Hydrology Summary for the Black Canyon Hydroelectric Project
FERC Project No. P-14110
August 2012

Prepared for
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1 Drainage Area Factored Flows

In the Preliminary Application Document (PAD) submitted May 25, 2010, Figure 5, the maximum, mean, and minimum annual hydrographs for the North Fork were developed using data from the USGS 12142000 gage. Figure 6, the flow duration curve was developed using data from the USGS 12142000 gage. The data was not scaled to reflect the increased drainage area of the proposed intake location.

Further hydrologic analysis conducted since the submittal of the PAD utilized stream flow information from USGS gages 12142000, NF Snoqualmie River Near Snoqualmie Falls, and gage 12143000, NF Snoqualmie River Near North Bend. The drainage area of USGS gage 12142000 is 64 square miles. The drainage area of USGS gage 12143000 is 95.7 square miles. The projects intake would be located approximately 5.16 miles upstream of the confluence of the North and Main forks of the Snoqualmie River with a drainage area of approximately 90 square miles.

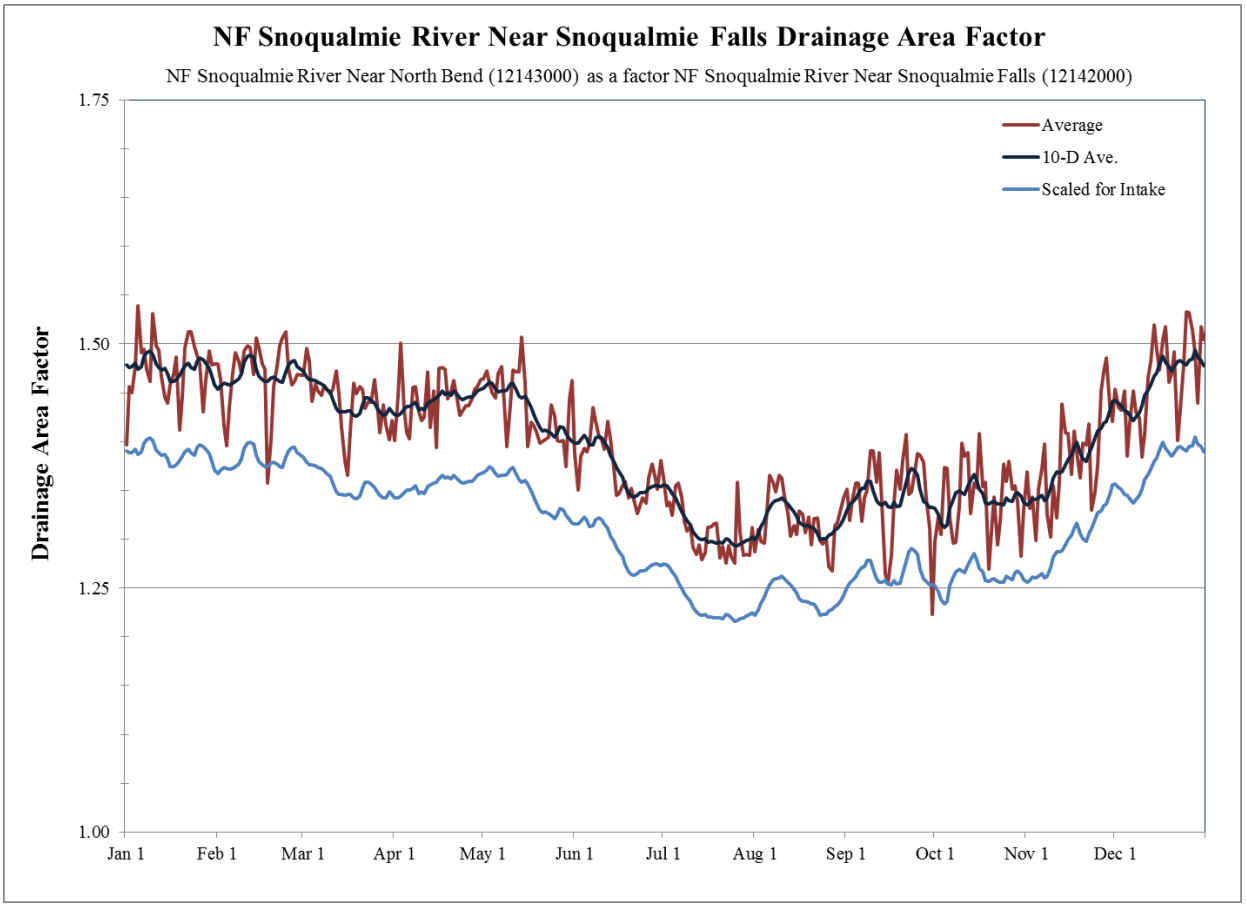


Figure 1 - Stream gage discharge as a factor of USGS 12142000 Gage.

To estimate the increased flows at the proposed intake location a drainage factor was used. Daily average discharge data was collected for the 12142000 and 12143000 gages for 1962-1970 civil years. The drainage factor was developed by dividing the 12143000 gage daily average discharge by the 12142000 gage daily average discharge for all days between January 1, 1962 and December 31, 1970. These daily factors were then averaged over the 9 years for each day of the year. The average daily factors were then scaled by the drainage area of the proposed intake relative to the 12113000 gage resulting in an estimate of flows at the proposed intake location. Because stream gages will be installed this data is provisional, although it is being used for planning purposes.

Figure 1 shows the drainage area factor, the red line is the average daily factor over the 1962-1970 period. Because of the abrupt shifts in the average, the line was smoothed by taking the ten day average, shown as the black line. The ten day average was then scaled to reflect the smaller drainage area of the intake relative to the 12143000 gage, shown as a blue line in Figure 1. It may be noticed that the drainage factor increases in the wetter months when runoff from precipitation contributes to surface water.

2 Hydrographs

Hydrographs for the proposed intake location were simulated using the mean, minimum, and maximum flows observed during the 1989 – 2011 water years multiplied by the derived drainage factor, Figure 2. Figure 3 shows only the mean and minimum hydrographs to provide the reader a hydrograph with improved resolution of the discharge values.

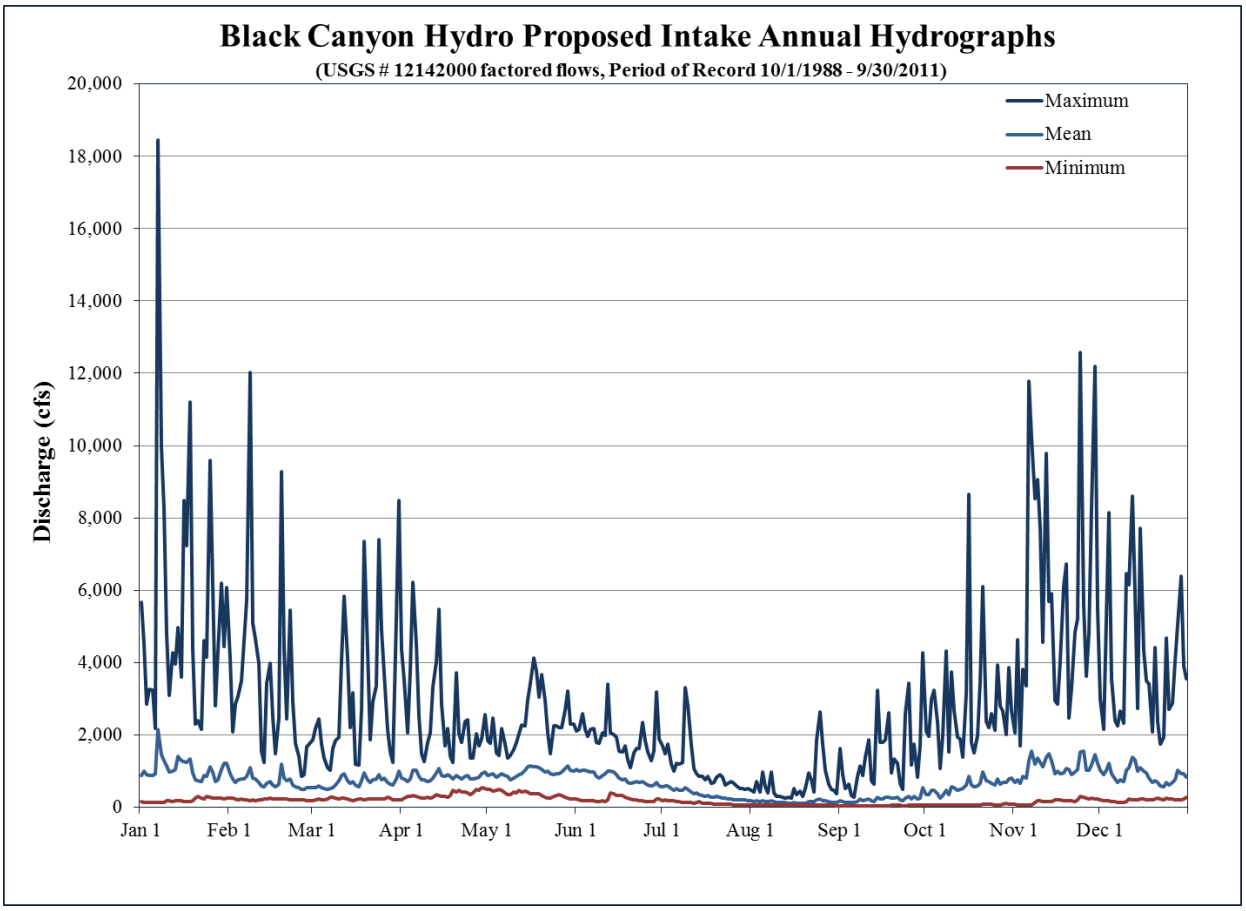


Figure 2 – Simulated maximum, mean, and minimum hydrographs for the proposed intake location.

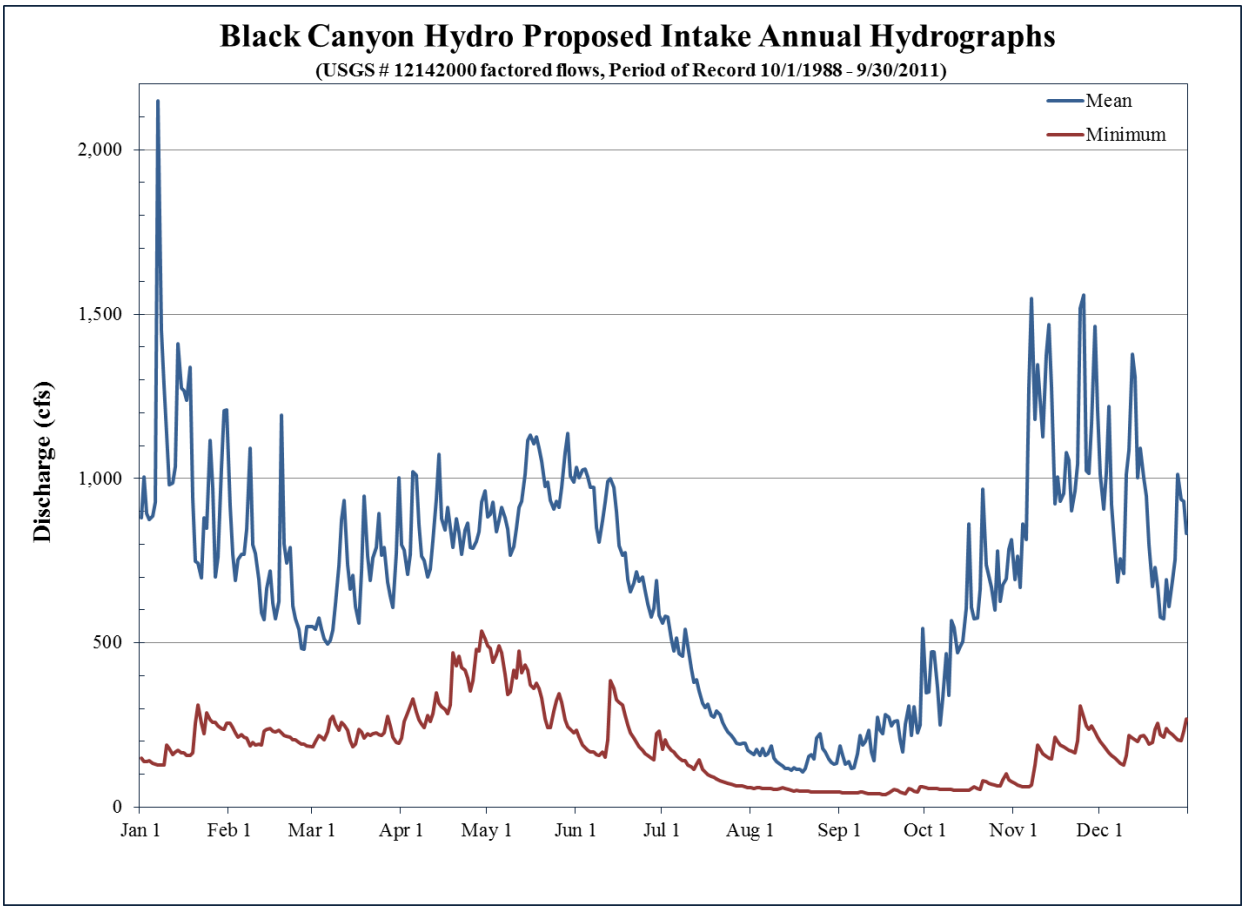


Figure 3 – Simulated mean and minimum hydrographs for the proposed intake location.

3 Flow Duration Curves

The flow duration curve presented in the PAD on page 26, Figure 6, was developed with the USGS Total Period Method using 1990-2011 calendar year data from the 12142000 gage. The flow duration curve was not scaled to reflect the increased flows available at the proposed intake location.

Figure 4 shows a flow duration curve scaled to reflect the increased flows at the proposed intake location. This flow duration curve was developed with the USGS Total Period Method using 1989-2011 water year data from the 12142000 gage scaled to reflect the increased drainage area of the proposed intake location.

Monthly flow duration curves were developed for the proposed intake with the USGS Total Period Method using 1989-2011 water year data from the 12142000 gage scaled to reflect the increased drainage area of the proposed intake location. These flow duration

curves are included as Appendix A – Monthly Flow Duration Curves.

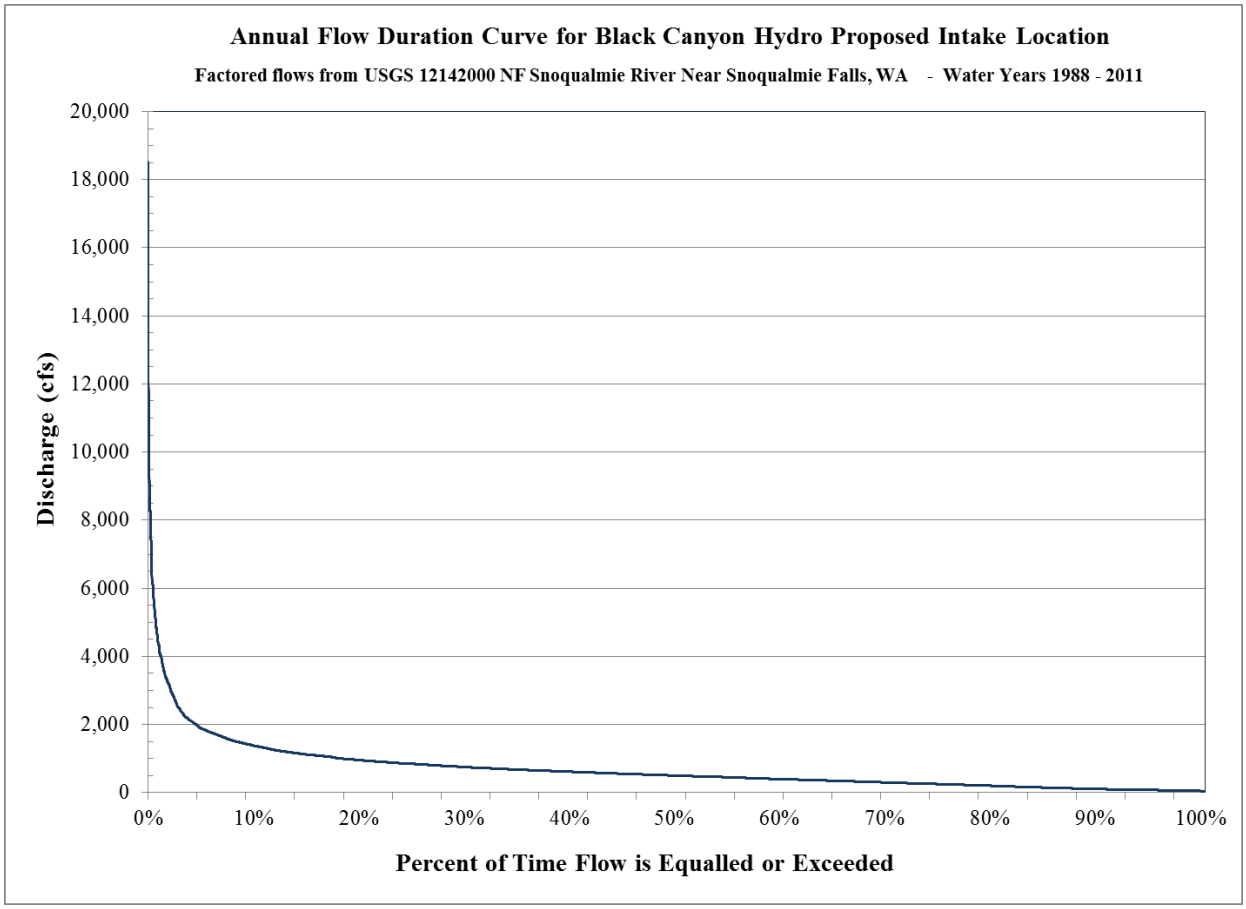
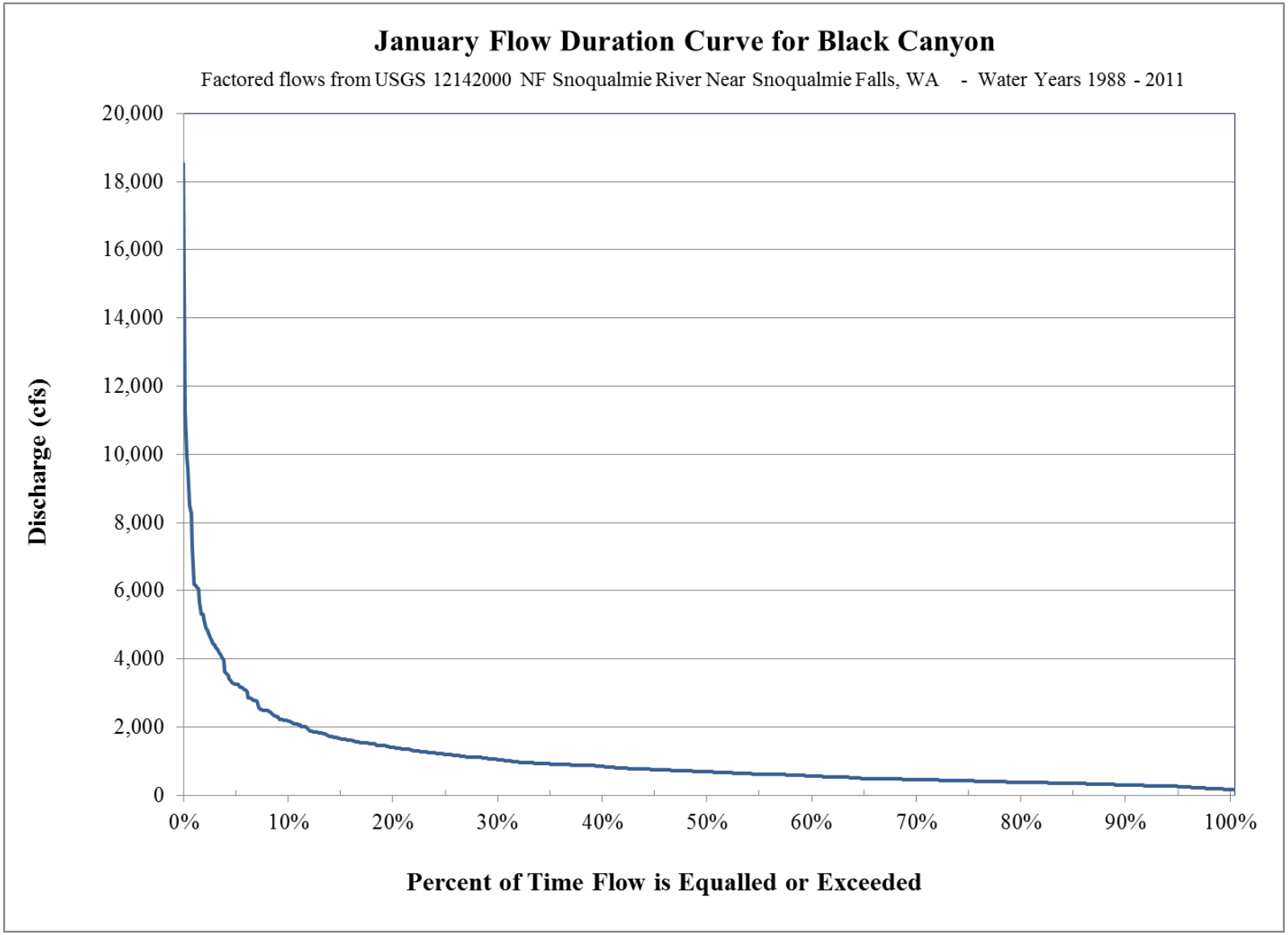
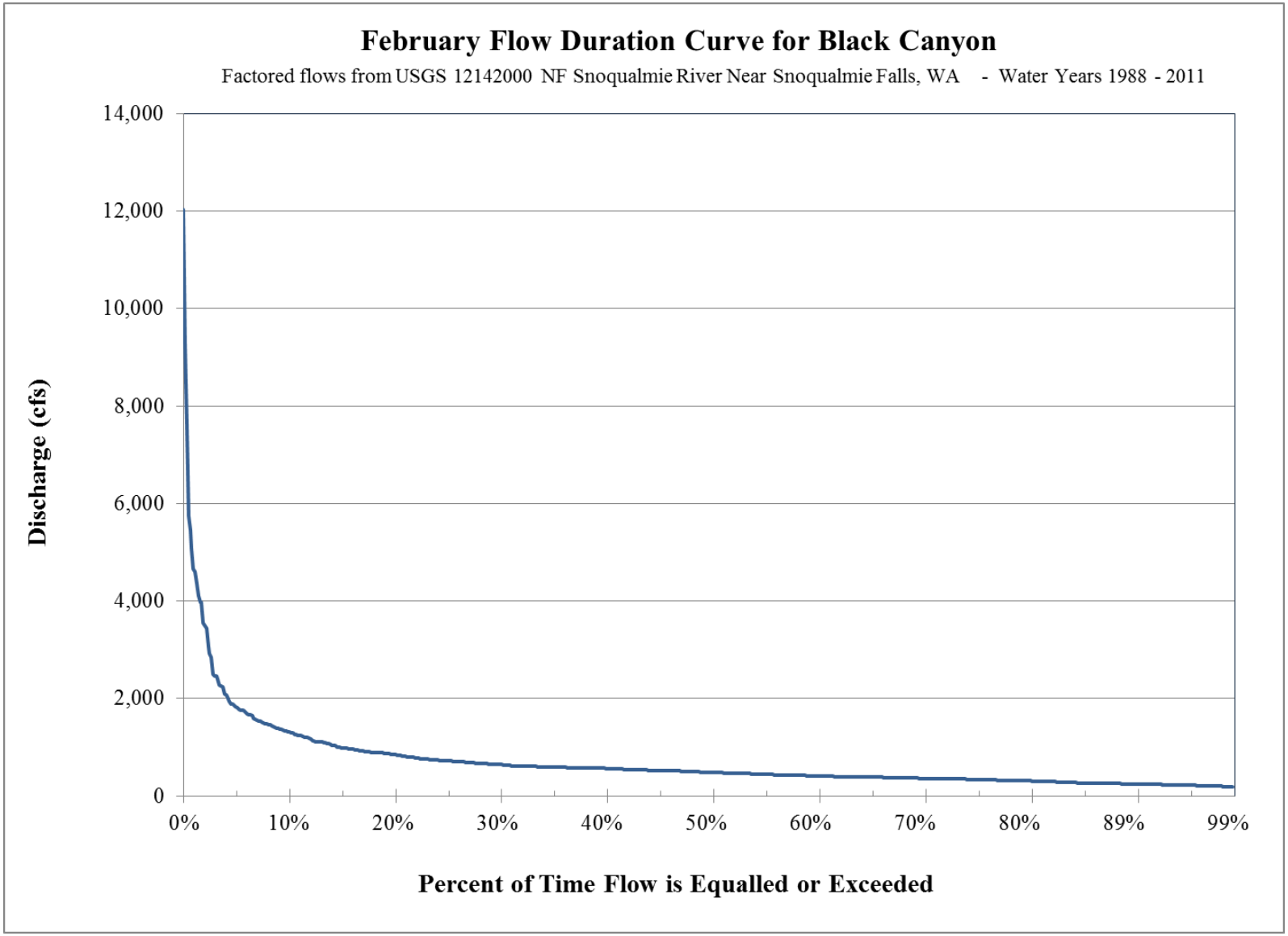
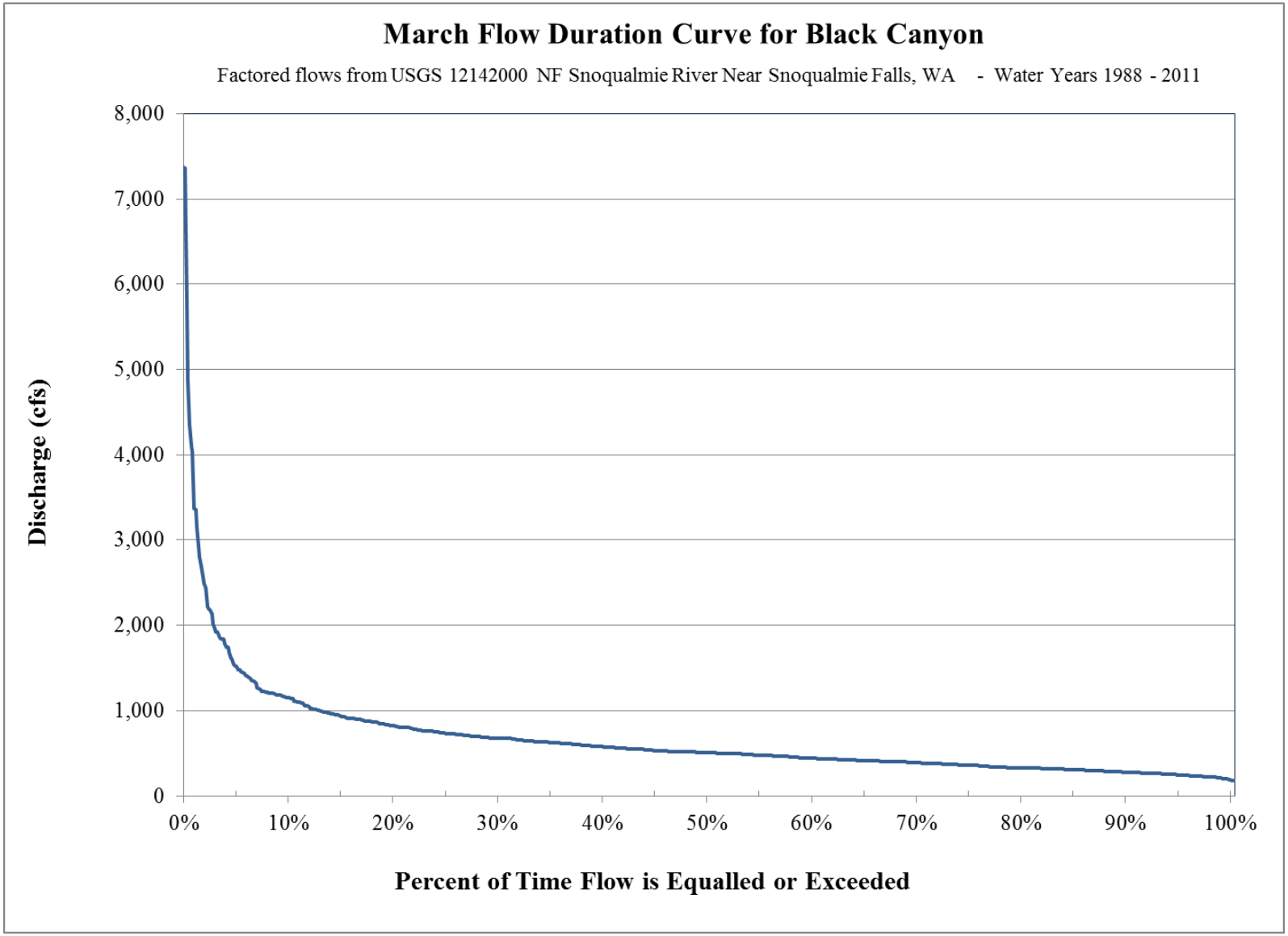


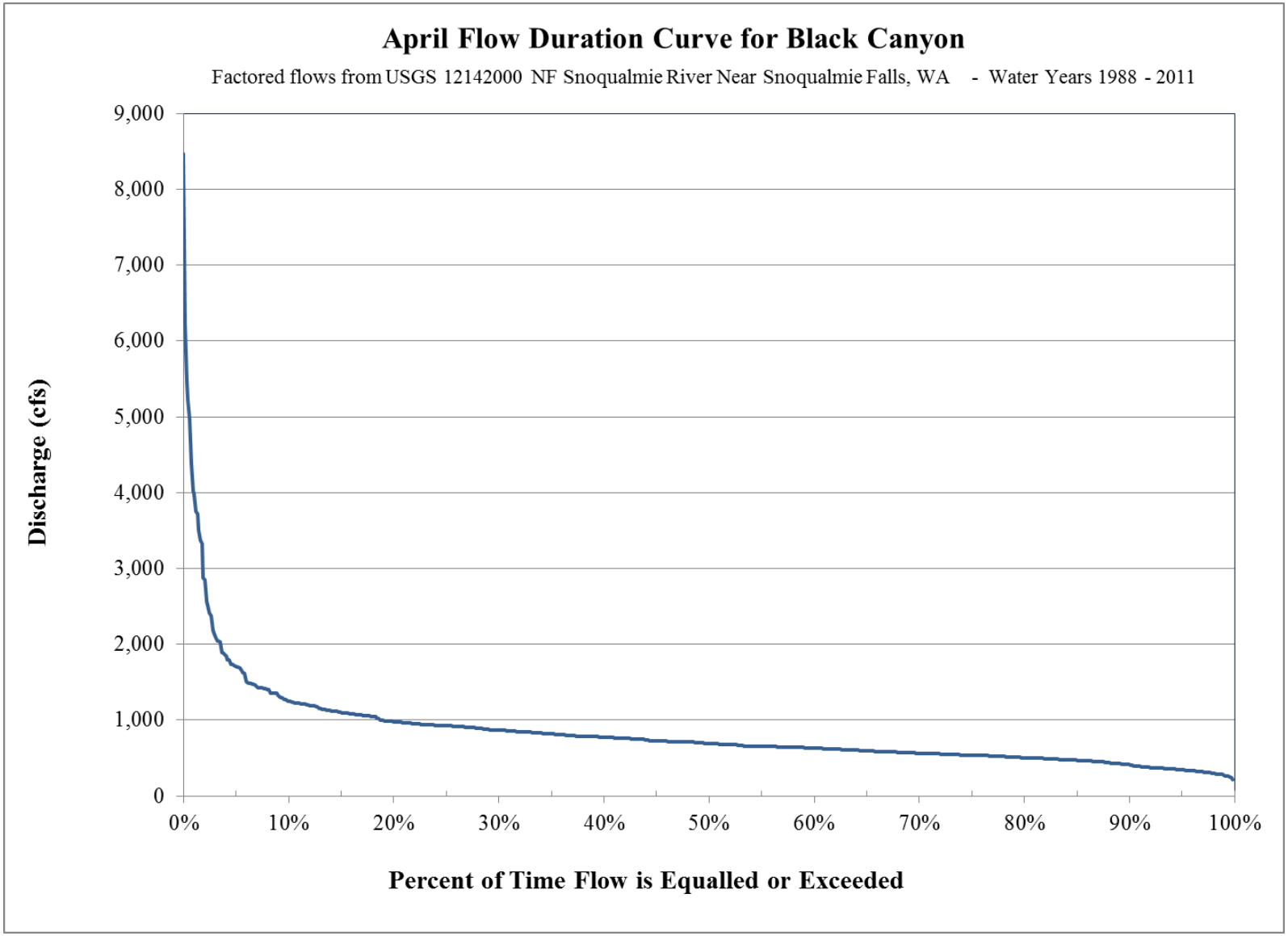
Figure 4 – Annual flow duration curve for the Black Canyon Hydroelectric Project proposed intake location.

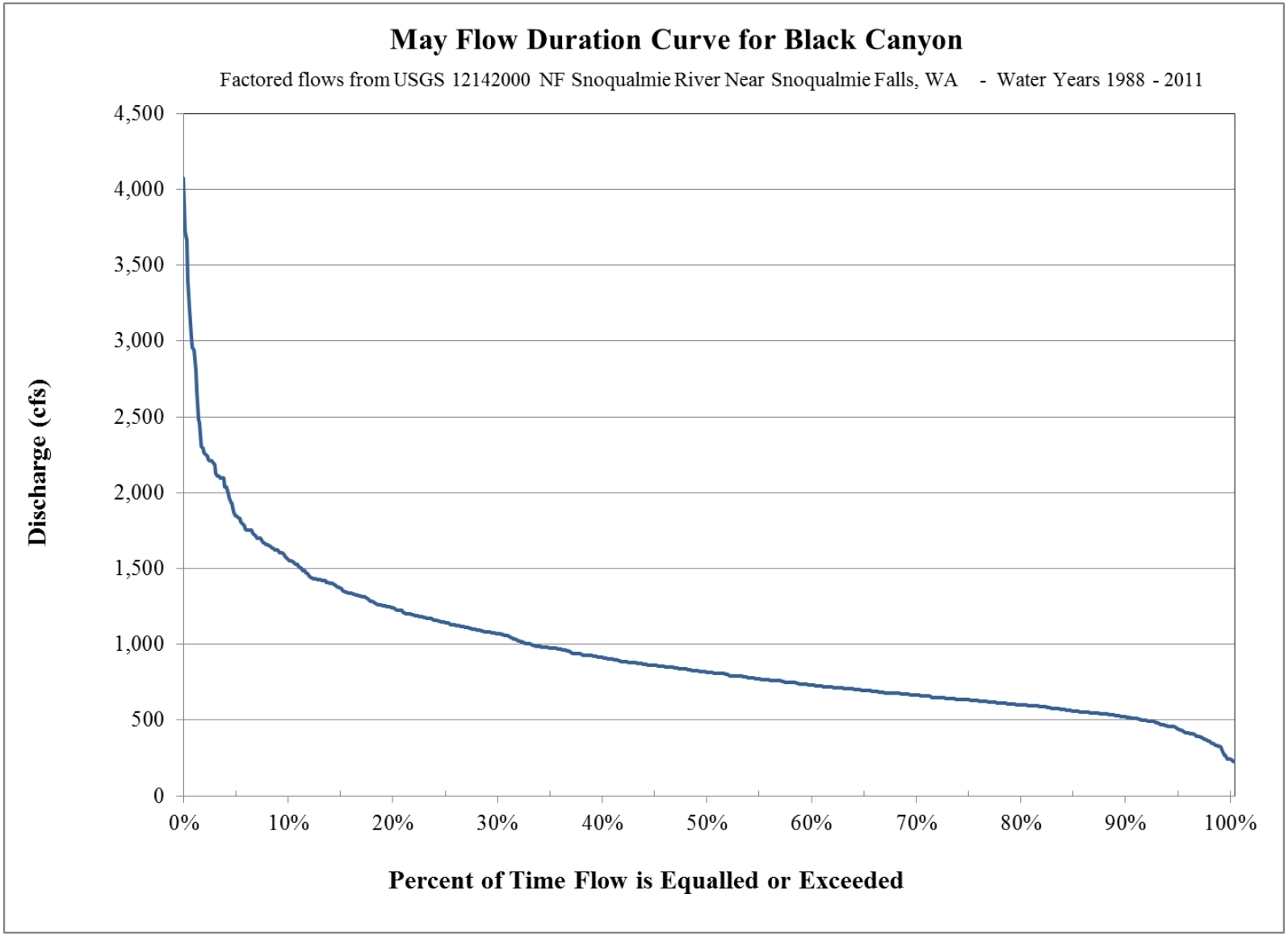
4 Appendix A – Monthly Flow Duration Curves

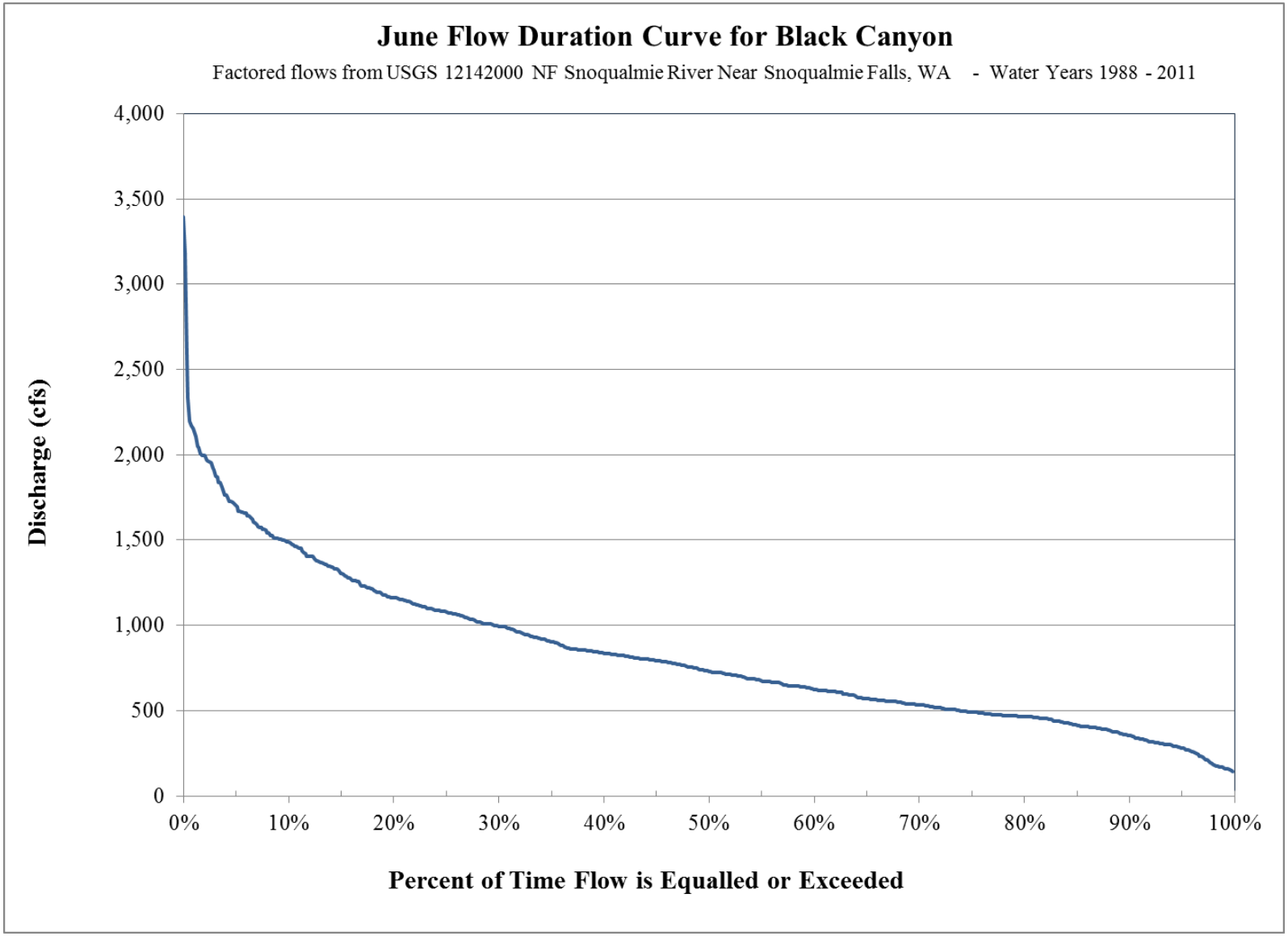


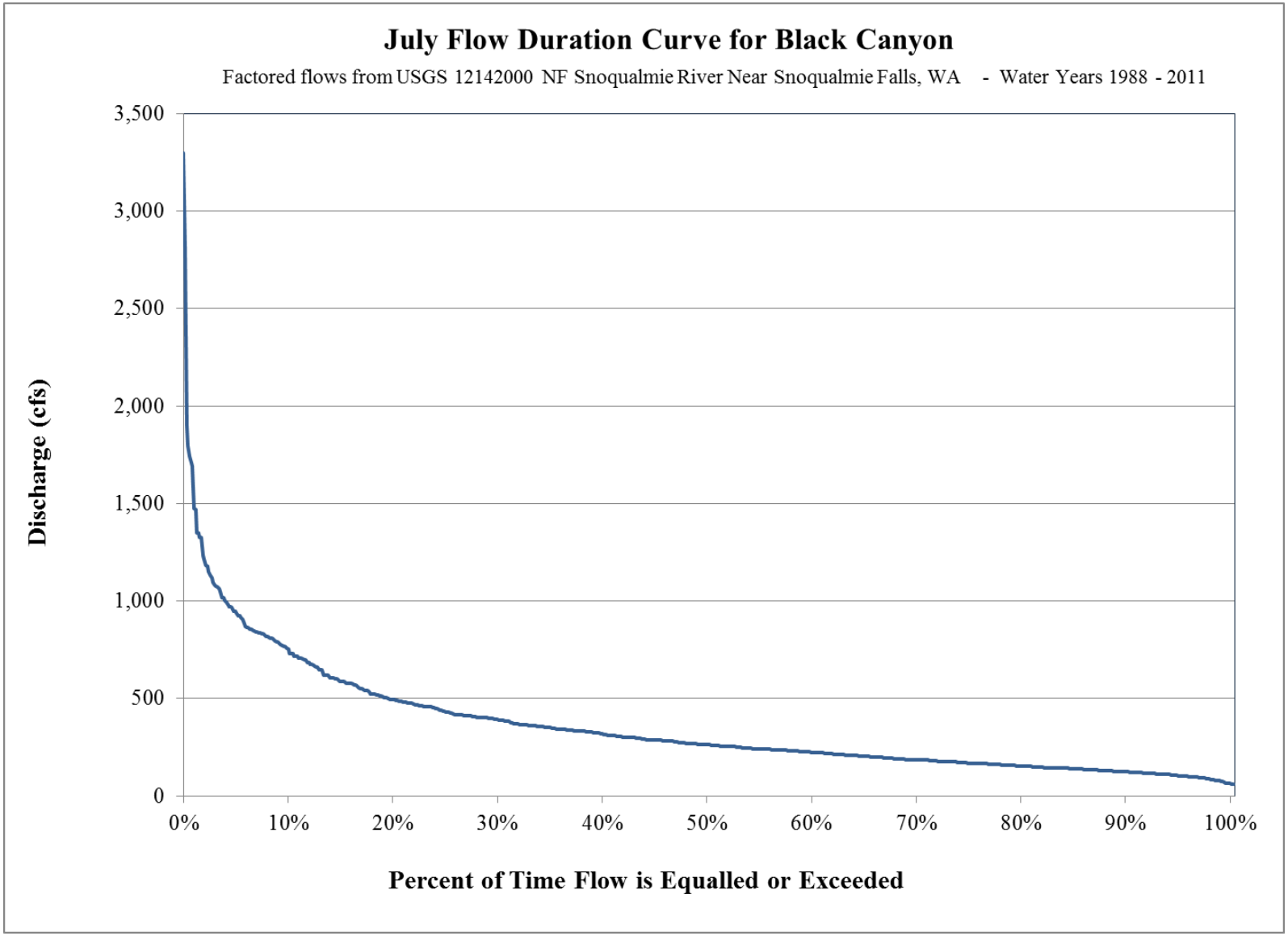

February Flow Duration Curve for Black Canyon
Factored flows from USGS 12142000 NF Snoqualmie River Near Snoqualmie Falls, WA - Water Years 1988 - 2011
Discharge (cfs)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
89%
99%
Percent of Time Flow is Equalled or Exceeded

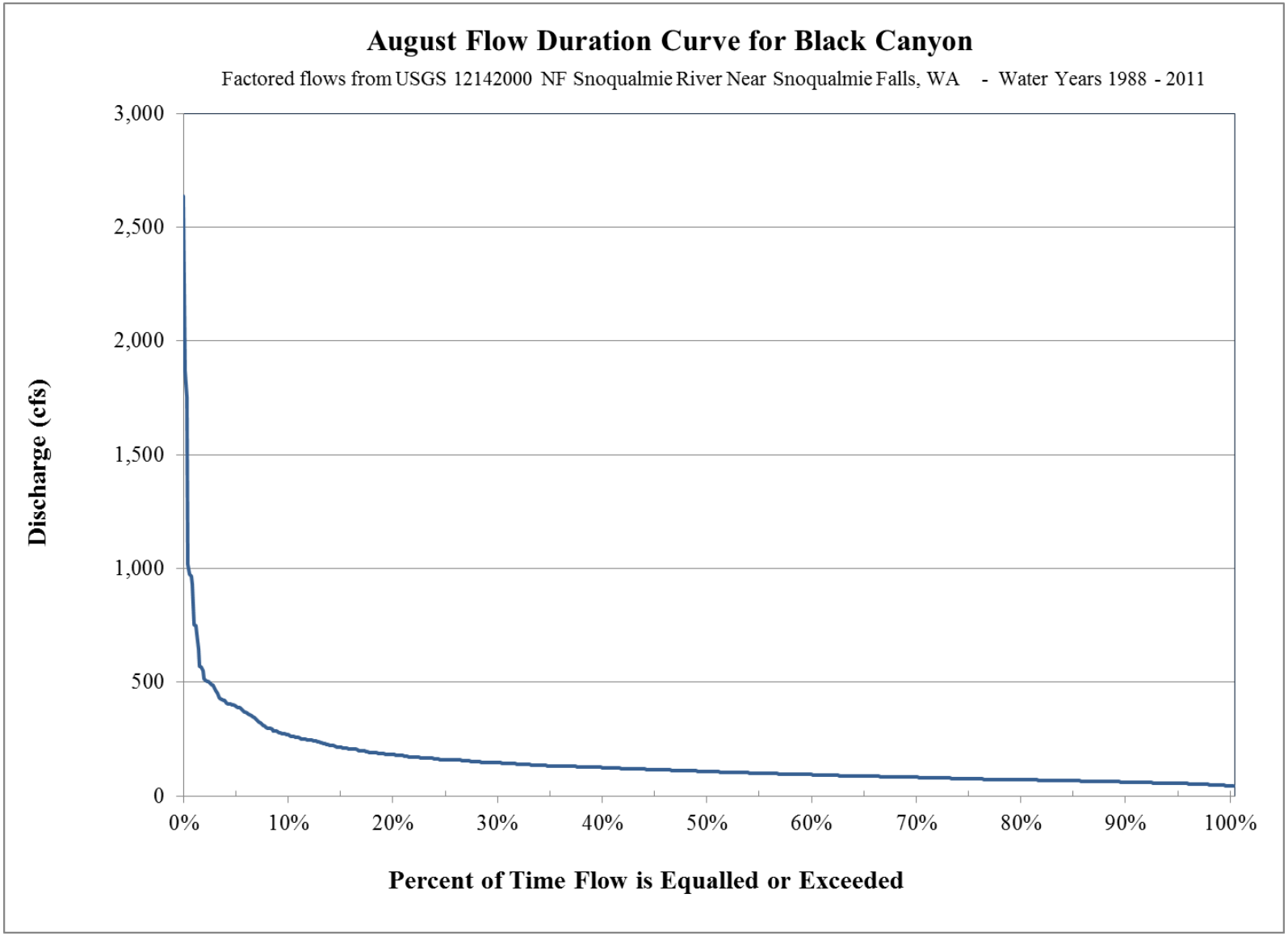

March Flow Duration Curve for Black Canyon
Factored flows from USGS 12142000 NF Snoqualmie River Near Snoqualmie Falls, WA - Water Years 1988 - 2011
Discharge (cfs)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Flow is Equalled or Exceeded

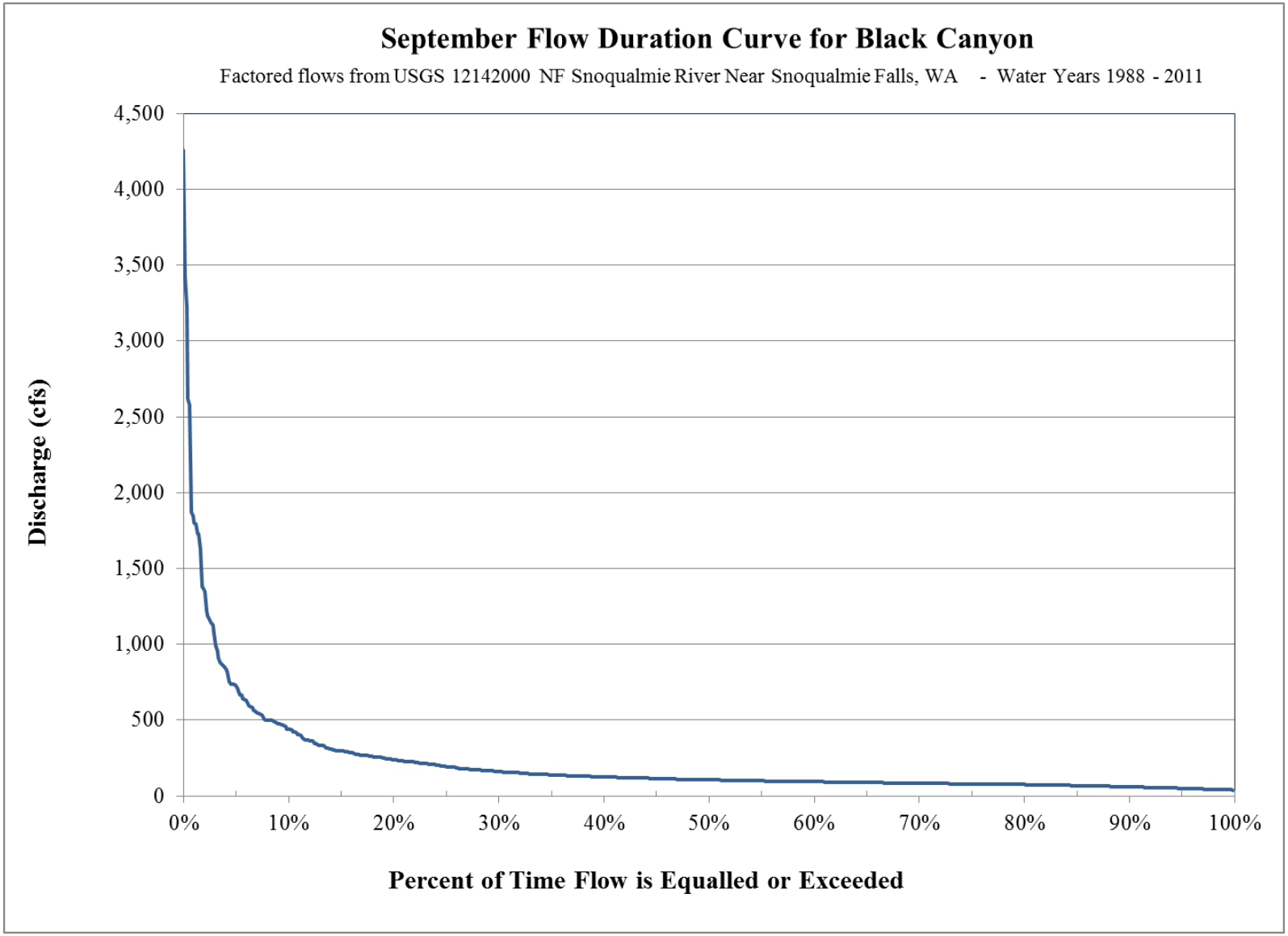

April Flow Duration Curve for Black Canyon
Factored flows from USGS 12142000 NF Snoqualmie River Near Snoqualmie Falls, WA - Water Years 1988 - 2011
Discharge (cfs)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Flow is Equalled or Exceeded

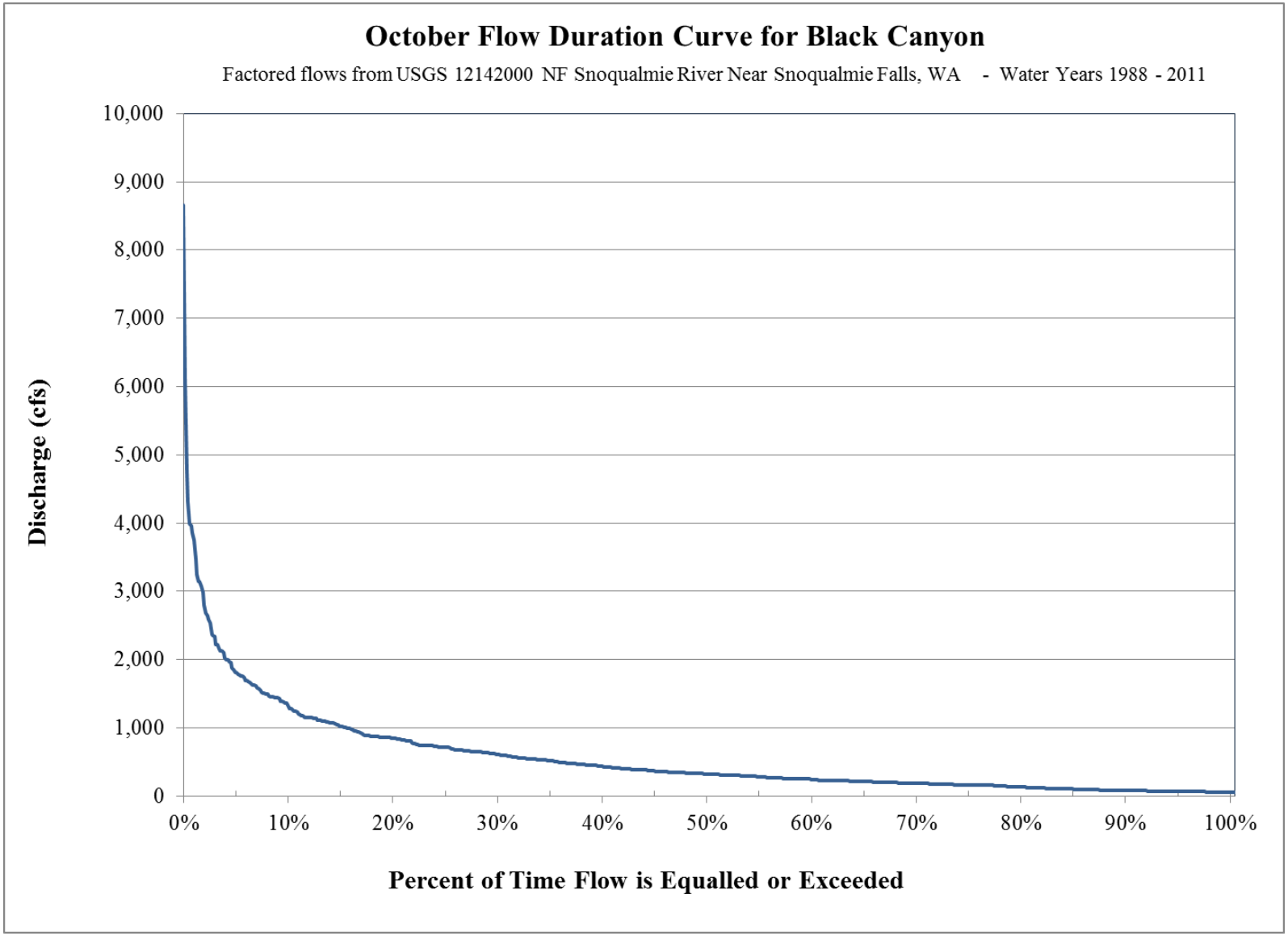

May Flow Duration Curve for Black Canyon
Factored flows from USGS 12142000 NF Snoqualmie River Near Snoqualmie Falls, WA - Water Years 1988 - 2011
Discharge (cfs)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Flow is Equalled or Exceeded

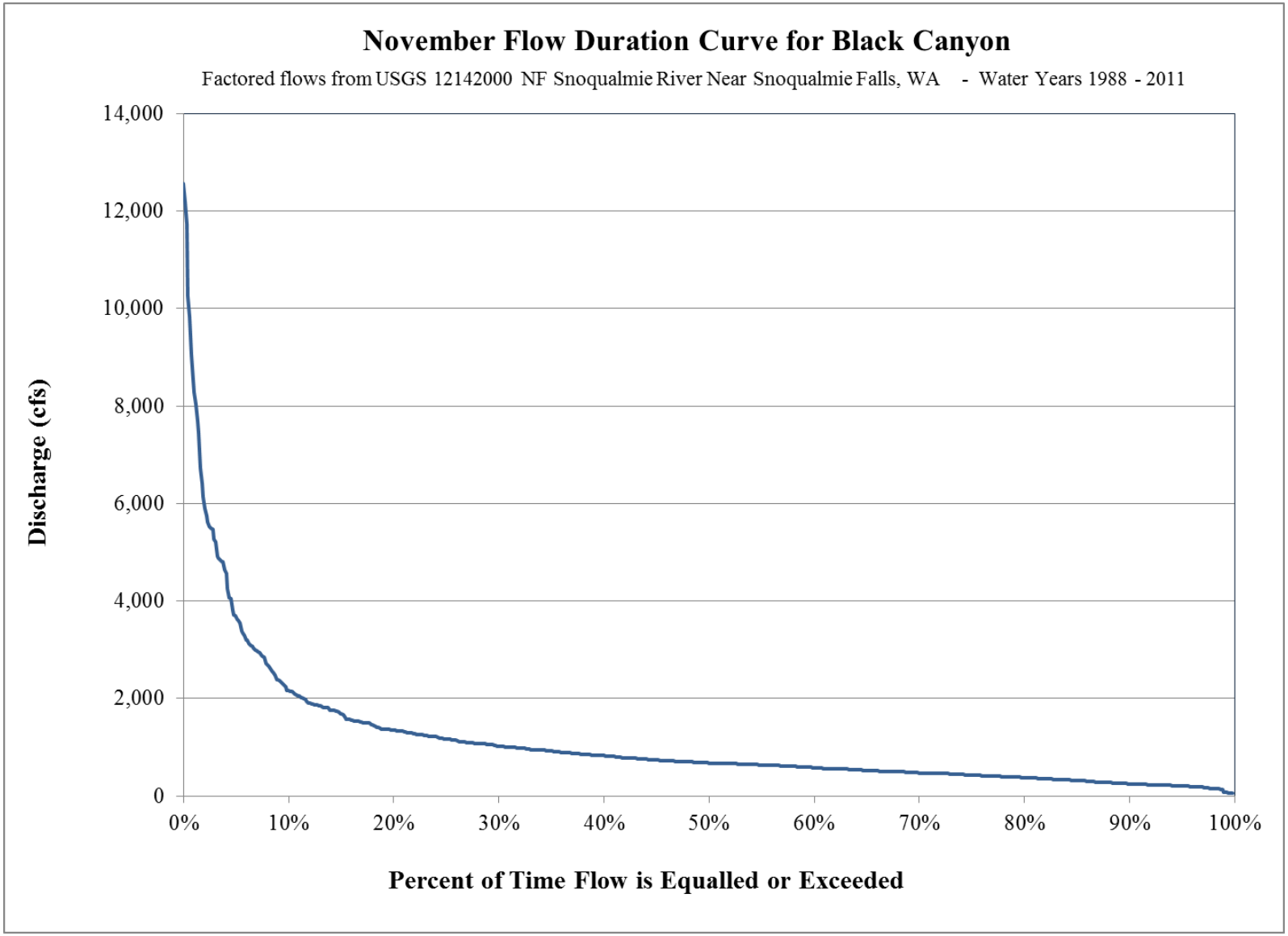

June Flow Duration Curve for Black Canyon
Factored flows from USGS 12142000 NF Snoqualmie River Near Snoqualmie Falls, WA - Water Years 1988 - 2011
Discharge (cfs)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Flow is Equalled or Exceeded

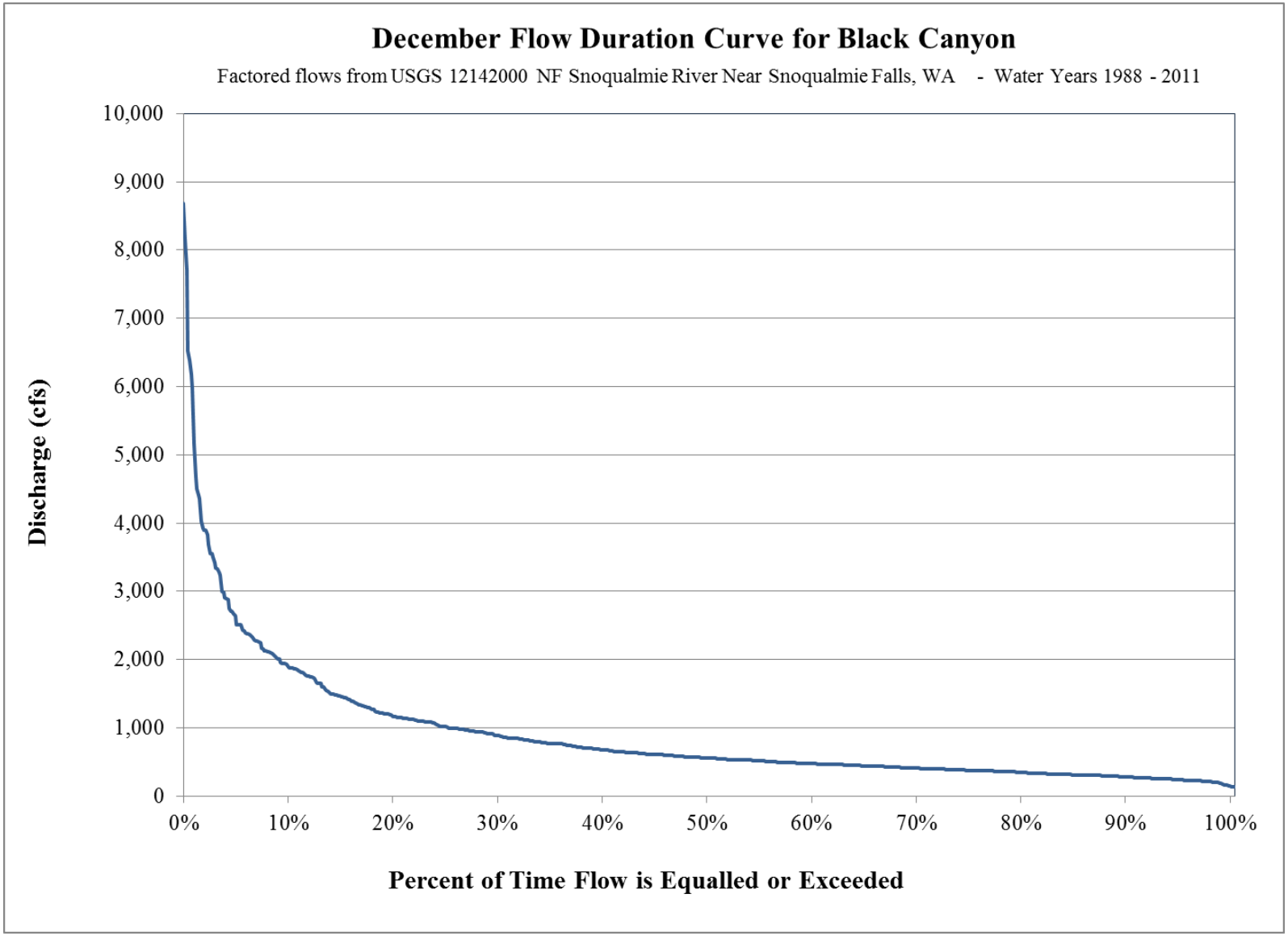

July Flow Duration Curve for Black Canyon
Factored flows from USGS 12142000 NF Snoqualmie River Near Snoqualmie Falls, WA - Water Years 1988 - 2011
Discharge (cfs)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Flow is Equalled or Exceeded


August Flow Duration Curve for Black Canyon
Factored flows from USGS 12142000 NF Snoqualmie River Near Snoqualmie Falls, WA - Water Years 1988 - 2011
Discharge (cfs)
3,000
2,500
2,000
1,500
1,000
500
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Flow is Equalled or Exceeded


September Flow Duration Curve for Black Canyon
Factored flows from USGS 12142000 NF Snoqualmie River Near Snoqualmie Falls, WA - Water Years 1988 - 2011
Discharge (cfs)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Flow is Equalled or Exceeded


October Flow Duration Curve for Black Canyon
Factored flows from USGS 12142000 NF Snoqualmie River Near Snoqualmie Falls, WA - Water Years 1988 - 2011
Discharge (cfs)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Flow is Equalled or Exceeded


November Flow Duration Curve for Black Canyon
Factored flows from USGS 12142000 NF Snoqualmie River Near Snoqualmie Falls, WA - Water Years 1988 - 2011
Discharge (cfs)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Flow is Equalled or Exceeded


December Flow Duration Curve for Black Canyon
Factored flows from USGS 12142000 NF Snoqualmie River Near Snoqualmie Falls, WA - Water Years 1988 - 2011
Discharge (cfs)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Flow is Equalled or Exceeded