BAKER RIVER PROJECT RELICENSE

Aquatic Resources Working Group Meeting
Technical Sub-committee on Instream Flows

June 24, 2004
9:00 a.m. – 2:00 p.m.
U.S. Forest Service Building
Conference Room A, Mountlake Terrace, WA

(Call in number 1-866-280-6429, participant number 144995#)

DRAFT MEETING OUTLINE

Meeting Purpose: To reach consensus on details of an operational scenario to incorporate into a Settlement Agreement for FERC relicensing of the Baker River Project.

Team Leader: Arnie Aspelund, PSE (arnie.aspelund@pse.com**)**

BACKGROUND

On May 17, 2004, with a handshake, final measures were tentatively agreed to by the Policy Team. The Policy Team assumed that Settlement would include an operational scenario involving a Lower Baker, 3-turbine powerhouse configuration. An operational scenario termed SNF.04 had been evaluated using the five representative Energy Years. Based on the results of the SNF.04 analysis, several iterations had also been requested for evaluation:

SNF.04 (Lower Baker 3-turbine configuration)
SNF.06 (SNF.04 with USFS reservoir pool levels)
SNF.07 (SNF.04 with three different modification proposed by The Nature Conservancy (TNC):
- Reduce minimum instream flow (MIF) from 1,200 to 1,000 cfs Oct. 21 to Mar. 1,
- May 1 to July 31, increase MIF from 1,200 to 1,500 cfs
- High-flow escape hatch April/May, set at Upper Baker 3% exc.flow(5,400 cfs)).

SNF.08 (SNF.04 with USFS and TNC mods)

All of these runs provided about the same amount of revenue - with SNF.04 providing slightly less revenue to PSE than SNF.07 or SNF.08. For planning purposes, the Policy Team assumed that the total cost of the final agreed-upon scenario would be less than or equal to SNF.04. Conference call participants were charged with identifying the most promising scenario to advance to Level 4 analysis,

where a longer term, hourly flow record would be used to confirm that the operational scenario performs as expected over a wider range of hydrologic conditions.

During the May 24, 2004 meeting, several participants supported the SNF.08 scenario, while other parties were against reducing the fall MIF from 1,200 cfs to 1,000 cfs. After much discussion, a compromise SNF.09 alternative was suggested: (SNF.04 with USFS mods and TNC mods 2 and 3). The task for the June 10, 2004 ARWG meeting was to evaluate SNF.09 using the five representative Energy Years. If SNF.09 provided as much or more total revenue than SNF.04 (is not more expensive), then SNF.09 would be run through the Level 4 analyses. However, if SNF.09 was more expensive than SNF.04 (less PSE revenue), all parties agreed to use SNF.06 as the default scenario and run SNF.06 through the Level 4 analyses.

Analysis of the SNF.09 scenario indicated that the economic costs were greater than SNF.04; however, rather than immediately defaulting to SNF.06, another alternative (SNF.10) was examined that incorporated several adjusted TNC modifications. During the June 10, 2004 ARWG meeting there was considerable discussion of each of the TNC suggested modifications. Consensus at the end of the meeting was to proceed with Level 4 analysis of SNF.06 (Energy Years 1991-2002). TNC and other potential modifications could be implemented as an element of future adaptive management provided the net effect of the modifications was within the cost exposure of SNF.04.

In addition to running SNF.06 through a Level 4 analysis, a Level 4 analysis would be run on SNF.06 with PSE's flood control proposal (earlier start of the flood control season and adding 29,000 acre-feet of flood control storage in Lake Shannon). The results of these analyses would be compared to a Level 4 analysis of PSE.01 (Existing Conditions), and in response to a request from the USFS, the run-of-river flow scenario (FS.03b) would also be run through the Level 4 analysis.

LEVEL 4 ANALYSES

Level 4 analyses consist of comprehensive post-processing of scenarios using available tools for a consecutive 12 Energy Year period (EYs 1991-2002). Level 4 processing was completed for four scenarios:

PSE.01 (Recent Conditions)
FS.03b (USFS run-of-river)
SNF.06 (SNF.04 with USFS reservoir mods)
PSE.21 (SNF.06 with PSE increased flood control offer)

In addition, IHA analyses were conducted comparing the results of the four scenarios to synthesized Baker River unregulated flows for the Baker River at Concrete, and Baker Unregulated/Skagit regulated for the Skagit River near Concrete.

A description of Level 4 post-HYDROPS processing procedures and a description of the hydrology pf each Energy Year 1991 through 2002 are contained in background files:

- *BakerLevel4Post-Processing.062204.doc*

Memo describing Level 4 analyses

- *12-YR Hydrologic Summary.060804.xls* ***(Meeting handout)***

Selected hydrologic statistics describing each Energy Year 1991 to 2002

- *IHA definitions.062204.doc*

Table defining the hydrologic statistics used in the IHA analyses

The initial step of Level 4 analyses is to use the HYDROPS model to run the scenarios through the 12 consecutive Energy Year period. HYDROPS output for each Energy Year is avai1able as .zip files in the eRoom HYDROPS folder under the Level 4 directory, within the subdirectory for each scenario. In most cases, the files have been divided into four .zip files to reduce file size.

HYDROPS output files [eRoom/HYDROPS/Level 4/…]			
PSE.01	**FS.03b**	**SNF.06**	**PSE.21**
PSE.01Level4.zip	*FS.03bL4-1.zip*	*SNF.06L4-1.zip*	*PSE.21L4-1.zip*
	FS.03bL4-2.zip	*SNF.06L4-2.zip*	*PSE.21L4-2.zip*
	FS.03bL4-3.zip	*SNF.06L4-3.zip*	*PSE.21L4-3.zip*
	FS.03bL4-4.zip	*SNF.06L4-4.zip*	*PSE.21L4-4.zip*

Level 2 Outputs

Each scenario is then processed to develop Level 2 output for each of the 12 Energy Years. The Level 2 output is contained in the eRoom HYDROPS folder under the Level 4 directory, within the subdirectory for each scenario and identified as .pdf files. EYs 1991 through 1996 are contained in the "a.pdf" file, and EYs 1997 - EY2002 are contained in the "b.pdf" file. As described in the Level 4 Post-Processing memo, a series of tables displaying the results of various hydrologic analyses are presented in a separate file for each scenario. In addition, Level 4 Tables are presented for synthesized Baker Unregulated flows used in the IHA analyses.

Scenario PSE.01 (Recent Conditions)
- *Level4-TablesPSE.01.doc* ***(Meeting handout)***
- *pse.01_Level2-12YearsOutput_a.pdf*
- *pse.01_Level2-12YearsOutput_b.pdf*

Scenario FS.03b (USFS run-of-river)
- *Level4-TablesFS.03b.doc* ***(Meeting handout)***
- F*S.03b_Level2-12YearsOutput_a.pdf*
- *FS.03b_Level2-12YearsOutput_b.pdf*

Scenario SNF.06 (SNF.04 with USFS reservoir mods)
- *Level4-TablesSNF.06.doc* ***(Meeting handout)***
- *snf.06_Level2-12YearsOutput_a.pdf* ***(Meeting handout of Figures 2-1, 2-2, 2-3 and 2-4 for each EY)***
- *snf.06_Level2-12YearsOutput_b.pdf* ***(Meeting handout of Figures 2-1, 2-2, 2-3 and 2-4 for each EY)***

Scenario PSE.21 (SNF.06 with PSE increased flood control offer)
- *Level4-TablesPSE.21.doc* ***(Meeting handout)***
- *PSE.21_Level2-12YearsOutput_a.pdf*
- *PSE.21_Level2-12YearsOutput_b.pdf*

Baker Unregulated and Baker Unregulated/Skagit Regulated (synthesized unregulated inflow)

- *Level4-TablesBRUnregSRReg.doc* ***(Meeting handout)***

Hydrologic and Habitat Indices

In Level 4 post-HYDROPS processing, the hydrologic and habitat indices previously used in Level 2 post-processing and the Baker Summary Comparison Tables are applied to the consecutive 12 Energy Year period (1991-2002) instead of the five representative Energy Years.

- *HydrologySpreadsheetforComparisonTable061804.xls*

Monthly and/or annual values for all 12 Energy Years (EY 1991-2002) for the hydrologic parameters used in the Baker Summary Comparison Tables presented during previous Baker instream flow meetings.

- *EuphoticSpreadsheetforComparisonTable061804.xls* ***(Meeting handout)***

Euphotic Zone Table for all 12 Energy Years (in Excel spreadsheet format). The Euphotic Zone Table provides annual values for the weighted volume of euphotic zone available in each reservoir under each Level 4 scenario.

- *MiddleSkagitRiverRamping.061704.xls* ***(Meeting handout)***

Transect-weighted, reach-averaged, monthly and annual total number of downramp events, and number of downramping events with rates exceeding WDFW Guidelines, one inch per hour, two inches per hour and four inches per hour for Chinook, pink, chum and steelhead using data from 23 transect locations for each Level 4 scenario for each of the 12 EYs.

- *MiddleSkagitRiverVarialZone.061704.xls* ***(Meeting handout)***

Transect-weighted, reach-averaged median monthly and median annual channel width (ft) of total varial zone, based on 12-hr upper extent/12-hr lower extent, 12-hr upper extent/7-day lower extent, and 12-hr upper extent/30-day lower extent using data from 23 transect locations for each Level 4 scenario for each of the 12 EYs.

- *MiddleSkagitRiverSpawningAllSpecies.061704.xls* ***(Meeting handout)***

Transect-weighted, reach-averaged, effective spawning width, effective spawning/incubation width (accounting for redd-scour only), effective spawning/incubation width (accounting for redd-dewatering only), and net effective spawning/incubation width (accounting for both redd-scour and redd-dewatering) for Chinook, pink, chum and steelhead using data from 23 transect locations in the middle Skagit River for each Level 4 scenario for each of the 12 EYs.

- *BakerRiverSpawningFlows.061704.xls* ***(Meeting handout)***

Analyses of Baker River salmonid spawning/incubation hydrologic statistics for Chinook, pink, chum and steelhead for each Level 4 scenario for each of the 12 EYs.

- *SideChannelExceedence.Level4.062204.xls*

Middle Skagit River wetted side channel area for all Level 4 runs. Exceedence data and plots are presented by 2-month periods (Aug-Sep, Oct-Nov, Dec-Jan, Feb-Mar, Apr-May, Jun-Jul), and calculated as the pooled 12-EY data set of daily values for each 2-month period.

- *BackwaterExceedence.Level4.062204.xls*

Middle Skagit River wetted backwater slough area for all Level 4 runs. Exceedence data and plots are presented by 2-month periods (Aug-Sep, Oct-Nov, Dec-Jan, Feb-Mar, Apr-May, Jun-Jul) and calculated as the pooled 12-EY data set of daily values for each 2-month period.

- *IHA Annual Summary.fs03bsnf06pse21.062304.xls* ***(Meeting handout)***
- *IHA Monthly Summary.fs03bsnf06pse21.062304.xls* ***(Meeting handout)***

Index of Hydrologic Alteration (IHA)-type analyses presented as bar charts comparing select annual and monthly hydrologic statistics for Level 4 scenarios to Baker River at Concrete under synthesized unregulated flows, and Skagit River near Concrete under Baker River Unregulated/Skagit River Regulated conditions.

Level 4 IHA-type Statistics (cfs)		
Monthly	**Annual Statistics**	
	Low Flow Indices	**High Flow Indices**
Median monthly	**7-day minimum**	**1-hour max**
Monthly 2-day min.	Baseflow	No. Freshets
Monthly 2-day max.	No. Low pulses	No. High pulses
	Low pulse duration	High pulse duration

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Aquatic Resources Working Group
Technical Sub-committee on Instream Flows

June 24, 2004
9:00 a.m. - 2:00 p.m.

U.S. Forest Service
Conference Room A (425-775-9702)
21905 - 64th Avenue West, Mountlake Terrace, WA

FINAL MEETING NOTES

Meeting Purpose: Develop a process to resolve flow-related issues for Baker River Project relicensing.

Fish Team Leader: Arnie Aspelund, 425-462-3442, aaspel@puget.com

PRESENT: Arnie Aspelund (PSE), Paul Wetherbee (PSE), Phil Hilgert (R2), Gary Sprague (WDFW), Mike Stansbury (Skagit County), Steve Fransen (NOAA Fisheries), Ruth Mathews (TNC), Scott Lentz by phone (USFS), Stan Walsh (SRSC), Irena Netik by phone (Powel Group), Lyn Wiltse, facilitator (PDSA Consulting), and Dawn Schink, (PSE) note taker.

MEETING HANDOUTS (files also available on eRoom)

- *6-24-04 IFG meeting outline.doc*
- *12-YR Hydrologic Summary.060804.xls*
- *Level4-TablesPSE.01.doc)*
- *Level4-TablesFS.03b.doc)*
- *Level4-TablesSNF.06.doc)*
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1) REVIEW MEETING AGENDA

- Background review of 06/30/04 deadline
  - Today's Objectives
- Level 4 Analysis
  - Level 2 Outputs
  - Hydrological & Habitat Indices
- Confirm Regime
- Next Steps

2) POLICY TEAM REPORT

At the last Policy Team Meeting on June 14th, the Policy Team made final revisions to a letter to the Federal Energy Regulatory Commission (FERC) requesting an extension of time to submit a signed Settlement Agreement. Policy Team members then reviewed the milestone dates identified by the Work Plan Teamlet. The Policy Team noted that all PMEs, including selection of an instream flow regime, must be finalized and reviewed by technical working groups and submitted to the Legal Working Group by June 30th.

3) BACKGROUND

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be run through the Level 4 analyses. However, if SNF.09 was more expensive than SNF.04 (less PSE revenue), all parties agreed to use SNF.06 as the default scenario and run SNF.06 through the Level 4 analyses.

Analysis of the SNF.09 scenario indicated that the economic costs were greater than SNF.04. However, rather than immediately defaulting to SNF.06, another alternative (SNF.10) was examined that incorporated a revised TNC modifications for fall minimum flows. During the June 10, 2004 ARWG meeting there was considerable discussion of each of the TNC suggested modifications. Consensus at the end of the meeting was to proceed with Level 4 analyses of SNF.06 (Energy Years 1991-2002). TNC suggested modifications and other potential modifications could be implemented in the future as an element of adaptive management provided the net effect of the modifications was within the cost exposure of SNF.04.

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4) LEVEL 4 ANALYSES

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  Table defining the hydrologic statistics used in the IHA analyses

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	FS.03bL4-2.zip	*SNF.06L4-2.zip*	*PSE.21L4-2.zip*
	FS.03bL4-3.zip	*SNF.06L4-3.zip*	*PSE.21L4-3.zip*
	FS.03bL4-4.zip	*SNF.06L4-4.zip*	*PSE.21L4-4.zip*

4a) 12 Consecutive Energy Year, Level 2 Outputs

Each scenario is then processed to develop Level 2 output for each of the 12 Energy Years. The Level 2 output is contained in the eRoom HYDROPS folder under the Level 4 directory, within the subdirectory for each scenario and identified as .pdf files. EYs 1991 through 1996 are contained in the "a.pdf" file, and EYs 1997 - EY2002 are contained in the "b.pdf" file. As described in the Level 4 Post-Processing memo, a series of tables displaying the results of various hydrologic analyses are presented in a separate file for each scenario. In addition, Level 4 Tables are presented for synthesized Baker Unregulated flows used in the IHA analyses.

Scenario PSE.01 (Recent Conditions)
- *Level4-TablesPSE.01.doc* ***(Meeting handout)***
- *pse.01_Level2-12YearsOutput_a.pdf*
- *pse.01_Level2-12YearsOutput_b.pdf*

Scenario FS.03b (USFS run-of-river)
- *Level4-TablesFS.03b.doc* ***(Meeting handout)***
- F*S.03b_Level2-12YearsOutput_a.pdf*
- *FS.03b_Level2-12YearsOutput_b.pdf*

Scenario SNF.06 (SNF.04 with USFS reservoir mods)
- *Level4-TablesSNF.06.doc* ***(Meeting handout)***
- *snf.06_Level2-12YearsOutput_a.pdf* ***(Meeting handout of Figures 2-1 thru 2-4 for each EY)***
- *snf.06_Level2-12YearsOutput_b.pdf* ***(Meeting handout of Figures 2-1 thru 2-4 for each EY)***

Scenario PSE.21 (SNF.06 with PSE increased flood control offer)
- *Level4-TablesPSE.21.doc* ***(Meeting handout)***
- *PSE.21_Level2-12YearsOutput_a.pdf*
- PSE.21_Level2-12YearsOutput_b.pdf

Baker Unregulated and Baker Unregulated/Skagit Regulated (synthesized unregulated inflow)

- *Level4-TablesBRUnregSRReg.doc* ***(Meeting handout)***

Meeting Discussion

- Phil reviewed the results of previous instream flow meetings and goals of the June 24th meeting.
- The Level 4 analyses provide a continuous 12-year run (Energy Years 1991-2002). Rather than characterizing each of the 12 years as dry or wet, Phil discussed various annual and seasonal hydrologic statistics displayed in the 12-year Hydrologic Summary spreadsheet. He suggested keeping the information handy when reviewing the results of the other analyses.
- The Level 4 analyses start with Level 2 output for each of the 12 Energy Years for each scenario - as shown in graphs and tables included in handouts.
- The group decided to use the scenario handouts for discussion (Level4-Tables*Scenario.*doc)
  - ✓ Output includes results of analyses of FS.03b and Baker unregulated/Skagit Regulated. FS.03b is a run-of-river scenario that includes power production with the existing Project facilities. The FS.03b scenario allows cost comparisons of un-of-river operations to other operational scenarios. As identified in the outputs, while they are very similar, there are some minor differences between FS.03b and Baker Unregulated conditions, such as maximum 1-hour flow statistics.
  - ✓ PSE.01 increased Lower Baker releases in late August compared to mid-September for other scenarios because PSE.01 was not restricted by USFS reservoir pool guidelines. HYDROPS started fall reservoir evacuation early to take advantage of the economic benefits.

Table 4-3 Median Monthly Flows

- PSE.21 and SNF.06 have similar flows except in April. Phil was unsure why the two scenarios exhibited slightly different springtime operations.

Table 4-5 Low Pulses

- The threshold value is based on annual calculations. It is important to identify the location for that threshold value (Upper Baker Reservoir or Baker River near Concrete; Skagit River above Baker River confluence or Skagit River near Concrete).
- Definitions of terms and statistics are in a file on eRoom (*IHA definitions.062204.doc).*
- The group went through the twelve Energy Years looking at how the various operating scenarios handle different hydrologic conditions, and how long potentially stressful conditions persist.
- Stan expressed some concern that in the future the Project may not be operated the same way as the HYDROPS results for a given scenario. PSE noted that the HYDROPS model is designed to optimize economics. The HYDROPS model was extensively modified for the Baker Relicensing task to provide all of the requested Level 4 analyses. While the same model may not be used to guide future operations, PSE intends to operate the Project to optimize economics using the same economic parameters and within the boundaries of the various environmental constraints.

Table 4-6 High Pulses

- The output suggests that during some years there would be a longer duration pulse under SNF.06 than PSE.01. The group questioned whether there was sufficient volume to sustain a pulse of such extended duration. SNF.06 assumes there are three turbines installed at Lower Baker, so it would not necessarily represent constant maximum flow releases of 5,600 cfs. Timing of spring runoff also affects duration of high pulses. For instance, in EY 2002, unusually high Lower Baker releases were sustained for a long time in mid-summer since there was high snowpack volume but a very cold spring that caused relatively low flows through May, then sustained high releases in late June and July when the snowpack finally melted.

Table 4-7 Freshets

- The 3-turbine configuration at the Lower Baker powerhouse appeared to perform as desired; it more closely mimics run-of-river conditions than PSE.01 with its single large unit at the Lower Baker powerhouse.
- SNF.06 and PSE.21 appear to consistently provide a constant Lower Baker release of 1,200 cfs through the month of March. March is typically a low flow month, but there are intermittent freshets. Ruth questioned whether we need to ensure some flow variation to avoid having constant Lower Baker releases during March of 1,200 cfs. Steve responded that the 1,200 cfs represents augmentation over unregulated low Baker River flow conditions and that the Sauk River and other tributaries will ensure that March flow in the Skagit River will still exhibit natural flow fluctuations. The group agreed that they would have looked at this differently if the mainstem Skagit River was not influenced by unregulated tributaries of the Sauk and Skagit Rivers.

Table 4-8 Exceedance

- SNF.06 and PSE.21 are constrained by the USFS reservoir guidelines. Economically, it would be better to start evacuating reservoir storage earlier in the fall, and delay spring refill instead of filling by Memorial Day. There may also be some fisheries benefits to starting fall evacuation a little earlier, or delaying spring refill. These types of minor tweaking, which do not reduce economic return, are envisioned under adaptive management.

Table 4-9 Negative Stage Changes

- Hourly stage changes were calculated for Baker River at Concrete, Skagit River below Baker River confluence (Skagit near Concrete) and Skagit River above Baker River confluence.
- The analyses were based on hourly data. The analyses started with all hourly readings, removed all readings that were static or increasing, and calculated the frequency and magnitude of stage reductions using the remaining hourly data set.
- Natural hourly stage reductions associated with snowmelt are often less than an inch per hour.

Table 4-11 2-Day High Flow

- Effects of flood flows on potential scour of mainstem Skagit River salmonid spawning habitat were the only flood-control related issue addressed by relicensing studies. Are there other impacts to the Skagit River that are of concern when evaluating changes in flood control? Are incremental increases in flood control exceeding some threshold of impact? Steve suggested that the small increase associated with PSE.21 will not be significant. Effects of, and mitigation for, flood control must be addressed by the Corps of Engineers and their local sponsor rather than PSE during relicensing.
- Differences between SNF.06 and PSE.21 are not readily apparent in HYDROPS output. Paul and Phil noted that the Level 4 HYDROPS runs were not intended to isolate and identify the effects of changes in flood control.
- Reservoir pools levels might be adjusted through adaptive management.

Table 4-12 2-Day Low Flow

- One objective of the preferred instream flow regime is to narrow the difference between high releases during the salmon spawning period and low flows during the incubation period.
- Several months during the 12-year period EY 1991-2002 have consecutive days where inflow is less than the minimum flow release. While the HYDROPS modeling suggests there is sufficient storage to always meet instream flows under the EY 1991-2002 period, Stan expressed concern that the utility could generate into a problem during unusual drought conditions. PSE could generate to increase revenue, thus reduce reservoir storage and wind up with insufficient reserve storage to sustain minimum flows during a drought that extends beyond previously experienced duration. Under a worst-case scenario, what would stop utility from generating itself into a condition where it cannot sustain low flow releases? According to anticipated License conditions, if PSE does not meet minimum flow releases, PSE would have to submit a written explanation of the event to the FERC. Stan would like an automatic trigger for the BRCC built into license articles so that BRCC meetings would be called if it appears that minimum flows would not be met.
- Group members related that during earlier discussions, Bob Wright-Ecology had stated that meeting minimum flows would take precedence over maintaining reservoir storage volume for water quality concerns.

4b) Hydrologic and Habitat Indices

In Level 4 processing, the hydrologic and habitat indices previously used in Level 2 processing are applied to the consecutive 12-Energy Year period (1991-2002) instead of the five representative Energy Years. Instead of a Summary Comparison Table that presents a single weighted average of the results of 5 representative Energy Years, tables are presented that display monthly and annual values for each of the analyses:

- *HydrologySpreadsheetforComparisonTable061804.xls*

Monthly and/or annual values for all 12 Energy Years (EY 1991-2002) for the hydrologic parameters used in the Baker Summary Comparison Tables presented during previous Baker Instream flow meetings.

- *EuphoticSpreadsheetforComparisonTable061804.xls* ***(Meeting handout)***

Euphotic Zone Table for all 12 Energy Years (in Excel spreadsheet format). The Euphotic Zone Table provides annual values for the weighted volume of euphotic zone available in each reservoir under each Level 4 scenario.

- *MiddleSkagitRiverRamping.061704.xls* ***(Meeting handout)***

Transect-weighted, reach-averaged, monthly and annual total number of downramp events, and number of downramping events with rates exceeding WDFW Guidelines, one inch per hour, two inches per hour and four inches per hour for Chinook, pink, chum and steelhead using data from 23 transect locations for each Level 4 scenario for each of the 12 EYs.

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Transect-weighted, reach-averaged median monthly and median annual channel width (ft) of total varial zone, based on 12-hr upper extent/12-hr lower extent, 12-hr upper extent/7-day lower extent, and 12-hr upper extent/30-day lower extent using data from 23 transect locations for each Level 4 scenario for each of the 12 EYs.

- *MiddleSkagitRiverSpawningAllSpecies.061704.xls* ***(Meeting handout)***

Transect-weighted, reach-averaged, effective spawning width, effective spawning/incubation width (accounting for redd-scour only), effective spawning/incubation width (accounting for redd-dewatering only), and net effective spawning/incubation width (accounting for both redd-scour and redd-dewatering) for Chinook, pink, chum and steelhead using data from 23 transect locations in the middle Skagit River for each Level 4 scenario for each of the 12 EYs.

- *BakerRiverSpawningFlows.061704.xls* ***(Meeting handout)***

Analyses of Baker River salmonid spawning/incubation hydrologic statistics for Chinook, pink, chum and steelhead for each Level 4 scenario for each of the 12 EYs.

- *SideChannelExceedence.Level4.062204.xls*

Middle Skagit River wetted side channel area for all Level 4 runs. Exceedance data and plots are presented by 2-month periods (Aug-Sep, Oct-Nov, Dec-Jan, Feb-Mar, Apr-May, Jun-Jul), and calculated as the pooled 12-EY data set of daily values for each 2-month period.

- *BackwaterExceedence.Level4.062204.xls*

Middle Skagit River wetted backwater slough area for all Level 4 runs. Exceedance data and plots are presented by 2-month periods (Aug-Sep, Oct-Nov, Dec-Jan, Feb-Mar, Apr-May, Jun-Jul) and calculated as the pooled 12-EY data set of daily values for each 2-month period.

Meeting Discussion

- Phil went through and discussed each handout. In general, the results of the 12 consecutive Energy Year runs were consistent with the results of the five representative Energy Year runs.
- Some downramping violations would occur even under Baker unregulated conditions, especially since State downramping guidelines prohibit stage reductions during springtime daylight hours.

- Skagit River Project (FERC No. 553) and Baker River Project's downramping completely overlaps less than 10 times a year.
- Baker River Project operators will use three different ramping rates to govern Lower Baker powerhouse operations under low, medium and high flow conditions. Operators will have to look at the Skagit River near Concrete gage to know what downramping rate they should follow.
- The extent of varial zone in SNF.06 is greater (more impact) than in FS.03b, but less than PSE.01.
- 12 hour – 12 hour analyses indicate the effects of flow fluctuations on aquatic organisms with rapid colonization rates, such as downstream-migrating salmonid fry.
- 12 hour – 7 day analyses indicate the effects of flow fluctuations on aquatic organisms with moderate colonization rates, such as aquatic invertebrates.
- 12 hour – 30 day analyses indicate the effects of flow fluctuations on aquatic organisms with long colonization rates, such as recovery of a nearly complete assemblage of aquatic invertebrate species. However, this longer-term period tends to mask differences between scenarios.
- Dewatering is based on an evaluation of 23 transects weighted by the proportion of channel they represent, adjusted for travel time and accretion and reach-averaged. Suitable spawning habitats are identified using substrate codes and the results of spawning surveys. On an hourly basis, do fish have physical access to those cells during the spawning period? If so, that cell is tracked to identify whether that cell was dewatered over a continuous 48-hour period, or scoured by high flow events through the incubation period (for example, 120 days for chum salmon).
  - ✓ Most of the time, Baker Project releases have little impact on the Skagit River since the Baker River contributes an annual average of 18 percent total Skagit River runoff. However, during low flow periods in the mainstem Skagit River, daily flow releases from the Lower Baker powerhouse can represent up to 50 percent of mainstem Skagit River flows.
  - ✓ The critical downramping flow is 26,000 cfs in the Skagit River above the Baker River confluence. The 26,000 cfs value was derived assuming a critical downramping flow of 30,000 cfs at the Skagit River near Concrete minus the Baker River contribution (assumed to be 4,000 cfs).
  - ✓ Stan believes that salmonid spawning tends to stop when flows in the mainstem Skagit River above the Baker River confluence exceeds 26,000 cfs.
  - ✓ In general, SNF.06 is slightly better than FS.03b (run-of river) for salmonid spawning/incubation, since winter peak flows are reduced and winter low flows are augmented.
  - ✓ SFN.06 particularly benefits chum salmon, because the higher minimum flows keep redds covered.
- Baker River hydrologic index of spawning/incubation
  - ✓ This statistic is a holdover from early attempts to ensure that Baker River incubation flows are at least 50 percent of flows released during the spawning period. The index is a hydrologic statistic and is not tied to any physical habitat measurement.

- ✓ The 30 percent values appear to provide more protection than the 50 percent values, but this is misleading since the 30 percent value simply assumes that redds can withstand a greater degree of dewatering.
- ✓ Even under Baker unregulated conditions, flow releases during the incubation period are less than 50 % of the spawning flows.
- ✓ Redd survival assumptions are critical to understanding hydrologic indices. The indices are of limited value in Baker River relicensing discussions since physical habitat measurements and modeling based on 23 transects in the middle Skagit River are available.

4c) IHA-Type Analyses

- *IHA Annual Summary.fs03bsnf06pse21.062304.xls* ***(Meeting handout)***
- *IHA Monthly Summary.fs03bsnf06pse21.062304.xls* ***(Meeting handout)***

Index of Hydrologic Alteration (IHA)-type analyses presented as bar charts comparing select annual and monthly hydrologic statistics for Level 4 scenarios to Baker River at Concrete under synthesized unregulated flows, and Skagit River near Concrete under Baker River Unregulated/Skagit River Regulated conditions.

Level 4 IHA-type Statistics (cfs)		
Monthly	**Annual Statistics**	
	Low Flow Indices	**High Flow Indices**
Median monthly	7-day minimum	1-hour max
Monthly 2-day minimum	Baseflow	Number freshets
Monthly 2-day maximum	Number low pulses	Number high pulses
	Low pulse duration	High pulse duration

Meeting Discussion

Phil and Ruth noted that Table 4-13 IHA Summary Data in the Level 4 files for each scenario contain the data used to develop the IHA charts and graphs. Ruth took the group through the packet of graphs

- Ruth reiterated that the IHA values were proposed as descriptive rather than prescriptive tools. The IHA can be used to identify natural flow patterns. Proposed flow regimes can then be developed that mimic, as much as possible or as much as desired, those natural flow patterns.
- Ruth noted that the Index of Hydrologic Alteration (IHA) for low flow values were about the same between PSE.01 (Existing Conditions) and SNF.06; although where PSE.01 had minimum flows that were lower than unregulated conditions, SNF.06 had low flows that were higher than unregulated

conditions. This is the result of changing minimum releases from 80 cfs (PSE.01) to 1,000 or 1,200 cfs (SNF.06) – where unregulated low flows were often in the 600 cfs range.

- Looking for patterns, or anomalies, in the continuous 12-Energy Year runs may identify problems where operational guidelines specific to a scenario do not adequately handle hydrologic conditions.
- One critical area of evaluation was to confirm that the Baker Project was able to sustain minimum flow releases through the 12-year period.
- The IHA increments are a proportional change and are essentially unit-less. Ruth suggested investigating changes where unit values exceed 0.5. High values of IHA are not necessarily bad, but indicate change from natural conditions and should be examined to ensure the change is intentional.

5) COMMENTS

- **Everyone in the room agreed that SNF.06 is the preferred operational scenario.**
- The only changes between SNF.04 and SNF.06 are the USFS pool elevations for recreation.
- Adaptive management must be incorporated into the draft PME language to allow minor adjustments - provided the net effect does not increase PSE's economic exposure. Ruth is concerned that the ARWG keeps talking about adaptive management, without it being documented and the lawyers knowing about it.
- Scott requested that the adaptive management description include a monitoring component.
- Phil noted that clearly identifying the commitments and boundaries of adaptive management would provide protection for PSE and the agencies, tribes and non-governmental organizations.
- It will be the responsibility of the Corps of Engineers and Skagit County to evaluate the effects of additional flood control at the Baker Project.
- Steve and Stan have not identified any major concerns with PSE.21.

6) NEW ACTION ITEMS

1. All – Get comments on study A-2 (Lower Baker River Habitat & Fish Use) by the August 12 ARWG meeting (draft report handed out during the June 24 meeting)
2. Arnie – Remind Cary of his Action Item (Emergency conditions, language, etc)
3. PDEA downramping language needs to be fixed. The critical downramping flow is 26,000 cfs in the Skagit River above the Baker River confluence. The 26,000 cfs value was derived assuming a critical downramping flow of 30,000 cfs at the Skagit River near Concrete minus the Baker River contribution (assumed to be 4,000 cfs).
4. Cary – Draft language describing adaptive management protocols.
5. Cary – Completely update this PME license article.