Rick Raymondi
Idaho Water Resources Department
322 E. Front St
PO Box 83720
Boise, Idaho 83720-0098

October 24, 2006

Dear Mr. Raymondi:

Thank you for the opportunity to participate in the recent Eastern Snake Hydrologic Modeling Committee meeting on September 28th and September 29th. The meeting topics included the role of the ESHMC in providing input to the Idaho Water Resource Board's (Board) process to develop the ESPA Comprehensive Management Plan Framework and revisions to the "Base Case Scenario". We are submitting the following questions and comments on these two topics. We are in receipt of the memo from Bryce Contor dated October 17, 2006 regarding the meeting results and have noted points of agreement or disagreement with the conclusions of the Contor memo.[1]

1. ESHMC AND IDAHO WATER RESOURCE BOARD

The following comments discuss the continuing role of the ESHMC and the information being requested by the Idaho Water Resource Board.

Role of ESHMC

Further clarification is needed regarding the future role of the ESHMC, especially as pertains to the development of the ESPA Comprehensive Management Plan Framework. Based on our understanding from attendance at the recent Board and ESHMC meetings, the role of the ESHMC is to provide information to the Board regarding the current and likely hydrologic condition of the ESPA. Is this correct?

Information to be Provided to the Idaho Water Resource Board by the ESHMC

If the ESHMC is tasked with providing information to the Board, as suggested above, then it is important to define what information is needed and what questions should be answered. We suggest the following topics should be addressed by the ESHMC and provided as information to the Idaho Water Resources Board:

- Summary of historical and current hydrologic conditions of the Eastern Snake Plain Aquifer (ground water levels, reach gains, spring flow, irrigated acreage, irrigation practices, tributary flow) with sufficient detail to evaluate mid-irrigation season conditions and other pertinent information.

[1] John Koreny of HDR Engineering, Inc., Chuck Brockway of Brockway Engineering, Inc., John Bowling of Idaho Power and Willem Schreüder of Principia Mathematica serve as technical participants in the ESHMC and represent the Surface Water Coalition, Idaho Power Co. and Clear Springs Foods.

- Summary of the ability of the ESPA to meet the current water demands (ground water, spring flow, surface water flow) for existing water supply uses (water supply, hydroelectric and natural resource uses).

- Conclusions regarding the appropriate application of and limitation of the ESPA model, and recommendations concerning ongoing efforts to improve the usefulness of the model for planning and water rights administration.

- Identify the range of potential future conditions for the ESPA (reach gains, ground water levels, spring flow levels). *The new scenario replacing the Base Case Scenario will be help to provide this information.*

- Summarize the ability of the ESPA to meet projected water demands.

- Identify the potential management options for the ESPA and evaluate the technical effectiveness of various options.

- Prepare a timely report summarizing the information described above.

Is this an appropriate scope for information needed by the Board to assist in decisions regarding future use and management of the Eastern Snake Plain Aquifer? If not, what scope is appropriate?

Procedure to Develop Information

We appreciate the ESHMC's role in providing input to IDWR (and IDWR's contractor IWRRI) during the development of the ESPA model and model scenarios. The ESHMC is being requested to provide information to the Idaho Water Resources Board. We suggest a clearly defined role for ESHMC involvement, including understanding and agreement on ESHMC's participation in development, review and comment on information products to be conveyed to the Board. The process needs to include the opportunity for ESHMC participants to provide data analysis and information that contributes to the work product being developed. The process also needs to allow ESHMC members to stipulate agreement or disagreement with information products in writing. There should be a clear understanding that comments or other information produced by individual ESHMC members will be reported and published as part of the ESHMC work product without revision. This procedure should be agreed to by all Committee members and documented. We realize that the production of information and the process used to review and comment on documents needs to be timely so that the Board can consider the information as part of their independent process to develop the ESPA Comprehensive Management Plan Framework. Memorializing the recommendations and decisions made at each ESHMC meeting would significantly aid the process of documenting different viewpoints and whether consensus was reached. We appreciate the meeting minutes that we distributed after the last meeting on October 17, 2006.

It is our understanding that the Board will develop goals and objectives for water management of the ESPA. We understand that this process will be independent of the ESHMC. We suggest that the ESHMC provide information that could be used to assist the Board in this process. It is also

possible that the ESHMC could provide additional input (such as quantitative modeling results) if requested by the Board.

2. NEW SCENARIO TO REPLACE THE BASE CASE SCENARIO

We appreciate the opportunity to participate in developing a new scenario to replace the Base Case Scenario. The following is a summary of the topics discussed in the meeting regarding the new scenario, a summary of our understanding of the decisions reached and our suggestions for important components to be included.

We understand that the following topics regarding the existing Base Case Scenario were agreed to by the ESHMC.

- The existing Base Case Scenario is not appropriate for evaluating the aquifer conditions with respect to the flow depletion or ground water levels from changes in net aquifer recharge. The existing Base Case Scenario is also not appropriate for evaluating future aquifer conditions.
- The early-1980s period in the existing Base Case Scenario incorporates greater surface water diversions and lower irrigation on-farm efficiency (sprinkler versus flood irrigation) than current aquifer conditions. This causes incidental recharge to be higher than occurring under current irrigation practices. The high incidental recharge simulated during the early-1980s should not be projected into the future.
- Current irrigation practices are probably reflected in the record from about the mid-1990s to present day. It is likely that conveyance and on-farm efficiency in the future will stay the same or become more efficient- not less efficient.
- Return flow increases in the model from 1980 to 2002. There is uncertainty regarding the assumption to increase return flow in the calibrated model, and these increases should probably not be included in the simulation of future conditions. Return flow should be examined in the next model calibration.
- The model should be updated to 2006. As an interim measure, this update can be performed using a process of correlation to recent historic indicators and recent similar years prior to running the revised scenario.
- It is not possible to precisely determine when climate variability will cause increases or decreases in the overall water supply conditions for the basin or the aquifer. Future modeling scenarios should clearly state this limitation.

We understand that the following topics regarding the new scenario that will replace the Base Case Scenario were discussed and agreed to by the ESHMC. Topics where agreement was not reached are noted below.

- The new scenario to replace the Base Case Scenario should be re-named, "**Current Water Use Practices Scenario**" to reflect that the simulation is a "*Simulation of aquifer conditions in response to current water-use and management practices over a representative hydrologic sequence*". The new scenario will incorporate the current irrigation practices (high

percentage of on-farm sprinkler distribution, current crop mix, recent surface water diversions, etc.).

- The replacement for the Base Case Scenario will also include model simulations to analyze the likely future aquifer conditions that will result if current declining trends in net aquifer recharge persist. This will be accomplished by developing **Separate Additional Simulations to Evaluate Future Aquifer Conditions**[2] with variations in model input parameters to evaluate potential aquifer conditions that may result if current declining trends in net aquifer recharge persist. These additional simulations are needed because current trends in declining net recharge (such as declining diversions and conversion to sprinklers) may continue in the absence of conscious actions.

- The model should be extended to 2006 prior to developing the new scenario. As an interim measure, this update can be performed using a process of correlation to recent historic indicators and recent similar years prior to running the revised scenario.

- The **Current Water Use Practices Scenario** and the **Separate Additional Simulations to Evaluate Future Aquifer Conditions** are described below:

  a) **Current Water Use Practices Scenario** Two options were discussed for this scenario.

  - Option 1- Repeat Past Historical Model Data into the Future:

    This approach would use a recent period of historical record from the ESPA model (updated through 2006) that is reflective of current irrigation practices and that also reflects the likely climatic variability in the future. If this approach is used, the simulation would either need to use the most-recent model years that incorporate the current high-percentage sprinkler estimates ***or*** a longer series of years between 1980 to 2006 with adjustments to surface water diversions, sprinkler percentages, crop type, return flow, canal leakance and other parameters that control incidental recharge to reflect current conditions. The data needed for this approach would be assembled as input files to ESPAM.EXE. The ***advantage*** of this approach is that it is simpler than Option 2 (described below) and allows full use of the data developed for model input/output through ESPAM.EXE without further modification. The ***disadvantage*** is that it only uses 26 years of model data (1980 to 2006), which may or may not reflect the full range of climatic variability in the basin water supply.

  - Option 2- Extension of Recent ESPA Model Period w/Correlation to Regional Index:

    This approach involves generating a synthetic dataset (not historical) for the ESPA model by correlating similar years from the 1995 to 2006 ESPAM.EXE input files to a regional index of precipitation and inflow to the Snake River and then extending the ESPAM.EXE input files over a longer period using the regional index record. The ***advantage*** of this approach is that it provides a longer period which may allow a more-complete simulation of the range of hydrologic variability. The ***disadvantage*** is that correlation of ESPAM.EXE input files to a regional index would involve significant analysis and judgment and the process to create the extended ESPAM.EXE input files would be more difficult than Option 1, described above. It also may be very difficult to

[2] The terminology "Separate Additional Simulations to Evaluate Future Aquifer Conditions" was not discussed at the meeting. This terminology is introduced only to characterize the type of analysis discussed.

correlate multi-year surface water irrigation practices between years to a regional index.

A decision was not reached on which option to use. Suggestions are included in the next section.

b) Separate Additional Simulations to Evaluate Future Aquifer Conditions It was agreed that additional simulations to evaluate future aquifer conditions should be conducted separate from the **Current Water Use Practices Scenario**. These additional simulations are intended to provide an evaluation of the most-likely future aquifer conditions. The scope and method to be used to run these simulations were not discussed. Suggestions are provided in the next section.

- Statistical approaches that incorporate an evaluation of uncertainty and hydrologic variability, as well as an approach to incorporate a forecast of near-future likely climate, were discussed. The group agreed that a statistical approach is necessary to address uncertainty. A decision was not reached regarding the best statistical approach to evaluate uncertainty.
- The group expressed interest in developing some method to forecast the near-future aquifer conditions that may result from recovery from drought conditions. It was discussed and recognized that: 1) uncertainty in forecasts increases with time and near-future forecasts beyond the current water year have a great deal of uncertainty, 2) analytical tools currently developed for this project do not allow for predictive forecasting. A decision was not reached on whether forecasting should be included or how forecasting should be accomplished.
- The revised model scenario should be organized so that it is clear that a forecast is not being made about long term future conditions. However, it is important to simulate absolute reach gains, ground water levels and spring flows. One suggestion was to number future years from 0 onward instead of designating calendar years.

We are submitting the following suggestions for the new scenario.

Specific Suggestions

- **Options for the Current Water Use Practices Scenario**: We suggest that the **Current Water Use Practices Scenario** use the "repeating years" method (Option 1) with adjustments in surface water diversions, sprinkler percentage, return flow, canal losses and crop type to reflect current irrigation practices. We suggest that period from the 1980s to 2006 incorporates sufficient hydrologic variability for present purposes. The input files to ESPAM can be easily modified to simulate current irrigation practices by providing adjustments to the sprinkler efficiency, return flow, canal losses and a few other components. The reason that we suggest using the "repeating years" method (Option 1) is to avoid the complexity of correlating ESPAM.EXE input data to a long-term regional index and synthetically generating the multiple year ESPAM.EXE input data for a long time period. Considerable analysis and judgment will be required to correlate between regional index-parameters and ESPAM.EXE input parameters. There are many uncertainties regarding climate, surface water irrigation practices, reservoir storage that affect aquifer recharge that would need to be correlated. Option 1 retains the usability of the input data to ESPAM.EXE for additional future conditions simulations. The method may be just as valid as Option 2,

because the climatic variability from the early 1980s to 2006 seems to be generally representative of the climatic variability from the longer available hydrologic record. Results from a supporting analysis on this issue are available upon request.

- **Separate Additional Simulations to Evaluate Future Aquifer Conditions** We suggest that the following aquifer management simulations be considered to be completed as separate additional simulations run as a variation to the **Current Water Use Practices Scenario** described above (other options could be included to the list below):
    - Decreased Surface Water Diversions This scenario would involve an analysis of the results of continued decreased surface water diversions that may result if historical trends in declining reach gains and declining surface water diversions continue in the future.
    - Increased Irrigation Efficiency This scenario would involve an analysis of the results of increased irrigation efficiency that may occur.
    - Changes in Crop Mix This scenario would involve an analysis of changes in future crop mixes that may occur.
    - Aquifer Management Options Other scenarios could be completed to evaluate the effects of changing aquifer management.

  These additional scenarios could be run either as independent runs; or super-position analyses with the results super-imposed on a baseline. This recognizes that the Current Water Use Practices Scenario will not incorporate continuing trends in net aquifer recharge that are likely to persist and that additional simulations are needed to reflect these continuing trends.

General Suggestions

- **Work Plan for New Scenario**: We suggest that a brief work plan be developed, reviewed and approved for the scenario that will describe the steps taken to run the model simulations in advance of the completing the simulation.
- **Ground Water Levels are Important**: The revised scenario needs to evaluate ground water levels in the aquifer. There are many water users that need to understand whether ground water levels will continue to decline in the ESPA.
- **Mid-Irrigation Season Reach Gains**: It is very important that the process used to develop the new scenario recognizes and addresses the significant and persistent declines in the mid-irrigation season (July to September) reach gains that have occurring since the 1970s to present day. These impacts have been documented and confirmed by statistical trend analysis. The current model is unable to simulate or replicate these severe and persistent mid irrigation-season reach gain declines. The model process needs to be revised to allow prediction of reach gains during the mid-irrigation season for the transient model. Ideally, the model should be adjusted so that it uses a monthly stress period to compare modeled results to historic monthly reach gain data. Incorporation of monthly stress periods is not unusual and has been accomplished for many other regional ground water assessments. We recognize that this would require significant data adjustments and model recalibration that

may not be possible at this time. However, at a minimum, a process needs to be included so that the model results can be correlated to monthly reach gain estimates in the middle of the irrigation season. This mid-irrigation season evaluation is essential to effective management of changing aquifer conditions, and understanding of the natural flow water supply available during the middle of the irrigation season.[3]

- **Thousand Springs-Reach Spring Flow**: If the model results for the individual Thousand Springs reaches are intended to be applied for the management of individual springs, then a full discussion needs to be included regarding the ability of the model to make predictions at individual springs based on measured data and model data. The ESHMC should be provided the opportunity to provide input into this issue.
- **Start Simple, Then Add Statistical Analysis if Necessary**: There is a risk that the model results could be very difficult to understand or replicate if statistical treatments are introduced to the initial simulation in the first step of building the scenario. We recommend that one simple initial model run be completed with additional separate scenarios representing possible future trends in variations representing different aquifer management options included as separate scenarios. If additional model runs are needed to statistically address model uncertainty- then these should be included as a follow-on step after the more simple analysis has been completed and reviewed.
- **Update of Model to 2006.** The process to be used to update the model to 2006 needs to include a comparison between simulated and measured ground water levels, reach gains and spring flows. We request that a process be used to evaluate the simulated and measured levels for the mid-irrigation season months.

3. COMMENTS ON BRYCE CONTOR MEMO, OCTOBER 17, 2005

This section provides specific comments to the memo by Bryce Contor dated October 17, 2005. The organization of comments is in the same order as the topics introduced in the memo. Please note that the information below is intended to provide clarity on information on the subject areas discussed. We appreciate the opportunity to participate and clarify our opinions:

Item 1

- Agree with all comments.
- Suggest the following *minor comment* on the statement, "*actual effects will be determined by future hydrologic conditions which are unknown and unknowable*". We can not predict the future with absolute certainty- some conditions can be predicted as the most-likely conditions that will occur. Here are some examples of hydrologic conditions that are likely to occur in the future.
    - The hydrologic variability in the natural water supply (river flow and precipitation) observed in the past record will be replicated in the future (disregarding the effects of climate change).

[3] Technical representatives for the Idaho Surface Water Coalition serving on the ESHMC committee strongly urged that: 1) monthly reach gains be analyzed to determine if there are declines in reach gains during the middle of the irrigation season and 2) that the ESPA model include monthly stress periods in order to evaluate mid-irrigation season reach gains. These requests have been presented since the beginning of the formulation of the model.

- Conveyance and on-farm distribution practices will not become less efficient. Any changes in the future will likely lead to more efficient water use. Consequently, future use scenarios should reflect actual conditions or more-efficient conditions.
- Surface water diversions have decreased as a result of both increased on-farm efficiency and lack of supply during portions of the irrigation season. They will not increase to the diversions occurring prior to the 1990s, unless some management practice is instituted that effects supply in the future. Consequently-future use scenarios should reflect the decreasing diversions (and associated decreasing net recharge) that is likely to occur in the future.

Item 2-4

Agree with all comments.

Item 5

- Clarification to "*generally agreed that the third question. . . should be addressed through specific superposition scenarios addressing particular management options*." Superposition methodology was not agreed to for evaluate timing of management scenarios. Superposition may or may not be the appropriate tool- depending on the scenario.
- Comment on, "*Upon further consideration, IWRRI sees merit in only addressing question two. . . Before we began recording on the white board, we discussed the possibility that this scenario should also attempt to represent possible future changes, i.e., reductions in surface water diversion volume or incidental recharge. We decided not to address future changes in this scenario . . .*" We do not agree with these statements and do not agree that consensus was reached on these issues. We believe the Board needs information on all three of questions posed and the model process should provide information for these questions. The new model scenario needs to incorporate a **Current Water Use Practices Scenario** that is reflective of current irrigation practices and future climatic variability. **Separate Additional Simulations to Evaluate Future Aquifer Conditions** with variations in model input parameters should be used to evaluate potential aquifer conditions that may result if current declining trends in incidental recharge (or other trends) persist into the future.

Item 6

- Comment: We do not agree that the first attempt at this simulation should include probalistic evaluations of climatic variability or other aquifer management parameters. The scenario should first be completed with one baseline run with results that can be reviewed and evaluated and then additional runs to evaluate likely aquifer conditions. Then, if additional probabilistic evaluations are necessary, they should be completed as follow-on analysis to the more simplistic evaluations. This will result in a process that can be understood, reviewed and replicated by all parties involved.

Item 7

- We do not understand the meaning of the comment, "*if starting heads are correctly represented, all prior hydrologic impacts are implicitly integrated into the modeling scenario*". Further clarification is needed to explain the meaning of this statement in the context of the scenario under consideration. Further discussions is needed on this subject.

- Comment on, "*At the meeting we concluded that in order to meet the first purpose, the simulation would need to incorporate multiple traces of possible future hydrologic conditions in order to define the upper and lower bounds. After discussion of ways to build synthetic data sets that contained the appropriate mean, variability and serial correlation, we agreed at the meeting to use actual historical records to establish the "representative hydrologic sequence"*. We believe that, although a discussion was held on the merits on various procedures, no conclusion or consensus was reached on this subject. Our suggestions on this subject have been presented above.

Item 8

- Items a, b and c were discussed but not "*tentatively concluded*" to by the group. We believe that the methodology described in items a, b and c is overly complex and too time consuming to produce results within a meaningful time frame for consideration by the Board. We agree with the suggestion on page 4 of the Contor memo that the method presents a concern, "*over the difficulty of constructing representative data sets*". We have suggested what we believe to be a simple, robust and reasonable approach (on page 5) that could be completed with a month. We have suggested that this approach be combined with providing basic information on the aquifer conditions so that the Board can use the information within a reasonable time period. The approach summarized in a, b and c will lead to many questions regarding the method that will enhance uncertainty in the result.
- Comment on: "*some components of the water budget might be eligible for negotiated modification. Those of us still in attendance agreed this was not a good idea*". We do not agree that some components of the water budget should not be modified in the future and this item was not agreed to at the meeting. We believe that the future conditions water budget should include a representation of the most-current aquifer management practices, and some components of the water budget should be modified to represent the most-current aquifer management conditions.
- Comment on statement, "*future hydrologic conditions will be the single biggest driver of actual events*". We do not agree that climatic variability in precipitation or river flow will drive the long-term aquifer conditions. It is clear that changes in incidental recharge and ground water pumping have caused the major changes in net aquifer recharge that have resulted in large-scale changes to ground water levels, spring flow and reach gains.
- We would like to offer a point of clarification for the statement, "*there are several developments that may have changed the utilization of storage water invalidating the use of the long-term record of carry-over storage as an indicator: 1) changes that <u>may</u> have occurred in reach gains*". It should be noted that there is no uncertainty in the fact that reach gains have declined in the middle of the irrigation season throughout most of the ESPA with statistically significant trends observed for most reaches.

Item 9 Corrections

Thank you for including this correction. We would like to provide some clarification on this subject. The TFCC natural flow diversions for June, July and August show a persistent decline from both 1950 to current and 1980 to current. We can provide graphs to confirm this conclusion.

Item 10

We appreciate that the items listed, and many other items described above, need further attention.

We would appreciate your confirmation or correction regarding our understanding of the items discussed above. We also would appreciate your input into our questions and suggestions. Thank you for the opportunity to provide comments.

Sincerely,

John Koreny
HDR Engineering, Inc.

Charles Brockway
Brockway Engineering, Inc.

Jon Bowling
Idaho Power Company

Willem Schreuder
Principia Mathematica

Copy:
Jerry Rigby, Idaho Water Resources Board
Diane Tate, CDR Associates
Hal Anderson, Idaho Water Resources Department
Karl Dreher, Idaho Water Resources Department
Allan Wylie, Idaho Water Resources Department
Tim Luke, Idaho Water Resources Department
Lyle Swank, Idaho Water Resources Department
Sean Vincent, Idaho Water Resources Department
Rick Allen, University of Idaho
Donna Cosgrove, Idaho Water Resource Research Institute
Bryce Contor, Idaho Water Resource Research Institute
Gary Johnson, Idaho Water Resource Research Institute
Chuck Brendecke, Hydrosphere Consultants, Inc.
Greg Sullivan, Spronk Water Engineers
Kathy Peter, U.S. Geological Survey
Steve Lipscomb, U.S. Geological Survey

Jim Bartolino, U.S. Geological Survey
R.D. Schmidt, U.S. Bureau of Reclamation
Patrick McGrane, U.S. Bureau of Reclamation
Mike Beus, U.S. Bureau of Reclamation
Gregg Ten Eyck, Leonard Rice Engineers, Inc.