COORDINATION TITLE: 13 MCN 02 McNary FGE study
COORDINATION DATE- 22 July 2013
PROJECT- McNary

Description of the problem:
A fish guidance efficiency (FGE) and fish condition study relative to partially raised operating gate (PROG) and stored operating gate (SOG) position is currently underway at McNary Dam and operations treatments are scheduled to end on 25 July. Hydroacoustic transducers are installed behind the trashracks and on the ESBS brackets in the A, B, and C intakes in turbine units 6, 7, 12, and 13.

Intake gate positions have been alternated among two turbine pairs for all three intakes of each turbine during this study as previously coordinated through FPOM. Currently head gates are lowered in units 6 and 13. Head gates are currently scheduled to be raised on Friday, 26 July 22, 2013. Project personnel typically work a four, ten hour day schedule with Fridays off. Project personnel would be required to work overtime on 26 and possibly 27 July to return the head gates to the raised position.

Type of outage required:
It is being requested to leave the head gates in the lowered position in units 6 and 13 until the following Monday, 29 July. Leaving head gates in the lowered position for these four extra days will deviate from the FPP August 1-December 15 time period for gates being lowered.

Impact on facility operation:
None expected

Length of time for repairs: N/A

Expected impacts on fish passage:
Leaving head gates in the lowered position in two units over an extra four day period will reduce FGE and may slightly affect smolt survival. Estimates of the potential impact to migrating subyearling Chinook smolts have been generated for Snake River and Mid and Upper Columbia River (See attached figures and tables). Although the results of the current study are not finalized, unofficial preliminary results suggests a minor reduction in FGE as a result of having head gates lowered.

Comments from agencies

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From: Gary Fredricks - NOAA Federal
To: Setter, Ann L NWW
Cc: Trumbo, Bradly A NWW; Lorz, Tom; Trevor Conder - NOAA Federal; Dugger, Carl R NWW
Subject: Re: 13 MCN 15 MCN Headgates in SOG position (UNCLASSIFIED)
Date: Tuesday, July 23, 2013 2:00:49 PM
Ann, Per our conversation today, I agree with the proposed operation with the addition of putting the lowered gate units (6 and 13) on the list for last on, first off basis to reduce the use of these units to the extent possible. The wind forecast for the weekend looks good but if we do have JBS channel

temperature concerns, the project should return to the normal FPP unit priority operation. The decision for that should be with the project. Thanks, Gary

Affects of leaving head gates in the SOG position in two units between 26 and 29 July, 2013.

Lowered head gates in two units at McNary Dam for an additional four days at the end of the study may reduce FGE and increase mortality associated with turbine passed fish. To approximate the proportion of migrating smolts that may be affected by leaving head gates down in two units for these four extra days, estimates of the total number of subyearling Chinook salmon collected at McNary Dam, and total number of sockeye arriving at McNary Dam were averaged among 2010, 2011, and 2012. These estimates were reported in the NOAA Fisheries Northwest Fisheries Science Center 2010, 2011, and 2012 memorandums (Table 1). The total number of subyearling Chinook salmon arriving at McNary dam was not provided in the NMFS memoranda; hence, estimated total number collected was used as a surrogate and is likely approximately 50% of the actual number of subyearling Chinook salmon arriving at McNary Dam. The average numbers of smolts collected or arriving at McNary were then applied to a simple equation that accounted for spill passage proportion, bypass and turbine survival estimates (2006-2009 data used for McNary COP), estimated proportion of the run that will pass during the four day period of interest, estimated turbine passage proportion, and an assumed 3% reduction in FGE for two turbine units (Swan and Norman 1987).

Table 1 Combined (wild and hatchery) number of subyearling Chinook smolts estimated arriving at McNary Dam in 2010, 2011, and 2012 (NOAA 2010, 2011, 2012). CH0=subyearling Chinook, SOC=sockeye, Snake=Snake River, Col=Mid and Upper Columbia stocks combined.

	CHO*	**SOC****
2010	5,487,615	401,215
2011	8,503,400	426,726
2012	6,319,768	391,162
Mean	**6,770,261**	**406,368**

*****Estimated total number of smolts collected at McNary Dam as a surrogate to number arriving at McNary Dam.

******Because of extreme year-to-year variability, the count used at McNary Dam for sockeye in 2010 was based on the average of the counts at the dam from 1988 to 2009; 2011 was based on the average of the counts at the dam from 1988 to 2010; 2012 was based on the average of the counts at the dam from 1990 to 2011 (NOAA 2010, 2011, 2012).

Subyearling Chinook

Assumptions:

- ~6,770,261 subyearling Chinook will be collected at McNary Dam
- ~0.042% of the run will arrive during the extended four day period with head gates in the SOG position (Figures 1-3)
- Spill passage efficiency will be ~56% leaving 44% of the run exposed to the powerhouse and ~24% pass turbines (2006-2009 data used for McNary COP)
- FGE reduction ~3% (Swan and Norman 1987)
- ~81% turbine survival and ~96% bypass survival
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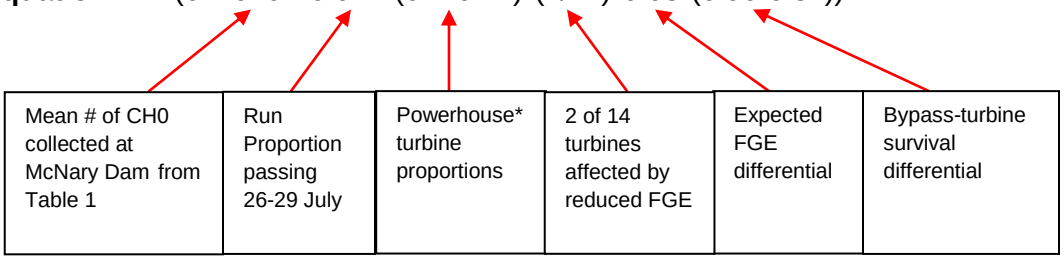
Equation 1: (6770261*0.042*(0.7*0.24)*(2/14)*0.03*(0.96-0.81))



Equation 1 was used to provide the following estimates of increased mortality for subyearling Chinook salmon using the mean smolt numbers from Table 1. Given the assumptions for subyearling Chinook are correct and an approximate 3% reduction in FGE occurs because the head gates are left in the SOG position for an extended four day period in two turbine units these estimates are realistic.

Table 2: Estimated increased percentage of the subyearling Chinook run that may experience mortality with an FGE reduction of 3% in two turbine units. FGE reduction is caused by having head gates in the SOG position for an extended four day period between 26 and 29 July, 2013. Estimates were generated for various spill passage proportions to encompass the mean 65% from 2006-2009 McNary data.

Snake and Columbia River Yearling Chinook Potential Increased Mortality

	Proportion Spill Passage				
	30	**40**	**50**	**60**	**70**
Percentage of Run	0.0019%	0.0016%	0.0014%	0.0011%	0.0008%

Juvenile Sockeye

Assumptions:

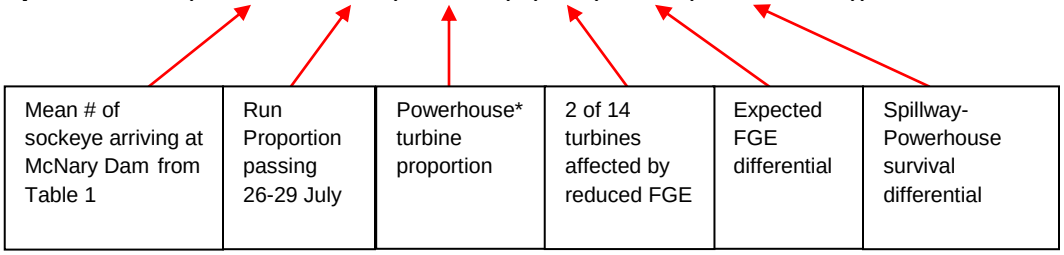
- ~406,368 Columbia and Snake River juvenile Sockeye will arrive at McNary Dam (NOAA 2010, 2011, 2012)
- ~0.002% of the run will arrive during the extended four day period with head gates in the SOG position (Figures 4-6)
- Spill passage efficiency will be ~68% leaving 32% of the run exposed to the powerhouse (Adams et al. 2011; Table 3)
- FGE reduction ~3% (Swan and Norman 1987)
- ~93% powerhouse survival and ~94% spillway survival (Adams et al. 2011; Table 4)

Table 3 Passage and survival probabilities for sockeye smolts at McNary Dam (Adams et al. 2011)

McNary 2006-2009 Sockeye Survival Probabilities

	PH	Spillway	Spill Prop
2006	92.6%	83.6%	67%
2007	98.6%	104.3%	61%
2008	85.8%	92.5%	80%
2009	93.0%	95.9%	63%
Mean	**92.50%**	**94.08%**	**68%**

Equation 2: (406368*0.002*(0.7*0.32)*(2/14)*0.03*(0.941-0.925))



Equation 2 was used to provide the following estimates of increased mortality for juvenile sockeye using the mean smolt numbers from Table 1. Given the assumptions for sockeye are correct and an approximate 3% reduction in FGE occurs because the head gates are left in the SOG position for an extended four day period in two turbine units these estimates are realistic. Bypass and turbine survival estimates were not available for sockeye; hence, powerhouse and spillway survival estimates were used as surrogates for these parameters and may not be completely representative of survival through the turbines or bypass system.

Table 4 Estimated increased percentage of the juvenile steelhead run that may experience mortality with an FGE reduction of 3% in two turbine units. FGE reduction is caused by having head gates in the SOG position for an extended four day period between 26 and 29 July, 2013. Estimates were generated for various spill passage proportions to encompass the mean 68% (Adams et al. 2011).

Columbia and Snake River Sockeye Potential Increased Mortality

	Proportion Spill Passage				
	30	**40**	**50**	**60**	**70**
Percentage of Run	0.0003%	0.0002%	0.0002%	0.0002%	0.0001%

Figure 1 Subyearling Chinook salmon 2010 smolt passage index used to estimate proportion of the run passing McNary during the extended four day period (26-29 July) requested to leave head gates in the SOG position in two turbine units at the conclusion of the FGE study.

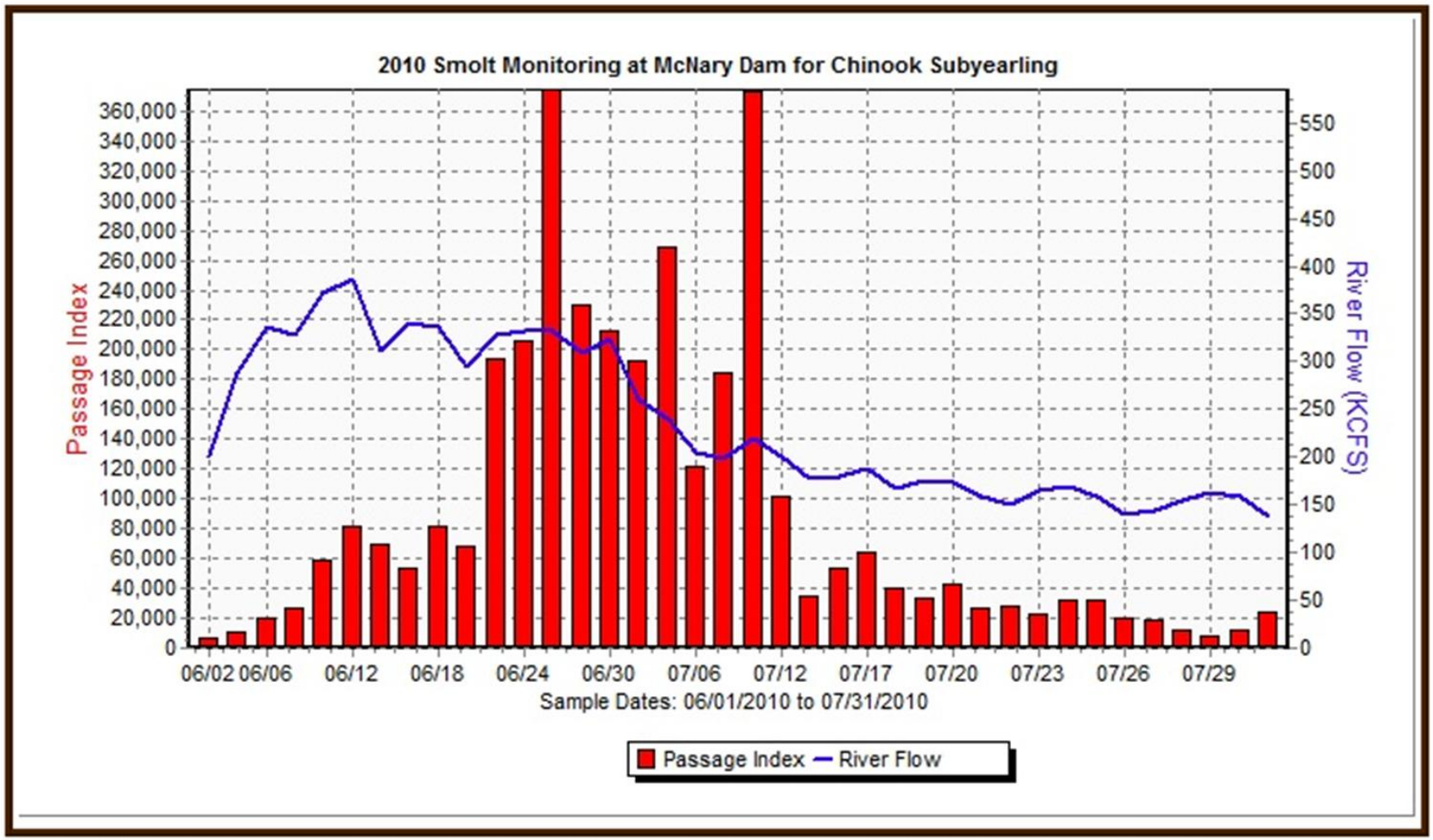


Figure 2 Subyearling Chinook salmon 2011 smolt passage index used to estimate proportion of the run passing McNary during the extended four day period (26-29 July) requested to leave head gates in the SOG position in two turbine units at the conclusion of the FGE study.

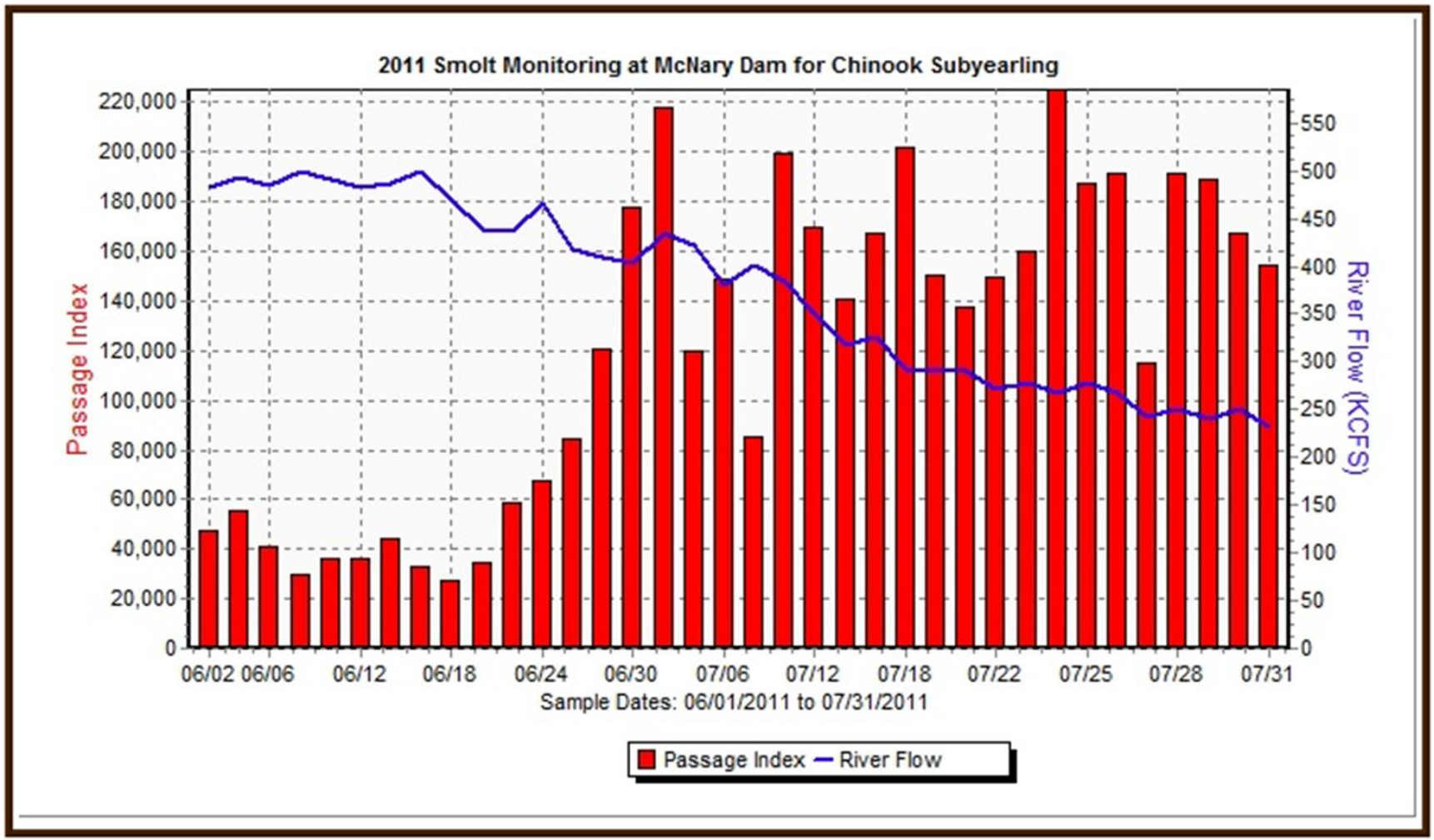


Figure 3 Subyearling Chinook salmon 2012 smolt passage index used to estimate proportion of the run passing McNary during the extended four day period (26-29 July) requested to leave head gates in the SOG position in two turbine units at the conclusion of the FGE study.

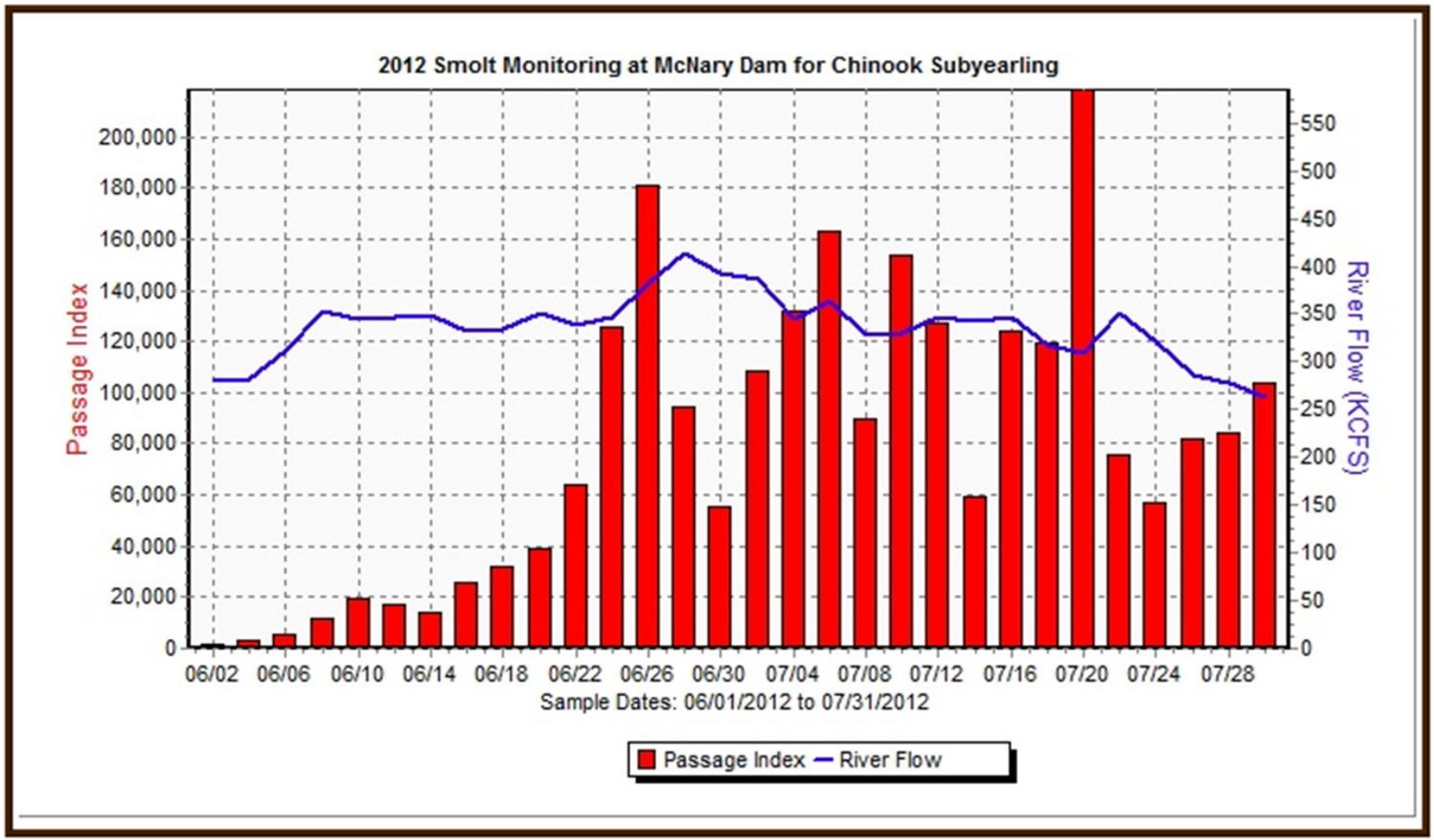


Figure 4 Juvenile wild Sockeye 2010 smolt passage index used to estimate proportion of the run passing McNary during the extended four day period (26-29 July) requested to leave head gates in the SOG position in two turbine units at the conclusion of the FGE study.

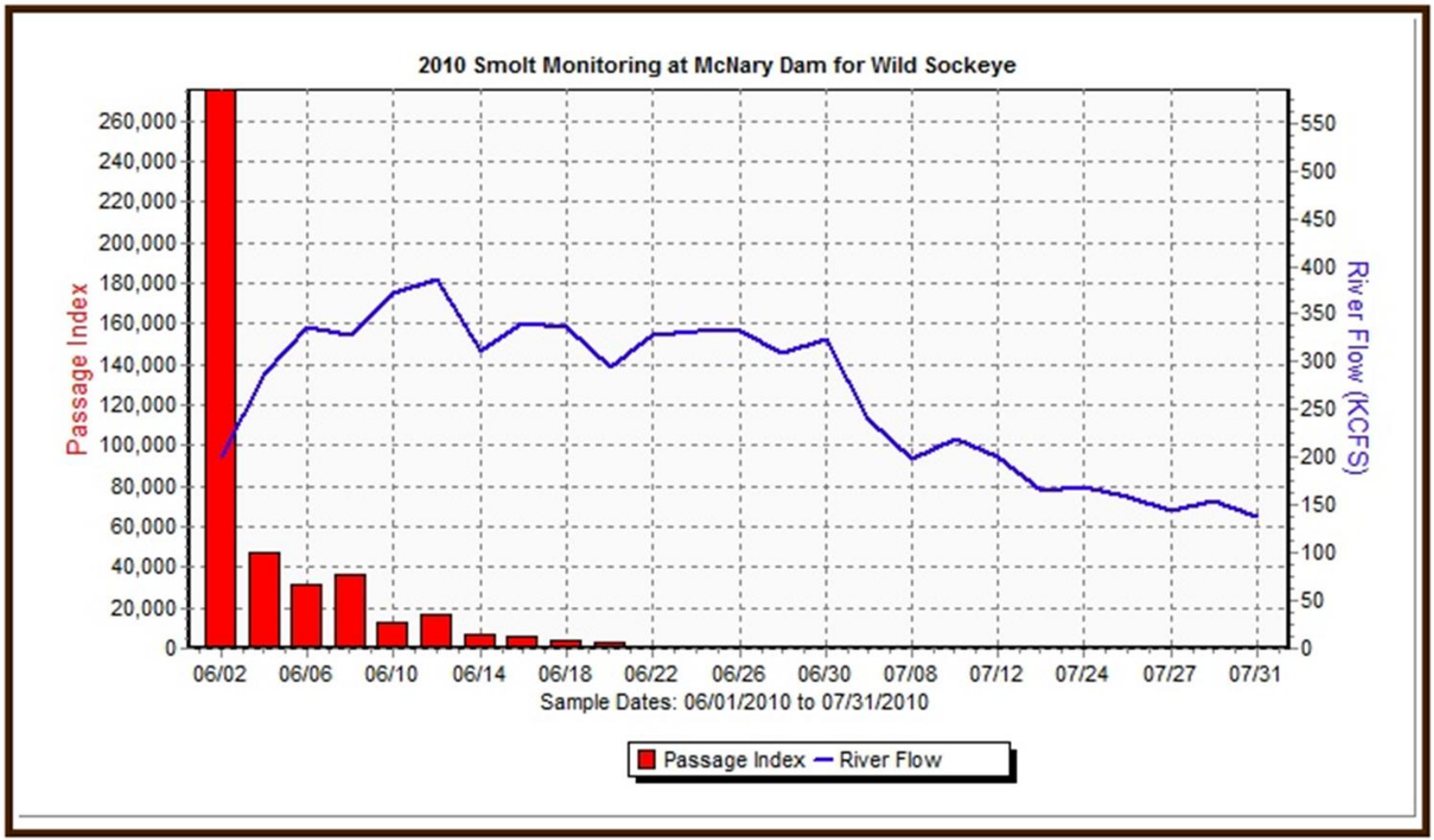


Figure 5 Juvenile wild Sockeye 2011 smolt passage index used to estimate proportion of the run passing McNary during the extended four day period (26-29 July) requested to leave head gates in the SOG position in two turbine units at the conclusion of the FGE study.

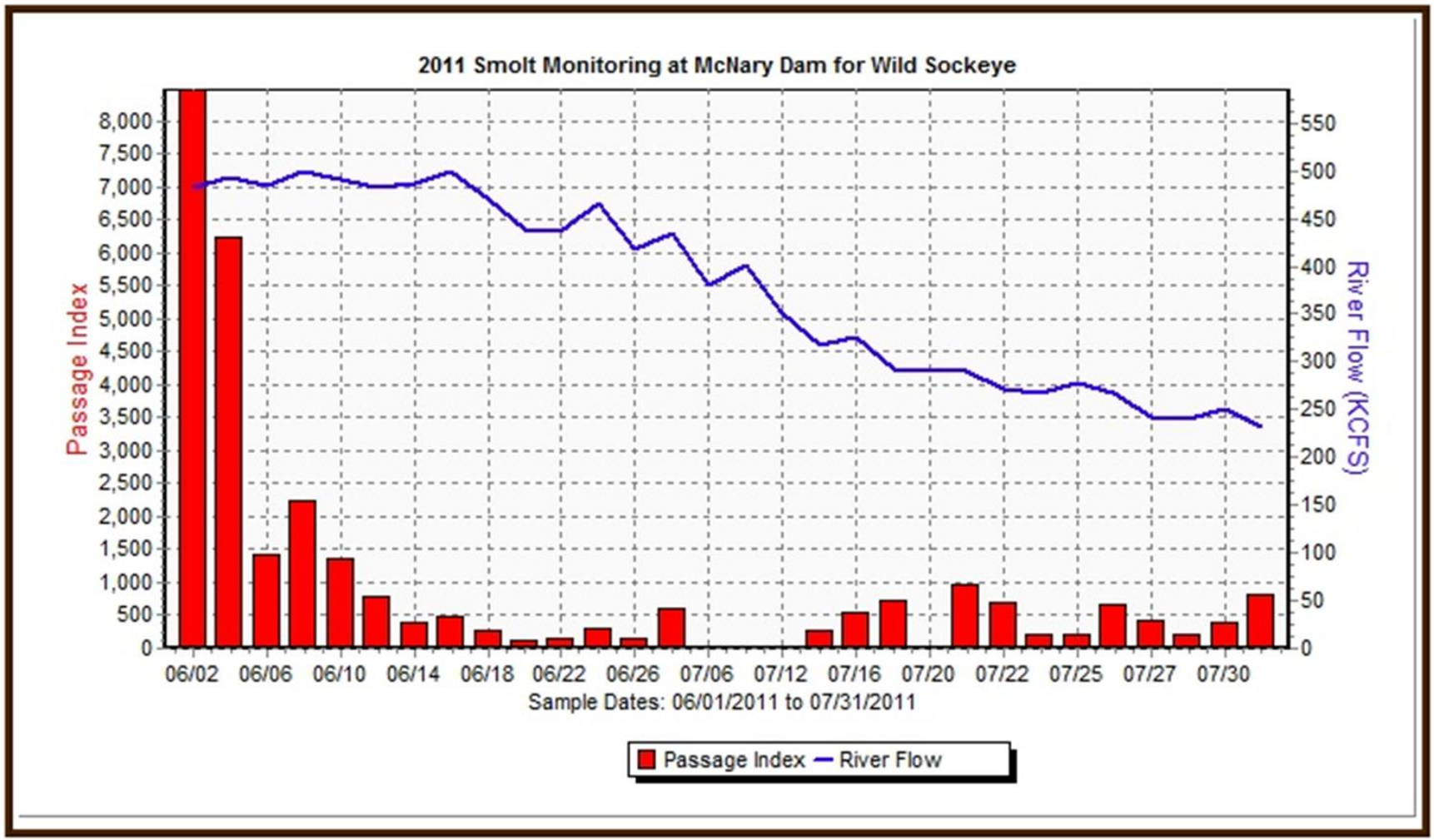
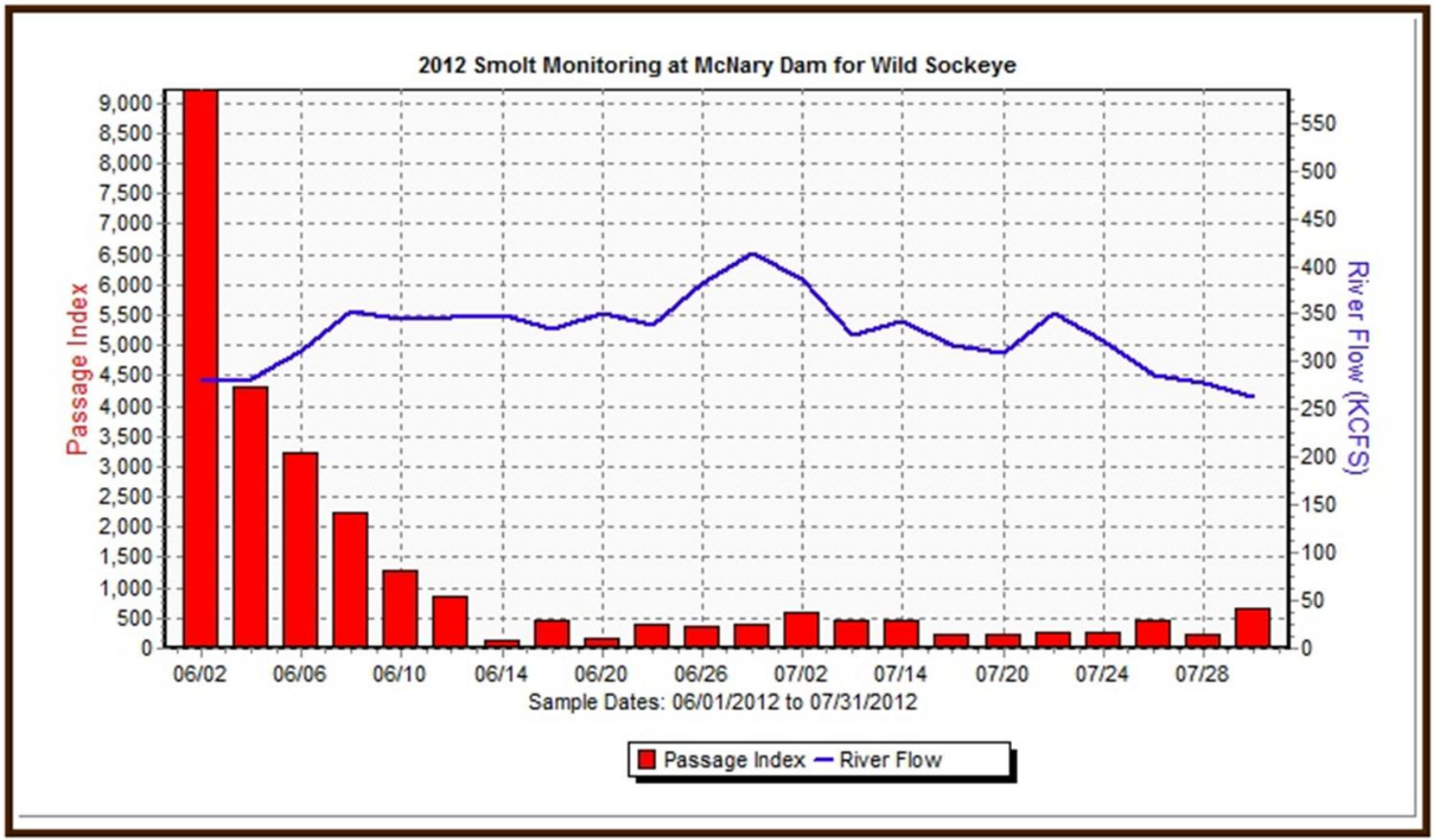


Figure 6 Juvenile wild Sockeye 2012 smolt passage index used to estimate proportion of the run passing McNary during the extended four day period (26-29 July) requested to leave head gates in the SOG position in two turbine units at the conclusion of the FGE study.



References

Adams, N.S., and Evans, S.D., eds., 2011, Summary of juvenile salmonid passage and survival at McNary Dam—Acoustic survival studies, 2006–09: U.S. Geological Survey Open-File Report 2011-1179.

(NOAA) National Oceanic and Atmospheric Administration. 2010. Memorandum: Estimation of Percentages for Listed Pacific Salmon and Steelhead Smolts Arriving at Various Locations in the Columbia River Basin in 2010. Northwest Fisheries Science Center, Seattle, Washington.

(NOAA) National Oceanic and Atmospheric Administration. 2011. Memorandum: Estimation of Percentages for Listed Pacific Salmon and Steelhead Smolts Arriving at Various Locations in the Columbia River Basin in 2011. Northwest Fisheries Science Center, Seattle, Washington.

(NOAA) National Oceanic and Atmospheric Administration. 2012. Memorandum: Estimation of Percentages for Listed Pacific Salmon and Steelhead Smolts Arriving at Various Locations in the Columbia River Basin in 2012. Northwest Fisheries Science Center, Seattle, Washington.

Swan, G. A., and W. T. Norman. 1987. Research to improve subyearling Chinook salmon fish guiding efficiency at McNary Dam, 1986. Report of the National Oceanic and Atmospheric Administration to the US Army Corps of Engineers, Walla Walla, Washington, under Contract DACW68-84-H-0034.