

LAKE LEVELS SUBCOMMITTEE WATER BUDGET  
REPORT No 2

Morgan C. France 27 February 2014

Interested parties view the topic of lake water levels historically as a debate between the users of the outflow from Deep Creek Lake (DCL) and the users of the waters in the lake. The Maryland Department of the Environment regulates the outflow from the lake.

The outflow is the subject of Water Appropriation Permit GA1992S009(08). To view the entire permit (12 pages) go to:

[http://www.mde.maryland.gov/programs/water/water\\_supply/documents/deep%20creek%20lake/brookfield%20permit-2011jun.pdf](http://www.mde.maryland.gov/programs/water/water_supply/documents/deep%20creek%20lake/brookfield%20permit-2011jun.pdf) .

On page two of the permit, condition number two lists the uses of the water: hydroelectric generation, temperature enhancement, whitewater boating enhancement, and the maintenance of minimum flows in the Youghiogheny River. Condition number 14, on page four, outlines the rule band for water levels to afford the users of the lake adequate water for boating purposes. Temperature enhancement releases are not subject to the rule band, and the permit allows whitewater releases down to one foot below the rule band. Exceptions A through E address maintenance and emergency conditions. The Code of Maryland and Rules (COMAR), Natural Resources Code Ann. 5-215.1.(a).1(2013 lists recreation among other things as a use for DCL.

There is a wealth of information in the Brookfield Annual Reports. The 2011 and 2012 Reports present data that was used herein.

According to the Fisheries paper <sup>(1)</sup> on page 6 of 8, "Threats" the statement is made that "During 2011 and 2012 the trout population densities and standing crops were reduced to levels observed prior to the temperature enhancement plan mainly due to the number and duration of temperature exceedances."

On page 292 <sup>(2)</sup>, 1 June 2011, the daily TER daily sheet calls for a TER because of the 118 cfs flow in the Yough at Oakland. The operator notes that no release he made no release because the plant was undergoing repairs. Without the release the maximum reported stream temperature was 24.10 °C. A temperature vs. time plot is attached <sup>(3)</sup>.

Perhaps the fisheries staff should look into other circumstances surrounding the decline in fish populations in 2011 and 2012.

The Hoyes gage (USGS 03076100) came on line at the end of July in 2011. After that date the discharges that can be correlated with the TER's and the excursions.

According to Table 2 in the 2011 Brookfield annual report the total time for temperature enhancement releases was 78 hours. Assuming a release rate of 630 cfs for 78 hours equals about 4,000 acre feet. That equates to about 1 foot for the three month period.

The 26 July 2011 excursion went to 27.29 °C, and was greater than 25 °C for 2 hours and ten minutes. The protocol called for a 2 hr. release at 12:30. The release started at 12:43 and ran until 14:38. Unfortunately the Hoyes gage was not on line to show the release <sup>(4)</sup>, or the base flow at Hoyes. The Oakland gage registered 45 cfs.

When the Hoyes gage came on line the plots of temperatures at the Sang Run Bridge and the releases from the plant shows several things that are related to how excursions occur, even with the release of 630 cfs of water into a stream flowing about 60 cfs.

Elementary calorimetric calculations indicate that the colder lake water at ten times the river flow rate should easily lower the temperature. The problem lies in the timing. The data plot from the 2011 Brookfield Annual Report <sup>(2)</sup> for 4 August shows temperature at Sang Run and the Hoyes flow gage <sup>(7)</sup>.

The protocol called for a two hour release at 1230h. The rising temperature gradient was about one degree Celsius per hour. The duration of the release exceeded the length of the excursion. Noting the rapid decrease in temperature about two hours after the release started, at least part of the problem is that the river temperature should be monitored at the plant to control the releases. The use of the Sang Run Bridge for control is too late...the damage has been done.

Using the full power of the plant for temperature control is like stepping on a mouse with an elephant. The bypass can control both the river base flow and the temperature. If the river temperature is 29°C and the flow is 40 cfs, and the bypass valve is set to 40 cfs at 19°C, then the river will be at 24°C. However, using the bypass will not control all of the potential temperature excursions.

Attachment WB-TER2012 <sup>(6)</sup> contains useful information from the Annual Report <sup>(5)</sup>. There were 41 TER's in 2012, fifteen of which failed to control the temperature. Of those, seven were not associated with a bypass release.

Back to the concept of elementary calorimetric calculations, of the 41 TER's sixteen of them occurred when the river flow was 40cfs or less. On those days the bypass flow of 40cfs would have controlled the river temperature per the example above.

The best way to control the temperature in the river is to use the temperature at the plant and coordinate with the Hoyes flow gage. The thermometer needs to be a short distance above the plant discharge into the river. The temperature in the river at the plant should not exceed 22.5°C. Opening the bypass can control the temperature to stabilize at 22.5°C. This procedure will take care of most of the hot days. If the temperature continues to rise to 23.5°C with the bypass valve at 80% then bring one turbine on line and leave it run until the upstream thermometer registers less than 23.5°C.

Having one or two hour releases is like trying to hit a clay pigeon with a big game rifle. The TER, even at 630 cfs does not last long enough. Reference 4 is the plot for 6 July 2012<sup>(8)</sup>. Both the timing issue and the inadequate bypass contributed to the failure on that date. The bypass flow was 8 cfs, with a capacity for 32 cfs. The river flow at the Hoyes gage on that day was 43 cfs that included the 8 cfs bypass. Bypass at 40 cfs, temperature excursion could have controlled the double excursion without the release that only punched a hole in the high temperature instead of a smaller longer release. And, by the way, the fish will benefit, and so will the other stakeholders.

One other observation is that the TER protocol is only for June, July, and August. In 2012 the flow on the Hoyes gage was below 50 cfs even with the bypass open most of the time in September. Is there any record of the temperatures in the river during September?

The TER's are a large item in the lake water budget...historically over a foot of water each year, and it is paid at the peak of the recreation season. And the TER's are not subject to the rule band.

Another item in the lake water budget is the whitewater releases. It takes about 2.8 feet of lake water to satisfy this demand. This committed demand needs to be budgeted into the lake levels as does a projection of the water needed for the TER's. The TER budget will probably be considerably less based on a more accurate methodology. Both TER's and whitewater releases need to be budgeted and managed to assure water is available for them without violating the

lower rule band. An allocation is not management...particularly when the income side is not knowable.

The water saved from better managed TER's will enable the power plant operators to make discretionary releases that are more advantageous to their market. When the market is right the discretionary releases will be longer than the TER's used to be. Longer releases are more valuable to the whitewater community as well.

The upper rule band needs to be kept above 2459 where it is currently at 2458. In August it needs to be 2461 and 2460 in September. The lower rule band is OK as long as it is not violated.

- (1) Maryland DNR, 6 December 2013, Watershed Characterization, LAKE\DNR\6Dec13 Fisheries Report
- (2) Brookfield Annual Report, 2011
- (3) 1JUNE 2011 TEMPERATURE EXCURSION ANALYSIS MADE 17 JANUARY 2014 FROM BROOKFIELD ANNUAL REPORT, NOT TO SCALE M. C. FRANCE.pdf (attached)
- (4) 26JULY 2011 TEMPERATURE EXCURSION ANALYSIS MADE 17 JANUARY 2014 FROM BROOKFIELD ANNUAL REPORT, NOT TO SCALE M. C. FRANCE.pdf (attached)
- (5) Brookfield Annual Report, 2012
- (6) WB-TER2012.pdf (attached)
- (7) 4AUGUST 2011 TEMPERATURE EXCURSION ANALYSIS MADE 17 JANUARY 2014 FROM BROOKFIELD ANNUAL REPORT, NOT TO SCALE M. C. FRANCE.pdf (attached)
- (8) 6JULY2012 TEMPERATURE EXCURSION ANALYSIS MADE 17 JANUARY 2014 FROM BROOKFIELD ANNUAL REPORT, NOT TO SCALE M. C. FRANCE.pdf (attached)
- (9) USGS GAGE 03076100 Youghiogheny River at Hoyes Run, Maryland, June-August 2012

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