

## Appendix B

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### Meeting Summaries Watershed Flow Evaluation Tool Project Stakeholder Meetings

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**Colorado Basin Roundtable Nonconsumptive Needs Assessment Subcommittee Meeting Summary**  
**Nonconsumptive Needs Quantification Water Supply Reserve Account Grant Project**  
**August 10, 2009**  
**Eagle, CO**

Following is a meeting summary from the Colorado's Basin Roundtable's Nonconsumptive Needs Assessment Subcommittee Meeting held August 10, 2009 in Eagle, CO. This a summary of the major outcomes, action items and discussion during the meeting. It does not contain a verbatim account of the meeting but is intended to provide a summary of the outcome and next steps for the roundtables Water Supply Reserve Account Grant for Nonconsumptive Needs Assessment Quantification. Attendees at the meeting were: Lane Wyatt, Ken Neubecker, Jim Pokrandt, Caroline Bradford, Kerry Sundeen, Bruce Hutchins, Sharon Clarke, Gerry Knapp, Kathy Kitzman, and Nicole Rowan.

Lane and Ken opened up the meeting by describing that what they wanted to discuss during the meeting included: gathering any feedback on the reports that were produced by CWCB on the nonconsumptive needs assessment mapping and the pilot of the Watershed Flow Evaluation Tool (WFET), discuss whether the committee should recommend to the Colorado Basin Roundtable that the work be conducted as outlined in the contract's scope of work and discuss potential first steps in conducting the work.

The outcomes and action items of the meeting are summarized as follows:

- The group agreed that before work begins on the completing the Watershed Flow Evaluation Tool per the Water Supply Reserve Account scope of work that one of the workshops detailed in the scope of work be held as soon as possible so that subcommittee members and water providers from the front range can work with the contractor's technical team in addressing questions and concerns about the technical basis of the WFET and application of WFET. This workshop will be held after the subcommittee and Front Range water providers provide a list of questions and comments about the WFET technical basis and application. The workshop will be organized to address the questions and comments.
- The subcommittee and Front Fange water providers will provide their questions and comments to Lane Wyatt, Ken Neubecker and Nicole Rowan by August 28, 2009. Members of the subcommittee requested that the questions and comments be distributed to the entire subcommittee by replying all to the email from Lane or Ken distributing this meeting summary. Lane, Ken and Nicole will compile the comments and send the compilation to the subcommittee.
- Lane and Ken will prepare a summary and recommendation to the Roundtable summarizing the activity that has occurred with the Water Supply Reserve Account to date and this summary will provide a recommendation that authorizes the contractor's technical team to proceed with assisting with the workshop but that the Nonconsumptive Subcommittee will decide and recommend to the roundtable at a point after that workshop whether or not to continue development of the WFET for the basin.

The discussion at the meeting mainly centered on comments on the WFET and not where to apply the tool or the next steps in the technical effort. These comments are summarized below and are organized by general comments about the nonconsumptive needs assessment quantification effort, the technical basis for WFET and the application of WFET.

#### General Comments and Questions about the Nonconsumptive Needs Assessment Quantification Effort

- The end products and outcomes of the study need to be defined and discussed at the workshop.
- The WFET effort needs to be coordinated with the supply availability study.
- An understanding of the type of modeling inputs needed for the supply availability study is needed (i.e., will the CRWAS model be a monthly time step?).
- CWCB (Ray Alvarado and perhaps Ross Bethel) should attend the workshop to discuss the WFET technical basis and application in relation to the Water Availability Study.
- There may be dual objectives with the study – one focusing on adequate methodology and the other is consideration of how results are applied to streams for flow evaluations and how it is used in the supply availability study.

#### Comments and Questions about the Technical Basis for the WFET

- There needs to be further validation and calibration of the tool. Some members of the subcommittee didn't feel that there was enough validation with the existing pilot.
- One subcommittee member felt that nothing was to be learned or new about the results of the WFET pilot, it doesn't tell us anything we don't already know just by looking.
- The basis for the riparian flow ecology relationship needs to be further explained in the workshop.
- The limitations of the tool need to be further discussed and clarified – especially in light of the Fountain Creek results. What are the implications of the pilot in regards to areas in the Colorado Basin where water has been added to some streams?
- One subcommittee member noted that WFET appears to have promise as a screening tool.
- Where is the tool applicable and not applicable with respect to channel type and geomorphology?

#### Comments and Questions about the Application of the WFET

- There were numerous comments on the example of developing a range of flows or range of hydrographs that was presented in the pilot report. It was mentioned numerous times that the flow needs for different attributes should be considered separately and not in a combined hydrograph.
- There was discussion that one potential application of the WFET would be to examine what change in flows would shift the risk categories defined in the tool.
- General quantifications based on percentages and Risk may work better for the tool than giving the numbers that the Risk evaluation is based on.

**Colorado Basin Roundtable Nonconsumptive Needs Assessment Subcommittee Meeting Summary  
Nonconsumptive Needs Quantification Water Supply Reserve Account Grant Project  
October 19, 2009 and November 5, 2009 Meetings**

**Participants in 1 or both meetings:** Gerry Knapp, Caroline Bradford, Lane Wyatt, Nicole Rowan, Thomas Clark, Paula Belcher, Kerry Sundeen, Kathy Kitzman, Ken Neubecker, Peggy Bailey, Kirk Klanke, Jacob Bornstein, LeRoy Poff, Pat Wells, John Sanderson, Brian Bledsoe, Jim Pokrandt

Following is a meeting summary from the Colorado's Basin Roundtable's Nonconsumptive Needs Assessment Subcommittee Meetings held October 19, 2009 in Glenwood Springs and November 5, 2009 in Avon. This a summary of the major outcomes, action items and recommended path forward decided at each meeting. It does not contain a verbatim account of the meetings but is intended to provide a summary of the outcome and next steps for the roundtable's Water Supply Reserve Account Grant for Nonconsumptive Needs Assessment Quantification.

**Major Outcomes**

Following are the major outcomes of the October 19, 2009 and November 5, 2009 meetings:

- At the October 19, 2009 meeting it was decided that if the effort moves forward that geomorphic sub-classification should be considered. This classification would allow for differentiation on the basis of stream physical characteristics and will help in assessing which flow-ecology relationships apply in various reaches in the basin. The group also discussed that as part of the Roaring Fork pilot there was differentiation in where flow-ecology relationships were applied. For example, the riparian flow-ecology relationship was applied below elevation of 9600' and the warm water fish flow-ecology relationship was applied at the very lower portions of Roaring Fork.
- At the November 5, 2009 it was agreed to request the consultant team to determine whether a flow metric and associated risk level could be established for channel form and pawning bed maintenance. It was discussed that the IHA software predicts a small and large "flood" that is related to channel maintenance.
- At the October 19, 2009 meeting it was recommended that if the project moves forward that the technical team would convene an expert panel to evaluate the riparian flow-ecology relationships. This workshop would be similar to the workshop held regarding fish during the pilot effort. In addition the flow relationship would be revised based on new studies available since the pilot project, and any input from the expert panel.
- At the October 19, 2009 meeting it was recommended that if the project moves forward recreational experts would be added to the technical team and would bring knowledge of the efforts from the Wild & Scenic process. This expertise would be used to evaluate the results of the application of the "Alberta relationship" for various stream segments in the Colorado basin.
- At the October 19, 2009 and November 5, 2009 it was discussed that a metric that it related to winter flows should be explored. At both meetings it was discussed that the macroinvertebrate flow-ecology

relationship should be utilized in the WFET where appropriate and that it may be able to provide insight into necessary winter conditions.

- At the October 19, 2009 it was agreed that it is inappropriate to develop a composite hydrographs based on risk levels and that each ecological or recreational indicator should be considered independently.
- At the November 5, 2009 meeting the group reviewed a map of the nodes being proposed for use in the CRWAS, and other existing CDSS nodes. The group suggested additional nodes for the CRWAS for purposes of comparing with the NCNA results. The group also recommended areas in the basin they would like additional nodes added for the Colorado basin NCNA.
- At the November 5, 2009 meeting the group discussed how to gather input from local stakeholders for purposes of identifying issues in reaches to be evaluated by WFET that may not be apparent in gage data, and ultimately for evaluating WFET results and . One of the first areas of gathering information from local stakeholders is to develop node maps for each SEO water district that the committee can then use for outreach in each water district. The group also discussed that an initial identification of potential high risk areas should be completed early on in the process and this could help focus where additional local input should be sought as well as to focus where validation and calibration should occur.
- At the November 5, 2009 meeting the group discussed methodologies for establishing risk levels for purposes of WFET analysis. The group decided that the procedure to be used will be to first examine what the literature and science reveal about risk levels and also the validation and calibration efforts before any social component is considered in the process.

### **Action Items**

Action Items from the meetings are as follows:

- The technical team will revise the node mapping based on feedback from the November 5, 2009 meeting and will create maps based on water district.

### **Path Forward**

If the roundtable decides to move forward with the effort the following are recommended next steps:

1. Finalize node mapping and add new CDSS nodes as appropriate
2. Complete initial hydrologic modeling and work with subcommittee to identify specific reaches and areas to focus on initially based on areas where existing nonconsumptive quantification has occurred in the basin (e.g. Upper Fraser, Colorado River from Windy Gap to the Blue River, and Upper Eagle).
3. Complete initial geomorphic sub-classification

4. Determine appropriate metric for winter flow relationship
5. Evaluate possibility of including channel maintenance, and spawning bed cleaning flows in WFET
6. Identify what and where flow-ecology and recreational relationships apply in the basin, including macroinvertebrate
7. Complete riparian flow-ecology relationship workshop and revise relationship as appropriate. Convene an expert panel to evaluate the riparian flow-ecology relationships.
8. Expand team to include recreational experts
9. Complete preliminary risk mapping
10. Schedule and hold required update workshops to gage progress.

After these steps are completed, there would be another meeting with subcommittee to gather feedback before proceeding to further steps. There would be regular conference calls with committee chairs and technical team as this work is completed.

It is essential that work begin and progress be made toward the completion of these goals in order to complete the aims of the WFET project and answer the various questions and concerns raised through the past several meetings and workshops. Therefore, the Subcommittee recommends to the CBRT that work as specified in the Grant proceed as outlined above.

## **Meeting Summary**

### **Colorado Basin Watershed Flow Evaluation Tool**

### **Colorado Basin Roundtable Nonconsumptive Committee Meeting**

**May 12, 2010**

**10:00 a.m. – 2:00 p.m.**

**Summit County Commons – Mount Royal Room**

**37 Peak One Drive, Frisco, CO**

**\*\* PLEASE MARK YOUR CALENDARS NEXT COMMITTEE MEETING – JUNE 11, 2010.  
10:00 A.M. TO 2:00 P.M. – LOCATION TO BE DETERMINED \*\***

### **Meeting Objectives:**

1. Review hydrology model nodes and review summary of request for additional nodes as part of CRWAS Phase II.
2. Review recreational risk flow metrics and methodology.
3. Finalize trout node selection and review initial results of upper basin nodes.

Following is a summary of the major discussion points of the meeting and a summary of the action items. This summary is not a verbatim account of the meeting and is intended to summarize the major points of the meeting and actions items for project in the coming months.

### **Introductions/Agenda Review:**

The group introduced themselves, reviewed the meeting objectives and agenda. The meeting attendees are summarized at the end of this summary.

### **Review mapping of hydrology models nodes and review summary of request for additional nodes to be develop during CRWAS Phase II:**

The group reviewed the requested additional baseflow or natural flow nodes based on the committee's December meeting. The project team has summarized this request to Ray Alvarado (CWCB Project Manager for the Colorado River Water Availability Study or CRWAS). Ray has indicated that as part of CRWAS Phase II additional baseflow or natural flow nodes can be developed. There were no additions to the list by the stakeholders. However, it was requested that the nodes where it was noted that just one of two nodes were needed that both be requested. This is reflected in the attached revised list updated after the meeting. The node mapping can be located on the project's website at: [www.cobasinwfet.org](http://www.cobasinwfet.org).

### **Review and discuss recreational risk flow metrics and methodology:**

At the October 19, 2009 meeting it was recommended that if the Colorado Basin WFET project moves forward that recreational experts would be added to the technical team and who would bring knowledge of efforts from the Wild & Scenic Process. This expertise would be used to evaluate the results of the application of the "Alberta Relationship" for various stream segments in the Colorado basin.

Nathan Fey and David Costlow provided the group a presentation of the survey work that American Whitewater has completed, an overview of the Alberta Equation, and a comparison of the Alberta Equation recreation flow ranges to the American Whitewater Survey, Expert Opinion, and the Stafford and McCutchen guidebook recreation flow range recommendations for 10 segments in the upper Colorado River Basin. The presentation that Nathan and David provided is included on the project website at [www.cobasinwfet.org](http://www.cobasinwfet.org) as it too large to email.

The major conclusions provided by David and Nathan were:

- The Alberta Equation tends to under predict or over predict recreation flows based on comparison to the American Whitewater survey ranges, expert opinion ranges, and guidebook ranges.
- Site-specific survey work such as the American Whitewater survey, expert opinion ranges, and guidebook ranges are more representative of recreational flow ranges in Colorado than the Alberta Equation.

The group discussed a potential path forward for including recreational attributes in the WFET effort. The proposed path forward did not include using the Alberta Equation in the future effort. The proposed path forward after discussion by the group was:

1. Identify important recreation reaches for the basin based on Basin Roundtables NCNA Phase 1 map and information from David, Nathan and BLM survey.
2. Summarize these reaches into major segments.
3. Identify ranges of flow related to each reach based on American Whitewater survey, expert opinion and guide books.
4. Using current hydrology from the CDSS and ranges in item 3 describe the type of recreation experience that exists today that can be used as a baseline for considering risk in the future.

Each meeting attendee was asked to comment on this proposed approach. The summary of this discussion was captures as the discussion was occurring and displayed using powerpoint and is as follows:

- A segment by segment description focusing on what types of recreation happens in the segment, number of users, gradient, etc. would be useful.
- Range of flows based on expert opinion and guide books is an appropriate approach to use for this effort.
- Technical team needs to develop statistics that describe how current flows relate to segments today and evaluate risk of current and future conditions.
- A description of who or how you are trying to manage the segments for if available would be useful. For example the segment descriptions should describe the type of user that uses the reach and keep this in broad categories – family, expert, rafting, kayaking, etc.
- BLM has survey on Colorado River from Byers to Dotsero that focuses on experiences with factors other than flow.

- In addition to the recreational flows that range from minimal to optimal – is there any information about the inverted "U" that Nathan presented that can also be included on a segment by segment basis if possible?
- Wild and Scenic used 20 year period of record from 1985 to the present – is this a reasonable period of record to consider?
- One way to examine this would be to look at the range of flows identified by American Whitewater, expert opinion, or guidebooks and look at last 20 years of hydrology and examine how frequently did it occur the recreation flows occur. Potentially the flow ranges could be broken into quartiles.
- BLM data could be used to help define current conditions.
- For the boating season how do we compare create a statistic that is a meaningful that measure changes in the future?
- A potential way to this is based on the range of flows developed there will a certain number of days that could be used for recreation. This could be set as a baseline and future changes could be evaluated against the number of recreation days.
- The information developed about changes for each quartile and statistic could be presented and this could be the basis of assigning risk levels..
- The timing of the change during the year or recreation season should be considered if possible.
- Recommend examining a daily statistic vs. a monthly statistic and performing a comparison to see if monthly is representative.
- Potentially could aggregate gages by stream reach but realize that streams could change for different flows – especially n the Colorado River.
- Reminder one of the purpose of this study is to identify areas that are in need of further site-specific study.
- It appears that there may more overlap between consumptive and nonconsumptive needs assessments then previously was apparent.
- There needs to be more communication between meetings in the form of written updates.
- The idea of including private boaters is import and there are more private boaters than knowledge of currently. This may increase in 25 years.
- The team should be encouraged to focus on environmental side first and the recreational side secondarily. This person had more interested in managing for the environment vs. recreation.
- The technical team should further the methodology but bring back to the group for discussion before going too far down the road.
- Should try to avoid conflict with environmental needs. Need to be careful about not developing a condition which will create a flat lined hydrograph. Focus more a natural hydrograph. Quick monthly model at a few sites and look at the daily and see what internal variability occurs. Consider wet, dry, average conditions.
- Recreation needs to be considered as the final overlay for the roundtable process. Don't want to lose the economic benefits of recreation in the basin. Look at the extremes potentially but don't want to lose what already have. Could consider risks similar to resource management plan.
- User seasons – focus on this. Family boater may have different season than kayaker.

- There is conflicting information about recreation being in conflict with the environment. Often times recreation flows can be considered in concert with environmental. Flat line hydrographs are not necessarily what commercial groups are looking for either.

The group agreed that a subset of streams should be examined using the following approach:

1. For the subset of reaches if information is available describe/define the type of reach such as typical recreational experience for the reach, types of users, number of users, stream type.
2. Identify ranges of flow related to each reach based on American Whitewater survey, expert opinion and guide books.
3. Using current hydrology from the CDSS and ranges in item 2 describe the type of recreation experience that exists today that can be used as a baseline for considering risk in the future. This will be based on a daily and/or monthly statistic. Seasons of recreation use will also be defined. For some reaches it may be appropriate to break the flow ranges into quartiles or some other statistic.
4. Describe methods for how future changes could be considered. Potential methods include utilizing information from Phase II of the CRWAS study that will model future demands and projects and to identify how these potential projects may change the timing, magnitude, frequency and duration of the recreation experience. The changes will be used to establish potential risk levels associated with changes in the future.
5. Suggestions for evaluation: Pumphouse to State Bridge; Below State Bridge to Dotsero; Grizzly Creek; Slaughter house reach on Roaring Fork; Smaller tributaries or streams; Eagle; lower Blue; Crystal.

#### **Review Trout Metric and Trout Nodes:**

The group briefly discussed the trout metric. The trout metric that will be used has not changed since the pilot study. Dave Graf and Nicole Rowan will meet via conference call to finalize the CDSS nodes where the trout metric will be applied for the lower portion of the basin. Dave will also review the metric with CDOW biologists and will discuss with Thomas Wilding any questions or clarifications before the next meeting.

#### **Front Range Water Council Letter:**

Gerry Knapp provided background and overview regarding the May 3, 2010 letter from the Front Range Water Council to Jennifer Gimbel (CWCB Director). The minutes that were mentioned in the letter will be forwarded to the committee for review. In addition, notes from the Technical Team from the Riparian Workshop will be forwarded to this committee.

Following is a summary of the discussion and questions that were raised regarding the Front Range Water Council's letter:

- The Front Range Water Council is still concerned about how information from this study will ultimately be used and if the process used will be applied statewide.
- Will this study be "accepted" by CWCB and what are the statewide implications of this?
- How will this information be used in the CRWAS Phase II study?

- Notes of the meetings need to be developed and distributed.
- There was concern about transparency in the process.

**Meeting Conclusion:**

Ken Neubecker and Lane Wyatt agreed to provide meeting summaries after each meeting. The Technical Team will do the best they can to send materials in advance of meetings and between meetings for committee consideration. The group agreed the meeting was a productive discussion regarding recreation needs and how to evaluate them in the basin. At the next meeting there will be a report out on the recreation methods discussed at the meeting.

**Meeting Attendees:**

- Lane Wyatt, NWWCOG and co-chair of Colorado Basin Roundtable Nonconsumptive Needs Committee
- Ken Neubecker, Trout Unlimited and co-chair of Colorado Basin Roundtable Nonconsumptive Needs Committee
- Kerry Sundeen, Grand River Consulting
- Gerry Knapp, Aurora Water
- Kathy Kitzman, Aurora Water
- Caroline Bradford, Eagle County Representative Colorado Basin Roundtable
- Jacob Bornstein, CWCB
- Nicole Rowan, CDM
- Nathan Fey, American Whitewater
- David Costlow, Rocky Mountain Adventures, Inc.
- Andy Windsor, BLM
- Dave Graf, CDOW
- Tom Clark, Kremmling

## **Meeting Summary**

### **Colorado Basin Watershed Flow Evaluation Tool**

### **Colorado Basin Roundtable Nonconsumptive Committee Meeting**

**June 11, 2010**

**10:00 a.m. – 2:00 p.m.**

**Summit County Commons – Buffalo Mountain Room**

**37 Peak One Drive, Frisco, CO**

#### **Meeting Objectives:**

1. Review geomorphic classification.
2. Review riparian flow ecology metrics based on results of February Workshop.
3. Discuss next steps

Following is a summary of the major discussion points of the meeting and a summary of the action items. This summary is not a verbatim account of the meeting and is intended to summarize the major points of the meeting and actions items for project in the coming months.

#### **Introductions/Agenda Review:**

The group introduced themselves, reviewed the meeting objectives and agenda. The meeting attendees are summarized at the end of this summary.

#### **Review geomorphic classification:**

Brian Bledsoe led the group in discussion of the geomorphic valley classification and these classifications relate to riparian ecosystems in the Upper Colorado River Basin. The slides that Brian used in his discussion are located on the project website: <http://www.cobasinwfet.org/documents>. Colorado State University has worked with the U.S. Forest Service on this valley type classification system that was presented to the committee.

#### **Review riparian flow ecology metrics:**

John Sanderson provided the group an overview of how the geomorphic valley classifications related to riparian species where there is information about flow-ecology relationships. John explained that the flow ecology relationships for riparian species would not be applied to the following geomorphic valley classifications: canyon, gorge, high-energy coupled, and high-energy open. John and Thomas Wilding's slides shared at the meeting are located on the project website:

<http://www.cobasinwfet.org/documents>. Thomas continued the discussion by describing the types of riparian (cottonwood species) where flow-ecology relationships exist. Thomas described where the different species occur and the mechanisms for their reproduction. Discussion and questions during the presentation included:

- The graphic on slide 7 needs to be described in more detail. Simulations by Richter & Richter (2000) predicted a gradual die-out of cottonwood forest on the Yampa River if flows above 125% of bankfull were lost. The number of days exceeding this discharge was the best indicator of lateral

migration of the channel, with riparian response measured as the percent of the floodplain in cottonwood forest.

- It was emphasized to the group that the geomorphic setting is the basis for where the flow ecology relationships will be applied and not the species type. Geomorphic setting determines the reproductive strategies that are most successful and also determines the degree of flow influence on riparian vegetation. Species is therefore secondary to geomorphic classification for our purpose.
- The suckering process and mechanisms were described in more detail based on questions from the group. The Aegiros Section cottonwoods (e.g. *P. deltoides*) reproduce primarily by seedfall, compared to narrowleaf cottonwood (*P. angustifolia*) that often rely on asexual reproduction through root-suckering. Floods that remove soil and disturb the roots can trigger root suckering, whereby new trees grow from the roots of existing trees. The clones can sustain an existing grove of cottonwoods, which is important in confined settings where recruitment from seedfall is rare. Studies indicate large floods are associated with recruitment in confined settings where root-suckering occurs. These confined settings are also where rockslides (colluvial processes) can act as a major disturbance that triggers asexual reproduction. Flow is therefore expected to be less important for recruitment in valleys strongly coupled to hillslopes.
- Question from group: Suckering is not that common unless there is some surface disturbance? What process in the flood plain would promote suckering? Answer: Under natural conditions and in the confined setting it would be a relatively infrequent event. However, it doesn't take wholesale channel change. The disturbance would include flood plain surface sediment mobilization – debris, gravel, cobbles, and this is what is creating the physical disturbance.
- Grazing and haying are human “disturbances” that also can cause suckering. Grazing can also limit growth of young cottonwoods, even when suckering is commonly occurring, e.g., on the Rio Grande there is suckering, but out-of-bank floods no longer occur and there is very little sexual recruitment (i.e., recruitment from seed). Human disturbances could be used to manage cottonwood reproduction in the absence of floods, but likely not on the scale that would retain extensive stands of cottonwoods. Also, grazing would have to be managed. Cottonwood reproduces in ‘unnatural’ settings, such as irrigation ditches. How? It was speculated that infrequent sexual reproduction occurs following ditch construction and cleaning, and that asexual reproduction is promoted by ditch riding, burning, etc.
- Question: Is suckering possible without disturbance? Answer: Possibly but it is infrequent.
- Friedman et al. (2006<sup>1</sup>) describe a transition in the San Miguel watershed from flood dependent reproduction of cottonwood in the lower river (relatively low gradient and wide valley bottom) to asexual reproduction associated with rockslides/colluvial processes in the upper watershed (relatively high gradient and confined valley).
- Question: Are there physical disturbance mechanisms that could be used besides floods? Answer: Yes (see notes above), but we don't know how effective this can be to maintain healthy riparian woodlands. The Nature Conservancy is conducting research on small enclosures along Rio Grande

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<sup>1</sup> Friedman, J. M., G. T. Auble, E. D. Andrews, G. Kittel, R. F. Madole, E. R. Griffin and T. M. Allred. 2006. Transverse and longitudinal variation in woody riparian vegetation along a montane river. *Western North American Naturalist* 66:78-91.

near Alamosa. They are examining actions that can be done to encourage cottonwood regeneration that can be done without flooding – some combination of disturbance and grazing management. It is analogous to instream habitat for fish in the sense that we believe we can manage habitat, but there are limits and it is probably resource intensive.

- Progress on a flow ecology relationship for the Medium Energy Coupled geomorphic valley classification was explained to the group. The flow ecology relationship for this classification would be a 10-15 year type flood. In this classification asexual recruitment flow floods that cause surface disturbance is the dominant (but not exclusive) process under natural conditions.
- Colluvial processes are also important in the medium energy coupled classification.
- Questions: Do we need to take a step back – are we limited by the species we are considering?  
Answer: Cottonwood and willows are foundation species in the rocky mountain streams. Cottonwood species are where we have most data and there isn't as much data on willow species. There is even less data on other species.
- The group was reminded that identifying management actions are not the intent of this study and that the studies purpose is to examine how flow ecology and riparian area relate to flow.
- Cottonwood are an indicator of ecological health in so much as the disturbance regime sustains a diverse forest with patches in various states of succession. Cottonwood are of direct importance to some wildlife (e.g. nesting for large birds of prey) and also provide an indicator of whether riparian processes have been sustained. The methods presented are not intended to predict if cottonwood will be present or healthy, but rather whether flow alteration is constraining the potential of the riparian vegetation. Other factors that are not related to flow management can constrain riparian vegetation, and therefore the methods provide an evaluation of risk of riparian effects from flow alteration. In other words, having good or even “natural” flows does not ensure good ecological outcomes, but it makes it more likely, whereas in the absence of flows that riparian vegetation needs, the chance of maintaining the riparian vegetation is low.
- Question: Is it fair to say the risk that may be defined in this study is that we may be accelerating succession from cottonwood to pine? What type of riparian area do we want to have – can we expect change or not – is change is acceptable? Perhaps change is acceptable. This is a question of values, not science, so it will be discussed further with the roundtable.
- There will places (stream segments) where there isn't flow dependency or flow ecology relationship. For example, in a high-gradient canyon, there is little opportunity for riparian vegetation, and no flow-ecology relationship will be applied.
- Questions: What about high flows where there isn't a metric? What about winter flows? The hydrologic maps that show flow differences for common flow metrics could be used in these instances although there will not be a risk associated with these areas. (See Roaring Fork pilot for examples.)
- If there are "blanks" in a dataset, it may be that we simply don't have any information from there area, not necessarily that something of value does not occur there.
- A summary map of where have good understanding of information, where we have and ok understanding where information is limited would be useful.
- The Merrit &Poff 2010 paper will be sent to the group.
- Thomas reviewed quantile regression with the group again.

- The best indicator metric for cottonwood in unconfined settings was the % alteration of the wet year 90-day maximum. Wet years were identified as those exceeding the 70th percentile mean annual flow (threshold calculated separately for pre-and post-alteration). The annual maxima series of the 90 day moving average was then reduced to wet years only, and flows averaged across wet years separately for both pre- and post-alteration periods. Percent change calculated as (post-pre)/pre alteration.
- Question: why use 90-day when expect disturbance to be a week or two long processes? Channel forming flows are likely to be shorter than 90 days, with many authors using instantaneous or daily-series maxima as an indicator metric, though the effective discharge will be longer lived. The 90 day max was a better predictor of cottonwood response and this presumably reflects the combined importance of effective discharge duration plus subsequent flow recession in the survival of cottonwood seedlings.
- Question: what happens during recession? The flood scours or deposits a bare unshaded sandy area that is moist. Cottonwood germinate in this environment, but require gradual water level recession (inch/day) for roots to maintain contact with moist substrate (otherwise dry-out and die).
- The 90 day metric is not as noisy as the instantaneous or 1-day peak. We compared the 1, 3, 7 and 90-day maximum as StateMod compatible flow metrics.
- longer period of times provide more robust predictors, e.g., StateMod prediction is better on monthly basis than daily.
- Questions: Please explain how quantile regression was used in this relationship. Answer: What quantile regression shows for the riparian metric for natural flows is that something else can further constrain riparian vegetation and therefore trump flow. The plot shows point where flow is unmodified but cottonwood are rare/absent. Flow is foundational – master variable. Flow bounds the potential response of riparian vegetation, but it is not the sole determinant. Can think of flow as a ceiling – puts a lid of the potential state of riparian vegetation. Risk of flow constraint increases as flow alteration increase.
- The flow ecology metric discussed is a wet year metric (a 3 in 10 event, or roughly a 1 in 3 year event)
- DOW has statewide riparian data – see if this is applicable for our application.
- Information about willow species were summarized. There are many species of willow in Colorado, but only half a dozen or fewer that are flow dependent. Dependence on a 2 to 5 year flood has been clearly demonstrated for some of these species, but it's not clear that we have enough information to know how chance of willow establishment changes with flow alteration. Studies to date have indicated that interactions between flow and beaver activities are important.
- Question: how does tamarisk compete? Under natural flows probability of tamarisk and cottonwood is about the same. Unaltered flows promote a mix of species types with disturbance supporting cottonwood recruitment and shade from large cottonwoods preventing tamarisk from dominating (as tamarisk does not like shade). Under greater flow modification tamarisk can dominate because cottonwood are lost.

**Next Steps:**

- Nicole will work with Lane, Ken, Jacob and the technical team to update the schedule for the project that takes into account CWCB's plans for needs assessment summary at the end of this year and consideration of CRWAS Phase 2.
- Nicole will work with Lane and Ken to develop dates for the next committee meeting and the discussion topics that will be part of this meeting. In addition, Nicole will work with Lane and Ken to examine the number of meetings left in the contract and to plan the best timing and content for these meetings.
- There will be conference calls to discuss interim products set-up before the next meeting.
- David Graf will work with DOW fish biologists to look at trout mapping results.
- For warm water fish information used in this study will be based on the endangered species work.

**Meeting Attendees:**

- Lane Wyatt, NWWCOG and co-chair of Colorado Basin Roundtable Nonconsumptive Needs Committee
- Kerry Sundeen, Grand River Consulting
- Gerry Knapp, Aurora Water
- Jacob Bornstein, CWCB
- Nicole Rowan, CDM
- Dave Graf, CDOW
- Tom Clark, Kremmling
- Brian Bledsoe, Colorado State University
- John Sanderson, The Nature Conservancy
- Thomas Wilding, Colorado State University
- Paula Belcher, BLM
- Pat Wells, Colorado Spring Utilities

## **Meeting Summary**

### **Colorado Basin Watershed Flow Evaluation Tool**

### **Colorado Basin Roundtable Nonconsumptive Committee Meeting**

**October 25, 2010**

**9:00 a.m. – Noon**

**Glenwood Springs Community Center**

#### **Meeting Objectives:**

- Recap of improvements to approach since Roaring Fork pilot study
- Review Revised Riparian Metrics and Results for the Roaring Fork
- Review Recreation Matrix and Useable Days Analysis
- Review Trout Metric Validation
- Next Steps
  - Warmwater Fish
  - Hydrologic Metrics Analysis

Following is a summary of the major discussion points of the meeting and a summary of the action items. This summary is not a verbatim account of the meeting and is intended to summarize the major points of the meeting and actions items for project in the coming months.

#### **Introductions/Agenda Review:**

The group introduced themselves and discussed the agenda. The meeting attendees are summarized at the end of this summary. The powerpoint slides discussed at the meeting are attached to this summary.

#### **Recap of improvements to approach since Roaring Fork pilot study:**

Nicole Rowan summarized the improvements made the WFET approach since the Roaring Fork pilot study. She reminded the group that any improvements made to the WFET during this study will supersede the results of the pilot study. The improvements included the following:

- A composite hydrograph will not be developed for the WFET model nodes to summarize study results
- Recreation Approach Improvements
  - Abandoned Alberta Equation as appropriate for use in Colorado River Basin in Colorado
  - Developed detailed matrix on location of important recreation river reaches, types of recreation occurring those reaches, user seasons, user numbers, and range of flow
  - Flows representing current conditions will be used instead of basing recreation flows on undeveloped flow conditions
- Riparian Approach Improvements
  - Utilized study that was completed after pilot study to revise the riparian metric
  - Completed geomorphic sub-classification to limit where riparian metrics are applied in the basin
- Completed additional validation for trout metric based on Instream Flow Information (R2Cross)



### **Review Revised Riparian Metrics and Results for the Roaring Fork:**

John Sanderson reviewed the handout that was sent prior to the meeting regarding the updated Riparian Flow Ecology relationship. John described the changes and refinements made to the riparian metrics since the Roaring Fork Pilot:

- Flow-ecology relationships are now described for three riparian types: i) cottonwoods on low- and moderate-gradient, meandering (open, or unconfined) rivers, ii) cottonwoods in moderate-gradient rivers of confined valleys and high-gradient rivers in unconfined valleys, and iii) willows in low-gradient, unconfined valleys.
- Quantitative flow-ecology relationships were developed only for the two cottonwood types. Despite some evidence of willow dependence on floods (Cooper et al. 2006), we lacked sufficient data to quantify this dependence over a range of flow alteration. For willows, the flow ecology relationship is described only conceptually.
- Flow-ecology relationships are now applied only in the specific elevation ranges and geomorphic settings where that relationship is expected to exist.
- A new, large data set on cottonwoods (Merritt and Poff 2010) allowed for development of a robust quantitative flow-ecology relationship for cottonwoods in low-gradient, unconfined geomorphic settings.
- Flood magnitude alteration is calculated only in the 30% of years with the highest mean annual flow.
- No hydrographs are developed based on break-points between risk classes, as was done in the Roaring Fork pilot.

John then described in detail the methods for broad leaf and narrow leaf cottonwoods and summarized that no flow ecology relationship for Willow could be developed at this time due to lack of sufficient data. Questions and discussion regarding John's presentation included the following:

- What validation has been conducted on the Valley Type/Geomorphic subclassification? The technical team will work with Brian Bledsoe to make sure that this is described in the write-up/report for the study.
- There was lengthy discussion by group regarding the risk to riparian communities if flow changes occur in the future or have occurred in the past. The "spectrum" of potential changes were discussed ranging from how a riparian community may shift from a cottonwood community to tamarisk community to a community may still have viable cottonwoods but no recruitment of new cottonwoods. Roundtable members expressed the desire to have an understanding of the potential risk of change in enough detail so that trade-offs we are facing as a state in meeting our future M&I, agricultural and environmental water needs could be understood. Roundtable members also expressed an interest in qualitative examples of riparian communities that have changed as a result of flow conditions in the Colorado River Basin.
- The group then discussed next steps for the riparian analysis. The technical team will provide information on the validation of the geomorphic subclassification. The technical team will also provide mapping for the groups review regarding where the riparian metrics will be applied. Finally,

a more detailed version of the riparian metrics in addition to the executive summary version sent out prior to the meeting will be distributed to the committee.

**Review Recreation Matrix and Useable Days Analysis:**

Nathan Fey summarized the recreation matrix based on the methodology that was developed in the May 2010 subcommittee meeting. The matrix (attached) was developed based on survey results based on studies conducted by America Whitewater and expert opinion from guidebooks. In addition, Nathan explained that recommended recreational boating metric is a usable days analysis. Information would be developed in this study to establish baseline usable days for the reaches in the matrix and this information could be used when evaluating future management changes in the future.

There was relatively little discussion by the group on the recreation presentation. One question was whether the BLM or USFS conduct similar studies and Nathan stated that they generally rely on American Whitewater to conduct these types of studies for them. Another comment was whether the technical team would be able to tie how the river is being managed for endangered species and how this benefits recreation. The team stated that we try and qualitatively address this in the study report.

**Review Trout Metric Validation:**

Thomas Wilding briefly walked the group the trout metric validation. Further information will be provided to the committee for their review. There was no feedback provided at the meeting due to the short amount of time available for this discussion.

**Next Steps:**

Following are the next steps for the project:

- Technical team will send out above mentioned items for the riparian analysis and committee will provide feedback.
- Committee needs to provide feedback on recreation matrix and usable days approach.
- Technical team will send out further information on trout validation for committee review.
- Technical team will complete warm water fish analysis and send to committee for review.
- Technical team will develop hydrologic metrics and discuss how these metrics are applied to the times of year where flow ecology relationships do not exist.

**Meeting Attendees:**

- Lane Wyatt, NWWCOG and co-chair of Colorado Basin Roundtable Nonconsumptive Needs Committee
- Ken Neubecker, Trout Unlimited and co-chair of Colorado Basin Roundtable Nonconsumptive Needs Committee
- Kerry Sundeen, Grand River Consulting
- Gerry Knapp, Aurora Water
- Nathan Fey, American Whitewater
- Ken Ransford, American Whitewater
- Phil Overeynder, City of Aspen

- Sharon Clarke, Roaring Fork Conservancy
- Jacob Bornstein, CWCB
- John Redifer, CWCB
- Jim Pokrandt, Colorado River Water Conservation District
- Thomas Wilding, Colorado State University
- Mike Eytel, Colorado River Water Conservation District
- John Sanderson, The Nature Conservancy
- Rachel Richards, Pitkin County
- Caroline Bradford, Eagle River Watershed
- Pat Wells, Colorado Springs Utilities

In addition to the attendees listed above, several attendees arrived later in the meeting due to weather and the above list is not 100 percent complete.

## **Meeting Summary**

### **Colorado Basin Watershed Flow Evaluation Tool**

### **Colorado Basin Roundtable Nonconsumptive Committee Meeting**

**April 19, 2011**

**12:30 – 3:30 p.m.**

**Frisco, CO**

Following is a summary of the action items based on the meeting discussion. This summary is not a verbatim account of the meeting and is intended to summarize the action items to complete the project.

#### **Introductions/Agenda Review:**

The group introduced themselves and discussed the agenda. The meeting attendees are summarized at the end of this summary. The information presented at the meeting can be accessed using the following website:

<https://docs.google.com/leaf?id=0BzJUCixe30UNDRiMmRhY2ItNDBjMi00MWUyLWJmYzQtOTc3MTRjNGJiYjgx&hl=en>

#### **Review Draft WFET Results and Discuss Report Outline:**

The group reviewed the draft mapping that had been completed to date based on the flow ecology metrics that had been completed based on committee feedback through December 2010. Following are the action items to be completed to finalize the mapping effort:

#### General Comments:

- Make streams without nodes a different color than streams with nodes so that is apparent where there are data available to complete the analysis
- Show all nodes on all maps but where they are not to be applied leave the node symbol blank and indicate that metric was determined to not be applied in a given location
- Incorporate information from the Phase 1 map on other risks in a general way so that areas that have issues besides flow in a given reach can quickly be identified and considered in light of flow conditions compared to a given attribute
- Create summary mapping based on risk level (i.e. show all attributes with high risk nodes on one map). This would allow for quicker identification or development of projects and methods for nonconsumptive areas.

#### Trout:

- Nodes 381441 and 380970 in the Roaring Fork Watershed should be at a higher risk level for trout – review the underlying data.
- Nodes in the Shoshone reach need to be examined as return flows from Shoshone are captured in the downstream gage and not at a more upstream node.

#### Warm Water:

- Delete nodes above the confluence of the Roaring Fork and the Frying Pan – warm water metric does not apply here
- Nodes in the Shoshone reach need to be examined as return flows from Shoshone are captured in the downstream gage and not at a more upstream node.

#### Riparian:

- Delete nodes on the Colorado above Lake Granby – cottonwoods don't occur here
- Delete nodes on the Fraser above Confluence with Strawberry Creek – cottonwoods don't occur here
- Delete node on Homestake Creek – cottonwoods don't occur here
- Delete nodes above Dillon Reservoir – cottonwoods don't occur here
- Look at elevation points on the above and examine other places in the watershed where it is likely that cottonwoods don't occur due to examining the above locations

#### Recreation:

Nathan walked the group through the user days analysis. Sharon Clarke said that she is having the recreation matrix reviewed for the Roaring Fork. For final recreation reach map will include the Phase 1 segments (even if flow recommendations do not exist for these reaches) to display full range of recreation attributes in the basin.

#### Report Outline:

The group reviewed the outline and didn't have any comments at the meeting on the outline. Also, due to time constraints the group did not review recommended language from the Front Range Water Council on application of WFET results in the future. The Front Range Water Council representatives will provide a bulleted list of points prior to the committee's conference call on 4/28 for the committee's review.

#### **Discuss Validation of WFET for Colorado Mainstem with Site-Specific Work**

Bill presented the draft validation results. There were not significant changes suggested to this work. Bill has drafted a report and this will be submitted to the committee for review. In general, the site-specific work was consistent with the WFET results for the Colorado River for trout and warm water fish between Kremmling and Dotsero.

#### **Discuss Report Section 3.8 Watershed Level Risked Based Flow Ranges for various attributes**

Due to time constraints this topic was not discussed and discussion on this item was deferred until the April 28<sup>th</sup> call. Proposed approach is attached to this meeting summary.

#### **Meeting Attendees:**

- Ken Neubecker, Trout Unlimited and co-chair of Colorado Basin Roundtable Nonconsumptive Needs Committee
- Kerry Sundeen, Grand River Consulting

- Gerry Knapp, Aurora Water
- Nathan Fey, American Whitewater
- Sharon Clarke, Roaring Fork Conservancy
- Jacob Bornstein, CWCB
- John Sanderson, The Nature Conservancy
- Kathy Kitzman, Aurora Water
- David Graf, CDOW
- Nicole Rowan, CDM
- Ken Neubecker, Trout Unlimited
- Karn Stiegelmeier, Summit County
- Bruce Hutchins, Grand County

## **Meeting Summary**

### **Colorado Basin Watershed Flow Evaluation Tool**

### **Colorado Basin Roundtable Nonconsumptive Committee Meeting**

**May 18, 2011**

**1:00 p.m. – 4:00 p.m.**

**Frisco, CO**

Following is a summary of the action items based on the meeting discussion. This summary is not a verbatim account of the meeting and is intended to summarize the action items to complete the project.

#### **Introductions/Agenda Review:**

The group introduced themselves and discussed the agenda. The meeting attendees are summarized at the end of this summary. The information presented at the meeting can be accessed using the following website:

[https://docs.google.com/leaf?id=0BzJUJcixe30UNDRiMmRhY2ItNDBjMi00MWUyLWJmYzQtOTc3MTRjNGJiYjgx&hl=en\\_US](https://docs.google.com/leaf?id=0BzJUJcixe30UNDRiMmRhY2ItNDBjMi00MWUyLWJmYzQtOTc3MTRjNGJiYjgx&hl=en_US)

#### **Review Watershed Flow Evaluation Tool Applications and Capabilities Draft Language (follow up to 5/5/2011 conference call):**

The group reviewed the draft language that had been worked on during a conference call between meetings. The original language was provided by the Front Range Water Council and was revised based on a phone call held on 5/5/2011. The group reviewed the updated language and provided further suggestions. These suggestions are attached to this meeting summary. Please provide final feedback on this version by June 3, 2011.

#### **Discuss Watershed Based Quantification (follow up to 5/5/2011 conference call):**

The group discussed at length the merits of a watershed based quantification. The group discussed the following benefits and concerns of complete this effort. Benefits discussed included:

- The Colorado Basin Roundtable has requested that their nonconsumptive needs be quantified – a watershed based approach would provide a high level and coarse understanding of nonconsumptive needs.
- The information about flows has been developed for each node and has been used to generate the risk levels. The committee has reached consensus that developing quantification or flow information related to ecological flow risk at each node is not appropriate. However, to prevent that activity from happening in the future it may be useful to develop higher level quantification information related to the ecological flow risks on a watershed basis to balance the desire for a amount of water associated with environmental needs with the limitations of the WFET tool.

Concerns discussed included:

- Putting any number out there may be misused and some on the committee did not know if they agreed that the WFET could be used for a high level quantification.
- A higher level analysis reduces the amount of detail and may "gloss over" areas that are at risk because of the magnitude of lower risk areas in a watershed.

The group agreed to move forward with the analysis for the committee consideration. The analysis will not quantify the total water needs for the environment but will attempt to provide a range of "gaps" on a watershed basis. Only modeled "gages" will be used for this analysis and not diversions as the model predicts information better at the gages than at diversions.

**Review updated mapping based on comments from 4/19/2011 meeting:**

Following were comments on the mapping that will be updated in the draft report:

- Different gages from other diversion nodes.
- Make the model nodes bigger on the maps.

**Meeting Attendees:**

- Ken Neubecker, Trout Unlimited and co-chair of Colorado Basin Roundtable Nonconsumptive Needs Committee
- Kerry Sundeen, Grand River Consulting
- Gerry Knapp, Aurora Water (attended portion of meeting)
- Sharon Clarke, Roaring Fork Conservancy
- Jacob Bornstein, CWCB
- John Sanderson, The Nature Conservancy
- Nicole Rowan, CDM
- Ken Neubecker, Trout Unlimited
- Pat Wells, Colorado Spring Utilities
- Melinda Kassen, IBCC
- Bud O'Hara, Pueblo Board of Water Works (attended portion of meeting)
- Alan Ward, Pueblo Board of Water Works (attended portion of meeting)