**MEETING MINUTES**
Yellowstone River Compact Commission
Technical Advisory Committee Spring Meeting
Thermopolis, Wyoming
April 6, 2017

The meeting was called to order at 8:30 a.m. by Beth Callaway.

**1. Introductions**
Meeting participants were introduced to the group. Everyone welcomed John Kilpatrick of USGS, the new Federal Chairman for the Yellowstone River Compact Commission, as well as Seth Davidson of USGS, the new Executive Secretary for the Commission. Mr. Kilpatrick presented a resolution honoring the service of Kim Overcast from Montana DNRC who retired in March 2017. A full list of in-person and remote GoTo Meeting attendees can be found in Appendix 1.

**2. Additions/Revisions to agenda**
No agenda additions or revisions were made.

**3. Hydrologic update**
Kirk Miller with the USGS reported on the current conditions for numerous Compact stream gages throughout the Yellowstone River System (Appendix 2). Going into the winter, stream flows in the basin were well below average until increased precipitation starting in October/November. The gages in the western portion of the Yellowstone River Basin indicated record wet precipitation starting in October. Recent streamflow conditions in the Wind/Bighorn River Basin appeared to be above average for many stream gages reported. On the other side of the Bighorn Mountains, Tongue and Powder River stream gages were also above average although streamflow did not measure as high as the Western tributaries.

**4. 2017 runoff forecasts**
*Wyoming* -- Lee Hackleman with the NRCS in Casper, WY reported on Wyoming snowpack and water supply conditions (Appendix 3):

| **2017 Water Year Snowpack and Water Supply Conditions -- as of April 6, 2017 --** | | | | |
|---|---|---|---|---|
| **River Basin** | **Current Snotel SWE (% of Median)** | **April 1st SWE (% of Median)** | **Precipitation To-Date (% of normal)** | **April 1st 50% Exceedance Forecast (April – Sept.)** |
| **Wind** | 108-269% | 198% | 203% | Boysen Reservoir – 1,650,000 AF |
| **Bighorn** | 61-236% | 110% | 154% | Bighorn River at Kane – 2,200,000 AF |
| **Shoshone** | 84-179% | 146% | 173% | Buffalo Bill Dam Inflow – 1,260,000 AF |
| **Yellowstone** | 70-179% | 137% | 160% | Yellowstone River at Lake Outlet – 1,080,000 AF |

| | | | | |
|---|---|---|---|---|
| **Powder** | 61-171% | 101% | 127% | Powder River at Locate – 270,000 AF |
| **Tongue** | 83-137% | 111% | 164% | Tongue River Reservoir inflow -- 250,000 AF |

Mr. Hackleman noted that this year the Wind River Basin saw historic highs both in snowpack and streamflow. When questioned how the streamflow forecasts from April 2011 (a very wet water year) compare to April 2017, Jim Fahey of NOAA/NWS confirmed that the snow stayed on the mountain longer in 2011.

*Montana* -- Luke Zukiewicz with the NRCS in Bozeman, MT gave a PowerPoint presentation on the conditions in Montana's portion of the basin (Appendix 4):

- Upper Yellowstone
    - Overall, this basin reported well above average snow water equivalent (SWE) and was the highest water year in precipitation at SNOTEL sites on record. Mr. Zukiewicz reiterated that Wyoming SNOTELS reported well above average precipitation.
    - The Upper Yellowstone Basin streamflow forecast (50% exceedance probability for April through July averaged across subbasins) was 119%.
- Basin-wide
    - The water year's snowpack onset was delayed by 1-2 weeks; at the time of this meeting not as much melt was occurring at elevations above 7,000 feet.
    - Although SWE had been below median at SNOTELs in the Tongue River Basin earlier in the water year, SWE recovered in March. Similarly for the Powder River Basin, lower than median SWE recovered by the beginning of April.
    - The 2017 Water Year set record highs for SWE in the Wind River Basin. Normal peak SWE was exceeded for all sites in this basin; November was the only month with below average SWE. Other years with record SWE in the Wind River Basin were 1986 and 1999 (where a second peak SWE occurred mid-June due to precipitation events).

*NOAA* – Mr. Fahey from the National Weather Service office in Riverton provided NOAA weather updates (Appendix 5):

- Similar to the other presentations, this year's snowpack appeared to be comparable if not higher than the 2011 season snowpack.
- The April through June three-month forecast showed chances for above average precipitation and equal chances of average (or a little above average) temperatures.
- Mr. Fahey gave an overview of the typical triggers for flooding, which include the combination of rain on melting snowpack, several sequential warm days, and warm/windy nights (above 37°F and 10,000 feet elevation). Runoff flooding is a result of timing and a combination of parameters.

Ms. Callaway inquired if La Niña conditions during the winter of 2016-17 were a factor in the high rate of winter precipitation in Wyoming. Mr. Fahey confirmed that Southern California storms sent precipitation up to the mountain ranges in Wyoming and likely contributed to the snowpack.

*Other federal agencies* -- There was no attendance from other federal agencies.

**5. YRCC Technical Advisory Committee Report**

Ms. Callaway and Mr. Dalby provided an overview of the Technical Advisory Committee's (TAC) assignment to assess forecasting tools with the goal of improving confidence in forecasting Tongue River state-line flows and the associated inflow to Tongue River Reservoir. The TAC met via conference call on July 22, 2016 to discuss flow forecasting procedures and the possibility of applying customized NRCS forecasting tools and approaches to the Tongue River Basin. The group also held a follow-up call on January 25, 2017 to evaluate these potential NRCS tools in more detail. Notes from these two meetings are included in Appendix 6.

Following the overview, Mr. Zukiewicz gave a brief PowerPoint presentation about the tools discussed during the TAC's meetings (also included in Appendix 6). He indicated that volumetric forecasts are difficult because of spring precipitation in the Tongue River Basin (i.e.- valley precipitation is a significant portion of the hydrograph and the current regression methodology does not entirely model this influence). He stated that for dry years, the NRCS forecast model adequately forecasts streamflow volumes until spring precipitation variability comes into play. In other basins, NRCS is working on calibrations for a new model in Colorado that is not regression-based. Other NRCS forecasting efforts that may be applicable to the Tongue River Basin involve a modified Precipitation Runoff Modeling System (PRMS) and the iSnowball model.

**6. Guest presentation: "High-Resolution Modeling of Precipitation, Snowpack and Streamfow in Wyoming: Quantifying Water Supply variations in Future Decades" by Dr. Bart Geerts from the University of Wyoming**

Dr. Geerts joined the meeting remotely to present findings from his research funded by the UW Office of Water Programs (Appendix 8). Following his presentation, Mr. Miller stated that the USGS focuses on the greatest area with snowpack that contribute to runoff which are elevations at or around 9,000 feet. Mr. Dalby stated that a University of Montana Geosciences study looked at the distribution of SNOTEL sites in southwestern Montana by elevation and found there were very few SNOTEL sites in the elevation zones that produce most of the runoff. The regression models used by NRCS do not tie snowpack directly to runoff (i.e.- it is just an indicator) and that PRMS-type forecast tools will need more climatic data. Dr. Geerts replied that the density and accuracy of SNOTEL siting is key. He also stated that, pertaining to the forecasting needs of the Yellowstone TAC, a total numerical physical approach may help close the gap in forecast uncertainty.

**7. Update on Wyoming's MODIS-based snow product work**

Ms. Callaway reported on the progress of Wyoming's contract with the Institute of Arctic and Alpine Research (INSTAAR) to estimate spatially distributed snow water equivalent (SWE) in the Upper Tongue River Basin. At the time of this meeting, INSTAAR was working on extending the model boundaries to the Upper Tongue. The SWE analysis and recommendations for next steps would likely be ready to share in time for the December 2017 Commission meeting.

**8. Wyoming Water Planning activities**

Ms. Callaway reported that the Wyoming Water Development Commission's (WWDC) update to the Powder/Tongue and Northeast River Basin Plan was still in process. The Groundwater study to accompany this River Basin Plan Update would be completed in 2018 by the Wyoming Geological Survey (WSGS). WSGS had also just completed a coalbed natural gas groundwater study to look at groundwater level responses of select BLM monitoring wells in the Powder River Basin. The Greybull Watershed Study (located in the Bighorn Basin) was approved for funding in 2017. The BLM would commence the Environmental Impact Statement development process for two new WWDC reservoir projects (Alkali Creek Reservoir in the Nowood River Basin and Leavitt Reservoir Expansion in the Beaver Creek Basin) in 2017. The Weather Modification feasibility study conducted in 2016 in the Bighorn Mountains was followed up by public meetings to be held in August of 2017. Draft reports were under review at the time of this meeting and no decisions had been made yet about how to proceed with the program.

**9. Reservoir Operations and Storage**

- Bighorn, Buffalo Bill, Boysen Reservoirs – Loren Smith, WY
    - Bighorn – Releases were at 10,000 cubic feet per second (cfs) as of April 5th, which is higher than the Bureau of Reclamation's Annual Operating Plan projection due to high flows from Buffalo Bill and Boysen reservoirs.
    - Buffalo Bill – Current storage was at 69% of capacity. The reservoir was performing flushing flows at this time due to sedimentation issues created below Willwood Dam.
    - Boysen – The reservoir was at 87% of capacity. Winter releases were set to 1,000 cfs. As of March 28th one-time flushing flows increased to 5,000 cfs; inflows were at 2,500 cfs. High foothill snowpack would likely jump inflows soon.
    - Bull Lake – The reservoir was drained last fall and recovered to 35% of full and it would likely fill in 2017.
    - Pilot Butte – The reservoir filled to normal winter carry over capacity in Fall 2016. Releases would be made for 2-3 weeks in April to make room for irrigation supply.
    - Mr. Dalby asked about the reasoning for flushing flows. Mr. Smith replied that it was due to requests from Game and Fish for downstream fisheries habitat improvement. Boysen Reservoir does not have a separate account for these releases but Buffalo Bill is accounted for by using water from the Bureau of Reclamation Pole Cat Bench account as this special release was over and above the agreed upon winter release. Since it is granted by Bureau of Reclamation the accounting shows that the water can only come from the Bureua of Reclamation account. For Boysen the practice is to reduce the winter release enough to make up the volume of storage needed for the flushing flow. The group expressed the desire to include the Wyoming Game and Fish Department onto next year's agenda to discuss flushing flows.

- Lake DeSmet – Dave Schroeder, WY
    - The reservoir saw about 82.7% carryover (~194,000 AF; 27,750 less than 2015). It was a tough year for 2016; accruing storage was advised over winter but a Wyoming Game and Fish dredging project prevented this from happening until later in the spring. The diversion was opened on March 22 and all Piney, Rock

and Shell Creek rights would likely fill. As of April 1st, the reservoir stored 196,511 AF.
    - The State of Wyoming's plan under House Bill 118 to empower Wyoming Water Development to negotiate for the acquisition of about 62,000 AF of Lake DeSmet storage water failed in the Senate. However, the feeling was that WWDC does not need approval to negotiate, but any such agreement will require approval and that the proposal was not dead.
    - Five new gages are now available on http://seoflow.wyo.gov: Sawmill Lakes, Dome Lake, Park, Big Horn, and Cross Creek.
- Tongue River Reservoir –Kevin Smith, MT
    - In December the reservoir storage was 50,000 AF which was maintained until February when it increased to 60,000 AF. As of the date of the meeting, storage was at 64,000 AF. Ice jamming in late March was removed from the system. Inflows ate the state line around April 1st were at 1,800 cfs.
    - Commissioner Tyrrell asked about the forecast for the Upper Missouri River Basin in Montana. Mr. Smith replied that the current water supply outlook was 115% of average and Jefferson was the lowest. The Missouri River Basin overall was about average.
- Tributaries to Clark's Fork – Kevin Smith, MT
    - Cooney Reservoir, Glacier at Timberline

**10. *Montana v Wyoming* update**

Chris Brown gave a summary of the main points from the Special Master Opinion issued in December 2016. At the time of this meeting, a proposed hearing date was set for May 1st for the two states to discuss decree provisions.

**11. Northern Cheyenne water purchase update**

Mr. Brown updated the group regarding the Northern Cheyenne Tribe's storage rights in the Tongue River Reservoir and the possibility of water users leasing those rights. Specifically, the issue pertains to whether or not there is an option to allow the tribe to contract water upstream of the reservoir into Wyoming. Mr. Brown said that the State of Wyoming would not be a party to the contracts but would act as a facilitator to make the process available to Wyoming water users in circumstances when deliveries appear to be short. He discussed this issue with the tribal attorney in Spring 2016 to get ideas about possible options. Ms. Spang Gion of the Northern Cheyenne added that the tribe is developing a comprehensive water marketing plan to establish possible lease rates and terms. A water budget for the Tongue River Basin would need to be created as well. Mr. Brown confirmed that the next step for Wyoming is to develop a proposed structure for the water contract.

**12. State Adjudications**

*Montana* – Mark Elison reported that Montana is targeting the year 2028 to complete adjudication. Since the last meeting there were 15 changes to water rights in the Yellowstone River Basin and most were to change irrigation methods from flood irrigation to center pivots (two were on the Tongue). Fifteen new permits were issued; one was in the Powder River Basin and the rest were near Billings. The Clarks Fork preliminary decree was issued as of April 6th; the rest of the basin already has a preliminary decree issued.

*Wyoming* – Dave Schroeder reported that in the 2016 Calendar year, there were 130 Surface Water adjudications in Division II. Of those, 63 were in the Yellowstone River Basin. Of that total, there were 27 reservoirs, five stock reservoirs, 30 ditches, and one enlargement to a ditch. The Board of Control endorsed 178 stock reservoirs in the Division, and 80 of them were in the Yellowstone River basin. The number of stock reservoir endorsements remained high as Division II staff continued to work with the Board of Control and Department of Environmental Quality to close out former CBM reservoirs. The impending increase to proof fees would probably swell new adjudications to come to the Board of Control before the changes were set to come into effect in July.

Loren Smith reported that due to the completion of the Bighorn General Adjudication in 2014, fewer proofs have been submitted in Division III: 97 proofs of appropriation or construction have been submitted this year. Within that total, 30 of the 97 were enlargements to adjudicate facilities on federal lands which had been granted federal reserved water rights during Phase II of the General Adjudication and the rest were domestic use. At the time of the meeting Division III was still working on the 1990 and 1996 enlargement to the Cody Canal. Heart Mountain Canal enlargement had been authorized by the Bureau of Reclamation to clean up remaining water service contracts and permit preparation was now taking place.

**13. Water user meetings**

The Yellowtail Long Term Issues Group meeting was scheduled for April 13th in Lovell, WY. The operating Committee was set to take place on May 10th. The Wyoming Water Updates meeting conducted by the WWDC for the Powder/Tongue River Basin was set for May 24th and the Wind/Bighorn Basin meeting was scheduled for May 25th.

**14. 2017 TAC meeting**

Montana will host the next TAC meeting. It was decided to hold the meeting on April 12th, 2018; location to be determined.

The meeting, conference call and Go To meeting concluded at 11:45am.

**Appendix 1:**

Yellowstone River Compact Commission
Technical Advisory Committee Spring Meeting Attendees
April 6, 2017

| Name | Agency | Email |
|---|---|---|
| John Kilpatrick | USGS | jmkilpat@usgs.gov |
| Seth Davidson | USGS | sdavids@usgs.gov |
| Loren Smith | WY SEO | loren.smith@wyo.gov |
| David Schroeder | WY SEO | d.schroeder@wyo.gov |
| Dave Pelloux | WY SEO | dave.pelloux@wyo.gov |
| Chuck Dalby | MT DNRC | cdalby@mt.gov |
| Kirk Miller | USGS | kmiller@usgs.gov |
| Chris Brown | WY AG | chris.brown@wyo.gov |
| Pat Tyrrell | WY SEO | patrick.tyrrell@wyo.gov |
| Beth Callaway | WY SEO | beth.callaway@wyo.gov |
| Jim Fahey | NOAA/NWS | james.fahey@noaa.gov |
| Dave Deutz | WY SEO | dave.deutz@wyo.gov |
| Philip Beamer | WY SEO | Philip.beamer@wyo.gov |
| Mark Elison | MT DNRC | melison@mt.gov |
| Timothee Hawkins | WY SEO | tim.hawkins@wyo.gov |
| Kevin Smith | MT DNRC | ksmith@mt.gov |
| Shanny Spang Gion | N. Cheyenne | shanara.spanggion@cheyennenation.com |

GoTo Meeting remote attendees:

| | | |
|---|---|---|
| Bart Geerts | University of Wyoming | Geerts@uwyo.edu |
| Lee Hackleman | NRCS | lee.hacklman@wy.usda.gov |
| Bern Hinckley | Hinckley Consulting | bhinckley@aol.com |
| Luke Zukiewicz | NRCS | Lucas.Zukiewicz@mt.usda.gov |

**Appendix 2:**

USGS Yellowstone Basin Flow Conditions Report

Kirk Miller, USGS

**Appendix 3:**

NRCS SWE and Water Supply Outlook Report

Lee Hackleman, NRCS Wyoming

**Appendix 4:**

NRCS Snowpack and Streamflow Update

Luke Zukiewicz, NRCS Montana

**Appendix 5:**

NOAA 2017 Water Year Runoff Highlights

Jim Fahey, NOAA/NWS

**Appendix 6:**

Tongue River Flow Forecasting Discussion Notes

YRCC Technical Advisory Committee

Lucas Zukiewicz, NRCS

**Appendix 7:**

"High-resolution modeling of precipitation and snowpack in Wyoming: Quantifying water supply variations in future decades"

Dr. Bart Geerts, University of Wyoming