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MINNESOTA DEPARTMENT OF NATURAL RESOURCES

DIVISION OF FISHERIES AND WILDLIFE

Brown Trout Young-of-Year Assessment

Brown Trout YOY Assessment on Little Rock Creek, Benton and Morrison County, Minnesota

October 23, 2012,

By

Steve Marod

Little Falls Area Fisheries

Submitted by: __Steve Marod_____ Date: _2/6/2013__

Approved by: __Eric R. Altena_____ Date: _3/12/2013__
Area Fisheries Supervisor

Approved by: _____ Date: _____
Regional Fisheries Supervisor

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ABSTRACT

A special brown trout young-of-year assessment was conducted on Little Rock Creek (M-078) at three stations, at County 234 in Morrison County (EF1), downstream of County 26 (EF2) and downstream of a minimum maintenance road off of County 40 (EF3) in Benton County on October 23, 2012. Population data was gathered to compare to prior surveys and for purposes of evaluating brown trout natural reproduction on the stream. Brown and brook trout were targeted although an attempt was made to capture all northern pike encountered during sampling. A total of 86 brown trout, 33 brook trout, and 7 northern pike were sampled in three electrofishing stations for catch rates of 176, 67 and 14 fish per mile respectively. Electrofishing efforts failed to document YOY brown trout. A total of 29 brook trout YOY were captured at one station downstream of County 26 for a catch rate of 217 per mile. Brown trout were captured at all three electrofishing stations. Brook trout were only observed at the County 26 station. Results of this assessment suggest that brown trout failed to reproduce naturally in 2011 despite the presence of a good population of adult fish. The presence of YOY brook trout in the stream suggested that conditions may have favored their reproductive strategy over that of brown trout in 2011.

STUDY AREA

Little Rock Creek is a DNR designated Class I A Brown Trout stream that drains lands east and north of Rice, MN to the Mississippi River in Benton County. The Little Rock Creek Watershed Basin covers approximately 108.01 mi^2 and is part of the Mississippi-Sartell major watershed. Little Rock Creek is a unique coldwater resource in central Minnesota and had a self-sustaining population of brown trout from 1908 through the early 1990's when trout apparently disappeared. Management efforts since 1995 have focused on reestablishing a self-sustaining population of brown or brook trout in the stream. Wild brown trout from southeastern Minnesota and a native strain of brook trout adapted to more marginal stream conditions have been stocked periodically from 1995 through 2009. Some natural reproduction of both species has occurred, but not enough to sustain a fishery. In 2010 and 2011, stocking was changed to brown trout fingerlings, as this strategy had produced self-sustaining populations in other central Minnesota streams. Brown trout were not stocked in 2012 in order to evaluate natural reproduction.

The extent of trout water on Little Rock Creek stretches from Morrison County Road 56 at the upstream end, to south of Benton County Road 40 above the Sartell WMA impoundment at the downstream end. Three electrofishing stations (Figure 1) were replicated from previous surveys in known trout areas that contained suspected YOY habitat.

Riparian habitat was primarily wooded with bottomland forest cover types featuring ash and silver maple. High banks had bur and red oak present. Land use in the watershed is primarily agricultural with greater than 70% of land cover types dominated by cultivated crops

and pasture/hay. Soils in the watershed are predominately sand which has been extensively irrigated to produce corn, soybeans and potatoes.

METHODS

Three backpack shocker electrofishing stations were sampled in early October to evaluate YOY brown trout abundance (Figure 1). Two backpack electrofishing units (Smith-Root 15-D POW gas powered and Halltech HT2000B battery powered) were utilized at all three stations (Table 1). Trout and northern pike were captured, enumerated and measured for total length. Trout were then released back into the stream. All northern pike captured during the assessment were sacrificed to accommodate stomach content analysis.

Water temperature was recorded hourly at six stations, TL1 through TL6, (Figure 1) from April 14, 2012 through September 18, 2012 using Onset HOBO Water Temp Pro v2 temperature recorders.

Level II Rosgen morphological description analysis was conducted at three stations (Figure 1) on Little Rock Creek; upstream of Co. 12, at the Minimum Maintenance Road off of Co. 40, and downstream of Co. 26 (Rosgen 1996).

RESULTS AND DISCUSSION

Fish Sampling Results

A total of 86 brown trout, 33 brook trout and 7 northern pike were sampled at three electrofishing stations totaling 0.49 miles of stream. No YOY brown trout were documented in this assessment. Brown trout sampled ranged from 5.8 to 17.3 inches in total length and averaged 9.3 inches (Table 2). Brown trout length distribution was similar at all stations (Table 3). All brown trout sampled appeared to be yearling age and older. Brown trout were sampled at all three stations with an average catch rate of 176 fish/mile of stream. Catch per mile at each station was 71 at EF1, 442 at EF2, and 105 at EF3 (Table 4). Catch rates were down when compared to the 2011 assessment due mainly to the lack of YOY in the population. While some brown trout captured may have been naturally reproduced, there was no way to differentiate stocked and natural fish as stocking occurred in all years except 2012.

Brook trout were last stocked in Little Rock Creek in 2008 so all brook trout captured were probably naturally reproduced. A total of 33 brook trout were captured and ranged from 3.3 to 16.7 inches in total length (Table 2 and 3). All brook trout sampled in the survey were captured at station EF2. The catch rate for brook trout at EF2 was 275/mile, and overall was 67/mile (Table 4). Twenty-nine of the brook trout sampled were YOY individuals. YOY brook trout ranged from 3.3 to 5.8 inches and averaged 4.3 inches.

A total of seven northern pike were captured during the assessment, two at station EF1 and five at station EF2. Northern pike sampled averaged 11.6 inches and ranged from 9.4 to 17.8 inches in total length (Table 2 and 3). All but one pike were YOY individuals. Catch per

mile of pike was 14 for all stations (Table 4). Only one northern pike had fed recently and had a creek chub in its stomach. No trout of either species were found in pike stomachs in this assessment.

Brown and brook trout have similar optimum and critical temperatures (Raleigh et al 1986, Raleigh 1982). Research has determined that stress ensues for both species as stream temperatures approach 70^{o} F. Brown trout have somewhat higher lethal temperatures while brook trout thrive in somewhat cooler temperatures. Both species can survive temperatures above 70 degrees for short periods of time with adequate acclimation time which typically occurs as temperatures gradually climb during summer. Temperature recorders were placed at six locations on Little Rock Creek and Bunker Hill Creek from April 14, 2012 through September 18, 2012. A recorder at County 26 became buried in sand and did not give accurate water temperatures through the summer months. Brown trout behavior has been shown to be disrupted if mean temperatures are within the upper critical range (66.2-76.5 degrees F). Mean daily water temperatures on Little Rock and Bunker Hill Creeks exceeded the minimum critical value at all stations (Figures 2-6) for periods of time in mid-summer. The stream reach with the most hospitable water temperature for trout was at County 40 where mean temperatures exceeded the minimum critical level on only 13 days. All other temperature monitoring stations had mean temperatures exceeding the minimum critical level for between 32 and 62 days. Brown trout have been shown to die when exposed to upper critical temperatures for a one week period (Elliott 1994). Mean and maximum daily temperatures rarely exceeded the upper critical range value (76.5 F) and trout were never exposed to upper critical temperatures

for a week long period at any temperature monitoring station. High stream temperatures corresponded with high ambient air temperatures and warm precipitation events.

Rosgen Stream Geomorphology and Classification Results

Rosgen stream classifications were obtained at three stations on Little Rock Creek in 2012 (Figure 1). Little Rock Creek was found to have a "C" type channel at all Rosgen stations. Streams with this classification generally have sand substrates, slope <0.02 ft/ft, and moderate sinuosity (Table 5). Other characteristics include point bars, pools and riffles, and a well-developed floodplain. Station Rosgen 1 downstream of Co. 26 was classified as a C4 channel due to the presence of coarser substrates and higher gradient (>0.001 ft/ft). Stations Rosgen 2 at the Minimum Maintenance Road crossing north of Co. 40 and Rosgen 3 upstream of Co. 12 were both classified as C5c- streams due to the dominance of sand substrates and lower stream slope (<0.001 ft/ft).

Rosgen analysis was also completed at these stations in 2007-2008 by MPCA. Locations of these stations were not well documented and results from 2012 were slightly different than those observed by MPCA. In general, MPCA measured higher gradient than DNR in 2012. Classifications by MPCA in 2007-2008 were C5 at Rosgen 1 and 2, and C4 at Rosgen 3.

MANAGEMENT IMPLICATIONS

Results of this assessment raised as many questions as it provided answers. The management goal when we switched to stocking brown trout fingerlings was that a natural

population would develop after initial stockings matured. This assessment was directed at evaluating natural reproduction of brown trout. Results of this assessment suggested that stream conditions disrupted spawning, egg survival or emergent fry survival. It was somewhat of a surprise that brook trout still existed in the stream. A comprehensive assessment completed in 2011 failed to document the presence of brook trout at six electrofishing stations while brown trout abundance exceeded 1,000 trout per mile at some stations. The fact that brook trout spawned successfully was perplexing, as they share similar spawning biology as brown trout; fall spawning, early spring hatching and fry emergence. Conditions must have favored brook trout reproduction over brown trout at some point between spawning time and this assessment.

Brown trout fingerling stocking was successful in providing a good fishable population of brown trout in Little Rock Creek. While natural reproduction was not observed in this assessment, documentation of sufficient natural reproduction in future years would indicate an even higher level of management success, especially if future stocking is not needed. Brown trout fingerling stocking should continue with gap years to further evaluate the potential for natural reproduction while providing a quality fishery for local anglers. If brown trout fail to reproduce, wild Minnesota strain brook trout remain a viable option for future management. Prior brook trout stockings provided a fishery with intermittent natural reproduction in the stream. Whether they would be capable of sustaining a fishable population would need to be studied further. Anglers have reported catching large trout of both species in 2012.

Efforts to protect habitat through purchase of trout stream easements will continue to be important. A recent easement purchase downstream of EF3 combined with previous easements will protect riparian habitat on a continuous corridor of approximately 1.1 stream miles. Remedial stream improvement projects using brush bundles to narrow the channel at EF3 appeared to provide habitat benefits including brush habitat input and scouring of gravel substrates. Utilization of these techniques on other easement sections and efforts to stabilize eroding banks should be attempted in the future for additional habitat improvement.

Little Rock Creek is a unique cold water resource in central Minnesota. A TMDL study by MPCA resulted in the stream being listed for a "lack of coldwater fish assemblage" in 2002. Participation in the TMDL process has, and will continue to be, important for DNR Fisheries in the future. Land use and management must not interfere with the coldwater nature of Little Rock Creek. Careful monitoring of ditching projects, irrigation and other land use in the watershed will continue to be important.

Replication of Rosgen geomorphology assessments in the future will be important to monitor positive or negative changes in stream morphology due to changes in land use practices or in-stream habitat improvement projects. Accurate documentation of geomorphology stations and locations is important for proper future monitoring.

LITERATURE CITED

Elliot, John M. 1994. Quantitative Ecology and the Brown Trout. Oxford University Press, New York, New York.

Raleigh, R. F. 1982. Habitat suitability index models: Brook trout. U. S. Dept. Int., Fish Wildl. Serv. FWS/OBS-82/10.24. 42 pp.

Raleigh, R. F., L. D. Zuckerman, and P. C. Nelson. 1986. Habitat suitability index models and instream flow suitability curves: Brown trout, revised. U. S. Fish Wildl. Serv. Biol. Rep. 82(10.124). 65 pp. [First printed as FWS/oBS-82/10.71, September 1984].

Rosgen, Dave. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, CO.

Table 1. GIS Locations of electrofishing stations on Little Rock Creek, Morrison and Benton Counties, Minnesota.

Station	Down UTMX	Down UTMY	Up UTMX	Up UTMY	Gear
EF1	407362.495	5078328.853	407411.346	5078490.370	Smith-Root 15-D POW gas powered
					Halltech HT2000B battery powered
EF2	406590.441	5075745.150	406681.814	5075859.570	Smith-Root 15-D POW gas powered
					Halltech HT2000B battery powered
EF3	407128.745	5073475.275	406975.431	5073586.934	Smith-Root 15-D POW gas powered
					Halltech HT2000B battery powered

Table 2. Length frequency distribution of brown trout, brook trout and northern pike sampled in Little Rock Creek, Morrison and Benton Counties, MN.

Length	BNT	BKT	NOP
<3.0			
3.0-3.9		8	
4.0-4.9		18	
5.0-5.9	1	3	
6.0-6.9	1	1	
7.0-7.9	18		
8.0-8.9	29	1	
9.0-9.9	19		2
10.0-10.9	3		2
11.0-11.9	5	1	2
12.0-12.9	5		
13.0-13.9			
14.0-14.9	2		
15.0-15.9	2		
16.0-16.9		1	
17.0-17.9	1		1
18.0-18.9			
19.0-19.9			
20+			
Total	86	33	7

Table 3. Maximum, minimum and average lengths of brown trout, brook trout and northern pike captured during electrofishing at all stations on Little Rock Creek, Morrison and Benton Counties, 2012.

Brown trout		Miles	N	Minimum Length	Maximum Length	Mean Length
EF1		0.17	12	7.2	12.9	9.8
EF2		0.12	53	5.8	17.3	9.3
EF3		0.2	21	7.8	14.4	9.3
	Total	0.49	86	5.8	17.3	9.3
Brook trout						
EF1		0.17	0	na	na	na
EF2		0.12	33	3.3	16.7	5.1
EF3		0.2	0	na	na	na
	Total	0.49	33	3.3	16.7	5.1
Northern pike						
EF1		0.17	2	9.9	10.2	10.1
EF2		0.12	5	9.4	17.8	12.3
EF3		0.2	0	na	na	na
	Total	0.49	7	9.4	17.8	11.6

Table 4. Catch per effort (fish/mile) at stations sampled in 2011 and 2012, Little Rock Creek, Morrison and Benton Counties, MN.

Brown trout	Miles Sampled 2012	Catch/Mile 2012	Miles Sampled 2011	Catch/Mile 2011
EF1	0.17	71	0.18	156
EF2	0.12	442	0	1,682
EF3	0.2	105	0.2	416
Brook trout				
EF1	0.17	na	0.18	na
EF2	0.12	275	0	0
EF3	0.2	na	0.2	na
Northern pike				
EF1	0.17	11	0.18	0
EF2	0.12	45	0	82
EF3	0.2	na	0.2	na

Table 5. Rosgen geomorphology classification data for three stations on Little Rock Creek, Benton and Morrison Counties, MN, 2012

Classification Data	Station		
	Rosgen 1	Rosgen 2	Rosgen 3
Valley Type	VIII	VIII	VIII
Valley Slope	0.0015 ft/ft	0.0013 ft/ft	0.004 ft/ft
Mean Bankfull Width	53.06 ft	39.36 ft	33.41 ft
Mean Bankfull Depth	2.41 ft	2.56 ft	2.03 ft
Flood-prone Width	150 ft	100 ft	152 ft
Particle Size (D50)	0.41 mm	0.23 mm	22.12 mm
Water Surface Slope	0.00077 ft/ft	0.00072 ft/ft	0.00316 ft/ft
Sinuosity	1.9	1.8	1.25
Bankfull Cross Sectional Area	127.9 sq ft	100.61 sq ft	67.76 sq ft
Entrenchment Ratio	2.83	2.54	4.55
Width to Depth Ratio	22.02	15.38	16.46
Rosgen Stream Classification	C5c-	C5c-	C4

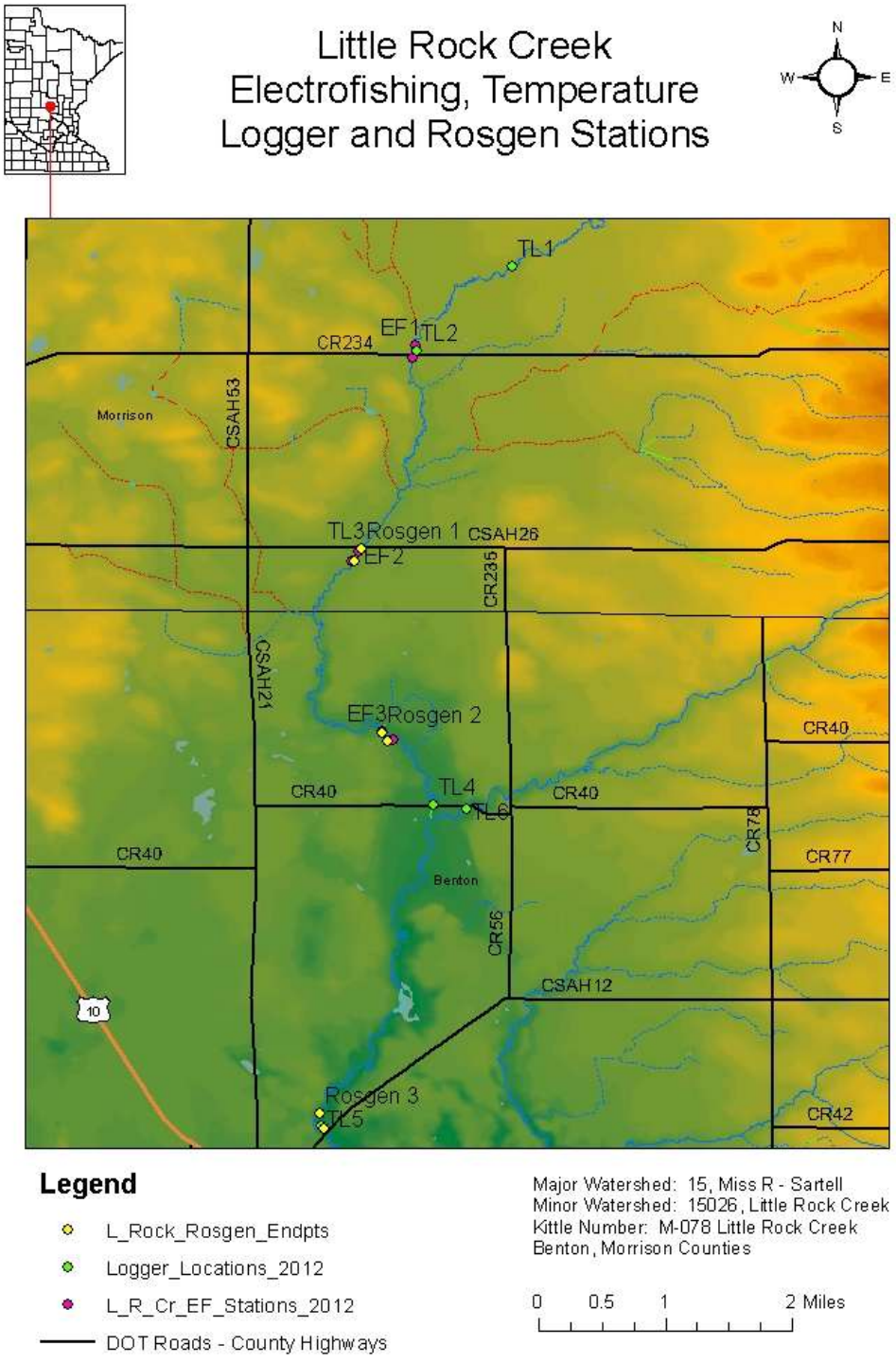

Figure 1. Map showing 2012 electrofishing stations, temperature logger locations, and Rosgen geomorphology stations on Little Rock Creek, Morrison and Benton Counties, MN.

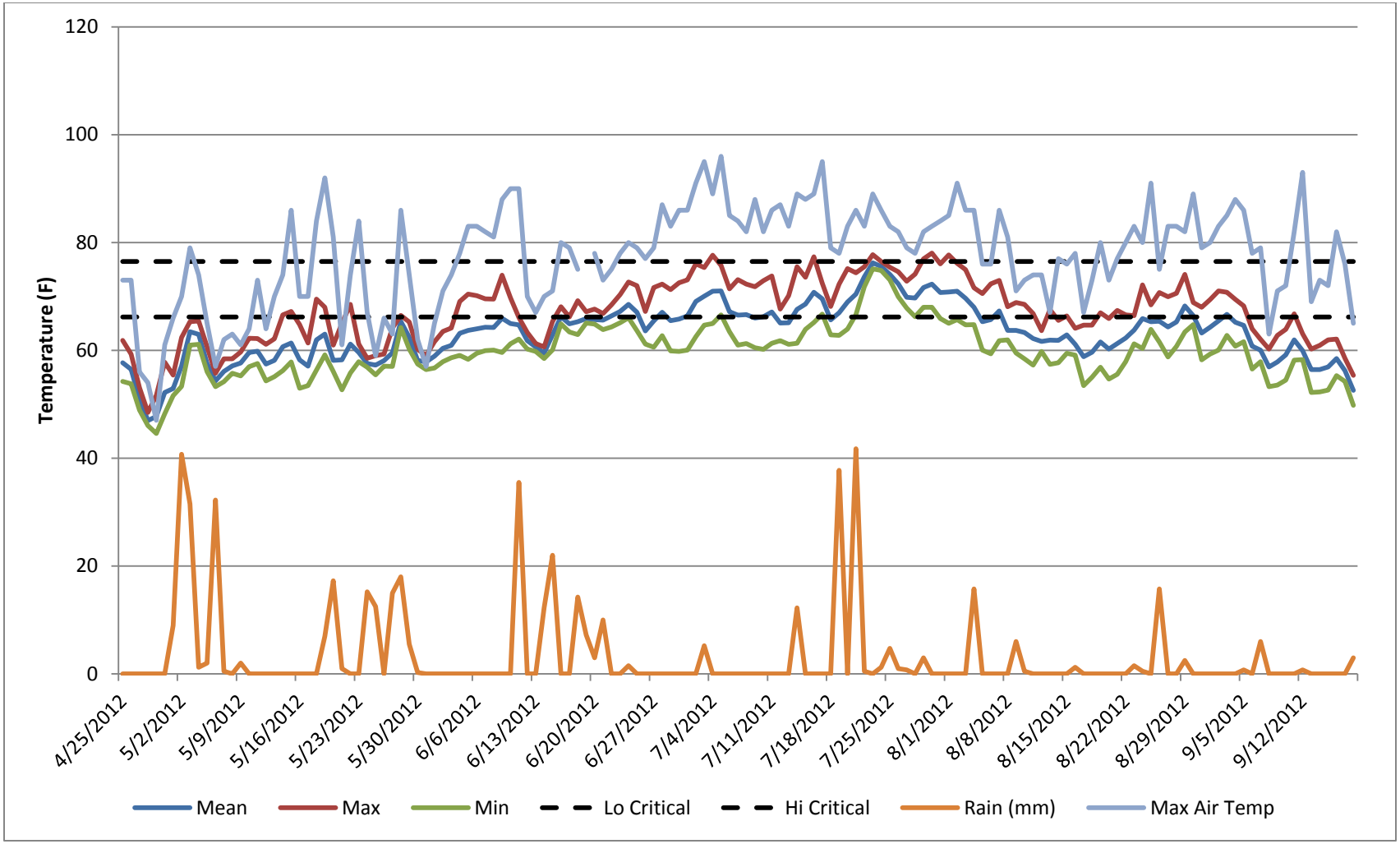

Figure 2. Mean daily water temperature, maximum and minimum daily water temperature, ambient air temperature and precipitation on Little Rock Creek, County Road 56, Morrison County, MN, 2012.

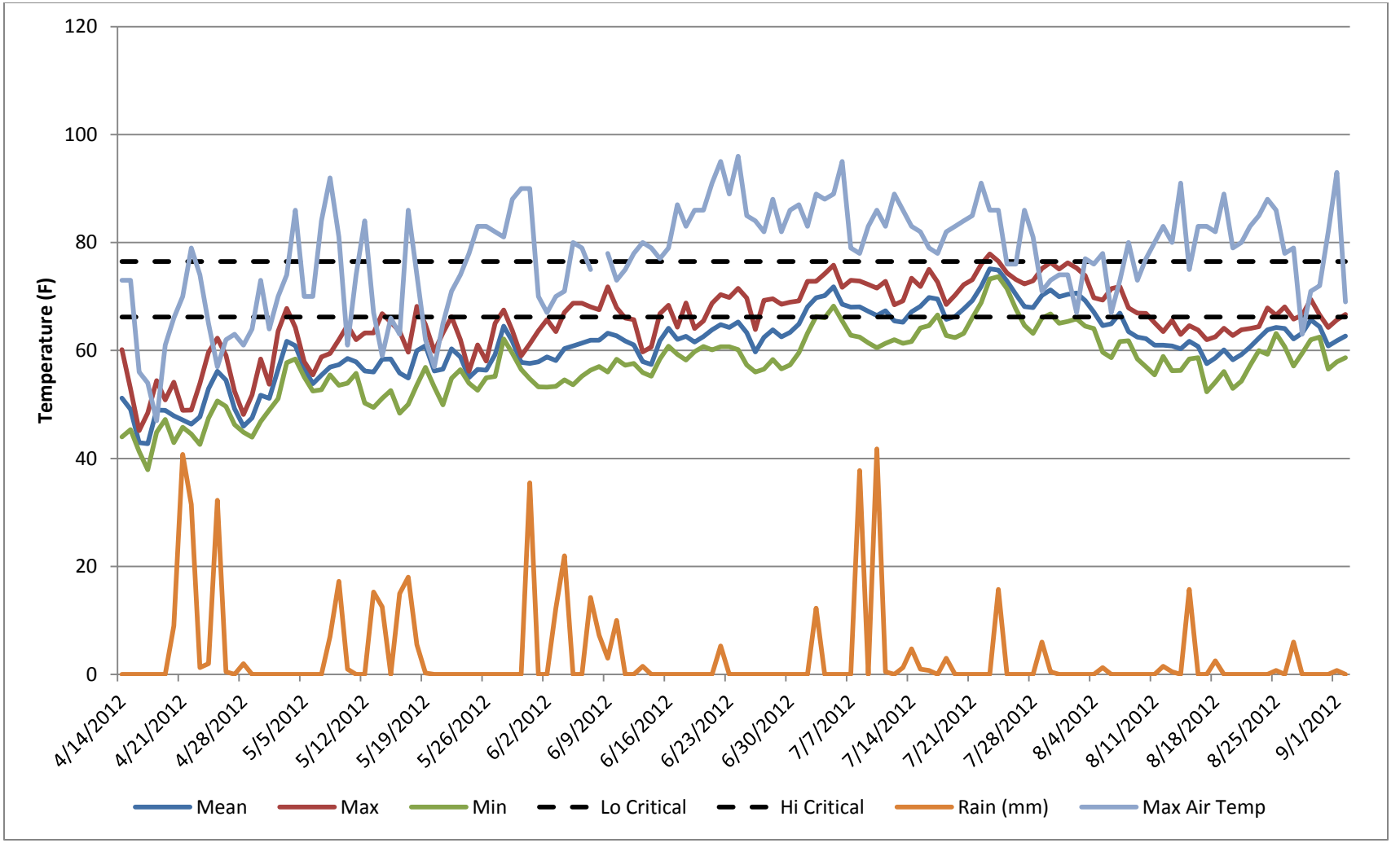

Figure 3. Mean daily water temperature, maximum and minimum daily water temperature, ambient air temperature and precipitation on Little Rock Creek, County Road 234 (EF1), Morrison County, MN, 2012.

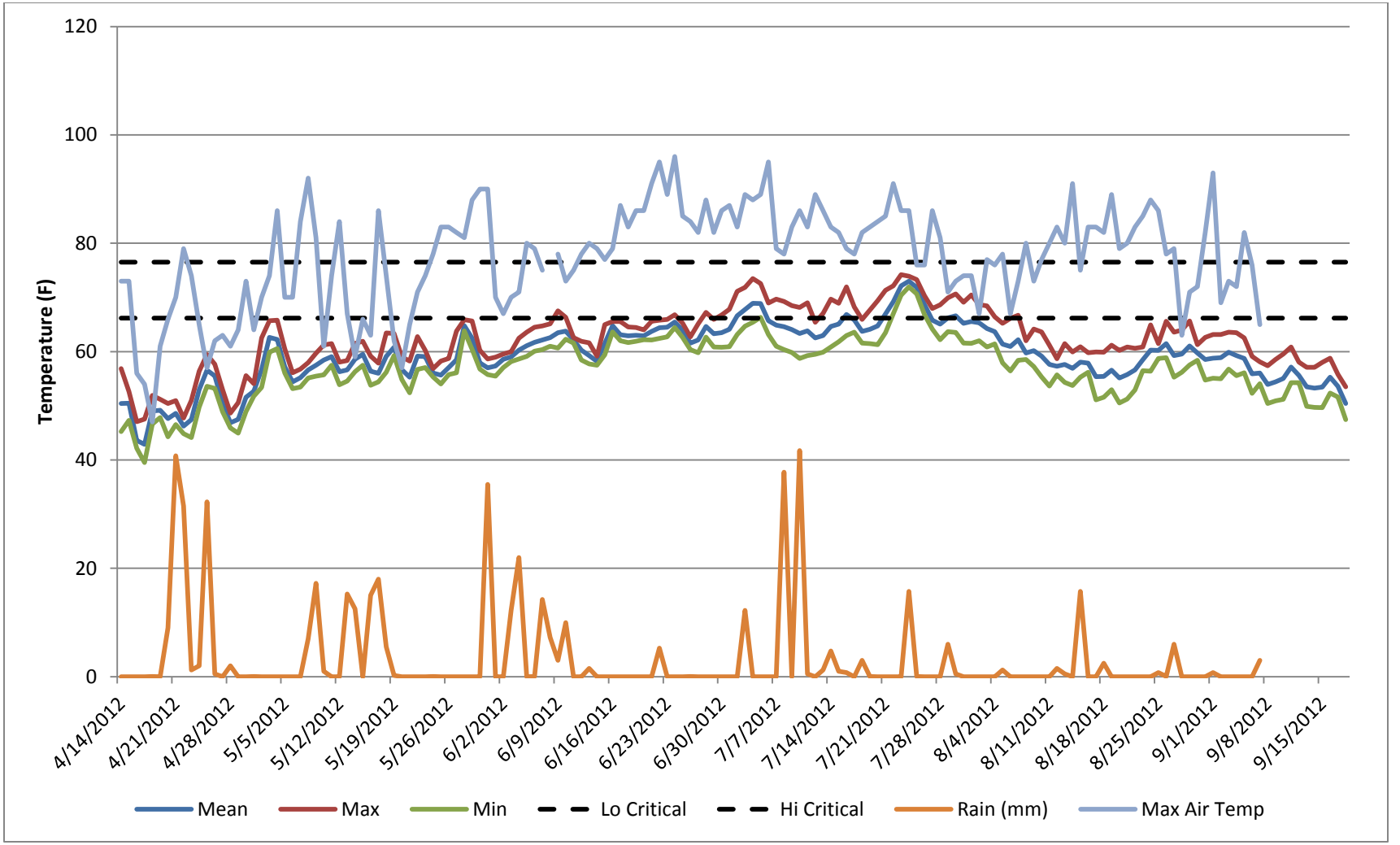

Figure 4. Mean daily water temperature, maximum and minimum daily water temperature, ambient air temperature and precipitation on Little Rock Creek, County Road 40 (near EF3), Benton County, MN, 2012.

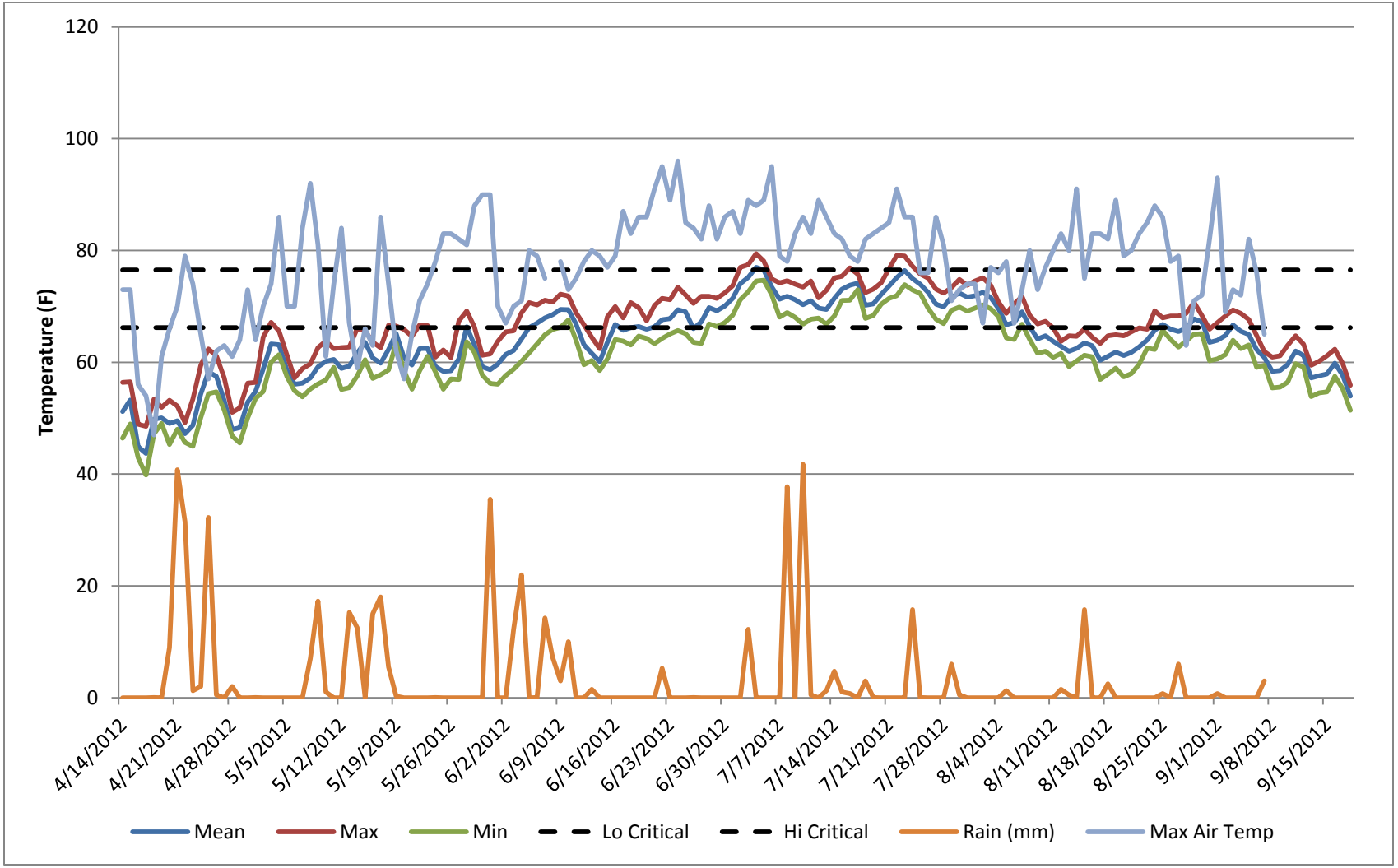

Figure 5. Mean daily water temperature, maximum and minimum daily water temperature, ambient air temperature and precipitation on Little Rock Creek, County Road 12, Benton County, MN, 2012.

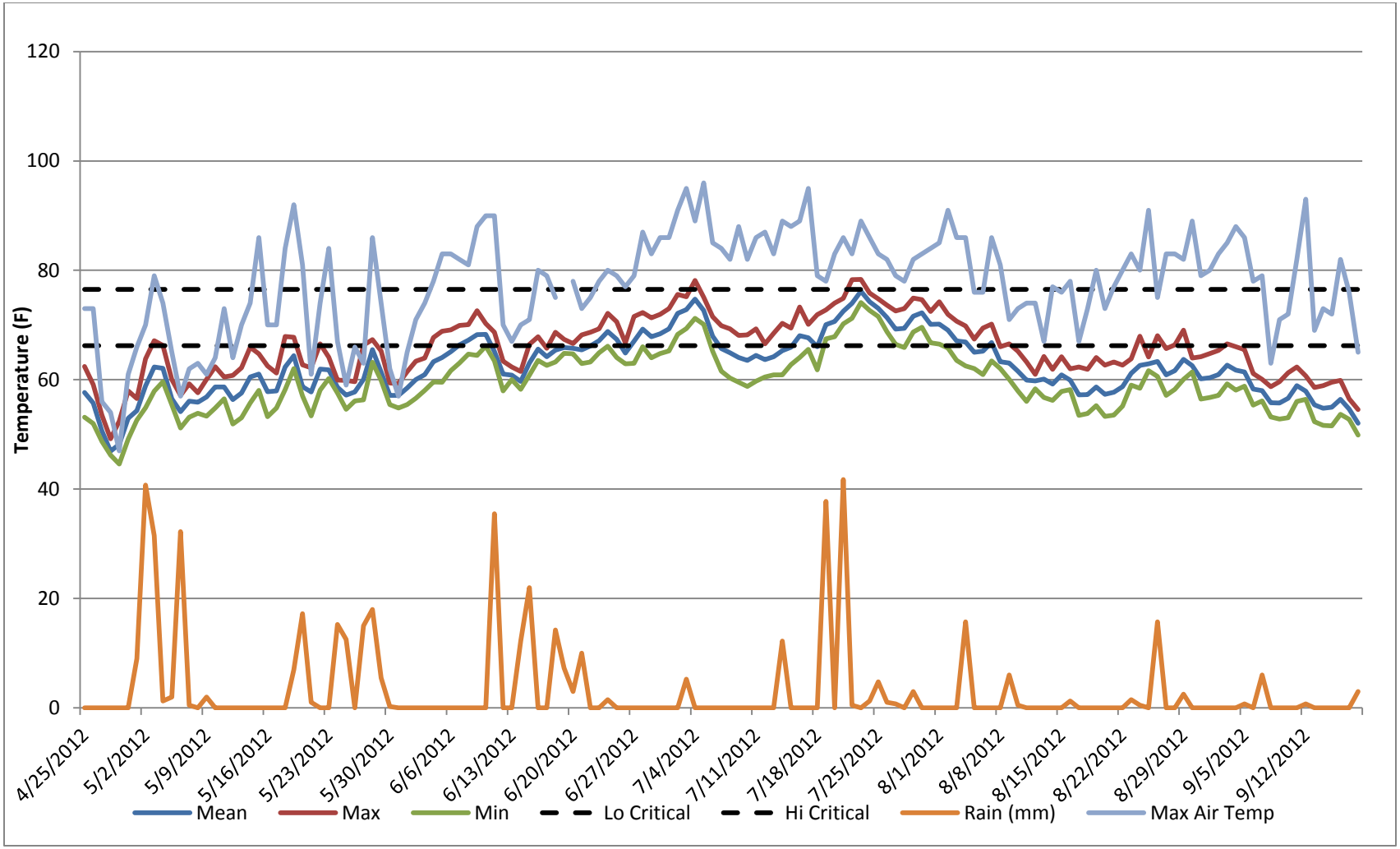

Figure 6. Mean daily water temperature, maximum and minimum daily water temperature, ambient air temperature and precipitation on Bunker Hill Creek, County Road 40, Benton County, MN, 2012.