Stream Temperature Observations for the Green River in Summer 2021

The Hoosic River Watershed Association's stream temperature project in 2021 focused on a 16 kilometer section of the Green River. The objective was to assess the potential effects of various watershed features along this tributary to the Hoosic River.

Water temperature sensors were placed at 12 locations, starting just south of the Williamstown/Hancock line on the West Branch of the river (site GW06.04, being 6.04 kilometers upstream of the confluence of the West Branch and the main or east branch of the river). Then at Caretaker Farm (GW04.21), at Old Mill Road (GW01.84), and at Bloedel Park (GW00.39). The next sensor was on the main Green River just downstream of the confluence of the West and east branches of the river and about 10 kilometers upstream of the confluence of the Green with the Hoosic (GN10.01). Additional sensors were located just upstream of the Route 43 bridge near Deer Run Rd. (GN09.13), upstream of the next bridge near Sucker Hole (GN08.28), upstream of Hooper Brook (GN06.15), downstream of Hopper Brook (GN06.01), downstream of the Blair Rd. bridge (GN05.23), off the Route 43 parking area (GN04.32), and a final location just upstream of the Route 2 bridge at Eastlawn Cemetery (GN01.15).

The sensors were placed on May 26 and set to record temperatures at one hour intervals. The stream flow at the gage on the Green River was about 40 cfs (cubic feet per second) when we placed the sensors. The flow on August 17 when we initially attempted to retrieve the sensors was about 37 cfs, but we found that the sensors had moved from their initial locations such that we found only 3 of the 12. Median flows in August are normally below 20 cfs. We did retrieve 3 more sensors on August 30 (flow was 65 cfs). Additional attempts (flows stayed at 65 cfs or above) were unsuccessful in finding additional sensors.

RESULTS and OBSERVATIONS

We learned to our sorrow that increases in storm intensity associated with climate change can derail our efforts to document temperature effects. During the 9 years we have placed sensors in the rivers, this year was the only one in which the sensors were moved by the stream flow. During June, the stream flow was normal, or just below, for that month. July started off wet, resulting in a flow of 1200 cfs on July 2 and followed by the major storm event associated with hurricane Ida reaching the southwest portion of the Hoosic basin on July7. On that date, the Green River stream flow was about 5000 cfs, well above (at least 3000 cfs above) any values during our previous monitoring of the Green River.

Assuming that the July 7 event resulted in the displacement of the sensors, we initially looked at the data from May 26 to July 1. Using the standard criterium of the 7 day mean maximum temperature for characterizing locations, this 7 day period was centered on June 28. Including all the data had no effect on this result as stream temperatures stayed well above normal for the rest of the summer as the rainfall stayed well above normal. Most years, the maximum mean 7 day temperature would be in late July or early August.

The watershed feature of interest farthest upstream is an area of beaver activity just north of the Williamstown/Hancock line. Downstream at Caretaker farm, the 7 day mean was the second

highest (Table 1), only exceeded by that at Eastlawn Cemetery, the location farthest downstream. Normally we would expect the temperature at the farther upstream location to be considerably cooler if there were no beaver swamp. Without the Hancock sensor, we can not determine how much warming occurred.

Table 1. Maximum 7 day Temperatures

Location	Temperature (degrees F)
GW04.21	69.11
GW01.84	67.23
GW00.39	68.21
GN10.01	66.90
GN06.15	68.70
GN01.15	69.50

Between Caretaker Farm and Old Mill Road, 5 perennial tributary streams enter the river from the west. Two of these are part of the Hoosic River Coldwater Fish Resource (CFR) mapped by the Massachusetts Division of Fisheries and Wildlife. The stream temperature at Old Mill Road was 1.9 degrees colder than at Caretaker Farm. Our previous studies of tributaries to the South Branch and others have show that the tributaries generally add colder waters to their next order streams.

Between Old Mill Road and Bloedel Park, the river flows through a golf course, with more open areas and two small ponds. Some warming might be expected and indeed the reading at Bloedel Park is 1 degree warmer than at Old Mill Road.

At the next location just downstream of the confluence of the West Branch with the east/main branch, the stream was 1.3 degrees colder than at Bloedel Park. We have previously determined that the east branch, measured near Southlawn Cemetery (GN10.62), is colder than the West Branch at Bloedel Park. Although the drainage areas are similar, the West Branch was 2.5 degrees, 2.11 degrees, and 3.6 degrees warmer in 2002 ,2003, and 2019. Thus the colder temperature downstream of the confluence would be expected and in the range seen.

The section of the watershed downstream to the location just upstream of the Hopper Brook shows both shaded and open areas and no perennial tributaries. Thus, the warmer temperature (1.8 degrees warmer) would be expected. From that point downstream, Hopper Brook would add colder water (8.28 degrees cooler in 2018 and 1.7 degrees cooler in 2019). Also, just downstream of Blair Road, two additional perennial streams enter the river.

At Eastlawn Cemetery, the 7-day maximum stream temperature was 69.5 degrees. For the other 4 years we had measurements at that location, 2 were higher, 1 was the same, and 1 was lower. At this location, the river is only slightly warmer that at Caretaker Farm. The degree of warming from just downstream of the confluence was just 2.6 degrees over 8.8 kilometers of stream

length. In 2020, Broad Brook showed warming of 3.6 degrees over 3.8 kilometers and Hopper Brook showed warming of about 7.8 degrees over 5.1 kilometers.

CONCLUSIONS

The best laid sensors can indeed go astray. We will try again next monitoring season to locate the missing sensors if water levels allow, and hopefully be able to expand our analyses. Our observations of stream temperatures, using the sensors recovered, do not allow for definitive statements as to specific cause and effect, but we can conclude that the Green River appears to be benefiting from its tributaries to help maintain its status as a cold water fishery. A recent article notes the value of deep groundwater to stream health. It would appear that many of the tributaries to the Green may benefit from deep, cold water springs.

As we continue our efforts to document and understand how climate change may affect the Hoosic River watershed, we need to include storm intensity and stream flow along with stream temperature.

REFERENCE

Continental-scale analysis of shallow and deep groundwater contributions to streams. 2021. Danielle K. Hare, et al. Nature Communications. https://doi.org/10.1038/s41467-021-21651-0