An Analysis of the July 2013 Thermal Stress Event in the Upper Delaware

Presented at *Water Water Everywhere IV*
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Background

- In October 2011, at *Water Water Everywhere II*, the development of a plan for alleviating thermal stress to the trout in the upper Delaware was set as central goal.
- Over the next year, Jim Serio of Hancock, Naresh Devineni of the Columbia Water Center and I worked on the problem. We reported our findings here last October at *Water Water Everywhere III*. We found that in most summers:
  - Serious thermal stress events occurred, but could be mitigated by pulsed releases of cold water from the Cannonsville reservoir.
  - The amount of water needed would not put the water needs of NYC or any of the 'Decree Parties' at risk.
  - Such thermal events can generally be forecasted and hence can be avoided by preplanned action.
- In the spring of 2013 we proposed to the DRBC and the Decree Parties a framework for a relief protocol, but our quantitatively based proposal was rejected without comment by the Decree Parties. Thus, once again, we entered the summer of 2013 without a protocol or guidelines in place .

The Events of July 2013

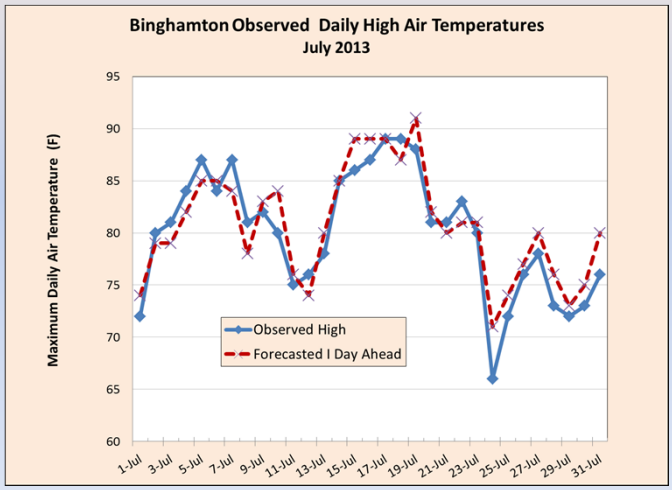
- The Weather Bureau forecasted a heat wave in mid July, and our models predicted a concomitant thermal stress event in the upper river. On July 14 the Delaware Watershed Conservation Coalition called for a stress relieving release of additional cold water from the Cannonsville dam. On July 15 the NYC reservoirs were at 96.9 % capacity.
- The Decree Parties had no preplanned protocol in place for handling such an event, preferring to handle such events on "a case-by-case basis." Moreover, a number of key decision makers were unavailable or unreachable during the critical days leading up to the heat wave.
- On July 16, after numerous petitions from the fishing community, the Decree Parties instituted a 300 cfs pulse relief release for July 17 & 18 that essentially followed what our protocol would have suggested. Severe thermal stress was largely avoided, but lack of an pre-approved protocol resulted in avoidable anxiety and agitation, less thermal protection and a less efficient use of available water.
- This presentation is a detailed analysis of the impact of the stress relief actions that were taken.

I. The Weather Forecasts

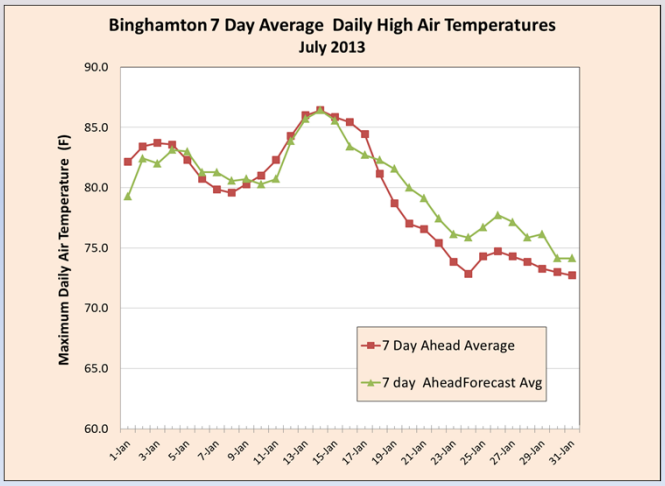
The Influence of Weather and Weather Forecasts

- The Binghamton weather bureau office has done a good job of forecasting high daily maximum air temperatures, and did a good job in July 2013. It identifies in advance individual days with very high temperatures and sequences of consecutive hot days – 'heat waves'.
- Our analysis presented to RFAC in the Spring of 2013 showed that local air temperatures, particularly during heat waves, have a strong influence on upper Delaware water temperatures and on the occurrence of potential severe stress events. (These have been defined by the coalition as days when the river temperatures exceed 23.9°C (75F°).)
- Relying in part on such air temperature forecasts, the PA F&BC has in recent years also done an excellent job of forecasting thermal stress events.

Binghamton Weather Bureau Office Accurately Forecasted the July 2013 Heat Wave (Here Looking 1 Day Ahead)



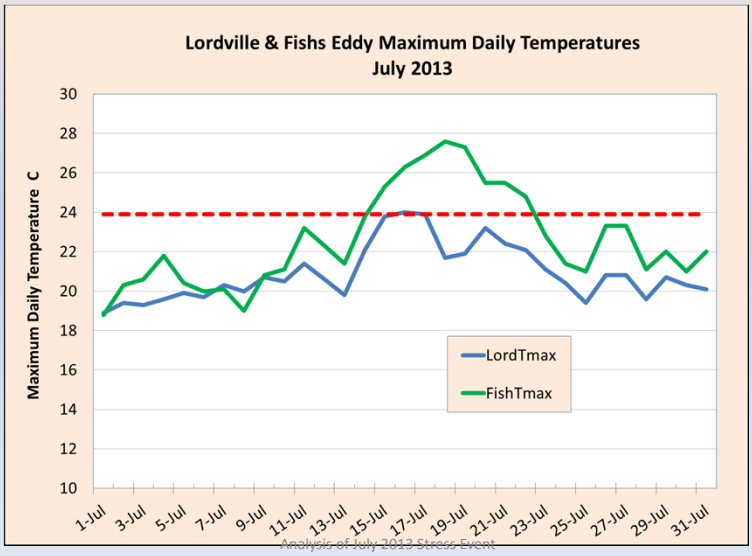
Binghamton Weather Bureau Office Accurately Forecasted the July 2013 Heat Wave
(Here Looking 7 Days Ahead)



II. What happened on the river in July 2013, day by day?

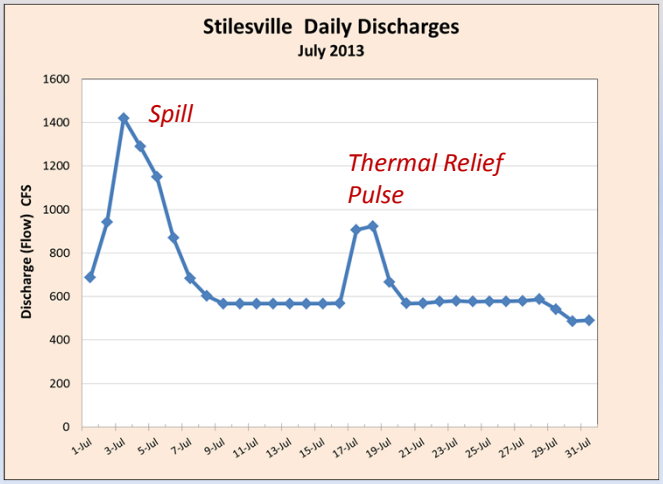
Water Temperatures at Lordville and Fishs Eddy

Per USGS Gages

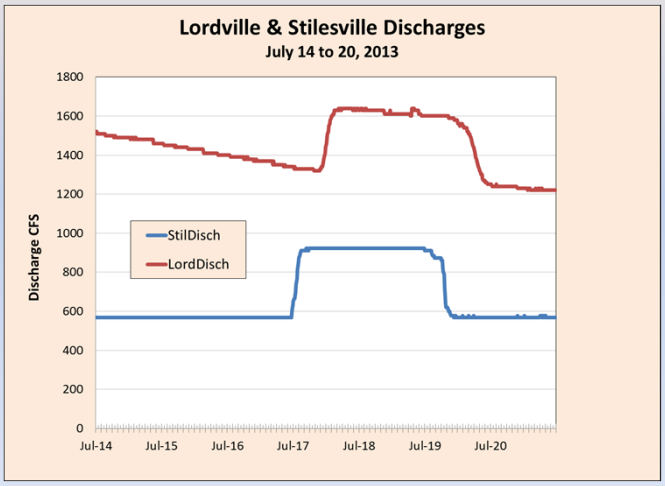


The Water Releases from Cannonsville

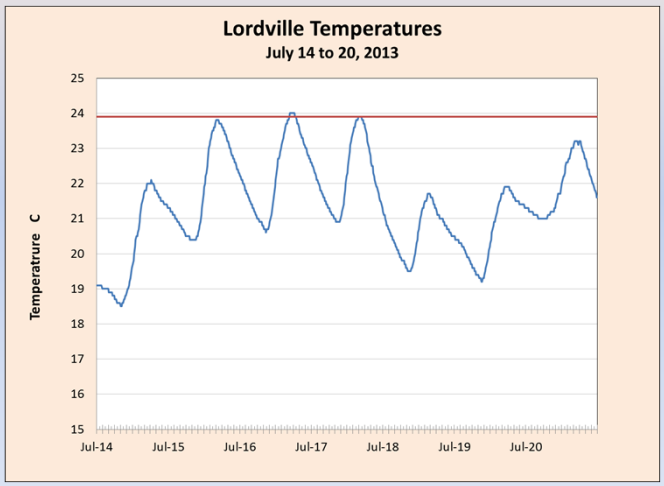
(Stilesville Discharges)



Cannonsville Releases and Resulting Discharges at Lordville During the Stress Event



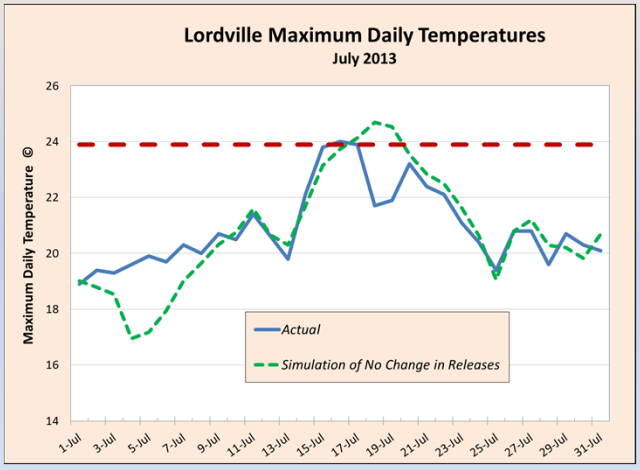
Lordville Temperatures July 14 to 20, 2013



What would have happened if,

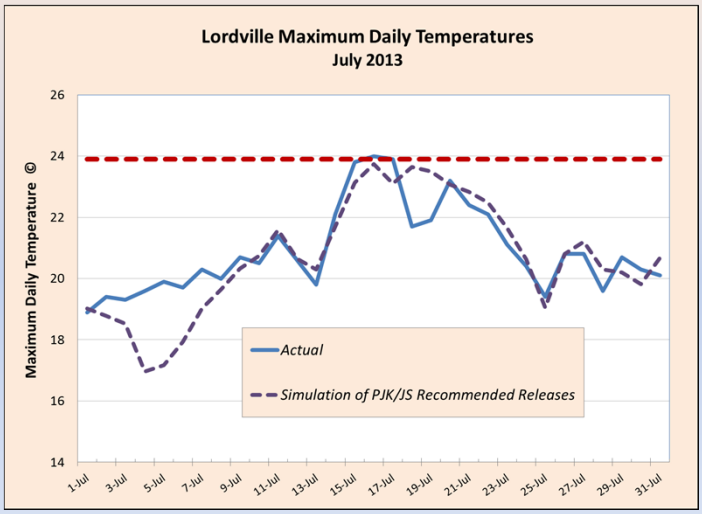
- There had been no additional releases.
- Releases had been per the Kolesar – Serio suggestions.

What would have happened if no additional releases had been made?

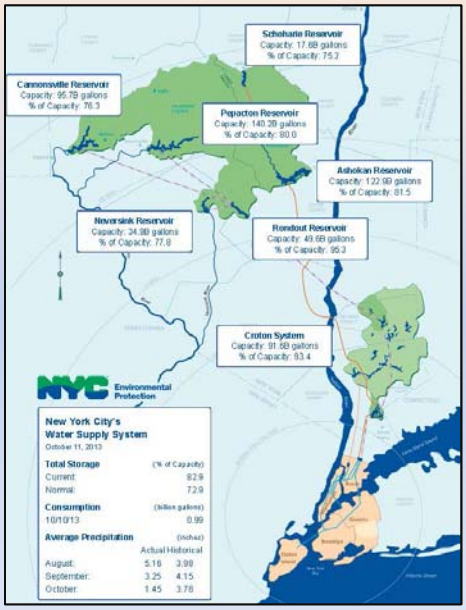


The 'No Additional Releases' temperatures were simulated using the Kolesar-Serio model presented to RFAC in March 2013

What Our Release Protocol Would Have Done



The temperatures under the alternative releases were simulated using the Kolesar-Serio model presented to RFAC in March 2013



The Long-Run Outcome

Where do the NYC reservoirs stand today?

Current Storage 82.9%

'Normal' Storage 72.0%

The July thermal stress pulse of 795 cfs days is 513 million gallons of water, or 0.2% of current storage of the NYC Delaware reservoirs.

Bottom Line

- River temperatures reached stress or near stress levels on July 15 (23.8°), on July 16 (24.0°) and on July 17 (23.9°).
- 794.6 cfs days of additional water was released from July 16 to 18.
- Had that water not been released , the Upper Delaware would have suffered significant additional thermal stress on July 17 (24.2°), on July 18 (24.7°) and on July 19 (24.5°).
- The additional releases were similar to those that our protocol would have suggested, and lowered river temperatures by about the amount that our model predicted.
- Our protocol would have started the additional releases one day earlier, and would have made the maximum increase 220 cfs rather than 300 cfs. We thereby would have used 34 cfs days less water and would have avoided any thermal stress.

Conclusions

- The reduction in river temperatures due to the additional releases of July 17 to 19 validate the models and analysis on which our March 2013 thermal stress relief protocol suggestions were based.
- Since there was no process in place for handling the emerging thermal stress event, numerous last minute phone calls, meetings and emails were needed. Several relevant officials and decision makers were not available. All in all, this contributed to:
  - Unnecessary delays in decision making
  - Wasted effort and inefficiency in the decision and analysis process.
  - A high level of anxiety in the upper river stakeholder and fishing environmental community.
- The agitation, scurrying around and delays in instituting these releases confirms the wisdom of our suggestion that the Decree Parties adopt a formal protocol for thermal relief as a component of the FFMP.

Recommendations

- The Decree parties should implement a thermal stress relief protocol in the 2014 revision of the FFMP. This would protect the trout from the worst stress conditions at no water availability risk to anyone, reduce stress on the river's managers, and relieve the fishing community of much summertime anxiety.
- The Delaware Watershed Coalition, the Upper Delaware stakeholders and the fishing community should continue to urge this on the Decree Parties.
- We again volunteer to collaborate with the Coalition, the Decree Parties, the DRBC and the Office of the Delaware River Master to this end.