2008 “RERUN” USING THE <u>60% SOLUTION</u> TO PREVENT FISH KILLS

If one could do a “rerun” of 2008 using the knowledge of hindsight and change how the reservoir was managed, could it be done differently so that there was 60% volume remaining on December 1, 2008? This is implementing the “60% solution”. The year 2008 was chosen to do a more detailed analysis because it is very recent and fresh in our memories, and due to severe drought conditions it is one of the toughest years historically to have been able to keep 60% volume in the reservoir on December 1.

<u>The analysis that follows concludes that even in one of the historically driest summers like 2008, there is more than enough water available to be able to keep 60% volume in the BEP reservoir for December 1. The water management method needs to change to allow this</u>. Important to WVIC, no hydropower generation would be lost; it would simply shift some of the water use and power generation from summer into the winter. And the DNR important minimum Wisconsin River flow of 1300 cfs is not violated.

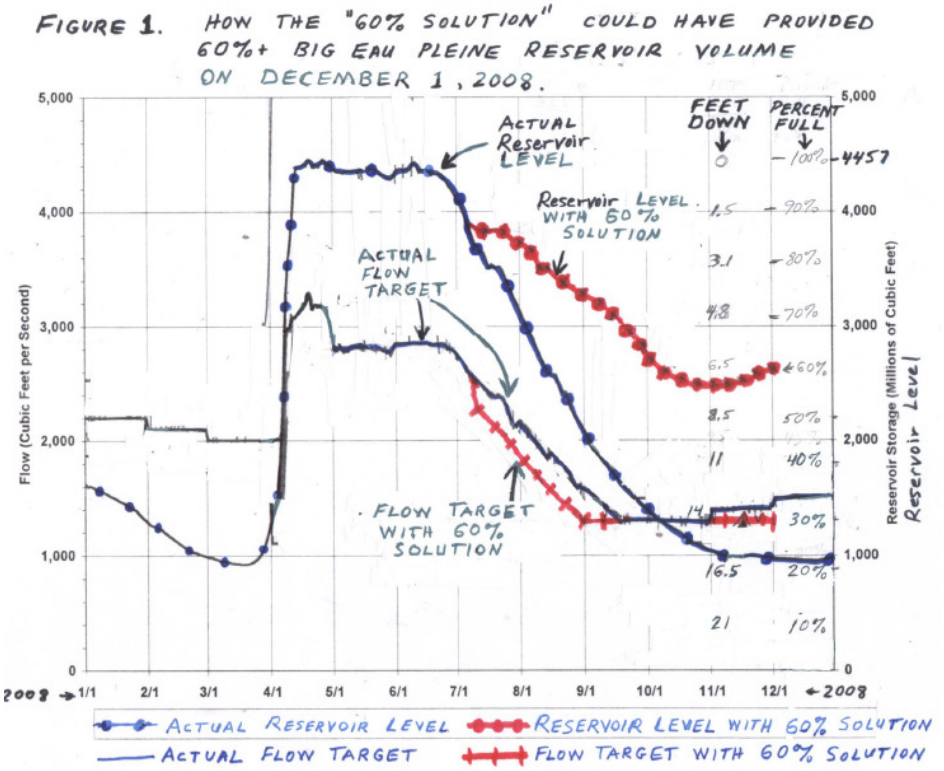

FIGURE 1

Figure 1 shows how the 60% Solution could do this. The “Actual Reservoir Level” line and the “Actual Flow Target” line on the graph are copied from WVIC’s Annual Operations Report for 2008. The solid black line shows the actual flow target for the Wisconsin River at Wisconsin Rapids using the scale on the left side. The black dotted line is the level in the Big Eau Pleine reservoir and uses the scale on the right side. WVIC releases water from the BEP reservoir as needed to control the water flow at Wisconsin Rapids to the flow target. WVIC must keep the water flow to within (+/-) 15% of the target according to their license. The target is set by formulas in their computer model

and in the license called the rule curves. Having the flow target set by formulas does not allow for any flexibility.

To keep the graph simpler, the actual flow is not shown. The actual flow normally cycles back and forth near the target flow as the reservoir is drawn down. The actual flow can go well above the target flow when there is heavy rain or from snowmelt in the spring.

Note that after spring runoff the reservoir level was full at 4457 MCF from mid April through late June. During this time the "actual flow target" for water flow in the Wisconsin River at Wisconsin Rapids was near 2850 CFS during much of May and June. 2850 is the "sweet spot" for flow at Wisconsin Rapids for maximum hydropower generation and no excess wasted water.

From late June through November the actual reservoir level dropped steadily until it was only 22% full on December 1. Also beginning in late June the actual flow target was gradually decreased, and that by mid September it was down to the DNR required minimum of 1300 CFS. The rule curves in WVIC's license require the decrease in the river flow target as the reservoir level drops.

The red dashed line shows how the flow target at Wisconsin Rapids could have been decreased by implementing the 60% Solution to have 60% volume in the BEP reservoir on December 1. It shows a flow target decrease of 230 CFS for 11 weeks during July through September, and a flow target decrease of 100 CFS during November. The red dotted line shows the effect this lower flow target would have had on the reservoir level. The reservoir level would have gone down at a much more gradual rate and would have gone back up slightly in November. There would have been 61% remaining volume in the reservoir on December 1 by using this "60% Solution". (The calculations for the amount of water saved are detailed in an endnote).

So what does this all mean? Remember that there is only a 4% chance of a fish kill with the reservoir at 60% full or higher on December 1, while there is a 60% chance of a fish kill with the reservoir below 60% full on December 1. The devastating fish kill following the summer of 2008 might very well never have happened had the 60% solution been implemented.

It is easy to see visually on the graph that the 60% solution can work. There would have been enough water available even in the extremely dry summer of 2008! There was no need to take the Wisconsin River flow below the DNR required minimum of 1300 cfs. <u>There is enough water but it needs to be managed differently</u> "to provide equal consideration for all purposes". There needs to be some give and take. <u>The rule curves need to be changed</u> to provide for this.

DIGGING A HOLE

"Digging a hole" means using a high flow target of up to 2850 cfs to maximize hydropower generation designed to take a large amount of water out of the reservoir early in the summer. This is done to make maximum use of the available water and make room

in the reservoir for more water storage in case there is a lot of rain. It makes sense to "dig a hole" early in the summer from the perspective of maximizing hydropower generation. But it does not make sense to keep digging the hole deeper and deeper all summer, resulting in not enough water to support the fishery in the winter in case it does not rain. Using the existing rule curves, which WVIC must follow, they kept digging the hole deeper in 2008 until mid September. On September 19 the Wisconsin River target flow was "finally" brought down to the 1300 cfs minimum when the BEP reservoir was at a mere 36% capacity.

The 60% solution implemented in the 2008 example left the river flow target high at the existing rule curve target to dig a small hole until the reservoir was 2 feet down. Then the flow target was more rapidly brought down to conserve water for later, should it not rain, to be able to provide 60% volume for December 1. Interestingly the decrease in the flow target of 230 cfs from July to September using the 60% solution shown is actually within the allowed +/- 15% flow deviation limits.

CONCLUSIONS

The particular target flows chosen for 2008 implementing the 60% Solution (230 cfs less than actual) would have worked for that year. But every year the conditions can be very different and cannot be predicted. The rule curve changes that need to be made must somehow provide enough flexibility to handle very diverse conditions.

Some general conclusions can be drawn from the 2008 example:

1) There is plenty of water to implement the 60% solution even in an extremely dry year.
2) WVIC must manage the reservoir to provide for the worst cases meaning assuming that it will be very dry in the summer and not rain much in the fall to help refill the reservoir. Most of the 11 years of fish kills in the last 40 years followed a similar reservoir level pattern to the summer of 2008, with 2008 being about as bad as it gets. There was a steady drawdown of the reservoir all summer long, meaning low rainfalls, and little or no refill in the fall. (The average refill in the fall from 1950 through 1990 is only 2 feet due to fall rains).
3) The decrease in flow target above the existing rule curve targets must begin early in the summer when the reservoir is still nearly full. During the summer of 2008 the 60% Solution implemented as a possible solution started decreasing the flow target by an additional 230 cfs once the reservoir was drawn down by 2 feet.
4) The flow target needs to be brought down the 1300 cfs minimum flow when the reservoir is still well above the 60% level. This is in case it does not rain so that the reservoir can still be further drawn down to provide the minimum 1300 cfs in the river and still provide 60% volume on December 1. In 2008 the flow target would have needed to be brought down to the 1300 cfs minimum flow by the time the reservoir was at 75% of capacity in order to provide 60% capacity by December 1.

WVIC has control of the computerized model that produces the existing rule curves. WVIC needs to update it to include the "60% Solution" need and then produce new rule curves so that we can have 60% volume minimum remaining in the Big Eau Pleine

reservoir on December 1 each year as much as possible. This will minimize the chances of future fish kills on the Big Eau Pleine flowage.

APPENDIX 1

Here is the math to calculate the 39% extra volume in the reservoir on December 1 that implementation of the 60% Solution could have provided:

1 cfs x 60 seconds/minute x 60 minutes per hour x 24 hours per day x 7 days per week / 1,000,000 = .6048 mcf. Therefore 1 cfs = / .6048 mcf per week

230 cfs x .6048 mcf/cfs x 11 weeks = 1530 mcf "saved" between early July and early September.

100 cfs x .6048 mcf/cfs x 4 weeks = 240 mcf "saved" in October.

1530 + 240 = 1770 total MCF "saved".

1770 mcf saved /4457 reservoir capacity =39% of the reservoir capacity "saved".

22% actual capacity on Dec. 1 + additional 39% saved = 61% capacity Dec 1 implementing the 60% solution.