



FISH PASSAGE CENTER

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MEMORANDUM

TO: Ron Boyce, ODFW

FROM: Michele DeHart

DATE: September 21, 2007

RE: Data request to estimate spill volumes under different project spill/transport operations

You requested that the FPC conduct an analysis of the spill that would result under different project operational scenarios for spill and transportation. Specifically, you asked for a comparison of spill volumes if the hydrosystem was operated to the 2000 Biological Opinion, the Proposed Action, the 2007 Agreement and the Oregon Plan under low, medium and high flows.

In order to conduct the analysis the FPC elected to use the hourly flow and spill data collected since 2000, and to stratify the data into low, medium and high flow years based on the pre-season estimated flow for each year. The low, medium and high years were as follows:

- Low Years: 2001, 2005
- Medium Years: 2004, 2007
- High Years: 2000, 2002, 2003, 2006

The table below summarizes the operations that were modeled. A summary of all the assumptions used in the analysis is attached to this document. The four modeled scenarios differ in both the amount of spill provided at a project, and in the duration of the spill implementation. The analysis assumes gas caps for the Biological Opinion that were historically consistent with operations under those years when the BIOP was implemented, whereas the more recently proposed scenarios use average spill caps as determined and established by the COE.

Operations Modeled:

Project	2000 BIOP	Proposed Action	2007 Operations	Oregon Plan
LGR	0/60Kcfs	20Kcfs/20Kcfs	20Kcfs/20Kcfs	40%/40%
LGS	0/Gas Cap (GC=45 Kcfs)	30%/30% (GC=30 Kcfs)	30%/30% (+ 14 nights Gas Cap) ^A (GC = 30 Kcfs)	40%/Gas Cap (GC = 30 Kcfs)
LMN	40 Kcfs/40 Kcfs	27 Kcfs/27 Kcfs	27 Kcfs/27 Kcfs	27 Kcfs/27 Kcfs
IHR	45 Kcfs/Gas Cap (GC=95 Kcfs)	30%/30% vs 45 Kcfs/ Gas Cap ^B (GC=95 Kcfs)	30%/30% vs 45 Kcfs/Gas Cap ^B (GC=95 Kcfs)	64 Kcfs/64 Kcfs
MCN	0/Gas Cap (GC=175 Kcfs)	40%/40% (GC=175 Kcfs)	40%/40% (GC=175 Kcfs)	161 Kcfs/161 Kcfs (GC=175 Kcfs)
JDA	0/60% ^C (GC=140 Kcfs)	0/60% ^C (GC=140 Kcfs)	0/60% ^C (GC=140 Kcfs)	Gas Cap/Gas Cap (GC=140 Kcfs)
TDA	40%/40% (GC=140 Kcfs)	40%/40% (GC=140 Kcfs)	40%/40% (GC=up to 126 Kcfs)	126 Kcfs/126 Kcfs (GC=140)
BON	75 Kcfs/Gas Cap (GC=120 Kcfs)	100 Kcfs/100 Kcfs	100 Kcfs/100 Kcfs	100 Kcfs/100 Kcfs

^A For 14 nights Gas Cap spill, assumed same nights as in 2007 (Apr 29-May 12)

^B Assumed 2007 schedule for 30%/30% vs 45 Kcfs/ Gas Cap treatments

^C Night time spill 18:00-06:00 Apr. 10-May 14; 19:00-06:00 May 15-June 30

The table below describes a summary of the volume of spill that occurs each year under the various scenarios.

All Projects

Year	Actual Spill	2000 BIOP Spill	2007 Agreement Spill		
	(KAF)	(KAF)	PA Spill (KAF)	(KAF)	OR Plan Spill (KAF)
2000	79,491	82,774	64,859	77,884	106,608
2001	6,569	37,575	26,948	32,325	57,597
2002	86,415	85,722	68,409	80,869	106,995
2003	74,357	80,510	63,386	76,396	105,919
2004	57,082	59,485	52,962	69,518	98,632
2005	52,179	56,045	46,382	55,977	82,373
2006	116,695 ^A	98,281	79,497	92,039	113,030
2007	73,134	63,205	56,973	73,029	103,006

^A Actual spill in 2006 appears much greater than any of the modeled operation. This is because the powerhouse capacity in 2006 was restricted with one unit out of operation, whereas the modeled scenarios assume full powerhouse capacity.

The following tables partition the All Projects Table to the two river reaches: Snake - Lower Granite to Ice Harbor dams; and, Lower Columbia – McNary to Bonneville dams. From these tables you can see that most of the difference in the scenarios occurs in the Lower Columbia (individual project results are also attached).

Snake River Projects (LGR, LGS, LMN, IHR)

Year	Actual Spill	2000 BIOP Spill	2007 Agreement Spill		
	(KAF)	(KAF)	PA Spill (KAF)	(KAF)	OR Plan Spill (KAF)
2000	21,404	24,238	14,926	18,780	23,654
2001	19	5,584	3,906	4,348	6,013
2002	18,028	23,499	14,312	18,351	23,220
2003	20,644	24,634	15,865	19,615	24,265
2004	10,393	8,053	9,508	16,998	21,068
2005	8,113	7,369	5,312	5,794	7,616
2006	27,830	26,928	17,777	22,036	27,512
2007	15,015	7,123	8,914	15,807	19,481

Lower Columbia Projects (MCN, JDA, TDA, BON)

Year	Actual Spill	2000 BIOP Spill	2007 Agreement Spill		
	(KAF)	(KAF)	PA Spill (KAF)	(KAF)	OR Plan Spill (KAF)
2000	58,087	58,536	49,933	59,103	82,954
2001	6,549	31,991	23,042	27,977	51,585
2002	68,387	62,223	54,097	62,518	83,774
2003	53,714	55,876	47,521	56,781	81,653
2004	46,688	51,433	43,454	52,519	77,564
2005	44,066	48,676	41,070	50,183	74,757
2006	88,865	71,353	61,721	70,003	85,518
2007	58,119	56,082	48,059	57,222	83,525

As stated previously, the FPC modeled the Proposed Action for spring migrants and assumed no spill occurred in June. The proposed Action does include an adaptive management clause, where spill is implemented when subyearling Chinook are present with certain criteria. In order to put this potential additional spill in perspective, the FPC assumed that subyearling Chinook met the criteria on June 1 and the summer spill would be initiated on these dates. The following table shows the maximum additional spill that would be provided by the Proposed Action in each year.

Spill at Snake River collector projects if spill occurred June 1 through June 15

Year	PA Spill Volume (KAF)		
	LGR	LGS	LMN
2000	535	637	505
2001	529	383	481
2002	505	765	472
2003	422	663	397
2004	535	812	504
2005	534	579	499
2006	534	872	502
2007	535	484	505

Assumptions used for the BiOP, PA, Agreement, OR Plan analysis:

- It was assumed that each project had a powerhouse minimum that was the same for all management scenarios (PH minimums were those reported in WMP for 2007).
- Summary of flow targets used to determine spill at the Snake River transportation projects:
 - 2000 BiOP- if average flows <85 Kcfs, no spill. Otherwise spill Apr. 3 – June 20.
 - PA
 - If average flows <65 Kcfs, no spill
 - If average flows 65-80 Kcfs, spill beginning April 3, 5, or 7 and ending on April 30, May 4, or May 9 for LGR, LGS, and LMN, respectively. No spill May 1 (LGR), May 5 (LGO), or May 9 (LMN) to May 31. Assumed no subyearlings in June, therefore no spill occurs in June (except for spill in excess of hydraulic capacity).
 - If average flows >80 Kcfs, spill April 3, 5, or 7 to May 31 for LGR, LGS, and LMN, respectively. Assumed no subyearlings in June so no spill in June (except for spill in excess of hydraulic capacity).
 - 2000 Agreement- if average flows < 70 Kcfs, no spill. Otherwise spill Apr. 3 – June 20.
 - OR Plan- if average flows <65 Kcfs, no spill. Otherwise spill Apr. 3 – June 20.
- Flow targets at McNary:
 - 2000 BiOP- Spill Apr. 10 – June 30, no minimum flows.
 - PA
 - If average flows <125 Kcfs, no spill
 - If average flows > 125 Kcfs, spill April 10-June 14. Assumed no subyearlings June 15-30 so no spill (except for hydraulic capacity)
 - 2000 Agreement-
 - If average flows <125 Kcfs, no spill
 - If average flows > 125 Kcfs, spill April 10-June 30.
 - OR Plan- Spill Apr. 10 – June 30, no minimum flows.
- No flow targets at non-transport projects. Spill occurs in all years.
- Categorized years as Low (<65 Kcfs), Medium (65-80 Kcfs), and High (>80 Kcfs) based on flow objectives published in Annual Reports
 - Low Years: 2001, 2005
 - Medium Years: 2004, 2007
 - High Years: 2000, 2002, 2003, 2006
- Additionally, modeled PA with spill for subyearlings (i.e., summer spill volumes June 1-15)

Lower Granite Dam

Year	Avg Daily Flow (Kcfs)	Actual Spill (KAF)	2000 BIOP Spill (KAF)	PA Spill (KAF)	2007 Agreement Spill (KAF)	OR Plan Spill (KAF)
2000	84.1	3,752	4,916	2,336	3,128	5,265
2001	47.5	0	0	0	0	0
2002	83.0	4,812	4,771	2,360	3,123	5,218
2003	90.0	4,340	5,181	2,843	3,512	5,631
2004	70.1	1,311	4	1,105	3,124	4,387
2005	66.3	983	14	0	0	0
2006	125.3	7,277	5,597	2,803	3,594	7,841
2007	61.2	3,110	0	1,109	3,128	3,830

Little Goose Dam

Year	Avg Daily Flow (Kcfs)	Actual Spill (KAF)	2000 BIOP Spill (KAF)	PA Spill (KAF)	2007 Agreement Spill (KAF)	OR Plan Spill (KAF)
2000	81.5	3,275	3,750	2,857	3,817	4,576
2001	48.4	0	0	0	0	0
2002	80.4	4,240	3,679	2,519	3,769	4,534
2003	88.1	3,500	4,105	2,902	4,009	4,686
2004	69.9	705	6	914	3,329	4,259
2005	65.7	279	9	0	0	0
2006	123.6	5,583	4,330	3,464	4,683	4,834
2007	59.5	2,832	0	920	2,906	4,069

Lower Monumental Dam

Year	Avg Daily Flow (Kcfs)	Actual Spill (KAF)	2000 BIOP Spill (KAF)	PA Spill (KAF)	2007 Agreement Spill (KAF)	OR Plan Spill (KAF)
2000	83.8	4,660	6,215	2,939	4,221	4,221
2001	50.7	0	0	0	0	0
2002	84.0	139	6,157	2,962	4,205	4,205
2003	87.8	4,674	6,317	3,341	4,463	4,463
2004	73.8	1,106	0	1,713	4,146	4,146
2005	67.6	667	0	0	0	0
2006	126.0	5,190	6,477	3,357	4,636	4,636
2007	59.9	3,469	0	1,740	4,139	4,139

Ice Harbor Dam

Year	Avg Daily Flow (Kcfs)	Actual Spill (KAF)	2000 BIOP Spill (KAF)	PA Spill (KAF)	2007 Agreement Spill (KAF)	OR Plan Spill (KAF)
2000	88.5	9,717	9,357	6,793	7,614	9,592
2001	49.9	19	5,584	3,906	4,348	6,013
2002	86.0	8,836	8,893	6,470	7,255	9,264
2003	91.6	8,130	9,032	6,780	7,630	9,485
2004	74.6	7,270	8,043	5,776	6,400	8,276
2005	68.7	6,185	7,345	5,312	5,794	7,616
2006	127.9	9,779	10,524	8,153	9,123	10,202
2007	61.3	5,605	7,123	5,146	5,633	7,443

McNary Dam

Year	Avg Daily Flow (Kcfs)	Actual Spill (KAF)	2000 BIOP Spill (KAF)	PA Spill (KAF)	2007 Agreement Spill (KAF)	OR Plan Spill (KAF)
2000	244.9	15,826	15,554	13,567	15,908	24,428
2001	123.9	323	4,965	0	0	12,005
2002	269.3	18,928	17,201	16,243	17,515	24,805
2003	231.4	12,253	14,439	12,743	15,027	23,602
2004	203.2	10,986	12,538	11,003	13,194	21,502
2005	195.7	11,699	11,770	10,281	12,709	21,213
2006	325.5	27,539	21,688	19,522	21,183	26,079
2007	239.6	16,987	14,812	13,089	15,560	25,279

John Day Dam

Year	Avg Daily Flow (Kcfs)	Actual Spill (KAF)	2000 BIOP Spill (KAF)	PA Spill (KAF)	2007 Agreement Spill (KAF)	OR Plan Spill (KAF)
2000	249.6	12,434	11,209	9,519	11,209	22,184
2001	126.7	792	4,959	4,161	4,959	12,362
2002	272.7	13,765	11,978	10,117	11,978	22,410
2003	231.4	9,229	10,627	8,937	10,627	21,839
2004	200.9	9,029	9,823	8,191	9,823	20,605
2005	192.7	8,838	8,929	7,432	8,929	19,349
2006	321.9	20,883	13,204	11,271	13,204	22,679
2007	231.0	10,060	10,685	9,135	10,685	22,047

The Dalles Dam

Year	Avg Daily Flow (Kcfs)	Actual Spill (KAF)	2000 BIOP Spill (KAF)	PA Spill (KAF)	2007 Agreement Spill (KAF)	OR Plan Spill (KAF)
2000	246.1	15,129	15,918	13,579	15,748	20,103
2001	126.8	2,500	8,095	6,654	8,095	12,294
2002	266.1	16,054	17,170	13,506	16,782	20,316
2003	230.9	13,744	14,980	12,558	14,892	19,976
2004	204.4	12,691	13,274	10,993	13,270	19,225
2005	190.9	10,619	12,398	10,180	12,398	18,049
2006	316.6	20,321	20,250	17,044	19,296	20,440
2007	227.3	14,797	14,758	12,570	14,742	19,963

Bonneville Dam

Year	Avg Daily Flow (Kcfs)	Actual Spill (KAF)	2000 BIOP Spill (KAF)	PA Spill (KAF)	2007 Agreement Spill (KAF)	OR Plan Spill (KAF)
2000	259.3	14,698	15,855	13,269	16,239	16,239
2001	135.5	2,934	13,972	12,227	14,923	14,923
2002	276.8	19,640	15,875	14,231	16,244	16,244
2003	250.7	18,487	15,831	13,283	16,236	16,236
2004	230.9	13,981	15,798	13,267	16,233	16,233
2005	200.1	12,910	15,579	13,177	16,147	16,147
2006	333.1	20,122	16,210	13,884	16,320	16,320
2007	241.9	16,274	15,828	13,266	16,236	16,236