COLUMBIA RIVER FORECAST GROUP

2012
ANNUAL
REPORT

CHAIRMAN: KYLE DITTMER, CRITFC
VICE-CHAIR: ERIK PYTLAK, BPA

APRIL 18, 2013

COLUMBIA RIVER FORECAST GROUP

2012 ANNUAL REPORT

SUMMARY

The Columbia River Forecast Group (CRFG) was formed to work to promote and support the advancement of forecasting skill, products, and techniques in the Columbia River Basin for the purpose of improving reservoir operations for the benefit of the region and as prescribed and documented in the Columbia Basin Fish Accords and 2008 Federal Columbia River Power System (FCRPS) Biological Opinion (BiOp), Reasonable and Prudent Alternative (#7) as shown below.

> ***RPA Action 7 – Forecasting and Climate Change/Variability:*** The Action Agencies will hold annual forecast performance reviews looking at in-place tools for seasonal volume forecasts and to report on the effectiveness of experimental or developing/emerging technologies and procedures. As new procedures and techniques become available and are identified to have significant potential to reduce forecast error and improve the reliability of a forecast, the Action Agencies will discuss the implementation possibilities with regional interests. The purpose is to improve upon achieving upper rule curve elevations by reducing forecasts errors and thereby providing for improved spring flows…

The Action Agencies and Fish Accord partners formed the Columbia River Forecast Group (CRFG) to collaboratively implement this RPA action. To address the RPA, the CRFG has provided an open forum for sharing, discussing, evaluating and potentially implementing new forecasting techniques, supporting procedures, and information into the planning and operation of the Columbia River Basin system. The term "forecasting" refers to both water supply forecasting and streamflow forecasting.

The CRFG developed a charter, organizational structure, expectations, and strategies in 2009. Under the terms of the charter, the CRFG is open for participation from any representative of a governmental organization, academic institution, or invited guests of the CRFG who are willing to contribute to the effectiveness and success of the group. The CRFG conducted four business meetings in 2012 and hosted by CRITFC: February 17, July 23, November 26 (field trip), and November 17 (annual review). Each meeting provided a forum to review the current runoff forecasts (or performance), discuss topics of common interest, and to hear speakers on topics related to water supply forecasting. Meetings were attended by staff from BC Hydro, Bonneville Power Administration (BPA), Bureau of Indian Affairs (BIA), Columbia River Inter-Tribal Fish Commission (CRITFC), Corps of Engineers (COE), Fish Passage Center (FPC), National Oceanic and Atmospheric Administration (NOAA) Fisheries, Natural Resources Conservation Service (NRCS), Northwest River Forecast Center (NWRFC), Oregon Dept. of Fish and Wildlife (ODFW), U.S Bureau of Reclamation (USBR), and U.S. Geological Survey (USGS).

TOPICS FOR DISCUSSION

Topics and discussion covered a wide range of interests and included:

- Review and discussion of current forecasts (winter/summer meetings) with a focus on forecast errors and challenges; summaries of snow and precipitation patterns.
- Formulation of possible 2012 CRFG activities and work elements.
- Loss of Monitoring Sites, Hydromet/WSF Variability and Operations.
- Implications of CSHS Hydro Forecasting Workshop, Vancouver BC, Oct. 2011.
- Systematic Evaluation of Forecasts.
- Coordination of NRCS and NWS-NWRFC WSFs for 2012 onward…new policy.
- BC Hydro Climate Change Study.
- 2010 Modified Flows Data Mining Project: Climate Change Signal Search.
- Field Trip to the former Condit Dam site.
- Columbia River Treaty Review and Forecasting.
- 2013 pre-season water supply forecasts.
- Summary of 20th Annual OR-AMS Winter Weather forecast meeting.
- Implementation of the updated 30-year averages data set (1981-2010).
- Updates on Canadian SNOTEL, future NWRFC forecast products, CRFG website.
- The 2012 wrap-up and review of runoff forecasts, comparison of results, discussion of challenges, and lessons learned.

PRESENTATION HIGHLIGHTS

Various guest speaker presentations were well received and appreciated by the group:

- David Garen, NRCS, *Implications of CSHS Workshop*. There is a gap between research community and operational hydrology. Issues – randomization of initial conditions for model input, uncertainty on model parameters, etc.

- Tracy Schwarz, COE (Walla Walla), *Status on New Dworshak Forecast*. Some CRFG members commented on the new procedure in 2011 and were considered by the COE. The "Z-score" method now replaces the Principal Component Analysis.

- David Garen, NRCS, and Randy Wortman, COE (Portland), *Systematic Evaluation of Forecasts*. Study questions: (1) What metrics should we have for forecast evaluations? (2) What is the framework? (3) Understand any spatial patterns?

- Rashawn Tama, NRCS, and Steve King, NWS-NWRFC, *Coordination of WSF*. Responsibilities have shifted with NWRFC – they will no longer coordinate their WSFs with the NRCS. NWRFC wants to run their models separately, but still discuss forecast issues and have more of an interactive approach.

- Stephanie Smith, BC Hydro, *BC Hydro Climate Change Study*. By 2050, inflow could drop up to 50% by late summer (even as mean flow increases 17%), more winter rain events and earlier freshets, based on eight new GCM model run results.

- Erik Pytlak, BPA, *2010 Modified Flows Data Mining Project*. Results were inconclusive, but early spring runoff may have begun to shift a little earlier in Canada over the past 80 years. Spring runoff in Canada may also be ending a few days sooner in the summer over time.

- Michael Lewis, USGS, *USGS Idaho Water Science Center*. IWSC gathers reliable and timely information about Idaho's water resources. Primary activities: (1) long-term data collection (using improved hydroacoustic tools), and (2) interpretive studies. The 255 streamgages in Idaho are the foundation of the data program.

- Gus Goodbody, NRCS, *Statistical model performance vs. ESP*. Study questions: (1) How good are the error bounds (10% and 90%)? (2) Can additional forecasts be combined to improve the overall ensemble? Western U.S. WSF project goals: new insight about forecast components, access to components, objective combination of forecasts, how to incorporate additional forecasts to the ensemble.

- Erik Pytlak, BPA, *Columbia River Treaty Review and Forecasting*. Two RMJOC climate change studies are being utilized in the CRT-2014 review process – the wettest and warmest of the set, then the driest with slightly less warming in the set.

- Steve King, NWRFC, *Updates from the NWRFC*. (1) New 30-year normals to go "live" on Jan. 1st, 2013, (2) Proposed changes to Published Runoff Locations, (3) Precipitation Processor – new line-up of the PP divisions with WSF basins .

ACCOMPLISHMENTS

CRFG work accomplishments and ongoing studies or issues the CRFG will continue to address:

- **Discussion of in-season forecasts.** It has been, and continues to be, extremely useful to see how the forecasts are tracking, and why conditions play out the way they did. Every season is different and sharing that wisdom in real-time has value.

- **Loss of Monitoring Sites.** The cooperative station network continues to degrade on both sides of the border. It is unclear what can be done to reverse this trend, given the growing importance of hydro-met information and water management, but also given the lack of replacement volunteers who live in one location for many decades. CRFG should talk with the Columbia River Treaty Hydromet Committee and BC Hydro for ideas.

- **Systematic Evaluation of Forecasts.** We talked about the best approach to do verification, based upon the professional views and experience of each agency. Unfortunately, due to the retirement of Randy Wortman (COE) who was spearheading the effort, and the group's key members who did not have the time in 2012 to conduct this study, we were unable to move forward. However, Andy Wood, the new DOH (science officer) at the NWS-NWRFC, is very interested in such a project. So, we may see progress in 2013.

- **Coordination of Water Supply Forecasts.** The NRCS and NWS-NWRFC have been coordinating WSF since the early 1970s. With the NWRFC now going on its own path, will this result in better or worse WSF products for the region? How will this impact WSF standardization? Both agencies should track the user response and concerns.

- **BC Hydro Climate Change Study.** The results are a "wake-up call" that we, as a region, need to pay very close attention to changing hydro- meteorological conditions in the far north of the Columbia Basin. The in-house study conducted by BPA generally supports the conclusions of the BC Hydro study that close monitoring for climate change-induced changes in streamflow needs to intensify.

- **Statistical model performance vs. ESP.** The new trend is the feasibility of combining multiple forecast methods, but how does one compare the forecast performance in a meaningful way?

- **Resurrected field-trip meeting.** This tradition that was highly valued by our predecessor group, the Columbia River Water Management Group. CRFG Chairman Kyle Dittmer proposed a day-trip to Condit Dam to tie together WSF, streamflow, and altered river hydraulics, due to the 2011 breaching of Condit Dam. The new 2013 Chairman and subsequent chairs are encouraged to run a field trip.

- **Finalized the CRFG 2011 Annual Report on the group's activities that includes an appendix that will track WSF performance each year**. Future Chairs are encouraged to get the annual report done by January of the following year.

A P P E N D I X A

Columbia River Forecast Group (CRFG)

The following pages document the CRFG Charter approved on July 21, 2009.

CRFG CHARTER

I. Purpose

The Columbia River Forecast Group will work to promote and support the advancement of forecasting skill, products, and techniques in the Columbia River Basin for the purpose of improving reservoir operations for the benefit of the region and as prescribed and documented in the Columbia Basin Fish Accords and 2008 FCRPS Biological Opinion, Reasonable and Prudent Alternative (#7). It will also provide an open forum for sharing, discussing, evaluating and potentially implementing new forecasting techniques, supporting procedures, and information into the planning and operation of the Columbia River Basin system. The term forecasting will refer to both water supply forecasting and streamflow forecasting.

II. Composition

The CRFG will be composed of technical representatives from the AAs, namely the BPA, the USACE, and the USBR, as well as the parties to the Fish Accords. The CRFG will also be open for participation from any representative of a governmental organization, academic institution or invited guests of the CRFG, who are willing to contribute to the effectiveness and success of the group.

The Chair of the CRFG will be a representative from the three AAs or Fish Accord Tribes. The Chair position will rotate annually among these four representative organizations or groups following the Fall Workshop.

III. Meetings and Workshops

A general business meeting will occur no less than quarterly but more frequently if workload and projects require it. Meetings and workshops will be called at the discretion of the Chair.

In addition to business meetings, there will be an Annual CRFG Meeting in the fall to review the performance of various operational and experimental forecast procedures over the previous water year, to report on any new approved procedures being implemented in the next year, and to plan committee work for the coming year.

IV. Functions

1. Facilitate the sharing of information and research pertinent to the improvement of forecasting for the Columbia River Basin, namely in the areas of water supply forecasting, operational streamflows forecasting, data quality and availability, weather forecasting (as it pertains to improving water supply and streamflow forecasting), and climate change.

2. Track and review the performance of current forecasting procedures and techniques, as well as sharing, discussing, and investigating the potential of new forecasting techniques and modeling.

3. When promising research or techniques are discovered and introduced for consideration, the CRFG will develop a strategy for either investigating the potential improvement with available technical staff within the CRFG or provide recommendations or proposals to the AAs for possible funding and support for further research and development.

4. The group will participate in the evaluation of proposed new forecast procedures, models, and techniques and provide recommendations on the incorporation of new procedures into the planning and operation of the Columbia River system.

5. Facilitate the sharing of data, where possible, and the monitoring of the data network and systems which enhance and support the forecasting capabilities of the region. When necessary, the group will provide recommendations on improvements and enhancements to the network.

6. When necessary, the group will plan and facilitate workshops with presenters speaking on current research and forecast projects. The group will also have a role in educating users on forecasting products and on specific focus areas, providing the technical expertise and platform for conducting seminars and workshops on various topics pertinent to the group's purpose.

V. <u>Reporting</u>

1. The CRFG will produce minutes of each official meeting for distribution to the group and for the purpose of summarizing the group's activities and achievements at the end of the year.

2. The CRFG will produce an annual summary of the group's activities, achievements, and recommendations no later than 4 months after the end of the water year. This report will be the basis for annual reporting required for the Biological Opinion and Fish Accord records.

3. The organization chairing the CRFG will be responsible for meeting notes and annual reporting at the end of the water year.

A P P E N D I X B

Columbia River Forecast Group - 2012 Meetings

The following meetings took place for the CRFG.

17 February 2012
23 July 2012
26 November 2012 (field meeting, Condit Dam, near White Salmon, WA)
27 November 2012 (Annual Review)

Reviewed and finalized Meeting notes are as follows:

Date: February 17, 2012, 8:30 am – 3:00 pm PST

Location: Columbia River Inter-Tribal Fish Commission, Celilo Room (basement conference room), 729 NE Oregon St, Suite 200, Portland.

Call in Number: (503) 326-7668 (GSA line…no access code required)

Contact: Kyle Dittmer (503) 731-1314, CRITFC

1. Introductions, logistics, Nov. 2011 notes – CRFG Chairman Kyle Dittmer (08:30 - 08:45)

2. Review and Discussion of 2012 forecasts, by agency. (~ 15 min. each) (08:45 – 10:15)

COE:	Kristian Mickelson (LIB), Steve Hall (DWR), and other points (TDA)
USBR:	Ted Day (GCL, HGH, Upper-Snake)
NRCS:	Rashawn Tama, Dave Garen
NWS/NWRFC:	Invited…TBA
BC Hydro:	Adam Gobena
CRITFC:	Kyle Dittmer (TDA)

Discussion: current hydromet conditions and trends, forecast uncertainty, and forecast improvement(s).

<<<BREAK TIME>>> Homemade Refreshments (10:15 – 10:30)

3. Status of 2011 CRFG Report (Ted Day – USBR Boise) (10:30 – 10:45)

4. Summary and Proceedings of CSHS Hydro Forecasting Workshop – Questions/Discussion?
http://www.cwra.org/branches/CSHS/PostCSHSWorkshopPresentation2011.aspx (10:45 – 11:00)

5. Status on new DWR forecast and Report (Tracy Schwarz - COE) (11:00 – 11:15)

6. Other forecast issues for 2012? (11:15 – 11:30)

<<<LUNCH…on your own>>> (see attached flyer) (11:30 – 12:15)

7. Systematic Evaluation of Forecasts (R. Wortman - COE, D. Garen - NRCS) (12:45 – 1:00)

8. Coordination of WSF for 2012 (R. Tama – NRCS; NWRFC Rep.) (1:00 – 1:30)

9. "The Sampler"…Probabilistic WSF and Decision-making…scoping input (D. Garen); Loss of Monitoring Sites, Hydromet/WSF Variability and Operations; (K. Dittmer) (1:30 – 2:30)

10. 2012 draft work plan (K. Dittmer) (2:30 – 2:45)

11. Other business: CGU Workshop; future agenda items, etc. (2:45 – 3:00)

12. Meeting Adjourned (3:00)

Columbia River Forecast Group–Winter Meeting, CRITFC, Portland, Oregon, Feb. 17, 2012

Introductions:
Chairman Kyle Dittmer welcomed everyone at 8:30 am. The 13 attendees introduced themselves.

Review & Discussion of 2012 Forecast Procedures and Performance:
COE (Steve Hall)…Dworshak forecast was 2504 KAF, 93% of normal, April-July (using the 2005 Principal Components Analysis method). Forecast is likely to drop in March. COE is running the "Z-score" method in parallel.

COE (Joel Fenolio)…Libby forecast was 5700 KAF, 97%, April-Aug. The observed BC snow packs are 100-107% of normal.

USBR (Ted Day)…Snow-packs in the Upper Snake started to catch up by late-January, but we are falling behind again. HGH Jan. 92% (PCA, Linear Regression match up), Feb. 97% (regression), 100% (PCA). Snow-packs are good in the Yakima basin but in decline in the Upper-Middle Snake.

NRCS (Rashawn Tama)…A SWE map was shown. Poor SWE values exist in southern Oregon, Idaho.

BC-Hydro (Adam Gobena)…Upper-Columbia snow is above normal but with a large snow-pack gradient. February has been dry in the Upper-Columbia. Southern BC is a concern.

CRITFC (Kyle Dittmer)…The MEI forecast method, for the Columbia River at The Dalles, offers 117 MAF, 109%. A MEI graph shows that La Niña likely hit its peak in January.

NWS-NWRFC (Steve King)…Precipitation is near normal in Washington, above normal in Upper-Columbia, western Montana, and below normal in southern Oregon, Idaho. The SWE increased 10% in the Yakima, Upper-Columbia, and western Montana. La Niña is likely to transition to ENSO-Neutral in March-May. The latest CPC forecast is for "equal chances" of near normal weather in FEB and MAR-APR-MAY. A new ESP 10-day QPF is ready – soon to be on the NWRFC website. Latest ESP forecasts: LIB 96%, HGH 85%, GCL 93%, LWG 83%, DWR 89%, TDA 89% (rank 34/52).

Status of 2011 Annual CRFG Report, Ted Day (USBR):
Work in progress...still gathering documents. He will likely follow the 2009, 2010 Reports.

CSHS Workshop, David Garen (NRCS):
He will submit a paper to the Canadian Water Resources Journal. The workshop showed the gap between research community and operational hydrology. Issues – randomization of initial conditions for model input, uncertainty on model parameters, etc.

Prof. Hamid Moradkhani's talk covered post-processing ensembles to reduce uncertainty of forecast (in cooperation with NRCS and NWRFC staff). Will there be another conference of this kind? Unknown, but if the BC folks are not able to do so, then perhaps the U.S. side should consider hosting.

Status on New Dworshak Forecast, Tracy Schwarz (COE):
The CRFG gave comments last summer. SOI combined with precipitation does improve the forecast, but only through the April forecast. In May, method switches to SWE only. We have moved from a duel to single forecast, with PCA run in the background. Patty noted that RPA-7 calls for a reduction in forecast errors, using new forecast procedures. Erik said look for RSME (Root Mean Square Error) improvements as generally used in the Columbia River Treaty Hydromet Committee. There is a 2% difference between the PCA and Z-score methods. How would "deviation required" change, using multi-models vs. single model?

Other Forecast Issues for 2012…None…at this time!

Systematic Evaluation of Forecasts, David Garen (NRCS) and Randy Wortman (COE):
Randy explained the "Draft Scope of Work to the CRFG" handout. They need 3-5 helpers to do the work. Hope to refine scope of work by April. Work load is 2-5 weeks per helper. We are reviewing Adam Gobena's paper on evaluation metrics. David asked us to consider (1) What metrics should we have for forecast evaluations?, (2) What framework?, and (3) Understand any spatial patterns? We are trying to better understand the Columbia at The Dalles forecast and other key points. Steve Hall asked how climate change will be addressed in a forecast? Randy noted that the COE doesn't have a historical forecast database set up for its projects (but the USBR does). Adam has volunteered (thanks). Rick (BPA) and Steve King (NWRFC) will see if they can assist.

Coordination of 2012 WSF, Rashawn Tama (NRCS), Steve King (NWRFC):
Responsibilities have shifted with NWS-NWRFC. The NWS-NWRFC will no longer coordinate their WSFs with the NRCS. They want to run their models separately, but still discuss and note issues and have more of an interactive approach. Most issues have been in logistics: different forecast periods, forecast release dates, 3-day vs. 10-day QPF, incorporation of ESP (one per week) vs. Linear Regression forecasts (one per month), etc. NRCS will not publish COE forecasts. NRCS will be consistent with its forecasts in the State and Westwide publications. NRCS has headwater points while the NWRFC has some headwater points but all downstream summation points (e.g., PRD, LWG, TDA). This decision by the NWRFC is for the Columbia Basin and not nation-wide.

Probabilistic WSF and Decision-making…scoping input, David Garen (NRCS):
How are decisions being made, based on WSF information? What about probabilistic results? Would a survey of users be of use? User groups – operational hydrologists, fish, agriculture, power. David will draft up some survey questions.

Loss of Monitoring Sites, Kyle Dittmer (CRITFC):
The degradation of the network of cooperative sites has been going on for 20+ years and seems to be getting worse. Even reporting of closed (or soon to close) sites is bad – poor external agency notification. A systematic inventory of closed stations is something that

the Columbia River Treaty – Hydromet Committee and BC Hydro has done. We should ask Ann McManamon (BPA) for the latest inventory for the CRFG to review. Randy asked, "Should the CRFG have a higher visible role in the Hydromet Committee?" The real-time data is very useful as an early warning trigger for Climate Change and Variability.

Hydrometeorological and WSF Variability and Operations, Kyle Dittmer (CRITFC):
How much of this variability is due to natural cycle processes? Is the variability increasing, decreasing? How long does a trend have to be for "significance?" Give some thought on these points. Daily updated forecasts are good, but more operational flexibility is needed.

2012 Draft Work Plan, Kyle Dittmer (CRITFC):
The draft was reviewed. Rashawn suggested that Gus Goodbody (NRCS) to talk about "ESP trace error/bias" and "Statistical vs. volume WSF approach." Kyle will follow-up on Gus. Randy offered to meet with the Salmon Managers at FPAC to discuss their WSF issues. "Limits to Forecasting" was also offered as a possible topic.

Other Business, Kyle Dittmer (CRITFC):
Kyle shared a flyer of the June 5-8 CSHS/CGU Workshop in Banff Alberta (www.elements2012.ca). Anyone who knows of an upcoming hydro workshop please notify Kyle so the CRFG can be promptly notified. For future meetings, he will see about Thursdays, to help dovetail with other meetings on Wednesdays. Meeting was adjourned at 2:45 pm.

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Attendance:
Day, Ted – USBR (Boise)
Dittmer, Kyle – CRITFC (Portland)
Filardo, Margaret – FPC (Portland)
Garen, David – NRCS (Portland)
Gobena, Adam – BC Hydro (Vancouver, BC)
Hall, Steve – COE (Walla Walla)
Low, Patti – COE (NW Division)
King, Steve – NWS/NWRFC (Portland)
Fenolio, Joel – COE (Seattle)
Pytlak, Erik – BPA (Portland)
Schwarz, Tracy – COE (Walla Walla)
Tama, Rashawn – NRCS (Portland)
Wortman, Randy – COE (Portland)

Absent:
NPCC
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Note-taker: Kyle Dittmer, Columbia River Inter-Tribal Fish Commission, Portland, Oregon
Revised February 24, 2012

Date: July 23, 2012, 8:30 am – 3:00 pm PDT

Location: Columbia River Inter-Tribal Fish Commission, Celilo Room (basement conference room), 729 NE Oregon St, Suite 200, Portland.

Call in Number: (503) 326-7668 (GSA line…no access code required)

Contact: Kyle Dittmer (503) 731-1314, CRITFC

1. Introductions, logistics, Feb. 2012 notes – CRFG Chairman Kyle Dittmer (08:30 - 08:45)

2. Challenges of 2012 Forecast Season, by agency (~ 15 min. each) (08:45 – 10:00)

COE: Kristian Mickelson (LIB), Steve Hall (DWR), and other points (TDA)
USBR: Ted Day (GCL, HGH, Upper-Snake)
NRCS: Rashawn Tama, David Garen
NWS/NWRFC: Steve King (*invited*)
BC Hydro: Adam Gobena
Discussion: What went right/wrong? Forecast uncertainty? Suggested forecast improvement(s)?

3. Annual CRFG Field Trip? (Kyle Dittmer, CRITFC) (10:00 – 10:15)

<<<BREAK TIME>>> Homemade Refreshments (10:15 – 10:30)

4. BC Hydro Climate Change Study (Stephanie Smith, BC Hydro) (10:30 – 11:00)

5. 2010 Modified Flows Data Mining Project: Climate Change Signal Search (Erik Pytlak, BPA) (11:00 – 11:30)

6. Status…Systematic Evaluation of Forecasts (David Garen, NRCS) (11:30 – 11:40)

<<<LUNCH…on your own>>> (see attached flyer) (11:40 – 12:40)

7. Status of 2011 CRFG Report…CRFG Review? (Ted Day, USBR) (12:40 – 1:00)

8. USGS Idaho Water Science Center (Michael Lewis, USGS) (1:00 – 1:30)

9. "The Sampler"…CSHS Workshop & Tech-Paper (D. Garen), Update on Canadian SNOTEL Initiative (E. Pytlak), Probabilistic WSF and Decision-making…scoping input (D. Garen); CSHS/CGU Workshop (all); 2012 Work Plan (K. Dittmer) (1:30 – 2:30)

10. Statistical model performance vs. ESP (Gus Goodbody, NRCS…*invited*) (2:30 – 2:50)

11. Other business: future agenda items, etc. (2:50 – 3:00)

12. Meeting Adjourned (3:00)

Columbia River Forecast Group–Summer Meeting, CRITFC, Portland, Oregon, July 23, 2012

Introductions:

Chairman Kyle Dittmer welcomed everyone at 8:35 am. The 20 attendees introduced themselves.

Challenges of 2012 Forecast Season:

COE (Steve Hall)…Dworshak forecast was 3236 KAF, 121% of normal, April-July (using the 2005 Principal Components Analysis method). Forecast started dry then quickly turned wet by late spring. COE is running the "Z-score" method in parallel. Results are close to PCA method. The mid-month forecast procedure has been side-lined for now due to development effort on Z-score method (which can do a mid-month forecast).

COE (Kristian Mickelson)…Libby forecast was a moving target this season: 5000 KAF (early winter), then 7100 MAF for May forecast, then the June forecast lands at 7240 MAF, 123%, April-Aug. Weather factors include the combination of rain and snowmelt was the highest since 1974. Record 1.5-inch above normal precipitation occurred in June at Bonners Ferry.

USBR (Ted Day)…There were similar weather impacts to HGH (June precipitation 200%). HGH was prepared to go to a 1-foot surcharge, but only 0.4-foot was used. Columbia Falls ran near flood stage for the latter half of June. The Boise River basin started with a late ski-season opening, a benign winter, then 200% above normal precipitation in March with 1000 cfs above flood stage for two weeks. The Yakima basin had good snow-packs, precipitation, and runoff.

NRCS (Rashawn Tama)…In southern Oregon, a dry winter was followed by a wet March. As reported before, the NRCS and NWS no longer will conduct coordinated forecasts, but "collaborative" forecasts. Both agencies will hold a post-season meeting to discuss impacts.

NWS-NWRFC (Steve King)…This was a very unusual winter and spring. We made the switch from regression based forecasting to ESP. Office is now running CHPS (Community Hydrologic Prediction System, http://adsabs.harvard.edu/abs/2010AGUFM.H53H..05G), a lumped hydro model (similar to NWSRFS), which many agencies can participate and share. We helped BPA spin-up a CHPS program for their operations. A major challenge is data quality.

BC-Hydro (Adam Gobena)… BC-Hydro (Adam Gobena)…Upper-Columbia saw highly variable snow and rain across the season, with 100-250% being typical. The June WSF for Mica was 122% for the Feb-July period. Challenges include weather extremes, forecast updates (1/3 of June's rainfall had already passed by the time the WSF forecast came out on June 6, but the runoff response from this rainfall was not included in the WSF!), incomplete snow info. (esp. at high elevations). We have been using the MODIS

snow cover extent as a visual aid to assess snow cover since this spring. Extended cloud covered periods and possibly forest cover confound the utility of the composite images.

Group discussion…Kyle said it was hard to see any "rules" of the season, now three years in a row. Stephanie said there is a weak connection of summer-to-summer weather patterns. Erik said June was hard to manage (high runoff with intense local precip events). Steve H. said we need to protect existing precipitation stations (esp. the long term ones).

Annual CRFG Field Trip? Kyle Dittmer (CRITFC)

Our predecessor, the Columbia River Water Management Group, offered an annual field trip. We should resurrect this fine tradition. The CRWMG trip was usually in June, but we can go whenever. Challenges are work schedules and funding. Kyle said that past CRWMG field trips emphasized water management challenges or case-studies…we can build upon that legacy and also consider sites with fish impacts. Kyle offered to have us go to Condit Dam, perhaps in mid-October. He will poll members soon as to schedules and availability.

BC Hydro Climate Change Study, Stephanie Smith (BC Hydro):

Various climate change assessments have been vetted by the RMJOC, UW-CIG, Western Canadian Cryosphere Network (W2CN), and the Pacific Climate Impacts Consortium (PCIC, http://pacificclimate.org). Studies emphasize multiple basin hydroclimate trend analysis. Results: BC has warmed 1.2 degC, precipitation increased 20% in autumn-winter-spring, April 1st SWE decreased 18%, and glacial area declined 11% (1985-2005). There are no runoff trends. Method – output of suite of Global Circulation Models was then statistically downscaled for regional hydro models. Scope – Willison basin, UC – Mica basin, Kootenay – Libby basin. By 2100, 50-100% of the glaciers in Mica will entirely melt. A PCIC 2050 study shows mean flow increasing 17%, with similar results from the CIG (+4%) and WC2N (+7%). By 2050, inflow could drop up to 50% by late summer, see more winter rain events, and an earlier freshet. The BC Hydro Report gives a summary of future (up to 2100) river flow scenarios, based on eight GCM runs. Next step: a $1.2 million adaptation strategy partnering with PCIC to be developed in four years. Special issues: glaciers, fewer people along waterways, risk tolerance/thresholds.

2010 Modified Flows Data Mining Project: Climate Change Signal Search, Erik Pytlak (BPA):

In-house study looked at the newly published 1928-2008 Modified Streamflow record. Results: No conclusive climate change signals were identified. However, BPA went in assuming they wouldn't find any signals at all. Instead, they found a few interesting signals in specific locations and times of the year which bear close watching.

There are hints that early spring runoff may have shifted a little earlier in Canada over the past 80 years, and spring runoff in Canada may be ending a few days sooner in the summer over time. Correlation coefficients are low, though, there was little temporal or spatial continuity in the signals, and there were no indications of increased fall runoff. All three conditions should be present if definitive climate change predicted by global modeling efforts was taking hold over the Basin. The study suggests we should watch BC closely (maybe western Montana, too) for increasing climate change impacts. The study

also confirmed the importance of the Pacific Decadal Oscillation (PDO), and that any climate change studies worth their weight need to take PDO into account.

Status…Systematic Evaluation of Forecasts, David Garen (NRCS):
With the recent retirement of Randy Wortman, this project has halted. Rashawn will ask Dave, "How to move forward?" Andy Wood, new science officer at the NWRFC, is very interested in forecast verification.

Status of 2011 Annual CRFG Report, Ted Day (USBR):
He is still working on it. A preliminary summary was given for the annual Fish Accords Report. Ted will try to have a draft ready to send out to us by late August.

USGS Idaho Water Science Center, Michael Lewis (USGS):
Center's Mission: collect and disseminate reliable, impartial, and timely information needed for the informed use and management of Idaho's water resources. The Center's main offices are located in Boise with field offices in Post Falls (near Spokane) and Idaho Falls (2). A staff of 75 includes hydrologic technicians, hydrologists, hydraulic engineers, aquatic biologists, geochemists, plus database, GIS and IT specialists, and administrative support. The Center's program is split into two primary activities: (1) long-term data collection, and (2) interpretive studies. The streamgage network is the foundation of the data program. The IDWSC, in close association with its funding partners, operates 255 streamgages (50% USGS Cooperative Water Program funded, 13% USGS NSIP funded, and 37% other Federal agency funded). Significant advances in the use of hydroacoustic measurement equipment (85% of actual streamflow measurements employed these technologies) has increased data accuracy, data-collection efficiency, and employee safety. Although subject to small year-to-year changes (new gages added or existing gages discontinued), the streamgage network has been relatively stable since the late 1950's. The interpretive studies program includes a diverse set of hydrologic studies conducted in close association with numerous funding partners. Current studies include: hydraulic and geomorphic investigations on the Kootenay River in support of sturgeon recovery efforts, aquatic habitat mapping on Lake Pend Oreille in support of kokanee salmon recovery efforts, water-quality studies in the Coeur d' Alene basin in support of remediation efforts addressing environmental damages from historic mining practices, and studies of bull trout habitat and movement, as they relate to water-management practices. Detailed descriptions of these studies and many more, are available on the Center's web site: http://id.water.usgs.gov/

"The Sampler"

CSHS Workshop & Tech-Paper, Adam Gobena (BC Hydro):
A paper has been written of the Workshop proceedings. Publication will be soon.

Update on Canadian SNOTEL Initiative, Erik Pytlak (BPA):
The BPA-BCH Memorandum-of-Understanding was finalized in April and formalized a cost-share of the gages and implementation. There will be five sites for Snow Pillows

(still site scoping). The "Keystone" snow course (Kootenay) will collocate with a Pillow in 2013.

Probabilistic WSF and Decision-making…scoping input, David Garen (NRCS):
Rashawn reported that they did a "10% event" calculation for a forecast. Steve K. said that the NWRFC has run a 90%/10% bookend forecast values for years for its users.

CSHS/CGU Workshop, Stephanie Smith (BC Hydro):
Workshop emphasized operational forecasting and show-cased UBC work, which was a sequel to the October 2011 conference in Vancouver. A three-part conference is planned for 2013, with a BC conference tentatively planned for March 2013.

2012 Draft Work Plan, Kyle Dittmer (CRITFC):
The draft was reviewed. Kyle suggested dropping item #4, "Forecast Verification" this year, until additional staffing power can be made available. Rich D. and Paul W. will follow-up with the Salmon Managers (FPAC) to inquire on specific fish passage and WSF issues. Members present voted to adopt the modified draft and finalize it.

Statistical model performance vs. ESP, Gus Goodbody (NRCS):
Most of this work was done by Andy Wood (formerly with the U. Washington, now with the NWRFC), in collaboration with researchers at CU and PSU, and Gus Goodbody and Dave Garen at NWCC. Western U.S. WSF project goals: new insight about forecast component, access to components, and objective combination of forecasts, and how to incorporate additional forecasts to the ensemble. The coordination process is challenging in part because computational methods are different amongst agencies. Questions of interest include: (1) How good are the error bounds (10%/90%)?, (2) Can additional forecasts be combined to improve the overall ensemble? A study is in process focusing on the Colorado basin, including sites such as Granby Lake inflows, using a 25-30 year re-forecast datasets. Initial findings show varying strengths and weaknesses among the models, and that an objective combination is feasible. Although the project is continuing and will further explore combination strategies this fall, interim findings of the pilot project will be reported on in autumn 2012.

Other Business, Ted Day (USBR):
Will a "30-year average" be formally published? NWS/NRCS may have a set of 30-year runoff averages ready by late 2012. It is expected that the NWS and NRCS will coordinate with the COE and USBR, as some of their projects are part of the regional dataset. What reference period is considered "good?" We need discussion of this issue at our next meeting. Meeting was adjourned at 2:50 pm.

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Attendance:
Annamalai, Maler – COE (NW Division)
Day, Ted – USBR (Boise)
Dittmer, Kyle – CRITFC (Portland)
Domingue, Rich – NOAA Fisheries
Gobena, Adam – BC Hydro (Vancouver, BC)

Golightly, Christine – CRITFC
Goodbody, Gus – NRCS (Portland)
Hall, Steve – COE (Walla Walla)
Hatch, Keith – BIA
Heinith, Bob – Consultant for CRITFC
King, Steve – NWS/NWRFC (Portland)
Kruger, Rick – ODFW
Lewis, Michael – USGS (Boise)
Mickelson, Kristian – COE (Seattle)
Pytlak, Erik – BPA (Portland)
Rodgers, Kasi – COE (NW Division)
Skiles, Tom – CRITFC
Smith, Stephanie – BC Hydro
Tama, Rashawn – NRCS (Portland)
Wagner, Paul – NOAA-Fisheries

Absent:
NPCC

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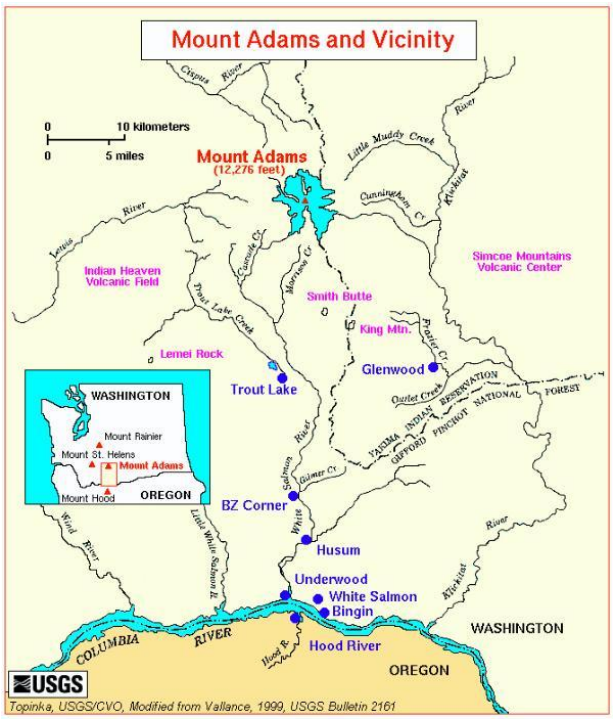
Note-taker: Kyle Dittmer, Columbia River Inter-Tribal Fish Commission, Portland, Oregon

Revised October 9, 2012

COLUMBIA RIVER FORECAST GROUP FIELD MEETING – November 26, 2012
LOCATION: White Salmon River, former Condit Dam site (near White Salmon, WA)



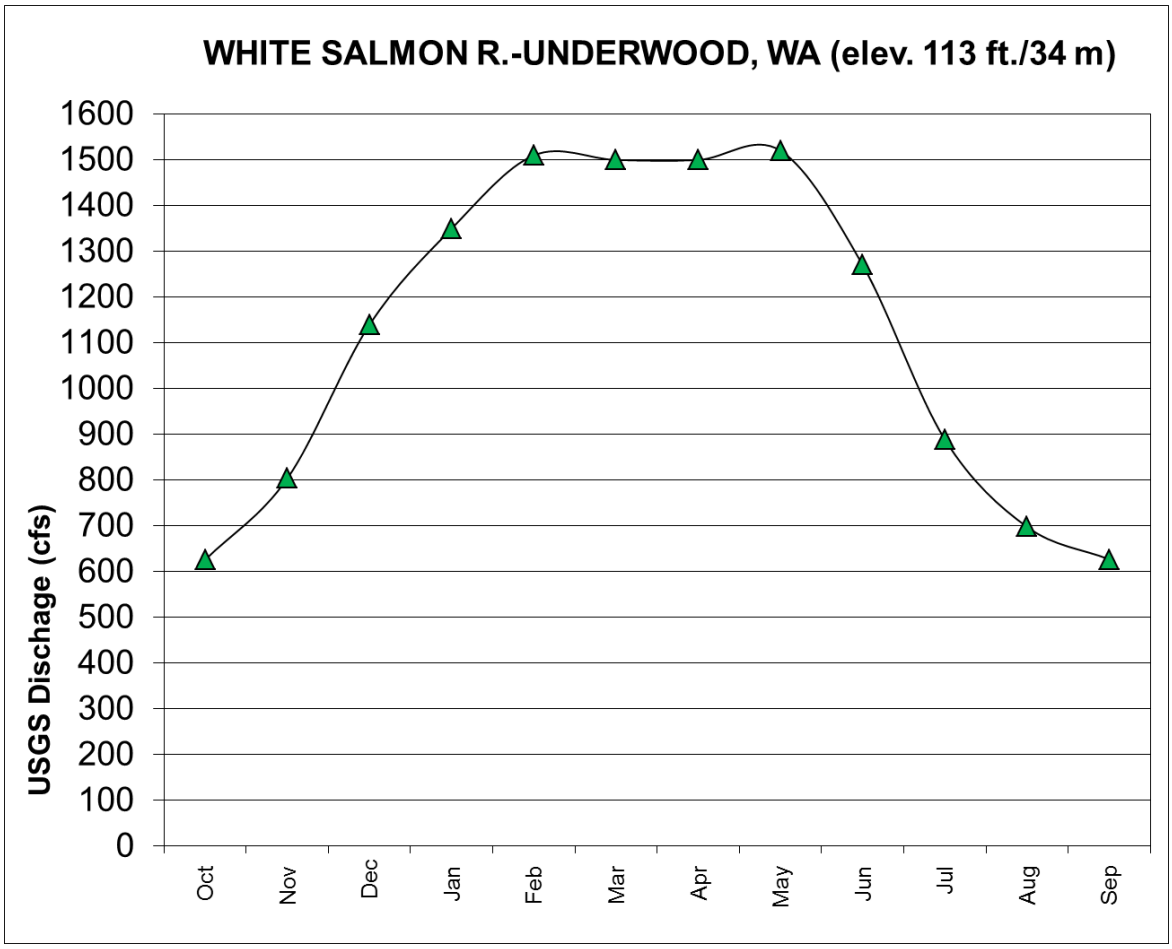
GEOGRAPHY/GEOLOGY: The White Salmon is a small basin (386 sq-mi; 1000 sq-km) of low-to-high elevation (72-12307 ft msl; 22-3750 m) relief. Topography is highly varied – starting from a glacial-covered volcano (Mt. Adams), rugged gorges and mountains, alpine valleys, down to rolling hills and river valleys. Quaternary (up to 2-million years ago) volcanism of the High Cascades laid the foundation for the basin. Pleistocene glaciation and weathering formed the rich porous soils, which provides good subsurface drainage.

HYDROLOGY: The White Salmon is a hybrid of west-side winter rain-dominated peaks, east-side early-season snowmelt, combined with summer glacier melt from Mt. Adams (see graph). October-March sees 75% of the basin precipitation; 40 inches (east end) to 95 inches (west, north end) per year (102-241 cm). The sustained glacier-fed summer-autumn base flows, combined with abundant alluvial gravels, makes for excellent salmon habitat and white-water rafting.

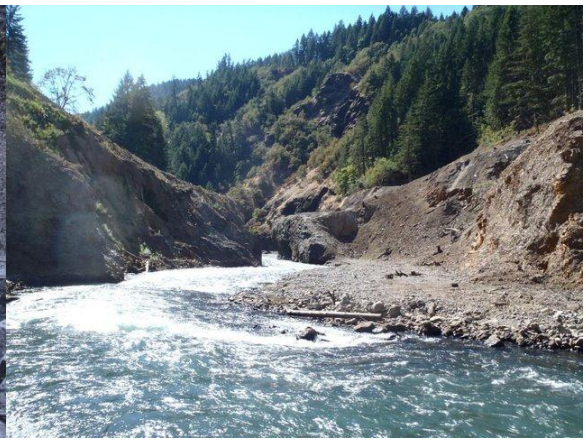
FOR FURTHER INFORMATION…LINKS:
USGS Real-time Streamflow data:
http://waterdata.usgs.gov/wa/nwis/uv?site_no=14123500
NPCC WS Subbasin Plan:
www.whitesalmonriver.org/files/EntirePlan__WS_subbasin_plan.pdf
Cascade Volcanism: http://vulcan.wr.usgs.gov/Volcanoes/Cascades/description_cascade_range.html
Studies, articles: http://www.whitesalmonriver.org/data.php

COLUMBIA RIVER FORECAST GROUP FIELD MEETING – November 26, 2012
LOCATION: White Salmon River, former Condit Dam site (near White Salmon, WA)

Period-of-record (1915-2011) hydrograph:



Husum Falls



Site of former Condit Dam

FIELD TRIP LEADERS: Bob Heinth (retired, CRITFC) and Kyle Dittmer (CRITFC).

Columbia River Forecast Group–Field Trip Meeting, White Salmon basin; November 26, 2012

Purpose:

We resurrected the once-a-year field trip tradition that our predecessor, the Columbia River Forecast Group, had benefited from over its existence. We traveled into the Columbia River Gorge to near White Salmon and explored the lower reach of the White Salmon basin to see the hydrologic and geomorphological changes that occurred since the breaching of Condit Dam.

Stop 1...White Salmon-Columbia River confluence:

Starting at 9:30 am, we drove 65 miles from Portland, crossed the bridge at Hood River, and stopped at the intersection of Highways 14 and 141, just west of White Salmon. We saw the new/modified confluence of the White Salmon and Columbia Rivers.

Kyle welcomed everyone and talked about the geography/geology/hydrology of the White Salmon (see handout). He then introduced Bob Heinith, CRITFC's former Hydro Program Coordinator, now retired, who shared the history (see handout) of Condit Dam, the decommissioning process, prospects of salmon recolonizing the basin, and importance of the White Salmon basin to the tribes (and Yakama Nation in particular).

Stop 2...former Condit Dam site:

We drove one-mile up Highway 141A then left onto Powerhouse Road and down one-mile. We had permission from Pacific-Corp to walk down onto the former dam site.

All the concrete has been broken down and removed. The exposed river banks are now fairly stable and have been reseeded, including small tree plantings. The river gravel bars have grown.

Stop 3...Northwestern Park:

We drove one-mile up Highway 141A then left onto Northwestern Lake Road. The Park is owned and managed by Pacific-Corp. The area did contain Northwestern Lake but is now gone after Condit Dam was breached. We observed the river banks being stabilized with new seeds and a new boat/kayak launch area.

Stop 4...Husum Falls:

We drove one-mile up Highway 141A to the town of Husum. We walked to the bridge and observed the Falls. There were no Chinook salmon or steelhead spotted that day.

We headed to Bingham for lunch, then back to Portland. The field meeting was adjourned at 2:00 pm.

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Attendance:
Broncheau, Michael – CRITFC (Portland)
Day, Ted – USBR (Boise)
Dittmer, Kyle – CRITFC (Portland)
Hall, Steve – COE (Walla Walla)
Heinith, Bob – consultant for CRITFC
Kruger, Rick – ODFW (Portland)
Shaffer, Kevin – COE (Seattle)
Ward, Jason – COE (NW Division)

Absent:
BC Hydro
NOAA-Fisheries
NPCC
NRCS
NWS/NWRFC
USGS

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Note-taker: Kyle Dittmer, Columbia River Inter-Tribal Fish Commission, Portland, Oregon

Revised December 4, 2012

Columbia River Forecast Group–Autumn Meeting and 2012 Forecast Review, CRITFC, Portland, Oregon; November 27, 2012

Introductions:

Chairman Kyle Dittmer welcomed everyone at 8:35 am. The 10 attendees introduced themselves. The July notes were reviewed and finalized.

Review of 2012 Forecast Season:

COE (Kevin Shaffer)… COE (Kevin Shaffer)…Libby forecast moved from 5524 KAF (January) to 7240 MAF (June), 123%, April-Aug. Project drafted heavily beginning in mid-March in advance of a greatly increased April forecast. June precipitation records were very high: 180% (Cranbrook) to 440% (Sandpoint). Forecast procedure uses QBO (which influences monsoonal moisture in the Northern Hemisphere), Oct.-Feb. seasonal precipitation, and March 1st snowpack for the March forecast. The QBO and early-season precipitation resulted in a 1.5 MAF decrease in 2012 as compared to the March 2011 forecast. The Seattle District plans to update the forecast and possibly remove or lessen the impact of climatic variables and early-season precipitation.

COE (Steve Hall)…The Clearwater missed much of the heavy precipitation to the north. So, the DWR forecast came in slightly above normal: 3236 KAF, 121% of normal, April-July (PCA Principle Components Analysis method). Forecast uses five SNOTEL sites and early season SOI. The new "Z-score" method, using 12 SNOTELs and one extra precipitation station, gave 3300 KAF (and can be updated daily). This is the first full year of using the Z-score method.

USBR (Ted Day)…The intense June precipitation (400-600% across eastern Washington and north Idaho) raised the Multiple Linear Regression and PCA forecasts. PCA is still experimental, running since 2007. The USBR forecast for HGH was closer than the NWRFC forecast. The COE forecast came in the closest. There was a distinct gradient of June precipitation from north Idaho declining to 50% or less in the Upper Snake. Hot temperatures in early April followed by rain on snow up to 9,000 feet in the Boise basin produced new record high peak flows for this time of year. Normal rain-on-snow events along western Idaho occur below 5,000 feet in elevation and during the mid-November to mid-February period. The full Biological Opinion flow augmentation water was delivered but the Upper Snake projects need serious refill.

NRCS (Ron Abramovich)… Observed April-July volumes in north Idaho were closer to the 10% exceedance forecasts. There was great snow loss in April 1 to May 1 north of the Snake River.

BC Hydro…no report was offered.

CRITFC (Kyle Dittmer)…The October 2011 pre-season forecast for the Columbia River at The Dalles, Jan.-July, of 117 MAF (109%) saw minor increases during autumn, then jumped by late winter, to 132 MAF (123%) by April 2012 in response to an increasingly

negative MEI signal. Verification (129 MAF): October forecast ± 9%; April forecast ± 2%. The average error of the best forecast (2006-2012) is ± 5%.

NWS-NWRFC (Steve King)…We entered WY 2012 with La Niña. Oct.-Feb. precipitation was 94% (reflecting a 6-week patch of very dry weather), but the Oct.-July precipitation jumped to 122%. Highly variable weather moved the forecasts all over the map. Assessing snow in the HGH basin was challenging – the USBR forecast did better than the RFC. A verification program has been ongoing for four years: ESP ("performed well") vs. other agency forecasts.

Group discussion…Steve H. said there was more snow in the upper reaches of LIB than expected. Erik said that the BPA-BCH MOU was signed for five new SNOTELs that will go in starting next summer (with one to three sites for 2013) over a 12-month installation plan. Kevin noted that more SNOTELs along a north-south traverse would have helped detect the highly variable rain patterns this year. Erik said that the CRT Hydromet Committee did approve of the NWRFC producing a WSF by the fifth working day and adding a 3-day QPF (Quantitative Precipitation Forecast) for the 2013 forecast season. He also noted that noticing and rapidly responding to changes and trends in weather patterns can be enhanced by internal model guidance. Steve H. said that the Brownlee inflow forecast process needs improvement and that COE-Walla Walla was working on a new procedure (more details to come), as there is a real disconnect of System vs. Local Flood Control regulation in the Upper Snake vs. the Federal Columbia Power System. Ted noted better collaboration with IPCo on forecast issues. Steve K. asked: "How about using natural flows in the Upper Snake?" Ron asked if satellite coverage (e.g., MODIS) of basins was being used as hydrological model input. Erik replied that persistent cloud cover was a strong obstacle. Steve H. said that three helicopter and/or flights of the Clearwater are done to map out aerial snow cover each year but are costly. Even then, we still don't know the SWE in some areas. It was mentioned that satellite microwave imagery may be able to penetrate cloud cover.

Ted reported that the ARS (Agricultural Research Service) did a study in the Reynolds Creek basin in Idaho that incorporates new satellite imagery data into the hydro model, as part of a three-year pilot program. ARS has been funded through a Reclamation Science and Technology (S&T) grant to perform a 3-year pilot program to apply an experimental distributed snow model to the Boise Basin. The model (ISNOBAL) has been developed and tested on the much smaller Reynolds Creek basin in Idaho and the study will test its value in providing operational short term snowmelt forecasts on a much larger scale. Phase 1 will be data and model application; Phase 2 will couple the model with short term weather forecasts; Phase 3 will couple the model with a streamflow prediction model. More information will follow as the study gets underway

2013 Pre-season Forecasts

COE (Kevin). The Nov. 1st forecast for Libby April-Aug. flow is 7194 KAF, 120%. The recent rains, 196% - 277%, have raised the forecast. The BCH folks calculated similar water supply forecasts for the Kootenay basin on the order of 110% to 126% of normal, but have proposed manually reducing the October precipitation inputs so as not to

mislead forecast users with a very high forecast early in the forecasting season. COE is also considering lowering the October precipitation inputs into the forecast to a set number of standard deviations (0.5 or 1.0, perhaps) above the median in order to maintain the influence of the very wet October but within the range of values for which the forecast procedure was designed. COE is unlikely to relax the December 31st draft requirement this year, but will depend on final precipitation numbers for November.

COE (Steve H.). The Nov. 1st forecast for Dworshak April-July flow is 2683 KAF, 101% (SOI driven), while the Z-score forecast is 2717 KAF. The new normals are being used.

CRITFC (Kyle). The Nov. 14 forecast for the Columbia River at The Dalles Jan. to July flow is 104 MAF, 95%. Temperature departures will be +1 degF. Precipitation will be 86% to 101%.

NWRFC (Steve K.). The November Sea-Surface Temperature anomalies are +0.3 degC. The IRI/CPC ensembles are trending to ENSO-neutral. The Oct. 1 to Nov. 19 precipitation stands at 189% (Columbia at The Dalles), 90-110% (Washington), 50-90% (Upper Snake). Latest ESP April-July forecasts: Mica 99%, HGH 86%, LIB 92%, GCL 96%, DWR 93%, LWG 88%, and TDA 101 MAF (Jan.-July) 94%.

Summary of 20th Annual OR-AMS Winter Weather meeting, Kyle Dittmer (CRITFC):
A handout (to be included with these notes) summarized the talks of the four forecasts given at OMSI on Nov. 17. Forecasts were similar: near normal-to-mild temperatures and near-to-below normal precipitation. Portland area snow chances are 70-80% (CRITFC) to 50% (ACS). Methods: NOAA – probabilistic, CRITFC – hydro-climate (i.e., hybrid of WSF plus probabilistic and analogue years), ODF, ODA, and ACS – analogue years. Forecasters noted that ENSO-neutral will play a role this winter and to expect high variability in the weather patterns.

Columbia River Treaty Review and Forecasting, Erik Pytlak (BPA):
We're still in the study phase. Climate change is being considered in the Review. Two RMJOC studies are being utilized – the wettest and one of the warmest of the set, then the driest with slightly less warming in the set. Although there was interest for many additional studies, there isn't enough time to run them. The group is in the process of converting 14-periods to daily flow data, which is a massive time and labor intensive effort. All study work needs to be done by March 2013.

Updates from the NWRFC, Steve King (NWRFC):

(1) New 30-year normals. The RFC completed the new normals a month ago. Plan is to implement by Jan. 1st. The estimated normals that have unofficially been used this year are close to the new official normals, which run 1% to 7% less than the old normals. Other differences: TDA -6% (Jan.-July), DWR -7%, LWG -9%. Steve H. asked, "Why don't we use the period of record for a normal?" Erik replied that the WMO mandates that a standardized 30-year moving average must be used for

meteorological variables, and since NOAA and NWS are parties to the WMO, they must follow along. Volume runoff is not a meteorological variable, but since the precipitation normals were updated in 2011, NWRFC followed suit with seasonal runoff.

(2) Proposed changes to Published Runoff Locations. The RFC wants to discontinue "local" flows, storage, and closed WSF locations. Concern was raised about accidently eliminating a user-point. Steve will share a list of proposed changes with the CRFG.

(3) Precipitation Processor. Methodology is changing to take advantage of quality-control checked daily data. There will be a new line-up of the PP divisions with WSF basins. Rashawn mentioned that SWE uses the median as the normal, which is different than a standard precipitation normal. The PRISM data needs updating – ask OSU for the work?

Condit Dam trip…slide-show, Kyle Dittmer (CRITFC):

Kyle showed the group his slides of our field trip-meeting. Bob Heinith was the primary guide and has tracked the Condit Dam issue for over 20 years (handouts will be included in the notes). The rapid regeneration of the river channel and its banks was amazing. The clean-up work was extensive and just completed. Pacific-Corp just reopened the area to the public 10 days ago.

"The Sampler"

Status of 2011 Annual CRFG Report, Ted Day (USBR):

The report is done. The 2010 Report was used as a template. A work matrix is still needed. Ted sent the draft report to the principal sovereigns for first review and wants feedback ASAP.

Ideas for 2012 Annual CRFG Report?, Kyle Dittmer (CRITFC):

No one had any specific ideas. Erik noted that the 2012 Report will be due much earlier, like January 31st, in order to comply with court-mandated Biological Opinion remand deadlines.

CRFG archive and website…update, Erik Pytlak (BPA):

A page has been dedicated on the "salmonrecovery.gov" website for the CRFG. Erik suggested that Ted and Kyle send over all materials – powerpoints, notes, etc. – of the last three years. He will then work with the BPA IT folks to get all materials posted in one shot.

Upcoming WSF conferences/meetings?:

Erik mentioned that Andy Wood, new Development Operations Hydrologist at the NWRFC, wants to have the AGU Chapman Conference hosted in Portland next summer. This conference covers short and long range streamflow forecasting, WSF, etc. and has been hosted in other cities. Andy is asking for agency/staff involvement. Any takers? Kyle suggested that we ask the local AIH (American Hydrologic Institute) Chapter. Erik

cautioned that he and Andy need to work out more details first, but the response from members present was good and enthusiastic.

Other Business, Kyle Dittmer (CRITFC):
Rashawn said that Jon Lea, NRCS Snow Survey Hydrologist, is retiring on November 30. We wished Jon well in his new life and much happiness.

The chairman's "gavel" was ceremoniously handed off to Erik Pytlak, who becomes the new chairman in January. Erik will likely have a conference-call set up in January. The meeting was adjourned at 2:50 pm.

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Attendance:
Davis-Butts, Kresta – IPCo (Boise)
Day, Ted – USBR (Boise)
Dittmer, Kyle – CRITFC (Portland)
Hall, Steve – COE (Walla Walla)
King, Steve – NWS/NWRFC (Portland)
Pytlak, Erik – BPA (Portland)
Shaffer, Kevin – COE (Seattle)
Tama, Rashawn – NRCS (Portland)
Vanderzweep, Rick – BPA (Portland)
Ward, Jason – COE (NW Division)
On the phone:
Abramovich, Ron – NRCS (Boise)
Benner, David – FPC (Portland)
IPCo staff (Pam Pace, Janak Timilsena, Tim Brewer)

Absent:
BC Hydro, NOAA-Fisheries, NPCC, ODFW
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Note-taker: Kyle Dittmer, Columbia River Inter-Tribal Fish Commission, Portland, Oregon

Revised December 4, 2012

Appendix C

Historical forecast results

Columbia River Forecast Group 2012

Historic forecast results:

Period Forecasts for different months = from

http://www.nwd.usace.army.mil/report/colriverflood.htm

Observed KAF = from runoff processor

Duncan: (Apr – Aug)

Year	Jan		Feb		Mar		Apr		May		Observed
	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF
2005	2003	109%	2013	110%	1972	108%	1968	107%	1876	102%	1834
2006	1839	87%	1906	90%	1946	92%	1922	91%	1932	91%	2120
2007	2087	88%	2122	90%	2096	88%	2221	94%	2257	95%	2370
2008	2202	113%	2091	107%	2091	107%	2059	105%	1985	101%	1957
2009	2003	123%	1945	120%	1866	115%	1859	114%	1787	110%	1627
2010	2030	125%	1962	121%	1825	113%	1817	112%	1813	112%	1621
2011	1846	82%	1942	86%	1912	85%	1997	89%	2057	91%	2251
2012	1987	77%	2039	79%	2015	78%	2138	83%	2227	87%	2571

Libby: (Apr – Aug)

Year	Jan		Feb		Mar		Apr		May		Observed
	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF
2005	5786	104%	5630	101%	5371	97%	5401	97%	5096	92%	5564
2006	5487	83%	6186	93%	6350	96%	6076	92%	6179	93%	6629
2007	6955	102%	6582	96%	6516	96%	6847	100%	6990	102%	6822
2008	6282	113%	6498	117%	6435	116%	6387	115%	6166	111%	5539
2009	5526	125%	5436	123%	5296	120%	5672	128%	5209	118%	4425
2010	5682	126%	5478	121%	5084	113%	5103	113%	4887	108%	4517
2011	5610	73%	6656	86%	7111	92%	7191	93%	8165	106%	7729
2012	5524	60%	5714	62%	5635	61%	6872	75%	7159	78%	9185

Hungry Horse: (May – Sep)

Year	Jan		Feb		Mar		Apr		May		Observed
	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF
2005	1647	132%	1418	114%	1144	92%	1217	98%	1173	94%	1245
2006	1826	101%	2024	112%	1958	108%	1912	106%	1824	101%	1811
2007	1823	136%	1803	135%	1786	134%	1495	112%	1425	107%	1337
2008	1840	76%	1859	77%	1876	78%	1913	79%	2131	88%	2410
2009	1809	112%	1864	115%	1697	105%	1817	112%	1816	112%	1618
2010	1654	103%	1429	89%	1284	80%	1305	81%	1345	84%	1608
2011	1944	61%	2139	67%	2222	69%	2357	73%	2798	87%	3212
2012	1691	80%	1781	85%	1739	83%	1906	91%	1680	80%	2102

Grand Coulee: (Apr – Aug)

Year	Jan		Feb		Mar		Apr		May		Observed
	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF
2005	54863	112%	53657	110%	45820	94%	47628	98%	47628	98%	48807
2006	55466	91%	58480	96%	57877	95%	57275	94%	58500	96%	61189
2007	60000	105%	61600	107%	61200	107%	61600	107%	61000	106%	57350
2008	59300	99%	59200	99%	61300	103%	61600	103%	60000	100%	59739
2009	55800	116%	54600	113%	53100	110%	55400	115%	54000	112%	48186
2010	54000	113%	49100	103%	45800	96%	44900	94%	45300	95%	47711
2011	56500	75%	61400	82%	62200	83%	64700	86%	70800	94%	75107
2012	44509	56%	56788	71%	60853	76%	68525	86%	72812	91%	79874

Brownlee: (Apr – Jul)

Year	Jan		Feb		Mar		Apr		May		Observed
	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF
2005	3170	88%	2590	72%	1740	48%	2180	60%	2440	68%	3612
2006	6690	75%	8016	89%	6940	77%	8380	93%	9020	101%	8975
2007	5200	185%	3630	129%	3760	134%	3300	118%	3040	108%	2807
2008	4390	101%	5260	120%	5500	126%	5400	124%	4860	111%	4368
2009	4260	76%	4020	72%	3350	60%	4970	89%	5000	90%	5575
2010	3300	72%	3020	66%	2470	54%	2590	56%	2780	61%	4586
2011	7230	69%	6280	60%	5690	54%	7510	71%	9060	86%	10549
2012	4783	86%	4986	90%	5211	94%	6388	115%	6162	111%	5535

Dworshak: (Apr – Jul)

Year	Jan		Feb		Mar		Apr		May		Observed
	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF
2005	1914	116%	1642	100%	1423	87%	1321	80%	1344	82%	1643
2006	2601	97%	2707	101%	2612	98%	2593	97%	2626	98%	2677
2007	2905	161%	2126	118%	2192	122%	1982	110%	1868	104%	1799
2008	2717	79%	2738	80%	2810	82%	3010	88%	3003	87%	3434
2009	3075	121%	2681	106%	2461	97%	2662	105%	2631	104%	2539
2010	2174	114%	1742	91%	1571	82%	1398	73%	1526	80%	1906
2011	3340	83%	3142	78%	3329	82%	3387	84%	3772	93%	4042
2012	2473	74%	2504	75%	2585	77%	2966	89%	3226	97%	3343

Lower Granite: (Jan – Jul)

Year	Jan		Feb		Mar		Apr		May		Observed
	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF
2005	20700	114%	18000	99%	14600	81%	15700	87%	16500	91%	18134
2006	31600	98%	34500	107%	31900	99%	33200	103%	34900	108%	32194
2007	28200	149%	23000	122%	23500	124%	21400	113%	20600	109%	18887
2008	27200	99%	29500	107%	29200	106%	28000	102%	26500	96%	27522
2009	25700	89%	25100	87%	22400	78%	26400	91%	26900	93%	28899
2010	22400	100%	19300	86%	17000	76%	16600	74%	17000	76%	22460
2011	31253	75%	30439	73%	30676	74%	32924	79%	36291	87%	41610
2012	23497	79%	25598	86%	26022	87%	29996	100%	30266	101%	29893

The Dalles: (Jan – Jul)

Year	Jan		Feb		Mar		Apr		May		Observed
	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF
2005	85600	105%	82400	101%	70700	87%	73800	91%	74700	92%	81349
2006	101000	88%	111000	97%	107000	93%	107000	93%	110000	96%	114672
2007	105000	110%	101000	105%	100000	104%	100000	104%	99100	104%	95738
2008	102000	103%	103000	104%	103000	104%	101000	102%	97300	98%	99209
2009	94700	105%	92900	103%	86200	96%	92000	102%	91100	101%	90244
2010	88500	104%	79200	93%	71800	85%	69700	82%	70900	84%	84718
2011	99041	69%	105851	74%	111213	78%	119785	84%	126943	89%	142616
2012	86041	66%	93781	72%	98799	76%	114135	88%	120043	93%	129441

The Dalles: (Apr – Aug)

Year	Jan		Feb		Mar		Apr		May		Observed
	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF
2005	74300	109%	69200	101%	57200	84%	60800	89%	61900	90%	68452
2006	87500	90%	94300	97%	91200	93%	92700	95%	95600	98%	97541
2007	91300	116%	88200	112%	88300	112%	85200	108%	84200	107%	78939
2008	88200	95%	91800	98%	94300	101%	94700	102%	90900	98%	93198
2009	82100	102%	79700	99%	74800	93%	82400	102%	81400	101%	80771
2010	76700	99%	68500	88%	62100	80%	60900	79%	62200	80%	77410
2011	90600	71%	92500	73%	92300	72%	101000	79%	113000	89%	127378
2012	77401	65%	84454	71%	90604	76%	103726	87%	110762	93%	119127

<end of tables>

CRFG Mailing List December, 2012

revised Jan. 30, 2013			
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