

**City of River Falls
North Kinnickinnic River Monitoring Project**

2011 Summary



**Report prepared by SEH Inc., for the
City of River Falls Engineering Department
December 2011
City of River Falls
North Kinnickinnic River Monitoring Project**

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Project Introduction:

The Kinnickinnic River is one of the premier, naturally sustaining trout fisheries in the Upper Midwest, primarily producing brown trout. There has been a lot of concern about how new development in River Falls may affect the river, especially due to storm water runoff from impervious surfaces in these urbanizing areas. Not only can storm water runoff contribute chemicals from lawns, cars, etc., but the thermal impacts of untreated storm water are also a concern, as described on the [North Kinnickinnic River Monitoring Project](#) website (see “The Thermal Impacts of Storm Water”). In 2002, the City adopted a new [Storm Water Management Ordinance](#), which is designed to protect the Kinnickinnic River from the negative impacts of storm water runoff associated with new development. For new development and re-development projects, the City of River Falls Storm Water Management Ordinance requires that, for a 1.5-inch, 24-hour rainfall event, the post-development runoff volume and peak flow rate must not exceed the pre-development runoff volume and peak flow rate. To achieve this requirement, developers must provide on-site infiltration of storm water.

To take an active role in the river's health and well-being, the City of River Falls implemented the North Kinnickinnic River Monitoring Project in 2004. The goal of the project is to evaluate

the effectiveness of our Storm Water Management Ordinance for preventing degradation of the Kinnickinnic River due to new City development. The project scope includes four primary monitoring elements:

- Temperature Monitoring
- Water Quality Monitoring
- Base Flow Surveys
- Macroinvertebrate Monitoring

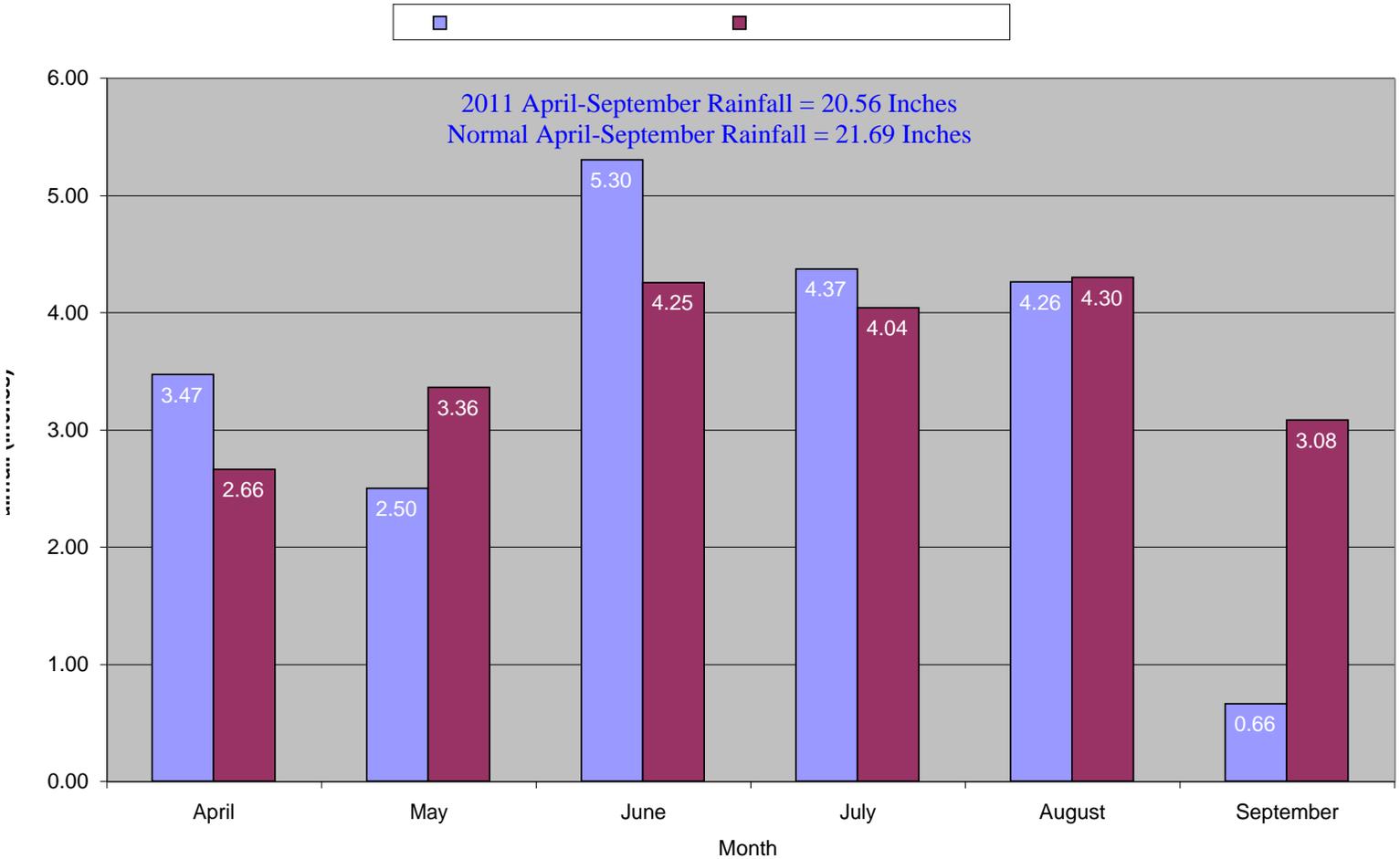
The City is examining the long-term results of each of these four monitoring elements to determine whether the storm water ordinance is protecting the river as new development occurs. The project uses an “upstream/downstream” approach to determine if storm water management practices in the Sterling Ponds subdivision protect downstream river conditions. We are also taking a focused look at the performance of the on-site storm water management practices that are incorporated into new developments. Our hope is that, due to the ordinance requirements, the thermal, water quality, and biological impacts of new development will be undetectable or greatly reduced.

River Falls Precipitation:

Due to the major influence of precipitation on river flow, temperature, and water quality, an analysis of seasonal precipitation is conducted as a part of this project. A total of 20.56 inches of precipitation was recorded in River Falls during the April-September 2011 period, 1.13 inches less than the normal total of 21.69 inches for the April-September time period. Rain fell on 62 days, or 34% of the April-September 2011 period.

Monthly rainfall amounts during the April-September 2011 period, with a comparison to normal monthly rainfall amounts, are presented in the figure below. April, June, and July were wetter than normal, with monthly rainfall excesses of 0.81 inch, 1.05 inches, and 0.33 inch, respectively. May and September were drier than normal, with a rainfall deficit of 0.86 inch evident in May and a significant deficit of 2.42 inches evident in September. Near-normal rainfall occurred in August. The combined rainfall during the three wettest months (June, July, and August) accounted for 68% of the total April-September 2011 precipitation. The largest rain events of the monitoring year occurred on April 26 (1.45 inches), June 21 (2.46 inches), and August 16 (1.78 inches). Well-above-normal precipitation during the July-September 2010 period and slightly-below-normal precipitation during the summer of 2011 kept drought conditions at bay through September 2011. However, with an extremely dry September 2011, abnormally dry conditions were again apparent in the North Kinnickinnic River Monitoring Project Area by mid-October 2011.

River Falls Monthly Rainfall: April-September 2011



Besides being slightly drier than normal, the April-September 2011 monitoring period was slightly cooler than normal. The mean air temperature in River Falls during the April-September 2011 period was 62.9° Fahrenheit (F), 0.8° F lower than the normal mean of 63.7° F for this time period. The months of April, May, June, and September were all cooler than normal, with April (-2.7° F) and September (-2.3° F) experiencing the greatest departures. The temperature in July was warmer than normal (+3.3° F), while the temperature in August was normal.

The City of River Falls Storm Water Management Ordinance should have provided infiltration of 94% (19.32 inches) of the total rainfall (20.56 inches) that occurred during the April-September 2011 period. This percentage was determined using some conservative estimates further described in the 2011 technical report.

Kinnickinnic River Flow:

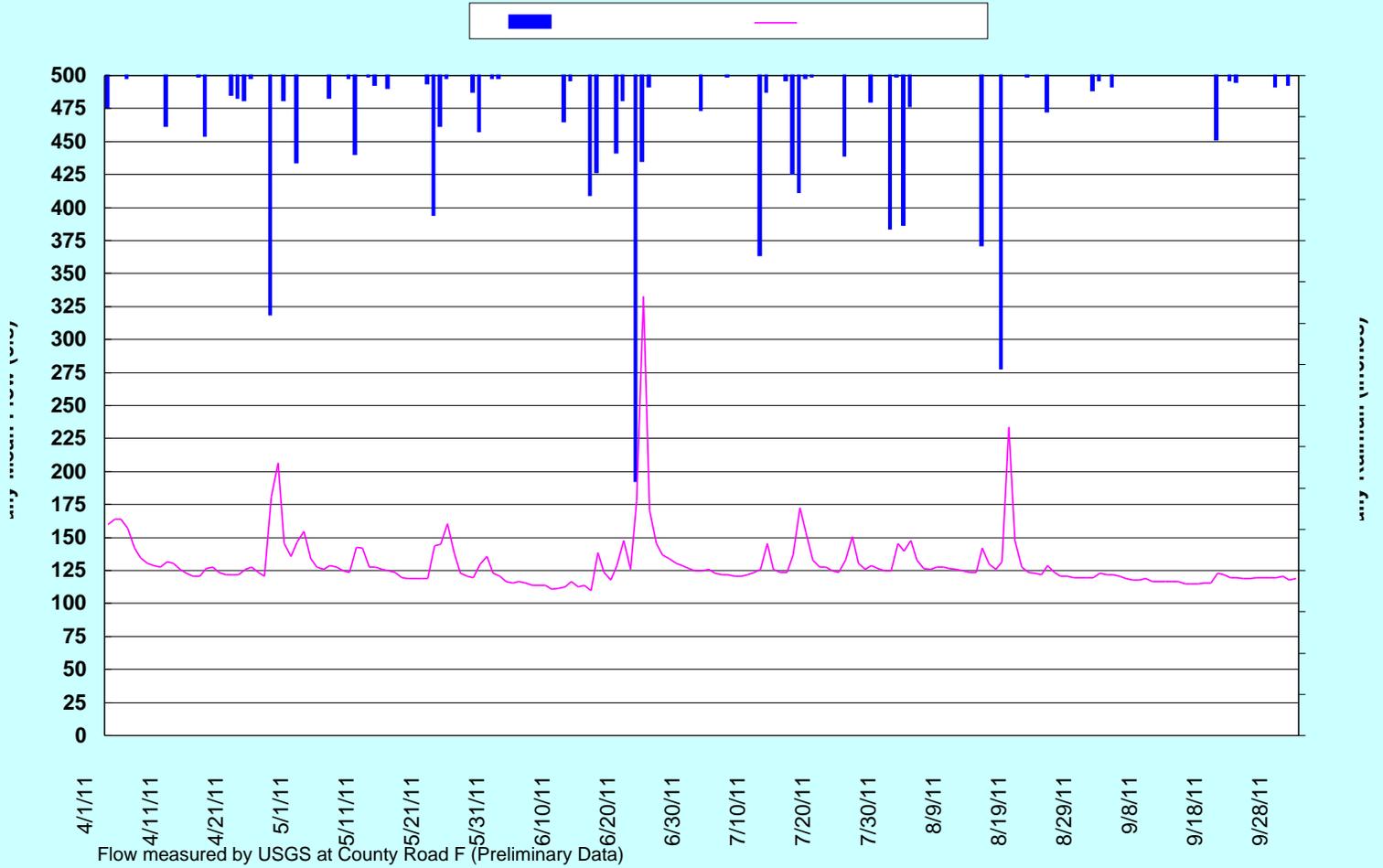
The flow of the Kinnickinnic River is a reflection of strong ground water contributions, as well as precipitation-induced storm water runoff from predominantly agricultural and urban land uses throughout the 165-square mile Kinnickinnic River Watershed. The daily mean (average) flow

of the Kinnickinnic River during the April-September 2011 period, as measured at the USGS monitoring station (County Highway F), is presented in the figure below. Daily rainfall, as measured at the USGS monitoring station, is also presented in the figure below.

The Kinnickinnic River hydrograph suggests that nine significant runoff events occurred during the April-September 2011 period (see the figure below). Peak daily mean flows for all of these runoff events exceeded 140 cubic feet per second (cfs). Two of these nine significant runoff events occurred in April, when the thermal impacts of storm water runoff are generally not a concern, but water quality impacts can be problematic. Back-to-back rain events on May 21 (0.85 inch) and May 22 (0.31 inch) produced a 5-day runoff event, with a peak daily mean flow of 161 cfs. A very large rain event on June 21 (2.46 inches), followed by a smaller rain event on June 22 (0.52 inch), produced the largest runoff event of the summer, with a peak daily mean flow of 333 cfs. A large rain event on July 10 (1.09 inches) produced a brief (1-day) runoff event, with a peak daily mean flow of 146 cfs. Back-to-back rain events on July 15 (0.60 inch) and July 16 (0.71 inch) produced a 4-day runoff event, with a peak daily mean flow of 173 cfs. Nearly back-to-back rain events on July 30 (0.93 inch) and August 1 (0.91 inch) also produced a 4-day runoff event, with a peak daily mean flow of 148 cfs. A large rain event on August 13 (1.03 inches) produced a brief (1-day) runoff event, with a peak daily mean flow of 142 cfs. A very large rain event on August 16 (1.78 inches) produced the second-largest runoff event of the summer, with a peak daily mean flow of 234 cfs. The seven runoff events in May, June, July, and August should be the focus for evaluating possible storm water impacts in the North Kinnickinnic River Monitoring Project Area in 2011, and are further analyzed in the 2011 technical report.

With near-normal rainfall during the April-September 2011 period, Kinnickinnic River base flows remained very stable throughout the April-September period, generally ranging from 110-125 cfs, as measured at County Highway F (see the figure below). Base flows tended to be a bit lower (110-120 cfs) during drier periods (late May to mid-June and early-mid September), and a bit higher (120-125 cfs) during wetter periods (late June, July, and August).

Kinnickinnic River Flow and River Falls Rainfall: April-September 2011



Temperature Monitoring:

The thermal impacts of untreated storm water discharges on segments of the Kinnickinnic River within the City of River Falls, especially in the downtown and Glen Park areas, have been clearly documented by temperature monitoring research conducted by the local Kiap-TU-Wish Chapter of Trout Unlimited (TU). These thermal impacts are also evident in the South Fork of the Kinnickinnic River. The TU temperature monitoring research can be viewed at:

<http://www.kiaptuwish.org/storm-water>



A direct storm sewer discharge to the Kinnickinnic River at Division Street

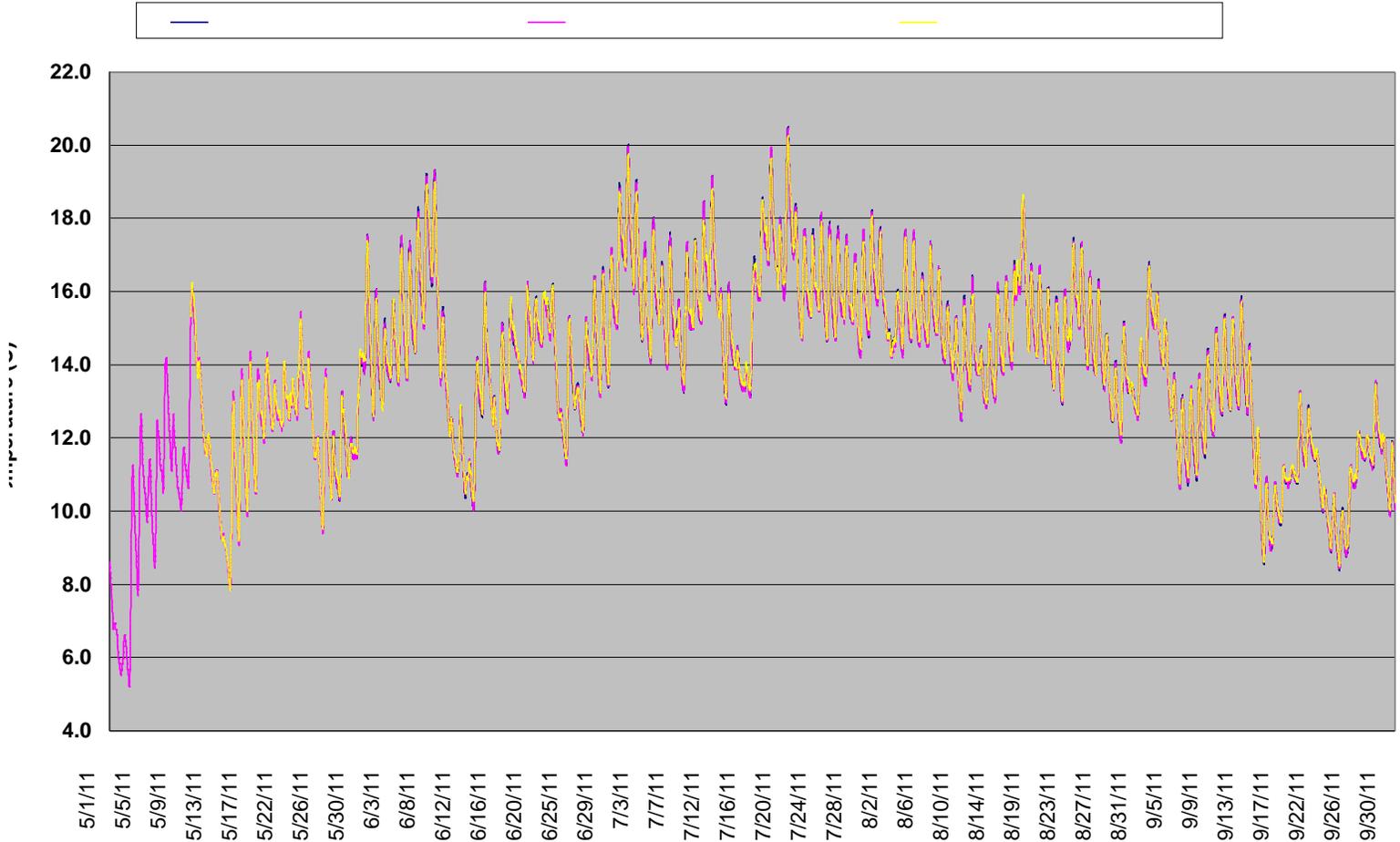
The intent of the City of River Falls Storm Water Management Ordinance is to prevent storm water impacts on the Kinnickinnic River, including thermal pollution, in areas of the city with new development, such as the Sterling Ponds subdivision.

Kinnickinnic River Temperature Monitoring Results:

May-September (summer) 2011 temperature monitoring data were obtained for the Kinnickinnic River at Sites 1, 1A, and 2. River temperatures at these three monitoring sites averaged 13.7° C and ranged from 5.2-20.5° C over the course of the summer. Lower-than-normal river temperatures probably prevailed in the North Kinnickinnic River Project Area during the summer of 2011, since the 2011 summer average air temperature of 19.2° C (66.5° F) was slightly lower than the normal summer average air temperature of 19.4° C (67.0° F). The 2011 summer average air temperature of 19.2° C was the fourth-lowest summer average air temperature recorded in the North Kinnickinnic River Monitoring Project Area during the 2004-2011 period. The 2011 summer average river temperature of 13.7° C (at Site 1A) was the lowest summer average river temperature recorded during the 2004-2011 period. The warmest summer average river temperature was recorded in 2007 (15.2° C), while summer average river temperatures in 2004-2006 and 2008-2010 ranged from 13.8°-14.9° C.

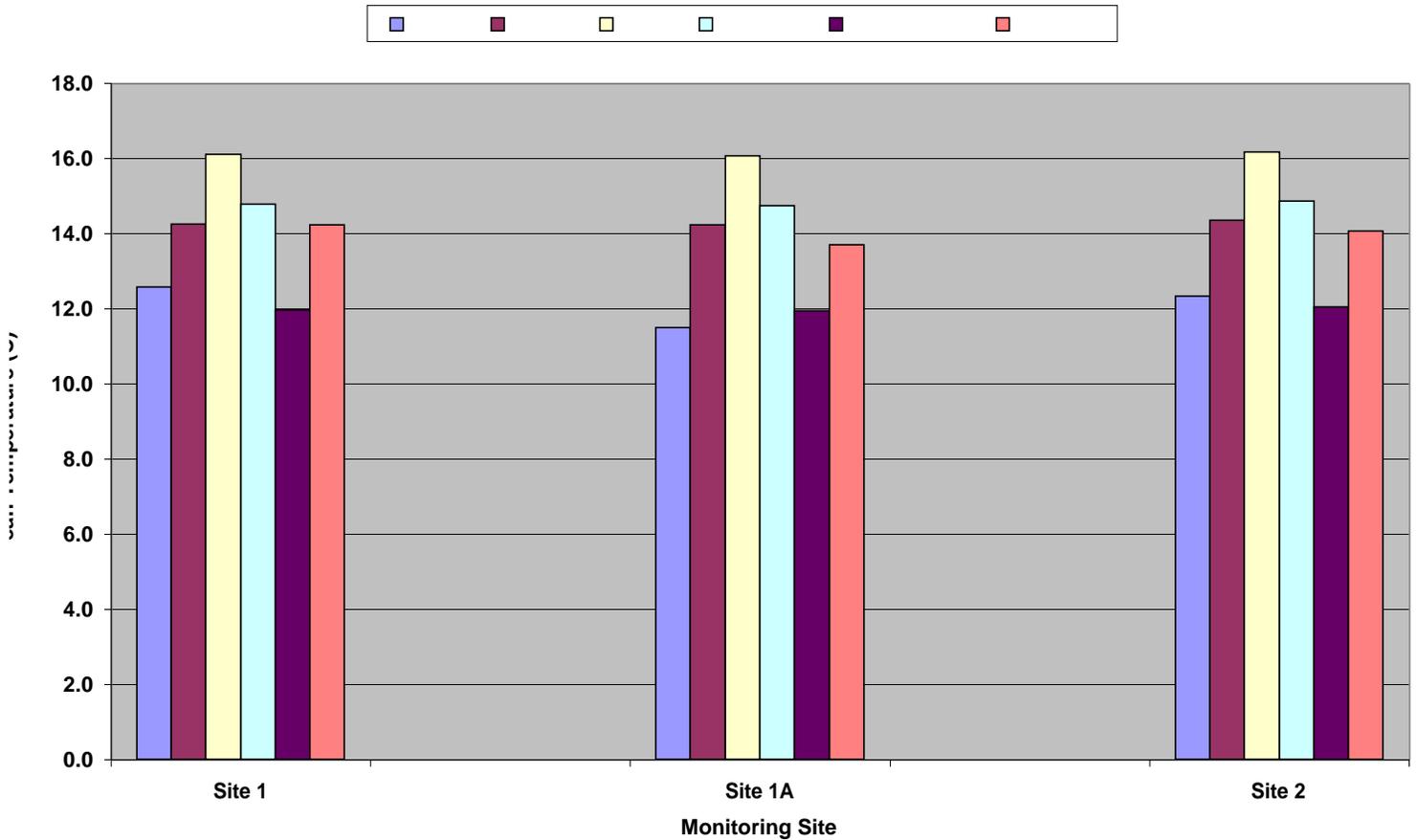
The most direct way to determine if any thermal impacts occurred in the Kinnickinnic River as a result of the Sterling Ponds subdivision is to compare the temperature monitoring data at Site 1, located immediately downstream from Sumner Creek, to the temperature monitoring data at Sites 1A and 2, located immediately upstream from Sumner Creek. In 2011, downstream summer temperatures at Site 1 were nearly identical to upstream summer temperatures at Sites 1A and 2, as shown below.

Kinnickinnic River Temperatures at Sites 1, 1A, and 2: May-September 2011



The 2011 monthly and summer mean (average) temperatures at Sites 1, 1A, and 2 were also nearly identical, as shown below.

**Monthly and Summer Mean Temperatures at Kinnickinnic River Monitoring Sites:
May-September 2011**



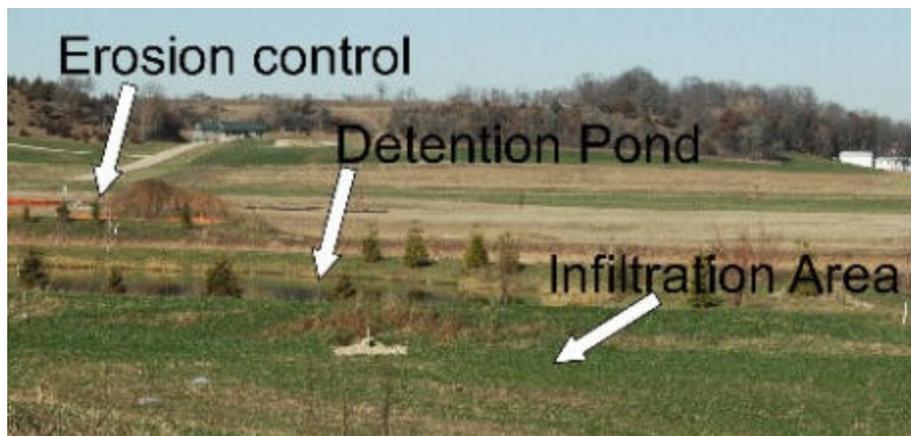
The summer 2011 temperature regime in the Kinnickinnic River at Sites 1, 1A, and 2 was generally excellent for coldwater macroinvertebrate and brown trout communities. Approximately 92% of all temperatures recorded at Sites 1, 1A, and 2 during the May-September 2011 period were less than or equal to (\leq) 17° C, which is the top of the optimum temperature range for a healthy coldwater macroinvertebrate community. A temperature of 17° C is also considered to be the optimum for brown trout survival. Approximately 99% of all temperatures recorded at Sites 1, 1A, and 2 during the May-September 2011 period were \leq 19° C, which is the top of the optimum temperature range for brown trout growth. Nearly 100% of all temperatures recorded at Sites 1, 1A, and 2 during the May-September 2011 period were \leq 20° C, which is the top of the optimum temperature range for brown trout survival. With a slightly cooler-than-normal summer, river temperatures exceeding 20° C were only recorded on one date in July.

Downstream from Sumner Creek and Sterling Ponds, no storm water-related thermal impacts were apparent at Site 1 after summer rain events, including seven significant rainfall events in May, June, July, and August 2011.



Sumner Creek and Sterling Ponds Temperature Monitoring Results:

May-September (summer) 2011 temperature monitoring data were obtained for Sumner Creek at Sites 4 and 4A (downstream from Sterling Ponds). Site 4 is located immediately downstream from Sterling Ponds, while Site 4A is located 1.5 miles downstream, near the mouth of Sumner Creek. Temperature monitoring data for the Sterling Ponds storm water management practices were obtained in the wet detention pond (Site 5P), at the wet pond discharge to the infiltration basin (Site 5IB), and at the wet pond discharge to Sumner Creek (Site 5MHW). The Sumner Creek and Sterling Ponds temperature monitoring results helped document the effectiveness of the City of River Falls Storm Water Management Ordinance in 2011.



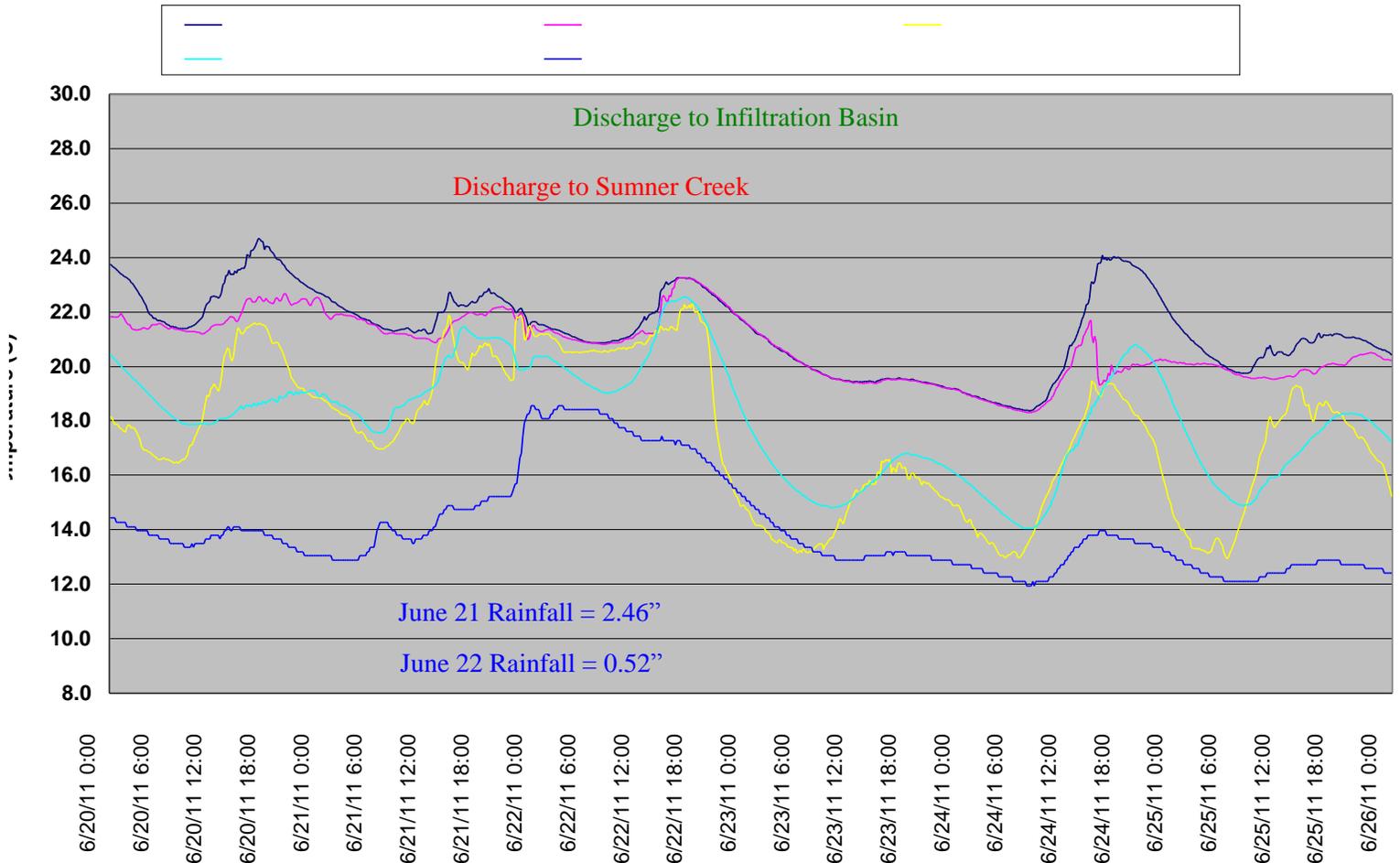
Storm water best management practices at Sterling Ponds

Temperature monitoring data indicate that the storm water management practices at Sterling Ponds prevented thermal impacts on the Kinnickinnic River during the May-September 2011 period. The summer mean temperature of the Sterling Ponds wet detention pond at Site 5P was 22.0° C (range = 12.0-35.0° C), but much of this warm storm water was effectively infiltrated in the wet pond and/or discharged to the adjacent infiltration basin. With the exception of three moderate to very large rain events in June, July, and August, all summer rainfall events were fully infiltrated, as required by the River Falls Storm Water Management Ordinance. These 47 rain events, ranging in magnitude from 0.01-1.09 inches, represent a total of 12.14 inches of precipitation, or 71% of the total summer rainfall amount (17.09 inches).

The Sterling Ponds wet detention pond only discharged to Sumner Creek during a very large rain event on June 21 (2.46 inches), a moderate rain event on July 16 (0.71 inch), and a very large rain event on August 16 (1.78 inches). During these events, the wet detention pond discharged warmer water (20.5-23.4° C) to Sumner Creek for extended time periods (14.7-18.2 hours). The warm storm water discharges during these three rain events caused thermal spikes in Sumner Creek at Site 4, and also contributed to extended durations of much warmer-than-normal water at Site 4A. Although wet pond discharges to Sumner Creek occurred on June 21, July 16, and

August 16, it seems likely that the majority of these rainfall events (a combined 4.95 inches) was infiltrated rather than discharged. The durations of these discharges to Sumner Creek were relatively short (14.7-18.2 hours), compared to the lengthy durations of discharges to the infiltration basin (7.0-9.9 days). While storm water discharges to Sumner Creek occurred during the very large rain events on June 21 and August 16, it should be noted that the 24-hour rainfall amounts for these two storms greatly exceeded the 1.5-inch infiltration standard set by the River Falls Storm Water Management Ordinance. The Sterling Ponds and Sumner Creek temperature monitoring results for the June 21 rain event are shown below. Temperature monitoring results for the July 16 and August 16 rain events are presented in the 2011 technical report.

Sterling Ponds and Sumner Creek Temperatures: June 20-25, 2011



Effectiveness of Sterling Ponds Storm Water Management Practices:

Temperature monitoring of the Sterling Ponds storm water practices during the 2005-2011 period indicates that storm water discharges to Sumner Creek typically occur during rain events larger than 1.5 inches, during back-to-back rain events, when rainfall amounts range from 0.7-1.5 inches and time periods between rain events are less than 48 hours, and during very intense rain events, when rainfall amounts range from 1.0-1.5 inches.

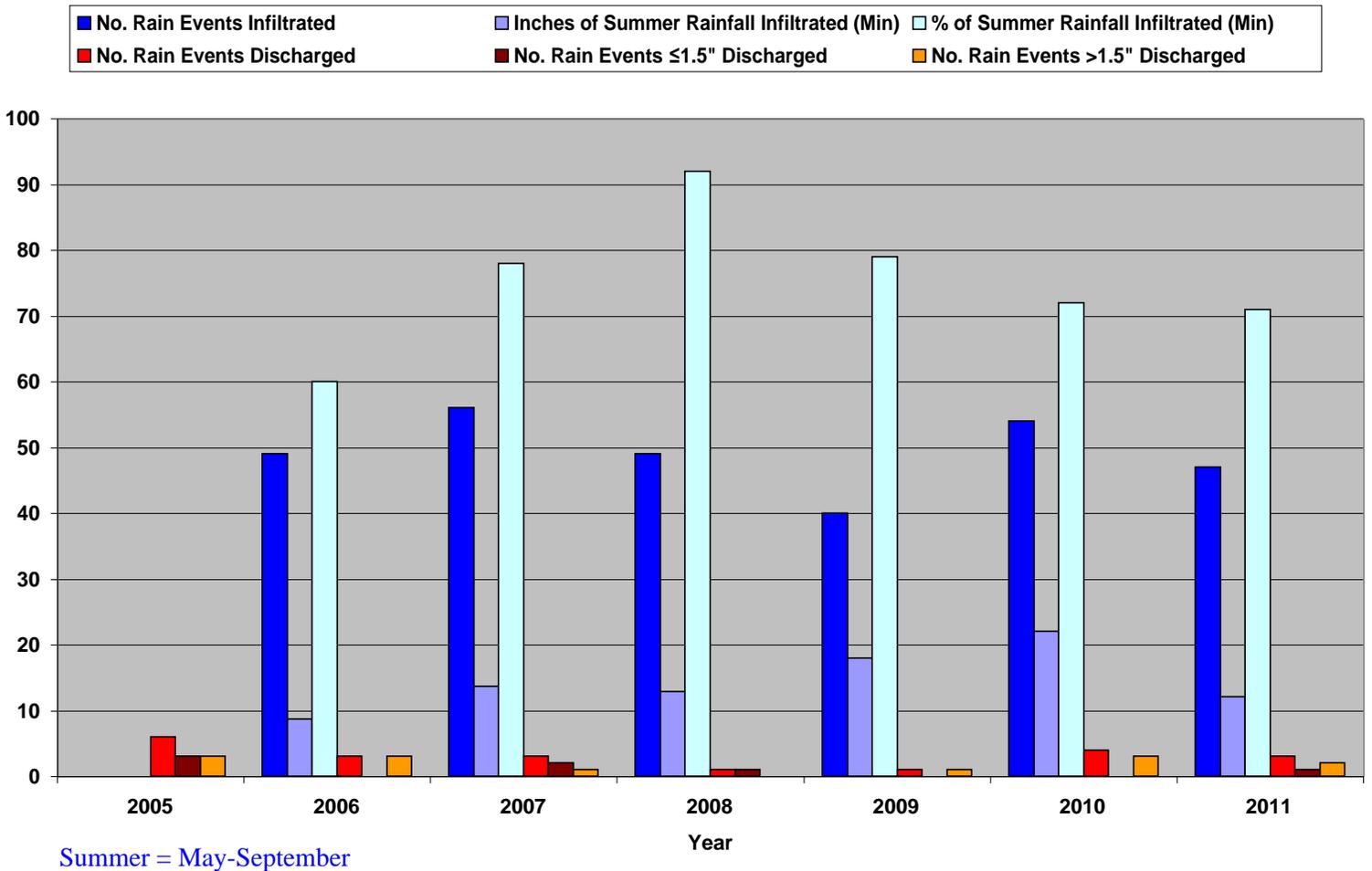
In June 2007, River Falls Engineering Department staff investigated these performance issues and determined that the control structure for the wet detention pond outlet should be raised by 6 inches, to provide more storm water storage in the wet pond and allow the discharge of more storm water volume to the infiltration basin. This modification should be beneficial for the back-to-back rain events and very intense rain events ≤ 1.5 inches that are occasionally causing wet pond discharges to Sumner Creek. More storm water storage capacity in the wet pond should also increase discharge lags and reduce the discharge times associated with rain events larger than 1.5 inches.

The modification made to the control structure for the Sterling Ponds wet pond outlet in June 2007 seemed to improve storage and infiltration capacity for these types of events in 2007, 2008, and 2009, but was not particularly helpful for the very large rain events (6 events ≥ 1.5 inches) that occurred in 2010 and 2011. Rain events larger than 1.5 inches exceed the intent of the River Falls Storm Water Management Ordinance, so storm water discharges to Sumner Creek might be expected. However, storm water discharges to Sumner Creek during back-to-back or very intense rain events, when rainfall amounts are less than the 1.5-inch ordinance requirement, may need further attention. For back-to-back rain events, more rapid delivery of storm water to the infiltration basin may be desirable between rain events, to ensure substantial infiltration of the first rain event within a 24-hour period. In addition, perhaps some provision should be made in the River Falls Storm Water Management Ordinance to ensure adequate infiltration of back-to-back 1.5-inch, 24-hour rain events. Additional capacity in the Sterling Ponds wet pond may be helpful for capturing more storm water volume during very intense rain events, but the increased volume in the pond could require more infiltration time, which may prove problematic when large, back-to-back rain events occur.

Given the frequent number of rain events ≥ 1.5 inches during the 2004-2011 monitoring period (20), including 14 that resulted in wet pond discharges to Sumner Creek during the 2005-2011 period, perhaps an ordinance amendment should be considered, to require infiltration of all 24-hour rain events ≤ 2.0 inches. Such an ordinance modification would have covered 9 (45%) of the 20 rain events ≥ 1.5 inches during the 2004-2011 monitoring period, and potentially would have resulted in 5 fewer rain events with wet pond discharges to Sumner Creek.

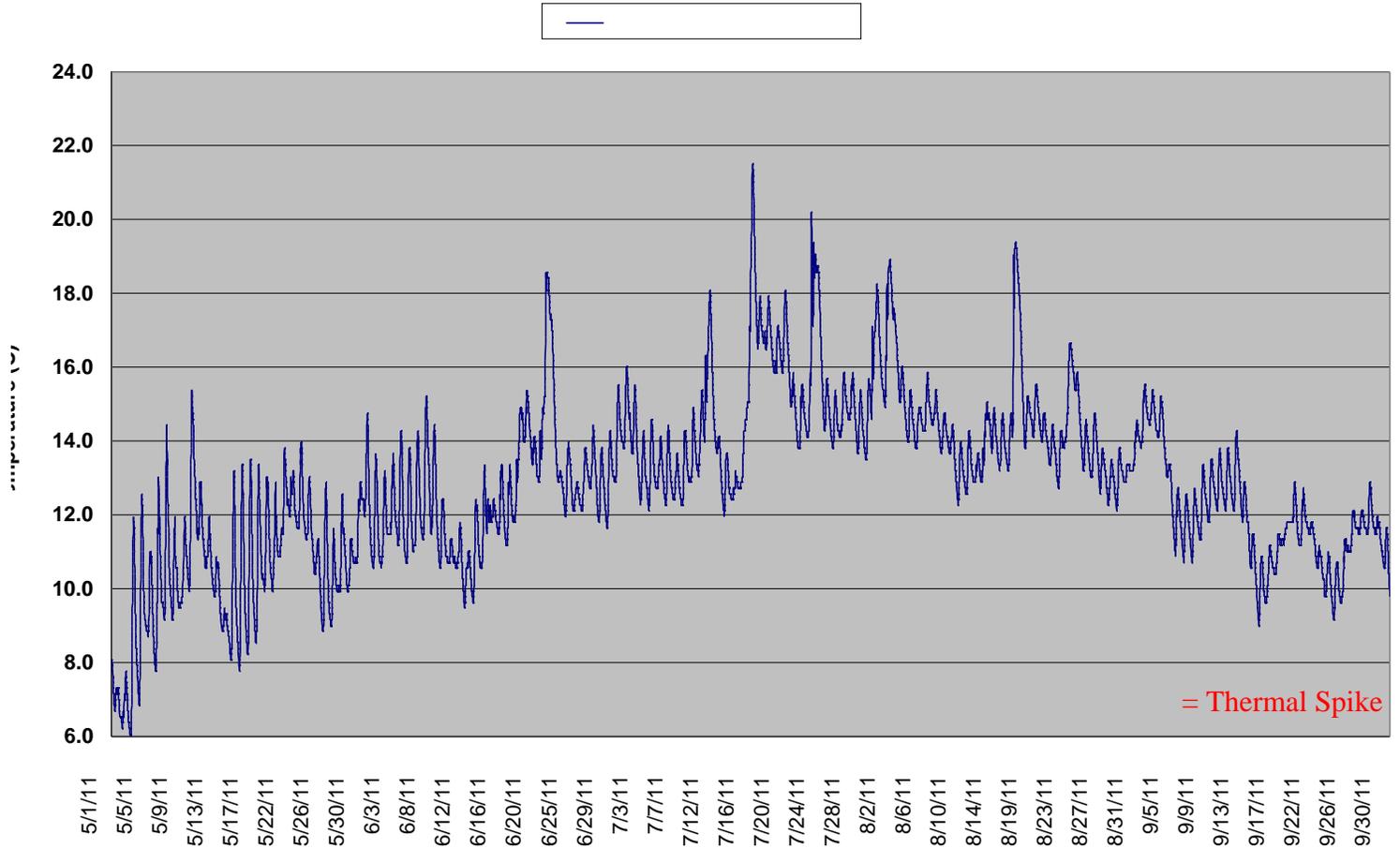
Based upon the 2005-2011 temperature monitoring results, it appears that the Sterling Ponds storm water management practices are producing long-term positive results that protect the Kinnickinnic River. A summary of the performance of Sterling Ponds storm water management practices during the 2005-2011 period is presented in the figure below. Note that the number of summer rain events infiltrated far exceeds the number of rain events (partially) discharged to Sumner Creek each year. Also note that the minimum percentage of summer rainfall infiltrated ranged from 60-92% during the 2006-2011 period. Beyond 2011, these same trends will be monitored from year to year, to determine if favorable results are apparent in the future.

Performance of Sterling Ponds Storm Water Management Practices: 2005-2011



Permanent flow occurred in lower Sumner Creek at Site 4A throughout the summer. The summer mean temperature (12.9° C) reflects strong spring flow. The creek potentially provides a good thermal environment for a brook trout fishery, and is an important contributor of cold water to the Kinnickinnic River. However, thermal spikes of notable magnitude (2.2-6.4° C) occurred at this location during seven rain events (0.49-2.46 inches) throughout the June-August period, as shown in the figure below. Storm water discharges at Sterling Ponds contributed to the extended thermal spikes evident after the June 21, July 16, and August 16 rain events; but all thermal spikes also had a more local cause that needs further investigation. Thermal spikes of this frequency and magnitude may have detrimental impacts on aquatic life (especially macroinvertebrates) in lower Sumner Creek.

Sumner Creek Temperature at Site 4A: May-September 2011



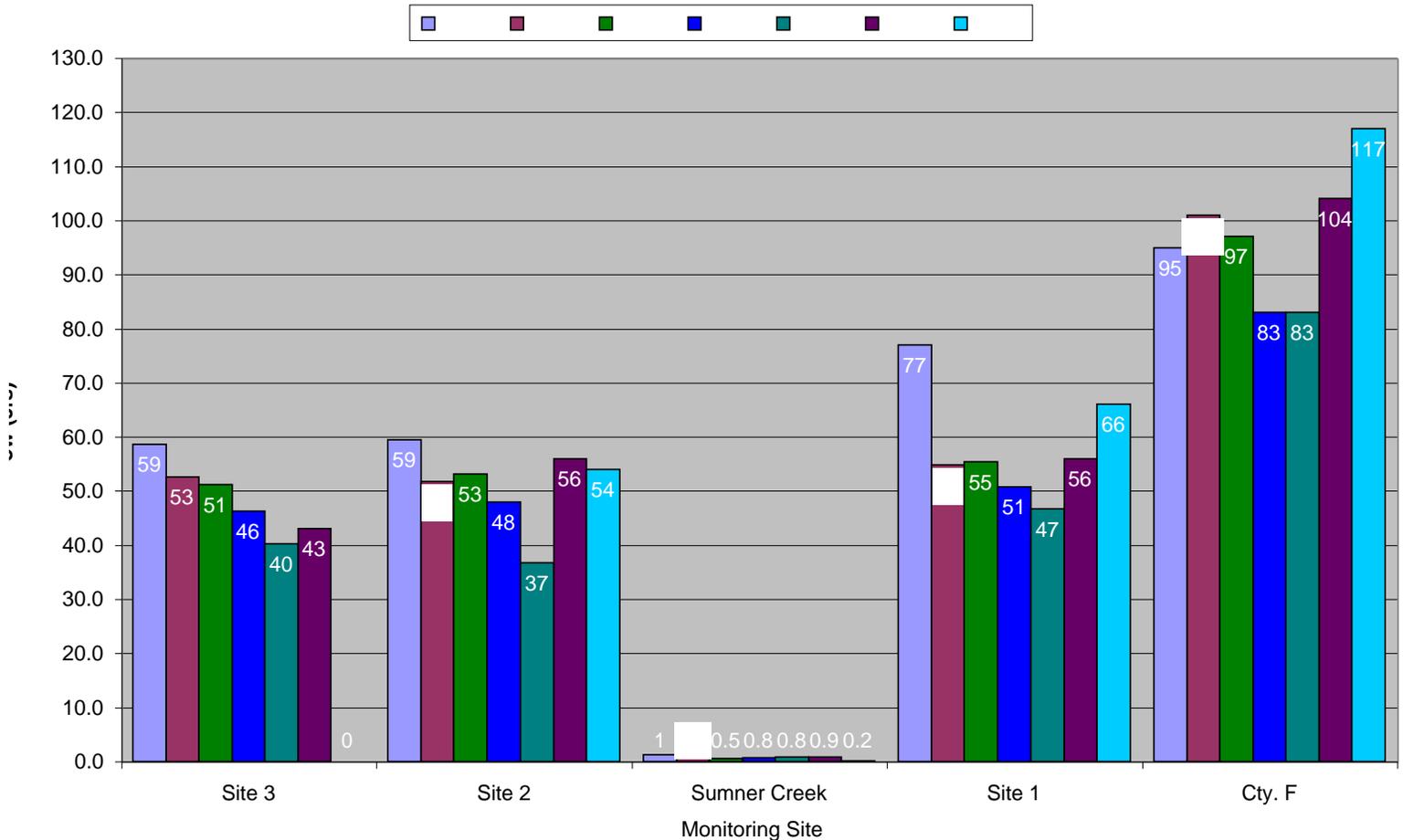
Base Flow Surveys:

In June (spring) and October (autumn) 2011, base flow surveys were conducted at Sites 1-3 in the Kinnickinnic River and at the mouth of Sumner Creek (Site 4A) within the North Kinnickinnic River Monitoring Project Area. Spring base flow surveys have been conducted for six consecutive years (2006-2011), while autumn base flow surveys have been conducted for seven consecutive years (2005-2011). The Kinnickinnic River was assumed to be in a base flow condition when 3-4 days of “flat-line” flow were observed at the USGS stream flow gauging station located at County Highway F (as described in the 2011 technical report). During the April-September 2011 period, the Kinnickinnic River generally maintained a base flow condition of approximately 110-125 cfs at County Highway F.

The autumn 2011 base flow survey results are presented below, with a comparison to the autumn 2005-2010 survey results. In autumn 2011, Kinnickinnic River base flows increased notably (22%) from upstream (Site 2) to downstream (Site 1), with Sumner Creek providing a small contribution upstream of Site 1. With above-normal precipitation in the summer of 2010 and near-normal precipitation in the summer of 2011, autumn base flows rebounded at all sites in

2010-2011, reversing a downward trend that had been occurring since 2005, due to three consecutive summers of below-normal precipitation (2006-2008) and a continuation of moderate-severe drought conditions throughout the summer of 2009.

Autumn Base Flow Conditions in the Kinnickinnic River and Sumner Creek:
2005-2011



More information on the spring and autumn base flow survey results can be found in the 2011 technical report. Based upon several years of base flow survey data, it seems apparent that climatic variability can cause significant annual changes in spring and autumn base flows within the North Kinnickinnic River Monitoring Project Area. One goal of the River Falls Storm Water Management Ordinance is to maintain strong base flow conditions in the Kinnickinnic River by requiring storm water management practices that promote infiltration of rainfall, thereby recharging and maintaining shallow aquifer levels, as well as the springs that provide cold water for the river. Performance monitoring at Sterling Ponds has demonstrated that the storm water management practices have provided excellent infiltration capacity since 2004, thereby helping to sustain groundwater recharge during an extended dry period (2006-2009). Annual spring and autumn base flow surveys will provide an ongoing measure for determining if base flow conditions will be sustained in the future as development progresses in the North Kinnickinnic River Monitoring Project Area.

Macroinvertebrate Monitoring:

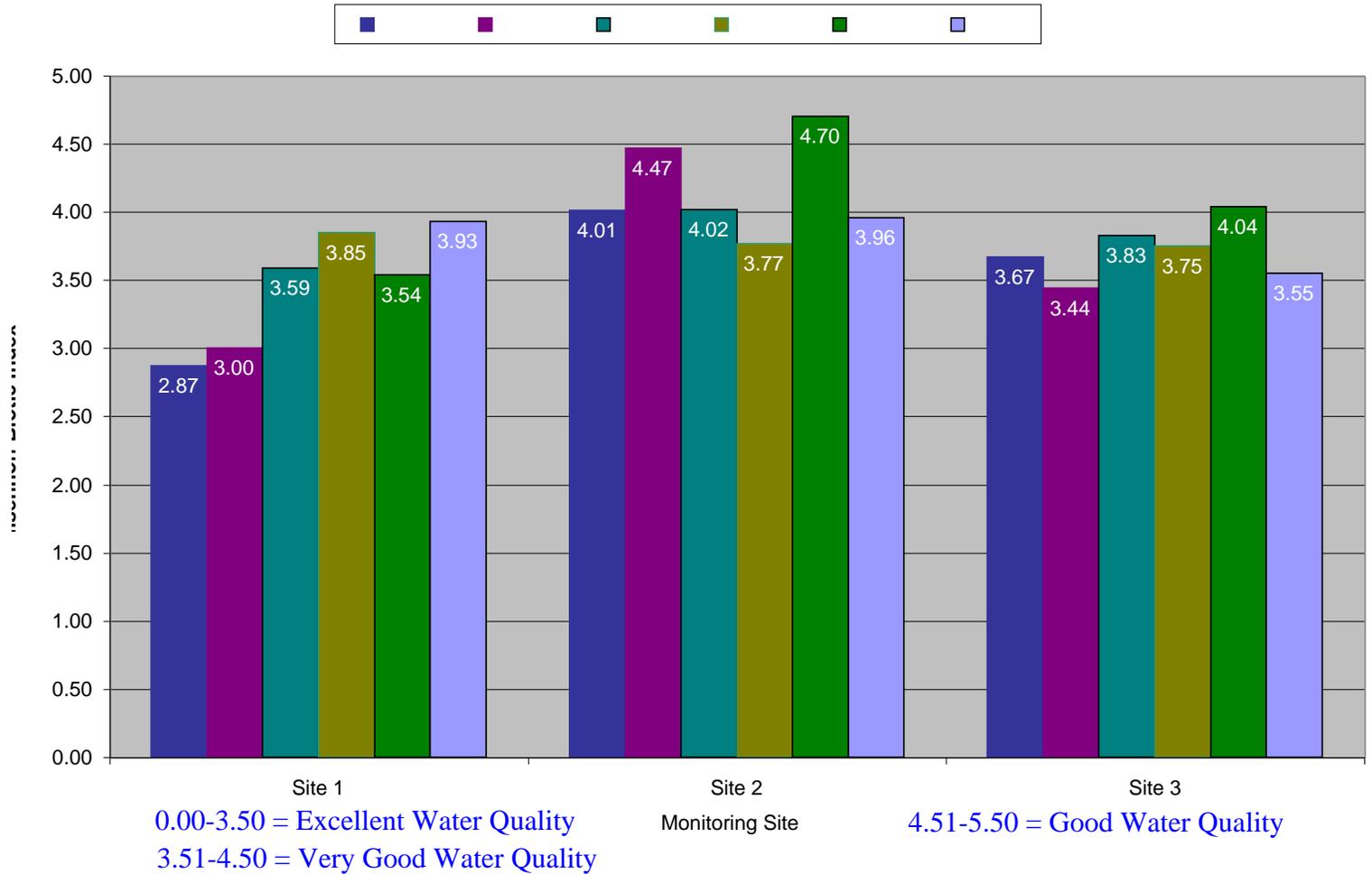
Biological indicators such as macroinvertebrates (aquatic insects) are often used to complement physical and chemical measurements in stream monitoring programs. Because macroinvertebrates live in the stream environment for a year or more, they are excellent indicators of past as well as present water quality conditions. Annual macroinvertebrate samples are collected at Sites 1-3 within the North Kinnickinnic River Monitoring Project Area. Organisms are identified and counted in the laboratory, and various biological indices can then be calculated for each monitoring site. The index values are indicative of water quality, depending upon the pollution tolerances of the macroinvertebrates collected at the monitoring sites.

The Hilsenhoff Biotic Index (HBI) is particularly useful for determining the influence of organic pollution on macroinvertebrates. The Wisconsin Department of Natural Resources has used this index for many years in long-term stream monitoring programs. Each macroinvertebrate taxon (genus and/or species) has been assigned a specific tolerance value, ranging from 0 (extremely intolerant of organic pollution) to 10 (extremely tolerant of organic pollution). The more intolerant taxa that are present, the lower the HBI value, indicating better water quality, as follows:

HBI Value	Water Quality	Degree of Organic Pollution
0.00-3.50	Excellent	No apparent organic pollution
3.51-4.50	Very Good	Slight organic pollution
4.51-5.50	Good	Some organic pollution
5.51-6.50	Fair	Fairly significant organic pollution
6.51-7.50	Fairly Poor	Significant organic pollution
7.51-8.50	Poor	Very significant organic pollution
8.51-10.00	Very Poor	Severe organic pollution

The 2004-2009 macroinvertebrate HBI values at Sites 1-3 in the North Kinnickinnic River Monitoring Project Area are presented below. The 2004-2009 data establish an ongoing baseline for assessing the long-term health of the macroinvertebrate community within the project area. During the 2004-2009 period, HBI values at Site 1 were indicative of very good-excellent water quality, HBI values at Site 2 were indicative of good-very good water quality, and HBI values at Site 3 were indicative of very good-excellent water quality. The annual HBI values at Site 1 are generally less than or comparable to the annual HBI values at Sites 2 and 3, indicating slightly better water quality at Site 1. The comparability of annual macroinvertebrate HBI values at Sites 1-3 during the 2004-2009 period indicates that no storm water impacts were apparent at Site 1, downstream from Sumner Creek and the Sterling Ponds subdivision.

Kinnickinnic River Macroinvertebrates: Hilsenhoff Biotic Index



Macroinvertebrate monitoring was also conducted in May 2010 and May 2011, but the analysis of these samples has not yet been completed by the University of Wisconsin-Stevens Point laboratory. Annual HBI values and other macroinvertebrate indices will continue to be posted as they become available, and long-term trends in these indices will continue to be evaluated, to assess the ongoing health of the Kinnickinnic River macroinvertebrate community.

Water Quality Monitoring:

At the outset of the North Kinnickinnic River Monitoring Project in 2004, water quality monitoring was envisioned at Kinnickinnic River Sites 1 and 2, to assess any water quality impacts related to storm water runoff from the Sterling Ponds subdivision. Due to technical difficulties with the automated monitoring equipment and the complexity of open-channel monitoring, no runoff event-based water quality monitoring has been conducted at Sites 1 and 2 to date. However, the results of temperature and macroinvertebrate monitoring at these locations have consistently demonstrated that Sterling Ponds storm water impacts on the Kinnickinnic

River have been very minimal. With these two key monitoring components in place, water quality monitoring is probably not necessary at Sites 1 and 2.

Rather, to obtain water quality information on the performance of the Sterling Ponds storm water management practices, the automated monitoring equipment at Sites 1 and 2 has been re-located to Sites 5IN (Sterling Ponds wet detention pond inlet) and 5MHW (Sterling Ponds wet detention pond outlet). Along with automated sampling at these two locations, grab sampling can be conducted at Site 5IB (Sterling Ponds infiltration basin). Monitoring at these three locations, beginning in 2012, will determine if Sterling Ponds wet pond pollutant removal efficiencies are meeting target removal efficiencies (80%) for total suspended solids (TSS) and total phosphorus (TP). Monitoring will also better characterize the water quality impacts of any Sterling Ponds wet pond discharges to Sumner Creek. In addition, potential impacts on pollutant removal efficiencies can be determined, if Sterling Ponds storm water management practices are adjusted to provide improved storm water infiltration capability.

North Kinnickinnic River Monitoring Project Indicators:

As a part of the North Kinnickinnic River Monitoring Project, key physical and biological indicators have been monitored to evaluate the effectiveness of the River Falls Storm Water Management Ordinance for preventing degradation of the Kinnickinnic River due to development-related storm water impacts. These ten key indicators, which have been monitored since the onset of the project in 2004, include:

- Total rainfall in River Falls during the April-September period
- % April-September rainfall infiltrated, per the River Falls Storm Water Management Ordinance
- Number of summer (May-September) rain events infiltrated and % summer rainfall infiltrated, as measured by monitoring at Sterling Ponds
- Summer (May-September) average air temperature in River Falls
- Summer (May-September) average temperatures in the Kinnickinnic River and Sumner Creek
- % of the summer Kinnickinnic River temperatures favorable for biota
- % of the summer Sumner Creek temperatures favorable for biota
- Spring base flow conditions in the Kinnickinnic River and Sumner Creek
- Autumn base flow conditions in the Kinnickinnic River and Sumner Creek
- Kinnickinnic River macroinvertebrate HBI values

The [North Kinnickinnic River Monitoring Project Indicators](#) for the 2004-2011 period can be found on the project website. As monitoring continues in the future, these indicators can evaluate the annual effectiveness of the River Falls Storm Water Management Ordinance and track long-term trends that document protection of the Kinnickinnic River.