

**Columbia River Regional Forum**  
**2010 Post Spill Season Monitoring System Review**  
**November 3, 2010**

**1. Meeting Purpose and General Overview**

The 2010 post spill season review of the U.S. Army Corps of Engineers (Corps) regional water quality monitoring program was chaired by Scott English (Corps) with representatives of U.S. Geological Survey (USGS), Bureau of Reclamation (Reclamation), Douglas County PUD, Grant County PUD, Fish Passage Center (FPC), the Corps and others attending. The purpose of today's meeting was to exchange water quality data evaluations from monitoring sites throughout the region. To identify any modifications or adjustments to equipment made during the year. To identify the quality processes implemented. Review the statistical evaluation and completeness of the data. To discuss any proactive steps that may be carried forward for next year's monitoring operations. The meeting consisted of presentations by the Portland, Seattle and Walla Walla Districts of the Corps Northwestern Division, as well as the Bureau of Reclamation and the public utilities districts of the mid-Columbia. Each presentation included a program overview, description of network sites and equipment, data quality review, and a summary of seasonal compliance with applicable water quality standards. The presentations are available on the TMT web page at <http://www.nwd-wc.usace.army.mil/tmt/wqnew/>.

**2. Portland District**

Jim Britton (Corps) and Dwight Tanner (USGS) gave a presentation on the Portland District water quality monitoring program for eight sites on the lower Columbia River. Four of the sites are monitored year-round and the other four during spill season only. Fixed monitoring stations are located in dam forebays and tailwater sites at Bonneville Dam, The Dalles Dam, John Day Dam, and at Warrendale and Camas-Washougal downstream of Bonneville Dam. All sites are calibrated every three weeks during spill season and every four weeks for the rest of the year.

Equipment: Field and lab equipment includes hydrolab minisondes and analog Vaisala barometers. A new Sutron Link 2 DCP that relays data to the satellite platform has been providing a steady stream of reliable hourly data. And a new digital barometer for field use has turned out to be highly accurate.

Season summary: Some forebay sites had readings of more than 115% and some tailwater sites more than 120% TDG saturation. Field checks for accuracy were within  $\pm 2\%$  saturation and most were within  $\pm 1\%$  saturation. There were some problems with equilibrating the equipment in the field. Barometric pressure readings were all within 1 mm Hg and temperature checks were all within  $\pm 0.2^{\circ}\text{C}$ . All in all, 99.7% of the data transmitted in real time passed USGS quality checks.

Data completeness: Most of the data loss in the Portland District in 2010 was at the Cascade Island site below Bonneville Dam, caused by two instances of broken membranes. These 80 hours of data were unrecoverable. Problems with the instrument cables at John Day tailwater resulted in another 38 hours of lost data that were also unrecoverable. Real-time data transmission problems from The Dalles forebay occurred, but these data were later retrieved. Overall, there were not a lot of missing data in 2010. A box plot graph shows hourly spill values in relation to the 115% forebay and 120% tailwater limits. The box plot shows hourly values only, not exceedances calculated as the average of the 12 highest consecutive hours as stipulated by WDOE.

A series of graphs correlate 2010 spill volumes at Bonneville Dam with the resulting TDG saturation levels at Cascade Island, Warrendale and Camas gauges. In summer 2010, spill volumes at Bonneville were more than 150 kcfs, causing TDG readings at Cascade Island to exceed 120%.

Field checks found that all barometric pressure readings were accurate within 1 mm mercury. Temperature checks were accurate within 0.2°C. Dissolved gas readings were up to 2% off at John Day forebay, due to slow equilibration of the sensors which are positioned 30 feet underwater. However, USGS has apparently solved that problem. Newer sensors didn't react as quickly in the field as the old ones had, a result of dead air trapped inside the sensor, which caused equilibration to be slow. Hydrolab redesigned the sensors and they work better now. The presentation ended with a photo of USGS sensors being calibrated in the lab, where equilibration hasn't been a problem like it has in the field. USGS will publish an online report based on today's presentation.

### **3. Seattle District**

Kent Easthouse (Corps) gave a presentation on five monitoring sites (Chief Joseph Dam and Albeni Falls Dam both forebays and tailwater, and Libby Dam tailwater).

Equipment: The equipment at all sites is very similar – Hydrolab minisondes, Sutron 9210 DCP sensors – except that Albeni Falls and Libby tailwater stations run on solar power. Recently the solar panel at Albeni Falls was vandalized. The five sites are calibrated every two weeks during spill season.

Data completeness: Results for 2010 are generally very good, with no missing values and 100% of data passing QA/QC checks at the Chief Joseph forebay and tailwater sites. Libby tailwater station often has problems, but there were no missing data values there this year.

In 2010 Albeni Falls was the biggest problem area – the forebay stations had 96% and 93% of temperature data pass QA/QC checks, but only 56% of the Albeni tailwater temperature data passed QA/QC. Most of the data loss at Albeni Falls was

due to barometer failure. Only a small portion was attributed to the smashed solar panel, which has been replaced.

Lab QA/QC checks of all sites showed a median difference in temperature field readings of 0.03°C, and temperature data were all within  $\pm 0.10^\circ\text{C}$  except at Albeni Falls tailwater station. Most TDG readings were accurate within  $\pm 10$  mm Hg except at Albeni Falls forebay and tailwater, where there were problems with the probes. At 22 feet of depth, Albeni Falls tailwater is not a safe place to put a third probe, John Lemons (Columbia Basin Environmental) observed, having lost TDG sensors there.

There was general group discussion of TDG probe malfunctions observed at the deeper sites like Albeni Falls. And John Day forebay site which is 30 feet deep and has a similar data bias, but the effect is not as extreme as at Albeni Falls, Joe Rinella (USGS Portland) observed. The Reclamation site at Grand Coulee is positioned 60 feet below the water surface. Lemons (CBE) said he's gotten that probe to equilibrate in 30 minutes by inverting it to let the air out.

There were also problems in 2010 with the barometer at Albeni Falls, Eastwood said. There were few problems at Chief Joseph and Libby; temperature data there were accurate within  $\pm 0.1^\circ\text{C}$ . Field calibrations for temperature were good at all sites except Albeni Falls.

Season summary: Chief Joseph forebay had a maximum TDG reading of 118% in 2010. Total dissolved gas there is largely a function of the gas Grand Coulee produces. The new deflectors on all spill bays at Chief Joseph, which were installed to reduce gas levels, are very dependent on tailwater elevation. Higher elevations tend to produce higher TDG readings. Spill volumes of up to 100 kcfs caused the gas levels at Chief Joseph tailwater to reach 125%. However, this is still considerably less gas than would be produced without the flow deflectors. Saturation levels at Chief Joseph were as high as 135%.

Despite the high spill volumes of summer 2010, the highest TDG values at Albeni Falls were around 116%, which is typical because higher spill volumes at Albeni Falls don't tend to raise tailwater gas levels. Gas there is more a function of the number of spill bays used and gas levels entering the forebay than spill volumes.

Temperatures at Albeni Falls remained around 22°C from mid-July to mid-August 2010. Use of the forebay barometer at Albeni Falls allowed for the recovery of the lost tailwater temperature data mentioned earlier. The tailwater barometer was repaired at the end of June or in early July.

Libby Dam had BiOp spill this year for sturgeon. The maximum TDG reading was 125% during sturgeon flows of 9 kcfs. Temperatures in the Kootenai River below Libby remained below 18°C the whole summer. Spill of 7 kcfs at Libby yielded gas levels of around 123%, but that increased to 125% when spill rose to 9 kcfs. Libby reservoir is subject to big temperature changes and has selective withdrawal gates for

temperature control. The only real problems at Libby this year were with the power supply to the first barometer, Lemons added.

#### **4. Walla Walla District**

Steve Juul (Corps), Kevin Wright and Dewey Copeland (USGS Kennewick) gave a presentation. The Walla Walla District operates fifteen water quality monitoring sites, six of them year-round and all fifteen during the spill season. These include forebay and tailwater sites at McNary Dam, all four lower Snake River dams, a tailwater site at Dworshak Dam, plus riverine sites at Anatone, Lewiston, Peck and Pasco. All fifteen sites were visited for maintenance and calibration every three weeks during the spill season, and the six tailwater sites were visited every four weeks during the rest of the year.

Equipment: Most of the 35 sondes the District uses are Hydrolob 4, 4A and MS5's (the MS5s were not used during the 2010 season due to a design problem with the TDG sensors). All sites use Sutron digital barometers. Fourteen of the stations use Sutron Satlink 2 HDR DCP's to transmit data. The Dworshak tailwater station relies on a Sutron 8210 HDR DCP since that station also uses a modem to transmit data to the project. Lab equipment includes two calibrated digital pressure gauges, two digital thermometers, and a ParoScientific digital barometric pressure standard.

Data completeness: The provisional BP, TDG, and water temperature data were 99.7%, 99.2%, and 99.6% complete, respectively, when the entire water year is considered. Most of the data losses were the result of DCP failures, vandalism, sonde malfunctions, and defective membranes. The Little Goose forebay and Lower Granite tailwater stations both produced 100% usable data for the entire reporting period. On a narrower scale encompassing the fish spill season between April 1 to August 30, 99.2% of the BP data, 98.9% of TDG data, and 99.1% of the water temperature data were received in real time and passed provisional QA/QC review. Of these percentages, three sites (PAQW, IDSW, and DWQI) accounted for 96.7% of BP, 72.5% of TDG, and 85.7% of water temperature missing data. The Ice Harbor tailwater and Pasco sites were both vandalized in 2010, resulting in 271 hours and 240 hours, respectively, of unusable data. The loss of 484 hours from the Dworshak data set were due primarily to transmission problems.

In the wake of a navigation accident that cut AC power from the Lower Granite navigation lock, the District switched that forebay station to solar power. As such, all of the forebay stations are now solar powered. The Dworshak tailwater station is the one remaining location that still utilizes AC power and will be converted to solar power during FY 2011.

The presentation ended with a discussion of general problem areas with specific references to the Pasco and Dworshak Dam tailwater stations. The sondes that were deployed during the past year at the Pasco site did not perform as well as they should have. Consequently, the deployment pipe was purged of accumulated silt using

compressed air prior to the fish spill season. Similar cleanouts were also completed at the Anatone and Peck stations later in the year. Additionally, amphipods and decapod crustaceans continue to inhabit the area surrounding the TDG sensors which occasionally leads to membrane failure. The Dworshak tailwater site also experienced issues with slow sonde response times when the project was discharging at minimum outflow. To correct this problem, the deployment pipe was extended approximately 30 feet into the river. The Dworshak tailwater station also experienced problems with data transmission. The DCP was replaced, but this action did not remedy the problem. Next steps include converting to solar power to eliminate voltage spikes and evaluating whether the modem could be causing some interference. The District plans to purchase a new Sutron 8310 DCP next year for that station since the current 8210's are no longer manufactured. Finally, Hydrolab redesigned the MS5 TDG sensors during summer 2010 and field testing was initiated. Initial results suggest that the new sensors are responding appropriately and retrofitting of the Districts MS5s will begin this fall,

Season summary: All field and laboratory calibrations were within prescribed guidelines. District data completeness is usually greater than 99%, so this year's rate of 1.1% lost data was slightly higher than normal, but still exceeded Division criteria. Vandalism at two sites and data transmission problems at Dworshak that are still being investigated account for the increase.

## **5. Bureau of Reclamation**

Norbert Cannon (Reclamation) and John Lemons (Columbia Basin Environmental) gave a presentation. The Reclamation manages four sites, including one each at Hungry Horse Dam, Columbia Falls, Grand Coulee Dam, and the international boundary 150 miles upstream on the Columbia River. The Hungry Horse site is monitored only in spring, as there is usually no spill at Hungry Horse in winter. The other three sites are monitored year-round. All sites are calibrated every two weeks during spill season and once a month the rest of the year.

Equipment and data completeness: The presentation included a breakdown of calibration summaries via a graph and box plots. Reclamation has had trouble replacing probes that are no longer manufactured and is looking for viable replacements. There was some data loss at Grand Coulee this year, due to a TDG sensor that gave increasingly low readings.

## **6. Chelan County Public Utility District**

This presentation was canceled. A quick review of calibration summaries from Chelan PUD showed there were no problems with probes this year. The presentation intended for today's meeting is posted online at <http://www.nwd-wc.usace.army.mil/tmt/wqnew/>.

## **7. Grant County Public Utility District**

Carson Keeler (Grant PUD) gave a presentation. Grant PUD operates four water quality monitoring sites, including forebay and tailwater sites at Priest Rapids and Wanapum dams. The tailwater sites are farther downstream of the dams than is typical. The Wanapum site at Beverly Bridge is 2.5 miles from the dam, and the Priest Rapids site is 9 miles downstream of the dam at Vernita Bridge. Both forebay sites are AC powered, but the tailwater site at Beverly Bridge uses solar power and the Vernita Bridge site will soon be converted to solar power.

Equipment: All four sites use 9210 DCP's and Sutron barometers, as well as Hydrolab MS5, 4A and 4a sondes. Of 20 probes in use, about half are MS5's which Grant PUD will send to Hydrolab to be exchanged. Equipment is calibrated biweekly during spill season and every three weeks the rest of the year.

Data completeness: The two major data losses in 2010 were caused by membrane failures. Of 14,688 data hours this year, 129 hours was missing, or 0.9% of data lost and 99.1% data completeness.

Joe Carroll (contractor) asked whether the new fish bypass at Wanapum Dam has resulted in significantly higher spill levels than in past years. Flows of 20 kcfs for the fish bypass have changed the way Grant PUD operates Wanapum Dam, Keeler replied. In 2011 work will begin on a fish bypass system at Priest Rapids Dam that will handle flows of up to 4 kcfs.

In response to the data completeness rate of more than 99%, Laura Hamilton (Corps) wondered why there have historically been more problems with vandalism and lightning in the Seattle District than in other areas. The Vernita Bridge and Beverly Bridge sites are both highly inaccessible to vandals, Keeler replied. Lightning is common at the north fork near Libby Dam and at Albeni Falls, Carroll added. Reclamation's international boundary site has twice been knocked out by lightning; a lightning arrestor has been installed to prevent further damage. The Albeni Falls tailwater site was also vandalized and in a bad location, so three years ago it was moved upstream, Lemons said. The current location is an improvement except that when flows cease, forebay and tailwater readings tend to drift apart.

## ***8. Douglas County Public Utility District***

Beau Patterson (Douglas PUD) gave a presentation on the two seasonal sites Douglas PUD manages in the forebay of Wells Dam and tailwater 2.6 miles downstream. The juvenile bypass system at Wells uses a constricting flow barrier design in spill bays 2, 4, 6, 8 and 10 to guide juveniles into a surface passage route.

Data completeness: Wells tailwater site data were validated using a model developed at the University of Iowa in 2009. Calibration data for 2010 were good, with no deviations of significance in any of the temperature or gas measurements. The forebay site generated no data from April 12-19, with 210 hours of missing data.

Fortunately, data from upstream and downstream sites indicated there were no exceedance issues in the area.

The Wells forebay site had 93.6% valid data during spill season from April 1 to September 15, a slightly longer period than usual per WDOE request. The tailwater site had almost 98% valid data, with 68 hours missing.

Season summary: There were no TDG exceedances in Wells forebay and four days of TDG exceedances in the tailrace, using WDOE's methodology of averaging the 12 highest consecutive hours. Overall there was 97% compliance at both sites during spill season. At Rocky Reach forebay downstream, there were exceedances on eight days for a 94% rate of compliance. All exceedances occurred between June 17 and July 2, 2010.

## **9. Other**

The Corps is working on updating 2010 Dissolved Gas Monitoring Plan of Action and will be soliciting final review comments from the group in late November. Preparations for the 2011 Dissolved Gas Monitoring Plan of Action will begin in December and incorporate any feedback and lessons learned from the 2010 season activities. This meeting summary prepared by technical writer Pat Vivian.

<b>Name</b>	<b>Affiliation</b>
Scott English	Corps, Northwestern Division
John Lemons	Columbia Basin Environmental
Jim Britton	Corps, Portland District
Mark Gunter	Private consultant
Carson Keeler	Grant County PUD
Beau Patterson	Douglas County PUD
Joe Carroll	Contractor
Kevin Wright	USGS, Kennewick
Dwight Tanner	USGS, Portland
Dewey Copeland	USGS, Kennewick
Joe Rinella	USGS, Portland
Heather Bragg	USGS, Portland
Kent Easthouse	Corps, Seattle District
Gwendolyn Hannam	Corps, Seattle District
Brandon Chockley	Fish Passage Center
Margaret Filardo	Fish Passage Center
Kim Johnson	Corps, Northwestern Division
Steve Juul	Corps, Walla Walla District
Russ Heaton	Corps, Walla Walla District
Laura Hamilton	Corps, Northwestern Division