On the Delaware Today: Thermal Stress, Yo-Yo Releases and Stalemate

Where We Are Now, Where We Came From, and Where We Need to Go

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First, Yes, Again, A Brief Case for Thermal Stress Relief!

- Recognizing that, notwithstanding the benefits of the FFMP OST, severe thermal stress to the trout in the upper Delaware still occurs, thermal relief has been a key goal of the Delaware Watershed Conservation Coalition since 2011.
- After a year of research, we presented a scientific framework for a thermal relief program to the Decree Parties at RFAC meetings in December 2012, again in March 2013, again in December 2015, and also at the DRBC "Listening Session " in 2013. Our research found that:
  - serious thermal stress events occur in most summers, and can be forecasted well in advance.
  - The magnitude of the cold water pulses needed to mitigate stress events was calibrated statistically.
  - Except in unusual circumstances, the amount of water needed for thermal stress relief is available in the reservoirs and would not put the needs of NYC or the other Decree Parties at risk.

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And a Let Us Offer a Few Critical Supporting Specifics

- Details of our analyses have been provided to your staff on multiple occasions, are posted on the RFAC website, and our analytic team (Peter Kolesar, Columbia Water Center; Naresh Devenini, CUNY Water Center; and James Serio, Delaware River Foundation) are available for discussions and consultation at your convenience, so they need not be repeated here.
- Yet, for sake of clarity, a few key points simply must be made again, this time to you in person.

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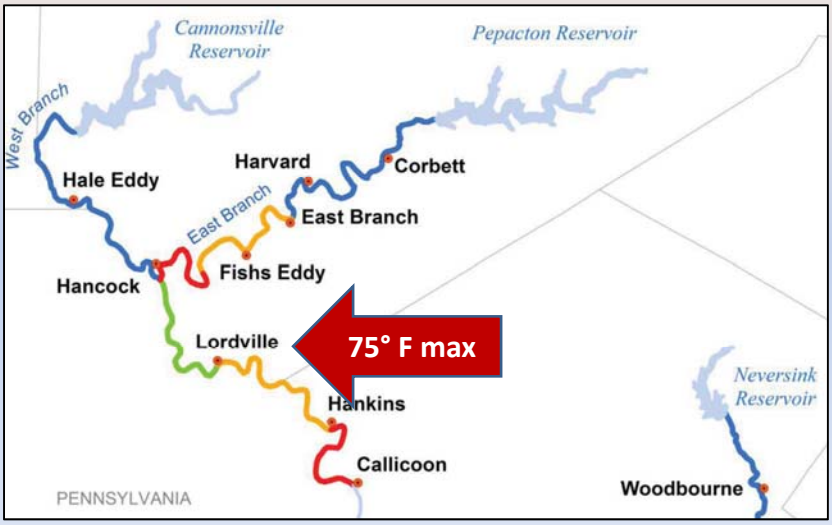
Our Goal is Modest: Mitigate Thermal Stress Down to Lordville

(Keep maximum river temperature below 75° F)



Source: Joint Fisheries White Paper, January 2010

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Severe Thermal Stress: A conservative and tradition bound concept

- The scientific literature shows that trout, a cold water species, are in 'severe thermal stress' whenever the daily maximum water temperature exceeds 75°F, that is, 23.9 C°.
- This definition has ample precedent on the Delaware :
  - DRBC Docket D77-20 CP Revision 1 (1977) and Revision 7, 2004, both have thermal targets of 75°F .
  - J. Douglas Sheppard, *New York Reservoir Releases Monitoring and Evaluation Summary Report Sheppard Report*, Technical Report 83-5, NYS-DEC, 1983
  - Mark Hartle, *Preliminary Report on Trout Habitat -Water Temperature Relationships in the Upper Delaware Basin*, PF&BC , SEF report the RFAC of the DRBC , August, 2010
  - John Pizzimenti, "Lackawaxen River Thermal Decision Support System, Progress Report, 2011"

Thermal Stress is a Serious Recurring Problem

(Lordville, 1993 to 2014)

Year	Stress Days	Degree Days
1993	7	4.9
1994	17	14.2
1995	23	19.3
Lordville Gage Not Operating		
2007	9	4.9
2008	18	19.3
2009	0	0.0
2010	18	18.6
2011	3	2.2
2012	14	8.1
2013	3	1.8
2014	0	0.0
Average	10.2	8.5
Minimum	0	0.0
Maximum	23	19.3

- In an average summer there were 10.2 severe thermal stress days requiring 8.5 degree days of cooling to bring them down to the 75° F benchmark.
- The worst summer, 1995, had 23 stress days requiring 19.3 degree days of cooling.

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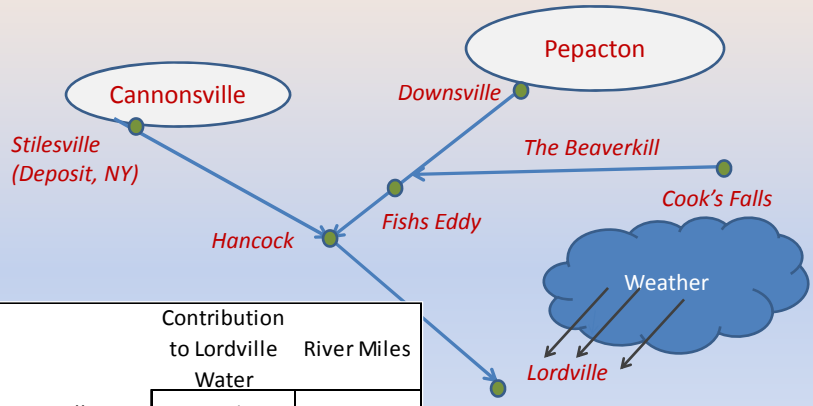
Our Engineering/Statistical Approach to Cooling at Lordville



	Contribution to Lordville Water	River Miles
Cannonsville	31%	27
Pepacton	14%	42
Beaverkill	30%	35
Other Tributaries	25%	-

$$\frac{\partial T}{\partial t} = -\frac{\partial (QT)}{A\partial x} + \frac{\partial}{A\partial x}\left(EA\frac{\partial T}{\partial x}\right) + \frac{H_f}{\rho c_p D} + S_b$$

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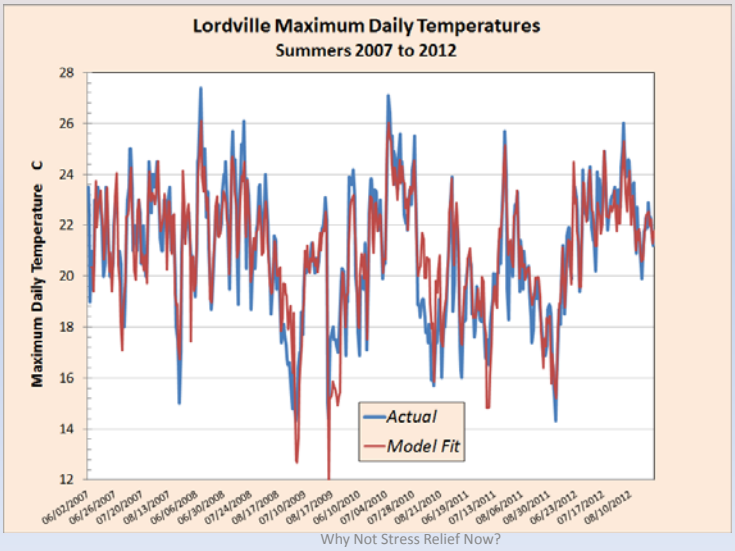
Our Extensive Analysis Produced a Reliable Model Tested Over Five Summers:



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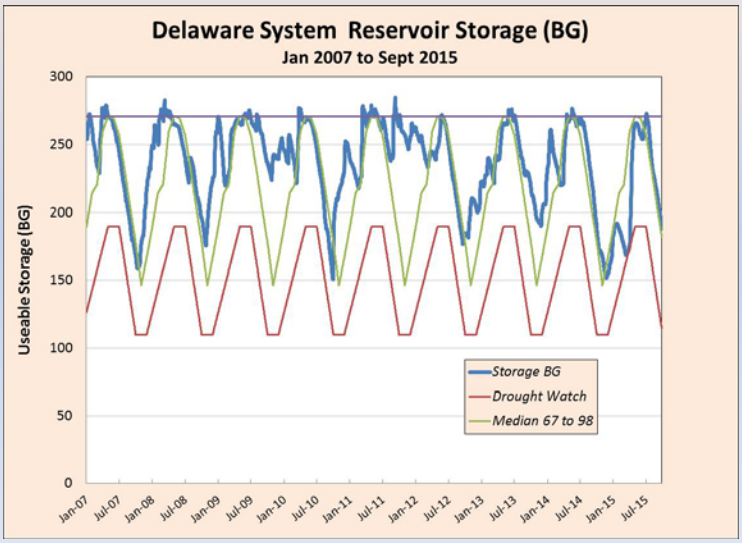
Except in all the most dire circumstances, the needed water is available.

1. Actual reservoir storage since 2007 (under the FFMP rules) has been well inside the normal range (L2), averaging 22 BG above the historical median. The reservoirs have spilled in every year since 2007.
2. According to the NYC-DEP's *OST-FFMP General Release Summaries,* actual releases have averaged about 250 cfs below NYC-DEP's own computation of water available.
3. The Croton Water Treatment Facility, restores 290 mgd of high quality water to NYC's water supply. This reduces the City's dependence on Delaware water and should be reflected in an increase of the OST-FFMP's computation of available water.
4. The NYC water supply system is very robust and should be able to handle the modest amounts of water needed for thermal relief.
5. The OST/FFMP program already has an IERQ water bank of 9,423 cfs days available to meet "special needs." In most summers significant amounts of the IERQ have not been used – 7,376 cfs days unused on average since 2007.

To Point 1. There is Typically Enough Water in the Reservoirs to Support Thermal Relief



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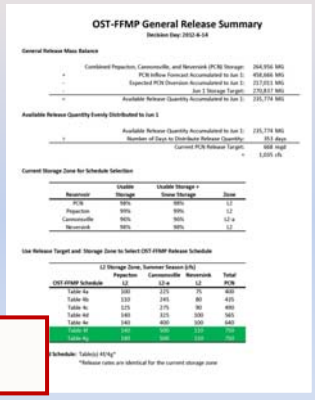
To Point 2. NYC's OST-FFMP computations show there is additional available unused water

June 14 2012: Storage at 98%, L2	(MG)
PCN Storage	264,956
Forecasted Inflow	458,666
Expected Diversion	217,011
June 1 Storage Target	270,837
Available Release Quantity	235,774
Days Remaining	353
Release Target mgd	668
cfs	1,035
Table 4g/f Release cfs	750
Excess cfs	285



These FFMP-OST Summaries are posted on the Rivermaster's website
http://water.usgs.gov/osw/odrm/weekly.html

To Point 4. The NYC water supply system is, by NYCDEP's own claims, and by recent experience very robust.

- During the July 2015 seepage event below the Cannonsville Dam FEMA ordered that the reservoir be emptied as fast as possible. Though the NYC-DEP was prepared to fully empty Cannonsville if necessary to deal with the seepage problem they, stated:

"Actions being taken at Cannonsville Reservoir do not pose a risk to New York City's water supply."

- During the seepage crisis the DEP was releasing 1,492 cfs into the river, about 900 cfs above 'normal'… far more than anything needed by a thermal relief program.
- And despite the July crisis, PCN reservoir storage rose to above normal by October of that year.

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Where Do We Stand Now on Thermal Relief?

- Based on these findings, we proposed that a conservative experimental thermal relief program be implemented, with the program details to be developed jointly by the NYS-DEC and PA-F&BC, using as a model the collaboration that led to the *Joint Fisheries White Paper* in 2010. We volunteered to collaborate in the effort.
- This modest proposal has been rejected/ignored -- without refutation of any of our analyses. Yet, we face the coming summer of 2016 without a relief protocol or guidelines in place.
- It was revealed at the December 3, 2015 RFAC meeting that one of the Decree Parties is prepared to veto this proposal, indeed any such proposal, regardless its 'reasonableness and feasibility' unless it gains approval of other far reaching requests. As these other issues are very consequential, complex and will undoubtedly take years and possibly litigation to resolve, the ecology of the upper river faces being held hostage long-term!

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What Would Be Rational Grounds for Rejection?

- Invalid Analysis. But, no such claim has been made. Our analysis is not novel. The core concepts derive from the scientific hydrological literature and have been implemented elsewhere. Our proposal parallels the current successful thermal relief program on the Lackawaxen, an important Delaware tributary. Our statistical results are broadly consistent with recent peer reviewed thermal research on the Delaware done by the USGS Water Smart Project.
- The Water Needed is Not Available, or Would Put the System at Risk. But the evidence (already shown) to the contrary is abundant. Pleases observe that we propose a "conservative experimental program." Because, under the FFMP-OST rules, the upper river suffers the biggest hit if reservoir storage falls below normal levels, it is not in our community's interest to risk putting the system into 'drought.'

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The Bigger Picture: Putting Things Into Perspective: Together, We Have Come a Long Way Since 1954

- There were no upper river ecological considerations in the 1931 and 1954 Supreme Court Decrees, and until 1977 no conservation release policy, at all. For example, over a 21 day span in August 1973, the release from Cannonsville was 40 cfs.
- In 1977, stimulated by the fishing community, New York State unilaterally imposed its Conservation Law Part 671 whose conservation releases were originally legally resisted by the Decree Parties, only to subsequently be included in the first official DRBC policy D 77-20 CP. The minimum summer-time release from Cannonsville was 45cfs.
- In 1983 Revision 1, as part of the Good Faith Agreement, the summertime Cannonsville releases increased to 325 cfs, thermal targets were created in the upper river, and reductions in releases and diversion were specified in case of drought. But, the conservation releases took the heaviest hit, with the Cannonsville releases dropping to 23 cfs in drought. These rules would be essentially maintained until 2004.

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Some Perspective, Continued

- Revision 7 of 2004, introduced flow targets in the upper River, created an interlocking system of 'habitat protection banks' whose administrative complexity was mindboggling. Recognizing its unsatisfactory scientific basis, and its chewing gum and baling wire complexity, the Decree Parties called for vigorous scientific evaluation and the development of a long term sustainable release plan by 2007. NYS-DEC was charged with leading this initiative.
- But by 2006, no progress had been made on the developing the desired revision. Moreover when in 2005 a severe thermal condition was unaddressed despite nearly full reservoirs, a coalition of TU, The Nature Conservancy, the Delaware River Foundation and Theodore Gordon Flyfishers, with the Columbia Water Center providing analytic capability, undertook to independently develop a fresh approach to releases. Subsequent collaboration with NYS-DEC produced the 2007 FFMP.
- In 2008 we proposed improving the FFMP by incorporating estimates of actual NYC diversions rather than the maximum allowable 800 mgd per the 54 Decree. NYC-DEP's initial response was "We will not even consider that idea." But, in 2010 the FFMP-OST did exactly that, with one of the FFMP-OST design team members having been on the original Columbia Water Center Team in 2006.
- The 2010 Joint Fisheries White Paper produced by a collaboration of NYS-DEC and the PA F&BC Bureaus of Fisheries, and supported by analyses from Columbia and the Delaware River Foundation led to the substantial release level increases in the 2010 FFMP OST.

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Yet, Overall, Where Do We Stand Now?

- We have a yo-yoing directed release policy that is stupidly and unnecessarily destructive, is easily fixed, and everyone of you knows it.
- We have a thermal stress potential in the upper river that endangers the fish, enrages the fishing community and stresses you, the Decree Parties, every time it happens. As we have argued today, its fixable.
- NYC-DEP has a computer model of its entire water supply system that it will not share with the other Decree Parties or with the pubic, even though every one in this room, and even the 1954 Supreme Court Decree, recognizes that the Delaware, Catskill and Croton systems are interlocked and interdependent. So, NJ-DEP has created their own model of the NYC system. But NYC-DEP has declined to even consider it.
- It took an unacceptable three years after the OST was incorporated into the FFMP for a modest update of the OASIS model of the Delaware to include OST elements.
- The operation of FFMP-OST release rules depend critically on NYC-DEP forecasts of reservoir inflows and diversions over the water year. Yet, not a single other Decree Party, nor anyone in stakeholder community, understands how the forecasts are made.
- We have had a complete stalemate on any constructive modifications to the Delaware release rules since 2010, with only grudging one year extensions since, all the while under a continual threat of a 'shoot ourselves in the foot' return to the archaic, unscientific and ecologically destructive Revision 1 of 1983.

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From the Decree Parties: Questions, please?

"People, I just want to say, can we just all get along?"

Rodney King, Los Angeles, 1992

Appendix: Extract from the Minutes of the December 2015 RFAC Meeting

"The Case for Thermal Relief in the Upper Main Stem of the Delaware River: An Update

Professor Peter Kolesar of Columbia University gave a presentation on a proposal for thermal relief releases from Cannonsville reservoir. Earlier versions of this proposal were presented to RFAC in 2012 and 2013. On average about ten serious thermal stress events occur per summer, and most could be mitigated by pulsed releases of cold water from Cannonsville reservoir. The objective is to mitigate thermal stress in the main stem Delaware River [down] to Lordville, NY, keeping maximum water temperature in the river below 75° F. Calculations indicate that the water needed for this program would be available, except in very dry years. The recommendation is to implement an experimental thermal stress relief protocol before the summer 2016."