

**NJDEP Division of Fish and Wildlife
Bureau of Freshwater Fisheries**



Stream Temperature Monitoring 2015

In 2013 the Bureau established an ambient stream temperature monitoring network on streams having trout fisheries that are recreationally important or of conservation interest. The temperature data collected will be used to assess current temperature conditions, evaluate long term trends, determine if ambient water quality is consistent with NJDEP's Surface Water Quality Standards, and aid in the management of coldwater (trout) fisheries inhabiting these streams. Integral to the establishment of this monitoring network was the development of a quality assurance plan that complied with NJDEP's regulations concerning the certification of laboratories and environmental measurements under N.J.A.C. 7:18-1 et seq. A Quality Assurance Project Plan (QAPP) for Ambient Stream Water and Air Temperature Monitoring was prepared and subsequently approved by NJDEP's Office of Quality Assurance in July 2013. This certification is renewed annually.

In 2015 water temperature was monitored at 39 sites ([see table](#)), including 2 new sites on the Lamington (Black) River (below Kay's Pond and south of Route 78 by Fiddler's Elbow Country Club), 2 new sites on the Paulins Kill, and 9 new sites on *Trout Production* streams located primarily inside the South Branch of the Raritan River watershed. Twenty-five of the sites are located on 17 recreationally important, trout-stocked streams (see map). Seventeen sites were located on stream sections classified as FW2-*Trout Production* (TP), nineteen were on stream sections classified as FW2-*Trout Maintenance* (TM), and three were on stream sections classified FW2-*Non-Trout* (NT). Five sites were located on small streams having populations of wild Brook Trout, as part of the Eastern Brook Trout Joint Venture initiative to assess climate change (using paired water/air thermographs). A total of 44 thermographs (Onset Hobo Pro v2) are currently deployed to record temperature at 30 minute intervals year round. The thermographs are calibrated and regularly checked to maintain the validity of the temperature data. See the 2015 Stream Temperature Monitoring Report for additional project information.

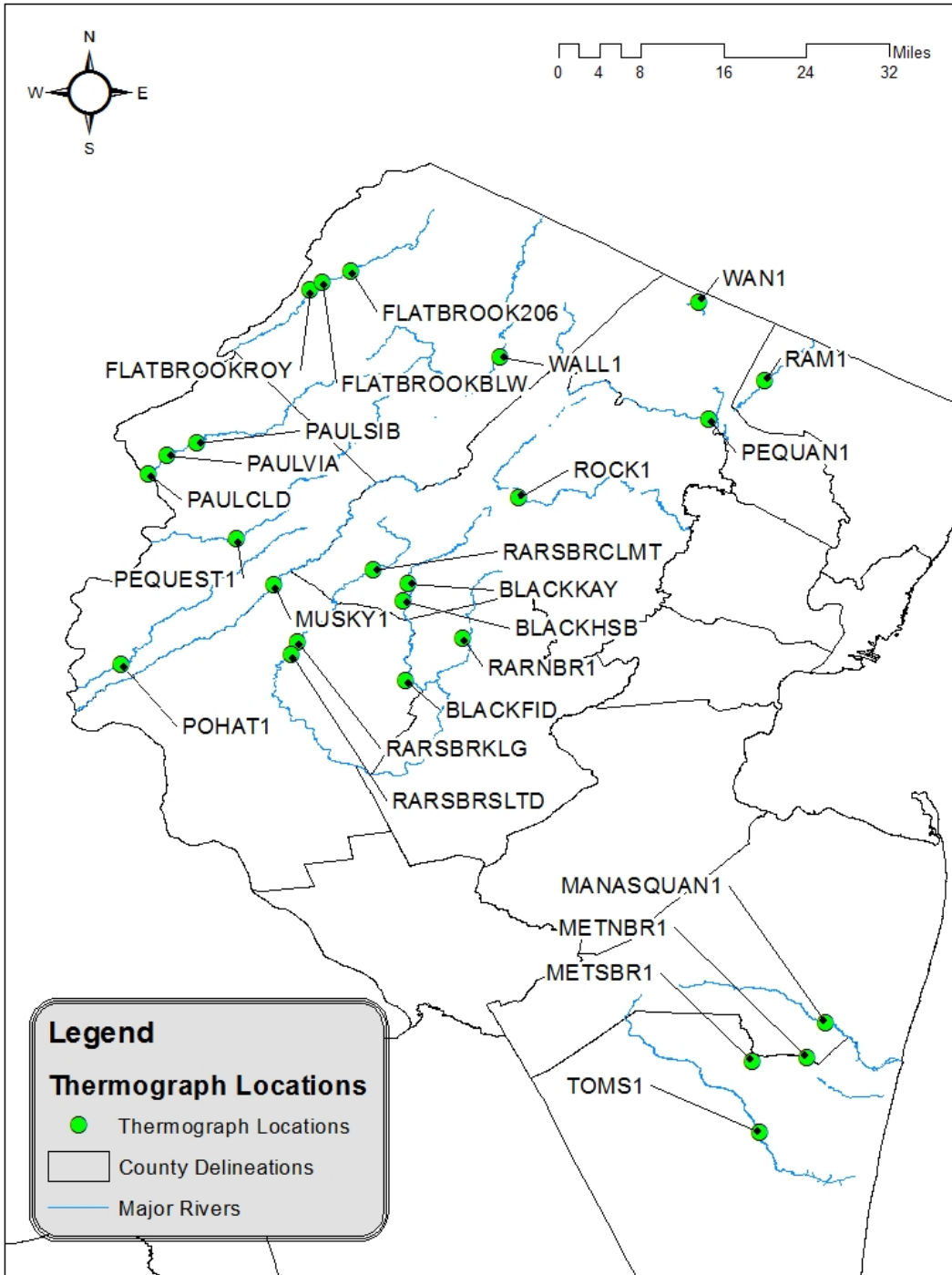
The following results are only inclusive of the twenty-five stream temperature monitoring sites located on 17 recreationally important trout-stocked.

Trout Stocked Waters

The stream temperature data collected in 2015 indicates that many of the streams stocked with trout experienced summer water temperatures that were stressful for trout. Much of the State experienced low rainfall and consistently warm air temperatures. Many of the stream sections monitored and classified as *Trout Production* or *Trout Maintenance* exceeded their respective rolling seven-day average of the daily maximum temperature criteria (23°C). At some of the *Trout Maintenance* sites, stream temperature criteria was exceeded over long periods of time causing chronic exposure of stocked trout to warm water (unless the trout are able to find areas of thermal refuge). This is a large concern as already marginal habitat is becoming less hospitable for the game fish that are stocked here for recreational anglers to access. One of the concerns of rising stream temperatures for NJDFW's trout stocking program is that the trout will

simply not reside close to their stocking points. This is not so much of an issue around the opening day of trout season, which occurs during the first or second Saturday in April, but when temperatures start to increase as the summer begins, sections of streams that typically had the ability to hold trout, will no longer be hospitable to trout. Currently, anglers report catching stocked trout on many of the trout stocked streams found in the table below, late into the summer and holdover trout are common. As temperatures continue to climb, there will be fewer habitats to occupy and stocked trout may find refuge elsewhere or competition for limited space may increase, impacting survival.

Figure 1. Locations of continuous stream temperature logger sites maintained by NJDFW in 2015 on recreationally important trout-stocked streams.



2015 NJDFW stream temperature monitoring network on recreationally important trout-stocked streams.

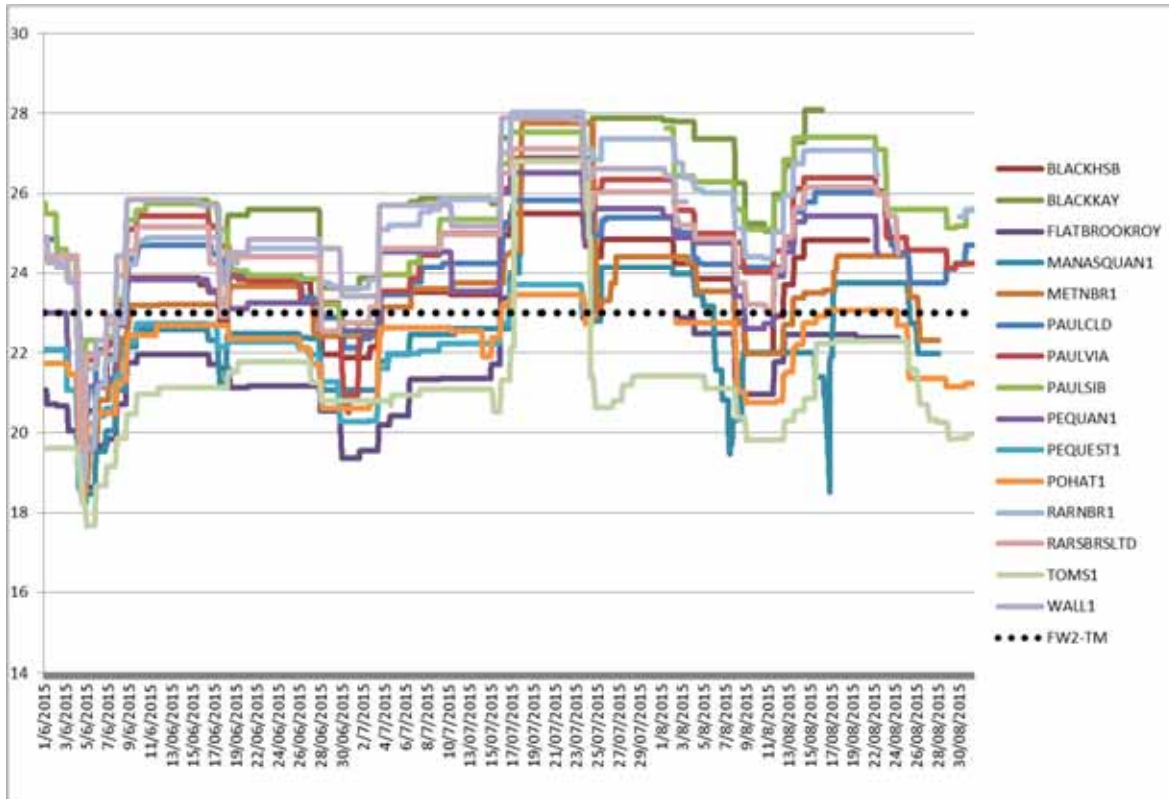
Stream	Site ID	Surface Water Classification	Monitoring Type
Black River	BLACKHSB	Trout Maintenance	water
Black River	BLACKKAY	Trout Maintenance	water
Black River	BLACKFID	Non-Trout	water
Big Flat Brook	FLATBROOK206	Trout Production	water
Big Flat Brook	FLATBROOKBLW	Trout Production	water
Flat Brook	FLATBROOKROY	Trout Maintenance	water
Manasquan River	MANASQUAN1	Trout Maintenance	water
Metedeconk River, N/Br	METNBR1	Trout Maintenance	water
Metedeconk River, S/Br.	METSBR1	Non-Trout	water
Musconetcong River *	MUSKY1	Trout Maintenance	water
Paulinskill	PAULCLD	Trout Maintenance	water
Paulinskill	PAULVIA	Trout Maintenance	water
Paulinskill	PAULSIB	Trout Maintenance	water
Pequannock River	PEQUAN1	Trout Maintenance	water
Pequest River	PEQUEST1	Trout Maintenance	water
Pohatcong Creek	POHAT1	Trout Maintenance	water
Ramapo River	RAM1	Non-Trout	water
Raritan River, N/Br.	RARNBR1	Trout Maintenance	water
Raritan River, S/Br. ***	RARSBKLG	Trout Maintenance	water
Raritan River, S/Br.	RARSBCLMT	Trout Production	water
Raritan River, S/Br.	RARSBRLTD	Trout Maintenance	water
Rockaway River **	ROCK1	Trout Maintenance	water
Toms River	TOMS1	Trout Maintenance	water
Wallkill River	WALL1	Trout Maintenance	water
Wanaque River **	WAN1	Trout Maintenance	water

* Thermograph lost in 2014 and not replaced in 2015. Location will be monitored in 2016.

** Thermograph lost in 2015

*** Error in installation or launching resulted in unreliable data

The graph below depicts the 7-day rolling average of the daily maximum stream temperature for each site monitored during summer weeks encompassing June 1 to August 31, 2015. The horizontal black-dotted line “FW2-TM” depicts the rolling 7-day average of the daily maximum of 23°C surface water criteria that *Trout Maintenance* streams should not exceed.



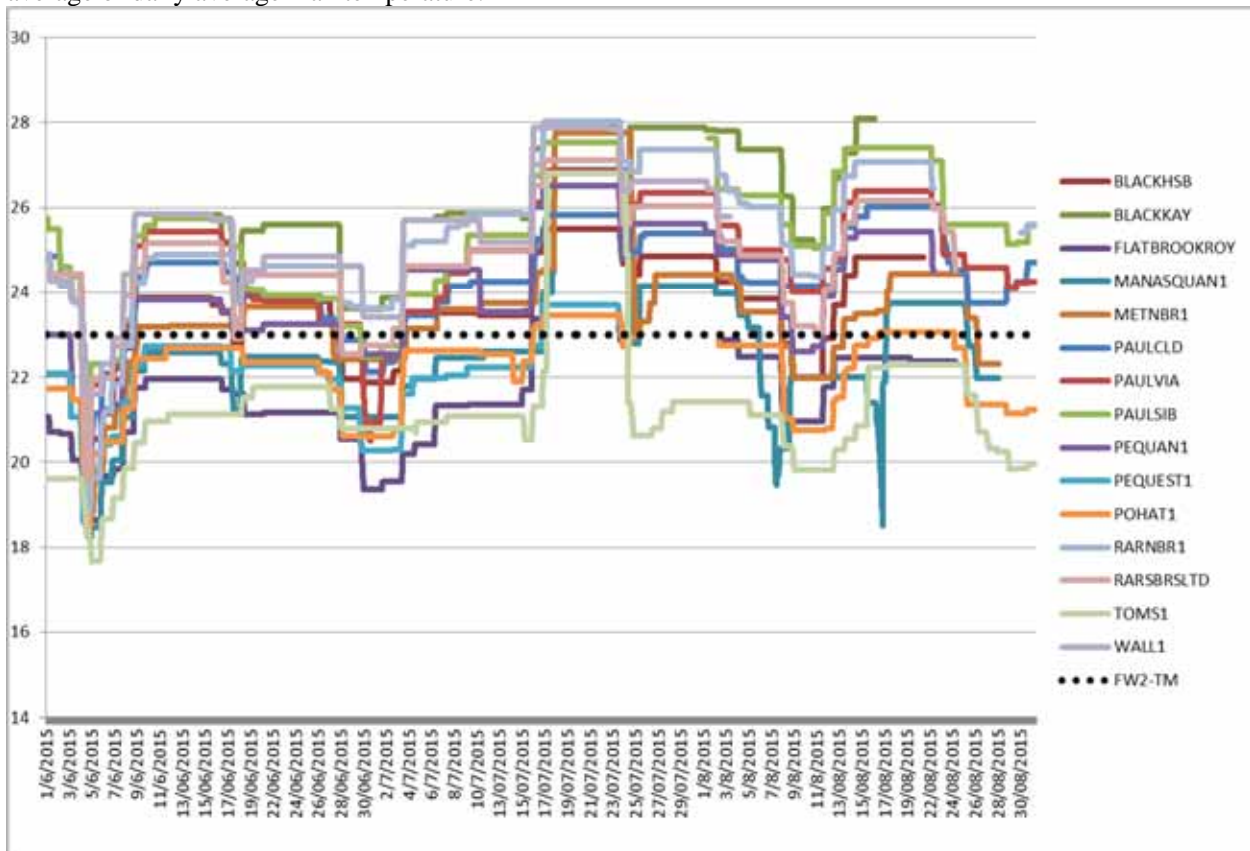
Trout Maintenance Streams

New Jersey’s Surface Water Quality, Standards New Jersey Administrative Code (N.J.A.C.) 7:9B states that for waters classified as FW-TM “temperatures shall not exceed a daily maximum of 25 degrees Celsius or rolling seven-day average of the daily maximum of 23 degrees Celsius, unless due to natural conditions.” In Figure 4, the seven-day rolling average of the daily maximum temperature for each site classified as FW-TM was compared against the FW-TM standard each week of summer. The results indicate that weekly average maximum temperatures at the TM sites are, more often than not, exceeding the FW-TM standard for a seven-day rolling average of stream temperature (Table 3). Some sites did not exceed the standard as often including, a site on the Flat Brook, Toms River, and Pequest River (all less than 13.63% of the time) but some sites may be cause for concern especially with a current classification that are, by definition, able to support trout year round. Two sites on the Black River, 3 sites on the Paulins Kill, and a site on the North Branch of the Raritan River all exceeded the TM temperature standard over 80% of the summer period.

Table 3: Percent of time that the seven-day rolling average of the daily maximum temperature for each site classified as FW-TM exceeded the Surface Water Quality Standard criteria of 23°C encompassing the time period of June 1 to August 31, 2015.

	BLACKHSB	BLACKKAY	FLAT-BROOKKRO-Y	MANA-SQUA-N1	METNB-R1	PAULC-LD	PAULV-IA	PAULS-IB	PEQUA-N1	PEQUES-T1	POHA-T1	RARNB-R1	RAR-SBR-SLTD	TOMS1	WAL-L1
Percent of readings exceeding the FW-TM threshold	80.74	100.0	11.14	32.01	76.67	89.52	91.55	90.92	79.95	13.63	18.18	94.44	89.15	8.22	93.96

Figure 4: Seven-day rolling average of the daily average maximum temperature for each FW2-TM site during summer weeks encompassing June 1 to August 31, 2014. The black-dotted horizontal line indicates the “FW-TM” criteria that Trout Maintenance streams should not exceed when observing their seven-day rolling average of daily average max temperature.



NonTrout Streams

New Jersey’s Surface Water Quality, Standards New Jersey Administrative Code (N.J.A.C.) 7:9B states that for waters classified as FW-NT “temperatures shall not exceed a daily maximum of 31 degrees Celsius or rolling seven-day average of the daily maximum of 28 degrees Celsius, unless due to natural conditions.” In Figure 5, the seven-day rolling average of the daily maximum temperature for each site classified as FW-NT was compared against the FW-NT standard each week of summer. The results showed that temperatures at the NT site on Black River exceeded the FW-NT standard 50% of the time and the Ramapo site exceeded the same standard 8% of the time (Table 4).

Figure 5: Weekly average of the daily average maximum temperature for each FW2-NT site during summer weeks encompassing June 1 to August 31, 2014. The red horizontal line indicates the “FW-NT” criteria that Non-Trout streams should not exceed when observing their seven-day rolling average of daily average max temperature.

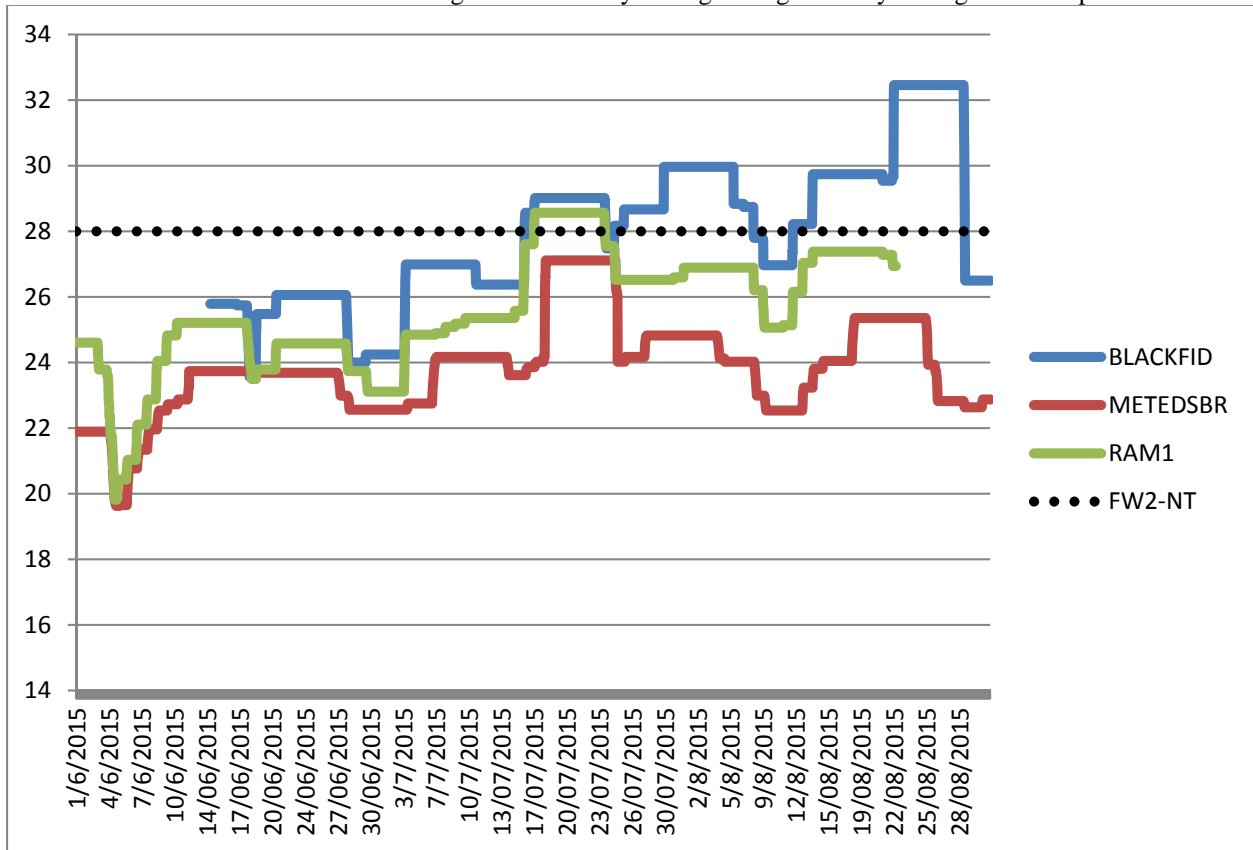


Table 4: Weekly average of the daily average maximum temperature for each FW2-NT site during summer weeks encompassing June 1 to August 31. Temperatures in red exceed the Surface Water Quality Standard criteria (FW2-NT) for a seven-day rolling average of stream temperature.

Site Name			
	BLACKFID	METEDSBR	RAM1
Percent of 7-day rolling average over 28	50.32	0	8.61

Trout Production Streams

New Jersey’s Surface Water Quality Standards New Jersey Administrative Code (N.J.A.C.) 7:9B states that for waters classified as FW-TP “temperatures shall not exceed a daily maximum of 22 degrees Celsius or rolling seven-day average of the daily maximum of 19 degrees Celsius, unless due to natural conditions.” In Figure 3, the seven-day rolling average of the daily maximum temperature for three sites classified as FW-TP (sites with paired thermographs excluded) was compared against the FW-TP criteria for each week of summer. The results indicate that weekly average maximum temperatures at the TP sites exceeded the FW-TP standard for a seven-day rolling average of stream temperature over 95% of the summer time period at each site (Table 2).

Figure 3: Weekly average of the daily average maximum temperature for each FW2-TP site during summer weeks encompassing June 1 to August 31, 2014. The red horizontal line indicates the “FW-TP” criteria that Trout Production streams should not exceed when observing their seven-day rolling average of daily average max temperature.

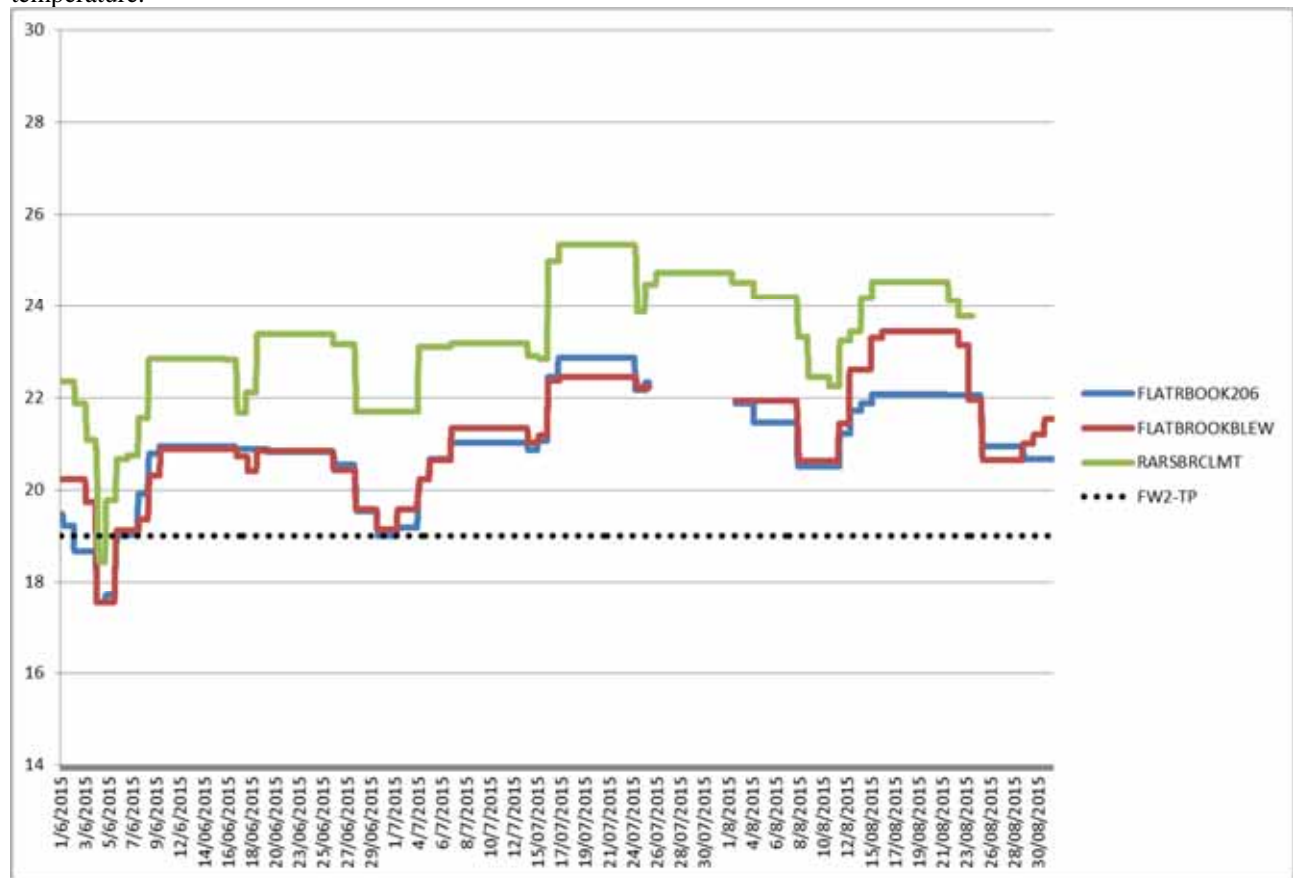


Table 2: Weekly average of the daily average maximum temperature for each FW2-TP site during summer weeks encompassing June 1 to August 31. Temperatures in red exceed the Surface Water Quality Standard criteria (FW2-TP) for a seven-day rolling average of stream temperature.

Site Name			
	BLACKFID	BLACKHSB	BLACKKAY
Percent of 7-day rolling average over 19	95.31	97.79	99.19

Due to continued human impacts, we know that unprotected habitats that are currently marginal for fish survival, in both space and time, will continue to degrade in temperature, flows, and other stream characteristics, and will exceed biological tolerances of sensitive species such as trout. Whether the causative factors of these abiotic responses are induced from climatic forces or from a localized disturbance, the necessity to monitor these changes closely is driven by their tendency to be subtle and virtually invisible unless monitored closely. Background data from stream temperature monitoring established in 2013 by NJDFW and fisheries surveys done in close proximity to temperature monitoring sites resulted in the following observations:

- Streams experiencing the coldest temperatures during trout egg incubation (i.e. Flat Brook) have low wild trout recruitment.
Note: Emergence times are delayed by cold winter stream temperatures, which may have led to low survival of wild trout (less time/slow growth, more subjected to redd scour from spring flows)
- *Trout Production* streams with higher Growing Degree Days (GDD) had better recruitment (slightly warmer streams).

These observations suggested the next steps to determine the limiting factors of recruitment of trout in New Jersey and if metrics could be developed for use in the monitoring of stream temperatures and in management of *Trout Production* streams.

2015 marks the beginning of a three year study to collect year-round continuous stream temperature data on wild *Trout Production* streams and assess their naturally reproducing trout populations. This study was initiated because excessively cold fall and winter temperatures (approaching 0°C) limit wild trout recruitment via late emergence and slow growth. The study was designed and fourteen *Trout Production* streams were picked, based on watershed location and population structure (struggling or well established trout populations) to help investigate this. On these streams, three years of year-round stream temperature monitoring and electrofishing surveys in these same locations will be conducted. The ultimate goals of the study are multi-faceted: (1) to develop a year to year analysis of how stream temperature is influencing New Jersey's wild trout populations, (2) submit data to NJDEP to determine if any streams qualify as part of 303(d) list, and (3) to develop metrics based on GDD, an understanding of emergence times, critical summer time temperatures, fall/winter/spring temperatures, and/or aerobic scope curves that can guide us in determining what streams are the best candidates for possible translocations.

Starting in the spring of 2015, 14 *Trout Production* streams were selected and stream temperature monitoring devices were placed. The fourteen streams include:

Trout Production Streams installed with Temperature Data loggers by NJDFW in 2015

Beerskill Creek
Black Brook
Forked Brook
Hickory Run
Raritan River S/Br. (Trib.)(Drakestown)
Raritan River S/Br. (Trib.)(SW of Budd Lake)
Rinehart Brook
Rocky Run
Stephensburg Brook
Stony Brook (Morris-Washington)
Sun Valley Brook
Trout Brook (Hacklebarney)
Turkey Brook
Willhoughby Brook

Subsequently, this summer, backpack stream electrofishing surveys were conducted on these streams following EPA bioassessment protocols to determine abundance and sizes of wild trout present. A full report will be provided at the end of the study period.