Comments on Docket UE-131723 4/14/2014

From: James Adcock, Electrical Engineer (MIT) with a 20+ year industry background in statistical modelling, including patents issued in this area.

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I address myself here to the questions asked in Notice of April 9, 2014 in regards to the questions asked relating to incremental hydropower calculation, pages 2-3, questions 1-3. I leave question 4 to others.

Questions 1-3: How should a historic period be best selected, What is the appropriate number of years, etc.

I remind readers (as if this were necessary) that stream flow is highly variable from day to day, and from year to year – a well-known problem with hydro generation. I believe that natural year-to-year variation in stream flow [but not in regards to say HDD temperature modeling] is so large that one should ignore human induced climate change in the stream flow modeling – which is causing variations in what months the stream flow is happening, but is less of a concern so far as to total yearly stream flow – compared to the simple "random" year-to-year fluctuation in total stream flow.

Chart 1 reminds us of the huge daily variations in stream flow. (Columbia Grand Coulee stream flow taken as the example.)

Chart 2 reminds us that the year-to-year variation of total stream flow averaged over the course of a year still remains large – we have "good years" and "bad years" in regards to hydro generation.

I am assuming for the sake of simplicity in exposition here that generation is simply proportional to stream flow – which is not correct – high flows tend to imply high heads resulting in higher than proportional generation, whereas low flows tend to imply low heads and conversely lower than proportional generation. So actually including power curves in this analysis (rather than direct stream flows) would only somewhat further increase the variability in results compared to what is given in these examples, making the good years even somewhat better, and the bad years even somewhat worse.

Chart 3 demonstrates the effects of 11-year averaging of stream flows. Why 11-years? 11-years is often taken instead of 10-years in climatic modeling since 11-years corresponds (roughly) to the sun spot cycle, thus 11-year averaging tends to average-out the effects of the sun-spot cycle. Chart 3 11-year averaging demonstrates a level of smoothness that seems plausible for the use in proposed calculations "Method one" and "Method two."

Chart 4 demonstrates the greater smoothness of 22-year averaging. It seems that the recognized greater dangers in proposed "Method three" would be best served by using 22-year averaging.

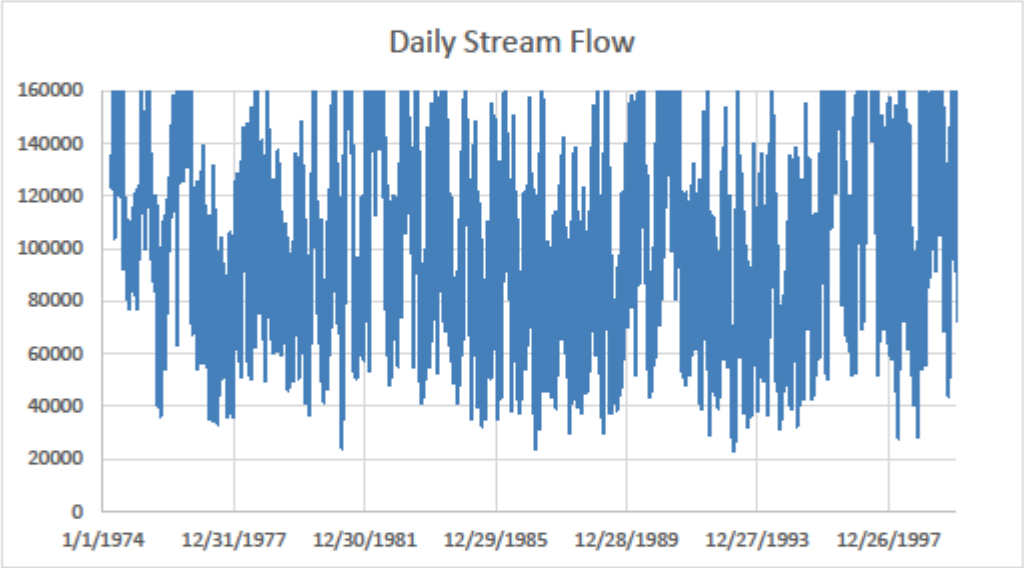
Please note that the 11-year and the 22-year options are the only ones I would suggest. I would not suggest using the current “at least XX” years language since that would invite “gaming” where an incremental-hydro operator would simply search out that combination of years which artificially appears to give them the greatest advantage – without an actual corresponding environmental benefit advantage actually accruing to the ratepayers. Further, other periods would lose the advantage of the sun-spot smoothing.

In closing, I suggest 11-years for Methods one and two, 22-years for Method three, and do not allow the “at least XX” years option because it invites “gaming.”

PS: Running yearly averages are only used instead of simple yearly averages in order to better illustrate the amount of statistical “smoothing” vs. “natural variability” left behind after performing an XX-year average. I do not mean to imply that running averages would somehow be used in the actual calculations, which presumably would need to be calculated from hourly stream flows, or perhaps could be calculated from daily stream flows.

Thank you for your consideration,

James Adcock


Daily Stream Flow
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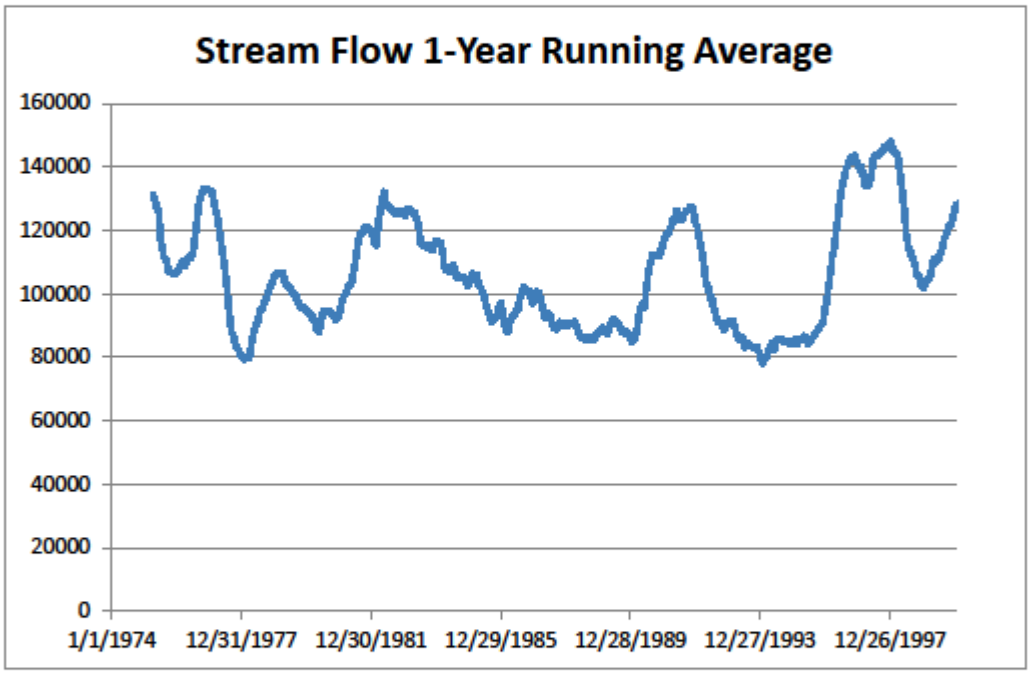
140000
120000
100000
80000
60000
40000
20000
0
1/1/1974
12/31/1977
12/30/1981
12/29/1985
12/28/1989
12/27/1993
12/26/1997


Stream Flow 1-Year Running Average
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140000
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80000
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1/1/1974
12/31/1977
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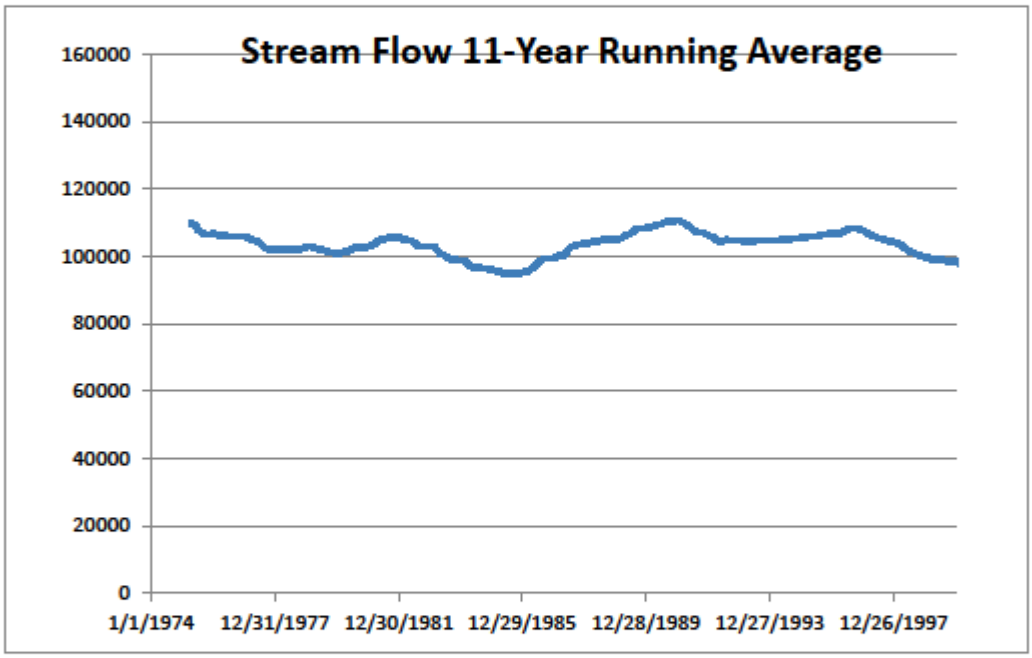
12/29/1985
12/28/1989
12/27/1993
12/26/1997


Stream Flow 11-Year Running Average
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80000
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20000
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1/1/1974
12/31/1977
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12/29/1985
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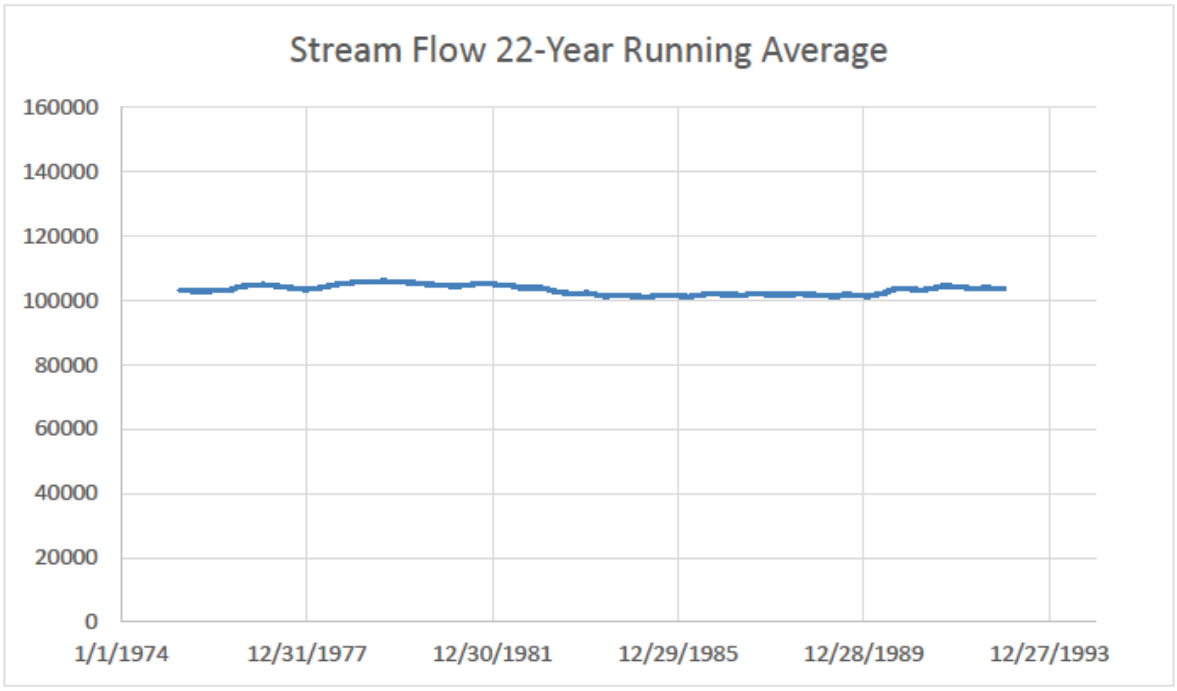
12/26/1997


Stream Flow 22-Year Running Average
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60000
40000
20000
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12/31/1977
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12/29/1985
12/28/1989
12/27/1993