COLUMBIA RIVER TECHNICAL MANAGEMENT TEAM
March 8, 2017
DRAFT Facilitator's Summary
Facilitator: Emily Stranz; Notes: Charles Wiggins, DS Consulting

The following Facilitator's Summary is intended to capture basic discussion, decisions and actions, as well as point out future actions or issues that may need further discussion at upcoming meetings. These notes are not intended to be the "record" of the meeting, only a reminder for TMT members. Official minutes can be found on the TMT website: http://www.nwd-wc.usace.army.mil/tmt/agendas/2017/

Official Water Supply Forecasts

Doug Baus, Corps, and Mary Mellema, BOR, provided an update on the official March water supply forecast, which is posted on the TMT website. Mary noted the final March forecast for Hungry Horse Dam inflow:

- March-July: 1,969 kaf ([%)
- January- July: 2,114 kaf (101%)
- April-August: 1,936 kaf (100%)
- May-September: 1,693 kaf (100%)

Mary also noted that the instream flow requirements of Hungry Horse for the rest of the calendar year are: 3,500cfs for Columbia Falls and 900cfs for Hungry Horse.

Doug noted the March forecast volumes for Corps projects:

- The Dalles, April-Sept: 98 maf (106%). Doug noted that this sets the sets the Grand Coulee adjustments and the summer draft will be 1,280.
- The Dalles, April-August: 92 maf (105%)
- Lower Granite, April-July: 25maf (125%)
- Libby, April-August: 6,783 kaf (117%). Doug noted that the March 31st flood risk management at LIB is 3,281.
- Dworshak, April - July: 2,867 kaf (118%)
- Grand Coulee, April-August: 57 maf (101%)
- Albeni Falls, April-August 13 maf (104%)

Since the official March forecasts have come The Dalles has increased to 106maf, which is 110% of average, and Lower Granite has increased to 29maf, which is 137% of average. Doug provided a brief summary of highlights of the NWRFC March 2016 Water Supply Briefing (link provided on TMT website). He said that the 6-10 and 8-14 day forecast is for below average temperatures and above average precipitation. The 10-30 day forecast suggests the same pattern. The group looked at the water year summary, noting that February precipitation values for the Snake River above Ice Harbor Dam was 214% of normal and the Columbia River above The Dalles Dam was195% of normal.

Dworshak Update
Steve Hall, Corps, provided an update on Dworshak operations. He noted that the forebay is currently at 1,514.7ft, compared to 1,521.5ft at the last TMT meeting on March 03, 2017. The project is releasing 17.4 kcfs, with 4.8 kcfs through the turbines and 12.5 kcfs spill. Total Dissolved Gas (TDG) levels are around 122%. At the Peck Gauge, (located at the confluence of the North Fork and the main stem of the Clearwater River), TDG levels were between 113-114 %. The Dworshak National Fish Hatchery is around 104%.

Other downstream measuring station readings: Cherry Lane between 109-110%, and 101.6-7% past the degassing unit; Big Canyon 100-101%. Steve reported that TDG probes are collecting data every 10-15 minutes for a continuous record; teams will gather spot readings through Friday and then continue downloading the data 1-2 times per week throughout this remainder of these conditions at DWR.

In river TDG numbers have leveled out at about 122% over the past few days. This may be because of the increased depth of the downstream plunge pool as discharge has increased above 15 kcfs. Another factor that may be leveling out the TDG is barometric pressure changes. The hatchery reports degassing operations are performing as expected, leveling off at 104 % at current discharge. It is unknown how the degassers will perform when TDG reaches 127-8%.

Andy Goodwin, USFWS, reported that the fish sampled at the hatchery are showing small numbers of gas bubbles, however, none yet on the fins. He noted that they are not looking at the gills, as fins and eyes are more reliable indicators of gas bubble disease. It was noted that GBD is not an instantaneous reaction and the longer the fish are exposed the worse it is likely to become.

Steve Hall noted that he ran another early bird water supply forecast for the basin, which predicts an April 1 forecast of 3.17 maf; he continued that the next ten days look exceptionally wet. The NW River Forecast Center weekly estimate is 1-1½ inches of precipitation in the Clearwater basin over the next two days, and another 1½ - 3 inches thereafter. Temperatures will be in the 32-40 degree range, suggesting low elevation snowmelt.

Steve presented six graphs, available on the TMT web site, modeling various scenarios that could meet the April 15 flood control rule. They show predictions at both a 2.9 and a 3.0 maf water year, and provide comparative traces from 1997, a 2.9 MAF year. They also show the effect of lowered discharge at the end of March to accommodate hatchery release.

Steve reported that Dworshak operations will continue to be stepped up at 1 kcfs daily to reach 22kcfs, which will likely occur on Monday, March 13th. After reaching 22kcfs, the Corps expects to need to increase to 25kcfs for a period of time, depending on weather and inflow. He also noted that if the forecast continues to look like a 3.2 maf year, they will have to prepare the reservoir before the office water supply forecast is out in April. Local flood control elevations for a 2.86 maf year are 1,515.2 at the end of March, and 1,497.6 on April 15th. In the event of a 3.2 MAF year, these figures move to 1,490.3 and 1497.6.

Several members asked whether there could be relief for the local Dworshak situation from other parts of the larger Columbia River Basin system. Julie Ammann, Corps, provided information about the broader system, noting that Idaho Power is struggling to meet its flood control rule, and Brownlee is also moving water. Conversations about Arrow in British Columbia involve an international treaty, and will not be feasible this year. The Upper Snake River above Heise has the highest water supply levels on record according to the NWS-RFC. The Boise River is predicted to remain above flood stage for a couple of months. Grand Coulee cannot help with flood control conditions on the Snake River side.

Jay Hesse, Nez Perce, responded to a question about the proposed dip in discharge for scheduled hatchery fish release at the end of March. None of the TDG levels being discussed are good for fish, especially when they are in the river. It is even harder on fish if TDG levels fluctuate, so a dip in discharge to 8 kcfs may not make as much sense as earlier. Russ Kiefer, Idaho Department of Fish & Game, said that because the water for their hatchery comes from the reservoir, not the river, they <u>will</u> want the dip.

→ ACTION: The hatchery representatives agreed to coordinate, and will bring a recommendation to TMT on Monday.

Steve Hall reported that a new scenario, posted on the TMT web site this morning, models Dworshak operations from April 4th through the end of June. It is based on 1996 after April 1st, a 3 maf year, and uses STP data. It shows the transition between the draft and the refill curves in mid-April. Steve noted that the refill curve was picked for volume rather than shape, and will vary depending on actual weather conditions. Under this forecast, assuming predicted inflows, discharge will drop to 12 kcfs on April 15th to meet the refill curve. Historically, the Corps has been requested to keep flows high through the end of April. Margaret Filardo, Fish Passage Center, expressed concern over the high outflows through April 15th and then subsequent decrease in flow down to 2kcfs in the beginning of May. There was a request for additional long-term scenarios, which Steve said he could provide. It was also noted that Dave Benner, Fish Passage Center, provided a late runoff graph as an appendix to the FPC letter presented and discussed at the March 3, 2017 TMT, and available on the TMT web site.

→ ACTION: The Corps will continue to step up discharge at DWR by 1kcfs per day until they reach 22kcfs, at which point they will determine if/how they will increase to 25kcfs. They will continue to operate DWR to meet 1,493ft by the end of March, assuming that there will be a two day drop to 8kcfs for the hatchery fish release.

TMT will reconvene at 2:00 on Monday, March 13, 2017.

Columbia River Regional Forum
TECHNICAL MANAGEMENT TEAM OFFICIAL MINUTES

March 8, 2017
Minutes: Pat Vivian

1. Introduction

Representatives of Idaho, Colville Tribe, Warm Springs Tribe, Montana, Nez Perce Tribe, BOR, USFWS, BPA, CRITFC/Umatilla Tribe, NOAA, COE and others participated in today's TMT conference call to discuss operations at Dworshak Dam and next steps in light of high inflows and TDG levels in the river. Doug Baus, COE, served as chair and Emily Stranz, DS Consulting, facilitated the conversation.

2. Official Water Supply Forecasts

2a. March Forecasts. Mary Mellema, BOR, gave official March inflow volume forecasts for Hungry Horse. These forecasts set BiOp minimum flows of 3500 cfs at Columbia Falls and 900 cfs downstream of Hungry Horse for the rest of the calendar year.

- (March-July) – 1969 kaf, 100% of average
- (January-July) – 2114 kaf, 101% of average
- (April-August) – 1936 kaf, 100% of average
- (May-September) – 1693 kaf, 100% of average

Baus gave official March inflow volume forecasts for COE projects:

- The Dalles (April-September) – 98 maf, 106% of average
- Lower Granite Dam (April-July) – 25 maf, 125% of average
- Libby (April-August) – 6783 kaf, 115% of average. This puts the Libby March 31 flood control elevation at 2382.1 ft.
- Dworshak (April-July) – 2867 kaf, 118% of average
- Grand Coulee (April-August) – 57 maf, 101% of average
- Albeni Falls (April-August) 13 maf, 104% of average

2b. The Dalles Current Forecast. The current April-September inflow forecast at The Dalles has increased to 102 maf, 110% of average. The NWRFC April-September final forecast for March sets the CRWMP adjustments at Grand Coulee as described in the Water Management Plan. The official March forecast of April-August inflow volume at The Dalles is 92 maf, 105% of average. The current March forecast of April-August inflow volume at The Dalles is 97 maf, 110% of average.

2c. Lower Granite Current Forecast. The current Lower Granite April-July inflow forecast has increased from 25 maf to 29 maf, 137% of average.

2d. Climate Forecast. The RFC climate forecast indicates temperatures for the next 6 to 10 days will be below average and precipitation will be above average across Oregon, Washington, Idaho and Montana. The same pattern persists for the 8-14 day outlook. The 30 day outlook validated on February 28, continues to show below average temperatures and above average precipitation.

2e. Water Year Summary. Baus showed TMT the River Forecast Center's seasonal and monthly precipitation and temperature graphs for 2017 to date. Temperatures in November were above average, but fell to below average from October through February. Precipitation has followed a similar pattern of above average through the water year. For example, precipitation on the Snake above Ice Harbor is 4.15 inches to date, which is 214% of normal. The Columbia mainstem above The Dalles has had 4.37 inches of precipitation, which is 195% of normal. Similar patterns extend across western Washington and Oregon. Well above average precipitation fell in February.

3. Dworshak Update

Steve Hall reported. The COE's early bird water supply forecast, based on current conditions and the 10 weather quantitative precipitation, puts the official April inflow forecast for Dworshak at 3.17 maf, 130% of average – assuming that's all the additional precipitation Dworshak gets in March. In other words, precipitation to date plus forecasted precipitation over the next 10 days would yield a 3.2 maf forecast, even if there is no additional precipitation after that point. This would require the COE to empty the reservoir to 1445 ft elevation for flood control by April 15th.

3a. Current Operations Data. Dworshak is currently at elevation 1514.7 ft, and drafting. Total outflow is 17.4 kcfs with 4.8-4.9 kcfs passing through the turbines and the remaining 12.5 kcfs as spill.

3b. Total Dissolved Gas Report. Yesterday TDG levels in the North Fork Clearwater below Dworshak got up to 122.9% and are currently at 122.5%. The Peck gage downstream of the confluence of the North Fork hit 114% yesterday and is down to 113.3%.

The COE has a team of experts in the field monitoring TDG in several locations. TDG in Dworshak National Hatchery has been consistently 104.4-104.3% in the collection channel, chinook raceway #85 and Burrows Pond 70, with slight variations among the three sites. Yesterday, dissolved oxygen levels were 103.9% in the collection channel, 103.2% in the chinook raceway, and 103.3% in Burrows Pond #70.

TDG values at Cherry Lane hatchery (downstream) in the river sump, were 109.2% this morning and 110.4% at 6 pm yesterday. Past the degasser, they were 101.6% this morning and 101.7% last night. So the Cherry Lane degassing equipment is working well. TDG in the Big Canyon out-plantation facility was 100.5% and 100.4% respectively.

The TDG monitoring team is taking spot readings, and the probes are collecting 10 minute data for a continuous record. The team will be visiting monitoring sites daily through March 10 and are attempting to install a permanent TDG monitoring station in the Dworshak National hatchery. After March 10, they will return at least once a week to collect data from the probes. A second team is working on maximizing the performance of degassing equipment at the hatchery.

The good news, Hall said, is that TDG levels in the Clearwater River have leveled out at 122% not 125% as was expected with 15 kcfs discharges out of Dworshak and flows increasing since March 5. It's possible the tailwater depth is suppressing TDG levels, or it could be a drop in barometric pressure from 735 to 733. Water passing through the RO gates at Dworshak plunges into a pool, which might suppress TDG levels with the increased tailwater depth. Tom Lorz asked, for how long might this reprieve continue? Has the COE looked at geometry and hydraulics in the area? Hall said yes, as flows increase, most of the volume will pass through the RO's so the conditions that produce lower than expected TDG levels are likely to persist.

The Dworshak hatchery degassing equipment is performing well. Current TDG saturation levels of 122-123% in the river are producing steady 104% readings in the hatchery. This is expected to continue as long as the river stays in the realm of 122-123% TDG.

Andy Goodwin, manager of USFWS fish health, reported that bubbles have been observed in fewer than half the fish, and in gills only. Paul Wagner pointed out that smolt monitoring on the Columbia inspects the condition of fins, not gills. In terms of TDG levels, however, Goodwin said the hatchery is concerned levels could climb if there's a change in barometric pressure, or if TDG in the river rises to 127-128%. If fish develop bubbles in fins, eyes and skin, these are indicators of severe internal problems from gas bubble trauma (GBT). So far, the hatchery isn't seeing these symptoms. However, GBT develops slowly if fish are exposed to high levels of TDG, Tom Lorz noted, so they could still develop problems.

3c. NWRFC Water Supply Forecast. Steve Hall showed TMT the RFC's 10 day weather streamflow forecast for Dworshak, which shows inflows going up to 30 kcfs, dropping to 20 kcfs then going back to 30 kcfs and leveling off. The 10 day weather forecast includes elevated precipitation, with 1.5-3 inches forecasted at the North Fork. Furthermore, temperatures are such that higher elevation snowpack is expected to increase along with lower elevation snowmelt. These conditions form the basis of the scenarios presented below.

3d. Dworshak Modeled Scenarios. Hall showed TMT six scenarios that depict short term operations through April 15. (A longer term scenario, prepared at the request of the Nez Perce hatchery, is shown as agenda item 3e.)

Scenario 1 – This uses STP inflows through April 15. A forecast of 2.93 maf puts the reservoir at elevation 1493 ft by end March for flood control. The 1 kcfs/day increases continue through March 13, then discharges rise to 25 kcfs and level off until March 27-28, when they drop to 8 kcfs for 2 days to accommodate the hatchery release. With this set of inflows, 22 kcfs discharges would get the reservoir to its flood control target of 1471 ft by April 15.

Scenario 2 – This uses the same assumptions as Scenario 1 except there is no 2 day drop to 8 kcfs for the fish release. It was prepared at the request of the Nez Perce Tribe. The 1 kcfs/day increases continue to 23 kcfs, then flatten out through the end of March. After that, 22 kcfs discharges would be needed to get the reservoir down to 1471 ft by April 15.

Scenario 3 – This depicts a 3 maf water year, which is probably closer to reality. It would require 25 kcfs releases through April 15 to get to within a foot of 1445 ft elevation which is empty.

Scenarios 4-6 – These use 1997 inflows instead of STP traces. The first shows that 1 kcfs/day increases would be needed up to 25 kcfs discharge. With 2 days of 8 kcfs discharges for the hatchery release, it would take 17 kcfs out to get to 1471 ft elevation by April 15. Without the fish release, discharges would be 22.5 kcfs and 17.2 kcfs to attain the flood control elevation. The final scenario includes 2 days of 8 kcfs for the fish release, but discharges would have to be 25 kcfs for the rest of March and April to get down to 1445 ft by April 15.

Paul Wagner asked if these scenarios mean the COE is assuming Dworshak releases will need to go up to 25 kcfs and Hall said yes. The plan for gradual increases of 1 kcfs/day up to 22 kcfs will continue for now, but the COE is keeping a close eye on this because it's possible the April 1 official forecast could come in even higher than 3.17 maf.

Tom Lorz, CRITFC/Umatilla, asked how system and local flood control elevations compare. The disparity between local and system flood control elevations starts to disappear when the inflow forecast gets up to 3.1-3.2 maf, Hall replied. Based on local flood control, the end of March elevation at DWR would be 1515.2 ft and for April 15, 1497.7 ft. But that April 15 elevation was based on a 2.9 maf year, not 3.2 maf. For the sake of comparison, a 3.2 maf year requires an April 1 elevation of 1490.3 ft and an April 15 elevation of 1497.6 ft. Both local and system flood control are designed to protect the Clearwater River down to Lewiston and Clarkston, Idaho, which have levees due to backwater influence from Lower Granite Dam. There's a specific set of flood control rules because if the levees overflow, the impacts would be severe.

Lorz suggested conferring with Idaho Power about possible ways of lowering TDG saturation in the Clearwater. He also proposed a flood control shift from Dworshak to Arrow Dam. Julie Ammann, COE, said that would require treaty negotiations with Canada, Furthermore the biggest risk now is in the Snake system, which a shift of flood

control space to Arrow wouldn't address. As Hall mentioned earlier, the COE ruled out a flood control shift from Dworshak to Grand Coulee this year because Dworshak lacks the capacity to return the space with only two units operating. Furthermore, drum gate maintenance requires an elevation below 1240 ft at Coulee this year, which rules out the option of using it for flood control. Idaho Power has increased Brownlee discharges to 55-56 kcfs in an effort to meet their own flood control requirements. Inflows are high everywhere; the upper Snake above Heise has the highest inflow forecast on record according to the NWS-RFC.

Jay Hesse, Nez Perce, recommended dropping the 2 days of 8 kcfs for hatchery releases from the Dworshak operations plan because inflows are too high. Even if hatchery fish are surviving at the moment, fish in the river are exposed to worse conditions. Fluctuating TDG levels are hardest on fish, so dropping releases to 8 kcfs for a few days doesn't make sense if they're going to be exposed to high TDG in the mainstem Clearwater a few days later.

However, Russ Kiefer said Idaho hatchery managers want those 2 days of 8 kcfs if at all possible. Idaho and the Nez Perce will address this issue and bring a joint recommendation to TMT.

3f. Dworshak Long Term Operations. Hall posted this scenario to today's agenda in response to a request from the Nez Perce Tribe at the last TMT meeting. It depicts Dworshak operations from April 4 to the end of June including the transition between drafting for flood control and managing outflows to the FCRC, which represents 95% confidence of refilling the reservoir for flow augmentation.

The long term scenario uses STP inflow traces through April 1, then 1996 inflows as an analog year because 1996 inflows were just over 3 maf. However, the shape of 1996 inflows could be very different from this year's shape, which has a significant impact on regulation. The scenario drafts DWR at 25 kcfs per day to 1445 ft elevation and holds that elevation until it intercepts the FCRC. After that, discharges are 2 kcfs and 1.5 kcfs to fill the reservoir by the end of June. If inflows are low, discharges would be 12 kcfs then drop to 8 kcfs as needed in April, with a new discharge rate set at the beginning of May.

Julie Ammann, COE RCC, asked for an example of a long term forecast with late runoff, which Hall said he would provide at the next TMT meeting. The goal is for the FCRC to be computed based on current inflows rather than the interpolation method the Fish Passage Center used to prepare scenarios for the March 3 TMT meeting before current inflow data were available.

Paul Wagner, NOAA, asked the COE to include inflow data from a location downstream of the North Fork that might be more representative of actual TDG readings on the Clearwater River. The underlying question is whether there are higher TDG fluctuations on the Clearwater than anticipated. In 1996, the 40 kcfs spike seen in Dworshak inflows was 55 kcfs at Spaulding, Hall replied. Peak inflow of 32 kcfs at

Dworshak was 66 kcfs at Spaulding. Inflows at Spaulding are roughly twice what they are at the North Fork.

Moving forward, the COE will continue the operation TMT coordinated on March 3, gradually increasing DWR discharges by 1 kcfs/day until total discharges reach 22.5 kcfs which is expected to occur at 8 pm March 12. At some point, probably within a few days of reaching 22 kcfs, discharges will need to go to 25 kcfs and remain there in order to meet the 1493 ft end of March flood control elevation.

Meanwhile, IDFG and USFWS hatchery managers will confer on whether to drop Dworshak discharges to 8 kcfs (or some other volume) for 2 days for hatchery releases and provide a joint recommendation to TMT.

It was agreed all these things make March 13 a critical decision point so TMT will meet in a conference call then. A decision will be made whether to implement the fish release reduction, and the COE will update TMT on flood control requirements. The agenda will include discussion of the longer term outlook for Dworshak operations.

Jay Hesse cautioned the COE to hold enough water in Dworshak reservoir to ensure that summer smolts have enough augmentation flows to make it to the ocean. Hall said all indications are there will be plenty of water this summer, and flows will be more limited by TDG concerns than available volume.

4. Next TMT Meeting

TMT will revisit Dworshak operations in a conference call March 13 at 2 pm. The next regular TMT meeting in person is March 15.

Name	***Affiliation***
Russ Kiefer	Idaho
Sheri Sears	Colville Tribe
Jen Graham	Warm Springs
Jim Litchfield	Montana
Jay Hesse	Nez Perce
Mary Mellema	BOR
Dave Swank	USFWS
Tony Norris	BPA
Tom Lorz	CRITFC/Umatilla
Paul Wagner	NOAA
Julie Ammann	COE
Doug Baus	COE
Brian Zigler	Snohomish PUD
Wayne Jousma	COE Walla Walla
Alfredo Rodriguez	COE Walla Walla
Steve Hall	COE Walla Walla
Margaret Filardo	FPC

Dave Benner	FPC
Chris XX	USFWS
Charles Wiggins	DSC
Michael Bryant	CBB
Lisa Wright	COE
Laura Hamilton	COE
Dan Turner	COE
Derek Fryer	COE
Bill Proctor	COE
Marilyn Blair	USFWS
Becky Johnson	Nez Perce
Andy Goodwin	USFWS
Howard Schaller	USFWS