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MEMORANDUM

TO: Ed Bowles, ODFW

FROM: FPC Staff

DATE: April 21, 2008

RE: Potential effects of Max-Transport/No Spill Operations proposed in 2007 Draft BiOp and 2008 Memorandum of Agreement

In response to your request, we have reviewed the proposed Max-Transport/No Spill operations in the 2007 Draft BiOp and the recent Memorandum of Agreement (MOA) between the Action Agencies and Tribes. Each of these proposals calls for the termination of spill sometime in May where Max-Transportation would be initiated. However, the two proposals differ in when this Max-Transport/No Spill operation would occur and its duration. Herein, we present analyses that illustrate potential effects of these two proposals on juvenile salmonids compared to a base case scenario, which was the 2007 BiOp without a Max-Transport/No Spill Operation (i.e., spill throughout May and June). A short summary of these results is presented below followed by a more detailed discussion of these analyses and their results.

- Based on the years we analyzed (2000, 2002-2004, 2006-2007), the average date of 10% passage for yearling Chinook at Lower Granite Dam was April 19th while the 90% date was May 16th (average median date May 4th). For steelhead the average 10% passage date was April 23rd while the average 90% passage date was May 24th. These passage dates for sockeye were May 1st (10%) and June 12th (90%). This illustrates that sockeye juveniles arrive at Snake River collector projects later than steelhead and yearling Chinook. However, sockeye passage at Lower Granite Dam was much more variable than that for yearling Chinook and steelhead and the period of peak passage typically occurred over a shorter time frame.

- A smaller proportion of coho, sockeye, and subyearling Chinook pass the Snake River collection projects during the Max-Transport/No Spill operation proposed under the MOA compared to the 2007 BiOp. However, a larger proportion of the yearling Chinook population pass the Snake River collector projects during this time under the MOA than under the 2007 draft BiOp. Finally, the proportion of the steelhead population passing during this operation is similar under the MOA and 2007 Draft BiOp.

- Compared to the base case of the 2007 BiOp (without Max-Transport/No Spill), the transport proportion under the 2007 BiOp (with Max-Transport/No Spill) increased from 77% to 81% for yearling Chinook, 76% to 83% for steelhead, and 76% to 86% for sockeye. Furthermore, the proportion transported under the MOA increased to 87% for yearling Chinook, 86% for steelhead, and 82% for sockeye.

- The MOA model runs resulted in the highest proportion of steelhead transported in 5 of the 6 years and in all years for yearling Chinook. The MOA model runs also resulted in an average of 8% of fish remaining in-river for steelhead, 9% for yearling Chinook, and 9% for sockeye.

- Both the MOA and the 2007 BiOp (with Max-Transport/No Spill) scenarios resulted in over 80% of sockeye being transported.

- The three modeled scenarios all resulted in low population proportions in-river below Lower Monumental Dam. The 2007 BiOp (without Max-Transport/No Spill) resulted in the highest in-river proportions below Lower Monumental dam; an average of 14% remained for sockeye and steelhead; while for yearling Chinook an average of 16% remained.

Summary of Proposed Max-Transport/No Spill Operations:

<u>2007 Draft BiOp</u>

In years where seasonal average flows exceed 65 Kcfs, the 2007 Draft BiOp calls for the termination of spring spill and implementation of Max-Transport at Snake River collector projects (LGR, LGS, and LMN), beginning May 15th. This operation would continue into June until summer spill volumes are initiated. The initiation of summer spill would be based on collections of subyearling Chinook. Specifically, summer spill will be initiated at these projects when subyearling Chinook collections exceed 50% of the total collection for a 3 day period, after June 1. If this criterion is not met prior to July 1, summer spill would be initiated on July 1.

<u>MOA</u>

In years where seasonal average flows exceed 65 Kcfs, the 2007 Draft BiOp calls for the termination of spring spill and implementation of Max-Transport at Snake River collector projects (LGR, LGS, and LMN), beginning May 7th. This operation would continue through May

20th. On May 21st, spring spill would resume at these three projects. Spring spill would continue until the initiation of summer spill, which is based on the same criteria outlined above.

Proportion of Population Passing Snake River Collector Projects during Proposed Max-Transport/No Spill Operations:

Methods

To investigate the potential impact of the proposed Max-Transport/No Spill operations FPC staff estimated the proportion of the population of yearling Chinook, steelhead, sockeye, coho, and subyearling Chinook passing Lower Granite, Little Goose, and Lower Monumental dams during these times, over the past ten years (1998-2007). These estimates are based on the daily passage index for each species at LGR, LGS, and LMN.

As mentioned above, the 2007 Draft BiOp calls for a Max-Transport/No Spill operation from May15th until the initiation of summer spill, which is based on subyearling Chinook collections for that year. For the years we analyzed, the average initiation date of summer spill was June 11, June 15, and June 15 for LGR, LGS, and LMN respectively. A summary of the results from this analysis is presented in Table 1.

Results

On average, a large proportion of Snake River sockeye and coho (63.4 to 76.9% for sockeye, 64.9 to 78.6% for coho) juveniles pass Snake River collector projects during the times of the Max-Transport/No Spill operation under the 2007 Draft BiOp (Table 1). The proportion of the yearling Chinook and steelhead populations that may be affected by this operation is somewhat smaller. On average, approximately 15 to 31.5% of yearling Chinook are passing Snake River collector projects during this operation, while 31.4 to 50.9% of steelhead are passing during this time (Table 1). Finally, only about 20.8 to 22.8% of subyearling Chinook pass these projects during this time.

Under the MOA, the proportion of the Snake River sockeye and coho juveniles passing Snake River collector projects during the Max-Transport/No Spill operation is significantly reduced. However, the proportion of yearling Chinook affected by the MOA Max-Transport/No Spill operation is much higher than that under the 2007 Draft BiOp (Table 1). This indicates that the MOA operation has the potential to have an even greater impact on yearling Chinook than the 2007 Draft BiOp. The MOA and 2007 Draft BiOp appear to have a similar impact on steelhead, with 34.1 to 42.9% of steelhead passing Snake River collector projects during the MOA Max-Transport/No Spill operation (Table 1). Finally, the proportion of subyearling Chinook affected by this operation is significantly reduced under the MOA, compared to the 2007 Draft BiOp (Table 1).

Table 1. Average percent of population migrating through Lower Granite, Little Goose, and Lower Monumental Dams during Max-Transport/No Spill Operation as proposed in 2007 Draft BiOp and Tribal-BPA MOA. Average based on 1998-2007 data.

		Average Percent Passing During Max-Transport/No Spill Operation				
Project	**Proposal**	**Yearling Chinook**	**Steelhead**	**Sockeye**	**Coho**	**Subyearling Chinook**
LGR	2007 BiOp	15.0	31.4	63.4	64.9	20.8
	MOA	30.7	34.1	38.5	35.7	1.4
LGS	2007 BiOp	30.8	40.7	63.6	73.9	20.9
	MOA	46.3	40.5	21.6	23.6	1.9
LMN	2007 BiOp	31.5	50.9	76.9	78.6	22.8
	MOA	45.7	42.9	24.1	26.5	1.8

Modeled Proportion Transported under Proposed Max-Transport/No Spill Operations:

Methods

To further describe the effects of the proposed Max-Transport/No Spill operations, FPC staff modeled the proportion of the population originating above Lower Granite Dam that would be transported. This was done for yearling spring/summer Chinook, steelhead, and sockeye. These modeling efforts were done under the two proposed Max-Transport/No Spill Operations (2007 Draft BiOp and the MOA). For comparison, we also modeled a third scenario which called for no Max-Transport/No Spill operation (herein referred to as the 2007 Draft BiOp without Max-Transport).

The 2007 Draft BiOp (without Max-Transport) scenario is essentially the same as the 2007 Draft BiOp (with Max-Transport/No Spill), except that there is no Max-Transport/No Spill Operation. Under this scenario, when seasonal average flows exceed 65 Kcfs, spring spill would be provided at Snake River collector projects from its initiation in April until the initiation of summer spill. The initiation of summer spill would be based on the same criteria as outlined above. Therefore, the only difference between these scenarios is whether a Max-Transport/No Spill operation is initiated and for how long.

To model the proportion of the population that is transported under these scenarios, the FPC estimated hourly spill proportions from April 1 to June 30, at LGR, LGS, and LMN under each of the three scenarios. This was done for six water years (2000, 2002, 2003, 2004, 2006, and 2007). Water years 2001 and 2005 were not modeled because these were low flow years that would have resulted in no spill under all three scenarios. Hourly proportion spill was modeled based on empirical hourly flow data from each project during these times.

The hourly volume of spill provided at each project was estimated assuming voluntary spill was to be managed to the 115/120% criteria. If the operation called for a set volume of spill then that volume was provided, unless flows were sufficiently high to warrant forced spill due to excess hydraulic capacity. If the planned operation called for a percent of the total flow then that percent of the hourly flow was provided as spill; in this case, if the necessary percent spill was greater then the estimated spill cap (Table 2), spill during these times was capped at the spill cap, unless flows were sufficiently high to warrant forced spill due to excess hydraulic capacity. Finally, if the planned operation called for gas cap spill then spill to the estimated spill cap (Table 2) was provided, unless flows were sufficiently high to warrant forced spill. During the proposed Max-Transport/No Spill operations, spill was set to 0 Kcfs, unless flows were in excess of hydraulic capacity and, thus, uncontrolled spill was provided. In this case, uncontrolled spill was any volume of flow over that project's hydraulic capacity. Minimum generation requirements were considered and all units were assumed to be in operation for these exercises (Table 2).

Table 2. Summary of operations specified in 2007 Draft BiOp and MOA and assumptions used for modeling hourly proportion spill from April 1 to June 30 at Snake River collector projects.

Project	Initiation of Spring Spill	Spring Spill Operation	Summer Spill Operation	Assumed Hydraulic Capacity (Kcfs)	Assumed Spill Cap (Kcfs)	Assumed Powerhouse Minimum (Kcfs)
LGR	Apr. 3	20 Kcfs (24-hours)	18 Kcfs (24-hours)	130	N/A*	11.5
LGS	Apr. 5	30% (24-hours)	30% (24-hours)	130	30	11.5
LMN	Apr. 7	Gas Cap (24-hours)	17 Kcfs (24-hours)	130	27	11.5

* Operations call for spill volumes much less than estimated spill cap at LGR, therefore an assumed spill cap is unnecessary.

All three operational scenarios call for the same level of spill and thus, the only difference in the hourly proportion spill between the three scenarios would be the timing and duration of the Max-Transport/No Spill operation. Table 3 provides a summary of the time periods when the Max-Transport/No Spill operations would be in effect at each project, under each of the modeled scenarios for each water year. Furthermore, all three scenarios call for the same criteria for the initiation of summer spill volumes and, thus, would initiate summer spill on the same date. Table 3 provides the date of initiation of summer spill for each project and year.

For each of the water years, fish arrival timing at Lower Granite Dam was used to distribute fish passage by date. This arrival timing was based on the passage index at Lower Granite Dam for that year. Appendix A provides arrival timing plots for each of the species and years we modeled. The daily population passing Lower Granite was expressed as a proportion of the seasonal total, and in turn the daily proportion was divided into hourly proportions (daily proportion/24) to match hourly spill data.

Table 3. Periods of proposed Max-Transport/No Spill Operation for each modeled scenario and estimated initiation of summer spill at each project for each of the modeled water years.

		Period of Max-Transport/No Spill Operation			
Project	**Water Year**	**2007 Draft BiOp (w/ Max-Transport)**	**2007 Draft BiOp (w/o Max-Transport)**	**MOA**	**Init. of Summer Spill**
LGR	2000	5/15-6/12	N/A	5/7-5/20	6/13
	2002	5/15-6/25	N/A	5/7-5/20	6/26
	2003	5/15-6/6	N/A	5/7-5/20	6/7
	2004	5/15-6/8	N/A	5/7-5/20	6/9
	2006	5/15-6/3	N/A	5/7-5/20	6/4
	2007	5/15-6/4	N/A	5/7-5/20	6/5
LGS	2000	5/15-6/17	N/A	5/7-5/20	6/18
	2002	5/15-6/18	N/A	5/7-5/20	6/19
	2003	5/15-6/16	N/A	5/7-5/20	6/17
	2004	5/15-6/11	N/A	5/7-5/20	6/12
	2006	5/15-6/3	N/A	5/7-5/20	6/4
	2007	5/15-6/8	N/A	5/7-5/20	6/9
LMN	2000	5/15-6/12	N/A	5/7-5/20	6/13
	2002	5/15-6/28	N/A	5/7-5/20	6/29
	2003	5/15-6/6	N/A	5/7-5/20	6/7
	2004	5/15-6/10	N/A	5/7-5/20	6/11
	2006	5/15-6/3	N/A	5/7-5/20	6/4
	2007	5/15-6/9	N/A	5/7-5/20	6/10

Based on spill efficiency functions (SPE) and assumed fish guidance efficiencies (FGE), the probability of fish being collected was modeled at each dam (see Table 4 for SPE coefficients and FGE values used in modeling). Due to lack of data for sockeye, SPE and FGE estimates derived for yearling Chinook were used to model the probability of sockeye being collected. Prior to the initiation of transportation (April 21) fish collected at Lower Granite Dam were modeled as returning to river (transport probability = 0). Following the initiation of transportation, all fish collected were considered removed for transportation. During this time, the probability of being transported (once collected) was assumed to be 1. The proportion of the hourly population collected and transported was removed from the in-river population.

Table 4. Spill efficiency function constants and coefficients (for logit model) used in modeling fish passage efficiency and FGE values used to model powerhouse collection efficiency (values from COMPASS modeling). Sockeye spill efficiency and FGE were modeled using values for yearling Chinook

	Yearling Chinook			Steelhead		
Project	**SPE constant**	**Logit SPE coefficient**	**FGE**	**SPE constant**	**Logit SPE coefficient**	**FGE**
LGR	0.835	0.986	0.814	1.817	1.186	0.925
LGS	0.006	0.979	0.874	0.032	0.989	0.964
LMN	1.797	0.997	0.817	1.797	0.997	0.817

Median travel time data derived from PIT-tag estimates for the years 2000 to 2007 (2001 was excluded) were used to move daily groups of fish downstream to the next dam. Travel times were averaged over the 7 years of for each weekly time period from April 1 to May 27. For dates later than May 27 the last median travel time was assigned. Estimates of PIT-tag yearling Chinook and steelhead travel time were readily available. However, since little data were available for sockeye, yearling Chinook travel times were used to model sockeye travel times once they passed Lower Granite Dam (Table 5).

Table 5. Median travel time estimates assigned to fish passing Lower Granite Dam from April 1 to June 20. Values were averaged from PIT-tag reach estimates for each time period from the years 2000 to 2007 (excluding 2001). Sockeye travel times were assumed to be the same as those for yearling Chinook.

	Yearling Chinook (and Sockeye)		Steelhead	
Time Period	LGR to LGS	LGS to LMN	LGR to LGS	LGS to LMN
4/1 to 4/8	11.3	8.4	5.6	5.9
4/9 to 4/15	8.1	6.7	4.2	4.9
4/16 to 4/22	6.8	3.7	3.7	3.8
4/23 to 4/29	5.2	2.4	3.4	3.9
4/30 to 5/6	3.9	2.7	3.4	3.9
5/7 to 5/13	4.3	2.0	3.2	2.5
5/14 to 5/20	3.6	1.9	2.7	2.3
5/20 to 6/30	2.7	1.6	2.8	2.3

Reach survival estimates from Lower Granite Dam to Little Goose Dam (LGR to LGS) and Little Goose Dam to Lower Monumental Dam (LGS to LMN) were derived from PIT-tag estimates for the years 2000 to 2007 (again 2001 was excluded). Survival estimates were averaged over 2 week periods beginning April 1 through June 3. For dates later than June 2 the last survival estimate was assigned. As in travel time data, estimates of PIT-tag yearling Chinook and steelhead survival estimates were readily available, but very little data were available for sockeye. Therefore, reach survivals for yearling Chinook were used to model sockeye survival once they passed Lower Granite Dam (Table 6).

Table 6. Reach survivals used to model transportation scenarios. Values were averaged from PIT-tag reach estimates for each time period from the years 2000 to 2007 (excluding 2001). Sockeye survivals were assumed to be the same as those for yearling Chinook.

	Yearling Chinook (and Sockeye)		Steelhead	
Time Period	LGR to LGS	LGS to LMN	LGR to LGS	LGS to LMN
4/1 to 4/21	0.92	0.90	0.92	0.97
4/22 to 5/5	0.92	0.91	0.90	0.89
5/6 to 5/19	0.93	0.89	0.87	0.85
5/20 to 6/30	0.94	0.87	0.93	0.91

The hourly population proportion remaining in-river to Lower Granite tailwater was assigned a travel time and survival to Little Goose Dam based on these seasonally adjusted median travel times and survival estimates. Based on the hour of arrival to Little Goose Dam the probability of being collected was calculated based on an SPE function of hourly spill proportion and an FGE value for LGS (Table 4). The proportion collected was considered removed for transport (after April 20) as at Lower Granite Dam. The proportion surviving in-river below Little Goose Dam was calculated and a travel time and survival to Lower Monumental Dam was assigned to that hourly population proportion. Finally, based on arrival timing at Lower Monumental Dam and hourly spill proportion, the probability of being collected at Lower Monumental was calculated based on the SPE and FGE values (Table 4).

Because survival from Lower Granite Dam to each of the downstream collector dams was accounted for in the model, the sum of the hourly proportions collected at each dam over the season could be used to determine the proportion of the overall population of fish beginning at Lower Granite Dam that would have been transported. Furthermore, the proportion surviving in-river to below Lower Monumental Dam could also be calculated in a similar way. The same SPE and FGE assumptions were used to model all three scenarios for each species.

Results

Under all three operational scenarios, the minimum average proportion transported ranged from 0.76 to 0.77 for yearling Chinook, steelhead, and sockeye juveniles (Table 7 and Figure 1). In fact, the 2007 BiOp (without Max-Transport) scenario consistently resulted in the lowest proportion transported and also the highest proportion of the population remaining in river, below Lower Monumental Dam, for all three species (Tables B-1, B-2, and B-3). This scenario was modeled to contrast the two proposed Max-Transport/No Spill operational scenarios with an operation that provides spill throughout May and early June, as is being provided under the court order.

The MOA model runs resulted in the highest proportion of steelhead transported in 5 of the 6 years. Under this scenario, the average proportion of the steelhead population transported was 86% (Table 7 and Figure 1); with a minimum of 80% in water year 2002 and a maximum of 88% in water year 2007 (Table B-1). The difference between these two years is likely due to the difference in steelhead timing to Lower Granite Dam in those years. In water year 2007, approximately 38% of steelhead juveniles passed Lower Granite Dam during the Max-Transport/No Spill operation, whereas in 2002 only 17% passed during this time (Figure A-1).

The MOA model runs resulted in the highest proportion of yearling Chinook transported in all 6 years. Under this scenario, the average proportion of the yearling Chinook population transported was 87% (Table 7 and Figure 1). The proportion transported under this operation was less variable than for steelhead. However, water year 2006 resulted in approximately 90% of the yearling Chinook population being transported under this scenario (Table B-2). This is likely due to both yearling Chinook timing in 2006 and flows in 2006. Of the water years modeled, 2006 had the highest proportion of yearling Chinook passing Lower Granite Dam during this Max-Transport/No Spill operation (35%) (Figure A-2). Water year 2006 also had the highest daily average discharge at tall three dams (Table C-1) but had the lowest spill proportion (Table C-2) at all three dams under this scenario. This lower spill proportion in 2006 was a partially a result of set spill volumes at Lower Granite and Lower Monumental dams during the highest flow year.

The MOA model runs resulted in the second highest proportion of sockeye transported in 5 of the 6 modeled years. Under this scenario, the average proportion of the sockeye population transported was 82% (Table 7 and Figure 1). Among the years, there was higher variability in the proportion transported for sockeye compared to steelhead and yearling Chinook (Table B-3). This variability in proportion transported reflects the variability in sockeye timing at Lower Granite. For example, among the years modeled, anywhere from 1 (2003) to 83% (2007) of sockeye juveniles passed Lower Granite during the period of the Max-Transport/No Spill operation (Figure A-3). Furthermore, peak passage period of sockeye at Lower Granite appears to be more brief than that for yearling Chinook and steelhead, particularly in 2003 and 2007.

The 2007 BiOp (with Max-Transport) model runs resulted in the second highest proportion of steelhead transported in 5 of the 6 years. Under this scenario, the average proportion of the steelhead population transported was 83% (Table 7 and Figure 1). This scenario also resulted in the least variability in the proportion transported for steelhead (Table B-1).

The 2007 BiOp (with Max-Transport) model runs resulted in the second highest proportion of yearling Chinook transported in all 6 years. Under this scenario, the average proportion of the yearling Chinook population transported was 81% (Table 7 and Figure 1). As with the MOA scenario, water year 2006 resulted in the highest proportion of yearling Chinook transported (85%) (Table B-2). However, the proportion of yearling Chinook transported under the BiOp (with Max-Transport) scenario was lower than that for the MOA. This is likely due to the fact that the BiOp (with Max-Transport) scenario had uncontrolled spill during much of the Max-Transport/No Spill operation in water year 2006.

The 2007 BiOp (with Max-Transport) model runs resulted in the highest proportion of sockeye transported in all 6 modeled years. Under this scenario, the average proportion of the sockeye population transported was 86% (Table 7 and Figure 1). The higher transport proportion under this scenario is likely due to the longer period of the Max-Transport/No Spill operation at the end of May and into early June. This is typically when most sockeye are passing Lower Granite Dam. For example, in 2007, approximately 71% of sockeye juveniles passed Lower Granite Dam during this period (Figure A-3).

Table 7. Average and standard errors (in parentheses) of modeled transportation proportions for smolt populations originating above Lower Granite Dam. Three scenarios were modeled based on fish timing at Lower Granite Dam and flow data for the water years 2000, 2002, 2003, 2004, 2006, and 2007.

	BiOp w/o max Transport	**BiOp with max Transport**	**MOA**
Steelhead	0.76 (0.010)	0.83 (0.002)	0.86 (0.016)
Yearling Chinook	0.77 (0.009)	0.81 (0.009)	0.87 (0.011)
Sockeye	0.76 (0.032)	0.86 (0.020)	0.82 (0.033)

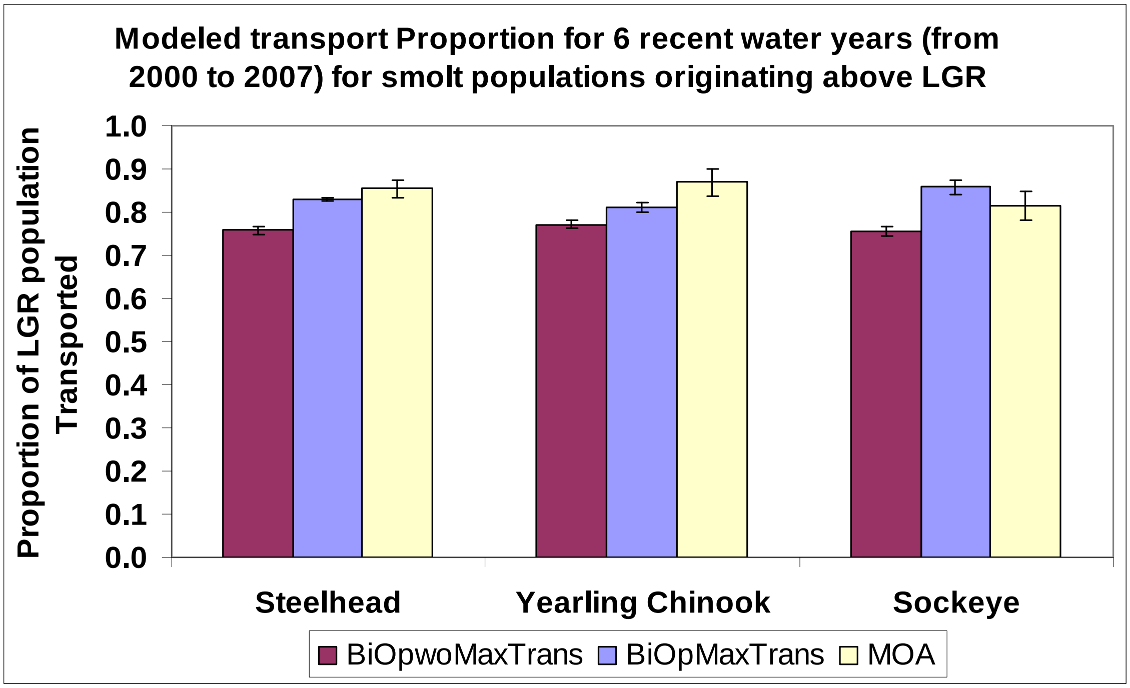


Figure 1. Modeled transport proportion (standard error bars) of the smolt populations originating above Lower Granite Dam. Three scenarios were modeled based on fish timing at Lower Granite Dam and flow data for the water years 2000, 2002, 2003, 2004, 2006, and 2007.

Discussion

The primary rational for eliminating voluntary spill and implementing maximum transport is to increase the proportion of the steelhead run that is transported. This is based in large part on studies that indicate higher SARs for transported hatchery steelhead versus those that migrated in-river or were bypassed. Although transported hatchery steelhead have higher SARs than those migrating in-river or bypassed, this is not the case for wild yearling Chinook. Furthermore, it is unknown what kind of impact transportation has on Snake River sockeye juveniles. Switching to maximum transportation with no spill will inevitably increase the proportion of yearling Chinook and sockeye that are transported, which could lead to a negative impact on these species.

Both the 2007 BiOp (with Max Transport) and the MOA resulted in the largest proportion of yearling Chinook being transported during years with the highest flows. In these modeled scenarios 2006 was the highest flow year, but consistently resulted in the highest proportion of yearling Chinook transported and conversely the lowest proportion remaining in-river past Lower Monumental Dam.

Appendix A
Lower Granite Dam Passage Timing of yearling Chinook, steelhead, and sockeye (2000, 2002-2004, 2006-2007)

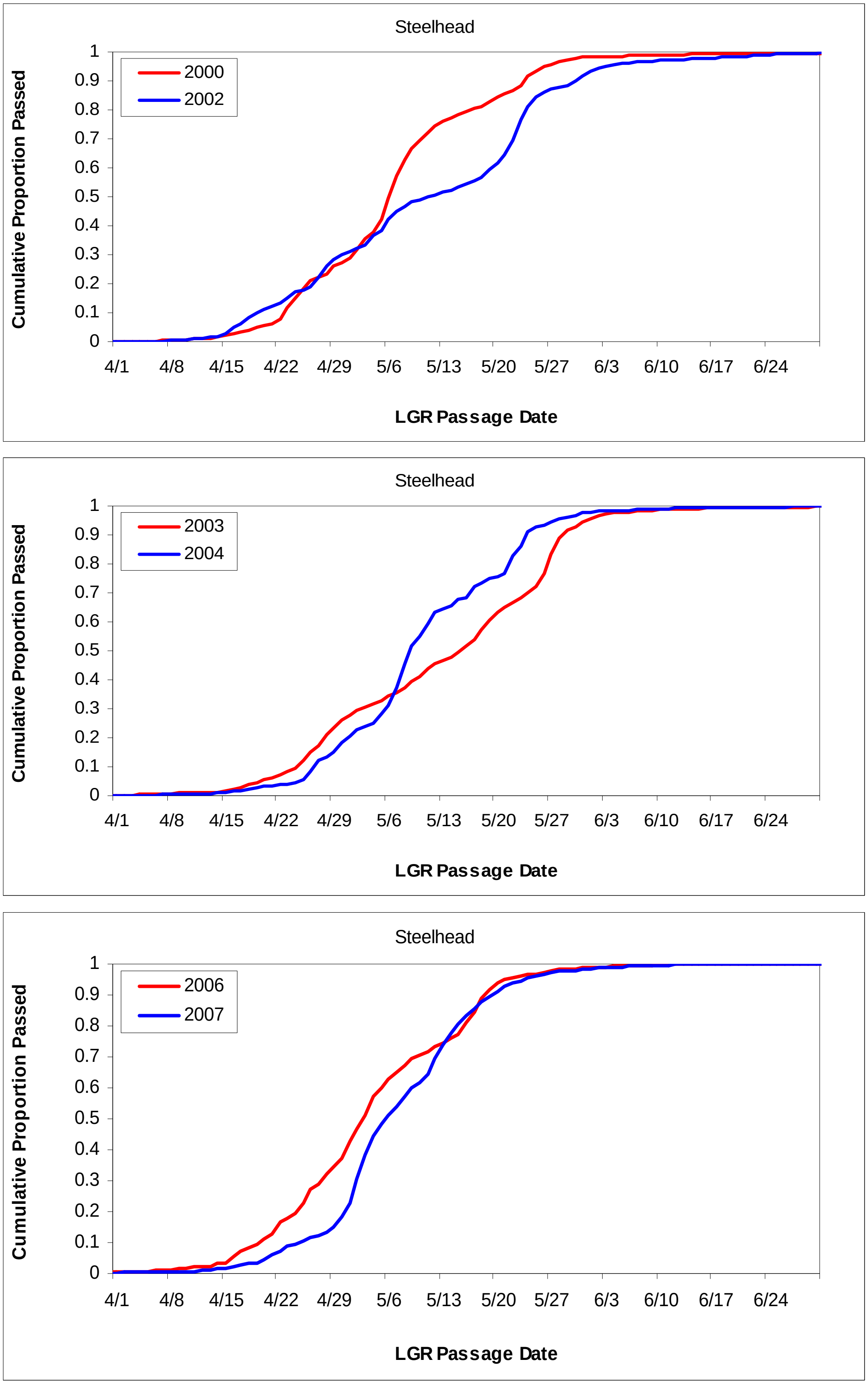
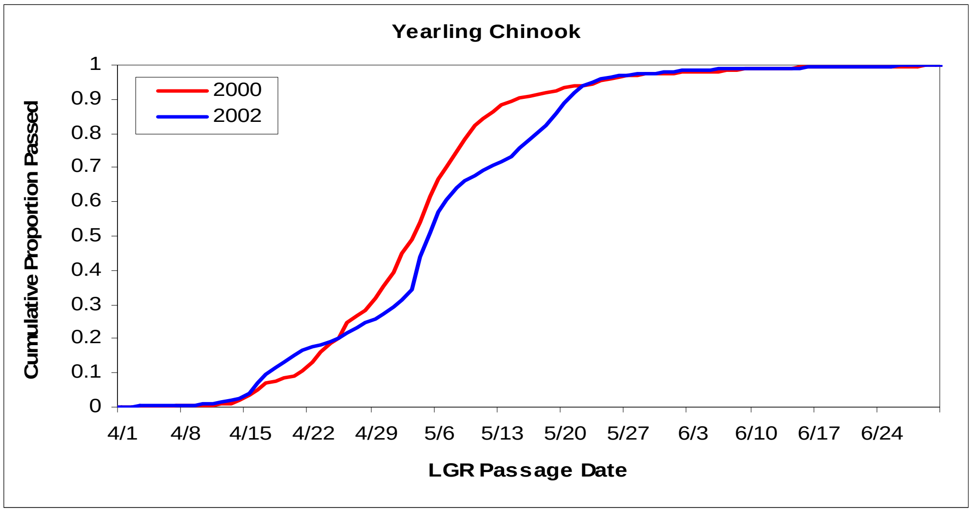
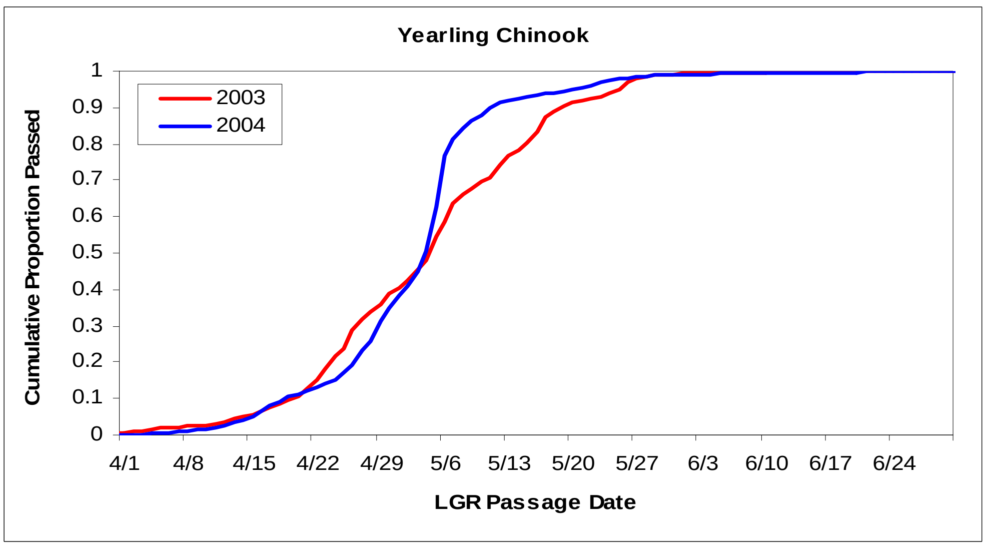


Figure A-1 – Passage timing of steelhead juveniles at Lower Granite Dam (2000, 2002-2004, 2006-2007)





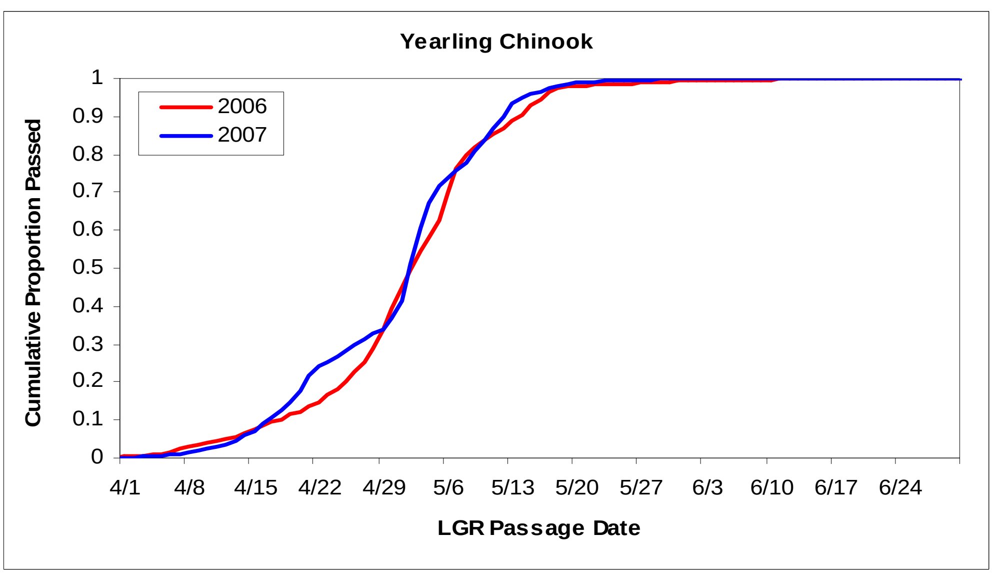
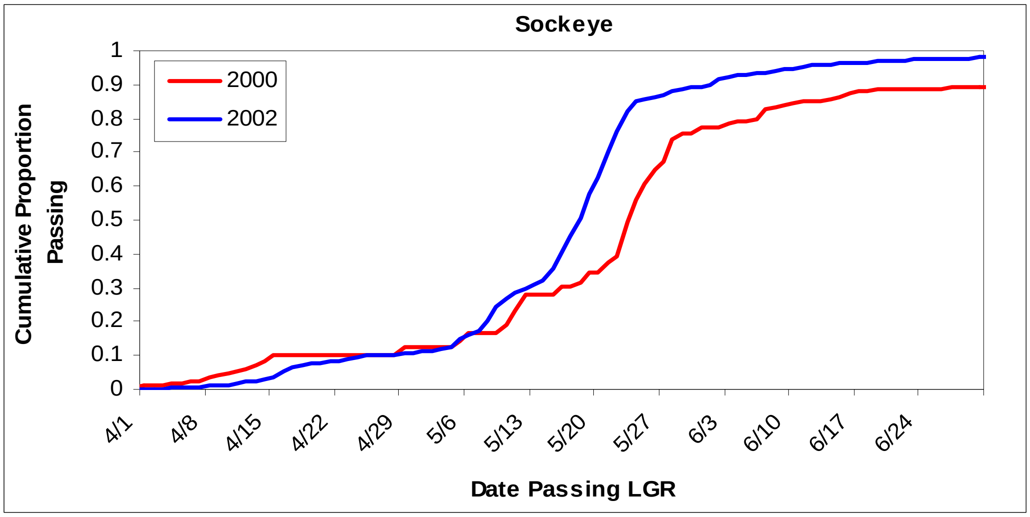
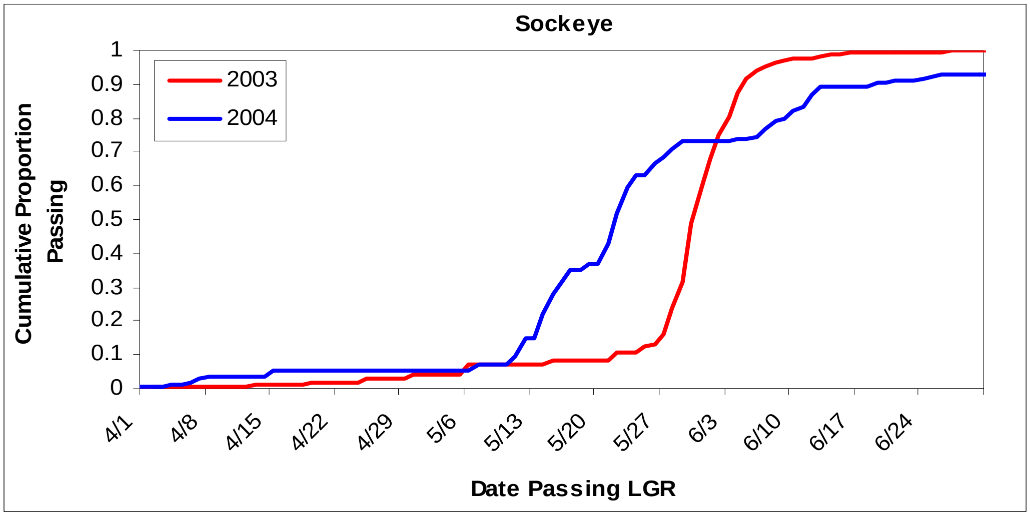


Figure A-2 – Passage timing of yearling spring/summer Chinook juveniles at Lower Granite Dam (2000, 2002-2004, 2006-2007)





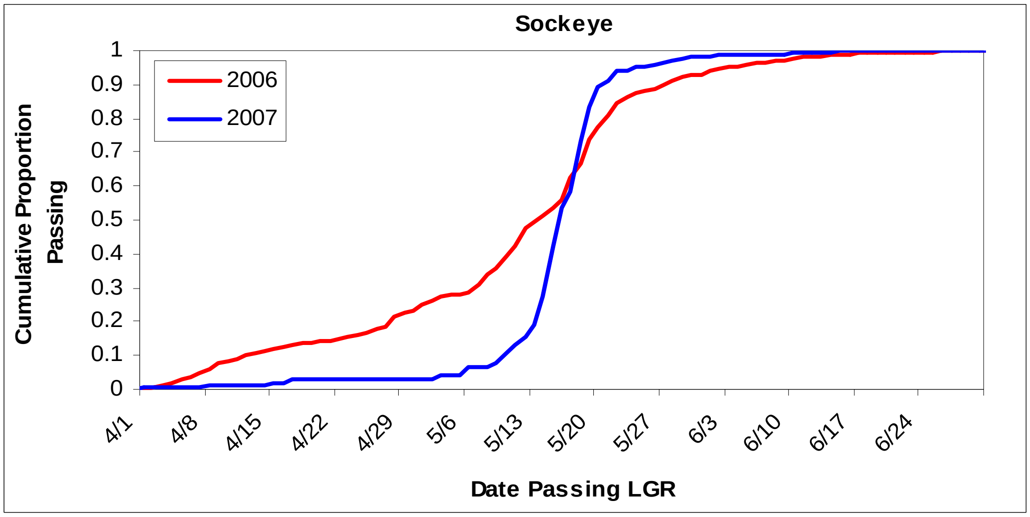


Figure A-3 – Passage timing of sockeye juveniles at Lower Granite Dam (2000, 2002-2004, 2006-2007)

Appendix B
Detailed Results from Modeled Transport Proportion

Table B-1 – Results of modeled scenarios estimating the probability of juvenile steelhead being transported at Snake River collector projects under 3 management scenarios.

Year	Operational Scenario	Probability of Smolts Originating Above LGR of being either Transported or remaining In-River				
		LGR Trans	LGS Trans	LMN Trans	Overall Transport	In River
2000	BiOpMaxTrans	0.49	0.30	0.04	0.83	0.09
2002	BiOpMaxTrans	0.54	0.25	0.03	0.82	0.11
2003	BiOpMaxTrans	0.48	0.31	0.04	0.84	0.09
2004	BiOpMaxTrans	0.48	0.31	0.05	0.84	0.08
2006	BiOpMaxTrans	0.44	0.34	0.04	0.83	0.10
2007	BiOpMaxTrans	0.47	0.33	0.04	0.83	0.09
2000	BiOpwoMaxTrans	0.36	0.36	0.04	0.76	0.14
2002	BiOpwoMaxTrans	0.31	0.38	0.04	0.73	0.17
2003	BiOpwoMaxTrans	0.34	0.39	0.04	0.76	0.14
2004	BiOpwoMaxTrans	0.30	0.41	0.04	0.74	0.15
2006	BiOpwoMaxTrans	0.42	0.35	0.04	0.81	0.11
2007	BiOpwoMaxTrans	0.33	0.39	0.03	0.75	0.15
2000	MOA	0.56	0.27	0.03	0.87	0.07
2002	MOA	0.43	0.33	0.04	0.80	0.12
2003	MOA	0.51	0.30	0.04	0.85	0.09
2004	MOA	0.57	0.27	0.03	0.87	0.07
2006	MOA	0.50	0.32	0.04	0.86	0.08
2007	MOA	0.56	0.29	0.04	0.88	0.06

Table B-2 – Results of modeled scenarios estimating the probability of juvenile spring/summer Chinook salmon being transported at Snake River collector projects under 3 management scenarios.

Year	Operational Scenario	Probability of Smolts Originating Above LGR of being either Transported or remaining In-River				
		LGR Trans	LGS Trans	LMN Trans	Overall Transport	In River
2000	BiOpMaxTrans	0.48	0.31	0.05	0.83	0.11
2002	BiOpMaxTrans	0.46	0.32	0.04	0.81	0.12
2003	BiOpMaxTrans	0.46	0.31	0.05	0.82	0.12
2004	BiOpMaxTrans	0.38	0.35	0.04	0.77	0.16
2006	BiOpMaxTrans	0.50	0.29	0.06	0.85	0.10
2007	BiOpMaxTrans	0.40	0.35	0.05	0.79	0.14
2000	BiOpwoMaxTrans	0.44	0.31	0.04	0.79	0.14
2002	BiOpwoMaxTrans	0.37	0.35	0.04	0.75	0.17
2003	BiOpwoMaxTrans	0.40	0.33	0.04	0.76	0.17
2004	BiOpwoMaxTrans	0.35	0.35	0.04	0.74	0.18
2006	BiOpwoMaxTrans	0.49	0.29	0.05	0.83	0.12
2007	BiOpwoMaxTrans	0.37	0.34	0.04	0.76	0.17
2000	MOA	0.54	0.30	0.05	0.88	0.06
2002	MOA	0.49	0.33	0.04	0.86	0.08
2003	MOA	0.53	0.28	0.04	0.86	0.09
2004	MOA	0.42	0.38	0.05	0.85	0.09
2006	MOA	0.58	0.27	0.05	0.90	0.06
2007	MOA	0.46	0.35	0.04	0.86	0.09

Table B-3 – Results of modeled scenarios estimating the probability of juvenile sockeye salmon being transported at Snake River collector projects under 3 management scenarios.

Year	Operational Scenario	Probability of Smolts Originating Above LGR of being either Transported or remaining In-River				
		LGR Trans	LGS Trans	LMN Trans	Overall Transport	In River
2000	BiOpMaxTrans	0.57	0.19	0.03	0.79	0.05
2002	BiOpMaxTrans	0.62	0.23	0.04	0.88	0.05
2003	BiOpMaxTrans	0.51	0.33	0.05	0.89	0.06
2004	BiOpMaxTrans	0.59	0.21	0.02	0.81	0.05
2006	BiOpMaxTrans	0.47	0.29	0.06	0.82	0.11
2007	BiOpMaxTrans	0.71	0.21	0.03	0.95	0.02
2000	BiOpwoMaxTrans	0.37	0.27	0.04	0.68	0.14
2002	BiOpwoMaxTrans	0.41	0.31	0.04	0.76	0.14
2003	BiOpwoMaxTrans	0.46	0.32	0.05	0.83	0.11
2004	BiOpwoMaxTrans	0.38	0.28	0.04	0.70	0.14
2006	BiOpwoMaxTrans	0.44	0.29	0.06	0.79	0.14
2007	BiOpwoMaxTrans	0.47	0.29	0.03	0.79	0.14
2000	MOA	0.44	0.24	0.03	0.71	0.11
2002	MOA	0.59	0.23	0.03	0.85	0.08
2003	MOA	0.46	0.32	0.05	0.83	0.10
2004	MOA	0.52	0.21	0.03	0.76	0.09
2006	MOA	0.52	0.25	0.06	0.83	0.11
2007	MOA	0.73	0.17	0.01	0.92	0.05

Appendix C
Summary of Spill Proportions and Flow Data for Modeling Transport Proportion

Table C-1 – Seasonal average daily flow at Lower Granite (4/1-6/20), Little Goose (4/1-6/30), and Lower Monumental Dam (4/1-6/30).

Site	Year	Average Discharge (Kcfs)
LGR	2000	83.46
	2002	82.96
	2003	89.40
	2004	69.62
	2006	123.99
	2007	60.83
LGS	2000	76.99
	2002	80.51
	2003	83.87
	2004	67.32
	2006	115.23
	2007	56.54
LMN	2000	79.29
	2002	83.97
	2003	83.61
	2004	70.54
	2006	117.36
	2007	56.86

Table C-2 – Average daily spill proportion under each of the modeled scenarios at Lower Granite (4/1-6/20), Little Goose (4/1-6/30), and Lower Monumental Dam (4/1-6/30).

		Operational Scenario		
Site	Year	BiOp (with Max-Transport)	BiOp (without Max-Transport)	MOA
LGR	2000	0.15	0.24	0.19
	2002	0.15	0.25	0.20
	2003	0.21	0.25	0.20
	2004	0.24	0.31	0.26
	2006	0.15	0.18	0.15
	2007	0.27	0.34	0.30
LGS	2000	0.17	0.28	0.24
	2002	0.17	0.28	0.23
	2003	0.20	0.28	0.23
	2004	0.19	0.28	0.24
	2006	0.20	0.25	0.22
	2007	0.26	0.26	0.26
LMN	2000	0.19	0.31	0.25
	2002	0.17	0.32	0.25
	2003	0.26	0.31	0.25
	2004	0.27	0.36	0.30
	2006	0.18	0.21	0.18
	2007	0.45	0.45	0.45