

## MEMORANDUM

**To: Water Right File No. 03-7018**  
**From: Aaron Marshall**  
**Date: October 25, 2007**  
**Re: Maximum Diversion Rate**

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Water right nos. 03-2023 and 03-2024 provide for power generation at Brownlee Dam with a combined maximum diversion rate of 30,000 cfs. Water right permit no. 03-7018 provides for an additional diversion rate of 5,000 cfs for power generation at Brownlee Dam. The following analysis was necessary to determine the maximum diversion rate for licensing water right no. 03-7018.

In 1998, Idaho Power provided IDWR with hourly data for calendar year 1997 that included power generation, headwater elevation, tailwater elevation, and gross head at Brownlee Dam. Headwater elevation data was only available from April 21 at 15:00 hrs through December 31. This provided 6,106 data values for headwater elevation. On October 18, 2007, Idaho Power provided IDWR with the k-factor for Brownlee Dam power plant. The k-factor equation defines the relationship between power generation and rate of water flow through the plant. The k-factor is dependent upon headwater elevation and increases are directly proportional. The k-factor can be used to estimate discharge and, for Brownlee Dam, is represented by the equation:

$$y = 0.0848x - 156.33$$

Where,  
y = k-factor, in kw/cfs  
x = headwater elevation, in feet

I applied the k-factor equation to the 1997 data to determine hourly k-factor values. I then calculated discharge values using the following equation:

$$Q = P / y$$

Where,  
P = power generation, in kilowatts

This resulted in 120 hourly discharge values greater than 35,000 cfs, or approximately 2% of the data set. The greatest discharge for the period was 38,945.7 cfs, on September 21, 1997, at 18:00 hrs, and was calculated using a headwater elevation of 2,041.54 feet and power generation of 654,000 kilowatts. Using the information provided by Idaho Power, the power plant in Brownlee Dam has beneficially used more than 35,000 cfs.

The maximum annual diversion volume in excess of 30,000 cfs but less than 35,000 cfs was calculated using the data provided by Idaho Power for 1997. First, I calculated the daily average discharge for each of the 255 days of discharge data available for the year. There were no daily averages exceeding 35,000 cfs. I totaled daily average discharge values exceeding 30,000 cfs then divided the total by 255 to compute a daily average for the data set of 129 cfs per day. I multiplied 129 cfs per day by 365 days per year and 1.9835 cfs per acre-foot per day and computed the annual diversion volume at **93,400 acre-feet**. This is the annual diversion volume beneficially used for power generation greater than 30,000 cfs.

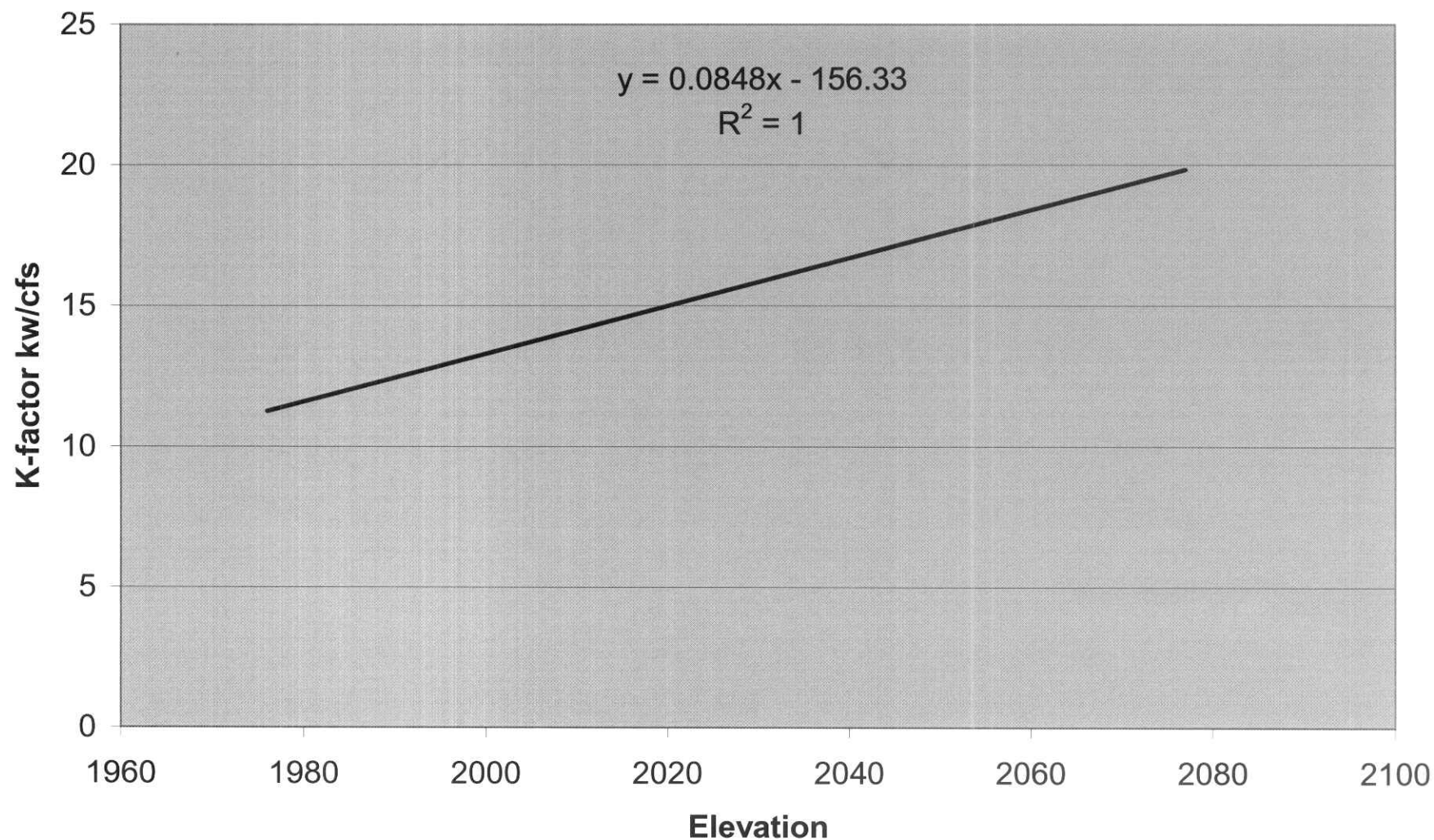
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## Brownlee k-factor



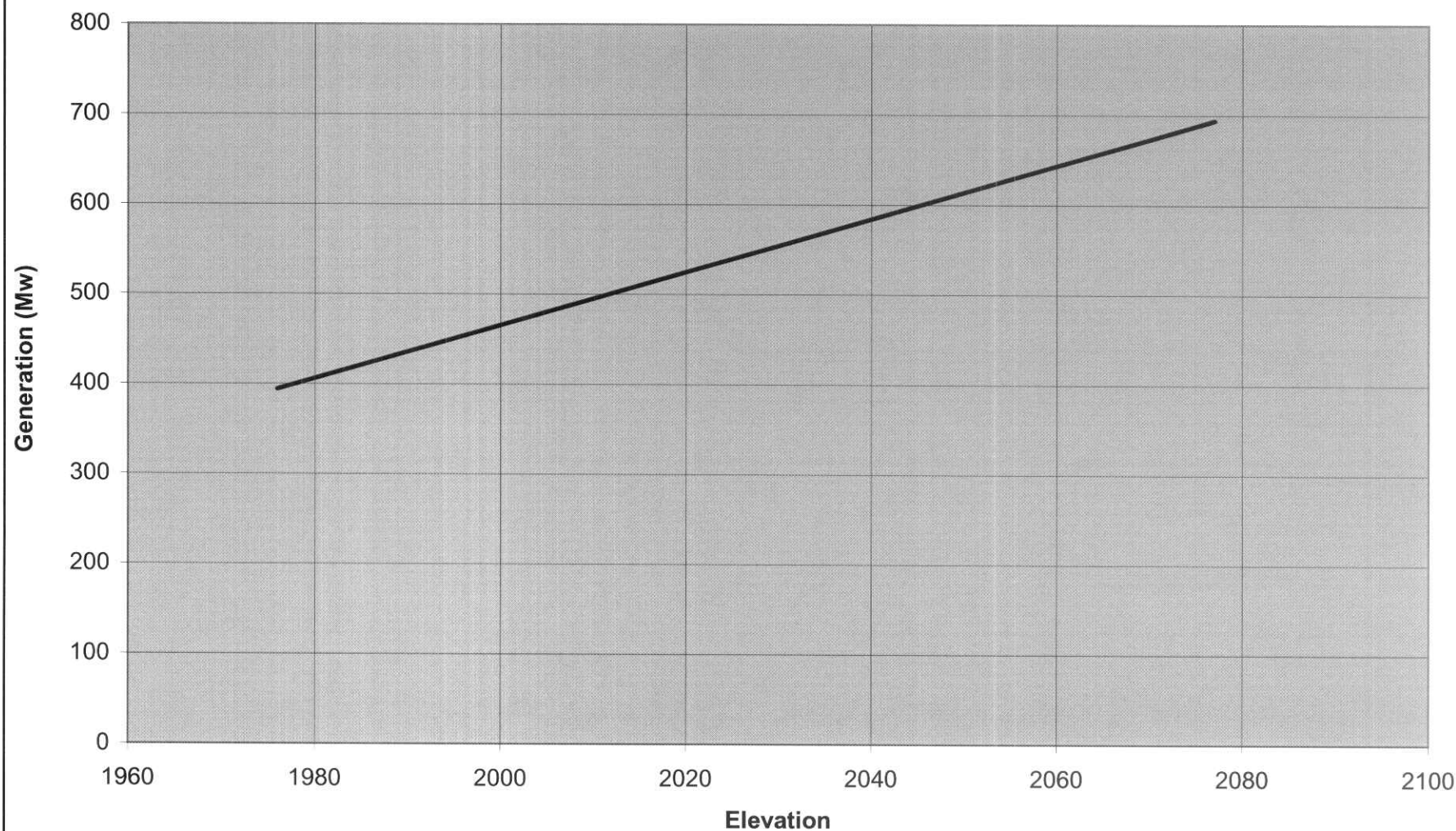
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**Brownlee Generation vs Elevation  
@ 35,000 cfs**

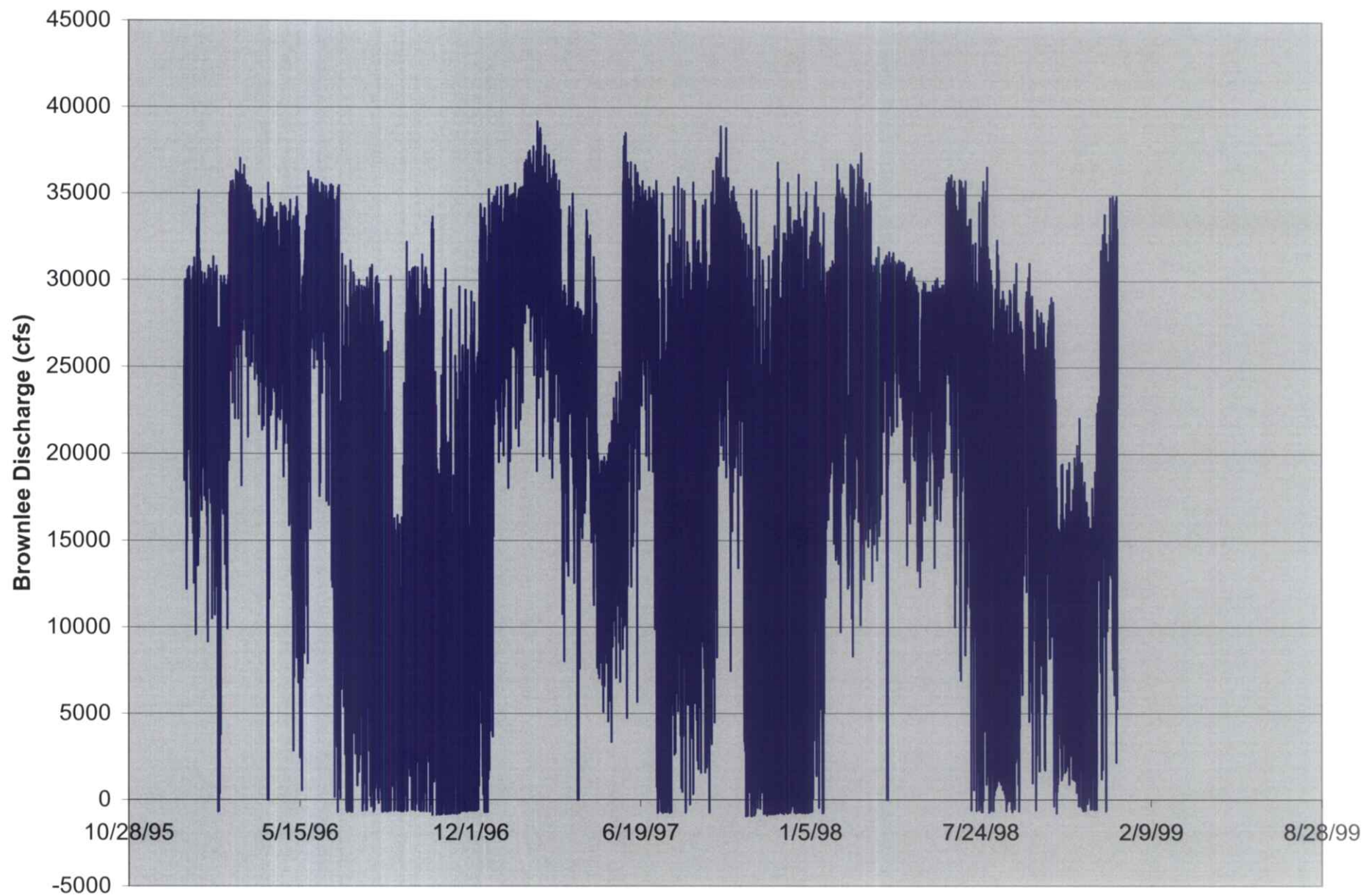


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# Brownlee Flow 1996 - 1998 (K-factor/Generation)



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