

## ESHMC Meeting Notes April 16, 2012

**Item 1 -** Introductions were made, and an attendance list was circulated. The following were present at the meeting:

- Rick Raymondi
- Allan Wylie
- Jennifer Sukow
- Chuck Brockway
- David Hoekema
- Greg Sullivan
- Mike McVay
- Bryce Contor
- Chuck Brendecke
- Dave Colvin
- Jon Boling
- Mat Weaver
- Harvey Walker
- Neal Farmer
- Sean Vincent
- John Koreny
- Bill Kramber\*

**\*Present at meeting but did not sign attendance sheet.**

**David Blew, Jim Brannon, Stacey Taylor, Kevin Boggs, and Willem Schreuder joined the meeting via polycom.**

**Item 2 –** Stacey Taylor began the meeting with a progress report regarding the water budget data that she is assimilating for model validation. She said that the majority of the data had been through a QC review, and corrections had been made for anomalies and inconsistencies. Stacey said that averages had been used for five of the datasets including the BIA diversions for 2009 and 2010. Chuck Brockway asked what will happen if we don't obtain the data before validation runs are completed. Allan said what we have will be sufficient for validation. Bryce said that averages were used in the final calibration of ESPAM version 1.1, and we will never have all of the data.

**Item 3 -** Stacey then briefed the committee on the progress of developing figures for the final report. She said that most of the time series figures had been completed, and she showed a spreadsheet of what was left to finish. Bryce reported no progress on his part. Chuck Brendecke asked whether the figures would be pre-PEST or post-PEST. Stacey said that both would be too much data. Bryce said that it would only refer to the time series charts. He also said the calibration report will have an indication of the changes made. Greg Sullivan asked when the reports will be finished, and Rick Raymondi said the reports will be assembled and circulated later this year. Allan Wylie said the

calibration report is close to being ready for circulation. Bryce said a draft of the Final Report should be ready by July.

**Item 4 -** Bill Kramber showed a chart and a bar graph of METRIC processed ET data for the western portion of the ESPA including the Northside Canal Company and AFRD2 service areas for 1996, 2000, 2002, 2006, and 2008. The total ET volume for 1996 was the highest year at 925,189 acre-feet. Greg Sullivan asked how the determination of what is irrigated is made. Bill explained the process that the IDWR GIS goes through for that determination.

Several recommendations were given to Bill by the committee:

- Chuck Brendecke recommended looking at total diversions for an efficiency comparison.
- Chuck Brockway recommended adding acre-feet/acre and acres irrigated to the graph.
- The committee agreed that the next year processed using METRIC, after Bill completes 1986, should be 1992.
- Chuck Brendecke said that potential ET should be added to the table. Greg Sullivan suggested adding reference ET to the table.

**Item 5 –** Rick Raymondi recommended that a subcommittee be established to meet and determine the best way to incorporate METRIC data into the next version of ESPAM and how to determine ET for the intervening years. Rick also suggested Mike McVay as the subcommittee lead. The committee agreed with setting up a subcommittee, and besides Mike McVay, volunteers to serve included Bryce Contor, Bill Kramber, Matt Weaver, Rick Allen, and David Hoekema. The subcommittee will make recommendations to the ESHMC.

**Item 6 -** Neal Farmer briefed the committee on the results of tracer tests near the Malad Gorge and the near-rim synoptic water level measurements. For the synoptic water level measurements, Neal discussed the well selection and location process and the letters written to landowners, and he indicated that 196 wells were eventually measured. Chuck Brockway asked if the recent use of a domestic well was a problem, and Neal said that the aquifer transmissivity is so high, that water levels recover rapidly.

Neal showed the springs below the rim and the area where ground water levels were measured. He said a GPS unit was used to determine the spring elevation at the highest point of emergence. Neal noted problems with the water level measurements using Heron meters. He presented geologic cross sections in the Rangen Spring area and the Crystal Springs area. Chuck Brockway asked how the spring data compares with the data in the report by Covington and Weaver, and Neal said he had not looked at the Covington and Weaver report. Then Neal showed a profile from the Malad Gorge to the Clear Springs area.

Chuck Brockway said he agreed with the DEQ divide related to flow patterns and water quality based on electrical conductivity in the ESPA. Dave Blew said the water level

and spring data are in agreement with the DEQ findings, but he is not sure whether it is a regional or local aquifer phenomena. Dave also said he was aware of seasonal signatures in the spring data during the spring and fall.

Neal said he wanted input on when to repeat the synoptic, as the previous effort was done in the fall. Chuck Brendecke said it would be good to perform the synoptic in the spring. Chuck Brockway suggested extending the synoptic to the east at least past Blue Lakes and added that there will be a difference in spring measurements. Chuck Brendecke said he believes the studies are worthwhile and should be continued.

**Item 7 -** Allan Wylie briefed the committee on the model validation effort using 2009 – 2010 data. He began by showing a comparison of the modeled vs. measured transient heads. The heads for the last two years followed the same seasonal trends as previous data and showed no greater divergence from the measured data. John Koreny asked if the validation period data were solved by PEST. Allan responded that the validation period data were not run through PEST. Sean Vincent asked what the date of the last calibration data was, and Allan said September 2008.

Then Allan went through the river reach gains. The validation period modeled vs. the measured showed a reasonable match similar to the previous period. Chuck Brendecke asked what the time step is for the observations, and Allan indicated the reach gains are monthly.

During the discussion of the springs, Allan indicated more data were needed for Blue Lakes Springs and for the National Fish Hatchery. He said the problem at Briggs Spring is the elevation, and he said that the GPS field observation collected by Neal Farmer and Dave Blew would allow him to raise the elevation and improve the seasonality. Bryce was still concerned why the amplitude was lost, and Allan said that since the seasonal change in head above low elevation springs represents a small percentage of the total head, the seasonal fluctuation in flow is small. High elevation springs have a much higher percentage change in head above the spring and hence more significant seasonal fluctuations in flow. Allan indicated that he suspects the Covington and Weaver elevation for Briggs Spring is the elevation of the USGS gauge, which is some distance from the rim and hence at a lower elevation than the actual spring.

Allan showed two graphs of the annual water budget for the model period with a vertical line showing the portion during the validation period. Greg Sullivan asked Allan to express validation results as the cumulative departure from the average. Allan agreed with Greg's idea, and indicated he would try to present the data as recommended. Chuck Brockway said that it is difficult to run statistics so there is a visual determination of what the data represents. Allan said from observation of the results, the data indicate the model is not invalidated. Bryce added that the model has not yet been shown to be invalidated.

Willem said that we have asked the model a question that it is not calibrated to, and it gave us the right answer. He added that he would have been shocked if it didn't. Chuck Brendecke commented that we didn't ask the model a hard question. Chuck Brockway said it would have been better if there were more years in the validation period. Allan said it would have been better if the last two years were somehow significantly different. Chuck Brockway said the 23 years in the calibrated model are adequate, but the normal procedure is to have a longer data set for validation. Willem said we still have to ask a question that the model is not calibrated to in order to have a real validation, and it doesn't matter how many years are in the dataset. Allan said he will find the missing data, make final 2009 – 2010 validation runs, and prepare a report.

Willem asked about the Malad data, and Allan said the data needs to be filtered with the approach taken by Pete Vidmar. Jon Boling said it is a complex area with a noisy dataset, but all-in-all the match looks OK.

Chuck Brockway asked if there will be statistics in the final report on calibration or will it be just visual. Allan said there will be lots of graphics with some statistics. Greg Sullivan said that the graphs that he submitted have statistics. Allan said there is a standard error calculation for heads but not by well, a mean residual calculation, etc. Chuck Brockway asked about statistics for reach gains. Allan said there will be a paragraph with a general discussion and a graph for each reach, and it will be posted in a week. Willem suggested doing a run of Greg's cross plots with different color dots for calibration and validation data. He also recommended a PEST run while only loading the validation data to obtain statistics that could easily be separated out.

Chuck Brockway said the  $R^2$  doesn't provide a complete picture of goodness of fit. Greg Sullivan asked what we should use. Willem suggested using the slope on cross plots to determine if we are under predicting or over predicting. Chuck Brockway said that for those who are statistically minded, the  $R^2$  may not be enough. Bryce Contor agreed with Chuck. Greg said we need bench marks so we can tell if we improve the model with each new version. Willem said it is our obligation to find statistics to report that make sense, so he recommended:

- Standard error
- $R^2$
- Absolute average
- Cumulative?
- Slope of the cross plot

Bryce said slope of the cross plot is a good choice. Chuck Brockway recommended the following statistical metrics:

- Mean error
- Mean absolute error
- RMS error

Chuck said these metrics should be done seasonally, and David Hoekema agreed.

Willem said all statistics should be expressed on a monthly basis, and Chuck Bredecke said the mean residuals should be determined monthly. Chuck Brockway showed a slide of statistics that could be reported. John Koreny said it is a mistake to create statistics on time series plots, and he was concerned that the plots do not reflect nuances in the data. John said that time series statistics are better represented on a graph. Dove Colvin said it is better to have statistics with a graphical representation so future comparisons can be made. Willem said that a number of different graphs with statistics should be shown. John Koreny said that there is the possibility that we will have a low  $R^2$ . Willem said that if you don't show the  $R^2$ , you will be accused of hiding it.

Bryce suggested that the committee should have a statistician advise members on what statistical measures should be used to support the results of calibration and validation. He said it would be worth the money and help avoid making unknown errors. Willem said that all we need to show is that the statistics for ESPAM version 2 are better than for version 1.1. Chuck Brockway asked what if they are not universally better. Willem said the statistics won't be universally better, but there should be an improvement. Willem said that, as a comparison, we will see how well ESPAM made the same predictions e.g., (curtailment). Allan said the IDWR will prepare a report with statistics for committee review.

Greg Sullivan asked if there are any issues with the 1902 validation. Allan said that he needs the average river flow for 1902, and he believes the data is available. Willem asked what formula will be used for self-calculation of stage in the Snake River. Allan said that he is using the Stream Flow Routing package that comes with MODFLOW and assuming that the river has a rectangular cross-section in the 1902 validation. Willem said this would be OK just as long as gains and losses are not large compared to river flow. David Hoekema asked how Allan is treating stream conductance, and Allan said he is using the river bed conductance from the calibrated model.

**Item 8 -** Jennifer Sukow led a discussion of the work plan for comparing ESPAM version 2.0 vs. 1.1. She indicated a draft work plan was sent to the committee for review and comment, and she said that she reviewed the IWRRI Curtailment Scenario (March 2006) in preparation for the comparison. Jennifer then reviewed the important characteristics of the ESPAM version 1.1 Curtailment Scenario including the predictions:

- Steady state response to continuous curtailment
- Transient response to continuous curtailment for 150 years
- Transient response to a one-year curtailment

She listed the approach in the ESPAM version 2. Curtailment Scenario Work Plan as:

- Numerical superposition version of EPSAM2.0
- Run with well files from ESPAM1.1 scenarios

- Run again with well files created using ESPAM2.0 input data
  - 2012 POD file
  - 2008 irrigated lands
  - Average groundwater fraction raster
  - Average precipitation from Nov 1998 – Oct 2008
  - Average ET from Nov 1998 – Oct 2008

Chuck Brockway asked if the exact same stress can be compared, and Jennifer said yes. Bryce asked what the significant differences might be, and Allan said he suspects the 2004 POD file is significantly different from the more recent POD file (i.e., 2012). Jennifer indicated that the Curtailment Scenario/ESPAM version 1.1 relied on the 2000 irrigated lands data, and there would be a difference in the irrigated acreage, in part due to changes in the reduction factor for non-irrigated inclusions between ESPAM1.1 and ESPAM2.0. The 2008 irrigated lands data set will also be different than 2000. Bryce asked how semi-irrigated lands were treated, and Jennifer said they were taken out of the 2008 irrigated lands data file. Mike McVay looked at the average surface water availability from 1980 through 2008 to estimate the average ground water source fraction for areas where the groundwater fraction was inflated during calibration to avoid incorrect calculation of deficit irrigation. These average groundwater fractions were applied to a few entities including the Big Lost and Oakley. The average groundwater fraction file also changes the water source for Montevieu and Mud Lake which were calibrated as a surface water source to allow simulation of canal seepage. Bryce questioned if the average ET for 1998 to 2008 was really 3.1 ft, but said that it seemed like a reasonable approach.

Chuck Brockway asked how Allan sorts the POD file to determine which wells are subject to curtailment. Allan said the steps are in Practicum 3 of the ESPAM version 1.1 training. He said the source fraction is set to 0, the priority fraction is set to 0, and then using the pdate script and the POD file, the priority fraction in each model cell is obtained by assuming the ratio between junior cfs to total cfs is equal to the ratio between junior acres to total acres in each model cell.

Chuck Brockway asked what the benefit of comparing the two model versions is. Willem commented that the Director will use the results. Jennifer said the results will help explain how the two models are different. Bryce said the comparison will also be an indicator of model uncertainty. He explained that the version of ESPAM in use is the best model available at the time, although both models are valid. He said the difference in output shows how much uncertainty is inherent in the models.

Dave Colvin asked if there is a different methodology for a real curtailment, and whether all the model improvements will be capitalized upon. Jim Brannon said there are different ways to determine the cell-by-cell junior fraction. Then Jim asked if there could be a preview before the actual training. Greg Sullivan asked if we could have the discussion now, and Jim responded that he did not have the details right now. Greg

said he wanted to know the conceptual differences in Jim Brannon's approach vs. how Allan presented it. Allan said the priority date source code can be found on the web site under model tools, and it is written in PERL.

([http://www.idwr.idaho.gov/Browse/WaterInfo/ESPAM/model\\_tools/current\\_version/](http://www.idwr.idaho.gov/Browse/WaterInfo/ESPAM/model_tools/current_version/)).

Chuck Brockway said that ESPAM versions 1.1 and 2 should both be run using the original well file, and both should be run using the new well file. Bryce Contor said the Director wants the combined effects of the model, the processing tools, processes, parameterization, etc. Allan agreed that new processes should be included in the test. Dave Colvin and Jim Brannon agreed to share their new processes to calculate the junior fraction, and Jennifer Sukow said she will share the current priority date source code.

Chuck Brockway asked if there were any other changes that need to be made, and Allan said that Basin 36 wells (below the rim) should be deleted out of the POD file. Chuck began asking questions about superposition, and Allan indicated that Gary Johnson had published a report on this subject and that the pdate program source code can be found on the web site under model tools, and it is written in PERL

([http://www.idwr.idaho.gov/Browse/WaterInfo/ESPAM/model\\_tools/current\\_version/](http://www.idwr.idaho.gov/Browse/WaterInfo/ESPAM/model_tools/current_version/)).

**Item 9 -** Allan Wylie presented the results of predictive uncertainty analyses to date focusing on the results of the simulated impacts (maximized and minimized) from WD 34 to the near Blackfoot to Minidoka reach, from WD 130 to the near Blackfoot to Minidoka reach, and from WD 130 to the Ashton to Rexburg reach. He used bar charts for each that showed how much each parameter was changed during each run. At the end, he indicated that PEST was not able to maximize the impact on the Henry's Fork without adversely impacting the objective function and the model did not stay calibrated.

Allan also showed a table of the 15 completed analyses to date, indicating the runs conducted with calibration 001 and 008. He asked the committee which future predictive uncertainty runs should be prioritized. The committee agreed that the impacts from the Water Districts on Blue Lakes Springs should have the lowest priority. Chuck Brockway asked for Allan's opinion on the difference in results using calibration 001 vs. 008. Allan said he did not think there would be much difference. Chuck Brendecke suggested that Allan complete the analyses under the SWCo (Surface Water Coalition) first, and then finish the Clear Lakes column, and then the Henry's Fork Column. Chuck Brockway said that then Allan should go back and repeat uncertainty runs previously done with calibration 001, starting with the Water District 34 impact on SWCo.

Greg Sullivan asked Allan to show where the stress was realized in addition to the reaches/springs in the table. Allan said this could be done with a pie chart. Greg also requested a few sentences on what is evident from the bar charts. Chuck Brendecke said that the few sentences should highlight anything that is evident and what it suggests for model conceptualization. Allan said that whether there are observations or data that could be collected to reduce uncertainty should also be included in the write-

up. Chuck Brendecke re-emphasized that any additional interpretation would be valuable. Chuck Brockway said that PEST is kind of doing its own thing and we are tagging along. Then he asked the question, regarding how the output should be used to better structure the model and get better data. He also said that we should use the output to inform the Director.

**Item 10** - The committee agreed that the next meeting should be June 21<sup>st</sup>, and the training should be held on the 22<sup>nd</sup>. The committee also agreed that as a backup, the meeting should be held the 13<sup>th</sup>, and the training would occur on the 14<sup>th</sup>.

### **DECISION POINT SUMMARY**

The following was agreed upon:

- 1) The committee agreed that after 1986 is completed the next irrigation season processed using METRIC should be 1992.
- 2) The committee agreed with setting up a subcommittee to determine the best way to incorporate METRIC data into the next version of ESPAM and how to calculate ET for the intervening years. The committee agreed to Mike McVay as the lead, and volunteers to serve included Bryce Contor, Bill Kramber, Matt Weaver, Rick Allen, and David Hoekema.
- 3) IDWR agreed to present the validation results as the cumulative departure from the average.
- 4) IDWR agreed to fill in the missing data, make final 2009 – 2010 validation runs, and prepare a report.
- 5) IDWR will prepare a report on the results of calibration and validation with statistics for committee review.
- 6) Dave Colvin and Jim Brannon agreed to share their processes to calculate the junior fraction, and Jennifer Sukow said she will post IDWR's current priority date source code. [Note: The Python code and draft documentation for the Curtailment IAR Tool were posted on the ESPAM website on April 17, 2012. A beta version of the Curtailment IAR Tool was made available for testing on May 9, 2012.]
- 7) IDWR agreed to make a report on superposition published by Gary Johnson available to the committee. ([http://www.if.uidaho.edu/~johnson/ifiwri/pub\\_docs/rf-BOR11.PDF](http://www.if.uidaho.edu/~johnson/ifiwri/pub_docs/rf-BOR11.PDF))
- 8) The committee agreed that the impacts from the Water Districts on Blue Lakes Springs should have the lowest priority for uncertainty runs.
- 9) IDWR agreed to complete uncertainty runs for the Water District impacts in the following priority: SWCo (Surface Water Coalition) first, and then Clear Lakes, and then the Henry's Fork. IDWR also agreed to then go back and repeat uncertainty runs previously done with calibration 001, starting with the Water District 34 impact on SWCo.
- 10) IDWR agreed to use a pie chart to show where the stress was realized in addition to the reaches/springs agreed upon for the uncertainty runs.
- 11) The committee agreed that the next meeting should be June 21<sup>st</sup>, and the training should be held on the 22<sup>nd</sup>. The committee also agreed that as a backup, the meeting should be held the 13<sup>th</sup>, and the training would occur on the 14<sup>th</sup>.