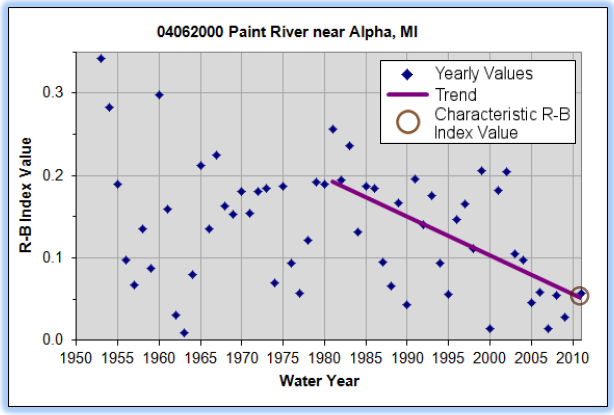


USGS Gage 04061500, Paint River at Crystal Falls, MI

- Drainage Area (square miles): 597
- Basin Number: 50
- Characteristic R-B Index Value: 0.109
- Rank: Upper Middle
- First Water Year: 1945
- Last Water Year: 1996
- Number of Water Years Analyzed: 51

Comments: Diurnal fluctuations caused by power plant immediately upstream; since storage capacity is small, daily flows are not affected appreciably.

Streams Tributary to Lake Michigan, Upper Peninsula (cont.)

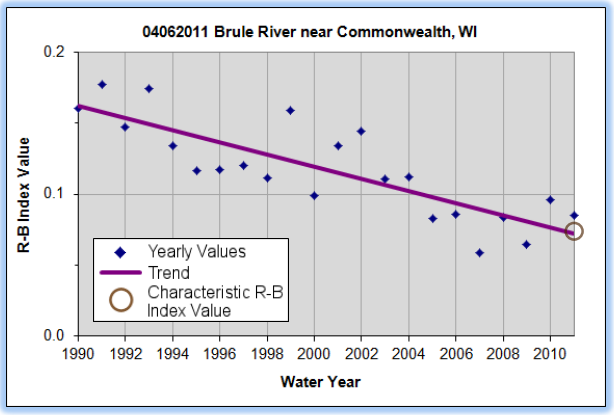


USGS Gage 04062000, Paint River near Alpha, MI

- Drainage Area (square miles): 631
- Basin Number: 50
- Characteristic R-B Index Value: 0.051
- Rank: Lowest
- Trend: decrease, p value: 0.00
- First Water Year: 1953
- First Water Year Analyzed, if different: 1981
- Last Water Year: 2011
- Number of Water Years Analyzed: 30

Comments:

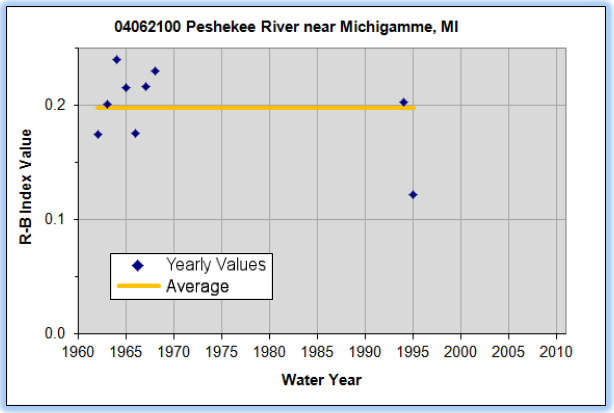
- Flow completely regulated by Lower Paint Dam 0.6 miles upstream.
- Initially published no trend for this gage. Additional data revises the analysis to decreasing trend for this report update.



USGS Gage 04062011, Brule River near Commonwealth, WI

- Drainage Area (square miles): 1020
- Basin Number: 50
- Characteristic R-B Index Value: 0.072
- Rank: Lower Middle
- Trend: decrease, p value: 0.00
- First Water Year: 1990
- Last Water Year: 2011
- Number of Water Years Analyzed: 22

Comments: Flow regulated by power plant 900 feet upstream and by Lower Paint Dam 8.2 miles upstream.

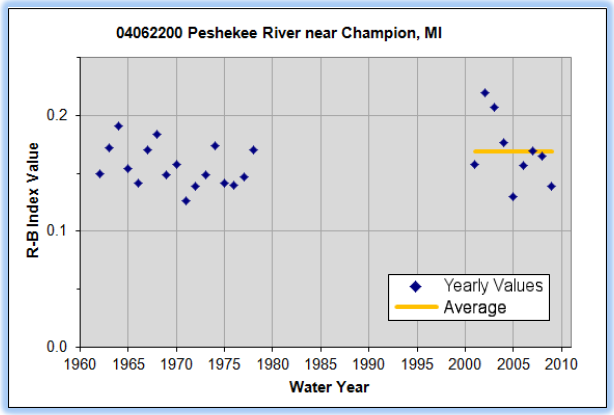


USGS Gage 04062100, Peshekee River near Michigamme, MI

Drainage Area (square miles): 66.5

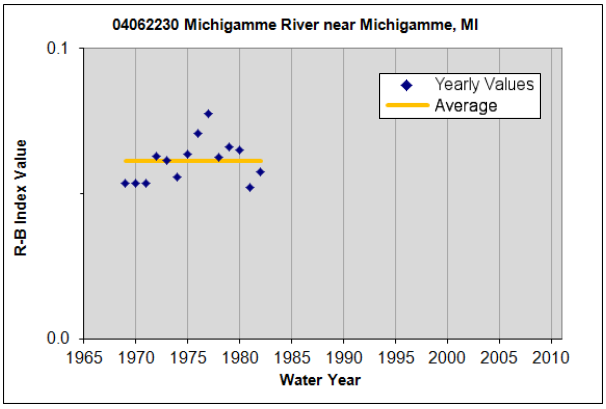
- Basin Number: 50
- Characteristic R-B Index Value: 0.197
- Rank: Upper Middle
- First Water Year: 1962
- Last Water Year: 1995
- Number of Water Years Analyzed: 9

Streams Tributary to Lake Michigan, Upper Peninsula (cont.)



USGS Gage 04062200, Peshekee River near Champion, MI

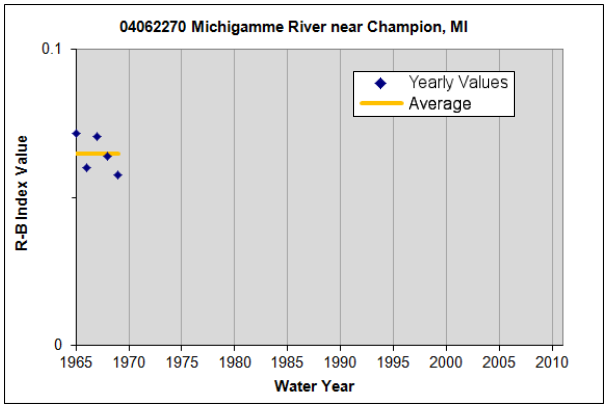
- Drainage Area (square miles): 133
- Basin Number: 50
- Characteristic R-B Index Value: 0.169
- Rank: Upper Middle
- First Water Year: 1962
- First Water Year Analyzed, if different: 2001
- Last Water Year: 2009
- Number of Water Years Analyzed: 9



USGS Gage 04062230, Michigamme River near Michigamme, MI

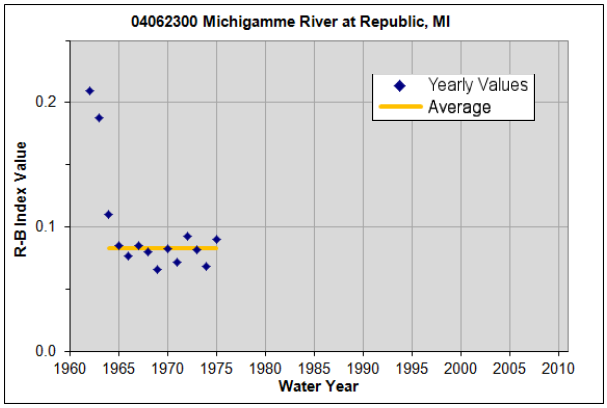
- Drainage Area (square miles): 194
- Basin Number: 50
- Characteristic R-B Index Value: 0.061
- Rank: Lowest
- First Water Year: 1969
- Last Water Year: 1982
- Number of Water Years Analyzed: 14

Comments: Gage may be affected by dam operations.



USGS Gage 04062270, Michigamme River near Champion, MI

- Drainage Area (square miles): 231
- Basin Number: 50
- Characteristic R-B Index Value: 0.065
- Rank: Lowest
- First Water Year: 1965
- Last Water Year: 1969
- Number of Water Years Analyzed: 5

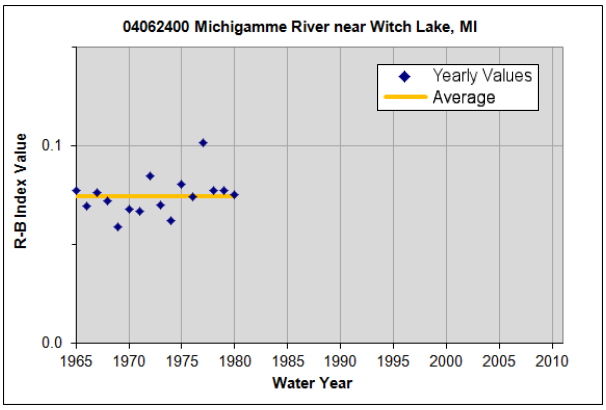


USGS Gage 04062300, Michigamme River at Republic, MI

- Drainage Area (square miles): 240
- Basin Number: 50
- Characteristic R-B Index Value: 0.083
- Rank: Lower Middle
- First Water Year: 1962
- First Water Year Analyzed, if different: 1964
- Last Water Year: 1975
- Number of Water Years Analyzed: 12

Comments: Prior to June 1, 1963 diurnal fluctuation caused by power plant 0.4 miles above station; power plant abandoned and only occasional regulation since. Since June 1, 1963 water diverted 0.5 miles above station for industrial use and returned to river by Gambles Creek five miles downstream.

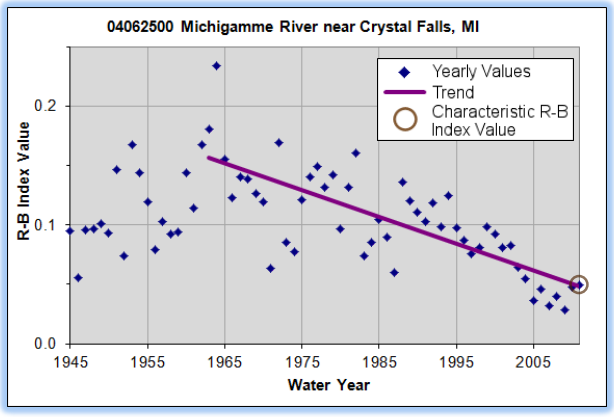
Streams Tributary to Lake Michigan, Upper Peninsula (cont.)



USGS Gage 04062400, Michigamme River near Witch Lake, MI

- Drainage Area (square miles): 316
- Basin Number: 50
- Characteristic R-B Index Value: 0.075
- Rank: Lower Middle
- First Water Year: 1965
- Last Water Year: 1980
- Number of Water Years Analyzed: 16

Comments: Water discharge records good except those from the winter period, which are fair. Occasional regulation 14 miles upstream. Some flow diverted and returned to the above station by an iron ore processing plant.

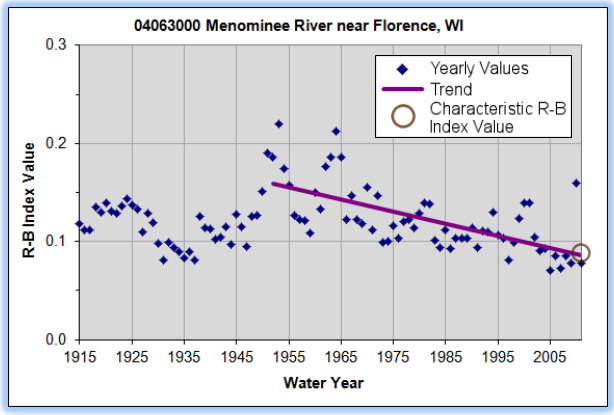


USGS Gage 04062500, Michigamme River near Crystal Falls, MI

- Drainage Area (square miles): 656
- Basin Number: 50
- Characteristic R-B Index Value: 0.048
- Rank: Lowest
- Trend: decrease, p value: 0.00
- First Water Year: 1945
- First Water Year Analyzed, if different: 1972
- Last Water Year: 2011
- Number of Water Years Analyzed: 40

Comments: Regulated by power plant and Michigan reservoir five miles upstream.

Streams Tributary to Lake Michigan, Upper Peninsula (cont.)

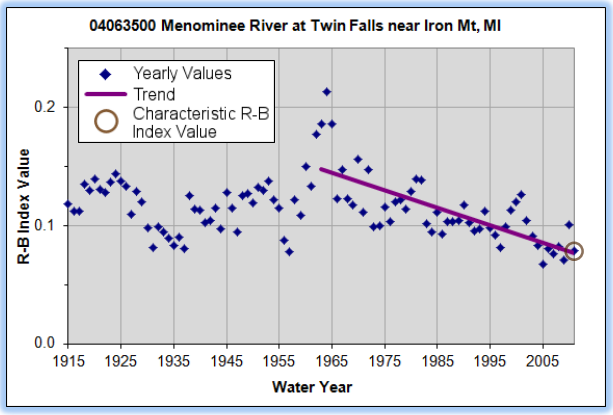


USGS Gage 04063000, Menominee River near Florence, WI

- Drainage Area (square miles): 1760
- Basin Number: 50
- Characteristic R-B Index Value: 0.086
- Rank: Upper Middle
- Trend: decrease, p value: 0.00
- First Water Year: 1915
- First Water Year Analyzed, if different: 1952
- Last Water Year: 2011
- Number of Water Years Analyzed: 60

Comments:

- Prior to July 1950 discharge determined from power plant records, flow regulated by power plants, Michigamme Reservoir, Peavy Pond, and many smaller reservoirs upstream from station.
- Initially published no trend for this gage. Additional data revises the analysis to decreasing trend for this report update.

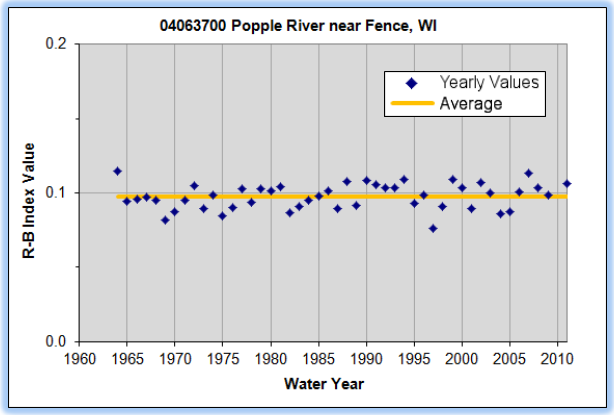


USGS Gage 04063500, Menominee River at Twin Falls near Iron Mountain, MI

- Drainage Area (square miles): 1800
- Basin Number: 50
- Characteristic R-B Index Value: 0.076
- Rank: Lower Middle
- Trend: decrease, p value: 0.00
- First Water Year: 1915
- First Water Year Analyzed, if different: 1963
- Last Water Year: 2011
- Number of Water Years Analyzed: 49

Comments:

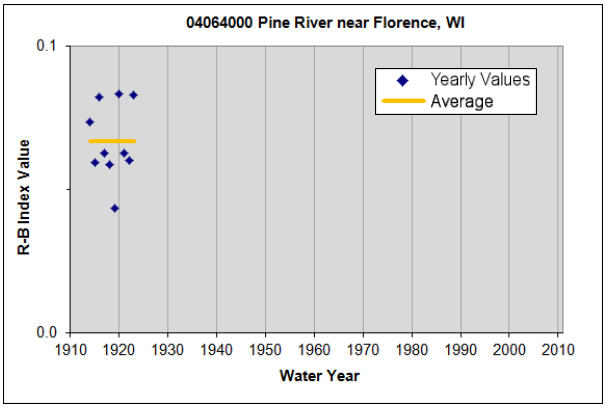
- Prior to 1957 discharge determined from power plant records. Flow regulated by power plants, Michigamme Reservoir, Peavy Pond, and many smaller reservoirs upstream from station.
- Initially published no trend for this gage. Additional data revises the analysis to decreasing trend for this report update.



USGS Gage 04063700, Popple River near Fence, WI

- Drainage Area (square miles): 139
- Basin Number: 50
- Characteristic R-B Index Value: 0.098
- Rank: Lower Middle
- First Water Year: 1964
- Last Water Year: 2011
- Number of Water Years Analyzed: 47

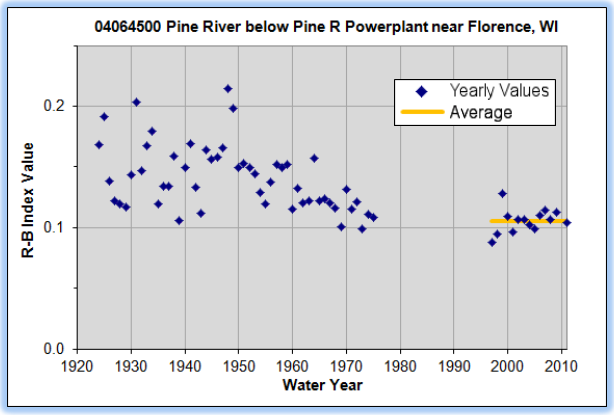
Comments: Gage added for this report update.



USGS Gage 04064000, Pine River near Florence, WI

- Drainage Area (square miles): 510
- Basin Number: 50
- Characteristic R-B Index Value: 0.067
- Rank: Lowest
- First Water Year: 1914
- Last Water Year: 1923
- Number of Water Years Analyzed: 10

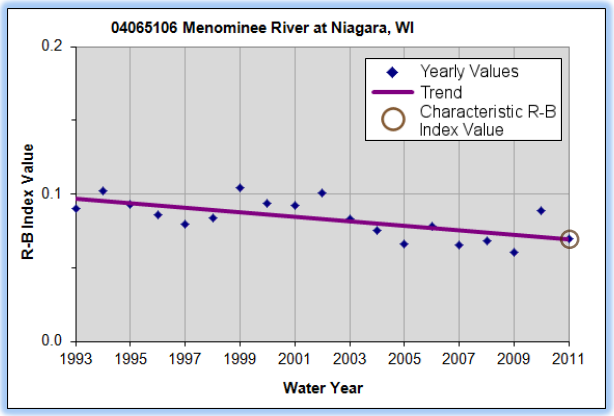
Comments: Gage added for this report update.



USGS Gage 04064500, Pine River below Pine River Powerplant near Florence, WI

- Drainage Area (square miles): 533
- Basin Number: 50
- Characteristic R-B Index Value: 0.106
- Rank: Upper Middle
- First Water Year: 1924
- First Water Year Analyzed, if different: 1997
- Last Water Year: 2011
- Number of Water Years Analyzed: 14

Comments: Gage added for this report update.

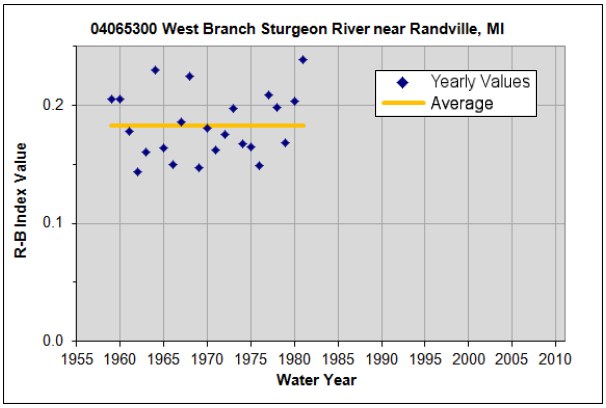


USGS Gage 04065106, Menominee River at Niagara, WI

- Drainage Area (square miles): 2470
- Basin Number: 50
- Characteristic R-B Index Value: 0.069
- Rank: Lower Middle
- Trend: decrease, p value: 0.00
- First Water Year: 1993
- Last Water Year: 2011
- Number of Water Years Analyzed: 19

Comments: Gage added for this report update.

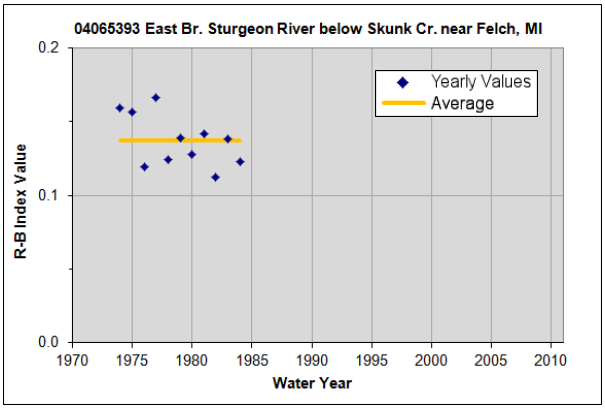
Streams Tributary to Lake Michigan, Upper Peninsula (cont.)



USGS Gage 04065300, West Branch Sturgeon River near Randville, MI

- Drainage Area (square miles): 56.1
- Basin Number: 50
- Characteristic R-B Index Value: 0.183
- Rank: Upper Middle
- First Water Year: 1959
- Last Water Year: 1981
- Number of Water Years Analyzed: 23

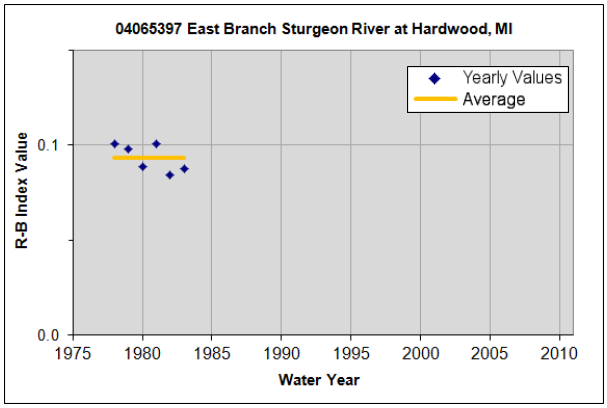
Comments: Since December 1958 diversion above for industrial use; figures of runoff adjusted thereafter. Small diversions for sprinkler irrigation.



USGS Gage 04065393, East Branch Sturgeon River below Skunk Creek near Felch, MI

- Drainage Area (square miles): 61.8
- Basin Number: 50
- Characteristic R-B Index Value: 0.137
- Rank: Lower Middle
- First Water Year: 1974
- Last Water Year: 1984
- Number of Water Years Analyzed: 11

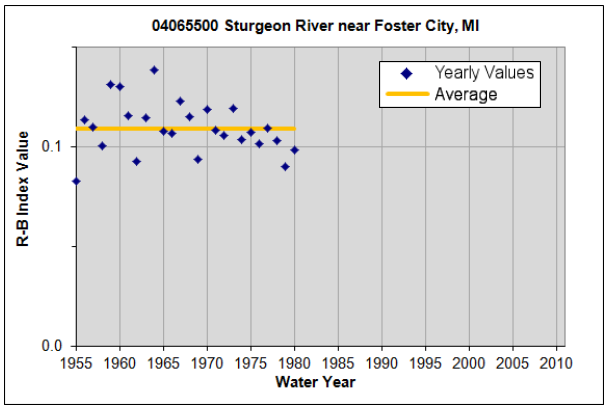
Comments: Since June 1975 occasional regulation during low flows by Gene Lake Reservoir three miles upstream.



USGS Gage 04065397, East Branch Sturgeon River at Hardwood, MI

- Drainage Area (square miles): 90.8
- Basin Number: 50
- Characteristic R-B Index Value: 0.093
- Rank: Lowest
- First Water Year: 1978
- Last Water Year: 1983
- Number of Water Years Analyzed: 6

Comments: Occasional regulation during low flows by Gene Lake Reservoir in headwater and hardwood reservoir 1.2 miles upstream.

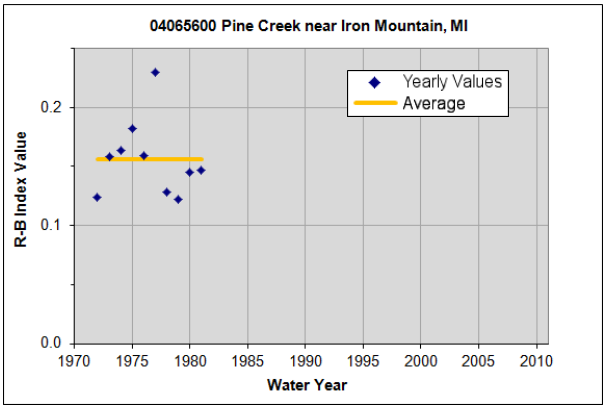


USGS Gage 04065500, Sturgeon River near Foster City, MI

- Drainage Area (square miles): 237
- Basin Number: 50
- Characteristic R-B Index Value: 0.109
- Rank: Upper Middle
- First Water Year: 1955
- Last Water Year: 1980
- Number of Water Years Analyzed: 26

Comments: Since December 1958 diversion above station for industrial use; figures of runoff adjusted thereafter. Since June 1975 occasional regulation during low flows by reservoirs in headwaters from East Branch. Small diversions for sprinkler irrigation.

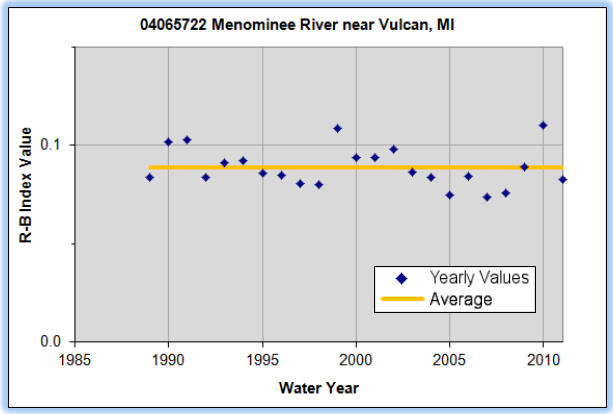
Streams Tributary to Lake Michigan, Upper Peninsula (cont.)



USGS Gage 04065600, Pine Creek near Iron Mountain, MI

- Drainage Area (square miles): 17
- Basin Number: 50
- Characteristic R-B Index Value: 0.156
- Rank: Lowest
- First Water Year: 1972
- Last Water Year: 1961
- Number of Water Years Analyzed: 10

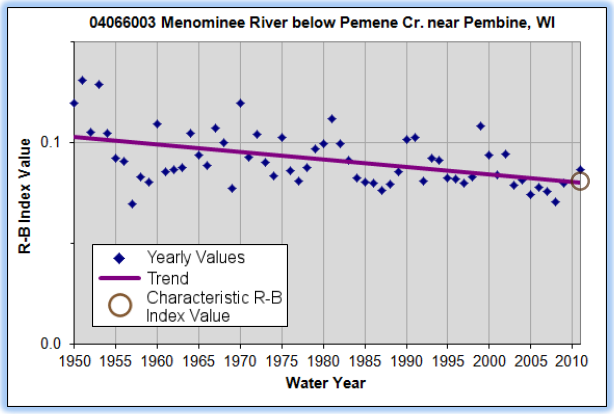
Comments: Flow includes an average of 5.6 cubic feet per second diverted from West Branch Sturgeon River basin.



USGS Gage 04065722, Menominee River near Vulcan, MI

- Drainage Area (square miles): 2900
- Basin Number: 50
- Characteristic R-B Index Value: 0.089
- Rank: Upper Middle
- First Water Year: 1989
- Last Water Year: 2011
- Number of Water Years Analyzed: 23

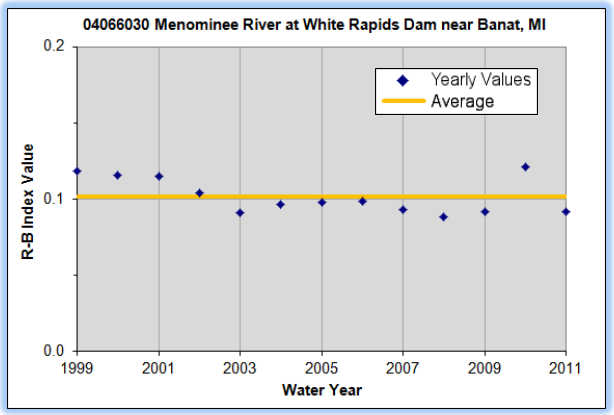
Comments: Flow regulated by power plants, Michigamme Reservoir, Peavy Pond, and many smaller reservoirs upstream from station.



USGS Gage 04066003, Menominee River below Pemene Creek near Pembine, WI

- Drainage Area (square miles): 3140
- Basin Number: 50
- Characteristic R-B Index Value: 0.080
- Rank: Upper Middle
- Trend: decrease, p value: 0.00
- First Water Year: 1950
- Last Water Year: 2011
- Number of Water Years Analyzed: 61

Comments: Flow regulated by power plants, Michigamme Reservoir, Peavy Pond, and many smaller reservoirs upstream from station. Discontinued Gage 04066000 considered equivalent.

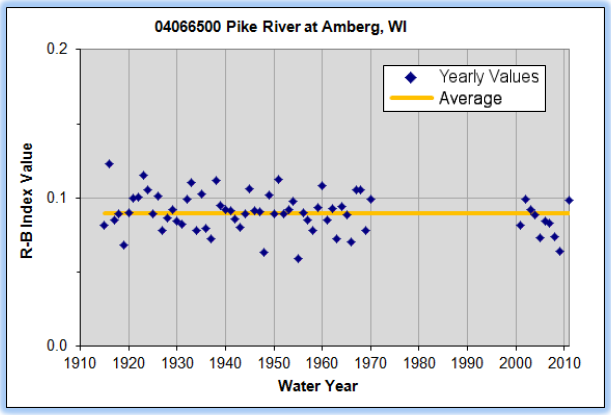


USGS Gage 04066030, Menominee River at White Rapids Dam near Banat, MI

- Drainage Area (square miles): 3190
- Basin Number: 50
- Characteristic R-B Index Value: 0.102
- Rank: Highest
- First Water Year: 1999
- Last Water Year: 2011
- Number of Water Years Analyzed: 13

Comments: Gage added for this report update.

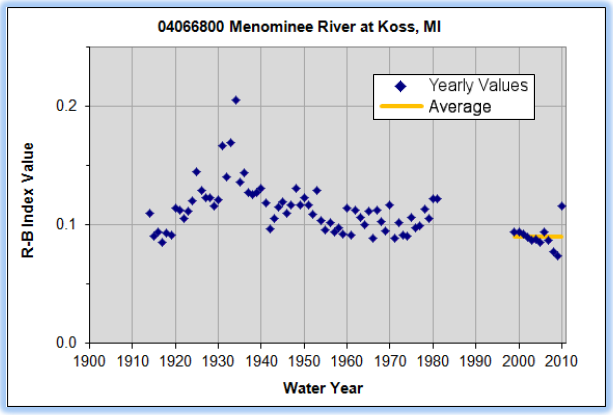
Streams Tributary to Lake Michigan, Upper Peninsula (cont.)



USGS Gage 04066500, Pike River at Amberg, WI

- Drainage Area (square miles): 255
- Basin Number: 50
- Characteristic R-B Index Value: 0.090
- Rank: Lower Middle
- First Water Year: 1915
- Last Water Year: 2011
- Number of Water Years Analyzed: 66

Comments: Gage added for this report update.



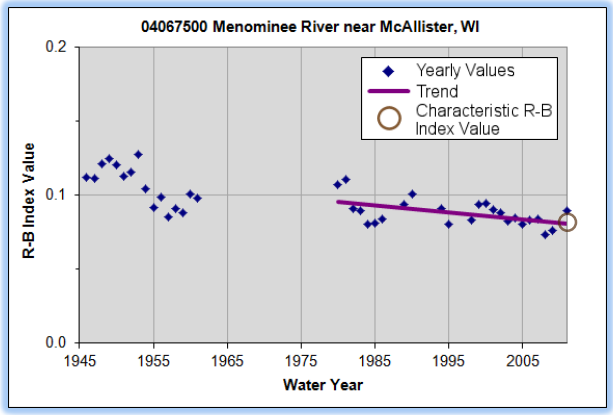
USGS Gage 04066800, Menominee River at Koss, MI

- Drainage Area (square miles): 3700
- Basin Number: 50
- Characteristic R-B Index Value: 0.090
- Rank: Upper Middle
- First Water Year: 1914
- First Water Year Analyzed, if different: 1999
- Last Water Year: 2011
- Number of Water Years Analyzed: 12

Comments:

- Flow regulated by power plants, Michigamme Reservoir, Peavy Pond on Michigamme River, and by smaller reservoirs above station.
- Gage listed as 04066700 in previous report.

Streams Tributary to Lake Michigan, Upper Peninsula (cont.)

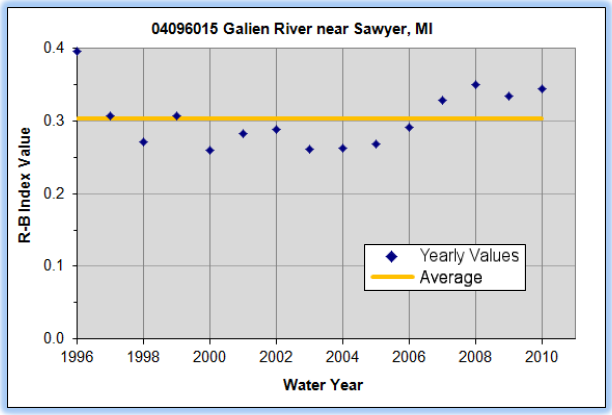


USGS Gage 04067500, Menominee River near McAllister, WI

- Drainage Area (square miles): 3930
- Basin Number: 50
- Characteristic R-B Index Value: 0.081
- Rank: Upper Middle
- Trend: decrease, p value: 0.01
- First Water Year: 1946
- First Water Year Analyzed, if different: 1980
- Last Water Year: 2011
- Number of Water Years Analyzed: 24

Comments: Gage added for this report update.

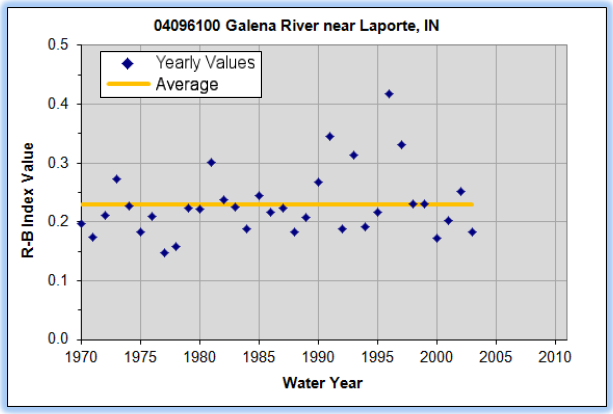
Streams Tributary to Lake Michigan, Southern Lower Peninsula



USGS Gage 04096015, Galien River near Sawyer, MI

- Drainage Area (square miles): 80.7
- Basin Number: 34
- Characteristic R-B Index Value: 0.304
- Rank: Highest
- First Water Year: 1996
- Last Water Year: 2010
- Number of Water Years Analyzed: 15

Comments: Initially published decreasing trend for this gage. Additional data revises the analysis to no trend for this report update.

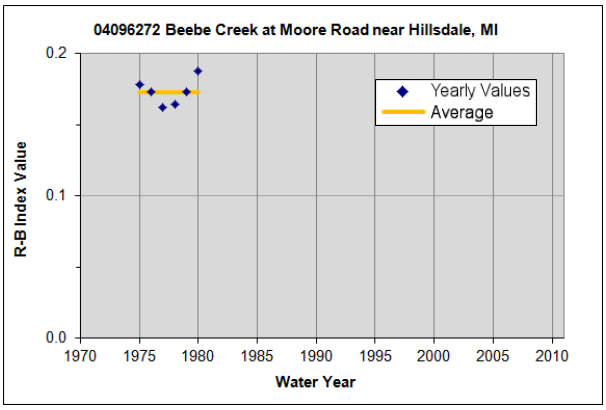


USGS Gage 04096100, Galena River near Laporte, IN

- Drainage Area (square miles): 17.2
- Basin Number: 34
- Characteristic R-B Index Value: 0.229
- Rank: Lower Middle
- First Water Year: 1970
- Last Water Year: 2003
- Number of Water Years Analyzed: 34

Comments: Gage added for this report update.

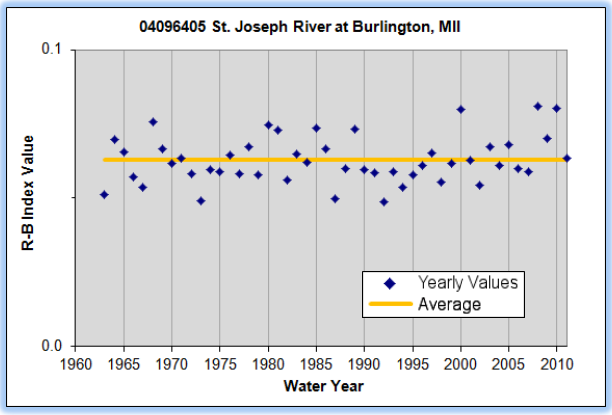
Streams Tributary to Lake Michigan, Southern Lower Peninsula (cont.)



USGS Gage 04096272, Beebe Creek at Moore Road near Hillsdale, MI

- Drainage Area (square miles): 42.4
- Basin Number: 34
- Characteristic R-B Index Value: 0.173
- Rank: Lower Middle
- First Water Year: 1975
- Last Water Year: 1980
- Number of Water Years Analyzed: 6

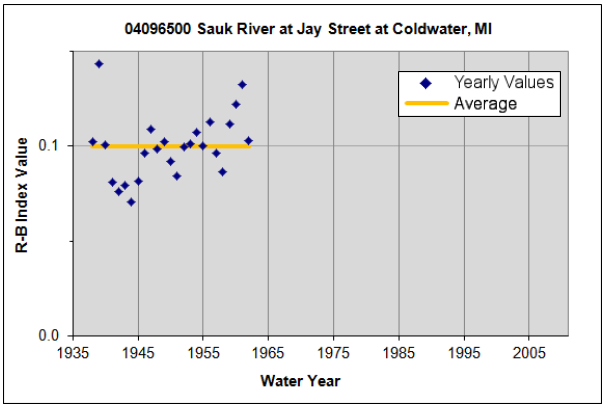
Comments: Occasional regulation by Lake Belair about five miles above location.



USGS Gage 04096405, St. Joseph River at Burlington, MI

- Drainage Area (square miles): 206
- Basin Number: 34
- Characteristic R-B Index Value: 0.063
- Rank: Lowest
- First Water Year: 1963
- Last Water Year: 2011
- Number of Water Years Analyzed: 49

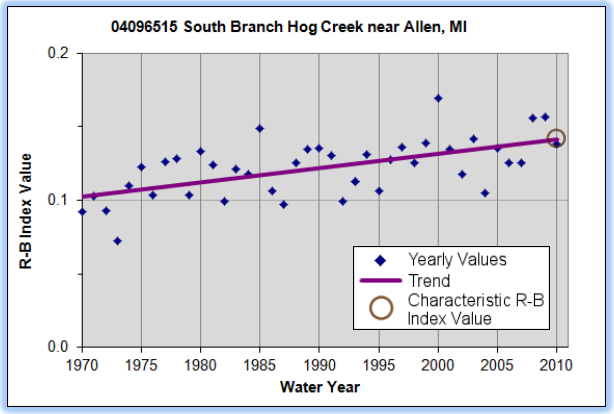
Comments: Discontinued gage 04096400 considered equivalent.



USGS Gage 04096500, Sauk River at Jay Street at Coldwater, MI

- Drainage Area (square miles): 60
- Basin Number: 34
- Characteristic R-B Index Value: 0.100
- Rank: Lowest
- First Water Year: 1938
- Last Water Year: 1962
- Number of Water Years Analyzed: 25

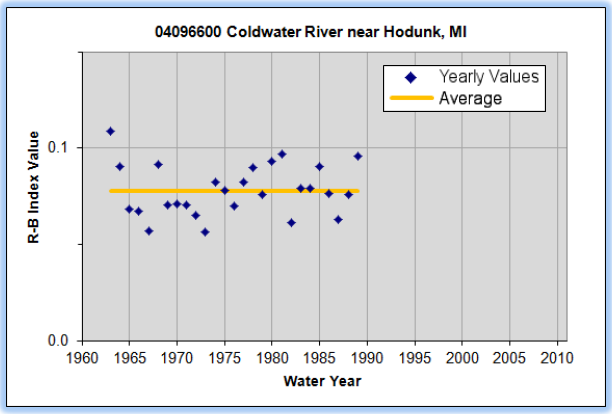
Comments: Drainage area indeterminate due to infrequent contribution to or from Coldwater Lake. Regulation caused by dam at outlet of Marble Lake.



USGS Gage 04096515, South Branch Hog Creek near Allen, MI

- Drainage Area (square miles): 48.7
- Basin Number: 34
- Characteristic R-B Index Value: 0.141
- Rank: Lower Middle
- Trend: increase, p value: 0.00
- First Water Year: 1970
- Last Water Year: 2010
- Number of Water Years Analyzed: 42

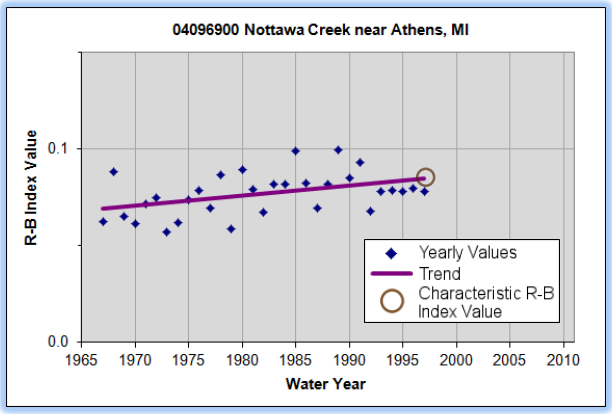
Streams Tributary to Lake Michigan, Southern Lower Peninsula (cont.)



USGS Gage 04096600, Coldwater River near Hodunk, MI

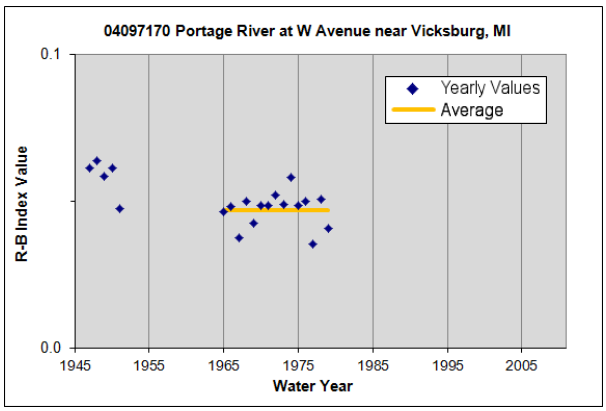
- Drainage Area (square miles): 293
- Basin Number: 34
- Characteristic R-B Index Value: 0.078
- Rank: Lower Middle
- First Water Year: 1963
- Last Water Year: 1989
- Number of Water Years Analyzed: 27

Comments: Diurnal fluctuation caused by mills upstream above station.



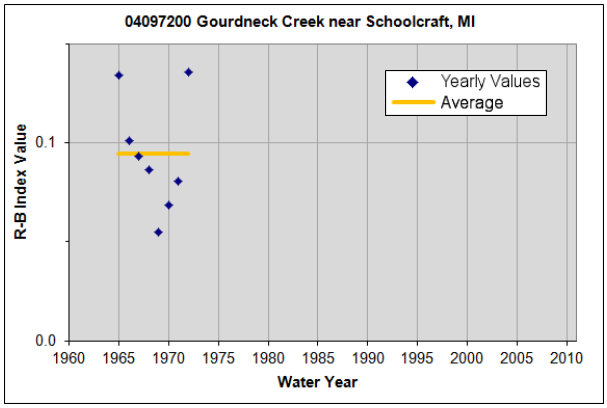
USGS Gage 04096900, Nottawa Creek near Athens, MI

- Drainage Area (square miles): 162
- Basin Number: 34
- Characteristic R-B Index Value: 0.084
- Rank: Lower Middle
- Trend: increase, p value: 0.02
- First Water Year: 1967
- Last Water Year: 1997
- Number of Water Years Analyzed: 31



USGS Gage 04097170, Portage River at W Avenue near Vicksburg, MI

- Drainage Area (square miles): 68.2
- Basin Number: 34
- Characteristic R-B Index Value: 0.047
- Rank: Lowest
- First Water Year: 1947
- First Water Year Analyzed, if different: 1965
- Last Water Year: 1979
- Number of Water Years Analyzed: 15

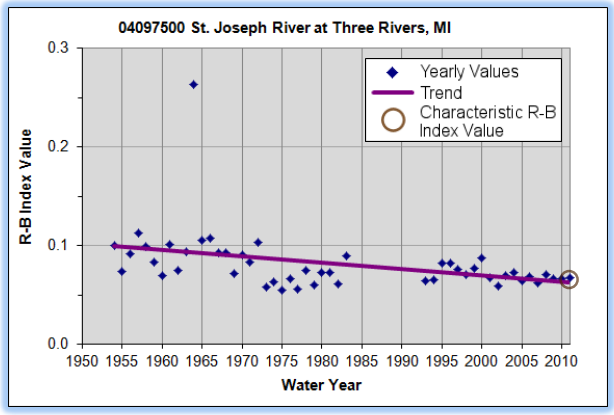


USGS Gage 04097200, Gourdneck Creek near Schoolcraft, MI

- Drainage Area (square miles): 7.29
- Basin Number: 34
- Characteristic R-B Index Value: 0.094
- Rank: Lowest
- First Water Year: 1965
- Last Water Year: 1972
- Number of Water Years Analyzed: 8

Comments: Gourdneck canal diverts water from stream 100 feet above station to sustain lake levels.

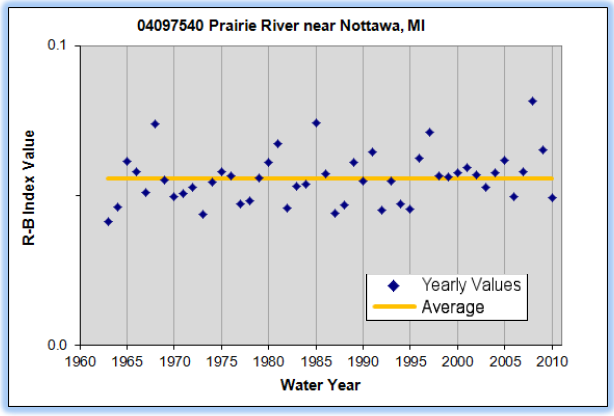
Streams Tributary to Lake Michigan, Southern Lower Peninsula (cont.)



USGS Gage 04097500, St. Joseph River at Three Rivers, MI

- Drainage Area (square miles): 1350
- Basin Number: 34
- Characteristic R-B Index Value: 0.062
- Rank: Lower Middle
- Trend: decrease, p value: 0.01
- First Water Year: 1954
- Last Water Year: 2011
- Number of Water Years Analyzed: 49

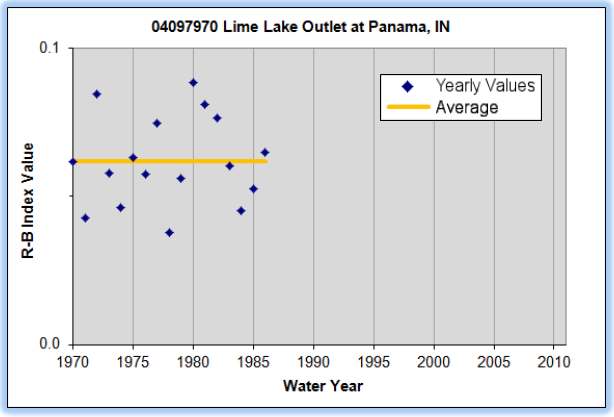
Comments: Flow regulated by power plant upstream from station.



USGS Gage 04097540, Prairie River near Nottawa, MI

- Drainage Area (square miles): 106
- Basin Number: 34
- Characteristic R-B Index Value: 0.056
- Rank: Lowest
- First Water Year: 1963
- Last Water Year: 2010
- Number of Water Years Analyzed: 48

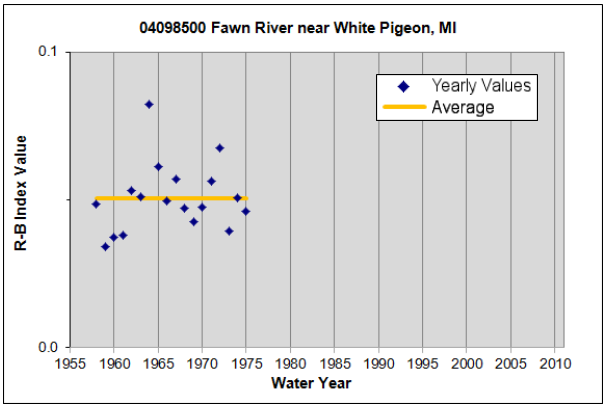
Comments: Since 1987 some diversion by pumping for sprinkler irrigation.



USGS Gage 04097970, Lime Lake Outlet at Panama, IN

- Drainage Area (square miles): 17.5
- Basin Number: 34
- Characteristic R-B Index Value: 0.062
- Rank: Lowest
- First Water Year: 1970
- Last Water Year: 1986
- Number of Water Years Analyzed: 17

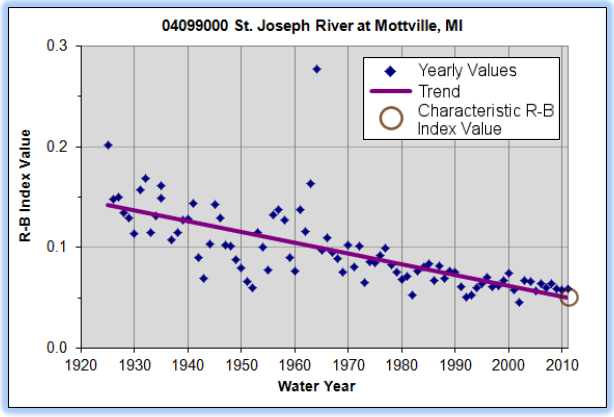
Comments: Gage added for this report update.



USGS Gage 04098500, Fawn River near White Pigeon, MI

- Drainage Area (square miles): 192
- Basin Number: 34
- Characteristic R-B Index Value: 0.051
- Rank: Lowest
- First Water Year: 1958
- Last Water Year: 1975
- Number of Water Years Analyzed: 18

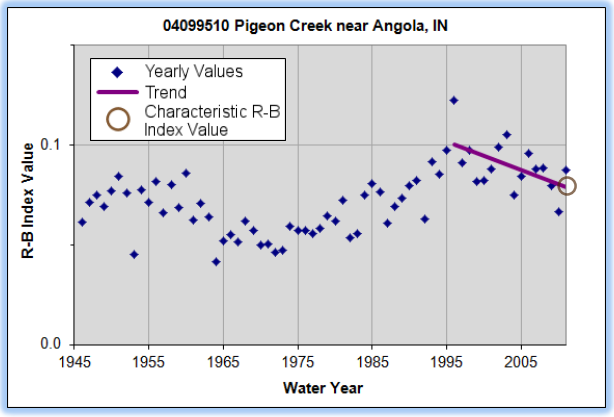
Comments: Small diurnal fluctuation caused by power plants above station.



USGS Gage 04099000, St. Joseph River at Mottville, MI

- Drainage Area (square miles): 1866
- Basin Number: 34
- Characteristic R-B Index Value: 0.050
- Rank: Lowest
- Trend: decrease, p value: 0.00
- First Water Year: 1925
- Last Water Year: 2011
- Number of Water Years Analyzed: 87

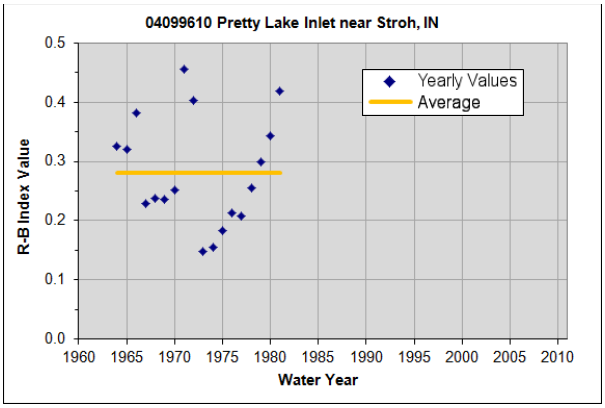
Comments: Flow regulated by power plants upstream from station.



USGS Gage 04099510, Pigeon Creek near Angola, IN

- Drainage Area (square miles): 106
- Basin Number: 34
- Characteristic R-B Index Value: 0.079
- Rank: Lower Middle
- Trend: decrease, p value: 0.04
- First Water Year: 1946
- First Water Year Analyzed, if different: 1996
- Last Water Year: 2011
- Number of Water Years Analyzed: 16

Comments: Gage added for this report update.

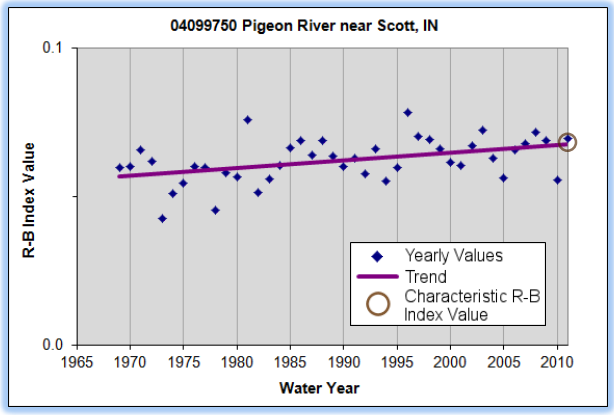


USGS Gage 04099610, Pretty Lake Inlet near Stroh, IN

- Drainage Area (square miles): 1.96
- Basin Number: 34
- Characteristic R-B Index Value: 0.281
- Rank: Lower Middle
- First Water Year: 1964
- Last Water Year: 1981
- Number of Water Years Analyzed: 18

Comments: Gage added for this report update.

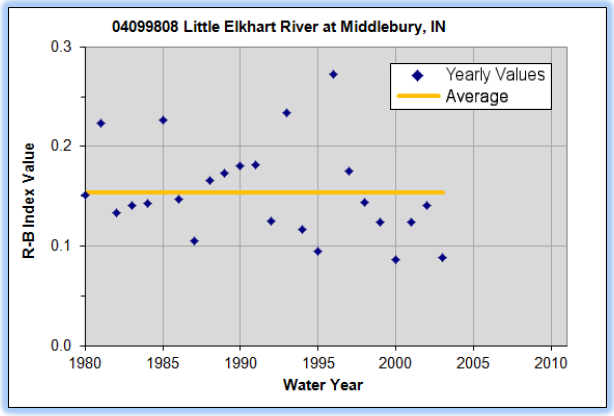
Streams Tributary to Lake Michigan, Southern Lower Peninsula (cont.)



USGS Gage 04099750, Pigeon River near Scott, IN

- Drainage Area (square miles): 307
- Basin Number: 34
- Characteristic R-B Index Value: 0.068
- Rank: Lower Middle
- Trend: increase, p value: 0.00
- First Water Year: 1969
- Last Water Year: 2011
- Number of Water Years Analyzed: 43

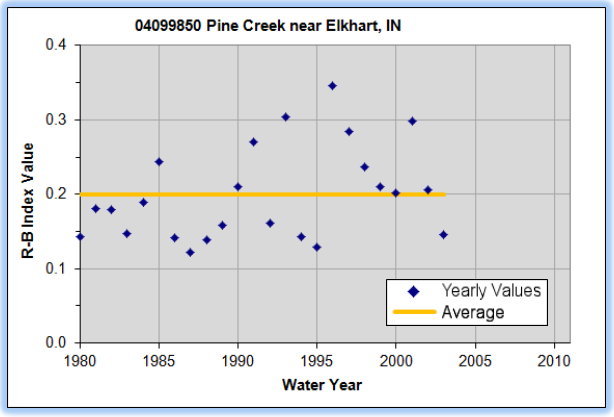
Comments: Gage added for this report update.



USGS Gage 04099808, Little Elkhart River at Middlebury, IN

- Drainage Area (square miles): 91.7
- Basin Number: 34
- Characteristic R-B Index Value: 0.154
- Rank: Lower Middle
- First Water Year: 1980
- Last Water Year: 2003
- Number of Water Years Analyzed: 24

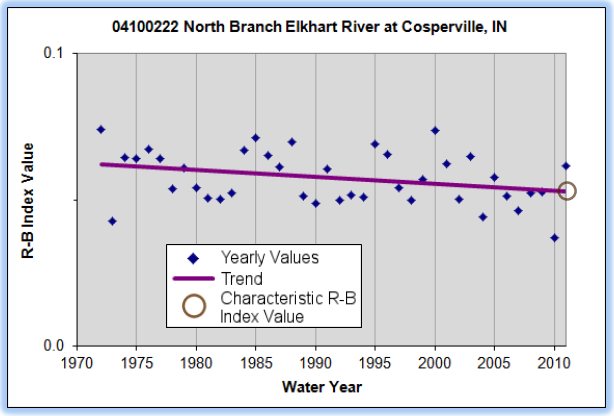
Comments: Gage added for this report update.



USGS Gage 04099850, Pine Creek near Elkhart, IN

- Drainage Area (square miles): 31
- Basin Number: 34
- Characteristic R-B Index Value: 0.200
- Rank: Upper Middle
- First Water Year: 1980
- Last Water Year: 2003
- Number of Water Years Analyzed: 24

Comments: Gage added for this report update.

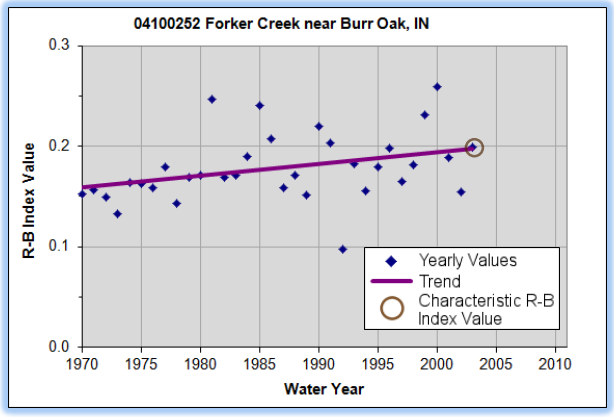


USGS Gage 04100222, North Branch Elkhart River at Cosperville, IN

- Drainage Area (square miles): 142
- Basin Number: 34
- Characteristic R-B Index Value: 0.053
- Rank: Lowest
- Trend: decrease, p value: 0.05
- First Water Year: 1972
- Last Water Year: 2011
- Number of Water Years Analyzed: 40

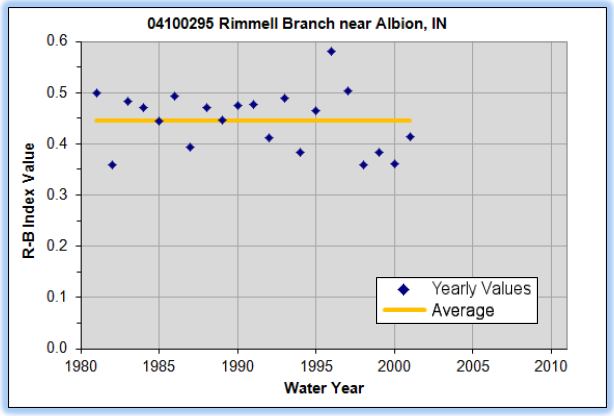
Comments: Gage added for this report update.

Streams Tributary to Lake Michigan, Southern Lower Peninsula (cont.)



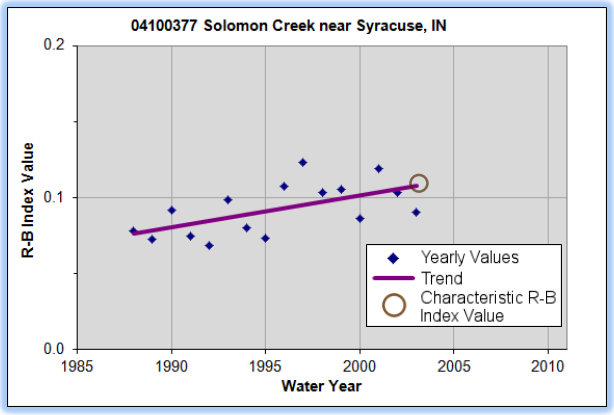
USGS Gage 04100252, Forker Creek near Burr Oak, IN
- Drainage Area (square miles): 19.2
- Basin Number: 34
- Characteristic R-B Index Value: 0.198
- Rank: Lower Middle
- Trend: increase, p value: 0.04
- First Water Year: 1970
- Last Water Year: 2003
- Number of Water Years Analyzed: 34

Comments: Gage added for this report update.



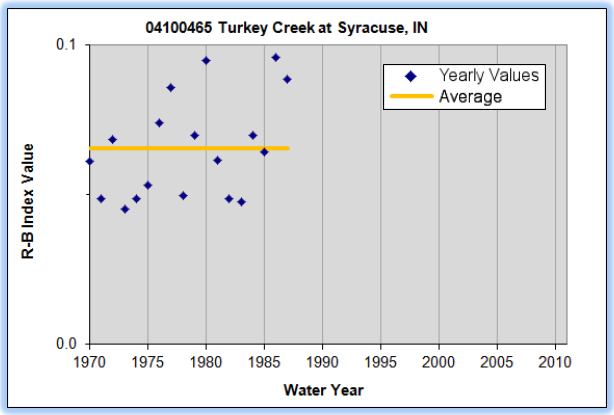
USGS Gage 04100295, Rimmell Branch near Albion, IN
- Drainage Area (square miles): 10.7
- Basin Number: 34
- Characteristic R-B Index Value: 0.446
- Rank: Upper Middle
- First Water Year: 1981
- Last Water Year: 2001
- Number of Water Years Analyzed: 21

Comments: Gage added for this report update.



USGS Gage 04100377, Solomon Creek near Syracuse, IN
- Drainage Area (square miles): 36.1
- Basin Number: 34
- Characteristic R-B Index Value: 0.108
- Rank: Lower Middle
- Trend: increase, p value: 0.02
- First Water Year: 1988
- Last Water Year: 2003
- Number of Water Years Analyzed: 16

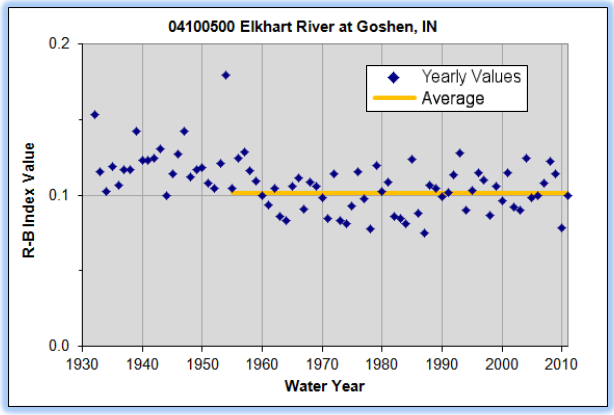
Comments: Gage added for this report update.



USGS Gage 04100465, Turkey Creek at Syracuse, IN
- Drainage Area (square miles): 43.8
- Basin Number: 34
- Characteristic R-B Index Value: 0.065
- Rank: Lowest
- First Water Year: 1970
- Last Water Year: 1987
- Number of Water Years Analyzed: 18

Comments: Gage added for this report update.

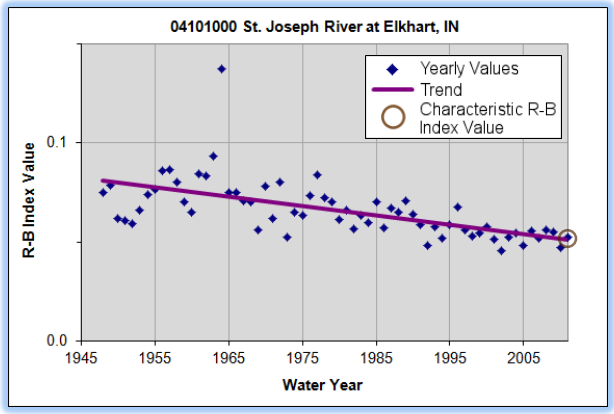
Streams Tributary to Lake Michigan, Southern Lower Peninsula (cont.)



USGS Gage 04100500, Elkhart River at Goshen, IN

- Drainage Area (square miles): 594
- Basin Number: 34
- Characteristic R-B Index Value: 0.102
- Rank: Lower Middle
- First Water Year: 1932
- First Water Year Analyzed, if different: 1955
- Last Water Year: 2011
- Number of Water Years Analyzed: 57

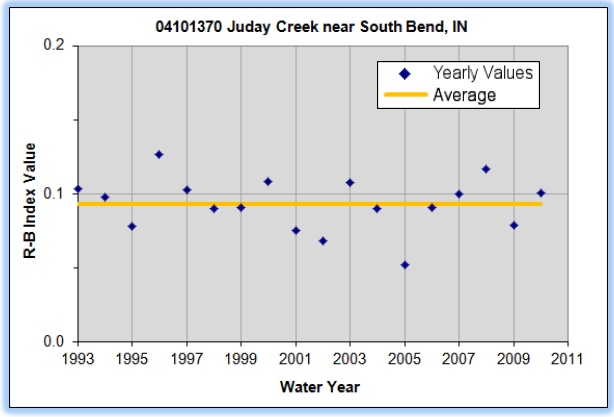
Comments: Gage added for this report update.



USGS Gage 04101000, St. Joseph River at Elkhart, IN

- Drainage Area (square miles): 3370
- Basin Number: 34
- Characteristic R-B Index Value: 0.051
- Rank: Lowest
- Trend: decrease, p value: 0.00
- First Water Year: 1948
- Last Water Year: 2011
- Number of Water Years Analyzed: 64

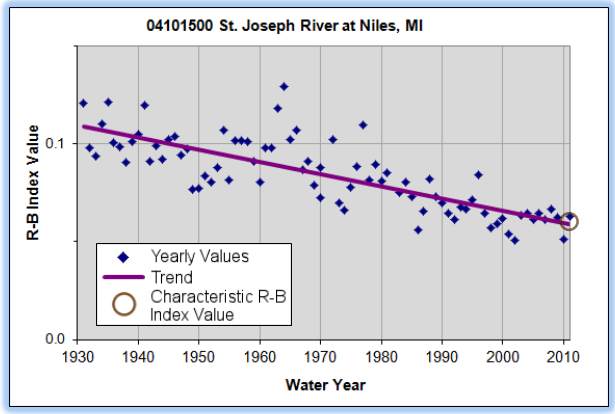
Comments: Gage added for this report update.



USGS Gage 04101370, Juday Creek near South Bend, IN

- Drainage Area (square miles): 38
- Basin Number: 34
- Characteristic R-B Index Value: 0.093
- Rank: Lowest
- First Water Year: 1993
- Last Water Year: 2010
- Number of Water Years Analyzed: 18

Comments: Gage added for this report update.

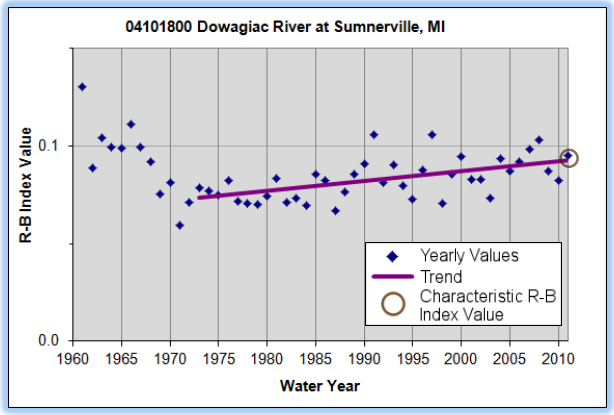


USGS Gage 04101500, St. Joseph River at Niles, MI

- Drainage Area (square miles): 3666
- Basin Number: 34
- Characteristic R-B Index Value: 0.059
- Rank: Lowest
- Trend: decrease, p value: 0.00
- First Water Year: 1931
- Last Water Year: 2011
- Number of Water Years Analyzed: 80

Comments: Flow regulated by power plants upstream from station.

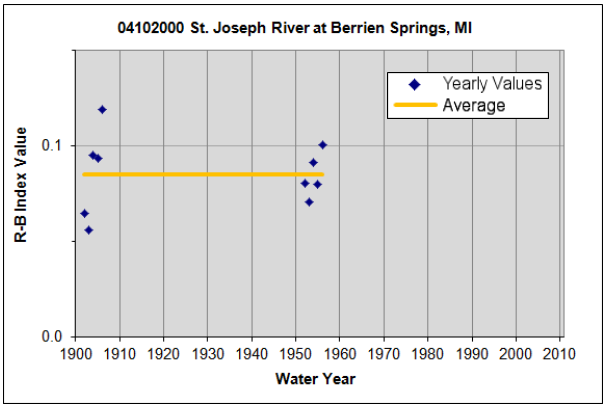
Streams Tributary to Lake Michigan, Southern Lower Peninsula (cont.)



USGS Gage 04101800, Dowagiac River at Sumnerville, MI

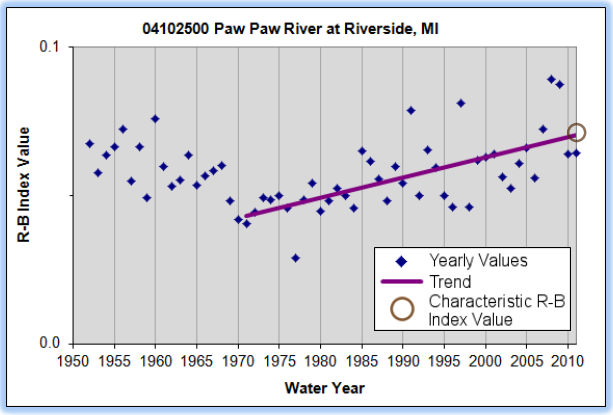
- Drainage Area (square miles): 255
- Basin Number: 34
- Characteristic R-B Index Value: 0.092
- Rank: Lower Middle
- Trend: increase, p value: 0.00
- First Water Year: 1961
- First Water Year Analyzed, if different: 1973
- Last Water Year: 2011
- Number of Water Years Analyzed: 39

Comments: Flow regulated by millpond and lake-level control dam upstream from station.



USGS Gage 04102000, St. Joseph River at Berrien Springs, MI

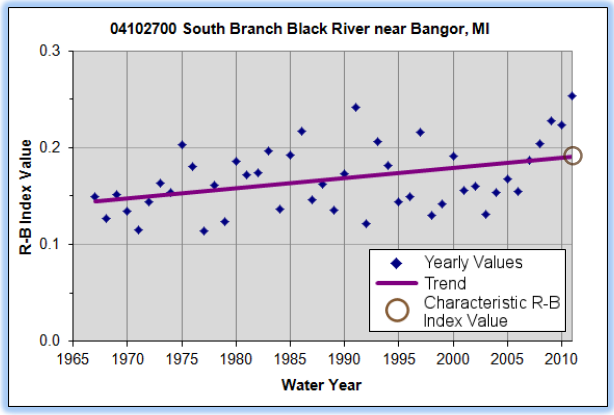
- Drainage Area (square miles): 4081
- Basin Number: 34
- Characteristic R-B Index Value: 0.085
- Rank: Upper Middle
- First Water Year: 1902
- Last Water Year: 1956
- Number of Water Years Analyzed: 10



USGS Gage 04102500, Paw Paw River at Riverside, MI

- Drainage Area (square miles): 390
- Basin Number: 34
- Characteristic R-B Index Value: 0.070
- Rank: Lower Middle
- Trend: increase, p value: 0.00
- First Water Year: 1952
- First Water Year Analyzed, if different: 1971
- Last Water Year: 2011
- Number of Water Years Analyzed: 41

Comments: Diurnal fluctuation, principally during low flow, caused by paper mill upstream from station.

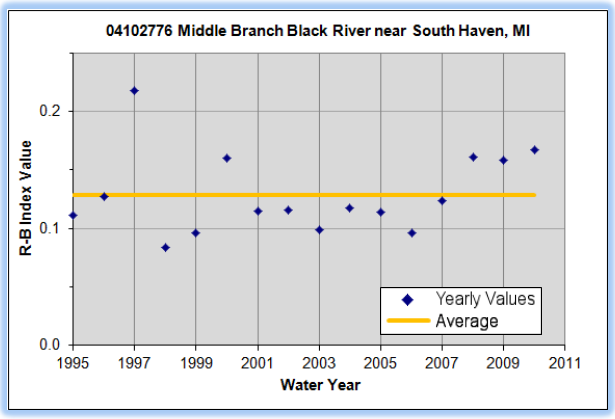


USGS Gage 04102700, South Branch Black River near Bangor, MI

- Drainage Area (square miles): 83.6
- Basin Number: 7
- Characteristic R-B Index Value: 0.191
- Rank: Upper Middle
- Trend: increase, p value: 0.01
- First Water Year: 1967
- Last Water Year: 2011
- Number of Water Years Analyzed: 45

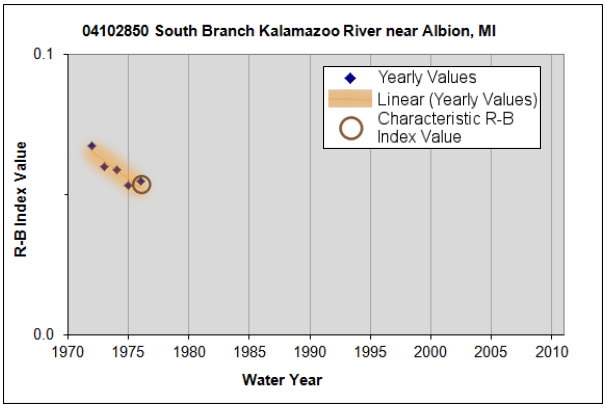
Comments:

- Occasional regulation caused by mills upstream from station.
- Initially published no trend for this gage. Additional data revises the analysis to increasing trend for this report update.



USGS Gage 04102776, Middle Branch Black River near South Haven, MI

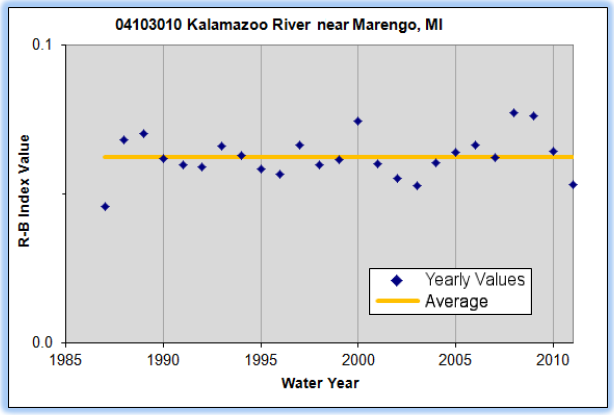
- Drainage Area (square miles): 83
- Basin Number: 7
- Characteristic R-B Index Value: 0.129
- Rank: Lower Middle
- First Water Year: 1995
- Last Water Year: 2010
- Number of Water Years Analyzed: 16



USGS Gage 04102850, South Branch Kalamazoo River near Albion, MI

- Drainage Area (square miles): 146
- Basin Number: 17
- Characteristic R-B Index Value: 0.052
- Rank: Lowest
- p value: 0.03
- First Water Year: 1972
- Last Water Year: 1976
- Number of Water Years Analyzed: 5

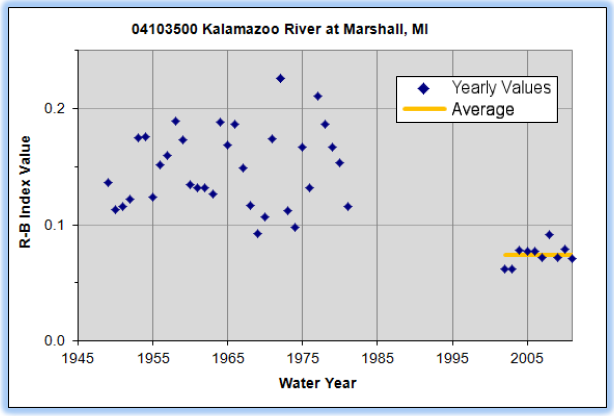
Streams Tributary to Lake Michigan, Southern Lower Peninsula (cont.)



USGS Gage 04103010, Kalamazoo River near Marengo, MI

- Drainage Area (square miles): 267
- Basin Number: 17
- Characteristic R-B Index Value: 0.063
- Rank: Lowest
- First Water Year: 1987
- Last Water Year: 2011
- Number of Water Years Analyzed: 25

Comments: Some diversion by pumping for irrigation.

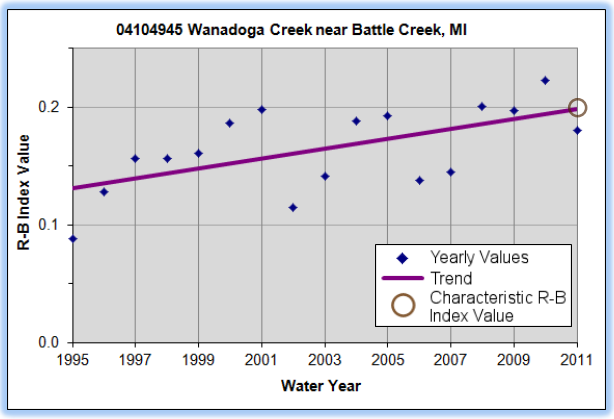


USGS Gage 04103500, Kalamazoo River at Marshall, MI

Drainage Area (square miles): 449

- Basin Number: 17
- Characteristic R-B Index Value: 0.074
- Rank: Lower Middle
- First Water Year: 1949
- First Water Year Analyzed, if different: 2002
- Last Water Year: 2011
- Number of Water Years Analyzed: 10

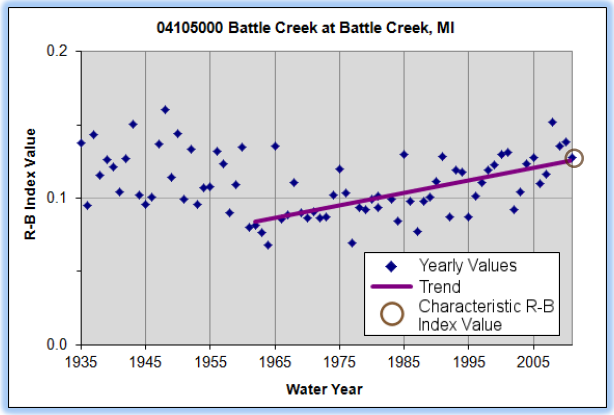
Comments: Flow regulated by power plant upstream from station.



USGS Gage 04104945, Wanadoga Creek near Battle Creek, MI

- Drainage Area (square miles): 48.3
- Basin Number: 17
- Characteristic R-B Index Value: 0.198
- Rank: Upper Middle
- Trend: increase, p value: 0.01
- First Water Year: 1995
- Last Water Year: 2011
- Number of Water Years Analyzed: 17

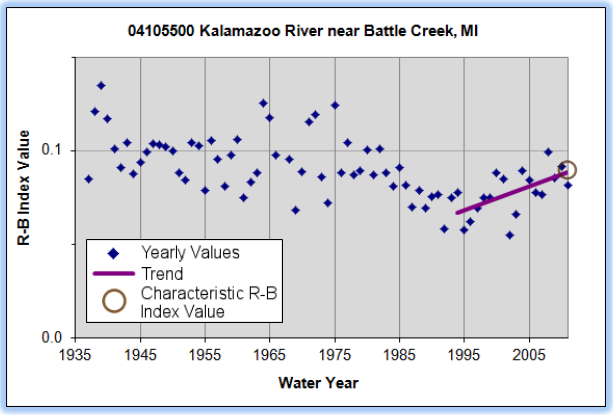
Comments: Initially published no trend for this gage. Additional data revises the analysis to increasing trend for this report update.



USGS Gage 04105000, Battle Creek at Battle Creek, MI

- Drainage Area (square miles): 241
- Basin Number: 17
- Characteristic R-B Index Value: 0.126
- Rank: Upper Middle
- Trend: increase, p value: 0.00
- First Water Year: 1935
- First Water Year Analyzed, if different: 1962
- Last Water Year: 2011
- Number of Water Years Analyzed: 50

Comments: Occasional slight regulation prior November 1943.

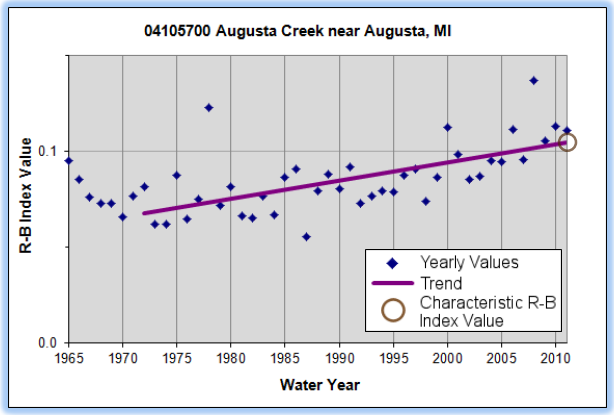


USGS Gage 04105500, Kalamazoo River near Battle Creek, MI

- Drainage Area (square miles): 824
- Basin Number: 17
- Characteristic R-B Index Value: 0.089
- Rank: Lower Middle
- Trend: increase, p value: 0.01
- First Water Year: 1937
- First Water Year Analyzed, if different: 1994
- Last Water Year: 2011
- Number of Water Years Analyzed: 18

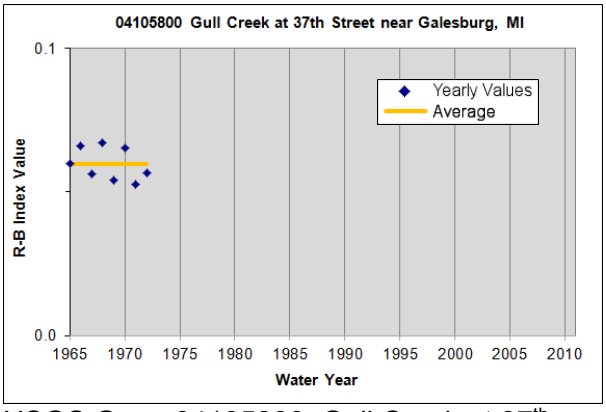
Comments:

- Diurnal fluctuation below 1500 feet per second caused by power plants upstream from station.
- Initially published decreasing trend for this gage. Additional data revises the analysis to increasing trend for this report update.



USGS Gage 04105700, Augusta Creek near Augusta, MI

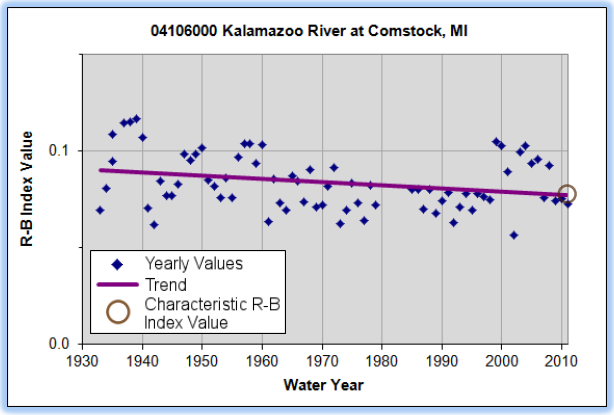
- Drainage Area (square miles): 38.9
- Basin Number: 17
- Characteristic R-B Index Value: 0.105
- Rank: Lower Middle
- Trend: increase, p value: 0.00
- First Water Year: 1965
- First Water Year Analyzed, if different: 1972
- Last Water Year: 2011
- Number of Water Years Analyzed: 40



USGS Gage 04105800, Gull Creek at 37th Street near Galesburg, MI

- Drainage Area (square miles): 38.1
- Basin Number: 17
- Characteristic R-B Index Value: 0.060
- Rank: Lowest
- First Water Year: 1965
- Last Water Year: 1972
- Number of Water Years Analyzed: 8

Comments: Occasional regulation by many dams upstream.

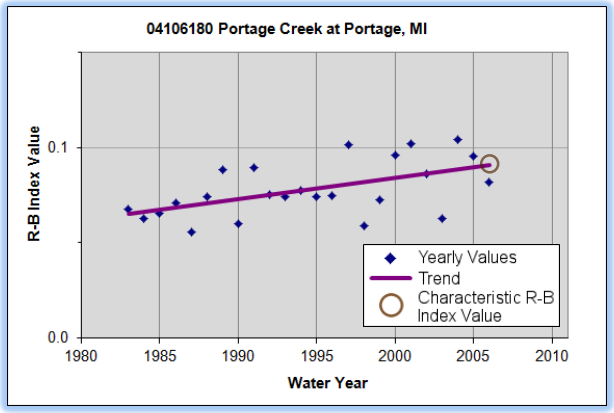


USGS Gage 04106000, Kalamazoo River at Comstock, MI

- Drainage Area (square miles): 1010
- Basin Number: 17
- Characteristic R-B Index Value: 0.077
- Rank: Lower Middle
- Trend: decrease, p value: 0.02
- First Water Year: 1933
- Last Water Year: 2011
- Number of Water Years Analyzed: 74

Comments:

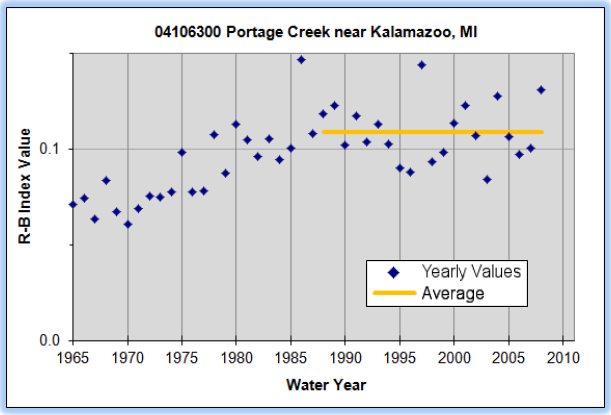
- Flow regulation by power plant 1.2 miles upstream from station.
- Initially published no trend for this gage. Additional data revises the analysis to decreasing trend for this report update.



USGS Gage 04106180, Portage Creek at Portage, MI

- Drainage Area (square miles): 16.5
- Basin Number: 17
- Characteristic R-B Index Value: 0.091
- Rank: Lowest
- Trend: increase, p value: 0.01
- First Water Year: 1983
- Last Water Year: 2006
- Number of Water Years Analyzed: 24

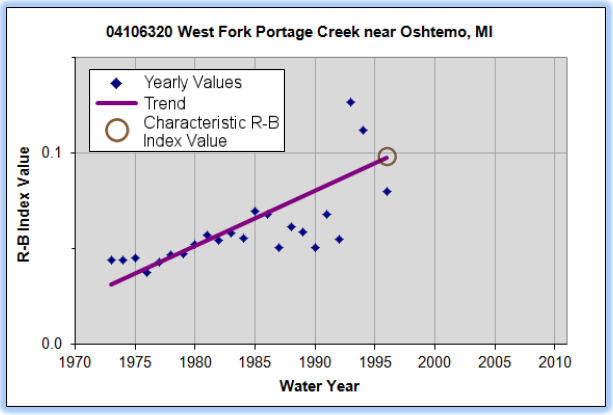
Streams Tributary to Lake Michigan, Southern Lower Peninsula (cont.)



USGS Gage 04106300, Portage Creek near Kalamazoo, MI

- Drainage Area (square miles): 22.4
- Basin Number: 17
- Characteristic R-B Index Value: 0.109
- Rank: Lowest
- First Water Year: 1965
- First Water Year Analyzed, if different: 1988
- Last Water Year: 2008
- Number of Water Years Analyzed: 21

Comments: Flow includes water which is pumped from ground water sources by industry and discharge into stream two miles upstream from station.

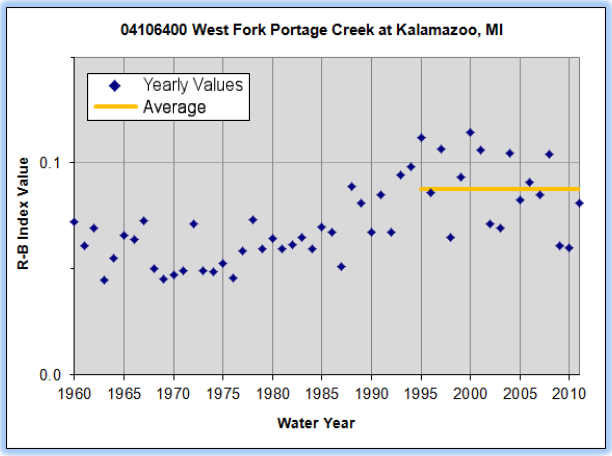


USGS Gage 04106320, West Fork Portage Creek near Oshtemo, MI

- Drainage Area (square miles): 13
- Basin Number: 17
- Characteristic R-B Index Value: 0.098
- Rank: Lowest
- Trend: increase, p value: 0.00
- First Water Year: 1973
- Last Water Year: 1996
- Number of Water Years Analyzed: 24

Comments: At times flow is affected by ground water withdrawals.

Streams Tributary to Lake Michigan, Southern Lower Peninsula (cont.)

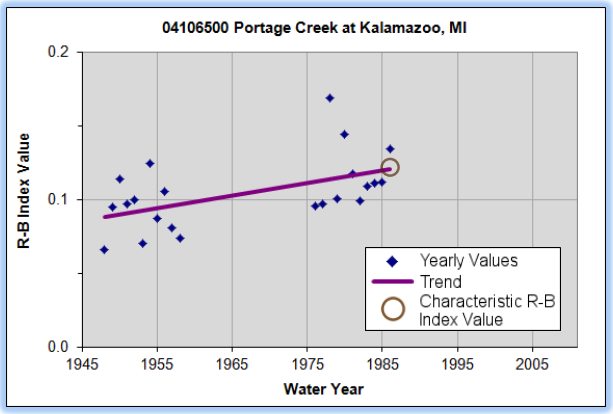


USGS Gage 04106400, West Fork Portage Creek at Kalamazoo, MI

- Drainage Area (square miles): 18.7
- Basin Number: 17
- Characteristic R-B Index Value: 0.088
- Rank: Lowest
- First Water Year: 1960
- First Water Year Analyzed, if different: 1995
- Last Water Year: 2011
- Number of Water Years Analyzed: 17

Comments:

- At times water is affected by water withdrawals.
- Initially published increasing trend for this gage. Additional data revises the analysis to no trend for this report update.

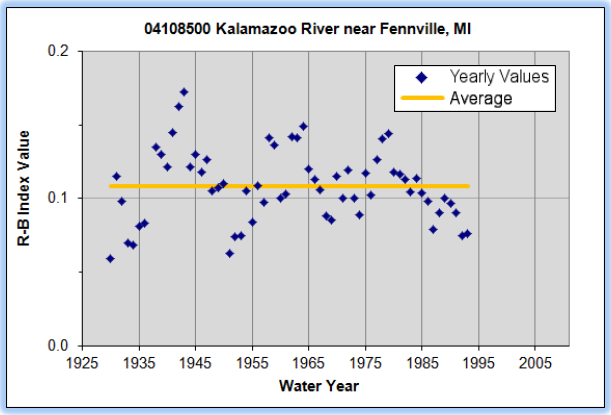


USGS Gage 04106500, Portage Creek at Kalamazoo, MI

- Drainage Area (square miles): 46.8
- Basin Number: 17
- Characteristic R-B Index Value: 0.121
- Rank: Lower Middle
- Trend: increase, p value: 0.01
- First Water Year: 1948
- Last Water Year: 1986
- Number of Water Years Analyzed: 22

Comments: Some regulation by mill ponds upstream from station. Flow includes water which is pumped from groundwater sources by industry and discharged into stream five miles upstream from station.

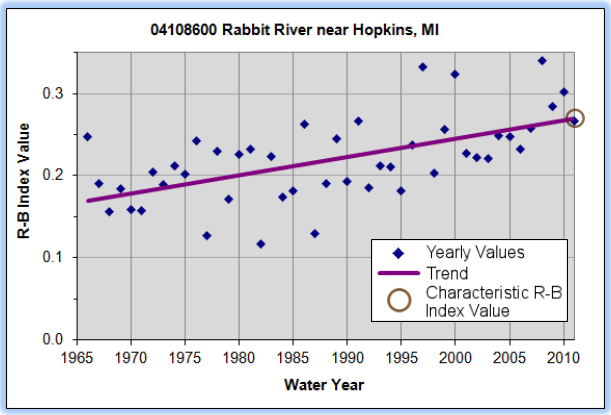
Streams Tributary to Lake Michigan, Southern Lower Peninsula (cont.)



USGS Gage 04108500, Kalamazoo River near Fennville, MI

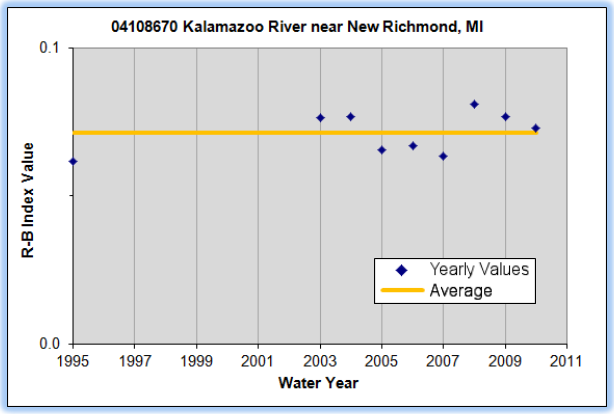
- Drainage Area (square miles): 1600
- Basin Number: 17
- Characteristic R-B Index Value: 0.108
- Rank: Highest
- First Water Year: 1930
- Last Water Year: 1993
- Number of Water Years Analyzed: 63

Comments: Flow regulated at low and medium flow stages by power plant upstream from station and since June 1936 by Calkins Dam and power plant four miles upstream.



USGS Gage 04108600, Rabbit River near Hopkins, MI

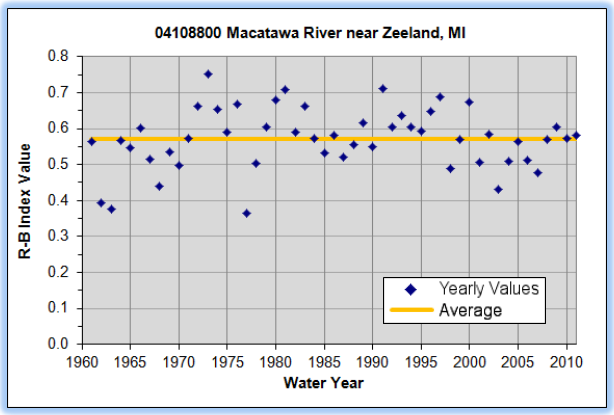
- Drainage Area (square miles): 71.4
- Basin Number: 17
- Characteristic R-B Index Value: 0.269
- Rank: Upper Middle
- Trend: increase, p value: 0.00
- First Water Year: 1966
- Last Water Year: 2011
- Number of Water Years Analyzed: 46



USGS Gage 04108670, Kalamazoo River near New Richmond, MI

- Drainage Area (square miles): 1994
- Basin Number: 17
- Characteristic R-B Index Value: 0.071
- Rank: Lower Middle
- First Water Year: 1995
- Last Water Year: 2010
- Number of Water Years Analyzed: 9

Comments: Gage added for this report update.

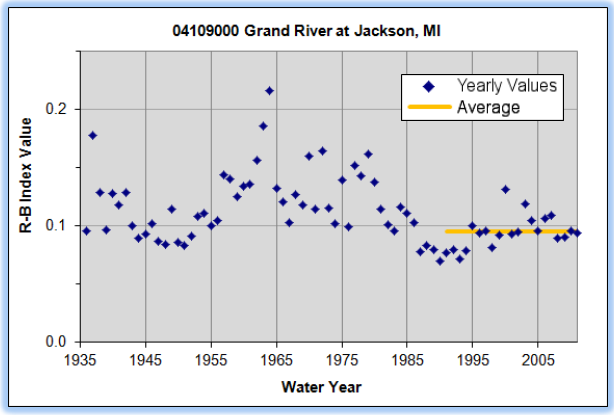


USGS Gage 04108800, Macatawa River near Zeeland, MI

- Drainage Area (square miles): 65.8
- Basin Number: 8
- Characteristic R-B Index Value: 0.571
- Rank: Highest
- First Water Year: 1961
- Last Water Year: 2011
- Number of Water Years Analyzed: 51

Comments: Prior to October 1978 published as Black River near Zeeland. Discontinued gage 04108801 considered equivalent.

Streams Tributary to Lake Michigan, Southern Lower Peninsula (cont.)

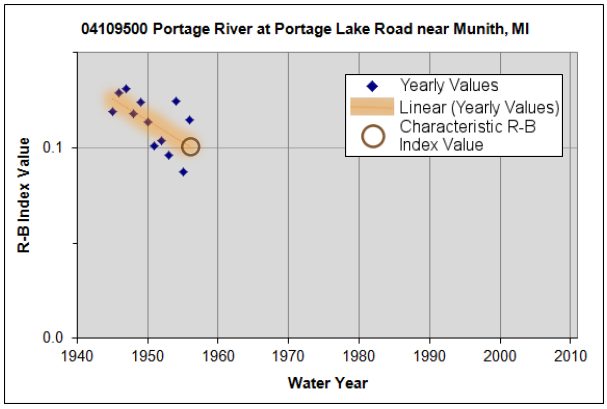


USGS Gage 04109000, Grand River at Jackson, MI

- Drainage Area (square miles): 174
- Basin Number: 14
- Characteristic R-B Index Value: 0.095
- Rank: Lower Middle
- First Water Year: 1936
- Last Water Year: 2011
- Number of Water Years Analyzed: 21

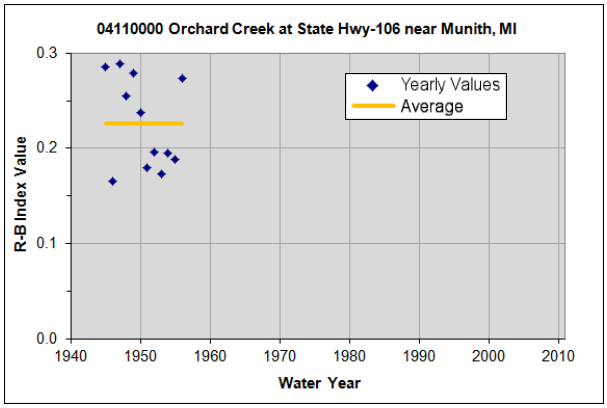
Comments:

- Slight regulation by mill upstream, flow includes 20 cubic feet per second as sewage effluent which originates from ground water sources from the City of Jackson.
- Initially published decreasing trend for this gage. Additional data revises the analysis to no trend for this report update.



USGS Gage 04109500, Portage River at Portage Lake Road near Munith, MI

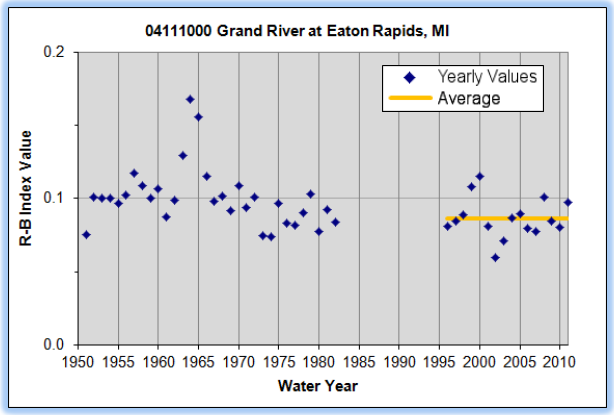
- Drainage Area (square miles): 55
- Basin Number: 14
- Characteristic R-B Index Value: 0.101
- Rank: Lowest
- p value: 0.04
- First Water Year: 1945
- Last Water Year: 1956
- Number of Water Years Analyzed: 12



USGS Gage 04110000, Orchard Creek at State Highway 106 at Munith, MI

- Drainage Area (square miles): 49
- Basin Number: 14
- Characteristic R-B Index Value: 0.226
- Rank: Upper Middle
- First Water Year: 1945
- Last Water Year: 1956
- Number of Water Years Analyzed: 12

Streams Tributary to Lake Michigan, Southern Lower Peninsula (cont.)

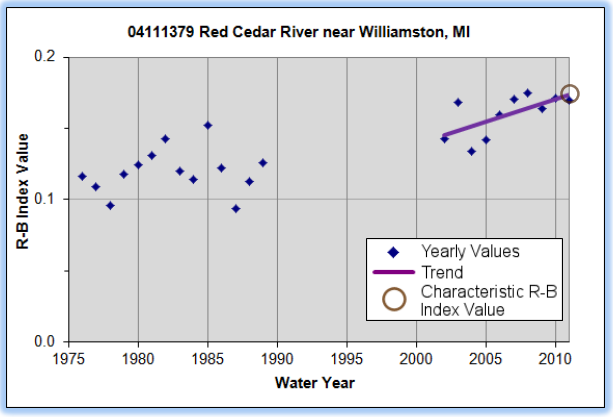


USGS Gage 04111000, Grand River at Eaton Rapids, MI

- Drainage Area (square miles): 661
- Basin Number: 14
- Characteristic R-B Index Value: 0.087
- Rank: Lower Middle
- First Water Year: 1951
- First Water Year Analyzed, if different: 1996
- Last Water Year: 2011
- Number of Water Years Analyzed: 16

Comments:

- Flow regulated by Smithville Dam and mills at Eaton Rapids.
- Initially published decreasing trend for this gage. Additional data revises the analysis to no trend for this report update.

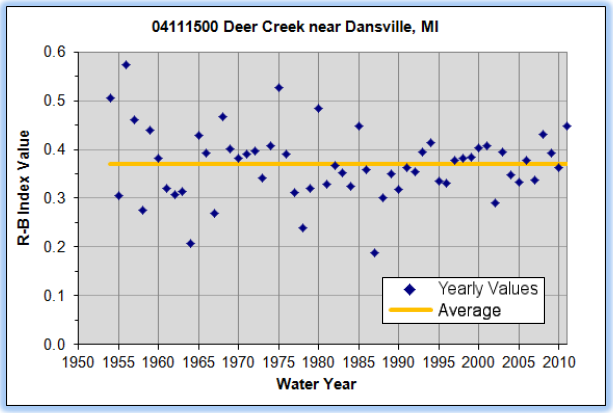


USGS Gage 04111379, Red Cedar River near Williamston, MI

- Drainage Area (square miles): 163
- Basin Number: 14
- Characteristic R-B Index Value: 0.174
- Rank: Highest
- Trend: increase, p value: 0.04
- First Water Year: 1976
- Last Water Year: 2011
- Number of Water Years Analyzed: 9

Comments:

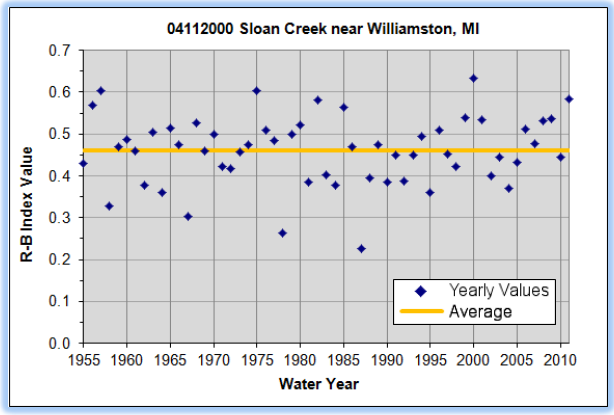
- Flow is regulated at times by pumpage for irrigation.
- Initially published no trend for this gage. Additional data revises the analysis to increasing trend for this report update.



USGS Gage 04111500, Deer Creek near Dansville, MI

- Drainage Area (square miles): 16.3
- Basin Number: 14
- Characteristic R-B Index Value: 0.370
- Rank: Upper Middle
- First Water Year: 1954
- Last Water Year: 2011
- Number of Water Years Analyzed: 58

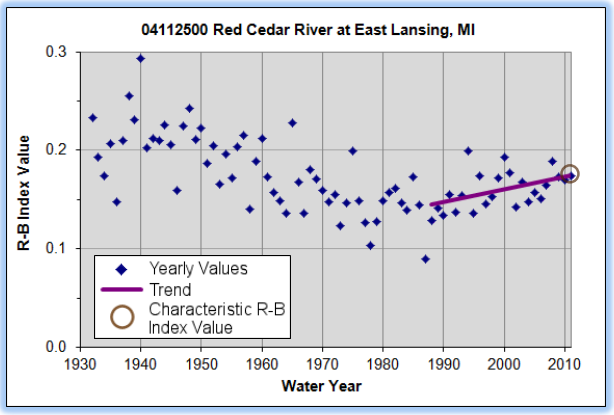
Streams Tributary to Lake Michigan, Southern Lower Peninsula (cont.)



USGS Gage 04112000, Sloan Creek near Williamston, MI

- Drainage Area (square miles): 9.34
- Basin Number: 14
- Characteristic R-B Index Value: 0.460
- Rank: Upper Middle
- First Water Year: 1955
- Last Water Year: 2011
- Number of Water Years Analyzed: 56

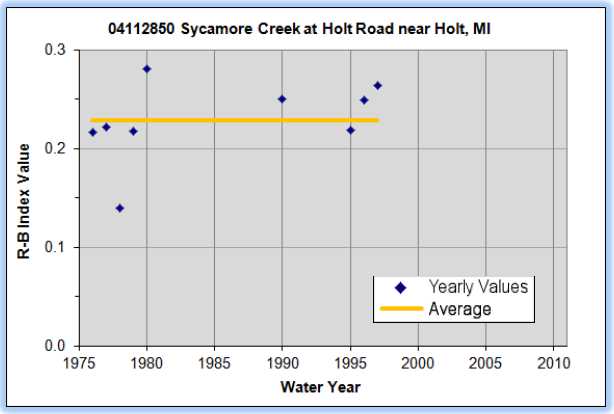
Comments: At times flow is regulated by pumpage from irrigation.



USGS Gage 04112500, Red Cedar River at East Lansing, MI

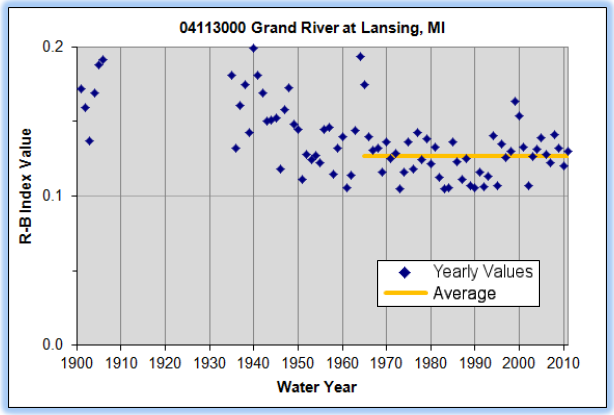
- Drainage Area (square miles): 355
- Basin Number: 14
- Characteristic R-B Index Value: 0.175
- Rank: Highest
- Trend: increase, p value: 0.02
- First Water Year: 1932
- First Water Year Analyzed, if different: 1988
- Last Water Year: 2011
- Number of Water Years Analyzed: 24

Comments: Prior to 1975 occasional regulation at low flow by mill at Williamston, 16 miles upstream.



USGS Gage 04112850, Sycamore Creek at Holt Road near Holt, MI

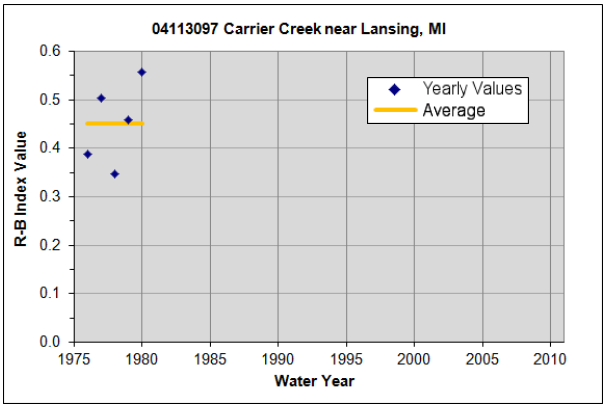
- Drainage Area (square miles): 80.6
- Basin Number: 14
- Characteristic R-B Index Value: 0.229
- Rank: Upper Middle
- First Water Year: 1976
- Last Water Year: 1997
- Number of Water Years Analyzed: 9



USGS Gage 04113000, Grand River at Lansing, MI

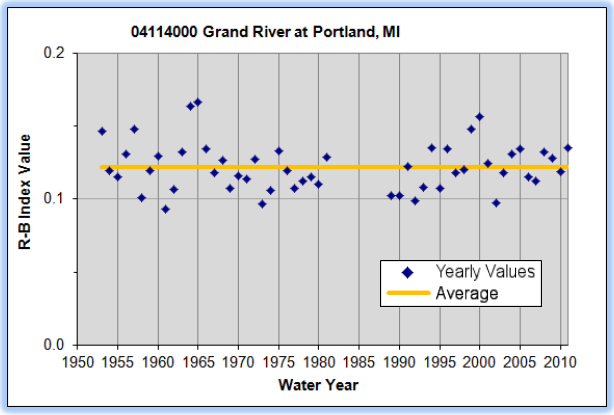
- Drainage Area (square miles): 1230
- Basin Number: 14
- Characteristic R-B Index Value: 0.127
- Rank: Highest
- First Water Year: 1901
- First Water Year Analyzed, if different: 1965
- Last Water Year: 2011
- Number of Water Years Analyzed: 47

Comments: Large diurnal fluctuation at low flow and medium flow caused by power plants upstream from station.



USGS Gage 04113097, Carrier Creek near Lansing, MI

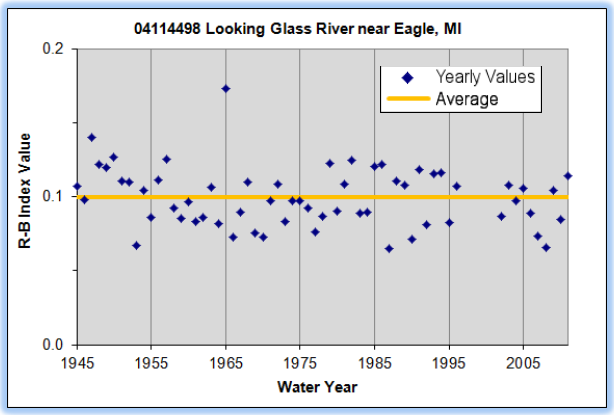
- Drainage Area (square miles): 12.1
- Basin Number: 14
- Characteristic R-B Index Value: 0.451
- Rank: Upper Middle
- First Water Year: 1976
- Last Water Year: 1980
- Number of Water Years Analyzed: 5



USGS Gage 04114000, Grand River at Portland, MI

- Drainage Area (square miles): 1385
- Basin Number: 14
- Characteristic R-B Index Value: 0.122
- Rank: Highest
- First Water Year: 1953
- Last Water Year: 2011
- Number of Water Years Analyzed: 52

Comments: Slight diurnal fluctuation caused by power plants upstream from station.

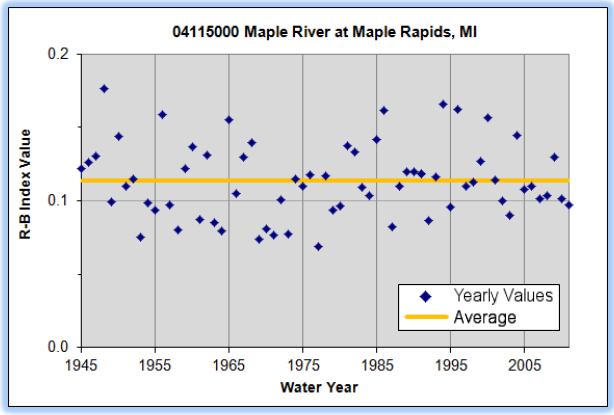


USGS Gage 04114498, Looking Glass River near Eagle, MI

- Drainage Area (square miles): 280
- Basin Number: 14
- Characteristic R-B Index Value: 0.100
- Rank: Lower Middle
- First Water Year: 1945
- Last Water Year: 2011
- Number of Water Years Analyzed: 62

Comments: Small intermittent diversions at times into Lake Geneva when discharge is above fifty cubic feet per second.

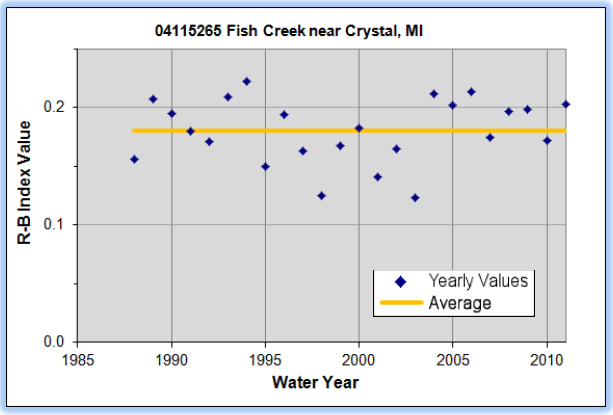
Streams Tributary to Lake Michigan, Southern Lower Peninsula (cont.)



USGS Gage 04115000, Maple River at Maple Rapids, MI

- Drainage Area (square miles): 434
- Basin Number: 14
- Characteristic R-B Index Value: 0.114
- Rank: Upper Middle
- First Water Year: 1945
- Last Water Year: 2011
- Number of Water Years Analyzed: 68

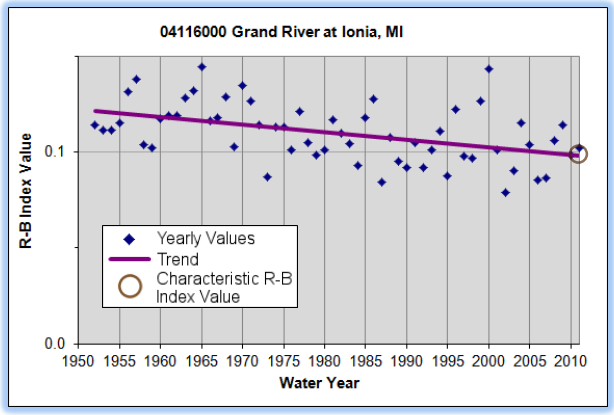
Comments: At times water is pumped from the river about eight miles upstream to fill the wetlands in the Maple River State Game Area. Some of the water is returned to the river at a later date, when the water levels are lowered.



USGS Gage 04115265, Fish Creek near Crystal, MI

- Drainage Area (square miles): 39.7
- Basin Number: 14
- Characteristic R-B Index Value: 0.180
- Rank: Upper Middle
- First Water Year: 1988
- Last Water Year: 2011
- Number of Water Years Analyzed: 24

Comments: At times low flow is affected by pumpage for irrigation.

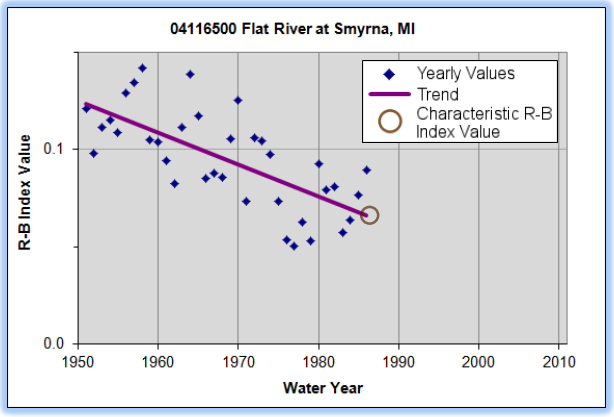


USGS Gage 04116000, Grand River at Ionia, MI

- Drainage Area (square miles): 2840
- Basin Number: 14
- Characteristic R-B Index Value: 0.098
- Rank: Upper Middle
- Trend: decrease, p value: 0.00
- First Water Year: 1952
- Last Water Year: 2011
- Number of Water Years Analyzed: 60

Comments:

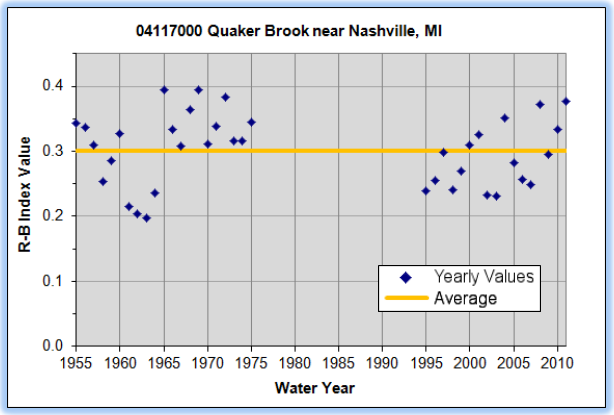
- Diurnal fluctuation below approximately 5,000 cubic feet per second caused by power plants upstream from station.
- Initially published no trend for this gage. Additional data revises the analysis to decreasing trend for this report update.



USGS Gage 04116500, Flat River at Smyrna, MI

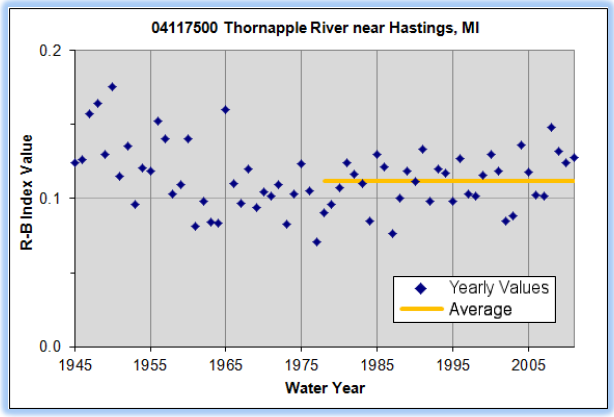
- Drainage Area (square miles): 528
- Basin Number: 14
- Characteristic R-B Index Value: 0.066
- Rank: Lowest
- Trend: decrease, p value: 0.00
- First Water Year: 1951
- Last Water Year: 1986
- Number of Water Years Analyzed: 36

Comments: Diurnal fluctuation caused by power plants above station prior to September 1956; occasional diurnal fluctuation since.



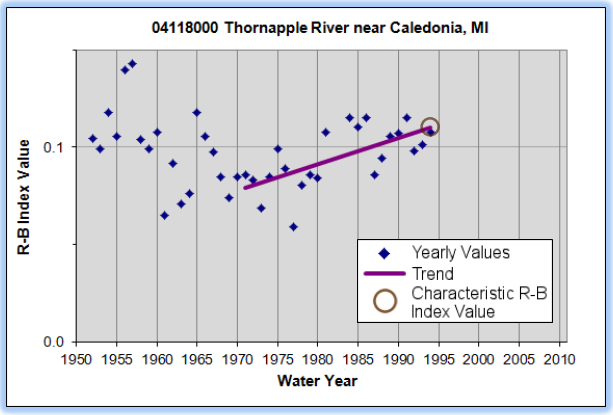
USGS Gage 04117000, Quaker Brook near Nashville, MI

- Drainage Area (square miles): 7.6
- Basin Number: 14
- Characteristic R-B Index Value: 0.301
- Rank: Upper Middle
- First Water Year: 1955
- Last Water Year: 2011
- Number of Water Years Analyzed: 38



USGS Gage 04117500, Thornapple River near Hastings, MI

- Drainage Area (square miles): 385
- Basin Number: 14
- Characteristic R-B Index Value: 0.112
- Rank: Upper Middle
- First Water Year: 1945
- First Water Year Analyzed, if different: 1978
- Last Water Year: 2011
- Number of Water Years Analyzed: 34

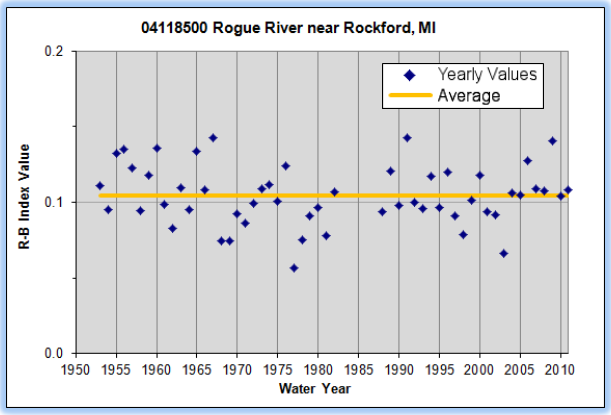


USGS Gage 04118000, Thornapple River near Caledonia, MI

- Drainage Area (square miles): 773
- Basin Number: 14
- Characteristic R-B Index Value: 0.110
- Rank: Upper Middle
- Trend: increase, p value: 0.00
- First Water Year: 1952
- First Water Year Analyzed, if different: 1971
- Last Water Year: 1994
- Number of Water Years Analyzed: 22

Comments: Prior to December 1958 and since October 1983 large diurnal fluctuation at low and medium flow and occasional regulation during high flow, caused by power plant upstream from station; occasional fluctuation during the interim period.

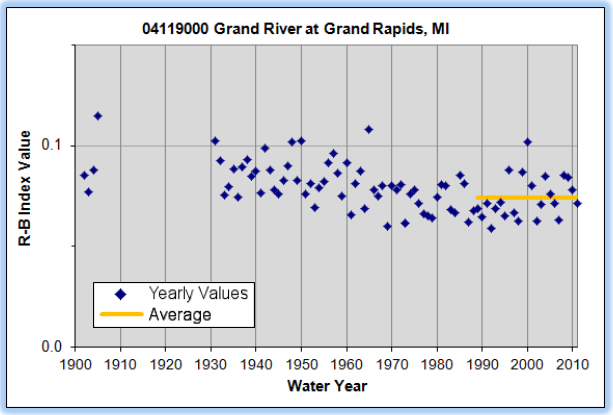
Streams Tributary to Lake Michigan, Southern Lower Peninsula (cont.)



USGS Gage 04118500, Rogue River near Rockford, MI

- Drainage Area (square miles): 234
- Basin Number: 14
- Characteristic R-B Index Value: 0.104
- Rank: Lower Middle
- First Water Year: 1953
- Last Water Year: 2011
- Number of Water Years Analyzed: 54

Comments: Some regulation caused by dam two miles upstream from station.

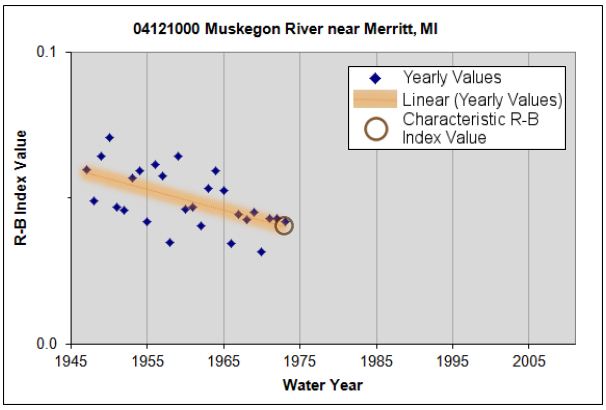


USGS Gage 04119000, Grand River at Grand Rapids, MI

- Drainage Area (square miles): 4900
- Basin Number: 14
- Characteristic R-B Index Value: 0.074
- Rank: Lower Middle
- First Water Year: 1902
- First Water Year Analyzed, if different: 1989
- Last Water Year: 2011
- Number of Water Years Analyzed: 23

Comments: Moderate diurnal fluctuation at low and medium flow caused by power plants upstream from station.

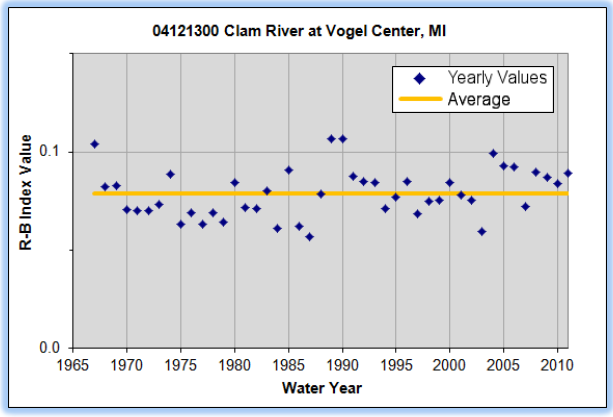
Streams Tributary to Lake Michigan, Northern Lower Peninsula



USGS Gage 04121000, Muskegon River near Merritt, MI

- Drainage Area (square miles): 355
- Basin Number: 22
- Characteristic R-B Index Value: 0.040
- Rank: Lowest
- p value: 0.00
- First Water Year: 1947
- Last Water Year: 1973
- Number of Water Years Analyzed: 27

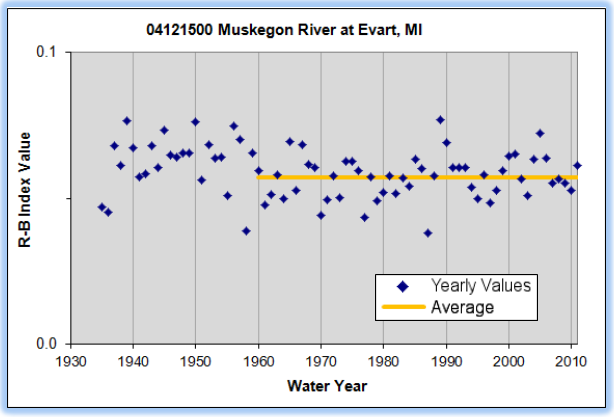
Comments: Occasional regulation by manipulation of stop logs at Reedsburg Dam.



USGS Gage 04121300, Clam River at Vogel Center, MI

- Drainage Area (square miles): 243
- Basin Number: 22
- Characteristic R-B Index Value: 0.079
- Rank: Lower Middle
- First Water Year: 1967
- Last Water Year: 2011
- Number of Water Years Analyzed: 45

Comments: Some regulation at low flow by dams upstream from station.

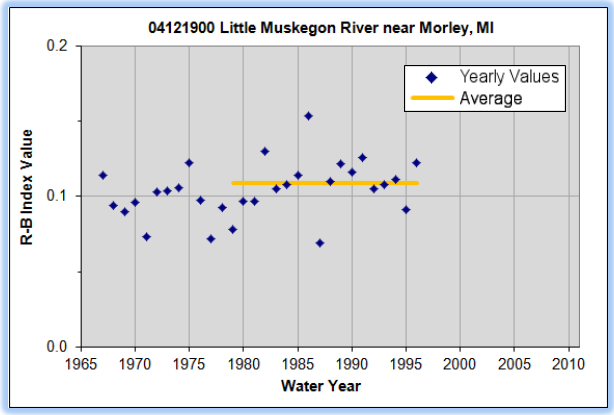


USGS Gage 04121500, Muskegon River at Evart, MI

- Drainage Area (square miles): 1433
- Basin Number: 22
- Characteristic R-B Index Value: 0.057
- Rank: Lowest
- First Water Year: 1935
- First Water Year Analyzed, if different: 1960
- Last Water Year: 2011
- Number of Water Years Analyzed: 52

Comments: Some regulation at low flow by dams upstream from station.

Streams Tributary to Lake Michigan, Northern Lower Peninsula (cont.)

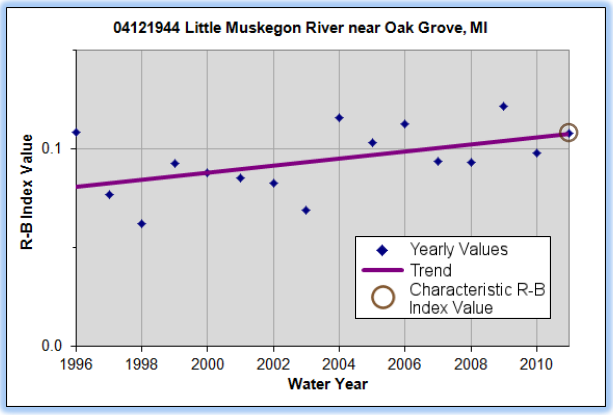


USGS Gage 04121900, Little Muskegon River near Morley, MI

- Drainage Area (square miles): 121
- Basin Number: 22
- Characteristic R-B Index Value: 0.109
- Rank: Upper Middle
- First Water Year: 1967
- First Water Year Analyzed, if different: 1979
- Last Water Year: 1996
- Number of Water Years Analyzed: 18

Comments:

- Some regulation by dam above station.
- Initially published increasing trend for this gage. Tighter p value standard changes this to no trend for this report update.

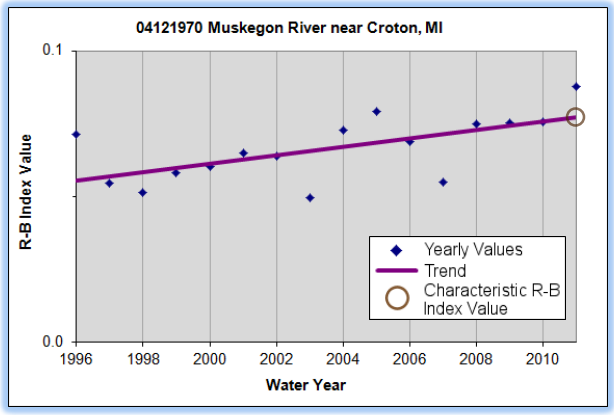


USGS Gage 04121944, Little Muskegon River near Oak Grove, MI

- Drainage Area (square miles): 345
- Basin Number: 22
- Characteristic R-B Index Value: 0.108
- Rank: Upper Middle
- Trend: increase, p value: 0.05
- First Water Year: 1996
- Last Water Year: 2011
- Number of Water Years Analyzed: 16

Comments: Initially published no trend for this gage. Additional data revises the analysis to an increasing trend for this report update.

Streams Tributary to Lake Michigan, Northern Lower Peninsula (cont.)

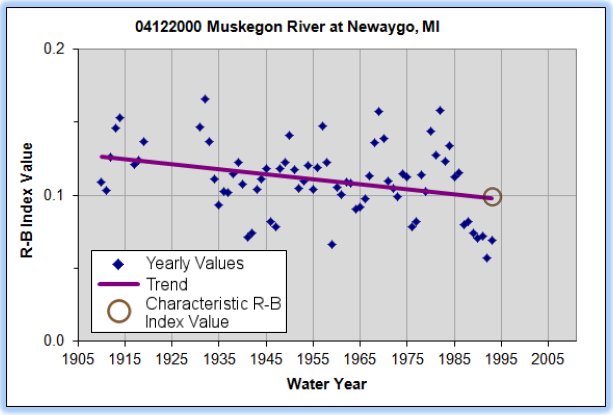


USGS Gage 04121970, Muskegon River near Croton, MI

- Drainage Area (square miles): 2313
- Basin Number: 22
- Characteristic R-B Index Value: 0.077
- Rank: Lower Middle
- Trend: increase, p value: 0.01
- First Water Year: 1996
- Last Water Year: 2011
- Number of Water Years Analyzed: 16

Comments:

- Flow completely regulated by Croton Dam 1,000 feet upstream.
- Initially published no trend for this gage. Additional data revises the analysis to an increasing trend for this report update.

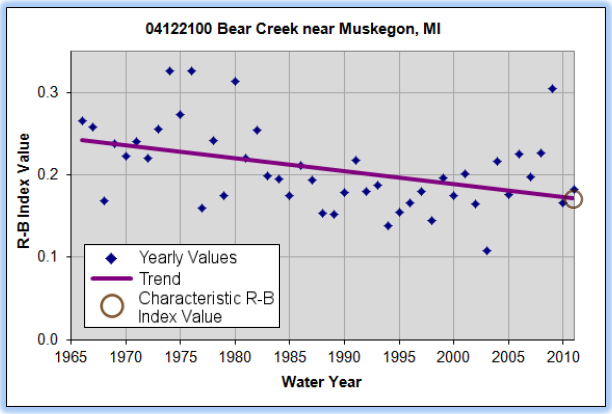


USGS Gage 04122000, Muskegon River at Newaygo, MI

- Drainage Area (square miles): 2350
- Basin Number: 22
- Characteristic R-B Index Value: 0.098
- Rank: Upper Middle
- Trend: decrease, p value: 0.01
- First Water Year: 1910
- Last Water Year: 1993
- Number of Water Years Analyzed: 71

Comments: Flow regulated by power plants upstream from station, the largest of which are Croton Dam, Hardy Dam, and Rogers Dam. Since December 27, 1965 power plant at Newaygo is non-operative. In January 1969, dam at Newaygo was removed.

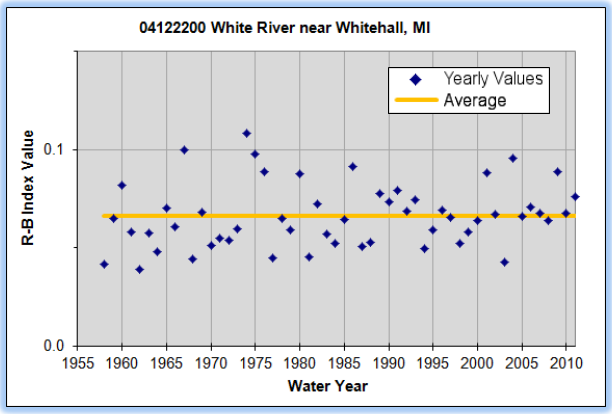
Streams Tributary to Lake Michigan, Northern Lower Peninsula (cont.)



USGS Gage 04122100, Bear Creek near Muskegon, MI

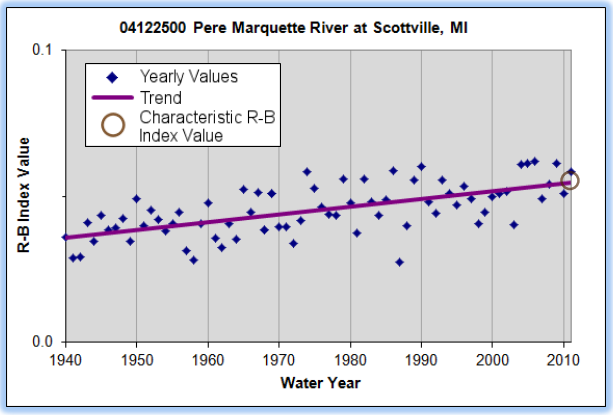
- Drainage Area (square miles): 16.7
- Basin Number: 22
- Characteristic R-B Index Value: 0.172
- Rank: Lower Middle
- Trend: decrease, p value: 0.00
- First Water Year: 1966
- Last Water Year: 2011
- Number of Water Years Analyzed: 46

Comments: Some regulation during low flow by dams and irrigation upstream from station.



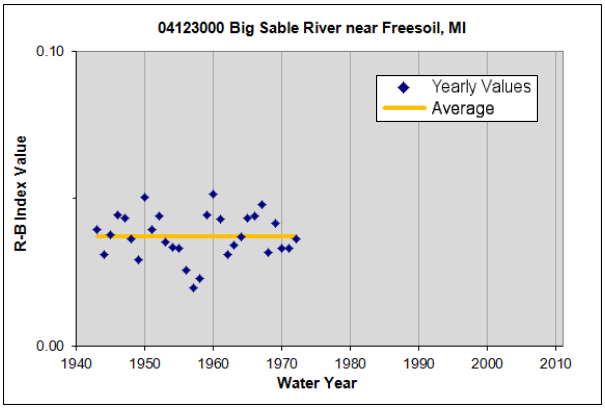
USGS Gage 04122200, White River near Whitehall, MI

- Drainage Area (square miles): 406
- Basin Number: 37
- Characteristic R-B Index Value: 0.066
- Rank: Lowest
- First Water Year: 1958
- Last Water Year: 2011
- Number of Water Years Analyzed: 54



USGS Gage 04122500, Pere Marquette River at Scottville, MI

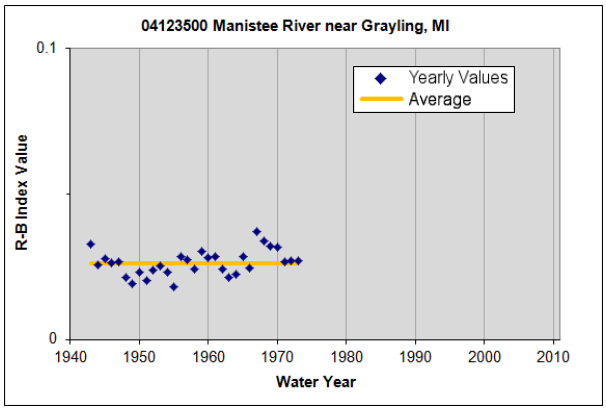
- Drainage Area (square miles): 681
- Basin Number: 25
- Characteristic R-B Index Value: 0.055
- Rank: Lowest
- Trend: increase, p value: 0.00
- First Water Year: 1940
- Last Water Year: 2011
- Number of Water Years Analyzed: 74



USGS Gage 04123000, Big Sable River near Freesoil, MI

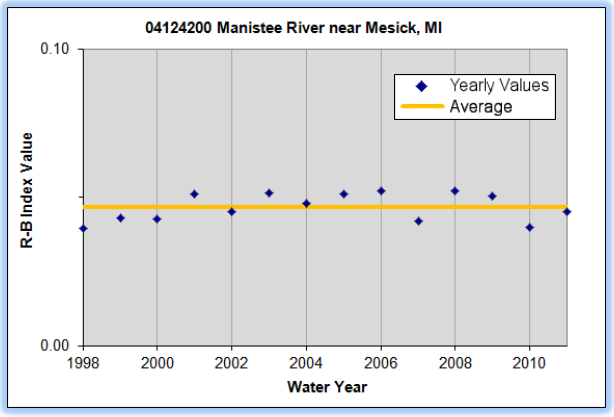
- Drainage Area (square miles): 127
- Basin Number: 5
- Characteristic R-B Index Value: 0.037
- Rank: Lowest
- First Water Year: 1943
- Last Water Year: 1972
- Number of Water Years Analyzed: 30

Streams Tributary to Lake Michigan, Northern Lower Peninsula (cont.)



USGS Gage 04123500, Manistee River near Grayling, MI

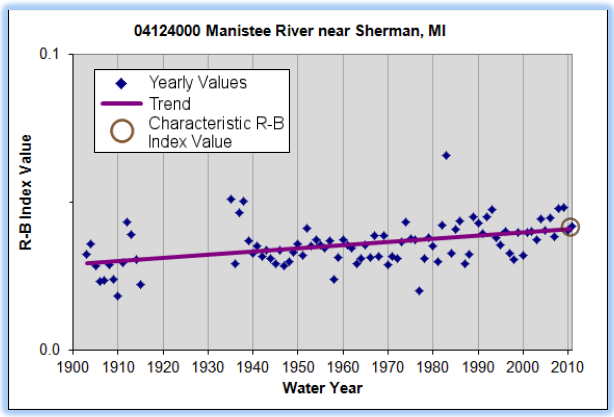
- Drainage Area (square miles): 123
- Basin Number: 20
- Characteristic R-B Index Value: 0.026
- Rank: Lowest
- First Water Year: 1943
- Last Water Year: 1973
- Number of Water Years Analyzed: 31



USGS Gage 04124200, Manistee River near Mesick, MI

- Drainage Area (square miles): 1018
- Basin Number: 20
- Characteristic R-B Index Value: 0.047
- Rank: Lowest
- First Water Year: 1998
- Last Water Year: 2011
- Number of Water Years Analyzed: 14

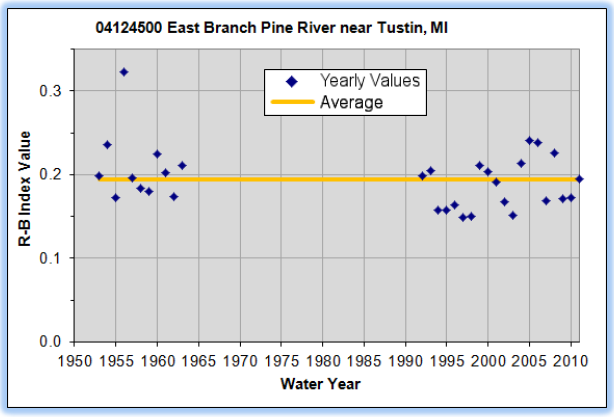
Comments: Flow completely regulated by Hodenpyl Dam 200 feet upstream.



USGS Gage 04124000, Manistee River near Sherman, MI

- Drainage Area (square miles): 857
- Basin Number: 20
- Characteristic R-B Index Value: 0.041
- Rank: Lowest
- Trend: increase, p value: 0.00
- First Water Year: 1903
- Last Water Year: 2011
- Number of Water Years Analyzed: 90

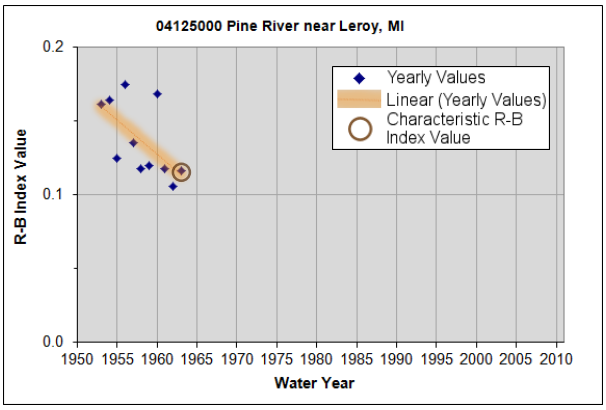
Comments: Initially published no trend for this gage. Additional data revises the analysis to an increasing trend for this report update.



USGS Gage 04124500, East Branch Pine River near Tustin, MI

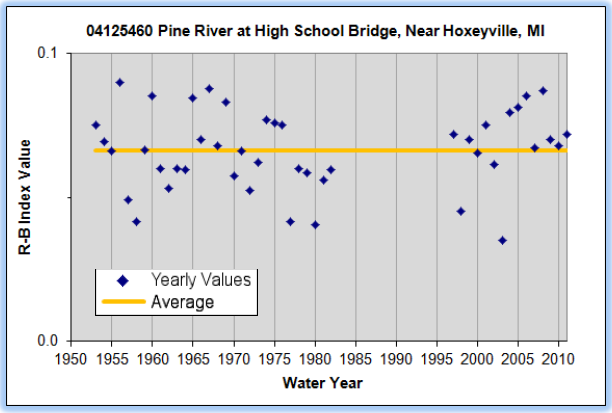
- Drainage Area (square miles): 60
- Basin Number: 20
- Characteristic R-B Index Value: 0.195
- Rank: Upper Middle
- First Water Year: 1953
- Last Water Year: 2011
- Number of Water Years Analyzed: 31

Streams Tributary to Lake Michigan, Northern Lower Peninsula (cont.)



USGS Gage 04125000, Pine River near Leroy, MI

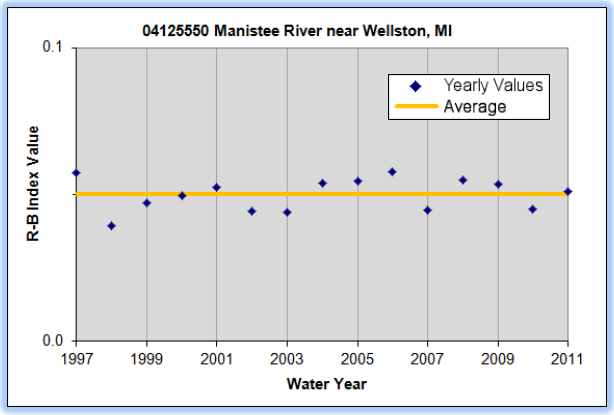
- Drainage Area (square miles): 128
- Basin Number: 20
- Characteristic R-B Index Value: 0.114
- Rank: Upper Middle
- p value: 0.05
- First Water Year: 1953
- Last Water Year: 1963
- Number of Water Years Analyzed: 11



USGS Gage 04125460, Pine River at High School Bridge, near Hoxeyville, MI

- Drainage Area (square miles): 245
- Basin Number: 20
- Characteristic R-B Index Value: 0.066
- Rank: Lowest
- First Water Year: 1953
- Last Water Year: 2011
- Number of Water Years Analyzed: 45

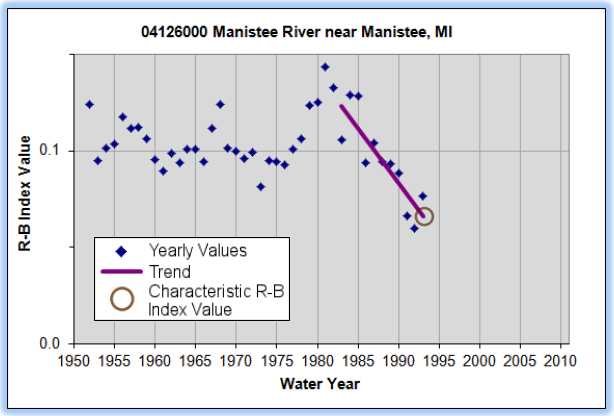
Comments: Discontinued gage 04125500 considered equivalent.



USGS Gage 04125550, Manistee River near Wellston, MI

- Drainage Area (square miles): 1451
- Basin Number: 20
- Characteristic R-B Index Value: 0.050
- Rank: Lowest
- First Water Year: 1997
- Last Water Year: 2011
- Number of Water Years Analyzed: 15

Comments: Flow completely regulated by Tippy Dam 700 feet upstream.

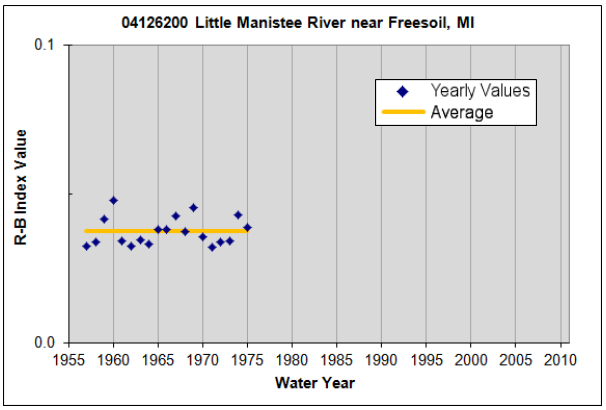


USGS Gage 04126000, Manistee River near Manistee, MI

- Drainage Area (square miles): 1677
- Basin Number: 20
- Characteristic R-B Index Value: 0.066
- Rank: Lower Middle
- Trend: decrease, p value: 0.00
- First Water Year: 1952
- First Water Year Analyzed, if different: 1983
- Last Water Year: 1993
- Number of Water Years Analyzed: 11

Comments: Flow regulated at all stages by Tippy Hydroelectric Power Plant 21 miles upstream.

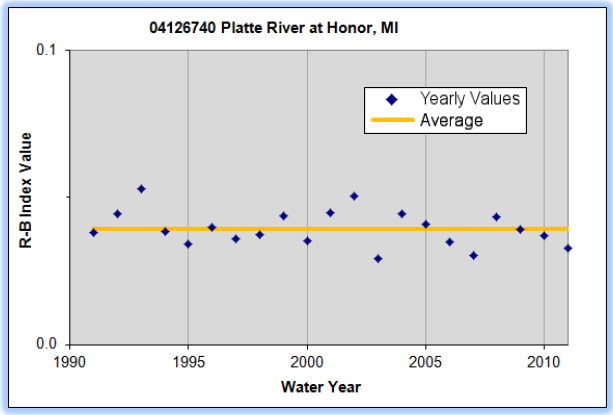
Streams Tributary to Lake Michigan, Northern Lower Peninsula (cont.)



USGS Gage 04126200, Little Manistee River near Freesoil, MI

- Drainage Area (square miles): 178
- Basin Number: 20
- Characteristic R-B Index Value: 0.037
- Rank: Lowest
- First Water Year: 1957
- Last Water Year: 1975
- Number of Water Years Analyzed: 19

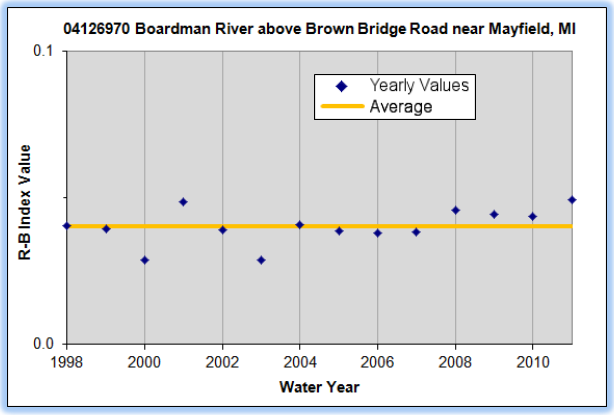
Comments: Some regulation above station.



USGS Gage 04126740, Platte River at Honor, MI

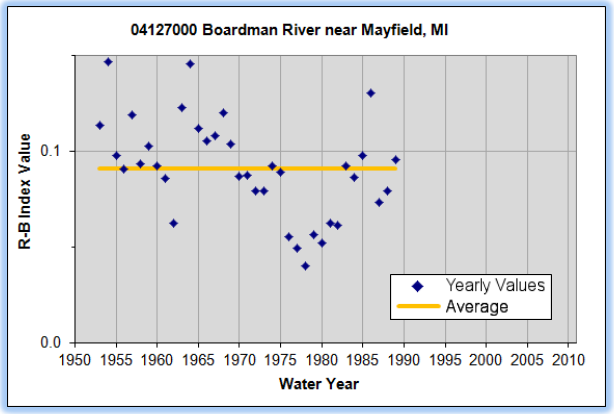
- Drainage Area (square miles): 125
- Basin Number: 28
- Characteristic R-B Index Value: 0.039
- Rank: Lowest
- First Water Year: 1991
- Last Water Year: 2011
- Number of Water Years Analyzed: 21

Comments: Some diversion for fish hatchery six miles upstream from station.



USGS Gage 04126970, Boardman River above Brown Bridge Road, near Mayfield, MI

- Drainage Area (square miles): 141
- Basin Number: 9
- Characteristic R-B Index Value: 0.040
- Rank: Lowest
- First Water Year: 1988
- Last Water Year: 2011
- Number of Water Years Analyzed: 14

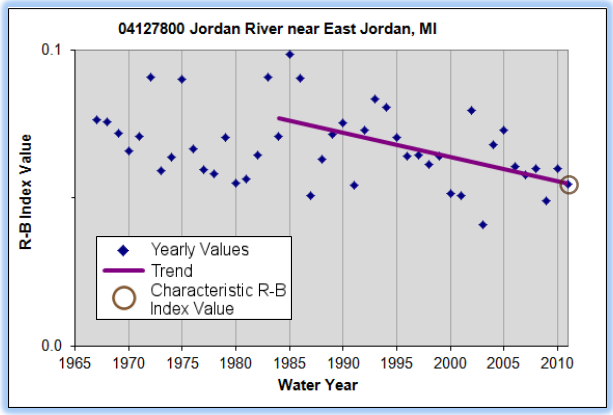


USGS Gage 04127000, Boardman River near Mayfield, MI

- Drainage Area (square miles): 182
- Basin Number: 9
- Characteristic R-B Index Value: 0.091
- Rank: Lower Middle
- p value: 0.00
- First Water Year: 1953
- Last Water Year: 1989
- Number of Water Years Analyzed: 37

Comments: Flow regulated by hydroelectric power plant nine miles above station.

Streams Tributary to Lake Michigan, Northern Lower Peninsula (cont.)

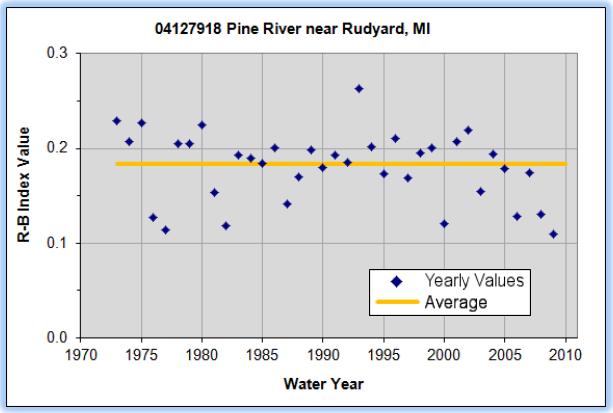


USGS Gage 04127800, Jordan River near East Jordan, MI

- Drainage Area (square miles): 67.9
- Basin Number: 10
- Characteristic R-B Index Value: 0.055
- Rank: Lowest
- Trend: decrease, p value: 0.01
- First Water Year: 1967
- First Water Year Analyzed, if different: 1984
- Last Water Year: 2011
- Number of Water Years Analyzed: 28

Comments: Some regulation at low flow by fish hatchery upstream from station.

Streams Tributary to Lake Huron

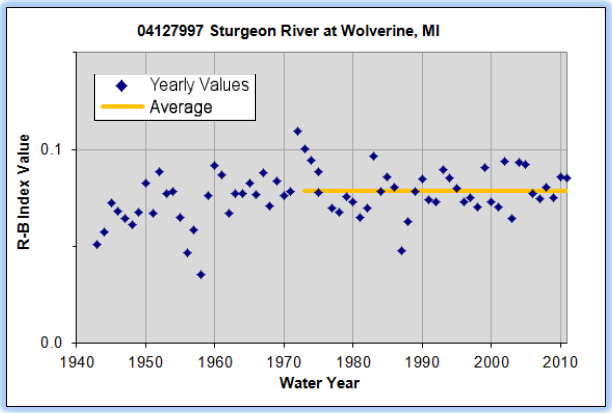


USGS Gage 04127918, Pine River near Rudyard, MI

- Drainage Area (square miles): 184
- Basin Number: 54
- Characteristic R-B Index Value: 0.184
- Rank: Highest
- First Water Year: 1973
- Last Water Year: 2010
- Number of Water Years Analyzed: 38

Comments: This gage is in the Upper Peninsula.

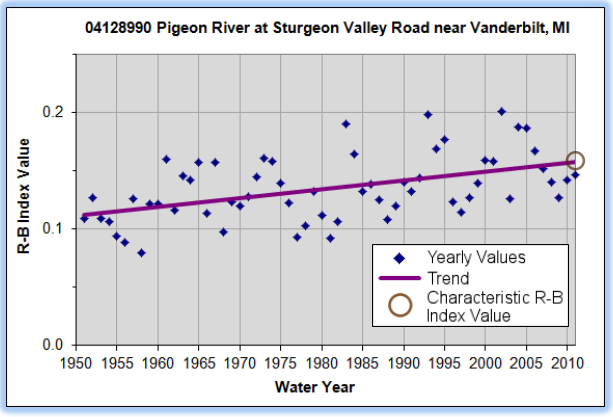
Streams Tributary to Lake Huron (cont.)



USGS Gage 04127997, Sturgeon River at Wolverine, MI

- Drainage Area (square miles): 192
- Basin Number: 11
- Characteristic R-B Index Value: 0.079
- Rank: Lower Middle
- First Water Year: 1943
- First Water Year Analyzed, if different: 1973
- Last Water Year: 2011
- Number of Water Years Analyzed: 39

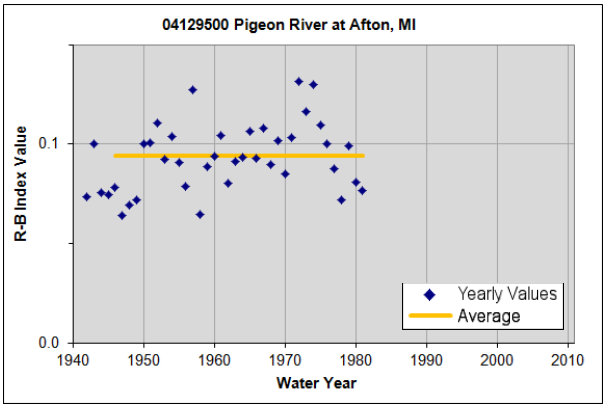
Comments: discontinued gage 04128000 considered equivalent. Prior to July 1975 intermittent regulation low flows from pond 2.4 miles upstream.



USGS Gage 04128990, Pigeon River at Sturgeon Valley Road near Vanderbilt, MI

- Drainage Area (square miles): 57.7
- Basin Number: 11
- Characteristic R-B Index Value: 0.158
- Rank: Lower Middle
- Trend: increase, p value: 0.00
- First Water Year: 1951
- Last Water Year: 2011
- Number of Water Years Analyzed: 61

Comments: Prior to May 1967 and since April 22, 1958 regulation by Lansing Club Dam one mile upstream.

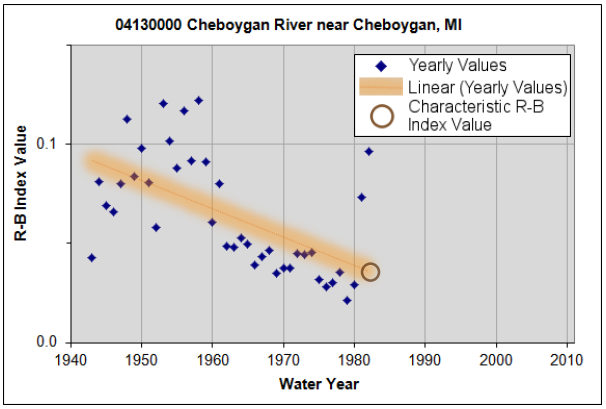


USGS Gage 04129500, Pigeon River at Afton, MI

- Drainage Area (square miles): 139
- Basin Number: 11
- Characteristic R-B Index Value: 0.094
- Rank: Lower Middle
- First Water Year: 1942
- First Water Year Analyzed, if different: 1946
- Last Water Year: 1981
- Number of Water Years Analyzed: 36

Comments: Prior to May 16, 1957 and since April 22, 1958 occasional regulation by Lansing Club Dam 22 miles above station.

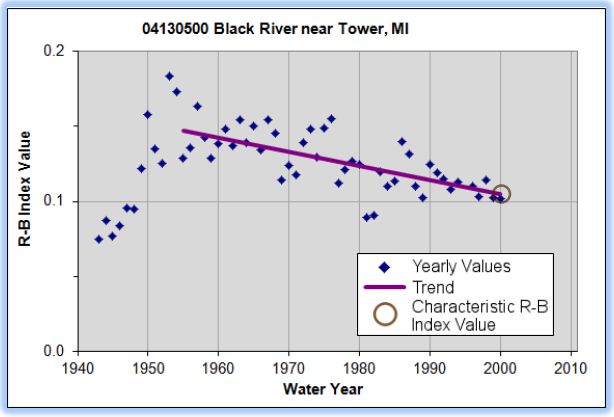
Streams Tributary to Lake Huron (cont.)



USGS Gage 04130000, Cheboygan River near Cheboygan, MI

- Drainage Area (square miles): 889
- Basin Number: 11
- Characteristic R-B Index Value: 0.036
- Rank: Lowest
- p value: 0.00
- First Water Year: 1943
- Last Water Year: 1982
- Number of Water Years Analyzed: 40

Comments: Flow regulated by dam in Cheboygan, prior to December 31, 1965 flow affected by variable backwater from power plant in Cheboygan 5.2 miles below station and by Alverno Power Plant.

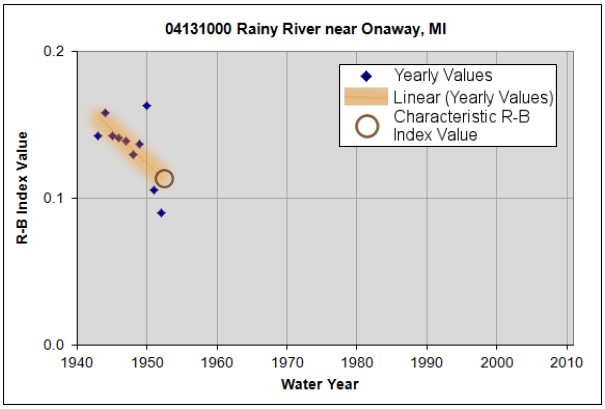


USGS Gage 04130500, Black River near Tower, MI

- Drainage Area (square miles): 311
- Basin Number: 11
- Characteristic R-B Index Value: 0.105
- Rank: Lower Middle
- Trend: decrease, p value: 0.00
- First Water Year: 1943
- First Water Year Analyzed, if different: 1955
- Last Water Year: 2000
- Number of Water Years Analyzed: 45

Comments:

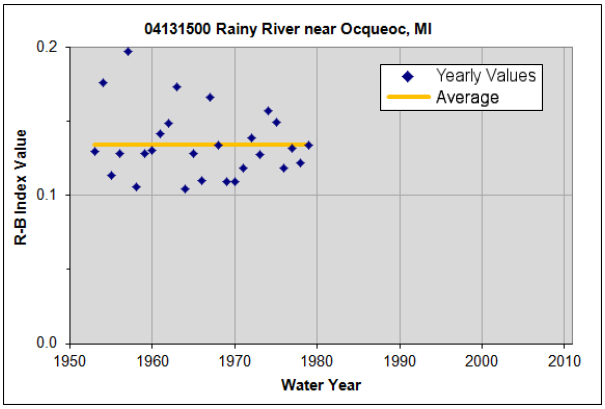
- Completely regulated by Kebler Dam 400 feet upstream.
- Initially published no trend for this gage. Cusum analysis revises the analysis to a decreasing trend for this report update.



USGS Gage 04131000, Rainy River near Onaway, MI

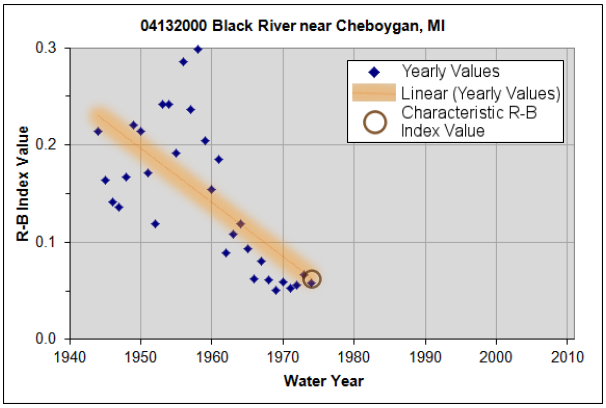
- Drainage Area (square miles): 79
- Basin Number: 11
- Characteristic R-B Index Value: 0.114
- Rank: Lower Middle
- p value: 0.05
- First Water Year: 1943
- Last Water Year: 1952
- Number of Water Years Analyzed: 10

Streams Tributary to Lake Huron (cont.)



USGS Gage 04131500, Rainy River near Ocqueoc, MI

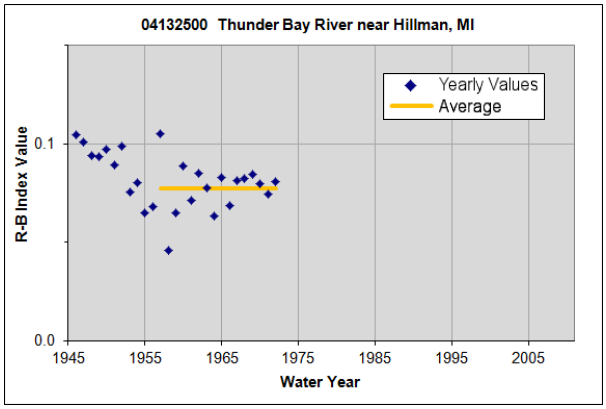
- Drainage Area (square miles): 87.9
- Basin Number: 11
- Characteristic R-B Index Value: 0.134
- Rank: Lower Middle
- First Water Year: 1953
- Last Water Year: 1979
- Number of Water Years Analyzed: 27



USGS Gage 04132000, Black River near Cheboygan, MI

- Drainage Area (square miles): 597
- Basin Number: 11
- Characteristic R-B Index Value: 0.063
- Rank: Lowest
- p value: 0.00
- First Water Year: 1944
- Last Water Year: 1974

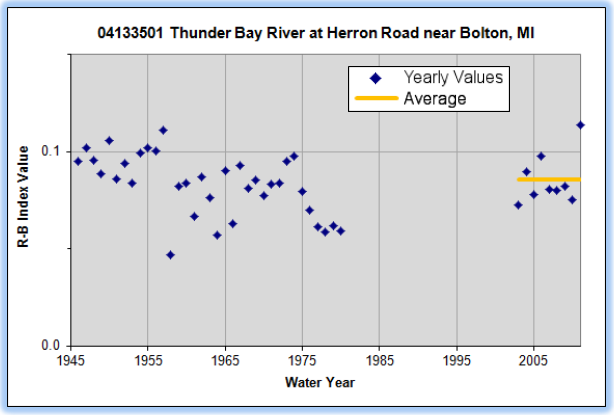
Number of Water Years Analyzed: 31
Comments: Flow regulated by Alverno Dam; prior to December 31, 1965 flow regulated by power plant at Alverno Dam.



USGS Gage 04132500, Thunder Bay River near Hillman, MI

- Drainage Area (square miles): 232
- Basin Number: 36
- Characteristic R-B Index Value: 0.077
- Rank: Lower Middle
- First Water Year: 1946
- First Water Year Analyzed, if different: 1957
- Last Water Year: 1972
- Number of Water Years Analyzed: 16

Comments: Prior to May 12, 1950 diurnal fluctuation below about 500 cubic feet per second by power plant at Atlanta, occasional regulation from dams above station.

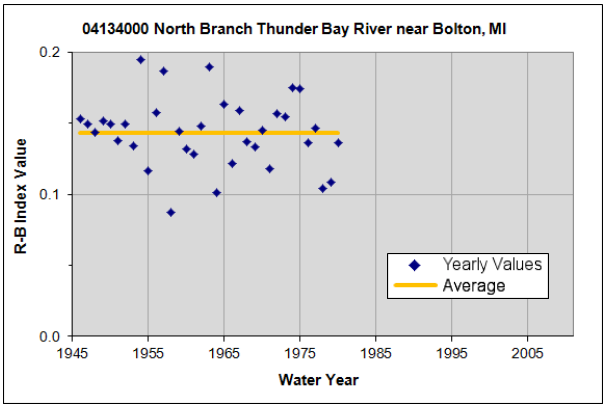


USGS Gage 04133501, Thunder Bay River at Herron Road near Bolton, MI

- Drainage Area (square miles): 586
- Basin Number: 36
- Characteristic R-B Index Value: 0.086
- Rank: Lower Middle
- First Water Year: 1946
- First Water Year Analyzed, if different: 2003
- Last Water Year: 2011
- Number of Water Years Analyzed: 9

Comments: Occasional regulation by dams upstream from station, discontinued gage 04133500 considered equivalent.

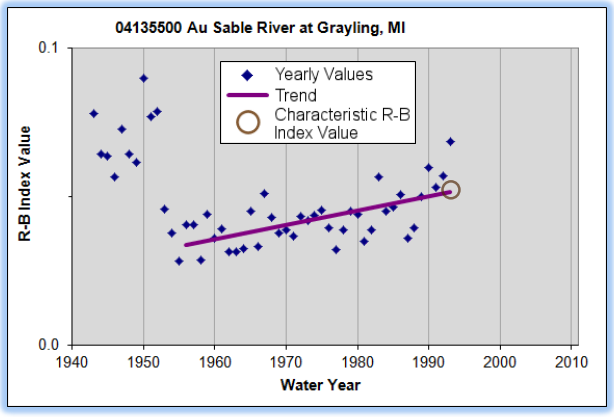
Streams Tributary to Lake Huron (cont.)



USGS Gage 04134000, North Branch Thunder Bay River near Bolton, MI

- Drainage Area (square miles): 184
- Basin Number: 36
- Characteristic R-B Index Value: 0.144
- Rank: Upper Middle
- First Water Year: 1946
- Last Water Year: 1980
- Number of Water Years Analyzed: 35

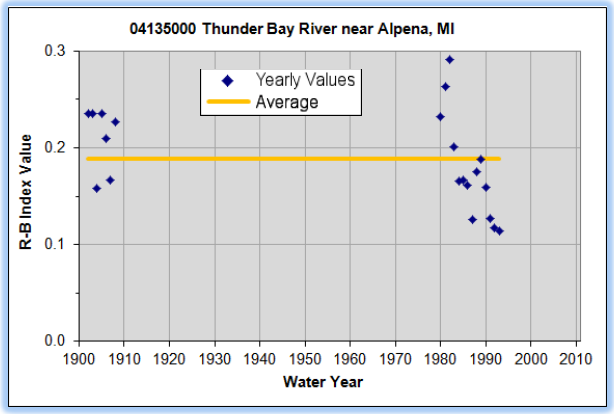
Comments: Occasional regulation during low flows by dam above station.



USGS Gage 04135500, Au Sable River at Grayling, MI

- Drainage Area (square miles): 110
- Basin Number: 2
- Characteristic R-B Index Value: 0.052
- Rank: Lowest
- Trend: increase, p value: 0.00
- First Water Year: 1956
- Last Water Year: 1993
- Number of Water Years Analyzed: 51

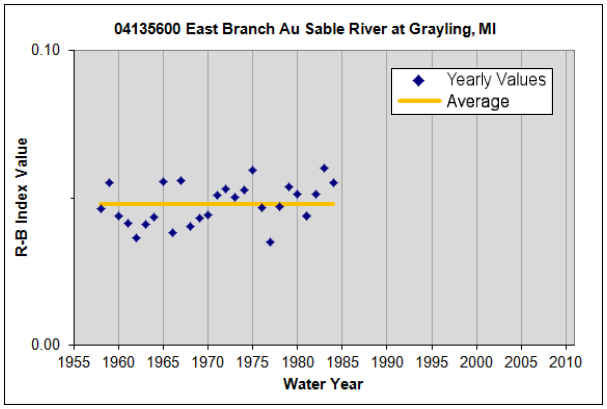
Comments: Prior to December 31, 1952 diurnal fluctuation caused by power plant 2.5 miles upstream.



USGS Gage 04135000, Thunder Bay River near Alpena, MI

- Drainage Area (square miles): 1238
- Basin Number: 36
- Characteristic R-B Index Value: 0.188
- Rank: Highest
- First Water Year: 1902
- Last Water Year: 1993
- Number of Water Years Analyzed: 21

Comments: Flow regulated at all stages by hydroelectric power plant 1,000 feet upstream.

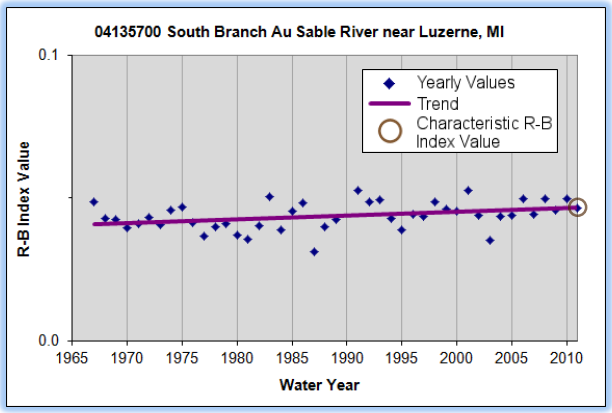


USGS Gage 04135600, East Branch Au Sable River at Grayling, MI

- Drainage Area (square miles): 76
- Basin Number: 2
- Characteristic R-B Index Value: 0.048
- Rank: Lowest
- First Water Year: 1958
- Last Water Year: 1984
- Number of Water Years Analyzed: 28

Comments: Occasional regulation by MDNR ponds above station.

Streams Tributary to Lake Huron (cont.)

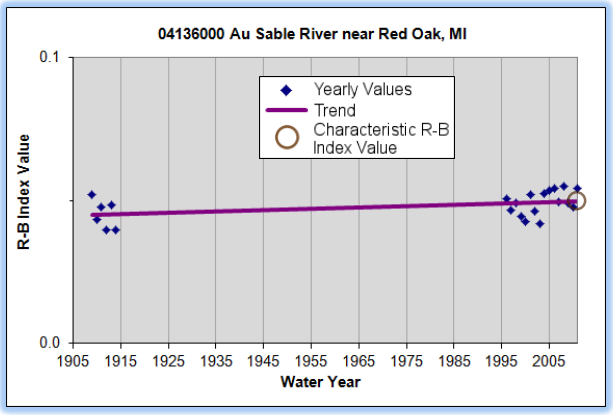


USGS Gage 04135700, South Branch Au Sable River near Luzerne, MI

- Drainage Area (square miles): 401
- Basin Number: 2
- Characteristic R-B Index Value: 0.047
- Rank: Lowest
- Trend: increase, p value: 0.02
- First Water Year: 1967
- Last Water Year: 2011
- Number of Water Years Analyzed: 44

Comments:

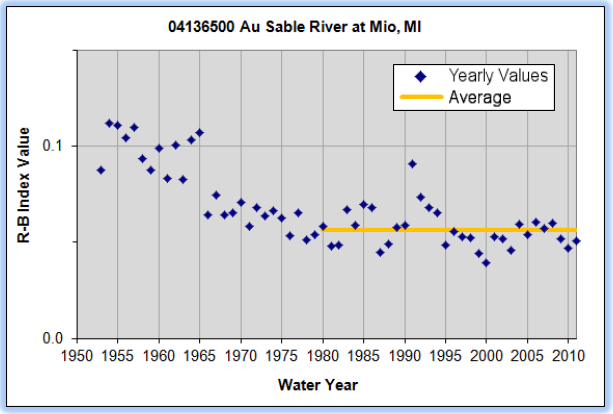
- Occasional regulation by dam upstream from station.
- Initially published no trend for this gage. Additional data revises the analysis to an increasing trend for this report update.



USGS Gage 04136000, Au Sable River near Red Oak, MI

- Drainage Area (square miles): 1108
- Basin Number: 2
- Characteristic R-B Index Value: 0.050
- Rank: Lowest
- Trend: increase, p value: 0.05
- First Water Year: 1909
- Last Water Year: 2011
- Number of Water Years Analyzed: 22

Comments: Initially published no trend for this gage. Additional data revises the analysis to an increasing trend for this report update.

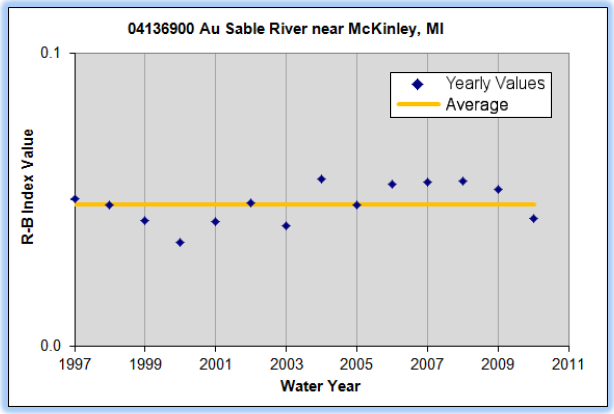


USGS Gage 04136500, Au Sable River at Mio, MI

- Drainage Area (square miles): 1361
- Basin Number: 2
- Characteristic R-B Index Value: 0.057
- Rank: Lowest
- First Water Year: 1953
- First Water Year Analyzed, if different: 1980
- Last Water Year: 2011
- Number of Water Years Analyzed: 32

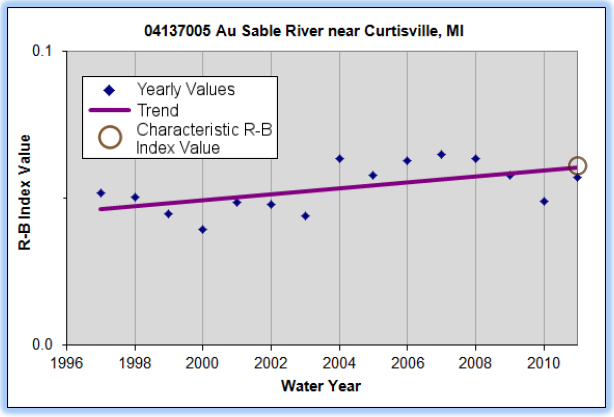
Comments: Flow regulated by Mio Dam 500 feet upstream.

Streams Tributary to Lake Huron (cont.)



USGS Gage 04136900, Au Sable River near McKinley, MI

- Drainage Area (square miles): 1513
- Basin Number: 2
- Characteristic R-B Index Value: 0.049
- Rank: Lowest
- First Water Year: 1997
- Last Water Year: 2011
- Number of Water Years Analyzed: 15



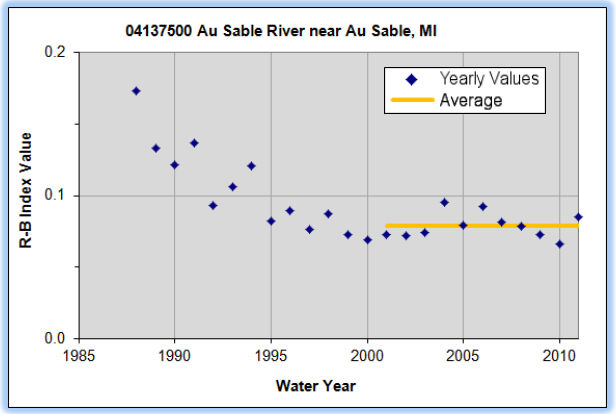
USGS Gage 04137005, Au Sable River near Curtisville, MI

- Drainage Area (square miles): 1598
- Basin Number: 2
- Characteristic R-B Index Value: 0.061
- Rank: Lower Middle
- Trend: increase, p value: 0.03
- First Water Year: 1997
- Last Water Year: 2011
- Number of Water Years Analyzed: 15

Comments:

- Flow completely regulated by Alcona Dam 300 feet upstream.
- Initially published no trend for this gage. Additional data revises the analysis to an increasing trend for this report update.

Streams Tributary to Lake Huron (cont.)

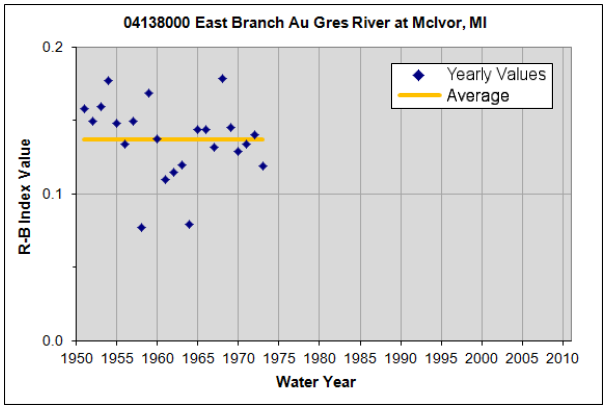


USGS Gage 04137500, Au Sable River near Au Sable, MI

- Drainage Area (square miles): 1739
- Basin Number: 2
- Characteristic R-B Index Value: 0.079
- Rank: Upper Middle
- First Water Year: 1988
- First Water Year Analyzed, if different: 2001
- Last Water Year: 2011
- Number of Water Years Analyzed: 11

Comments:

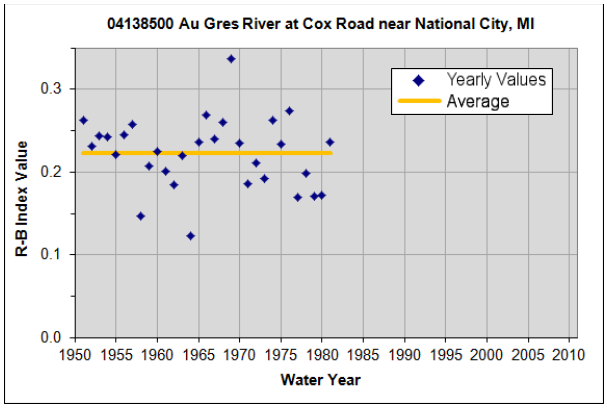
- Flow regulated by Foote Dam 0.6 miles upstream.
- Initially published decreasing trend for this gage. Additional data revises the analysis to no trend for this report update.



USGS Gage 04138000, East Branch Au Gres River at McIvor, MI

- Drainage Area (square miles): 84
- Basin Number: 1
- Characteristic R-B Index Value: 0.137
- Rank: Lower Middle
- First Water Year: 1951
- Last Water Year: 1973
- Number of Water Years Analyzed: 23

Comments: Some intermittent regulation at low and medium flow by dam 2.5 miles above station during period 1952-1966.

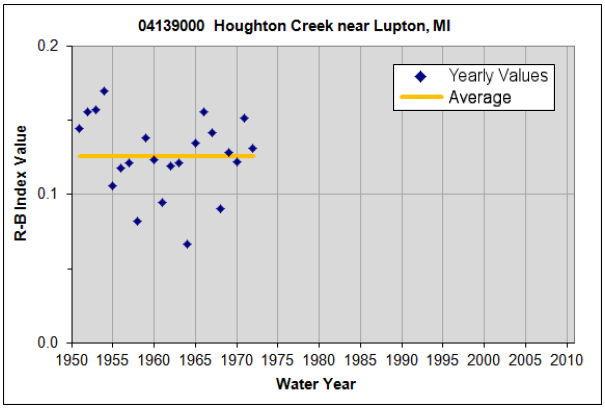


USGS Gage 04138500, Au Gres River at Cox Road near National City, MI

- Drainage Area (square miles): 154
- Basin Number: 1
- Characteristic R-B Index Value: 0.223
- Rank: Highest
- First Water Year: 1951
- Last Water Year: 1981
- Number of Water Years Analyzed: 31

Comments: Some regulation at low flows.

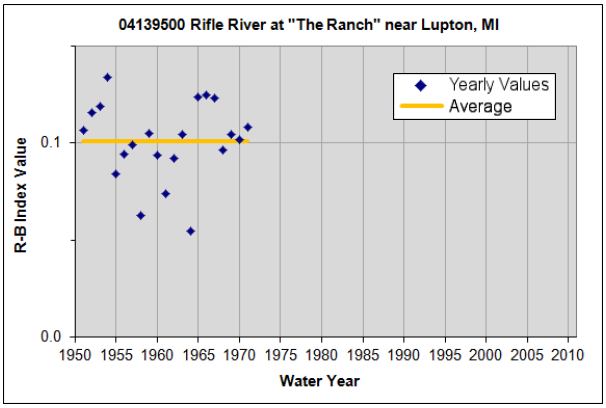
Streams Tributary to Lake Huron (cont.)



USGS Gage 04139000, Houghton Creek near Lupton, MI

- Drainage Area (square miles): 29.7
- Basin Number: 30
- Characteristic R-B Index Value: 0.126
- Rank: Lowest
- First Water Year: 1951
- Last Water Year: 1972
- Number of Water Years Analyzed: 22

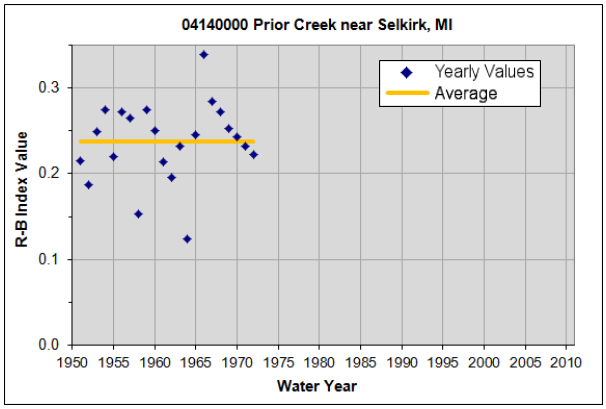
Comments: Intermittent regulation at low flow by sawmill on Sandback Creek at Rose City prior to June 1955 and since November 1958.



USGS Gage 04139500, Rifle River at "The Ranch" near Lupton, MI

- Drainage Area (square miles): 56.8
- Basin Number: 30
- Characteristic R-B Index Value: 0.101
- Rank: Lower Middle
- First Water Year: 1951
- Last Water Year: 1971
- Number of Water Years Analyzed: 21

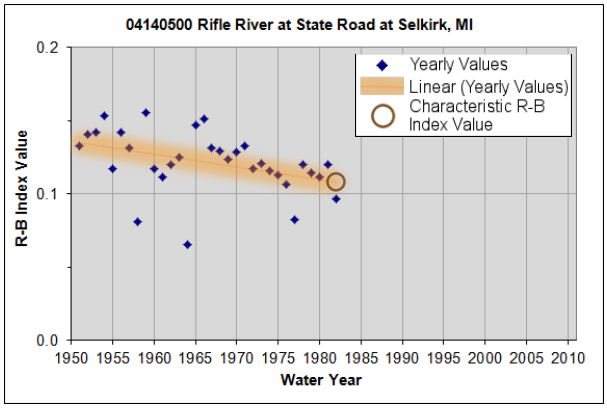
Comments: Occasional regulation by dams above station.



USGS Gage 04140000, Prior Creek near Selkirk, MI

- Drainage Area (square miles): 21.4
- Basin Number: 30
- Characteristic R-B Index Value: 0.237
- Rank: Lower Middle
- First Water Year: 1951
- Last Water Year: 1972
- Number of Water Years Analyzed: 22

Comments: Some regulation from dam at lake outlet.

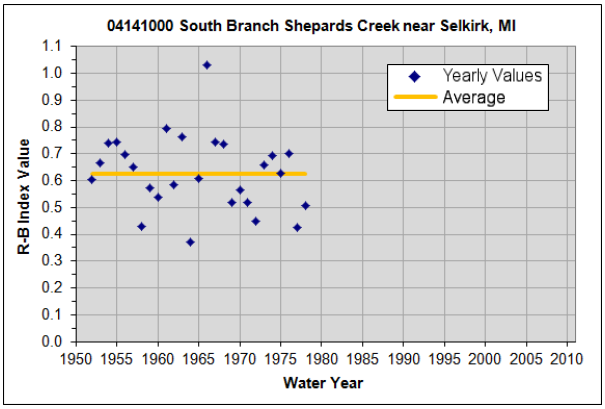


USGS Gage 04140500, Rifle River at State Road at Selkirk, MI

- Drainage Area (square miles): 117
- Basin Number: 30
- Characteristic R-B Index Value: 0.108
- Rank: Upper Middle
- p value: 0.02
- First Water Year: 1951
- Last Water Year: 1982
- Number of Water Years Analyzed: 32

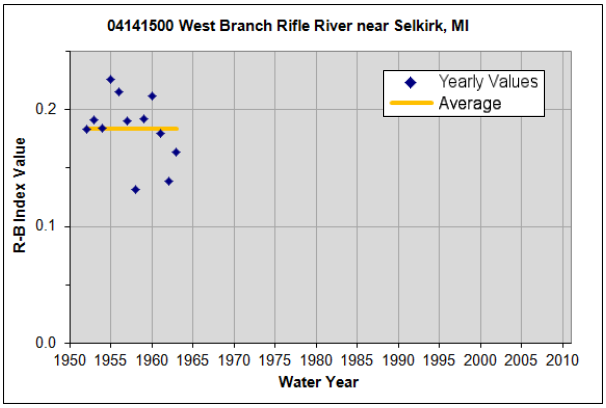
Comments: Some regulation by dams above station.

Streams Tributary to Lake Huron (cont.)



USGS Gage 04141000, South Branch Shepards Creek near Selkirk, MI

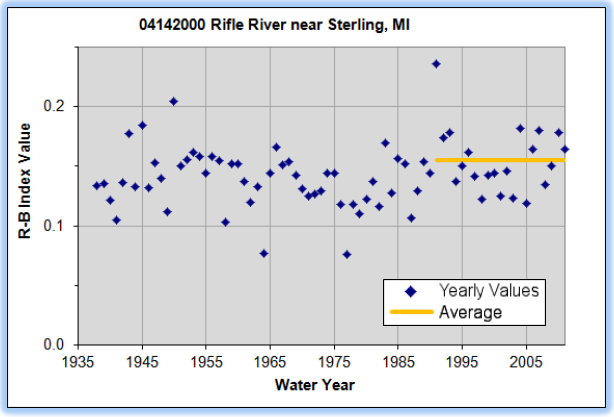
- Drainage Area (square miles): 1.15
- Basin Number: 30
- Characteristic R-B Index Value: 0.627
- Rank: Highest
- First Water Year: 1952
- Last Water Year: 1978
- Number of Water Years Analyzed: 27



USGS Gage 04141500, West Branch Rifle River near Selkirk, MI

- Drainage Area (square miles): 51
- Basin Number: 30
- Characteristic R-B Index Value: 0.184
- Rank: Upper Middle
- First Water Year: 1952
- Last Water Year: 1963
- Number of Water Years Analyzed: 12

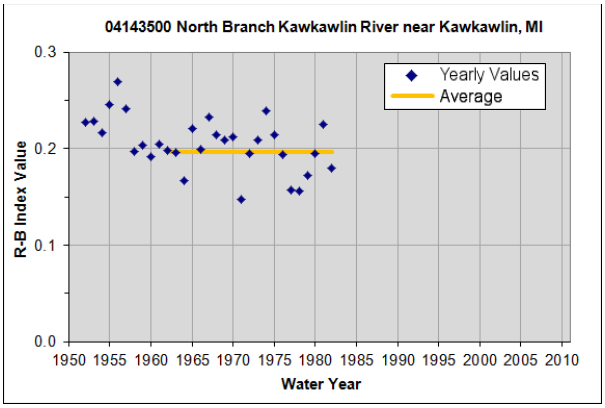
Comments: Occasional regulation from mill about seven miles upstream.



USGS Gage 04142000, Rifle River near Sterling, MI

- Drainage Area (square miles): 320
- Basin Number: 30
- Characteristic R-B Index Value: 0.155
- Rank: Highest
- First Water Year: 1938
- First Water Year Analyzed, if different: 1991
- Last Water Year: 2011
- Number of Water Years Analyzed: 21

Comments: Occasional regulation by dams upstream from station.

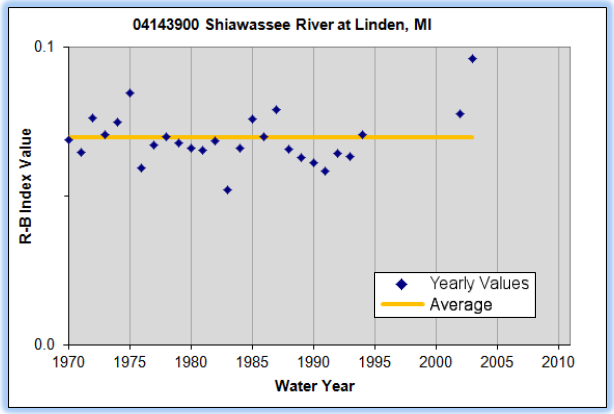


USGS Gage 04143500, North Branch Kawkawlin River near Kawkawlin, MI

- Drainage Area (square miles): 101
- Basin Number: 18
- Characteristic R-B Index Value: 0.197
- Rank: Highest
- First Water Year: 1952
- First Water Year Analyzed, if different: 1962
- Last Water Year: 1982
- Number of Water Years Analyzed: 21

Comments: Some diversions above station for irrigation. Some regulation during low flows by dams above station.

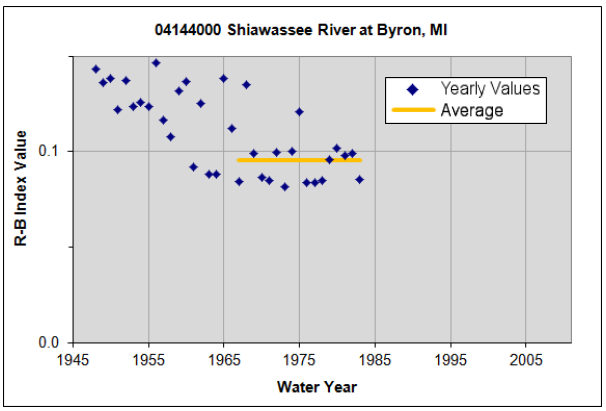
Streams Tributary to Lake Huron (cont.)



USGS Gage 04143900, Shiawassee River at Linden, MI

- Drainage Area (square miles): 83.7
- Basin Number: 32
- Characteristic R-B Index Value: 0.070
- Rank: Lowest
- First Water Year: 1968
- Last Water Year: 2003
- Number of Water Years Analyzed: 29

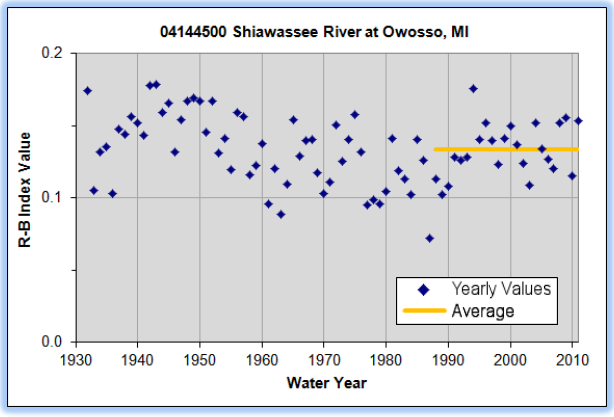
Comments: Flow regulated by dam at Linden since 1967.



USGS Gage 04144000, Shiawassee River at Byron, MI

- Drainage Area (square miles): 365
- Basin Number: 32
- Characteristic R-B Index Value: 0.096
- Rank: Lower Middle
- First Water Year: 1948
- First Water Year Analyzed, if different: 1967
- Last Water Year: 1983
- Number of Water Years Analyzed: 17

Comments: Low flow slightly regulated at times by mills above station.

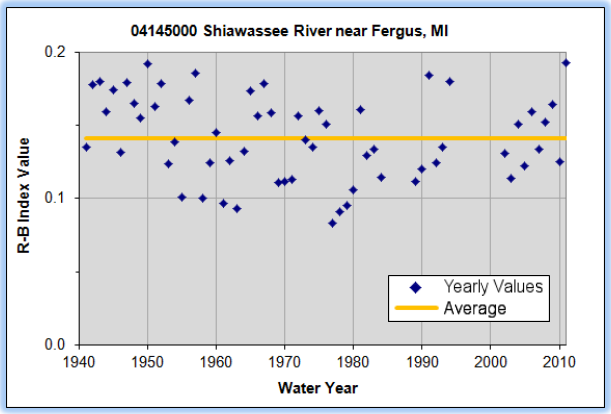


USGS Gage 04144500, Shiawassee River at Owosso, MI

- Drainage Area (square miles): 538
- Basin Number: 32
- Characteristic R-B Index Value: 0.134
- Rank: Upper Middle
- First Water Year: 1932
- First Water Year Analyzed, if different: 1988
- Last Water Year: 2011
- Number of Water Years Analyzed: 24

Comments: Flow regulated approximately 800 cubic feet per second by power plant at Shiawassee town prior to February 1953, occasional regulation at low stages since.

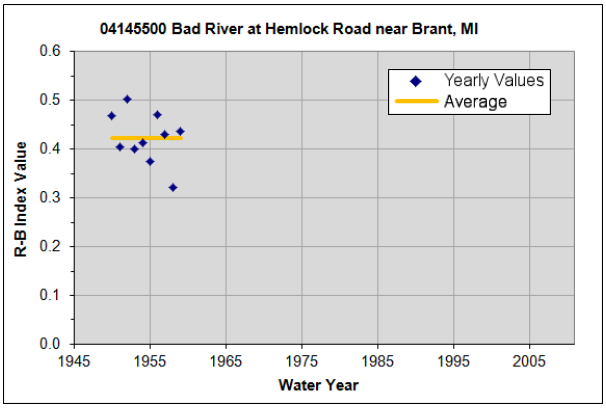
Streams Tributary to Lake Huron (cont.)



USGS Gage 04145000, Shiawassee River near Fergus, MI

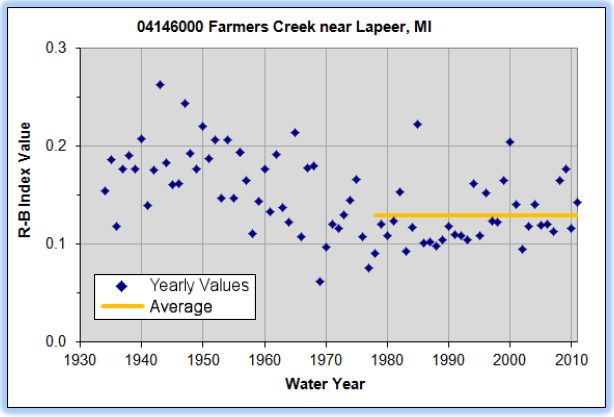
- Drainage Area (square miles): 637
- Basin Number: 32
- Characteristic R-B Index Value: 0.141
- Rank: Upper Middle
- First Water Year: 1941
- Last Water Year: 2011
- Number of Water Years Analyzed: 60

Comments: Some regulation at low stages by power plant at Shiawassee town prior to February 1953, occasional regulation at low stages since.



USGS Gage 04145500, Bad River at Hemlock Road near Brant, MI

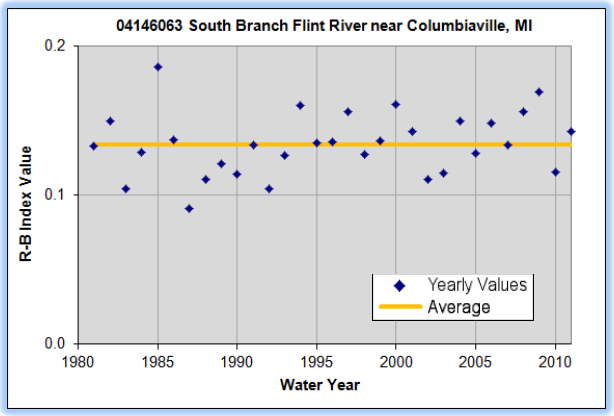
- Drainage Area (square miles): 89
- Basin Number: 32
- Characteristic R-B Index Value: 0.422
- Rank: Highest
- First Water Year: 1950
- Last Water Year: 1959
- Number of Water Years Analyzed: 10



USGS Gage 04146000, Farmers Creek near Lapeer, MI

- Drainage Area (square miles): 55.3
- Basin Number: 32
- Characteristic R-B Index Value: 0.130
- Rank: Lower Middle
- First Water Year: 1934
- Last Water Year: 2011
- Number of Water Years Analyzed: 34

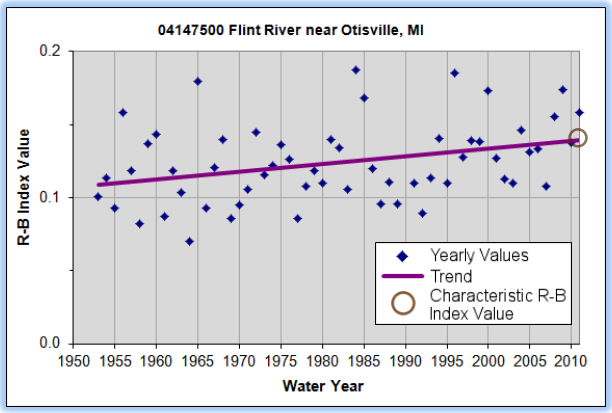
Comments: Prior to 1941 occasional regulation caused by Dam upstream from station.



USGS Gage 04146063, South Branch Flint River near Columbiaville, MI

- Drainage Area (square miles): 221
- Basin Number: 32
- Characteristic R-B Index Value: 0.134
- Rank: Upper Middle
- First Water Year: 1981
- Last Water Year: 2011
- Number of Water Years Analyzed: 31

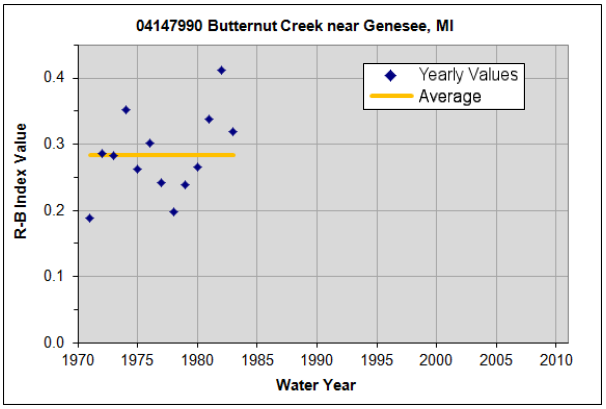
Streams Tributary to Lake Huron (cont.)



USGS Gage 04147500, Flint River near Otisville, MI

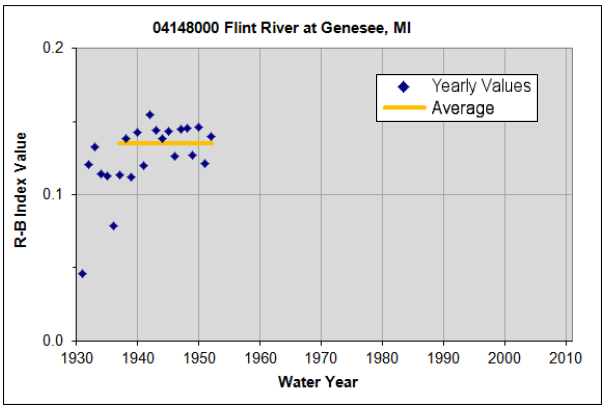
- Drainage Area (square miles): 530
- Basin Number: 32
- Characteristic R-B Index Value: 0.140
- Rank: Upper Middle
- Trend: increase, p value: 0.01
- First Water Year: 1953
- Last Water Year: 2011
- Number of Water Years Analyzed: 58

Comments: Flow regulated by Holloway reservoir 1.5 miles upstream from station. From 1954 to 1991 annual mean discharge and runoff adjusted for change in contents in Holloway Reservoir.



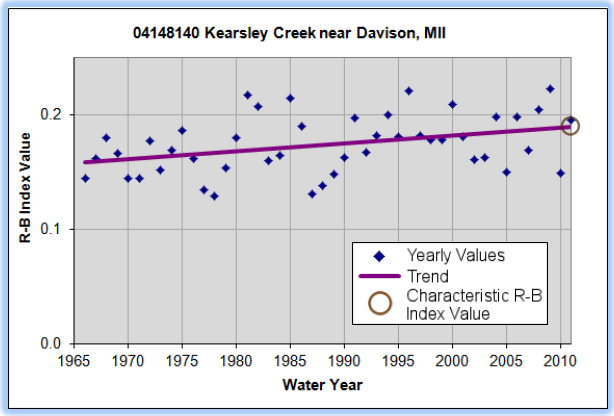
USGS Gage 04147990, Butternut Creek near Genesee, MI

- Drainage Area (square miles): 34.7
- Basin Number: 32
- Characteristic R-B Index Value: 0.284
- Rank: Upper Middle
- First Water Year: 1971
- Last Water Year: 1983
- Number of Water Years Analyzed: 13



USGS Gage 04148000, Flint River at Genesee, MI

- Drainage Area (square miles): 593
- Basin Number: 32
- Characteristic R-B Index Value: 0.135
- Rank: Upper Middle
- First Water Year: 1931
- First Water Year Analyzed, if different: 1937
- Last Water Year: 1952
- Number of Water Years Analyzed: 16

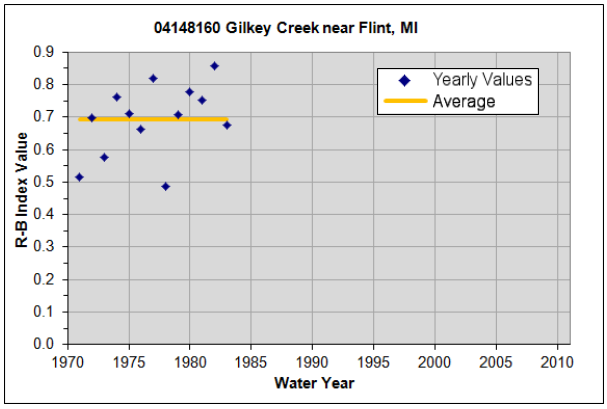


USGS Gage 04148140, Kearsley Creek near Davison, MI

- Drainage Area (square miles): 99.4
- Basin Number: 32
- Characteristic R-B Index Value: 0.190
- Rank: Upper Middle
- Trend: increase, p value: 0.01
- First Water Year: 1966
- Last Water Year: 2011
- Number of Water Years Analyzed: 46

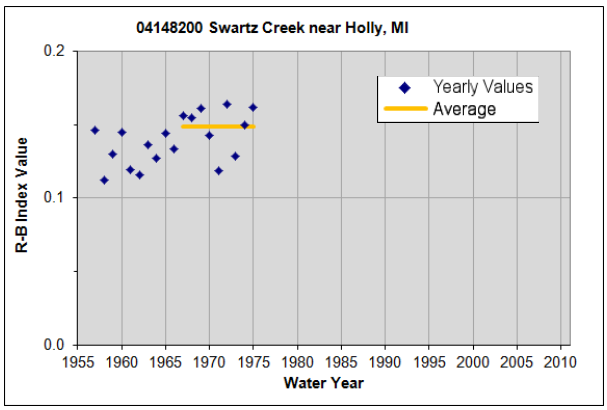
Comments:

- Some diurnal fluctuation caused by small dams and occasional diversion from irrigation upstream from station.
- Initially published no trend for this gage. Additional data revises the analysis to an increasing trend for this report update.



USGS Gage 04148160, Gilkey Creek near Flint, MI

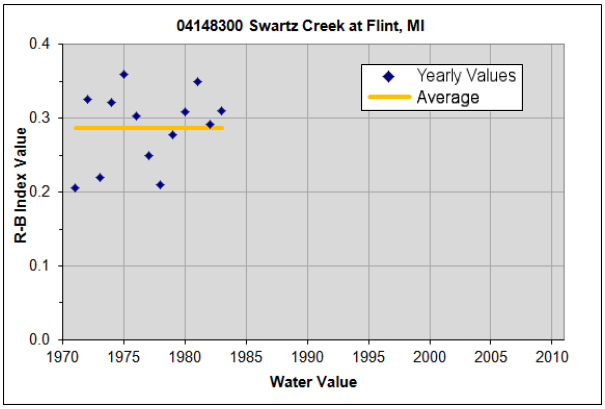
- Drainage Area (square miles): 6.43
- Basin Number: 32
- Characteristic R-B Index Value: 0.693
- Rank: Highest
- First Water Year: 1971
- Last Water Year: 1983
- Number of Water Years Analyzed: 13



USGS Gage 04148200, Swartz Creek near Holly, MI

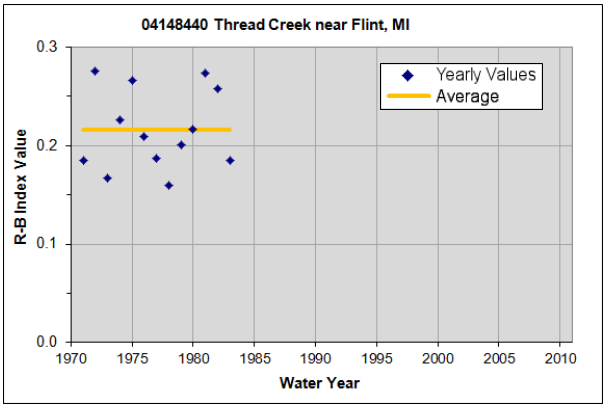
- Drainage Area (square miles): 12.1
- Basin Number: 32
- Characteristic R-B Index Value: 0.149
- Rank: Lowest
- First Water Year: 1957
- First Water Year Analyzed, if different: 1967
- Last Water Year: 1975
- Number of Water Years Analyzed: 9

Streams Tributary to Lake Huron (cont.)



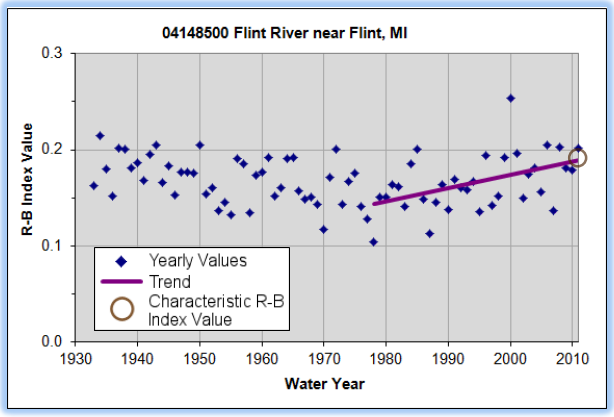
USGS Gage 04148300, Swartz Creek at Flint, MI

- Drainage Area (square miles): 115
- Basin Number: 32
- Characteristic R-B Index Value: 0.287
- Rank: Highest
- First Water Year: 1971
- Last Water Year: 1983
- Number of Water Years Analyzed: 13



USGS Gage 04148440, Thread Creek near Flint, MI

- Drainage Area (square miles): 54.4
- Basin Number: 32
- Characteristic R-B Index Value: 0.216
- Rank: Upper Middle
- First Water Year: 1971
- Last Water Year: 1983
- Number of Water Years Analyzed: 13

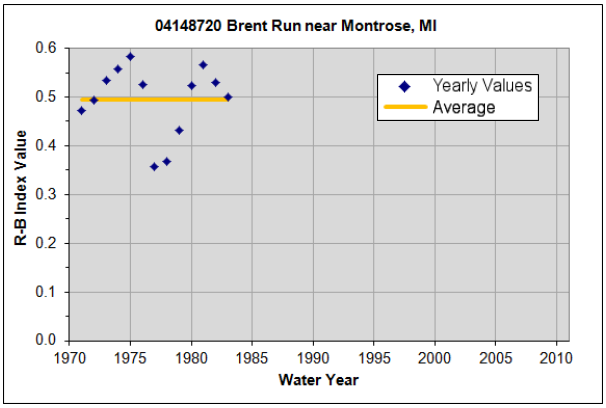


USGS Gage 04148500, Flint River near Flint, MI

- Drainage Area (square miles): 956
- Basin Number: 32
- Characteristic R-B Index Value: 0.189
- Rank: Highest
- Trend: increase, p value: 0.01
- First Water Year: 1933
- First Water Year Analyzed, if different: 1978
- Last Water Year: 2011
- Number of Water Years Analyzed: 34

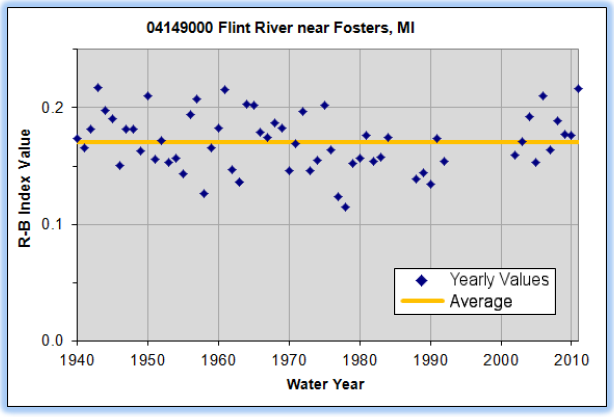
Comments: Some regulation by small reservoirs upstream from station and by Holloway reservoir. From 1954 to 1991 annual mean discharge and runoff figures adjusted for change in contents in Holloway Reservoir occasional diversion for industrial use. Since 1967 flow contains up to fifty cubic feet per second as sewage effluent which originates outside the basin.

Streams Tributary to Lake Huron (cont.)



USGS Gage 04148720, Brent Run near Montrose, MI

- Drainage Area (square miles): 20.8
- Basin Number: 32
- Characteristic R-B Index Value: 0.496
- Rank: Highest
- First Water Year: 1971
- Last Water Year: 1983
- Number of Water Years Analyzed: 13

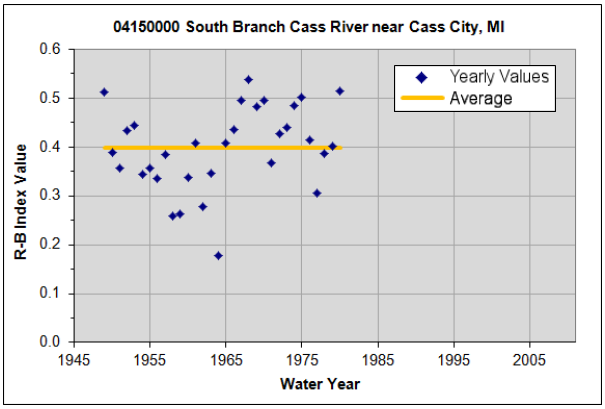


USGS Gage 04149000, Flint River near Fosters, MI

- Drainage Area (square miles): 1153
- Basin Number: 32
- Characteristic R-B Index Value: 0.170
- Rank: Highest
- First Water Year: 1940
- Last Water Year: 2011
- Number of Water Years Analyzed: 61

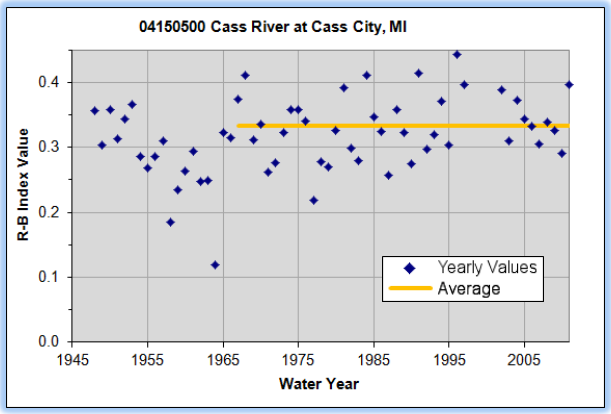
Comments:

- Prior to October 1, 1992 water stage records include flow of Birch Run, some regulation by reservoirs upstream from the City of Flint.
- Initially published a decreasing trend for this gage. Additional data revises the analysis to no trend for this report update.



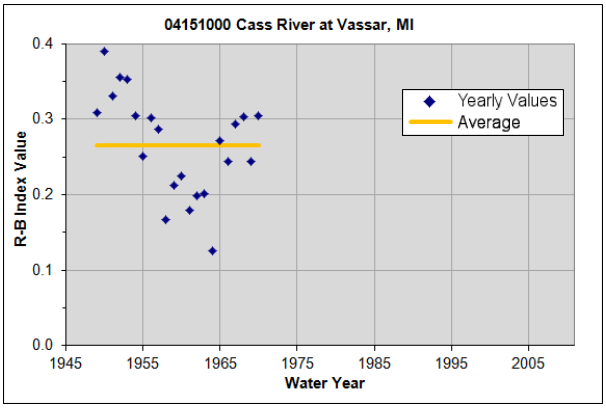
USGS Gage 04150000, South Branch Cass River near Cass City, MI

- Drainage Area (square miles): 238
- Basin Number: 32
- Characteristic R-B Index Value: 0.397
- Rank: Highest
- First Water Year: 1949
- Last Water Year: 1980
- Number of Water Years Analyzed: 32



USGS Gage 04150500, Cass River at Cass City, MI

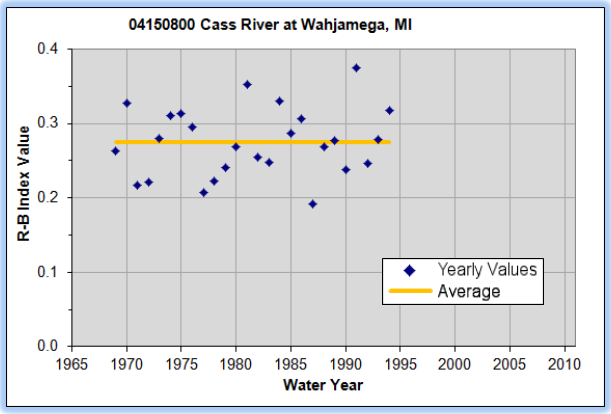
- Drainage Area (square miles): 359
- Basin Number: 32
- Characteristic R-B Index Value: 0.333
- Rank: Highest
- First Water Year: 1948
- First Water Year Analyzed, if different: 1967
- Last Water Year: 2011
- Number of Water Years Analyzed: 41



USGS Gage 04151000, Cass River at Vassar, MI

- Drainage Area (square miles): 710
- Basin Number: 32
- Characteristic R-B Index Value: 0.266
- Rank: Highest
- p value: 0.04
- First Water Year: 1949
- Last Water Year: 1970
- Number of Water Years Analyzed: 22

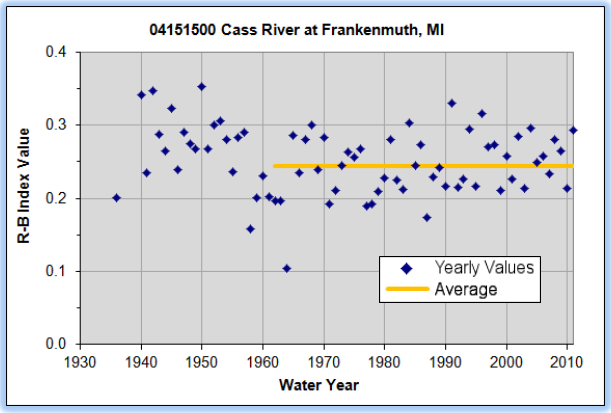
Comments: Some regulation by dam at Michigan Sugar Company 12.6 miles above station.



USGS Gage 04150800, Cass River at Wahjamega, MI

- Drainage Area (square miles): 645
- Basin Number: 32
- Characteristic R-B Index Value: 0.275
- Rank: Highest
- First Water Year: 1969
- Last Water Year: 1994
- Number of Water Years Analyzed: 26

Comments: Some regulation by dam at Michigan Sugar Company 1.9 miles upstream from station.

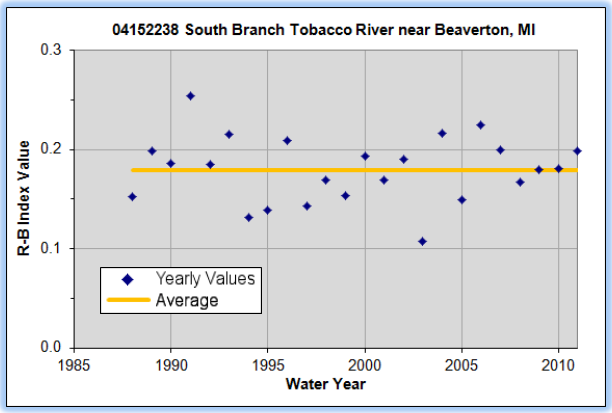


USGS Gage 04151500, Cass River at Frankenmuth, MI

- Drainage Area (square miles): 841
- Basin Number: 32
- Characteristic R-B Index Value: 0.244
- Rank: Highest
- First Water Year: 1936
- First Water Year Analyzed, if different: 1962
- Last Water Year: 2011
- Number of Water Years Analyzed: 50

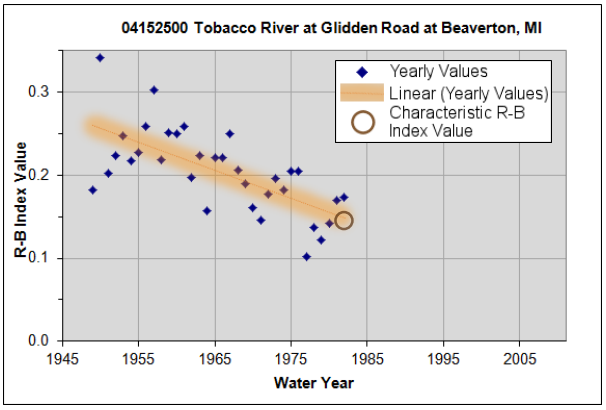
Comments: Occasional regulation by dams upstream from station. Prior to 1950 regulation at low and medium flows by mill upstream from station.

Streams Tributary to Lake Huron (cont.)



USGS Gage 04152238, South Branch Tobacco River near Beaverton, MI

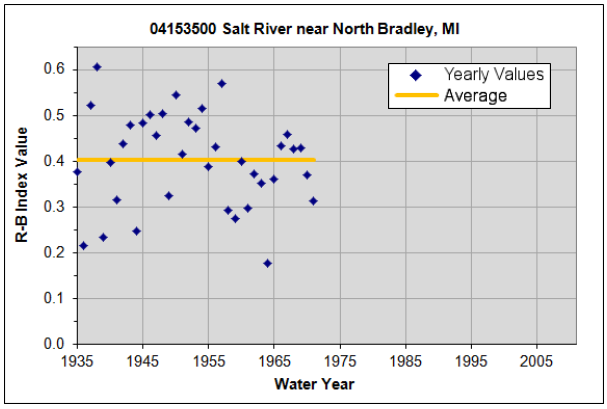
- Drainage Area (square miles): 160
- Basin Number: 32
- Characteristic R-B Index Value: 0.180
- Rank: Highest
- First Water Year: 1988
- Last Water Year: 2011
- Number of Water Years Analyzed: 24



USGS Gage 04152500, Tobacco River at Glidden Road at Beaverton, MI

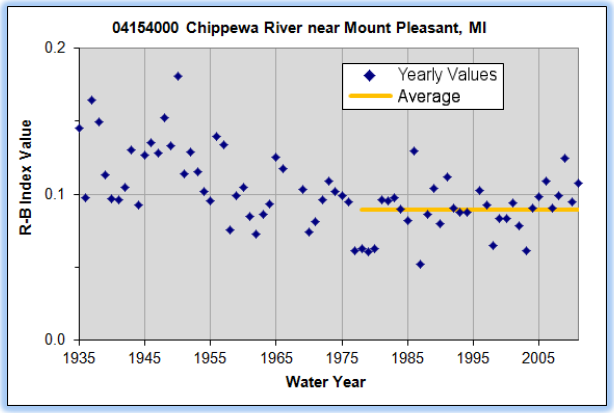
- Drainage Area (square miles): 487
- Basin Number: 32
- Characteristic R-B Index Value: 0.149
- Rank: Upper Middle
- p value: 0.00
- First Water Year: 1949
- Last Water Year: 1982
- Number of Water Years Analyzed: 34

Comments: Prior to February 21, 1961 regulation at all stages by hydroelectric power plant one mile above station, occasional regulation since.



USGS Gage 04153500, Salt River near North Bradley, MI

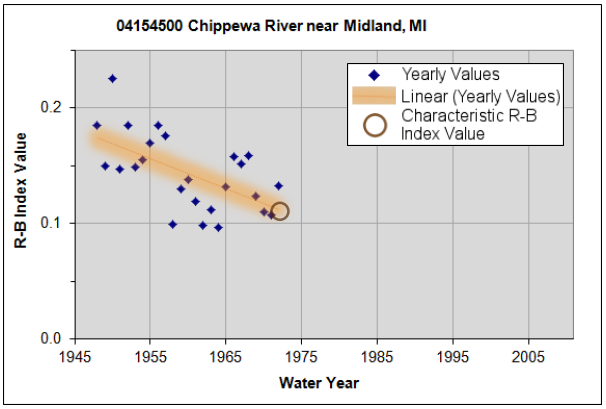
- Drainage Area (square miles): 138
- Basin Number: 32
- Characteristic R-B Index Value: 0.402
- Rank: Highest
- First Water Year: 1935
- Last Water Year: 1971
- Number of Water Years Analyzed: 37



USGS Gage 04154000, Chippewa River near Mount Pleasant, MI

- Drainage Area (square miles): 416
- Basin Number: 32
- Characteristic R-B Index Value: 0.089
- Rank: Lower Middle
- First Water Year: 1934
- First Water Year Analyzed, if different: 1978
- Last Water Year: 2011
- Number of Water Years Analyzed: 33

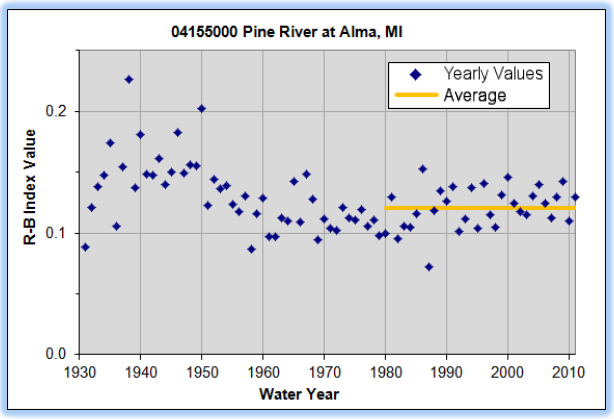
Comments: Diurnal fluctuation below 750 cubic feet per second caused by power plant at Mount Pleasant prior to 1962, occasional regulation at low flow since. Since July 30, 1968 occasional regulation from control structures on lake outlets.



USGS Gage 04154500, Chippewa River near Midland, MI

- Drainage Area (square miles): 597
- Basin Number: 32
- Characteristic R-B Index Value: 0.112
- Rank: Upper Middle
- p value: 0.00
- First Water Year: 1948
- Last Water Year: 1972
- Number of Water Years Analyzed: 25

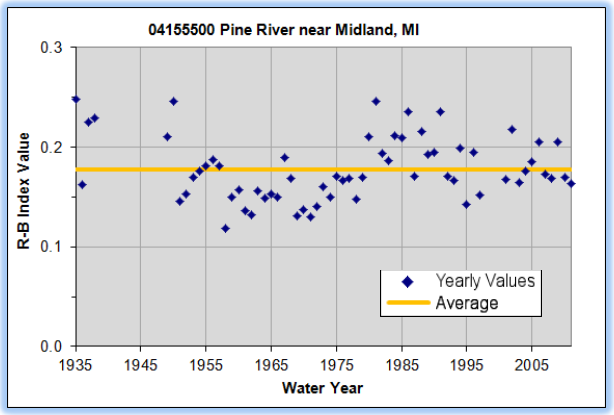
Comments: Diurnal fluctuation below 750 cubic feet per second caused by power plant at Mount Pleasant prior to 1962, occasional regulation at low flow since. Since July 30, 1968 occasional regulation from control structures on lake outlets.



USGS Gage 04155000, Pine River at Alma, MI

- Drainage Area (square miles): 288
- Basin Number: 32
- Characteristic R-B Index Value: 0.121
- Rank: Upper Middle
- First Water Year: 1931
- First Water Year Analyzed, if different: 1980
- Last Water Year: 2011
- Number of Water Years Analyzed: 32

Comments: Flow regulated by dam 0.6 miles upstream from station, and by variable backwater from power plant at St. Louis 5.2 miles downstream.

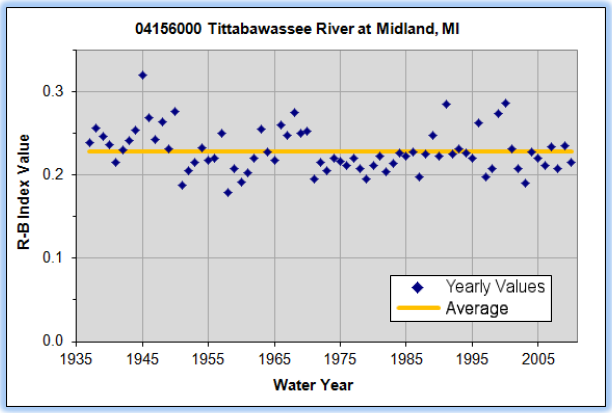


USGS Gage 04155500, Pine River near Midland, MI

- Drainage Area (square miles): 390
- Basin Number: 32
- Characteristic R-B Index Value: 0.178
- Rank: Highest
- First Water Year: 1935
- Last Water Year: 2011
- Number of Water Years Analyzed: 64

Comments: Regulation at low and medium flows by hydroelectric power plant at St. Louis. Some diversions from station for irrigation.

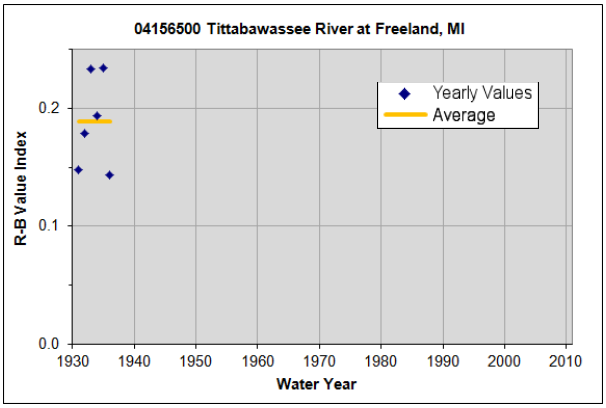
Streams Tributary to Lake Huron (cont.)



USGS Gage 04156000, Tittabawassee River at Midland, MI

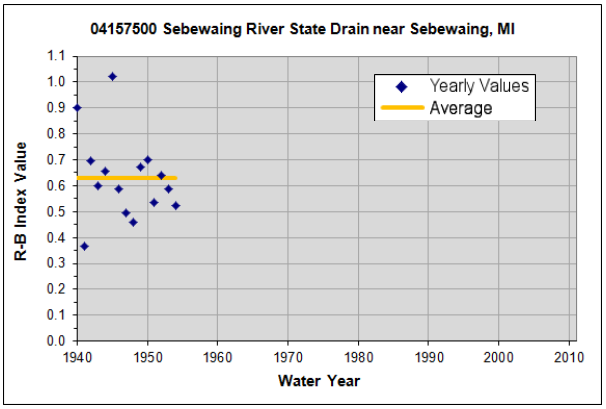
- Drainage Area (square miles): 2400
- Basin Number: 32
- Characteristic R-B Index Value: 0.229
- Rank: Highest
- First Water Year: 1937
- Last Water Year: 2011
- Number of Water Years Analyzed: 75

Comments: Prior to 1992 a diversion was used in computing annual mean discharge and runoff figures, extremes and daily discharge were not adjusted for diversion. Prior to May 20, 1970 discharge below 4,000 cubic feet per second regulated by dam 2,000 feet upstream from station; fixed crest dam.



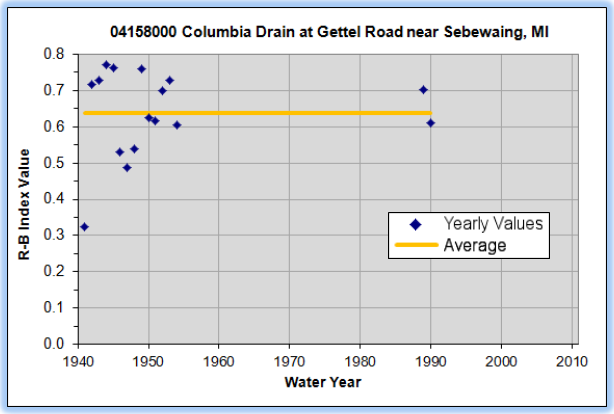
USGS Gage 04156500, Tittabawassee River at Freeland, MI

- Drainage Area (square miles): 2530
- Basin Number: 32
- Characteristic R-B Index Value: 0.189
- Rank: Highest
- First Water Year: 1931
- Last Water Year: 1936
- Number of Water Years Analyzed: 6



USGS Gage 04157500, Sebewaing River State Drain near Sebewaing, MI

- Drainage Area (square miles): 67.3
- Basin Number: 33
- Characteristic R-B Index Value: 0.630
- Rank: Highest
- First Water Year: 1940
- Last Water Year: 1954
- Number of Water Years Analyzed: 15

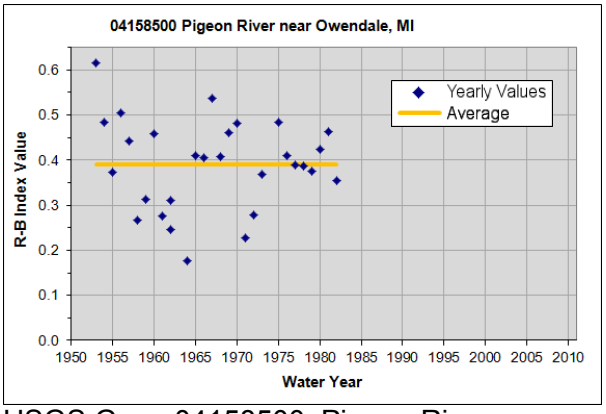


USGS Gage 04158000, Columbia Drain at Gettel Road near Sebewaing, MI

- Drainage Area (square miles): 33.9
- Basin Number: 33
- Characteristic R-B Index Value: 0.638
- Rank: Highest
- First Water Year: 1941
- Last Water Year: 1990
- Number of Water Years Analyzed: 16

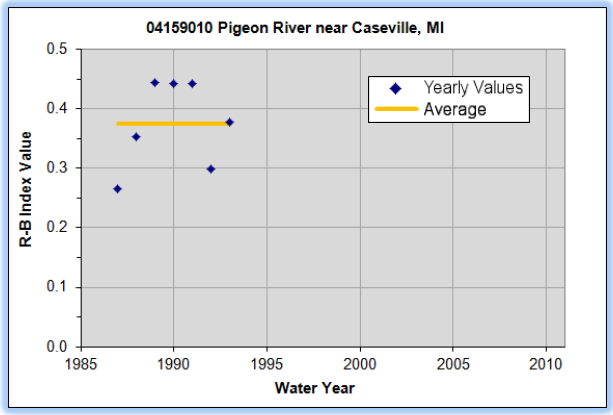
Comments: Some regulation by dam at Michigan Sugar Company 1.9 miles upstream from station.

Streams Tributary to Lake Huron (cont.)



USGS Gage 04158500, Pigeon River near Owendale, MI

- Drainage Area (square miles): 53.2
- Basin Number: 26
- Characteristic R-B Index Value: 0.390
- Rank: Highest
- First Water Year: 1953
- Last Water Year: 1982
- Number of Water Years Analyzed: 21

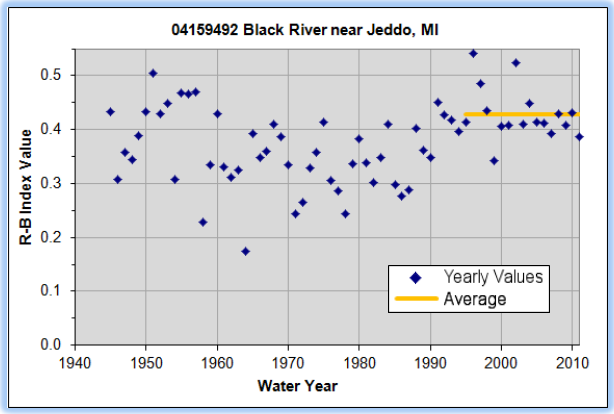


USGS Gage 04159010, Pigeon River near Caseville, MI

- Drainage Area (square miles): 125
- Basin Number: 26
- Characteristic R-B Index Value: 0.375
- Rank: Highest
- First Water Year: 1987
- Last Water Year: 1993
- Number of Water Years Analyzed: 7

Comments: Some diversions at low flows for agricultural irrigation.

Streams Tributary to St. Clair River



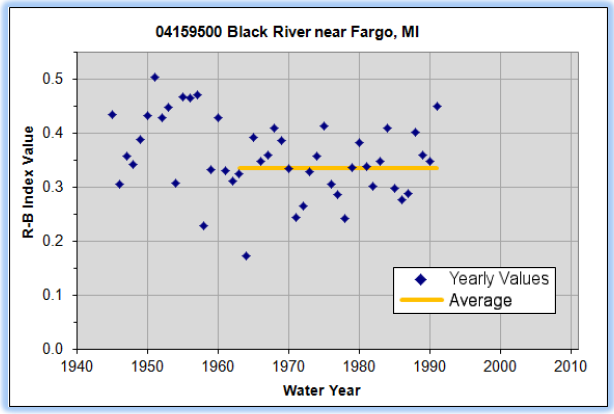
USGS Gage 04159492, Black River near Jeddo, MI

- Drainage Area (square miles): 464
- Basin Number: 6
- Characteristic R-B Index Value: 0.429
- Rank: Highest
- First Water Year: 1945
- Last Water Year: 2011
- Number of Water Years Analyzed: 17

Comments:

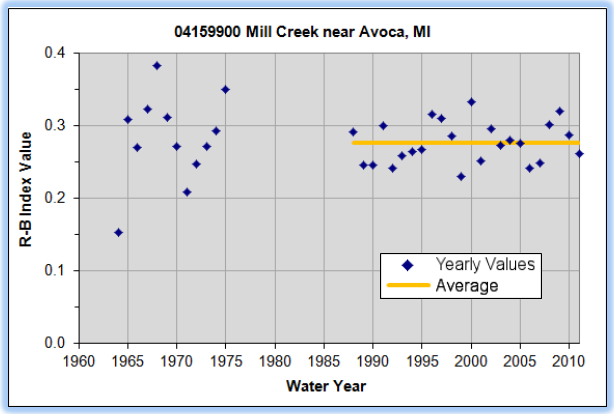
- Diurnal fluctuation principally during low flow, caused by an unknown source upstream from station.
- Initially published an increasing trend for this gage. Additional data revises the analysis to no trend for this report update.

Streams Tributary to St. Clair River (cont.)



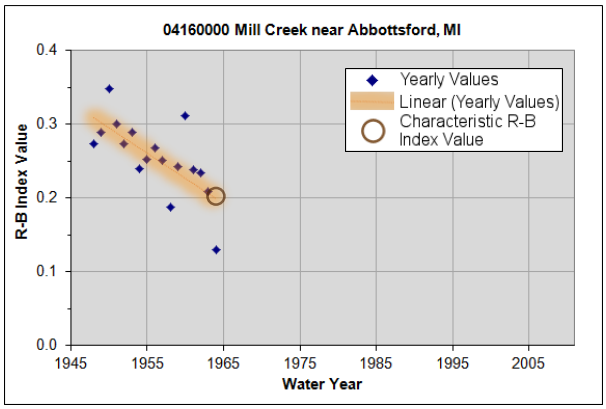
USGS Gage 04159500, Black River near Fargo, MI

- Drainage Area (square miles): 480
- Basin Number: 6
- Characteristic R-B Index Value: 0.335
- Rank: Highest
- First Water Year: 1945
- First Water Year Analyzed, if different: 1963
- Last Water Year: 1991
- Number of Water Years Analyzed: 29



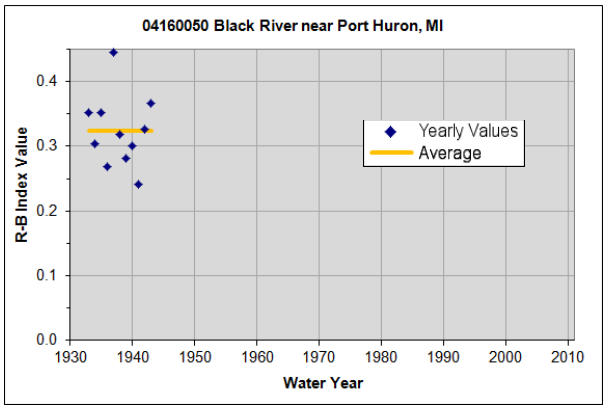
USGS Gage 04159900, Mill Creek near Avoca, MI

- Drainage Area (square miles): 169
- Basin Number: 6
- Characteristic R-B Index Value: 0.279
- Rank: Highest
- First Water Year: 1964
- First Water Year Analyzed, if different: 1988
- Last Water Year: 2011
- Number of Water Years Analyzed: 24



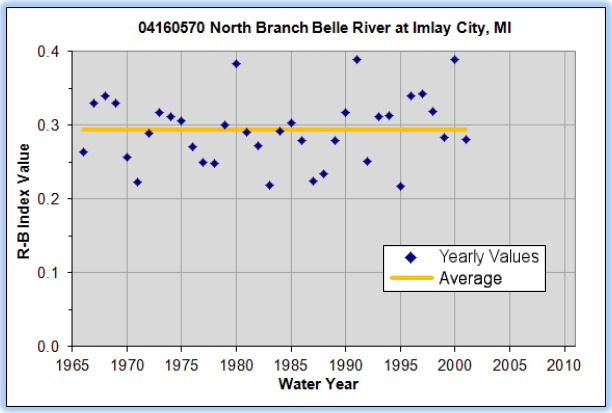
USGS Gage 04160000, Mill Creek near Abbottsford, MI

- Drainage Area (square miles): 208
- Basin Number: 6
- Characteristic R-B Index Value: 0.200
- Rank: Highest
- p value: 0.00
- First Water Year: 1948
- Last Water Year: 1964
- Number of Water Years Analyzed: 17



USGS Gage 04160050, Black River near Port Huron, MI

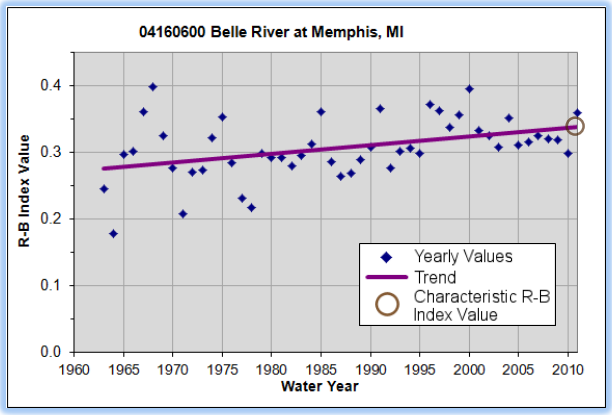
- Drainage Area (square miles): 684
- Basin Number: 6
- Characteristic R-B Index Value: 0.323
- Rank: Highest
- First Water Year: 1933
- Last Water Year: 1943
- Number of Water Years Analyzed: 11



USGS Gage 04160570, North Branch Belle River at Imlay City, MI

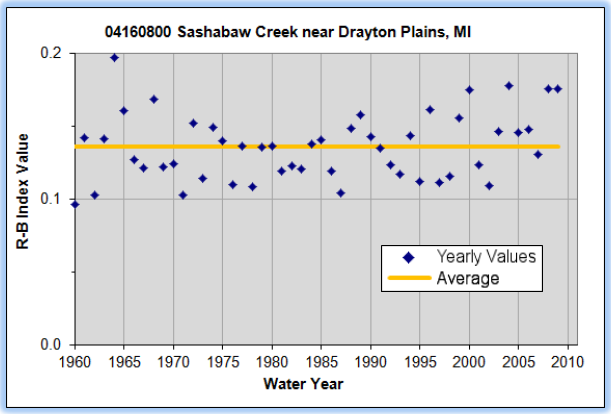
- Drainage Area (square miles): 18
- Basin Number: 3
- Characteristic R-B Index Value: 0.294
- Rank: Lower Middle
- First Water Year: 1966
- Last Water Year: 2011
- Number of Water Years Analyzed: 36

Comments: Some diversion by pumping for sprinkler irrigation.



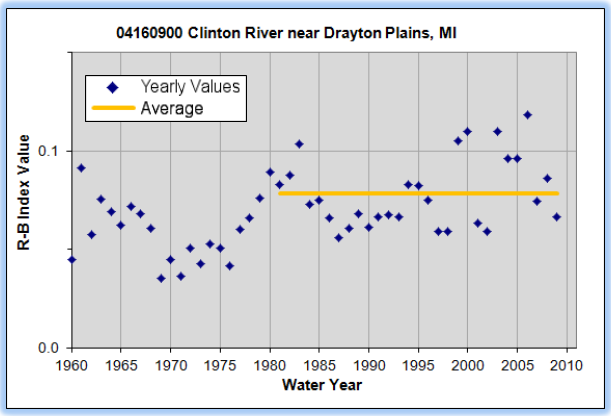
USGS Gage 04160600, Belle River at Memphis, MI

- Drainage Area (square miles): 151
- Basin Number: 3
- Characteristic R-B Index Value: 0.338
- Rank: Highest
- Trend: increase, p value: 0.00
- First Water Year: 1963
- Last Water Year: 2001
- Number of Water Years Analyzed: 49



USGS Gage 04160800, Sashabaw Creek near Drayton Plains, MI

- Drainage Area (square miles): 20.9
- Basin Number: 12
- Characteristic R-B Index Value: 0.136
- Rank: Lowest
- First Water Year: 1960
- Last Water Year: 2009
- Number of Water Years Analyzed: 50

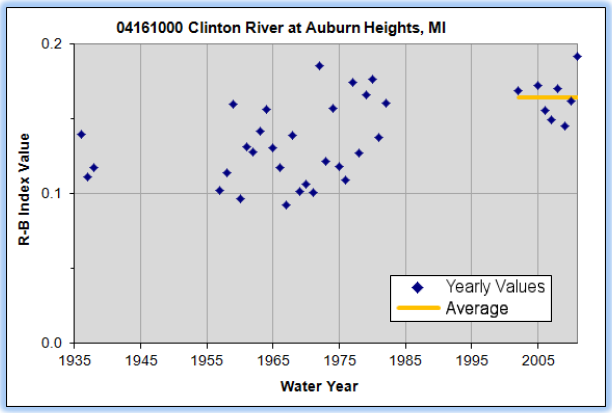


USGS Gage 04160900, Clinton River near Drayton Plains, MI

- Drainage Area (square miles): 79.2
- Basin Number: 12
- Characteristic R-B Index Value: 0.079
- Rank: Lowest
- First Water Year: 1960
- First Water Year Analyzed, if different: 1981
- Last Water Year: 2009
- Number of Water Years Analyzed: 29

Comments: Some regulation and occasional diversion for lake-level control at many lakes upstream from station.

Streams Tributary to Lake St. Clair (cont.)

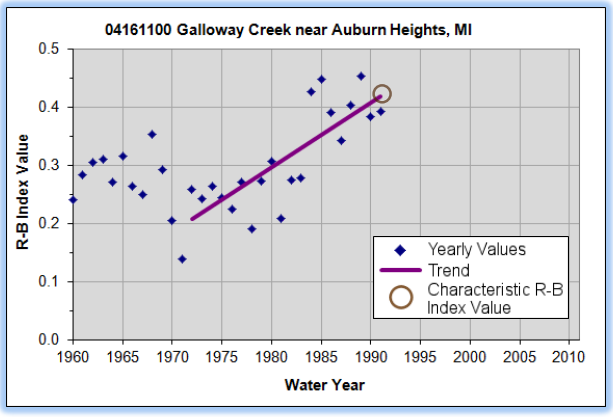


USGS Gage 04161000, Clinton River at Auburn Heights, MI

- Drainage Area (square miles): 123
- Basin Number: 12
- Characteristic R-B Index Value: 0.164
- Rank: Upper Middle
- First Water Year: 1936
- First Water Year Analyzed, if different: 2002
- Last Water Year: 2011
- Number of Water Years Analyzed: 8

Comments:

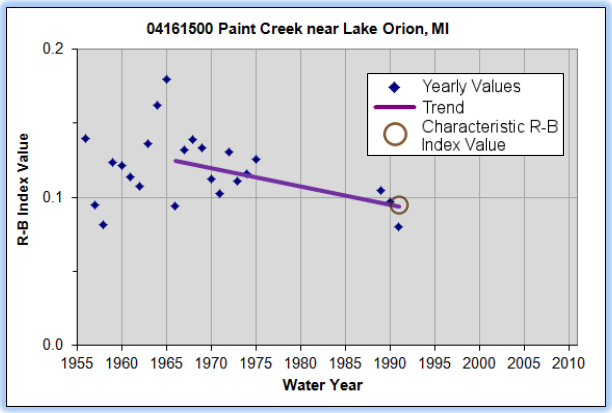
- Some regulation by many lakes upstream from station. Flow includes sewage effluent, most of which originates from sources outside the Basin.
- Initially published an increasing trend for this gage. Additional data revises the analysis to no trend for this report update.



USGS Gage 04161100, Galloway Creek near Auburn Heights, MI

- Drainage Area (square miles): 17.9
- Basin Number: 12
- Characteristic R-B Index Value: 0.419
- Rank: Upper Middle
- Trend: increase, p value: 0.00
- First Water Year: 1960
- First Water Year Analyzed, if different: 1972
- Last Water Year: 1991
- Number of Water Years Analyzed: 20

Streams Tributary to Lake St. Clair (cont.)

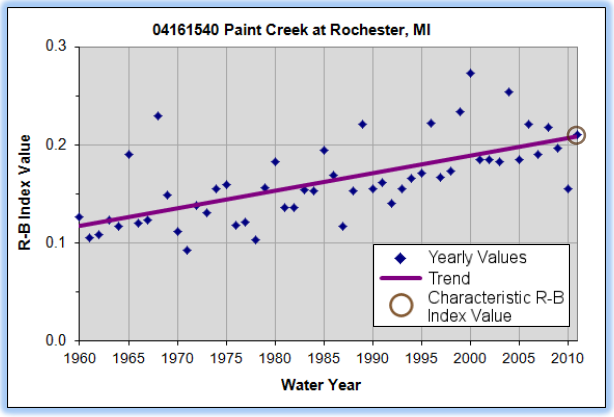


USGS Gage 04161500, Paint Creek near Lake Orion, MI

- Drainage Area (square miles): 38.5
- Basin Number: 12
- Characteristic R-B Index Value: 0.094
- Rank: Lowest
- Trend: decrease, p value: 0.02
- First Water Year: 1956
- First Water Year Analyzed, if different: 1966
- Last Water Year: 1991
- Number of Water Years Analyzed: 13

Comments:

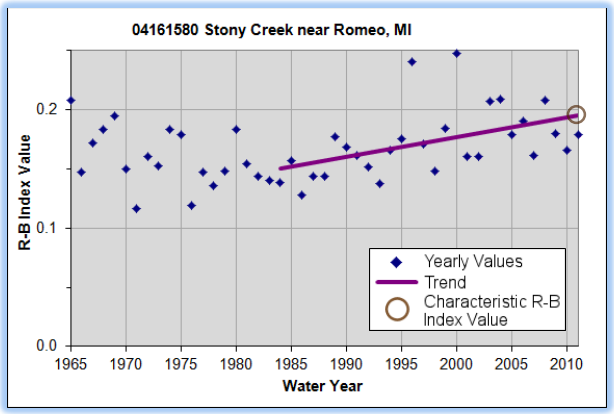
- Occasional regulation by Lake Orion.
- Initially published no trend for this gage. Cusum analysis revises the analysis to a decreasing trend for this report update.



USGS Gage 04161540, Paint Creek at Rochester, MI

- Drainage Area (square miles): 70.9
- Basin Number: 12
- Characteristic R-B Index Value: 0.209
- Rank: Upper Middle
- Trend: increase, p value: 0.00
- First Water Year: 1960
- Last Water Year: 2011
- Number of Water Years Analyzed: 52

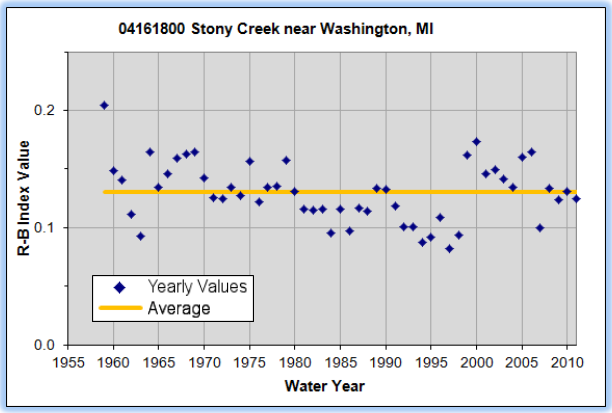
Comments: Occasional regulation by Lake Orion.



USGS Gage 04161580, Stony Creek near Romeo, MI

- Drainage Area (square miles): 25.6
- Basin Number: 12
- Characteristic R-B Index Value: 0.195
- Rank: Lower Middle
- Trend: increase, p value: 0.01
- First Water Year: 1965
- First Water Year Analyzed, if different: 1984
- Last Water Year: 2011
- Number of Water Years Analyzed: 28

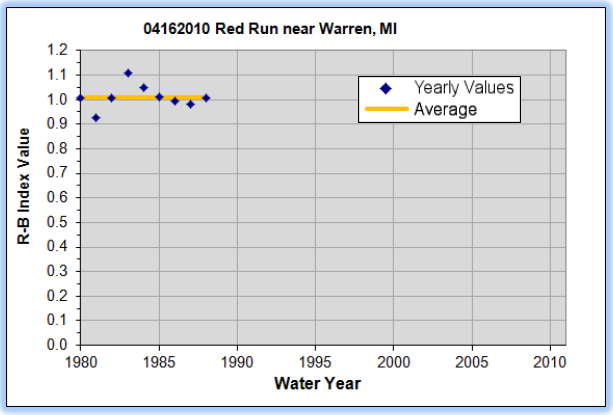
Streams Tributary to Lake St. Clair (cont.)



USGS Gage 04161800, Stony Creek near Washington, MI

- Drainage Area (square miles): 68.2
- Basin Number: 12
- Characteristic R-B Index Value: 0.130
- Rank: Lower Middle
- First Water Year: 1959
- Last Water Year: 2011
- Number of Water Years Analyzed: 53

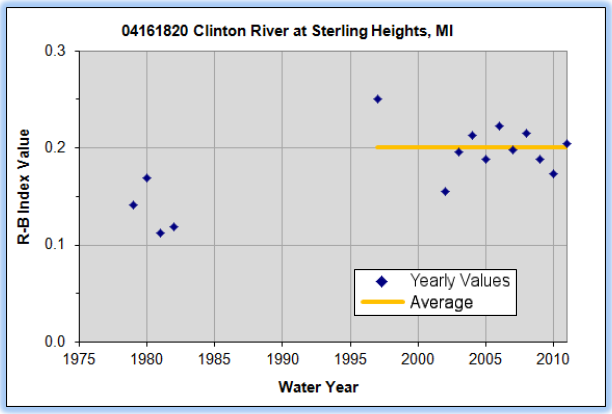
Comments: Occasional diurnal fluctuation caused by mills upstream from station prior to February 1963, occasional regulation by Stony Lake since.



USGS Gage 04162010, Red Run near Warren, MI

- Drainage Area (square miles): 34.2
- Basin Number: 12
- Characteristic R-B Index Value: 1.009
- Rank: Highest
- First Water Year: 1980
- Last Water Year: 1988
- Number of Water Years Analyzed: 9

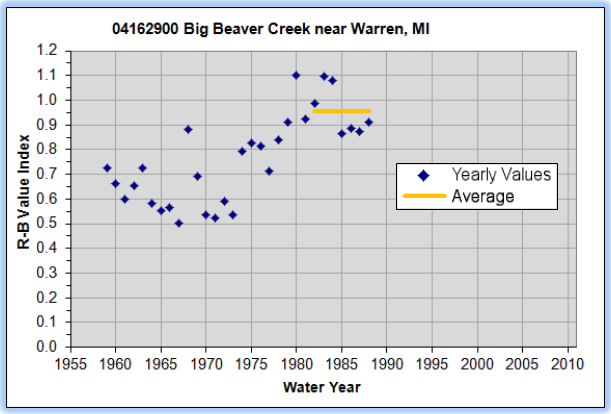
Comments: Diversions from Big Beaver Creek Basin via Henry-Graham Drain started in 1976 is ongoing and increasing with further development of new drains.



USGS Gage 04161820, Clinton River at Sterling Heights, MI

- Drainage Area (square miles): 309
- Basin Number: 12
- Characteristic R-B Index Value: 0.201
- Rank: Highest
- First Water Year: 1979
- First Water Year Analyzed, if different: 1997
- Last Water Year: 2011
- Number of Water Years Analyzed: 11

Streams Tributary to Lake St. Clair (cont.)

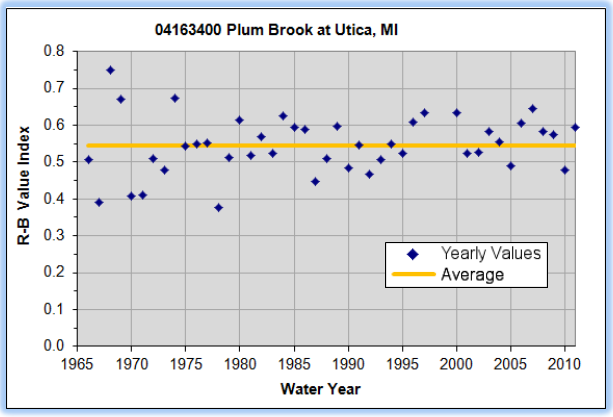


USGS Gage 04162900, Big Beaver Creek near Warren, MI

- Drainage Area (square miles): 23.5
- Basin Number: 12
- Characteristic R-B Index Value: 0.957
- Rank: Highest
- First Water Year: 1959
- First Water Year Analyzed, if different: 1982
- Last Water Year: 1988
- Number of Water Years Analyzed: 7

Comments:

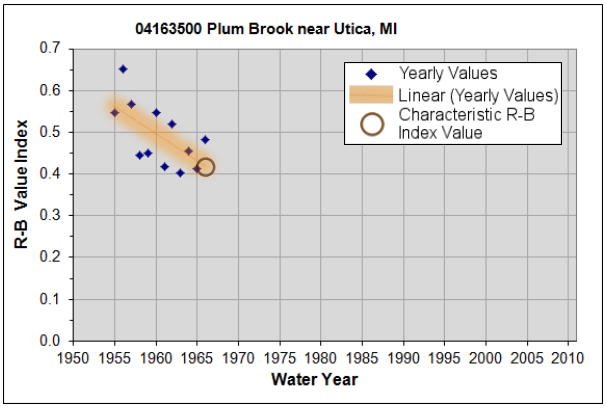
- Diversions from the Henry-Graham Drain started in 1976 is ongoing and increasing with further development for new drains.
- Initially published an increasing trend for this gage. Cusum analysis revises the analysis to no trend for this report update.



USGS Gage 04163400, Plum Brook at Utica, MI

- Drainage Area (square miles): 16.5
- Basin Number: 12
- Characteristic R-B Index Value: 0.546
- Rank: Highest
- First Water Year: 1966
- Last Water Year: 2011
- Number of Water Years Analyzed: 44

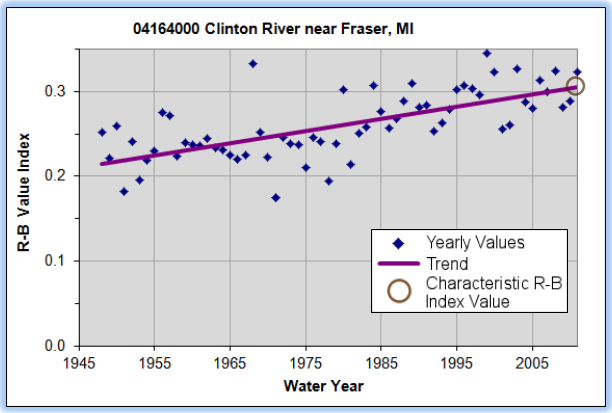
Comments: Prior to 1998 occasional diversion for sprinkler irrigation.



USGS Gage 04163500, Plum Brook near Utica, MI

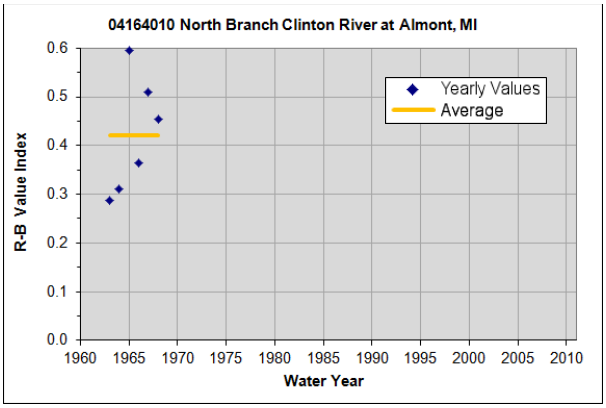
- Drainage Area (square miles): 22.9
- Basin Number: 12
- Characteristic R-B Index Value: 0.419
- Rank: Upper Middle
- p value: 0.03
- First Water Year: 1955
- Last Water Year: 1966
- Number of Water Years Analyzed: 12

Streams Tributary to Lake St. Clair (cont.)



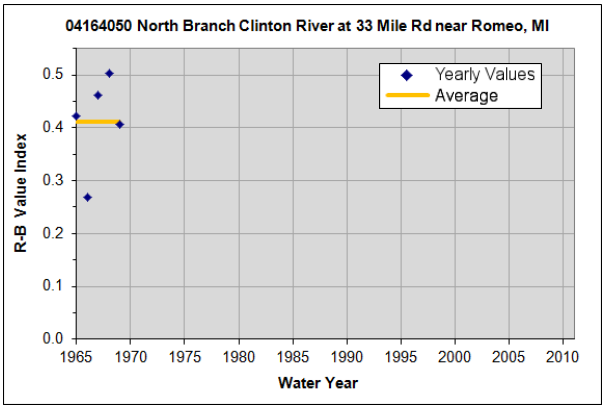
USGS Gage 04164000, Clinton River near Fraser, MI

- Drainage Area (square miles): 444
- Basin Number: 12
- Characteristic R-B Index Value: 0.305
- Rank: Highest
- Trend: increase, p value: 0.00
- First Water Year: 1948
- Last Water Year: 2011
- Number of Water Years Analyzed: 65



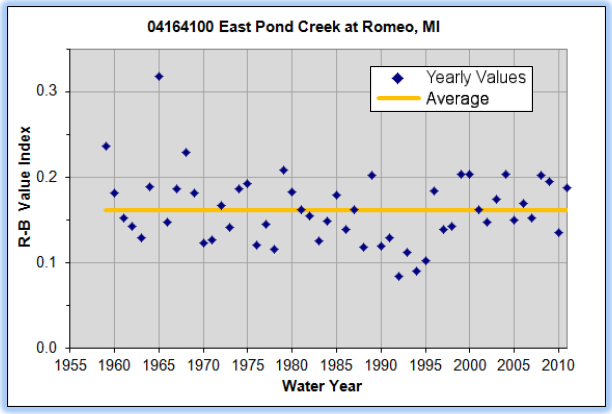
USGS Gage 04164010, North Branch Clinton River at Almont, MI

- Drainage Area (square miles): 10
- Basin Number: 12
- Characteristic R-B Index Value: 0.420
- Rank: Upper Middle
- First Water Year: 1963
- Last Water Year: 1968
- Number of Water Years Analyzed: 6



USGS Gage 04164050, North Branch Clinton River at 33 Mile Road near Romeo, MI

- Drainage Area (square miles): 49.7
- Basin Number: 12
- Characteristic R-B Index Value: 0.412
- Rank: Highest
- First Water Year: 1965
- Last Water Year: 1969
- Number of Water Years Analyzed: 5

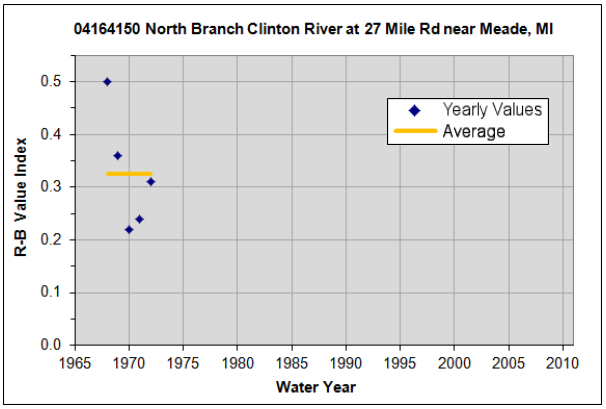


USGS Gage 04164100, East Pond Creek at Romeo, MI

- Drainage Area (square miles): 21.8
- Basin Number: 12
- Characteristic R-B Index Value: 0.162
- Rank: Lower Middle
- First Water Year: 1959
- Last Water Year: 2011
- Number of Water Years Analyzed: 53

Comments: Occasional regulation upstream from station.

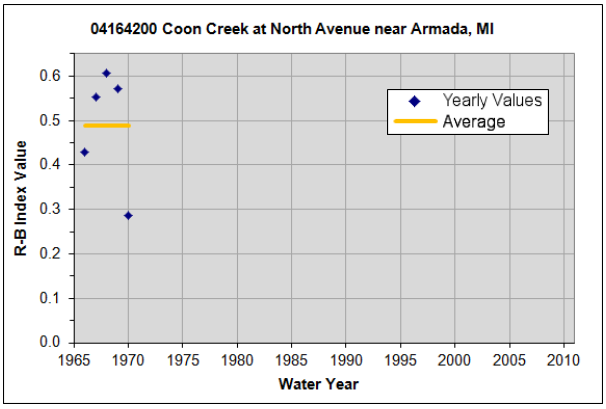
Streams Tributary to Lake St. Clair (cont.)



USGS Gage 04164150, North Branch Clinton River at 27 Mile Road near Meade, MI

- Drainage Area (square miles): 89.6
- Basin Number: 12
- Characteristic R-B Index Value: 0.325
- Rank: Highest
- First Water Year: 1968
- Last Water Year: 1972
- Number of Water Years Analyzed: 5

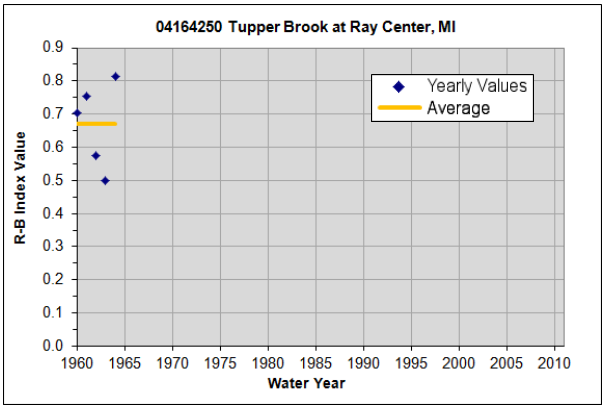
Comments: Occasional regulation at low flow by Mill Pond above station.



USGS Gage 04164200, Coon Creek at North Avenue near Armada, MI

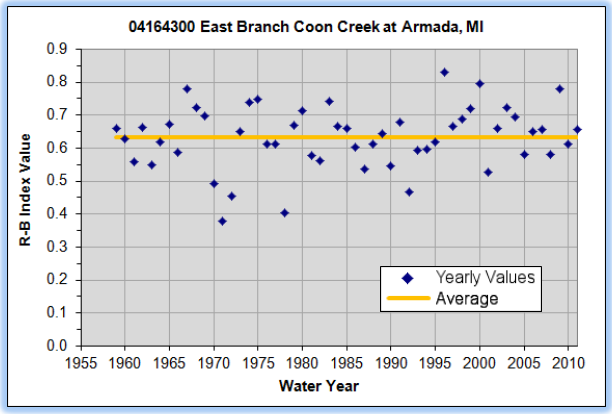
- Drainage Area (square miles): 9.56
- Basin Number: 12
- Characteristic R-B Index Value: 0.489
- Rank: Upper Middle
- First Water Year: 1966
- Last Water Year: 1970
- Number of Water Years Analyzed: 5

Comments: Occasional diversion for sprinkler irrigation.



USGS Gage 04164250, Tupper Brook at Ray Center, MI

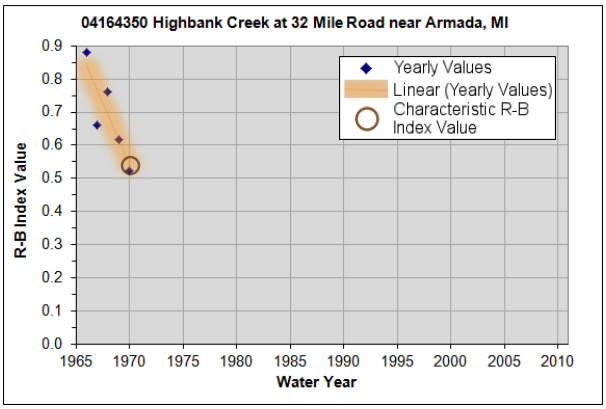
- Drainage Area (square miles): 8.62
- Basin Number: 12
- Characteristic R-B Index Value: 0.669
- Rank: Highest
- First Water Year: 1960
- Last Water Year: 1964
- Number of Water Years Analyzed: 5



USGS Gage 04164300, East Branch Coon Creek at Armada, MI

- Drainage Area (square miles): 13
- Basin Number: 12
- Characteristic R-B Index Value: 0.633
- Rank: Highest
- First Water Year: 1959
- Last Water Year: 2011
- Number of Water Years Analyzed: 53

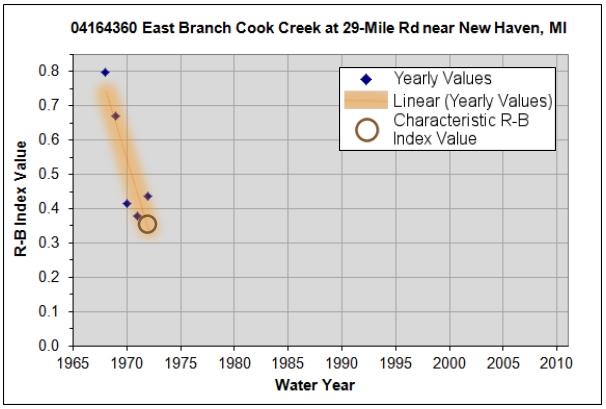
Streams Tributary to Lake St. Clair (cont.)



USGS Gage 04164350, Highbank Creek at 32 Mile Road near Armada, MI

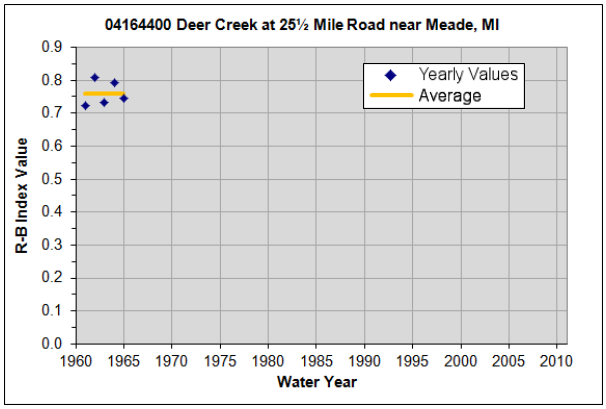
- Drainage Area (square miles): 14.9
- Basin Number: 12
- Characteristic R-B Index Value: 0.537
- Rank: Highest
- p value: 0.05
- First Water Year: 1966
- Last Water Year: 1970
- Number of Water Years Analyzed: 5

Comments: Occasional diversion for sprinkler irrigation.



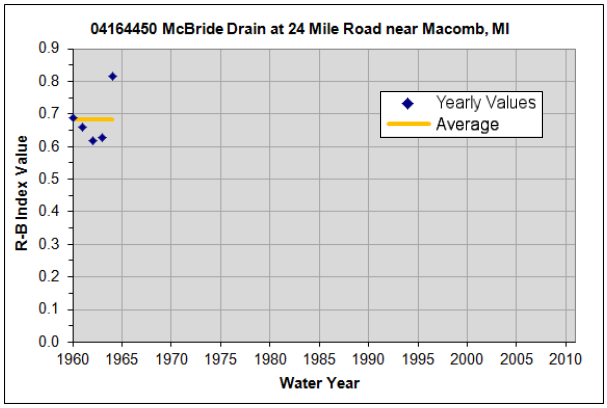
USGS Gage 04164360, East Branch Cook Creek at 29-Mile Road near New Haven, MI

- Drainage Area (square miles): 36.1
- Basin Number: 12
- Characteristic R-B Index Value: 0.336
- Rank: Highest
- p value: 0.05
- First Water Year: 1968
- Last Water Year: 1982
- Number of Water Years Analyzed: 5



USGS Gage 04164400, Deer Creek at 25½ Mile Road near Meade, MI

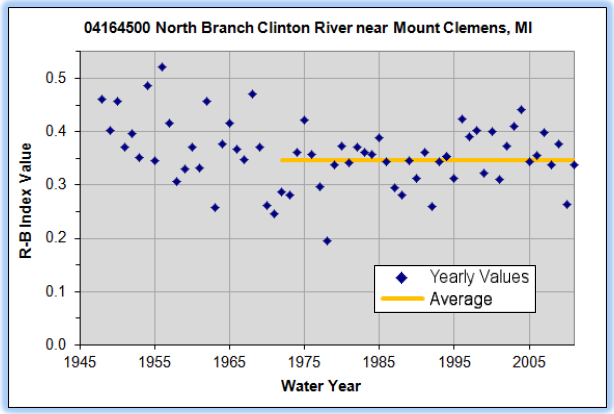
- Drainage Area (square miles): 12.7
- Basin Number: 12
- Characteristic R-B Index Value: 0.760
- Rank: Highest
- First Water Year: 1961
- Last Water Year: 1965
- Number of Water Years Analyzed: 5



USGS Gage 04164450, McBride Drain at 24 Mile Road near Macomb, MI

- Drainage Area (square miles): 5.79
- Basin Number: 12
- Characteristic R-B Index Value: 0.682
- Rank: Highest
- First Water Year: 1960
- Last Water Year: 1964
- Number of Water Years Analyzed: 5

Streams Tributary to Lake St. Clair (cont.)

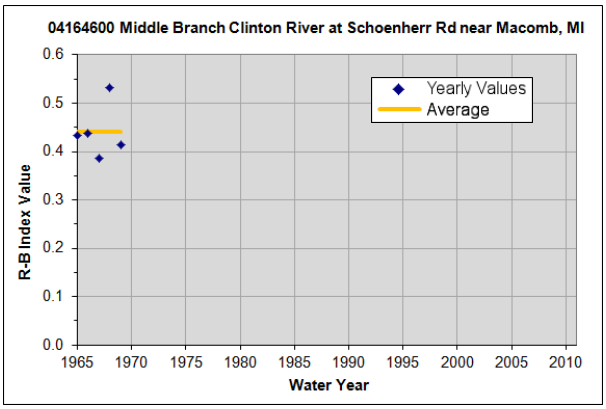


USGS Gage 04164500, North Branch Clinton River near Mount Clemens, MI

- Drainage Area (square miles): 199
- Basin Number: 12
- Characteristic R-B Index Value: 0.346
- Rank: Highest
- First Water Year: 1948
- First Water Year Analyzed, if different: 1972
- Last Water Year: 2011
- Number of Water Years Analyzed: 41

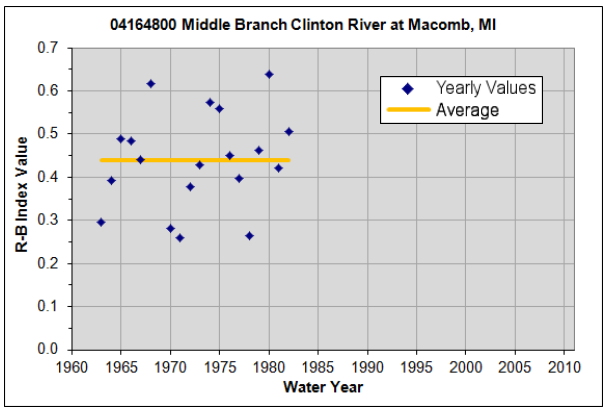
Comments:

- Some regulation by mill upstream.
- Initially published an increasing trend for this gage. Additional data revises the analysis to no trend for this report update.



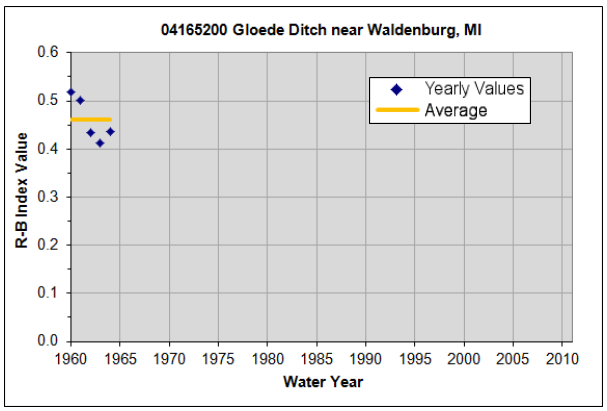
USGS Gage 04164600, Middle Branch Clinton River at Schoenherr Road near Macomb, MI

- Drainage Area (square miles): 22.2
- Basin Number: 12
- Characteristic R-B Index Value: 0.441
- Rank: Upper Middle
- First Water Year: 1965
- Last Water Year: 1969
- Number of Water Years Analyzed: 5



USGS Gage 04164800, Middle Branch Clinton River at Macomb, MI

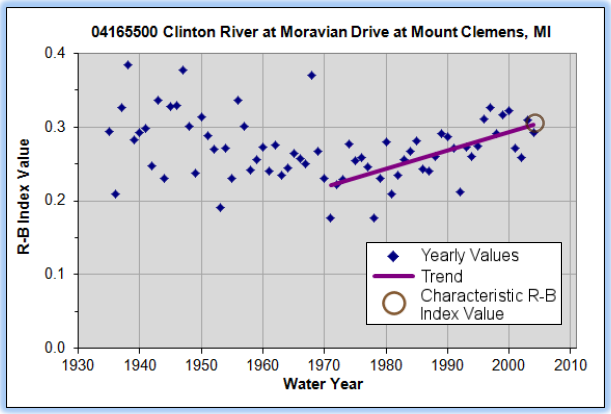
- Drainage Area (square miles): 41
- Basin Number: 12
- Characteristic R-B Index Value: 0.439
- Rank: Highest
- First Water Year: 1963
- Last Water Year: 1982
- Number of Water Years Analyzed: 19



USGS Gage 04165200, Gloede Ditch near Waldenburg, MI

- Drainage Area (square miles): 16
- Basin Number: 12
- Characteristic R-B Index Value: 0.461
- Rank: Upper Middle
- First Water Year: 1960
- Last Water Year: 1964
- Number of Water Years Analyzed: 5

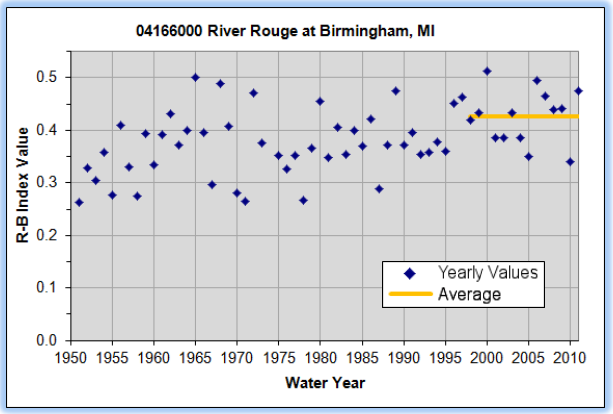
Streams Tributary to Lake St. Clair (cont.)



USGS Gage 04165500, Clinton River at Moravian Drive at Mount Clemens, MI

- Drainage Area (square miles): 734
- Basin Number: 12
- Characteristic R-B Index Value: 0.303
- Rank: Highest
- Trend: increase, p value: 0.00
- First Water Year: 1935
- First Water Year Analyzed, if different: 1971
- Last Water Year: 2004
- Number of Water Years Analyzed: 34

Streams Tributary to Detroit River



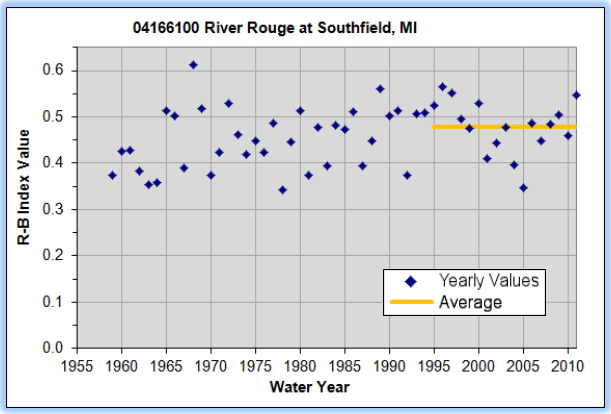
USGS Gage 04166000, River Rouge at Birmingham, MI

- Drainage Area (square miles): 33.3
- Basin Number: 31
- Characteristic R-B Index Value: 0.426
- Rank: Highest
- First Water Year: 1951
- First Water Year Analyzed, if different: 1998
- Last Water Year: 2011
- Number of Water Years Analyzed: 14

Comments:

- Occasional regulation by Quarton Lake upstream from station.
- Initially published an increasing trend for this gage. Additional data revises the analysis to no trend for this report update.

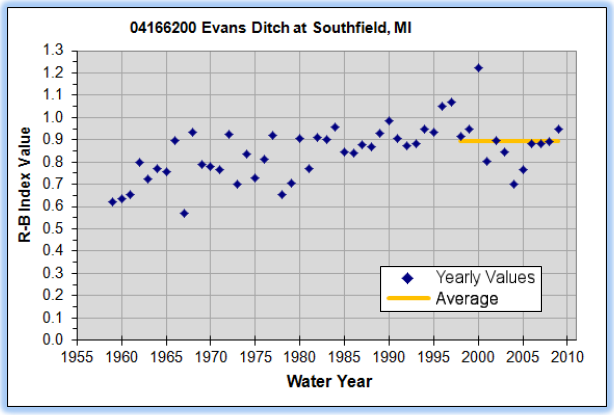
Streams Tributary to Detroit River (cont.)



USGS Gage 04166100, River Rouge at Southfield, MI

- Drainage Area (square miles): 87.9
- Basin Number: 31
- Characteristic R-B Index Value: 0.479
- Rank: Highest
- First Water Year: 1959
- First Water Year Analyzed, if different: 1995
- Last Water Year: 2011
- Number of Water Years Analyzed: 17

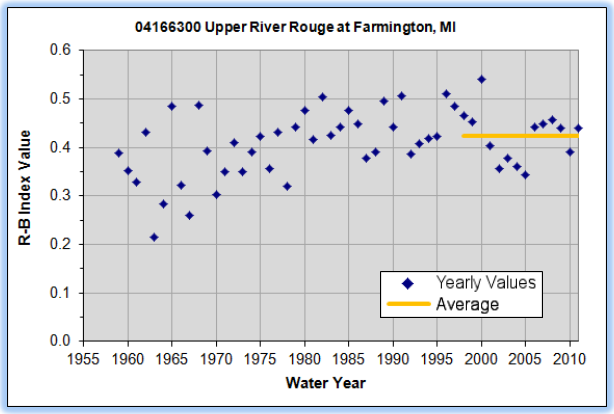
Comments: Initially published an increasing trend for this gage. Additional data revises the analysis to no trend for this report update.



USGS Gage 04166200, Evans Ditch at Southfield, MI

- Drainage Area (square miles): 9.49
- Basin Number: 31
- Characteristic R-B Index Value: 0.892
- Rank: Highest
- First Water Year: 1959
- First Water Year Analyzed, if different: 1998
- Last Water Year: 2009
- Number of Water Years Analyzed: 12

Comments: Initially published an increasing trend for this gage. Additional data revises the analysis to no trend for this report update.

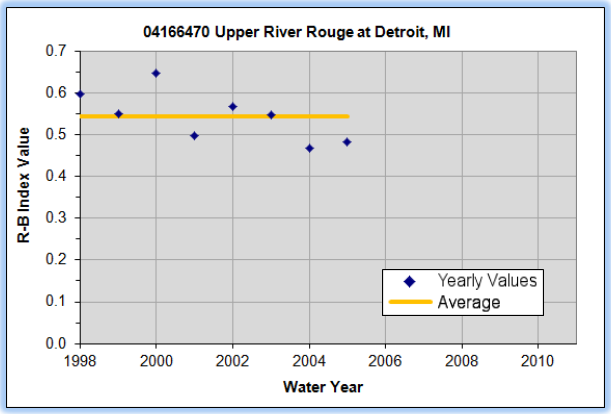


USGS Gage 04166300, Upper River Rouge at Farmington, MI

- Drainage Area (square miles): 17.5
- Basin Number: 31
- Characteristic R-B Index Value: 0.423
- Rank: Upper Middle
- First Water Year: 1959
- First Water Year Analyzed, if different: 1998
- Last Water Year: 2011
- Number of Water Years Analyzed: 14

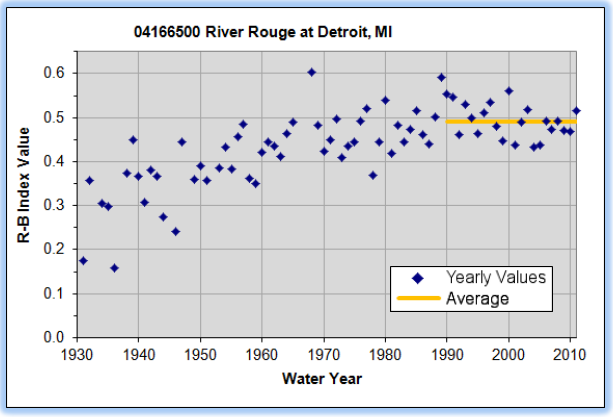
Comments: Initially published an increasing trend for this gage. Additional data revises the analysis to no trend for this report update.

Streams Tributary to Detroit River (cont.)



USGS Gage 04166470, Upper River Rouge at Detroit, MI

- Drainage Area (square miles): 67.3
- Basin Number: 31
- Characteristic R-B Index Value: 0.545
- Rank: Highest
- First Water Year: 1998
- Last Water Year: 2005
- Number of Water Years Analyzed: 8



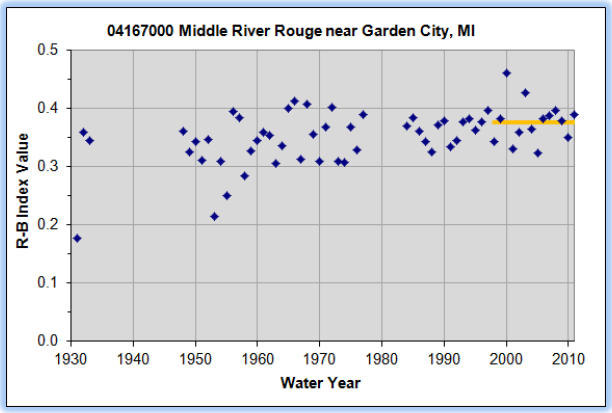
USGS Gage 04166500, River Rouge at Detroit, MI

- Drainage Area (square miles): 187
- Basin Number: 31
- Characteristic R-B Index Value: 0.492
- Rank: Highest
- First Water Year: 1931
- First Water Year Analyzed, if different: 1990
- Last Water Year: 2011
- Number of Water Years Analyzed: 22

Comments:

- Regulation by water retention structure upstream from station and some diversion by pumping for sprinkler irrigation.
- Initially published an increasing trend for this gage. Additional data revises the analysis to no trend for this report update.

Streams Tributary to Detroit River (cont.)

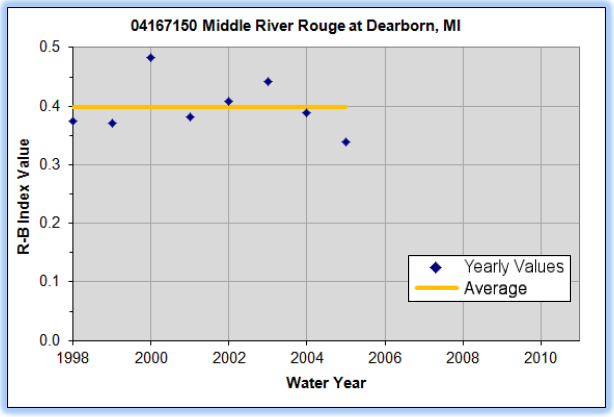


USGS Gage 04167000, Middle River Rouge near Garden City, MI

- Drainage Area (square miles): 99. 9
- Basin Number: 31
- Characteristic R-B Index Value: 0.377
- Rank: Highest
- First Water Year: 1931
- First Water Year Analyzed, if different: 1998
- Last Water Year: 2011
- Number of Water Years Analyzed: 14

Comments:

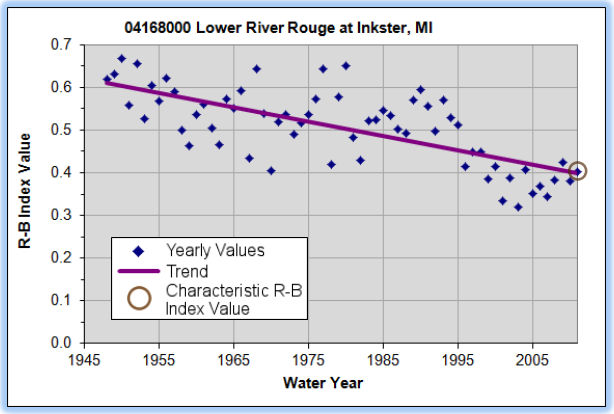
- Regulation by storm water retention structures and occasional regulation by reservoirs upstream of the station since 1956.
- Initially published an increasing trend for this gage. Additional data revises the analysis to no trend for this report update.



USGS Gage 04167150, Middle River Rouge at Dearborn, MI

- Drainage Area (square miles): 110
- Basin Number: 31
- Characteristic R-B Index Value: 0.399
- Rank: Highest
- First Water Year: 1998
- Last Water Year: 2005
- Number of Water Years Analyzed: 8

Comments: Regulation by storm water retention structures and occasional regulation by reservoirs upstream from station.

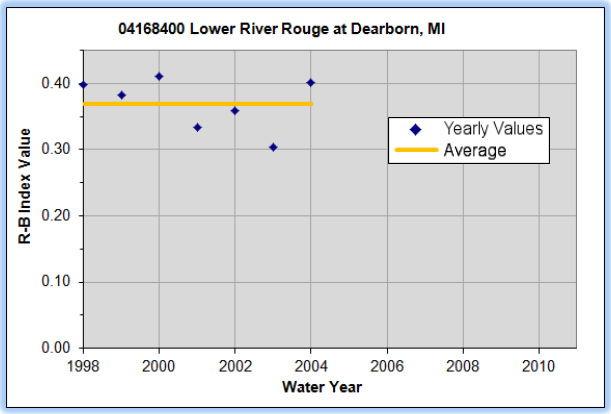


USGS Gage 04168000, Lower River Rouge at Inkster, MI

- Drainage Area (square miles): 83.2
- Basin Number: 31
- Characteristic R-B Index Value: 0.400
- Rank: Highest
- Trend: decrease, p value: 0.00
- First Water Year: 1948
- Last Water Year: 2011
- Number of Water Years Analyzed: 64

Comments: Since 1995 flow contains effluent sewage treatment plant which originates outside the basin.

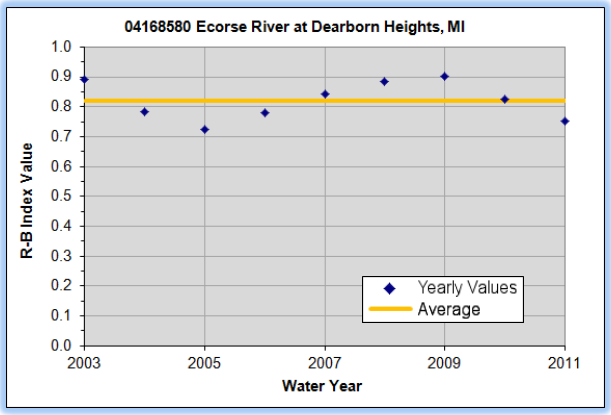
Streams Tributary to Detroit River (cont.)



USGS Gage 04168400, Lower River Rouge at Dearborn, MI

- Drainage Area (square miles): 91
- Basin Number: 31
- Characteristic R-B Index Value: 0.370
- Rank: Highest
- First Water Year: 1998
- Last Water Year: 2004
- Number of Water Years Analyzed: 7

Comments: Flow contains effluent from sewage treatment plant, which originates outside the basin.

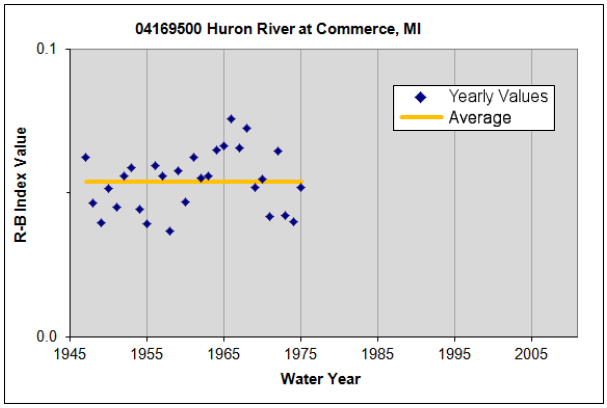


USGS Gage 04168580, Ecorse River at Dearborn Heights, MI

- Drainage Area (square miles): 10
- Basin Number: 31
- Characteristic R-B Index Value: 0.821
- Rank: Highest
- First Water Year: 2003
- Last Water Year: 2011
- Number of Water Years Analyzed: 9

Comments: Gage added for this report update.

Streams Tributary to Lake Erie

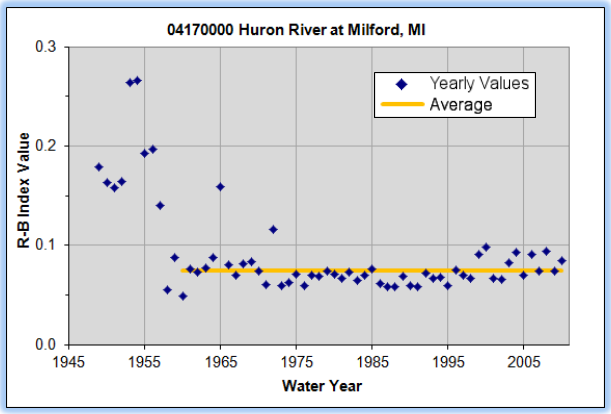


USGS Gage 04169500, Huron River at Commerce, MI

- Drainage Area (square miles): 57.3
- Basin Number: 15
- Characteristic R-B Index Value: 0.054
- Rank: Lowest
- First Water Year: 1947
- Last Water Year: 1975
- Number of Water Years Analyzed: 29

Comments: Some regulation by dams operated for lake level control of Pontiac, Oxbow, and Union Lakes.

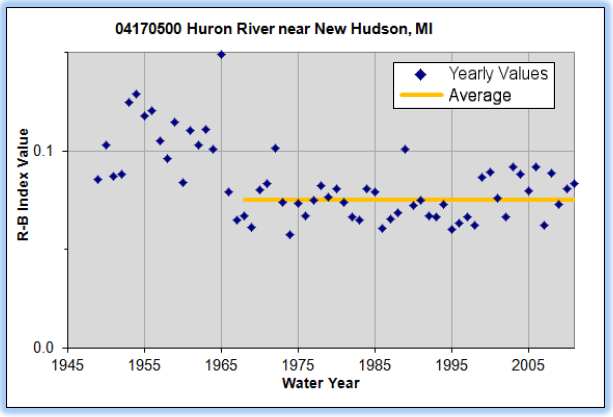
Streams Tributary to Lake Erie (cont.)



USGS Gage 04170000, Huron River at Milford, MI

- Drainage Area (square miles): 132
- Basin Number: 15
- Characteristic R-B Index Value: 0.075
- Rank: Lowest
- First Water Year: 1949
- First Water Year Analyzed, if different: 1960
- Last Water Year: 2011
- Number of Water Years Analyzed: 52

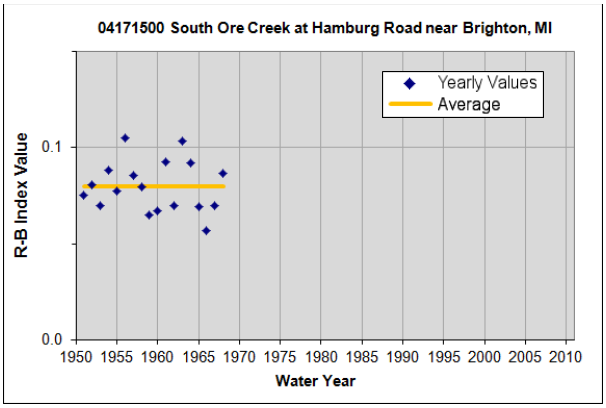
Comments: Flow regulation about 300 cubic feet per second regulated by power plant 1.5 miles upstream from station prior to May 29, 1957. Occasional regulation for lake level control since.



USGS Gage 04170500, Huron River near New Hudson, MI

- Drainage Area (square miles): 148
- Basin Number: 15
- Characteristic R-B Index Value: 0.075
- Rank: Lowest
- First Water Year: 1949
- First Water Year Analyzed, if different: 1968
- Last Water Year: 2011
- Number of Water Years Analyzed: 44

Comments: Occasional regulation by Kent Lake.

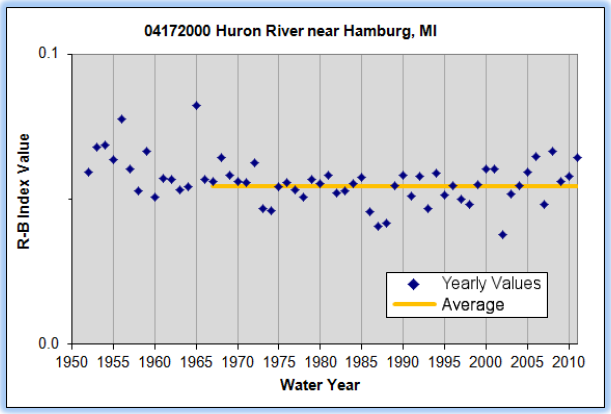


USGS Gage 04171500, South Ore Creek at Hamburg Road near Brighton, MI

- Drainage Area (square miles): 33.7
- Basin Number: 15
- Characteristic R-B Index Value: 0.080
- Rank: Lowest
- First Water Year: 1951
- Last Water Year: 1968
- Number of Water Years Analyzed: 18

Comments: Occasional regulation by lakes above station.

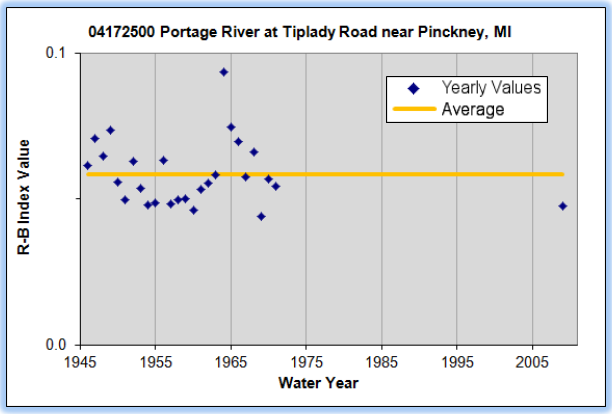
Streams Tributary to Lake Erie (cont.)



USGS Gage 04172000, Huron River near Hamburg, MI

- Drainage Area (square miles): 308
- Basin Number: 15
- Characteristic R-B Index Value: 0.054
- Rank: Lowest
- First Water Year: 1952
- First Water Year Analyzed, if different: 1967
- Last Water Year: 2011
- Number of Water Years Analyzed: 45

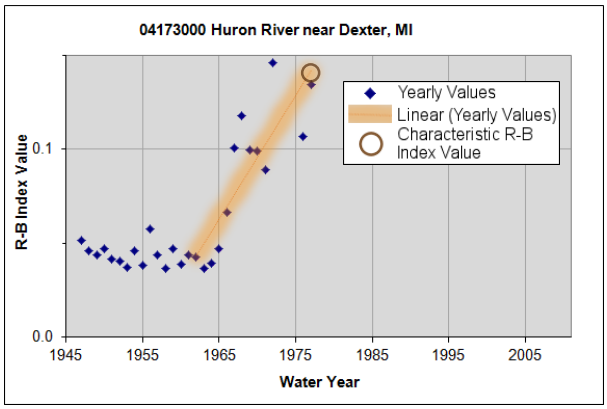
Comments: Occasional regulation by Kent Lake 11 miles upstream.



USGS Gage 04172500, Portage River at Tiplady Road near Pinckney, MI

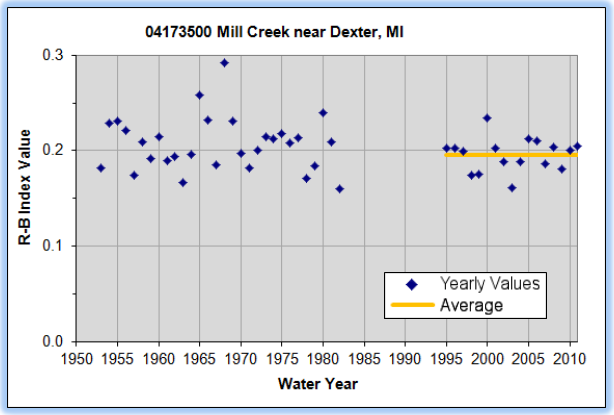
- Drainage Area (square miles): 79.1
- Basin Number: 15
- Characteristic R-B Index Value: 0.058
- Rank: Lowest
- First Water Year: 1946
- Last Water Year: 2009
- Number of Water Years Analyzed: 27

Comments: Regulation by Hiland Lake 2.5 miles above station. Data point for 2009 is from MDEQ data.



USGS Gage 04173000, Huron River near Dexter, MI

- Drainage Area (square miles): 522
- Basin Number: 15
- Characteristic R-B Index Value: 0.143
- Rank: Upper Middle
- p value: 0.00
- First Water Year: 1947
- First Water Year Analyzed, if different: 1962
- Last Water Year: 1977
- Number of Water Years Analyzed: 13

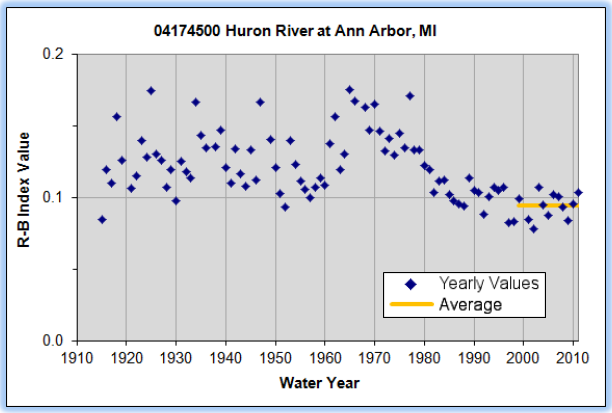


USGS Gage 04173500, Mill Creek near Dexter, MI

- Drainage Area (square miles): 128
- Basin Number: 15
- Characteristic R-B Index Value: 0.196
- Rank: Highest
- First Water Year: 1953
- First Water Year Analyzed, if different: 1995
- Last Water Year: 2011
- Number of Water Years Analyzed: 17

Comments: Initially published a decreasing trend for this gage. Additional data revises the analysis to no trend for this report update.

Streams Tributary to Lake Erie (cont.)

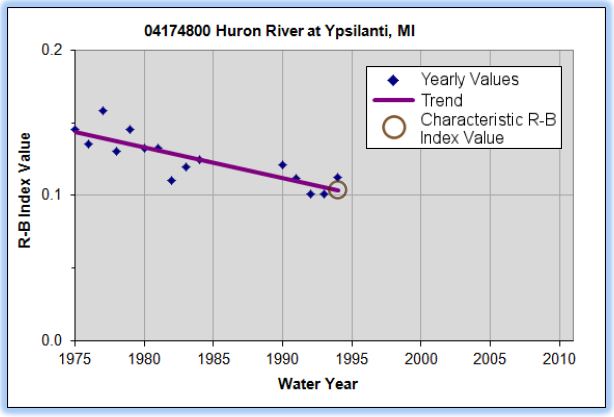


USGS Gage 04174500, Huron River at Ann Arbor, MI

- Drainage Area (square miles): 729
- Basin Number: 15
- Characteristic R-B Index Value: 0.094
- Rank: Lower Middle
- First Water Year: 1915
- First Water Year Analyzed, if different: 1999
- Last Water Year: 2011
- Number of Water Years Analyzed: 12

Comments:

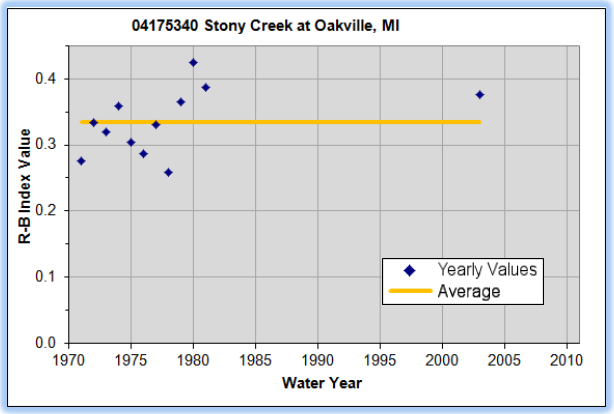
- Prior to 1955 diversion upstream from station from Ann Arbor municipal supply had negligible effect on natural flow, annual mean discharge and runoff figures adjusted for diversion from 1955 to 1991. Flow regulation by power plants prior to May 1962. From June 1962 to 1975 occasional regulation for lake level control operations upstream from station. Since 1975 extensive regulation of flow exists due to automation of gates at dams upstream from station.
- Initially published a decreasing trend for this gage. Additional data revises the analysis to no trend for this report update.



USGS Gage 04174800, Huron River at Ypsilanti, MI

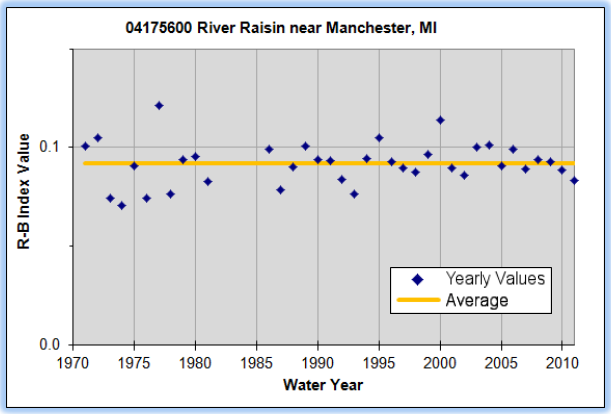
- Drainage Area (square miles): 807
- Basin Number: 15
- Characteristic R-B Index Value: 0.104
- Rank: Lower Middle
- Trend: decrease, p value: 0.00
- First Water Year: 1975
- Last Water Year: 1994
- Number of Water Years Analyzed: 15

Comments: Considerable regulation caused by many dams upstream from station.



USGS Gage 04175340, Stony Creek at Oakville, MI

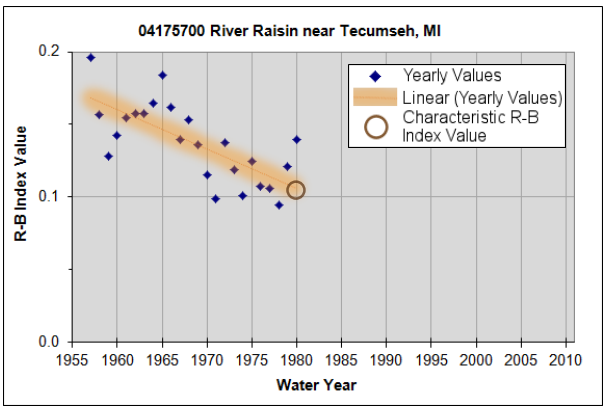
- Drainage Area (square miles): 68
- Basin Number: 35
- Characteristic R-B Index Value: 0.335
- Rank: Highest
- First Water Year: 1971
- Last Water Year: 2003
- Number of Water Years Analyzed: 12



USGS Gage 04175600, River Raisin near Manchester, MI

- Drainage Area (square miles): 132
- Basin Number: 29
- Characteristic R-B Index Value: 0.092
- Rank: Lower Middle
- First Water Year: 1971
- Last Water Year: 2011
- Number of Water Years Analyzed: 37

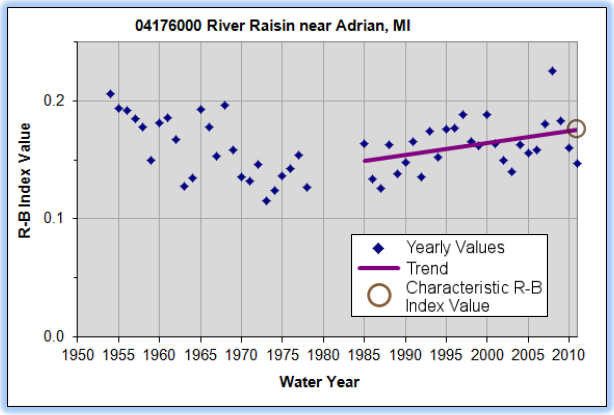
Comments: Occasional regulation caused by many dams upstream from station.



USGS Gage 04175700, River Raisin near Tecumseh, MI

- Drainage Area (square miles): 267
- Basin Number: 29
- Characteristic R-B Index Value: 0.106
- Rank: Upper Middle
- p value: 0.00
- First Water Year: 1957
- Last Water Year: 1980
- Number of Water Years Analyzed: 24

Comments: Diurnal fluctuation caused by power plant 5.5 miles above station prior to June 27, 1968.

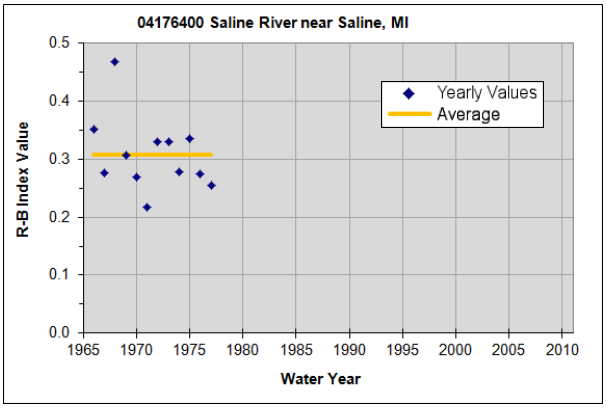


USGS Gage 04176000, River Raisin near Adrian, MI

- Drainage Area (square miles): 463
- Basin Number: 29
- Characteristic R-B Index Value: 0.176
- Rank: Highest
- Trend: increase, p value: 0.04
- First Water Year: 1954
- First Water Year Analyzed, if different: 1972
- Last Water Year: 2011
- Number of Water Years Analyzed: 27

Comments: Diurnal fluctuation caused by power plant at Tecumseh, 11 miles upstream from station prior to June 27, 1968 occasional regulation since.

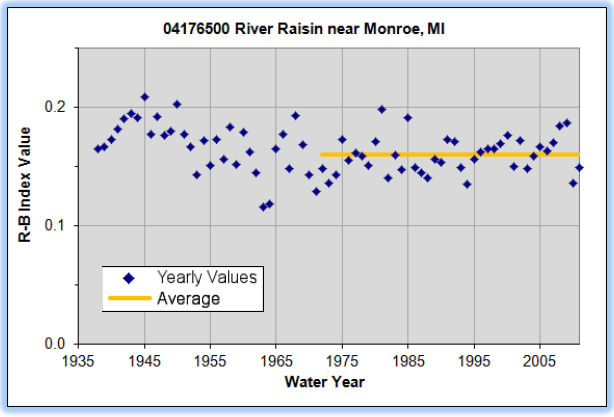
Streams Tributary to Lake Erie (cont.)



USGS Gage 04176400, Saline River near Saline, MI

- Drainage Area (square miles): 94.6
- Basin Number: 29
- Characteristic R-B Index Value: 0.308
- Rank: Highest
- First Water Year: 1966
- Last Water Year: 1977
- Number of Water Years Analyzed: 12

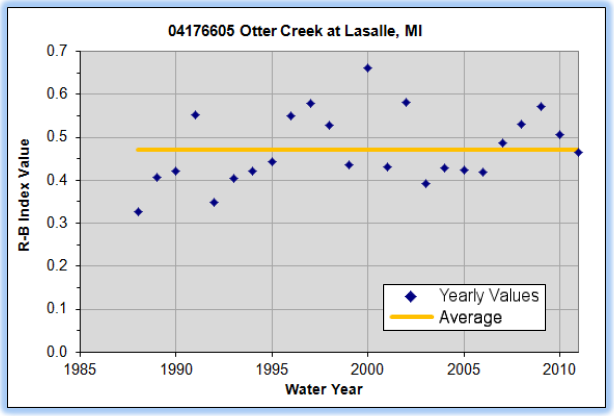
Comments: Slight regulation for lake level control. Pumpage for irrigation diverts an indeterminate amount of water. Saline's sewage effluent, which originates as ground water, is included in flow.



USGS Gage 04176500, River Raisin near Monroe, MI

- Drainage Area (square miles): 1042
- Basin Number: 29
- Characteristic R-B Index Value: 0.160
- Rank: Highest
- First Water Year: 1938
- First Water Year Analyzed, if different: 1972
- Last Water Year: 2011
- Number of Water Years Analyzed: 40

Comments: Diurnal fluctuation caused by power plants upstream from station prior to June 27, 1968. At times flow is affected by irrigation pumpage.



USGS Gage 04176605, Otter Creek at Lasalle, MI

- Drainage Area (square miles): 51
- Basin Number: 29
- Characteristic R-B Index Value: 0.471
- Rank: Highest
- First Water Year: 1988
- Last Water Year: 2011
- Number of Water Years Analyzed: 24

Statistical Analysis Summary

Details of the R-B flashiness statistical analysis for each gaged site are provided in Table 9. The sites are ordered by gage number, which places them in the following order:

1. Streams Tributary to Lake Superior
2. Streams Tributary to Lake Michigan, Upper Peninsula
3. Streams Tributary to Lake Michigan, Southern Lower Peninsula
4. Streams Tributary to Lake Michigan, Northern Lower Peninsula
5. Streams Tributary to Lake Huron
6. Streams Tributary to St. Clair River
7. Streams Tributary to Lake St. Clair
8. Streams Tributary to Detroit River
9. Streams Tributary to Lake Erie

Table 9 lists R-B Index values and related statistics as calculated for all of the data and also as calculated for a selected portion of the data for those gages where cusum analysis indicated a trend change in the data. Total Water Years may be less than the ending water year minus the starting water year because of gaps in the data. The flashiness trend in the table is based on the trend slopes. Statistical significance is based on the 'p' value of the regression line. A p value of 0.05 or less equates to 95 percent statistical significance. The table also includes the major watershed number, as shown on the map of Michigan's Major Watersheds, Appendix B, or https://www.michigan.gov/-/media/Project/Websites/egle/Documents/Programs/WRD/Hydrologic-Data/Michigan-watersheds.pdf.

Table 9 - R-B Flashiness Statistical Analysis Details – Ordered by Gage Number.

Gage Number	Gage Description	Total Drainage Area (sq. mi.)	Major Watershed	Watershed Number	Characteristic R-B Index Value	Quartile Rank	Flashiness Trend	p Value	First Water Year of Record	First Water Year Analyzed, if different	Last Water Year	Water Years Analyzed
	Streams Tributary to Lake Superior											
04001000	Washington Creek at Windigo, MI	13	Portage	55	0.225	Lower Middle			1965		2003	39
04028000	Montreal River at Ironwood, MI	61	Montreal	51	0.284	Upper Middle			1919		1954	9
04029000	West Branch Montreal River at Gile, WI	78	Montreal	51	0.174	Upper Middle			1919		1947	12
04029990	Montreal River at Saxon Falls near Saxon, WI	261	Montreal	51	0.179	Highest			1939		2010	56
04030000	Montreal River near Saxon, WI	264	Montreal	51	0.144	Upper Middle			1939		1970	32
04031000	Black River near Bessemer, MI	200	Presque Isle	56	0.220	Highest			1955		2010	38
04031500	Presque Isle River at Marenisco, MI	171	Presque Isle	56	0.113	Upper Middle			1946		1982	37
04032000	Presque Isle River near Tula, MI	261	Presque Isle	56	0.138	Upper Middle			1946		1973	28
04032500	Iron River near White Pine, MI	98	Presque Isle	56	0.266	Upper Middle			1953		1957	5
04033000	Middle Branch Ontonagon River near Paulding, MI	164	Ontonagon	53	0.081	Lower Middle			1943	1976	2009	29
04034500	Middle Branch Ontonagon River near Trout Creek, MI	203	Ontonagon	53	0.049	Lowest	decrease	0.02	1943		2011	69
04035000	East Branch Ontonagon River near Mass, MI	272	Ontonagon	53	0.170	Upper Middle			1943		1979	37
04035500	Middle Branch Ontonagon River near Rockland, MI	671	Ontonagon	53	0.233	Highest			1943		2008	66
04036000	West Branch Ontonagon River near Bergland, MI	162	Ontonagon	53	0.060	Lowest	decrease	<0.01	1943	1978	2011	34
04037500	Cisco Branch Ontonagon River at Cisco Lake Outlet, MI	51	Ontonagon	53	0.281	Upper Middle	increase	<0.01	1945	1977	2011	35
04039500	South Branch Ontonagon River at Ewen, MI	348	Ontonagon	53	0.141	Upper Middle			1943		1971	28
04040000	Ontonagon River near Rockland, MI	1340	Ontonagon	53	0.181	Highest			1943		2010	68
04040500	Sturgeon River near Sidnaw, MI	171	Portage	55	0.153	Upper Middle			1944		2010	67
04041500	Sturgeon River near Alston, MI	346	Portage	55	0.123	Upper Middle	decrease	<0.01	1933	1963	2011	49

Gage Number	Gage Description	Total Drainage Area (sq. mi.)	Major Watershed	Watershed Number	Characteristic R-B Index Value	Quartile Rank	Flashiness Trend	p Value	First Water Year of Record	First Water Year Analyzed, if different	Last Water Year	Water Years Analyzed
04042500	Otter River near Elo, MI	162	Portage	55	0.176	Highest			1943		1972	30
04043000	Sturgeon River near Arnheim, MI	705	Portage	55	0.095	Lower Middle			1943		1973	31
04043050	Trap Rock River near Lake Linden, MI	28	Portage	55	0.233	Lower Middle			1967		2010	44
04043150	Silver River near L'Anse, MI	65	Falls	48	0.250	Upper Middle			2002		2010	9
04043244	East Branch Salmon Trout River near Dodge City, MI	10	Falls	48	0.144	Lowest			2006		2010	5
04043275	Yellow Dog River near Big Bay, MI	32	Falls	48	0.117	Lower Middle			2006		2010	5
04044400	Carp River at US Highway 41 near Negaunee, MI	51	Dead	45	0.088	Lowest			1962		1985	24
04044583	Cherry Creek near Harvey, MI	4.5	Chocolay	43	0.005	Lowest			1966		1981	7
04044724	AuTrain River at Forest Lake, MI	81	Au Train	39	0.046	Lowest			1994		2011	18
04045500	Tahquamenon River near Paradise, MI	790	Tahquamenon	60	0.055	Lowest			1954		2010	57
	Streams Tributary to Lake Michigan, Upper Peninsula											
04046000	Black River near Garnet, MI	28	Carp	41	0.128	Lowest			1952		2011	44
04049500	Manistique River at Germfask, MI	341	Manistique	49	0.040	Lowest			1939		1970	32
04054500	Duck Creek near Blaney, MI	92	Manistique	49	0.092	Lowest			1939		1954	16
04055000	Manistique River at Cookson Bridge near Blaney, MI	704	Manistique	49	0.048	Lowest			1938		1970	33
04056000	West Branch Manistique River near Manistique, MI	322	Manistique	49	0.058	Lowest			1939		1956	18
04056500	Manistique River near Manistique, MI	1100	Manistique	49	0.050	Lowest			1939		2009	71
04057000	Indian River near Manistique, MI	302	Manistique	49	0.029	Lowest			1939	1965	1993	8
04057510	Sturgeon River near Nahma Junction, MI	183	Sturgeon	58	0.089	Lower Middle	decrease	0.01	1967	1984	2009	26
04057800	Middle Branch Escanaba River at Humboldt, MI	46	Escanaba	46	0.153	Lower Middle	decrease	0.03	1960		2009	50
04057820	Middle Branch Escanaba River near Greenwood, MI	73	Escanaba	46	0.101	Lower Middle			1973		1982	10
04057900	Black River near Republic, MI	34	Escanaba	46	0.154	Lower Middle			1962		1968	7
04058000	Middle Branch Escanaba River near Ishpeming, MI	128	Escanaba	46	0.131	Upper Middle			1955		1975	21

Gage Number	Gage Description	Total Drainage Area (sq. mi.)	Major Watershed	Watershed Number	Characteristic R-B Index Value	Quartile Rank	Flashiness Trend	p Value	First Water Year of Record	First Water Year Analyzed, if different	Last Water Year	Water Years Analyzed
04058100	Middle Branch Escanaba River near Princeton, MI	210	Escanaba	46	0.090	Lower Middle			1962	1996	2011	15
04058200	Schweitzer Creek near Palmer, MI	24	Escanaba	46	0.204	Lower Middle			1961		2009	49
04058300	Warner Creek near Palmer, MI	14	Escanaba	46	0.195	Lower Middle			1962		1978	13
04058400	Goose Lake Outlet near Sands Station, MI	38	Escanaba	46	0.084	Lowest			1966		1982	17
04058500	East Branch Escanaba River at Gwinn, MI	124	Escanaba	46	0.133	Upper Middle			1955		1980	26
04059000	Escanaba River at Cornell, MI	870	Escanaba	46	0.103	Lower Middle			1951	1996	2009	14
04059400	Ten Mile Creek at Perronville, MI	39	Ford	47	0.165	Lower Middle			1972		1977	6
04059500	Ford River near Hyde, MI	450	Ford	47	0.113	Upper Middle			1955		2009	55
04060500	Iron River at Highway 424 at Caspian, MI	92	Menominee	50	0.069	Lowest	decrease	<0.01	1949		2009	37
04060993	Brule River at US-2 near Florence, WI	366	Menominee	50	0.080	Lower Middle			1915		2009	66
04061500	Paint River at Crystal Falls, MI	597	Menominee	50	0.109	Upper Middle			1945		1996	51
04062000	Paint River near Alpha, MI	631	Menominee	50	0.051	Lowest	decrease	<0.01	1953	1981	2011	30
04062011	Brule River near Commonwealth, WI	1020	Menominee	50	0.072	Lower Middle	decrease	<0.01	1990		2011	22
04062100	Peshekee River near Michigamme, MI	67	Menominee	50	0.197	Upper Middle			1962		1995	9
04062200	Peshekee River near Champion, MI	133	Menominee	50	0.169	Upper Middle			1962	2001	2009	9
04062230	Michigamme River near Michigamme, MI	194	Menominee	50	0.061	Lowest			1969		1982	14
04062270	Michigamme River near Champion, MI	231	Menominee	50	0.065	Lowest			1965		1969	5
04062300	Michigamme River at Republic, MI	240	Menominee	50	0.083	Lower Middle			1962	1964	1975	12
04062400	Michigamme River near Witch Lake, MI	316	Menominee	50	0.075	Lower Middle			1965		1980	16
04062500	Michigamme River near Crystal Falls, MI	656	Menominee	50	0.048	Lowest	decrease	<0.01	1945	1972	2011	40
04063000	Menominee River near Florence, WI	1760	Menominee	50	0.086	Upper Middle	decrease	<0.01	1915	1952	2011	60

Gage Number	Gage Description	Total Drainage Area (sq. mi.)	Major Watershed	Watershed Number	Characteristic R-B Index Value	Quartile Rank	Flashiness Trend	p Value	First Water Year of Record	First Water Year Analyzed, if different	Last Water Year	Water Years Analyzed
04063500	Menominee River at Twin Falls near Iron Mt, MI	1800	Menominee	50	0.076	Lower Middle	decrease	<0.01	1915	1963	2011	49
04063700	Popple River near Fence, WI	139	Menominee	50	0.098	Lower Middle			1964		2011	47
04064000	Pine River near Florence, WI	510	Menominee	50	0.067	Lowest			1914		1923	10
04064500	Pine River below Pine River Powerplant near Florence, WI	533	Menominee	50	0.106	Upper Middle			1924	1997	2011	14
04065106	Menominee River at Niagara, WI	2470	Menominee	50	0.069	Lower Middle	decrease	<0.01	1993		2011	19
04065300	West Branch Sturgeon River near Randville, MI	56	Menominee	50	0.183	Upper Middle			1959		1981	23
04065393	East Branch Sturgeon River below Skunk Creek near Felch, MI	62	Menominee	50	0.137	Lower Middle			1974		1984	11
04065397	East Branch Sturgeon River at Hardwood, MI	91	Menominee	50	0.093	Lowest			1978		1983	6
04065500	Sturgeon River near Foster City, MI	237	Menominee	50	0.109	Upper Middle			1955		1980	26
04065600	Pine Creek near Iron Mountain, MI	17	Menominee	50	0.156	Lowest			1972		1961	10
04065722	Menominee River near Vulcan, MI	2900	Menominee	50	0.089	Upper Middle			1989		2011	23
04066003	Menominee River below Pemene Creek near Pembine, WI	3140	Menominee	50	0.080	Upper Middle	decrease	<0.01	1950		2011	61
04066030	Menominee River at White Rapids Dam near Banat, MI	3190	Menominee	50	0.102	Highest			1999		2011	13
04066500	Pike River at Amberg, WI	255	Menominee	50	0.090	Lower Middle			1915		2011	66
04066800	Menominee River at Koss, MI	3700	Menominee	50	0.090	Upper Middle			1914	1999	2011	12
04067500	Menominee River near McAllister, WI	3930	Menominee	50	0.081	Upper Middle	decrease	0.01	1946	1980	2011	24
	Streams Tributary to Lake Michigan, Southern Lower Peninsula											
04096015	Galien River near Sawyer, MI	81	St. Joseph	34	0.304	Highest			1996		2010	15
04096100	Galena River near Laporte, IN	17	St. Joseph	34	0.229	Lower Middle			1970		2003	34
04096272	Beebe Creek at Moore Road near Hillsdale, MI	42	St. Joseph	34	0.173	Lower Middle			1975		1980	6
04096405	St. Joseph River at Burlington, MI	206	St. Joseph	34	0.063	Lowest			1963		2011	49

Gage Number	Gage Description	Total Drainage Area (sq. mi.)	Major Watershed	Watershed Number	Characteristic R-B Index Value	Quartile Rank	Flashiness Trend	p Value	First Water Year of Record	First Water Year Analyzed, if different	Last Water Year	Water Years Analyzed
04096500	Sauk River at Jay Street at Coldwater, MI	60	St. Joseph	34	0.100	Lowest			1938		1962	25
04096515	South Branch Hog Creek near Allen, MI	49	St. Joseph	34	0.141	Lower Middle	increase	<0.01	1970		2010	42
04096600	Coldwater River near Hodunk, MI	293	St. Joseph	34	0.078	Lower Middle			1963		1989	27
04096900	Nottawa Creek near Athens, MI	162	St. Joseph	34	0.084	Lower Middle	increase	0.02	1967		1997	31
04097170	Portage River at W Avenue near Vicksburg, MI	68	St. Joseph	34	0.047	Lowest			1947	1965	1979	15
04097200	Gourdneck Creek near Schoolcraft, MI	7.3	St. Joseph	34	0.094	Lowest			1965		1972	8
04097500	St. Joseph River at Three Rivers, MI	1350	St. Joseph	34	0.062	Lower Middle	decrease	0.01	1954		2011	49
04097540	Prairie River near Nottawa, MI	106	St. Joseph	34	0.056	Lowest			1963		2010	48
04097970	Lime Lake Outlet at Panama, IN	18	St. Joseph	34	0.062	Lowest			1970		1986	17
04098500	Fawn River near White Pigeon, MI	192	St. Joseph	34	0.051	Lowest			1958		1975	18
04099000	St. Joseph River at Mottville, MI	1866	St. Joseph	34	0.050	Lowest	decrease	<0.01	1925		2011	87
04099510	Pigeon Creek near Angola, IN	106	St. Joseph	34	0.079	Lower Middle	decrease	0.04	1946	1996	2011	16
04099610	Pretty Lake Inlet near Stroh, IN	2.0	St. Joseph	34	0.281	Lower Middle			1964		1981	18
04099750	Pigeon River near Scott, IN	307	St. Joseph	34	0.068	Lower Middle	increase	<0.01	1969		2011	43
04099808	Little Elkhart River at Middlebury, IN	92	St. Joseph	34	0.154	Lower Middle			1980		2003	24
04099850	Pine Creek near Elkhart, IN	31	St. Joseph	34	0.200	Upper Middle			1980		2003	24
04100222	North Branch Elkhart River at Cosperville, IN	142	St. Joseph	34	0.053	Lowest	decrease	0.05	1972		2011	40
04100252	Forker Creek near Burr Oak, IN	19	St. Joseph	34	0.198	Lower Middle	increase	0.04	1970		2003	34
04100295	Rimmell Branch near Albion, IN	11	St. Joseph	34	0.446	Upper Middle			1981		2001	21
04100377	Solomon Creek near Syracuse, IN	36	St. Joseph	34	0.108	Lower Middle	increase	0.02	1988		2003	16
04100465	Turkey Creek at Syracuse, IN	44	St. Joseph	34	0.065	Lowest			1970		1987	18
04100500	Elkhart River at Goshen, IN	594	St. Joseph	34	0.102	Lower Middle			1932	1955	2011	57
04101000	St. Joseph River at Elkhart, IN	3370	St. Joseph	34	0.051	Lowest	decrease	<0.01	1948		2011	64

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04101370	Juday Creek near South Bend, IN	38	St. Joseph	34	0.093	Lowest			1993		2010	18
04101500	St. Joseph River at Niles, MI	3666	St. Joseph	34	0.059	Lowest	decrease	<0.01	1931		2011	80
04101800	Dowagiac River at Sumnerville, MI	255	St. Joseph	34	0.092	Lower Middle	increase	<0.01	1961	1973	2011	39
04102000	St. Joseph River at Berrien Springs, MI	4081	St. Joseph	34	0.085	Upper Middle			1902		1956	10
04102500	Paw Paw River at Riverside, MI	390	St. Joseph	34	0.070	Lower Middle	increase	<0.01	1952	1971	2011	41
04102700	South Branch Black River near Bangor, MI	84	Black	7	0.191	Upper Middle	increase	0.01	1967		2011	45
04102776	Middle Branch Black River near South Haven, MI	83	Black	7	0.129	Lower Middle			1995		2010	16
04102850	South Branch Kalamazoo River near Albion, MI	146	Kalamazoo	17	0.052	Lowest			1972		1976	5
04103010	Kalamazoo River near Marengo, MI	267	Kalamazoo	17	0.063	Lowest			1987		2011	25
04103500	Kalamazoo River at Marshall, MI	449	Kalamazoo	17	0.074	Lower Middle			1949	2002	2011	10
04104945	Wanadoga Creek near Battle Creek, MI	48	Kalamazoo	17	0.198	Upper Middle	increase	0.01	1995		2011	17
04105000	Battle Creek at Battle Creek, MI	241	Kalamazoo	17	0.126	Upper Middle	increase	<0.01	1935	1962	2011	50
04105500	Kalamazoo River near Battle Creek, MI	824	Kalamazoo	17	0.089	Lower Middle	increase	0.01	1937	1994	2011	18
04105700	Augusta Creek near Augusta, MI	39	Kalamazoo	17	0.105	Lower Middle	increase	<0.01	1965	1972	2011	40
04105800	Gull Creek at 37th Street near Galesburg, MI	38	Kalamazoo	17	0.060	Lowest			1965		1972	8
04106000	Kalamazoo River at Comstock, MI	1010	Kalamazoo	17	0.077	Lower Middle	decrease	0.02	1933		2011	74
04106180	Portage Creek at Portage, MI	17	Kalamazoo	17	0.091	Lowest	increase	0.01	1983		2006	24
04106300	Portage Creek near Kalamazoo, MI	22	Kalamazoo	17	0.109	Lowest			1965	1988	2008	21
04106320	West Fork Portage Creek near Oshtemo, MI	13	Kalamazoo	17	0.098	Lowest	increase	<0.01	1973		1996	24
04106400	West Fork Portage Creek at Kalamazoo, MI	19	Kalamazoo	17	0.088	Lowest			1960	1995	2011	17
04106500	Portage Creek at Kalamazoo, MI	47	Kalamazoo	17	0.121	Lower Middle	increase	0.01	1948		1986	22
04108500	Kalamazoo River near Fennville, MI	1600	Kalamazoo	17	0.108	Highest			1930		1993	63
04108600	Rabbit River near Hopkins, MI	71	Kalamazoo	17	0.269	Upper Middle	increase	<0.01	1966		2011	46

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04108670	Kalamazoo River near New Richmond, MI	1994	Kalamazoo	17	0.071	Lower Middle			1995		2010	9
04108800	Macatawa River near Zeeland, MI	66	Macatawa	8	0.571	Highest			1961		2011	51
04109000	Grand River at Jackson, MI	174	Grand	14	0.095	Lower Middle			1936		2011	21
04109500	Portage River at Portage Lake Road near Munith, MI	55	Grand	14	0.101	Lowest			1945		1956	12
04110000	Orchard Creek at State Highway 106 at Munith, MI	49	Grand	14	0.226	Upper Middle			1945		1956	12
04111000	Grand River at Eaton Rapids, MI	661	Grand	14	0.087	Lower Middle			1951	1996	2011	16
04111379	Red Cedar River near Williamston, MI	163	Grand	14	0.174	Highest	increase	0.04	1976		2011	9
04111500	Deer Creek near Dansville, MI	16	Grand	14	0.370	Upper Middle			1954		2011	58
04112000	Sloan Creek near Williamston, MI	9.3	Grand	14	0.460	Upper Middle			1955		2011	56
04112500	Red Cedar River at East Lansing, MI	355	Grand	14	0.175	Highest	increase	0.02	1932	1988	2011	24
04112850	Sycamore Creek at Holt Road near Holt, MI	81	Grand	14	0.229	Upper Middle			1976		1997	9
04113000	Grand River at Lansing, MI	1230	Grand	14	0.127	Highest			1901	1965	2011	47
04113097	Carrier Creek near Lansing, MI	12	Grand	14	0.451	Upper Middle			1976		1980	5
04114000	Grand River at Portland, MI	1385	Grand	14	0.122	Highest			1953		2011	52
04114498	Looking Glass River near Eagle, MI	280	Grand	14	0.100	Lower Middle			1945		2011	62
04115000	Maple River at Maple Rapids, MI	434	Grand	14	0.114	Upper Middle			1945		2011	68
04115265	Fish Creek near Crystal, MI	40	Grand	14	0.180	Upper Middle			1988		2011	24
04116000	Grand River at Ionia, MI	2840	Grand	14	0.098	Upper Middle	decrease	<0.01	1952		2011	60
04116500	Flat River at Smyrna, MI	528	Grand	14	0.066	Lowest	decrease	<0.01	1951		1986	36
04117000	Quaker Brook near Nashville, MI	7.6	Grand	14	0.301	Upper Middle			1955		2011	38
04117500	Thornapple River near Hastings, MI	385	Grand	14	0.112	Upper Middle			1945	1978	2011	34

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04118000	Thornapple River near Caledonia, MI	773	Grand	14	0.110	Upper Middle	increase	<0.01	1952	1971	1994	22
04118500	Rogue River near Rockford, MI	234	Grand	14	0.104	Lower Middle			1953		2011	54
04119000	Grand River at Grand Rapids, MI	4900	Grand	14	0.074	Lower Middle			1902	1989	2011	23
	Streams Tributary to Lake Michigan, Northern Lower Peninsula											
04121000	Muskegon River near Merritt, MI	355	Muskegon	22	0.040	Lowest			1947		1973	27
04121300	Clam River at Vogel Center, MI	243	Muskegon	22	0.079	Lower Middle			1967		2011	45
04121500	Muskegon River at Evart, MI	1433	Muskegon	22	0.057	Lowest			1935	1960	2011	52
04121900	Little Muskegon River near Morley, MI	121	Muskegon	22	0.109	Upper Middle			1967	1979	1996	18
04121944	Little Muskegon River near Oak Grove, MI	345	Muskegon	22	0.108	Upper Middle	increase	0.05	1996		2011	16
04121970	Muskegon River near Croton, MI	2313	Muskegon	22	0.077	Lower Middle	increase	0.01	1996		2011	16
04122000	Muskegon River at Newaygo, MI	2350	Muskegon	22	0.098	Upper Middle	decrease	0.01	1910		1993	71
04122100	Bear Creek near Muskegon, MI	17	Muskegon	22	0.172	Lower Middle	decrease	<0.01	1966		2011	46
04122200	White River near Whitehall, MI	406	White	37	0.066	Lowest			1958		2011	54
04122500	Pere Marquette River at Scottville, MI	681	Pere Marquette	25	0.055	Lowest	increase	<0.01	1940		2011	74
04123000	Big Sable River near Freesoil, MI	127	Big Sable	5	0.037	Lowest			1943		1972	30
04123500	Manistee River near Grayling, MI	123	Manistee	20	0.026	Lowest			1943		1973	31
04124000	Manistee River near Sherman, MI	857	Manistee	20	0.041	Lowest	increase	<0.01	1903		2011	90
04124200	Manistee River near Mesick, MI	1018	Manistee	20	0.047	Lowest			1998		2011	14
04124500	East Branch Pine River near Tustin, MI	60	Manistee	20	0.195	Upper Middle			1953		2011	31
04125000	Pine River near Leroy, MI	128	Manistee	20	0.114	Upper Middle			1953		1963	11
04125460	Pine River at High School Bridge, near Hoxeyville, MI	245	Manistee	20	0.066	Lowest			1953		2011	45
04125550	Manistee River near Wellston, MI	1451	Manistee	20	0.050	Lowest			1997		2011	15

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04126000	Manistee River near Manistee, MI	1677	Manistee	20	0.066	Lower Middle	decrease	<0.01	1952	1983	1993	11
04126200	Little Manistee River near Freesoil, MI	178	Manistee	20	0.037	Lowest			1957		1975	19
04126740	Platte River at Honor, MI	125	Platte	28	0.039	Lowest			1991		2011	21
04126970	Boardman River above Brown Bridge Road, near Mayfield, MI	141	Boardman	9	0.040	Lowest			1988		2011	14
04127000	Boardman River near Mayfield, MI	182	Boardman	9	0.091	Lower Middle			1953		1989	37
04127800	Jordan River near East Jordan, MI	68	Pine	10	0.055	Lowest	decrease	0.01	1967	1984	2011	28
	Streams Tributary to Lake Huron											
04127918	Pine River near Rudyard, MI	184	Pine	54	0.184	Highest			1973		2010	38
04127997	Sturgeon River at Wolverine, MI	192	Cheboygan	11	0.079	Lower Middle			1943	1973	2011	39
04128990	Pigeon River at Sturgeon Valley Road near Vanderbilt, MI	58	Cheboygan	11	0.158	Lower Middle	increase	<0.01	1951		2011	61
04129500	Pigeon River at Afton, MI	139	Cheboygan	11	0.094	Lower Middle			1942	1946	1981	36
04130000	Cheboygan River near Cheboygan, MI	889	Cheboygan	11	0.036	Lowest		<0.01	1943		1982	40
04130500	Black River near Tower, MI	311	Cheboygan	11	0.105	Lower Middle	decrease	<0.01	1943	1955	2000	45
04131000	Rainy River near Onaway, MI	79	Cheboygan	11	0.114	Lower Middle			1943		1952	10
04131500	Rainy River near Ocqueoc, MI	88	Cheboygan	11	0.134	Lower Middle			1953		1979	27
04132000	Black River near Cheboygan, MI	597	Cheboygan	11	0.063	Lowest			1944		1974	31
04132500	Thunder Bay River near Hillman, MI	232	Thunder Bay	36	0.077	Lower Middle			1946	1957	1972	16
04133501	Thunder Bay River at Herron Road near Bolton, MI	586	Thunder Bay	36	0.086	Lower Middle			1946	2003	2011	9
04134000	North Branch Thunder Bay River near Bolton, MI	184	Thunder Bay	36	0.144	Upper Middle			1946		1980	35
04135000	Thunder Bay River near Alpena, MI	1238	Thunder Bay	36	0.188	Highest			1902		1993	21
04135500	Au Sable River at Grayling, MI	110	Au Sable	2	0.052	Lowest	increase	<0.01	1956		1993	51
04135600	East Branch Au Sable River at Grayling, MI	76	Au Sable	2	0.048	Lowest			1958		1984	28

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04135700	South Branch Au Sable River near Luzerne, MI	401	Au Sable	2	0.047	Lowest	increase	0.02	1967		2011	44
04136000	Au Sable River near Red Oak, MI	1108	Au Sable	2	0.050	Lowest	increase	0.05	1909		2011	22
04136500	Au Sable River at Mio, MI	1361	Au Sable	2	0.057	Lowest			1953	1980	2011	32
04136900	Au Sable River near McKinley, MI	1513	Au Sable	2	0.049	Lowest			1997		2011	15
04137005	Au Sable River near Curtisville, MI	1598	Au Sable	2	0.061	Lower Middle	increase	0.03	1997		2011	15
04137500	Au Sable River near Au Sable, MI	1739	Au Sable	2	0.079	Upper Middle			1988	2001	2011	11
04138000	East Branch Au Gres River at McIvor, MI	84	Au Gres	1	0.137	Lower Middle			1951		1973	23
04138500	Au Gres River at Cox Road near National City, MI	154	Au Gres	1	0.223	Highest			1951		1981	31
04139000	Houghton Creek near Lupton, MI	30	Rifle	30	0.126	Lowest			1951		1972	22
04139500	Rifle River at "The Ranch" near Lupton, MI	57	Rifle	30	0.101	Lower Middle			1951		1971	21
04140000	Prior Creek near Selkirk, MI	21	Rifle	30	0.237	Lower Middle			1951		1972	22
04140500	Rifle River at State Road at Selkirk, MI	117	Rifle	30	0.108	Upper Middle			1951		1982	32
04141000	South Branch Shepards Creek near Selkirk, MI	1.2	Rifle	30	0.627	Highest			1952		1978	27
04141500	West Branch Rifle River near Selkirk, MI	51	Rifle	30	0.184	Upper Middle			1952		1963	12
04142000	Rifle River near Sterling, MI	320	Rifle	30	0.155	Highest			1938	1991	2011	21
04143500	North Branch Kawkawlin River near Kawkawlin, MI	101	Kawkawlin	18	0.197	Highest			1952	1962	1982	21
04143900	Shiawassee River at Linden, MI	84	Saginaw	32	0.070	Lowest			1968		2003	29
04144000	Shiawassee River at Byron, MI	365	Saginaw	32	0.096	Lower Middle			1948	1967	1983	17
04144500	Shiawassee River at Owosso, MI	538	Saginaw	32	0.134	Upper Middle			1932	1988	2011	24
04145000	Shiawassee River near Fergus, MI	637	Saginaw	32	0.141	Upper Middle			1941		2011	60
04145500	Bad River at Hemlock Road near Brant, MI	89	Saginaw	32	0.422	Highest			1950		1959	10
04146000	Farmers Creek near Lapeer, MI	55	Saginaw	32	0.130	Lower Middle			1934		2011	34
04146063	South Branch Flint River near Columbiaville, MI	221	Saginaw	32	0.134	Upper Middle			1981		2011	31

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04147500	Flint River near Otisville, MI	530	Saginaw	32	0.140	Upper Middle	increase	0.01	1953		2011	58
04147990	Butternut Creek near Genesee, MI	35	Saginaw	32	0.284	Upper Middle			1971		1983	13
04148000	Flint River at Genesee, MI	593	Saginaw	32	0.135	Upper Middle			1931	1937	1952	16
04148140	Kearsley Creek near Davison, MI	99	Saginaw	32	0.190	Upper Middle	increase	0.01	1966		2011	46
04148160	Gilkey Creek near Flint, MI	6.4	Saginaw	32	0.693	Highest			1971		1983	13
04148200	Swartz Creek near Holly, MI	12	Saginaw	32	0.149	Lowest			1957	1967	1975	9
04148300	Swartz Creek at Flint, MI	115	Saginaw	32	0.287	Highest			1971		1983	13
04148440	Thread Creek near Flint, MI	54	Saginaw	32	0.216	Upper Middle			1971		1983	13
04148500	Flint River near Flint, MI	956	Saginaw	32	0.189	Highest	increase	0.01	1933	1978	2011	34
04148720	Brent Run near Montrose, MI	21	Saginaw	32	0.496	Highest			1971		1983	13
04149000	Flint River near Fosters, MI	1153	Saginaw	32	0.170	Highest			1940		2011	61
04150000	South Branch Cass River near Cass City, MI	238	Saginaw	32	0.397	Highest			1949		1980	32
04150500	Cass River at Cass City, MI	359	Saginaw	32	0.333	Highest			1948	1967	2011	41
04150800	Cass River at Wahjamega, MI	645	Saginaw	32	0.275	Highest			1969		1994	26
04151000	Cass River at Vassar, MI	710	Saginaw	32	0.266	Highest			1949		1970	22
04151500	Cass River at Frankenmuth, MI	841	Saginaw	32	0.244	Highest			1936	1962	2011	50
04152238	South Branch Tobacco River near Beaverton, MI	160	Saginaw	32	0.180	Highest			1988		2011	24
04152500	Tobacco River at Glidden Road at Beaverton, MI	487	Saginaw	32	0.149	Upper Middle			1949		1982	34
04153500	Salt River near North Bradley, MI	138	Saginaw	32	0.402	Highest			1935		1971	37
04154000	Chippewa River near Mount Pleasant, MI	416	Saginaw	32	0.089	Lower Middle			1934	1978	2011	33
04154500	Chippewa River near Midland, MI	597	Saginaw	32	0.112	Upper Middle			1948		1972	25
04155000	Pine River at Alma, MI	288	Saginaw	32	0.121	Upper Middle			1931	1980	2011	32
04155500	Pine River near Midland, MI	390	Saginaw	32	0.178	Highest			1935		2011	64
04156000	Tittabawassee River at Midland, MI	2400	Saginaw	32	0.229	Highest			1937		2011	75
04156500	Tittabawassee River at Freeland, MI	2530	Saginaw	32	0.189	Highest			1931		1936	6

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04157500	Sebewaing River State Drain near Sebewaing, MI	67	Sebewaing	33	0.630	Highest			1940		1954	15
04158000	Columbia Drain at Gettel Road near Sebewaing, MI	34	Sebewaing	33	0.638	Highest			1941		1990	16
04158500	Pigeon River near Owendale, MI	53	Pigeon	26	0.390	Highest			1953		1982	21
04159010	Pigeon River near Caseville, MI	125	Pigeon	26	0.375	Highest			1987		1993	7
	Streams Tributary to St. Clair River											
04159492	Black River near Jeddo, MI	464	Black	6	0.429	Highest			1945		2011	17
04159500	Black River near Fargo, MI	480	Black	6	0.335	Highest			1945	1963	1991	29
04159900	Mill Creek near Avoca, MI	169	Black	6	0.279	Highest			1964	1988	2011	24
04160000	Mill Creek near Abbottsford, MI	208	Black	6	0.200	Highest			1948		1964	17
04160050	Black River near Port Huron, MI	684	Black	6	0.323	Highest			1933		1943	11
04160570	North Branch Belle River at Imlay City, MI	18	Belle	3	0.294	Lower Middle			1966		2001	36
04160600	Belle River at Memphis, MI	151	Belle	3	0.338	Highest	increase	<0.01	1963		2011	49
	Streams Tributary to Lake St. Clair											
04160800	Sashabaw Creek near Drayton Plains, MI	21	Clinton	12	0.136	Lowest			1960		2009	50
04160900	Clinton River near Drayton Plains, MI	79	Clinton	12	0.079	Lowest			1960	1981	2009	29
04161000	Clinton River at Auburn Heights, MI	123	Clinton	12	0.164	Upper Middle			1936	2002	2011	8
04161100	Galloway Creek near Auburn Heights, MI	18	Clinton	12	0.419	Upper Middle	increase	<0.01	1960	1972	1991	20
04161500	Paint Creek near Lake Orion, MI	39	Clinton	12	0.094	Lowest	decrease	0.02	1956	1966	1991	13
04161540	Paint Creek at Rochester, MI	71	Clinton	12	0.209	Upper Middle	increase	<0.01	1960		2011	52
04161580	Stony Creek near Romeo, MI	26	Clinton	12	0.195	Lower Middle	increase	0.01	1965	1984	2011	28
04161800	Stony Creek near Washington, MI	68	Clinton	12	0.130	Lower Middle			1959		2011	53
04161820	Clinton River at Sterling Heights, MI	309	Clinton	12	0.201	Highest			1979	1997	2011	11
04162010	Red Run near Warren, MI	34	Clinton	12	1.009	Highest			1980		1988	9
04162900	Big Beaver Creek near Warren, MI	24	Clinton	12	0.957	Highest			1959	1982	1988	7
04163400	Plum Brook at Utica, MI	17	Clinton	12	0.546	Highest			1966		2011	44

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04163500	Plum Brook near Utica, MI	23	Clinton	12	0.419	Upper Middle			1955		1966	12
04164000	Clinton River near Fraser, MI	444	Clinton	12	0.305	Highest	increase	<0.01	1948		2011	65
04164010	North Branch Clinton River at Almont, MI	10	Clinton	12	0.420	Upper Middle			1963		1968	6
04164050	North Branch Clinton River at 33 Mile Road near Romeo, MI	50	Clinton	12	0.412	Highest			1965		1969	5
04164100	East Pond Creek at Romeo, MI	22	Clinton	12	0.162	Lower Middle			1959		2011	53
04164150	North Branch Clinton River at 27 Mile Road near Meade, MI	90	Clinton	12	0.325	Highest			1968		1972	5
04164200	Coon Creek at North Avenue near Armada, MI	9.6	Clinton	12	0.489	Upper Middle			1966		1970	5
04164250	Tupper Brook at Ray Center, MI	8.6	Clinton	12	0.669	Highest			1960		1964	5
04164300	East Branch Coon Creek at Armada, MI	13	Clinton	12	0.633	Highest			1959		2011	53
04164350	Highbank Creek at 32 Mile Road near Armada, MI	15	Clinton	12	0.537	Highest			1966		1970	5
04164360	East Branch Cook Creek at 29-Mile Road near New Haven, MI	36	Clinton	12	0.336	Highest			1968		1982	5
04164400	Deer Creek at 25 1/2 Mile Road near Meade, MI	13	Clinton	12	0.760	Highest			1961		1965	5
04164450	McBride Drain at 24 Mile Road near Macomb, MI	5.8	Clinton	12	0.682	Highest			1960		1964	5
04164500	North Branch Clinton River near Mount Clemens, MI	199	Clinton	12	0.346	Highest			1948	1972	2011	41
04164600	Middle Branch Clinton River at Schoenherr Road near Macomb, MI	22	Clinton	12	0.441	Upper Middle			1965		1969	5
04164800	Middle Branch Clinton River at Macomb, MI	41	Clinton	12	0.439	Highest			1963		1982	19
04165200	Gloede Ditch near Waldenburg, MI	16	Clinton	12	0.461	Upper Middle			1960		1964	5
04165500	Clinton River at Moravian Drive at Mount Clemens, MI	734	Clinton	12	0.303	Highest	increase	<0.01	1935	1971	2004	34
	Streams Tributary to Detroit River											
04166000	River Rouge at Birmingham, MI	33	Rouge	31	0.426	Highest			1951	1998	2011	14
04166100	River Rouge at Southfield, MI	88	Rouge	31	0.479	Highest			1959	1995	2011	17
04166200	Evans Ditch at Southfield, MI	9.5	Rouge	31	0.892	Highest			1959	1998	2009	12
04166300	Upper River Rouge at Farmington, MI	18	Rouge	31	0.423	Upper Middle			1959	1998	2011	14
04166470	Upper River Rouge at Detroit, MI	67	Rouge	31	0.545	Highest			1998		2005	8

Gage Number	Gage Description	Total Drainage Area (sq. mi.)	Major Watershed	Watershed Number	Characteristic R-B Index Value	Quartile Rank	Flashiness Trend	p Value	First Water Year of Record	First Water Year Analyzed, if different	Last Water Year	Water Years Analyzed
04166500	River Rouge at Detroit, MI	187	Rouge	31	0.492	Highest			1931	1990	2011	22
04167000	Middle River Rouge near Garden City, MI	100	Rouge	31	0.377	Highest			1931	1998	2011	14
04167150	Middle River Rouge at Dearborn, MI	110	Rouge	31	0.399	Highest			1998		2005	8
04168000	Lower River Rouge at Inkster, MI	83	Rouge	31	0.400	Highest	decrease	<0.01	1948		2011	64
04168400	Lower River Rouge at Dearborn, MI	91	Rouge	31	0.370	Highest			1998		2004	7
04168580	Ecorse River at Dearborn Heights, MI	10	Rouge	31	0.821	Highest			2003		2011	9
	Streams Tributary to Lake Erie											
04169500	Huron River at Commerce, MI	57	Huron	15	0.054	Lowest			1947		1975	29
04170000	Huron River at Milford, MI	132	Huron	15	0.075	Lowest			1949	1960	2011	52
04170500	Huron River near New Hudson, MI	148	Huron	15	0.075	Lowest			1949	1968	2011	44
04171500	South Ore Creek at Hamburg Road near Brighton, MI	34	Huron	15	0.080	Lowest			1951		1968	18
04172000	Huron River near Hamburg, MI	308	Huron	15	0.054	Lowest			1952	1967	2011	45
04172500	Portage River at Tiplady Road near Pinckney, MI	79	Huron	15	0.058	Lowest			1946		2009	27
04173000	Huron River near Dexter, MI	522	Huron	15	0.143	Upper Middle			1947	1962	1977	13
04173500	Mill Creek near Dexter, MI	128	Huron	15	0.196	Highest			1953	1995	2011	17
04174500	Huron River at Ann Arbor, MI	729	Huron	15	0.094	Lower Middle			1915	1999	2011	12
04174800	Huron River at Ypsilanti, MI	807	Huron	15	0.104	Lower Middle	decrease	<0.01	1975		1994	15
04175340	Stony Creek at Oakville, MI	68	Stony Creek	35	0.335	Highest			1971		2003	12
04175600	River Raisin near Manchester, MI	132	Raisin	29	0.092	Lower Middle			1971		2011	37
04175700	River Raisin near Tecumseh, MI	267	Raisin	29	0.106	Upper Middle			1957		1980	24
04176000	River Raisin near Adrian, MI	463	Raisin	29	0.176	Highest	increase	0.04	1954	1972	2011	27
04176400	Saline River near Saline, MI	95	Raisin	29	0.308	Highest			1966		1977	12
04176500	River Raisin near Monroe, MI	1042	Raisin	29	0.160	Highest			1938	1972	2011	40
04176605	Otter Creek at Lasalle, MI	51	Raisin	29	0.471	Highest			1988		2011	24

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Appendices

Appendix A: Explanation of Cusum Analysis

Visual examination of the gage data plots indicates that some gages have experienced trend changes. To identify where the trend change occurs, a cumulative sum statistical technique, termed cusum, was then applied to the data. For each gage in question, the differences between the yearly R-B Index value and the average R-B Index value were cumulatively summed, as shown in Table A1 and Figure A1. Cusum curve inflection points, rather than extremes, indicate the timing of trend changes, as shown in Figures A2 and A3. Taking the first derivative of the cusum curve therefore helps identify trend change points.

In order to eliminate some of the annual variability associated with actual gage data, the first derivative of a five-year moving average of the cusum data was used for the flashiness analysis. Example graphs from trend analyses for two gages are shown in Figures A4 through A7. Gage 04127997 has a statistically significant increasing trend when evaluating all of the data, but no trend when performing a regression analysis on the data since 1973, Figures A4 and A5. Gage 04165500 has no statistically significant trend when evaluating all of the data, but a statistically significant increasing trend when performing a regression analysis on the 1972 to 2004 data, Figures A6 and A7. Both breakpoints are extremes on the first derivative cusum plots. Best professional judgment is applied to selection of breakpoints that best represent the gage.

Table A1 – Sample Data and Cusum Calculation.

Year	R-B Index Value	Average	Difference	Cusum
1995	0.115	0.100	0.015	0.015
1996	0.115	0.100	0.015	0.030
1997	0.100	0.100	0.000	0.030
1998	0.100	0.100	0.000	0.030
1999	0.100	0.100	0.000	0.030
2000	0.115	0.100	0.015	0.045
2001	0.092	0.100	-0.008	0.037
2002	0.068	0.100	-0.032	0.005
2003	0.085	0.100	-0.015	-0.010
2004	0.110	0.100	0.010	0.000

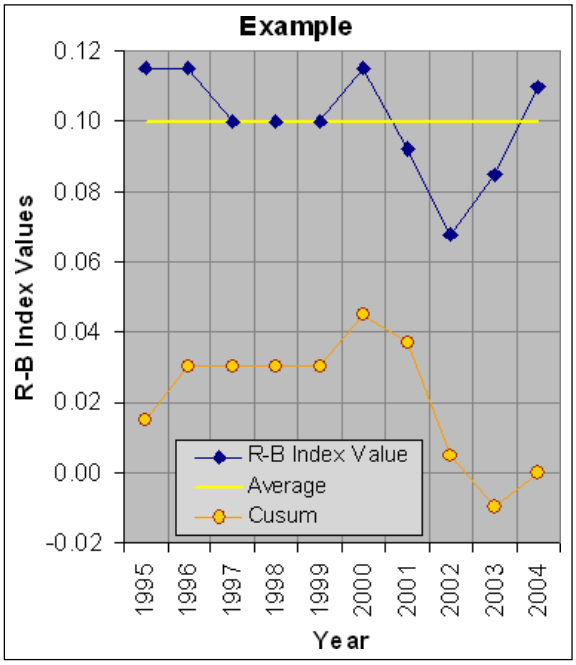

Figure A1 – Sample Data and Cusum Plots.

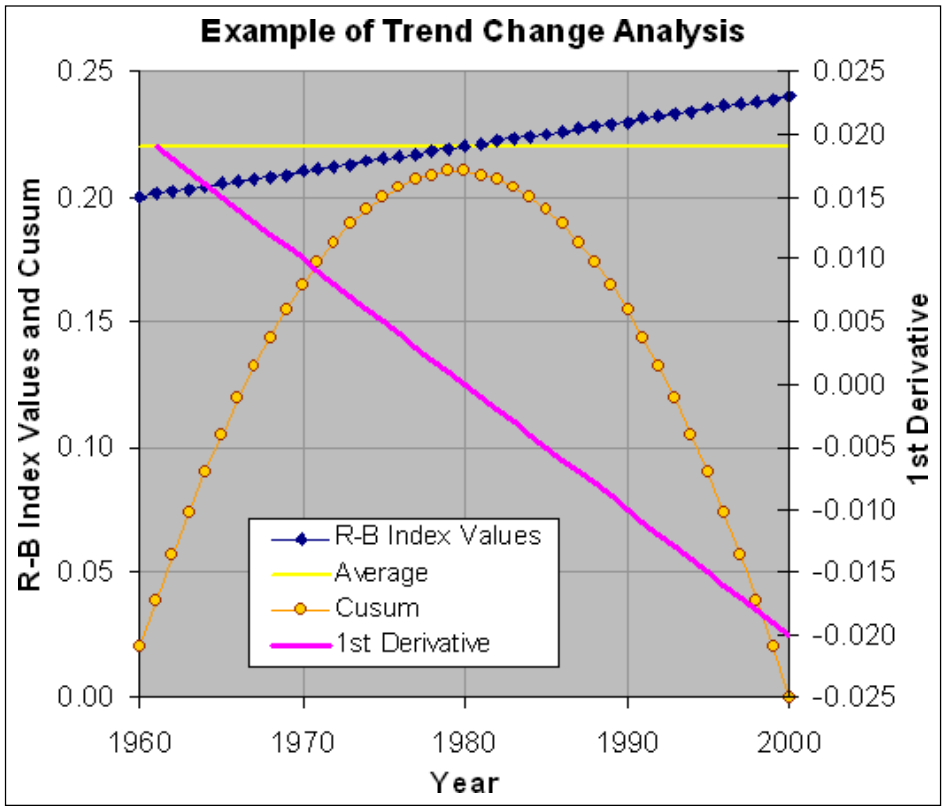

Figure A2 – Example of Cusum Analysis Showing no Trend Change.

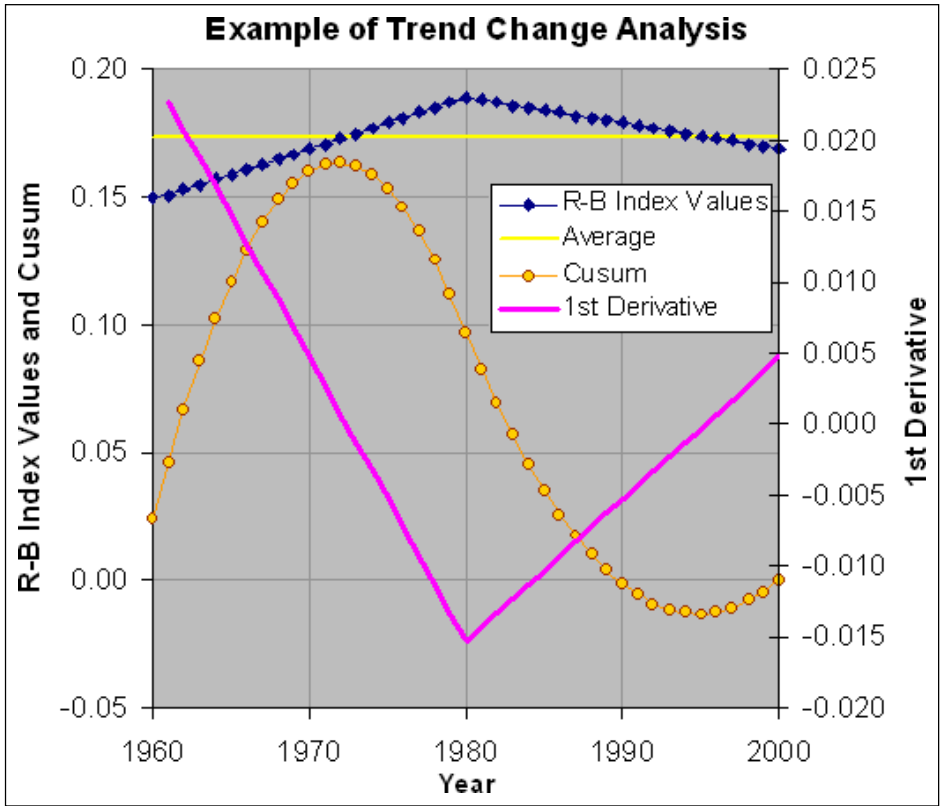

Figure A3 – Example of Cusum Analysis Showing Trend Change at 1980.

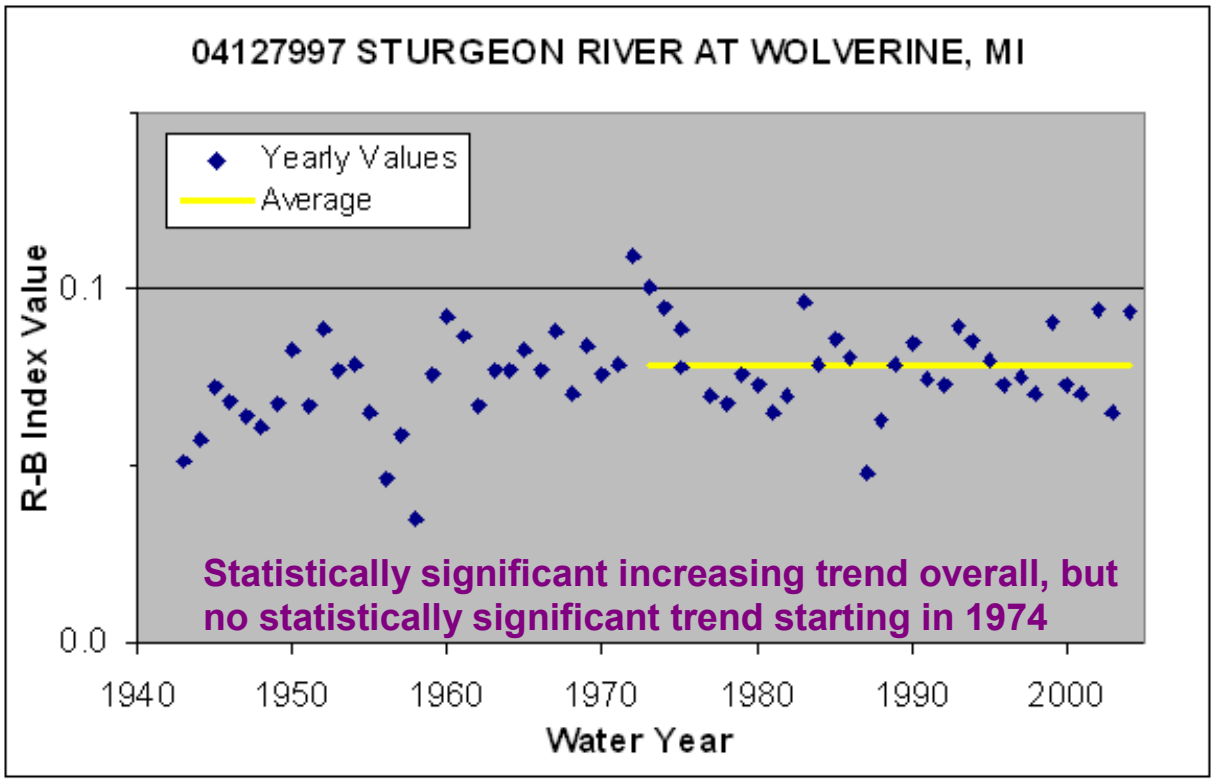

Figure A4 – USGS Gage 04127997 R-B Index Values.

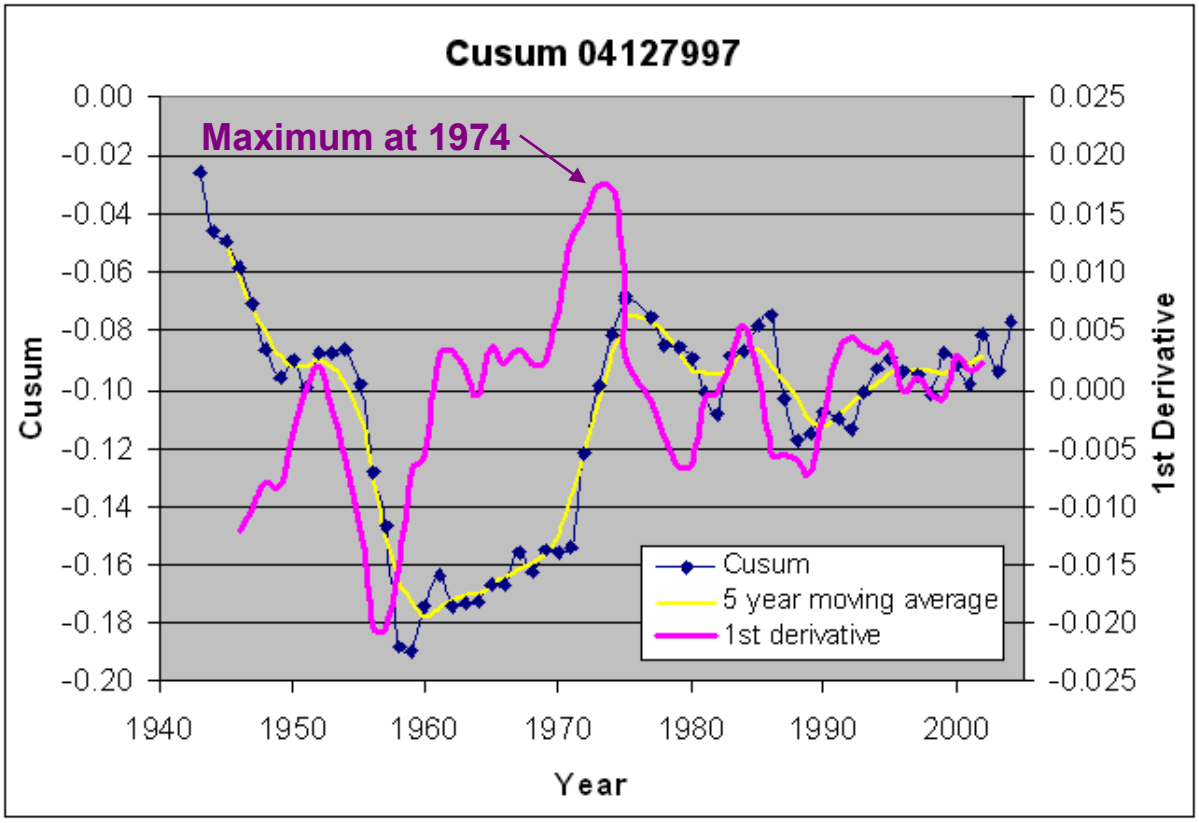

Figure A5 – Cusum Analysis, Defining Potential Breakpoint at 1974.

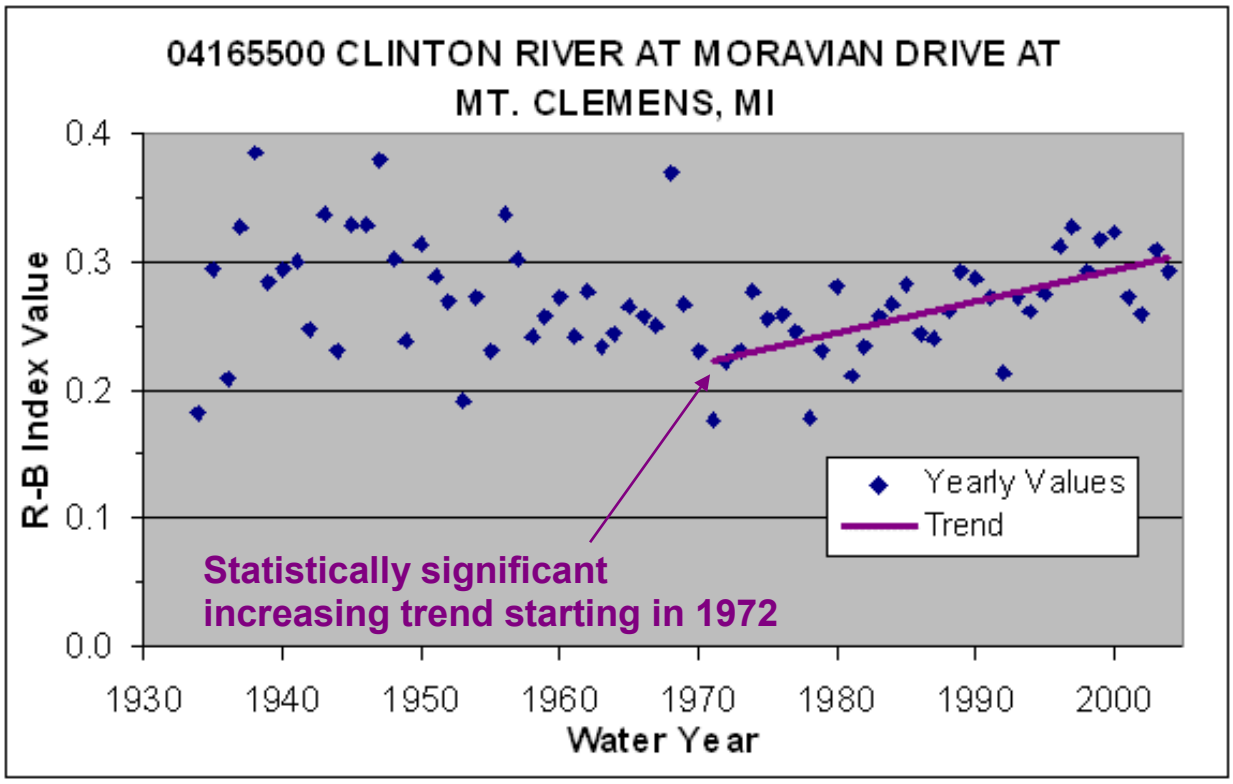

Figure A6 – USGS Gage 04165500 R-B Index Values.

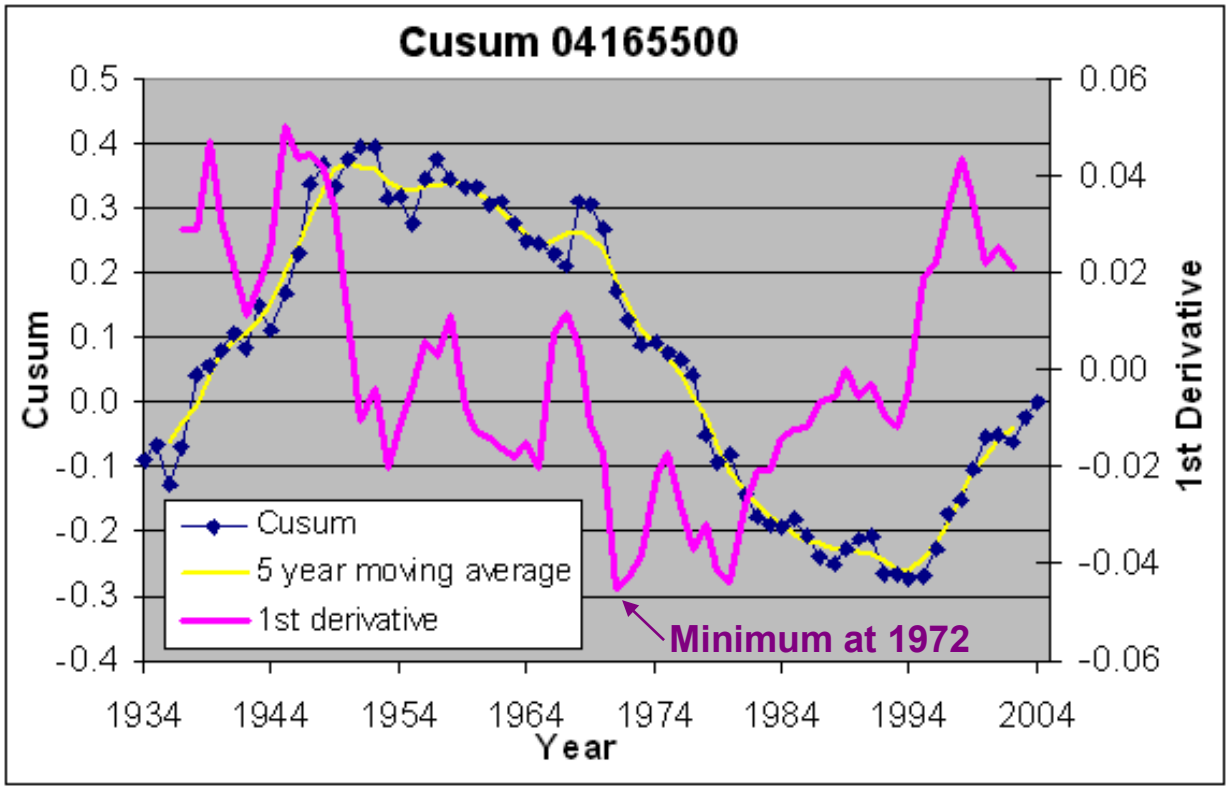

Figure A7 – Cusum Analysis, Defining Potential Breakpoint at 1972.

Water Resources Division

Appendix B: Michigan's Major Watersheds

State of Michigan
DEQ
Department of Environmental Quality

1	Au Gres	20	Manistee	41	Carp
1A	E. Br. Au Gres	21	Maumee	42	Cedar
2	Au Sable	22	Muskegon	43	Chocolay
2A	Pine	23	Occueoc	44	Days
3	Belle	24	Pentwater	45	Dead
4	Betsie	25	Pere Marquette	46	Escanaba
5	Big Sable	26	Pigeon	47	Ford
6	Black	27	Pine	48	Falls
7	Black	28	Platte	49	Manistique
8	Macatawa	29	Raisin	50	Menominee
9	Boardman	30	Rifle	50A	Paint
10	Pine	31	Rouge	50B	Brule
10A	Boyne	32	Saginaw	50C	Michigamme
10B	Jordan	32A	Cass	50D	Pine
11	Cheboygan	32B	Flint	50E	Sturgeon
12	Clinton	32C	Shiawassee	51	Montreal
13	Elk	32D	Tittabawassee	52	Munuscong
14	Grand	32E	Chippewa	53	Ontonagon
14A	Red Cedar	33	Sebewaing	54	Pine
14B	Looking Glass	34	St. Joseph	55	Portage
14C	Maple	34A	Paw Paw	55A	Sturgeon
14D	Thornapple	34B	Pigeon	56	Presque Isle
14E	Flat	34C	Elkhart	57	Rapid
14F	Rogue	35	Stony Creek	58	Sturgeon
15	Huron	36	Thunder Bay	60	Tahquamenon
17	Kalamazoo	37	White	61	Two Hearted
18	Kawkawlin	38	Willow	62	Waiska
19	Lincoln	39	Au Train	63	Whitefish
		40	Black		

Note: Basin Numbers containing an "L" represent Lake Drainage

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