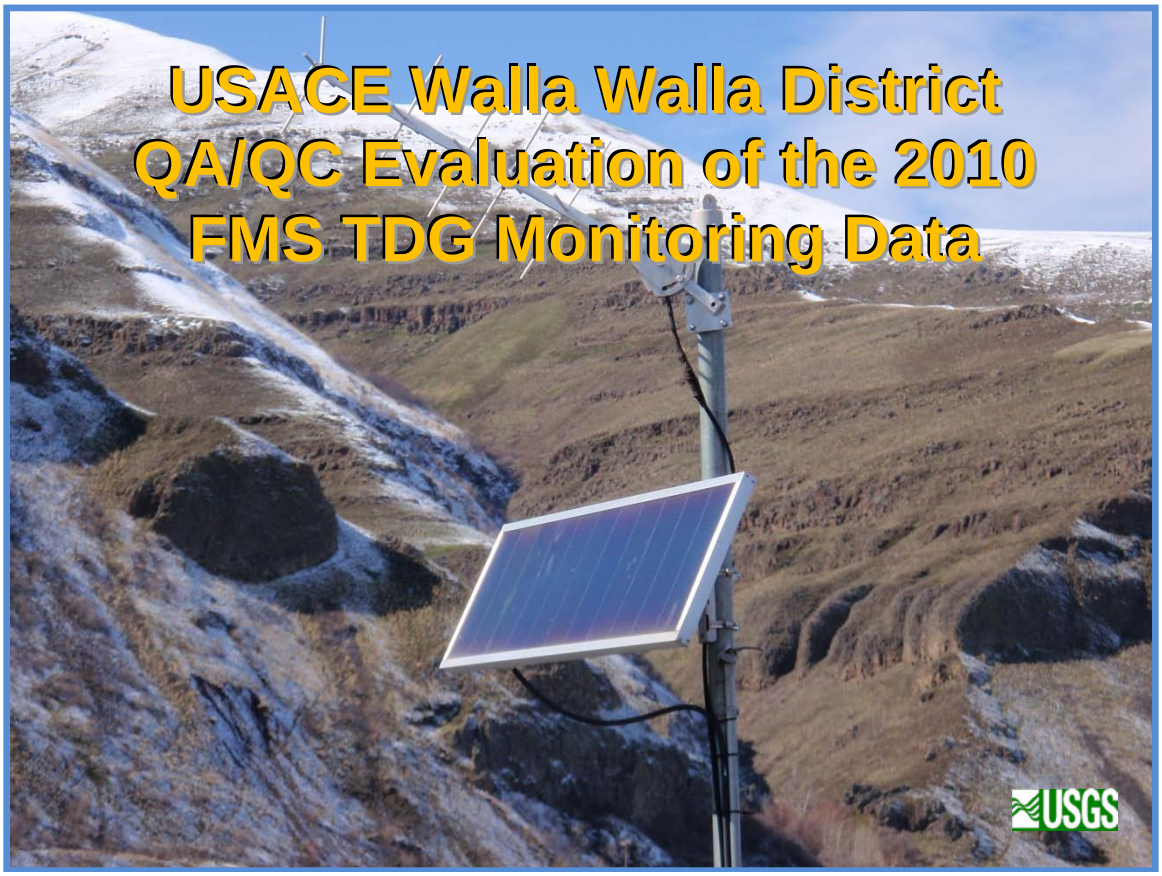
Appendix J

Walla Walla District TDG Report (Includes McNary, Ice Harbor, Lower Monumental, Little Goose, Lower Granite and Dworshak Dams)



Includes:

McNary, Ice Harbor,
Lower Monumental, Little Goose,
Lower Granite, and Dworshak Projects

USACE Walla Walla District QA/QC Evaluation of the 2010 FMS TDG Monitoring Data

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ABSTRACT

The U.S. Army Corps of Engineers (USACE), Walla Walla District (CENWW), operated fifteen fixed-monitoring system (FMS) stations (nine seasonal and six year round) for total dissolved gas (TDG), barometric pressure (BP), and temperature as part of their 2010 water-quality program. These stations are located on the Columbia, Lower Snake and Clearwater Rivers. This report provides a summary of the 2010 water-year quality assurance/ quality control (QA/QC) evaluation. Highlights include:

- 99.68 , 99.23, and 99.61 percent of the BP, TDG, and water temperature data, respectively, were received in real-time and passed provisional QA/QC review. Percent completeness subsequently increased to 99.78, 99.48, and 99.77 for BP, TDG, and temperature, respectively, after the data was compared to the information from the electronic data logger (EDL)
- 32.26 percent of the invalid/missing provisional real-time BP+TDG data was due to DCP failure followed by 23.50 and 20.09 percent attributable to vandalism and sonde failure, respectively. When the data was corrected with information from the EDL, 34.38 percent of the aberrant data was due to vandalism while 26.40 percent was attributed to DCP failure.
- The sonde pre-deployment check had calculated median TDG and temperature differences of -0.2 mmHg and -0.01 °C, respectively.
- The sonde post-deployment check revealed median TDG and temperature differences of -0.01 percent and -0.02 °C, respectively.
- Two stations were vandalized (Pasco and Ice Harbor tailwater).
- Silt accumulation in the deployment pipes at four stations (*i.e.*, Pasco, Lewiston, Peck, and Anatone) was purged with compressed air.
- The Dworshak tailwater deployment pipe was extended approximately 30-ft to provide better circulation around the sonde during low-flow conditions.

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1.0 INTRODUCTION

Six hydropower projects – McNary, Ice Harbor, Lower Monumental, Little Goose, Lower Granite, and Dworshak – operated by the Walla Walla District (CENWW) of the U.S. Army Corps of Engineers (USACE) are included in the basin-wide fixed-monitoring system (FMS) network. Six of the stations (*i.e.*, the tailwater stations at McNary Dam, Ice Harbor Dam, Lower Monumental Dam, Little Goose Dam, Lower Granite Dam, and Dworshak Dam) are operated throughout the year (Figure J-1; Table J-1). The remaining nine stations record data from 1 April through 31 August.

Three water-quality parameters are monitored at these facilities. One is total dissolved gas (TDG). This parameter is of interest since gas supersaturation results when air is entrained as water flows over the spillways and plunges into the stilling basin where water pressure causes the air to go into solution. The river subsequently becomes shallow beyond the stilling basin and the result is water supersaturated with TDG relative to atmospheric conditions. The U.S. Environmental Protection Agency (USEPA) has established an upper limit of 110 percent saturation for protection of freshwater aquatic life. Concentrations above this level can cause gas bubble trauma in fish and adversely affect other aquatic organisms. The State of Washington water-quality standards provide exemptions to this criterion when water is spilled for fish passage, as well as during high river discharge events (*i.e.*, flows greater than the 7Q10). WAC 173-201A-070 states that the averages of the twelve highest consecutive daily TDG values when water is spilled for fish passage can reach 115 percent in the forebays and 120 percent in the tailwaters. The one-hour maximum TDG measurement cannot exceed 125 percent. Two additional parameters that influence TDG saturation are barometric pressure and water temperature. As such, measurements for these two constituents are also recorded and stored in the database.

Measurements were completed hourly at all stations and transmitted via the Geostationary Operational Environmental Satellite Program (GOES) system to USACE and U.S. Geological Survey (USGS) databases.. The Corps Water Management System (CWMS) database at the Northwestern Division (CENWD) office in Portland, Oregon can be accessed at http://www.nwd-wc.usace.army.mil/report/total.html. The link to real-time USGS data for Washington is http://waterdata.usgs.gov/wa/nwis/current/ ?type =quality.

2.0 PURPOSE AND SCOPE

The purpose of gas monitoring is to provide managers, agencies, and interested parties with near real-time data for managing stream flows and TDG levels downstream from power-producing dams. As with any data collection activity, an important component that cannot be overlooked is the quality of the data. Measurement of data quality allows determination of the usefulness and relevance of the data for current and future decision processes.

This 2010 report:

- Describes the data collection methods.
- Evaluates quality assurance/ quality control (QA/QC) data for the FMS stations at McNary, Ice Harbor, Lower Monumental, Little Goose, and Lower Granite reservoirs. Additionally, this data-collection system provided water-quality information for the Clearwater River downstream of Dworshak Dam, the Columbia River near Pasco, and the Snake River near Anatone, Washington (Figure J-1; Table J-1).

- The QA/QC data includes:

    1. Instrument Data. This data was used to evaluate how an instrument performed as a function of the magnitude and direction that individual sensors deviated over time from their respective laboratory standards. These relationships were determined for each sensor before and after each deployment.

    2. Station Data: These data present comparisons between an in-place instrument that was deployed at a given station for a specified cycle and a newly calibrated QA/QC instrument (field standard). The Sutron® barometers at each station were evaluated with a hand-held barometer that served as a portable field standard for barometric pressure. Fifteen stations were visited for routine maintenance once every three weeks between 1 April and 31 August. The six year-round stations were maintained once every four weeks for the remainder of the year.

3.0 METHODS

3.1 DATA COLLECTION

The instrumentation at each FMS station consisted of components provided by CENWW and the USGS Kennewick, Washington, office. A 12-volt battery charged by a solar panel and/or 120-volt alternating-current line powered each station. Twenty-nine Hydrolab® multi-parameter probes (*i.e.*, Minisondes, MS4A's, and MS5's) were utilized. Twenty- one of these units were provided by CENWW and the remaining eight belong to the USGS.

3.2 LABORATORY PROCEDURES

The TDG sensor measures the sum of the partial pressures of gaseous compounds dissolved in the water and reports the result in millimeters of mercury (mmHg). The TDG sensor requires a two-step calibration procedure (*i.e.*, adjustments are made at two points on the calibration curve) that is completed prior to and after deployment. The atmospheric pressure calibration point (Lab BP) is equal to the atmospheric pressure at the time of calibration as measured with a ParoScientific® digiquartz barometric pressure standard that is calibrated yearly at the factory. The differences between Lab BP and the pressure measured by the sonde [Δ(BP-PT)] were recorded before and after deployment. The slope of each sensor response was also evaluated to ensure that measurements were interpolated correctly over the full range of expected field values. To accomplish this task, a Heise™ PTE-1 hand held certified pressure calibrator, calibrated yearly at the factory (primary standard) and an Ashcroft digital test gauge, also calibrated yearly at the factory (primary standard), were used to apply pressure to the TDG sensor. Three hundred mmHg were added to Lab BP during the pre-deployment check and the differences between Lab BP+300 and the sondes' response were recorded as Δ[(BP+300)-PT]. Similar tests were completed post-deployment when 100 mmHg was added to Lab BP, and the resulting differences were recorded as Δ[(BP+100)-PT]. Pre-deployment pressure tests were made without a membrane installed. Post-deployment tests were made with a dry membrane in place.

Each sonde also includes a sensor for reporting water temperature in degrees Celsius (°C). Sonde thermometers are factory calibrated and cannot be adjusted. However, temperature sensor performance was evaluated pre- and post-deployment by comparing instrument readings to two Barnant model 600 digital thermistors. Both of these instruments were checked quarterly against a National Institute of Standards and Technology (NIST) mercury thermometer standard.

3.3 FIELD PROCEDURES

The differences in barometric pressure, water temperature, and TDG between a secondary standard instrument (*i.e.,* replacement sonde) and the fixed-station monitors after three or four weeks of field deployment were measured and recorded as part of the field inspection and calibration procedure. These differences, defined as the secondary standard value minus the field instrument value, were used to compare and quantify the precision between two independent instruments. The Sutron® barometers were checked using a Novalynx® model 230-355 hand-held digital barometer that is calibrated yearly at the factory. The water temperature and TDG comparisons were made *in situ* with the secondary standard (*i.e.*, a recently calibrated Hydrolab®) positioned alongside the field Hydrolab®.

3.4 DEFINING INVALID AND MISSING DATA VALUES

The provisional real-time data were examined daily during the workweek by CENWW and/or USGS employees. Missing values and those that appeared to be outside the expected range were flagged. If a reasonable explanation (*e.g.*, routine maintenance, DCP failure, or defective membrane) could be attributed to the incident, then the data point, or points, was not included in the final data set used for this analysis. Outlying data points that could not be attributed to a specific cause were retained.

The corrected data set was subsequently developed based on information stored in the electronic data logger (EDL). This final data set is more complete and representative of the TDG and temperature environment than the provisional one.

4.0 RESULTS AND DISCUSSION

4.1 INVENTORY-WIDE SONDE QA/QC PERFORMANCE

4.1.1 Pre-deployment

The pre-deployment evaluation of the sondes consisted of 183 individual checks for barometric pressure (Table J-2). The evaluation of the sonde pressure sensors to the standard revealed a calculated mean of -0.11 mmHg, and a range of -0.90 to 0.80 mmHg (Table J-2; Figure J-3). Three hundred millimeters of mercury (mmHg) was added to the TDG sensor in the laboratory using the laboratory barometer as the baseline standard. The difference between the barometer with 300 mmHg of pressure and the instrument was compared against the expected value. The calculated mean was based on the 183 measurements. The sonde pressure differences ranged from -0.10 percent to 0.10 percent (Figure J-4; Tables J-2 and J-3). The calculated mean and median values were -0.01 percent and -0.02 percent, respectively (Figure J-4; Tables J-2 and J-3).

The dissimilarities between the NIST-traceable thermometer and the sonde thermistors were also quite small. The calculated average and median values for all the instruments were-0.02 ºC and -0.01 °C, respectively. These calculated values were based on 183 measurements, with the medians for individual sondes ranging from -0.15 °C to 0.10 °C (Tables J-2 and J-3; Figure J-5). The instrument manufacturer's specification is ±0.2 °C for all instruments within a sample pool.

4.1.2 Post-deployment

The evaluation of the post-deployment QA/QC data also displayed favorable results. A total of 170 data points were used for the evaluation. The differences between the laboratory barometric pressure and that recorded by the sondes ranged from -5.00 mmHg to 1.30 mmHg, with a mean of 0.01 mmHg (Tables J-2 and J-4; Figure J-3). The results of the post calibration checks using barometric pressure +100 mmHg showed a calculated mean of -0.01 percent, and a range of -0.40 to 0.10 percent (Table J-2; Figure J-4).

There were 170 post deployment checks available for temperature evaluation. Temperature post calibration checks resulted in a calculated mean of -0.03 °C with a range between -0.15 °C and 0.10 °C (Tables J-2 and J-4; Figure J-5).

4.2 System-wide Station QA/QC Performance

The analysis of the station QA/QC data showed that the in-place barometric air pressure, TDG, and temperature instruments performed well when compared to the secondary standards (Figures J-6 through J-8). A total of 180 readings were used to calculate the mean and median values for barometric pressure (Table J-5). The median of all the differences calculated between the station barometers and the secondary standards was 0.00 mmHg (Table J-5; Figure J-6). The stations that departed from this median to the greatest extent were McNary forebay (MCNA), Pasco (PAQW), Lower Granite forebay (LWG), Lewiston (LEWI), Peck (PEKI), and Anatone (ANQW) where the differences were +/-0.10 mmHg (Table J-6).

The overall median for the TDG differences between the in-place and replacement sondes was -0.1 percent saturation (Table J-5; Figure J-7). Individual median station values ranged from -0.3 percent saturation to 0.0 percent saturation (Table J-6).

A total of 160 readings were used to calculate the temperature mean and median values (Table J-5). The calculated mean and median temperature differentials for the field data were both -0.01°C (Table J-5; Figure J-8). The station where the calculated median value departed from the overall median to the greatest extent was Lower Monumental tailwater at -0.05 °C (Table J-6). The manufacturer's specification for the temperature sensor is +/- 0.20 °C.

4.3 FMS Data Completeness and Station Statistics

Percent completeness can be examined from two perspectives: real-time data transmission from the DCP and corrected data based on the electronic data loggers (EDL). Percent completeness for the real-time TDG, barometric pressure, and temperature data were 99.23, 99.68, and 99.61 percent, respectively (Table J-9). The EDL corrected data set had fewer missing/anomalous data points resulting in higher percentages for the same three parameters: TDG (99.48 percent), BP (99.78 percent), and temperature (99.77 percent) (Table J-10). The most common reasons that were attributed for missing or anomalous real-time/EDL data were DCP failures (453/251 hours), missed transmissions (360/240 hours), and defective sondes (244/173 hours) (Tables J-9 and J-10). Regardless of the data set considered, the real-time DCP and EDL both exceeded the required 95 percent criterion.

4.3.1 Barometric Pressure

Barometric pressure data was 100 percent complete at eight of the fifteen FMS stations based on the provisional real-time DCP data (Table J-7) and at thirteen of the stations when the EDL corrected data is considered (Table J-8). One of the EDL incomplete stations (Dworshak tailwater) was greater than 99 percent complete in spite of a DCP failure. The other station (Pasco) that was not 100 percent complete in the EDL data set was still greater than 97 percent complete. Missed data transmissions were the cause of this station failing to be 100 percent complete (Tables J-10 and J-12).

4.3.2 Total Dissolved Gas

The TDG data from the fifteen stations averaged 99.23 percent complete based on the real-time DCP data and 99.48 percent complete when the EDL corrected data is considered (Tables J-9 and J-10). The Ice Harbor forebay (IHRA), Little Goose forebay (LGSA), and Lower Granite tailwater (LGNW) stations were all 100 percent complete regardless of the dataset considered (Tables J-7 and J-8). The stations that experienced the greatest amount of data loss were Dworshak (DWQI), Ice Harbor tailwater (IDSW), and Pasco (PAQW) where the DCP/EDL data completeness statistics were 98.24/99.04, 97.63/98.21, and 97.82/97.82 percent complete and correct, respectively (Tables J-7 and J-8). Defective membranes, sondes, and missed transmissions accounted for the majority of the data losses at those stations (Tables J-13 and J-14).

4.3.3 Temperature

The temperature data from the fifteen FMS stations averaged 99.61 and 99.77 percent complete based on the real-time DCP and EDL corrected data, respectively. Three stations attained 100 percent completeness (Table J-7 and J-8) regardless of the data set considered. Four stations: Pasco (PAQW), Ice Harbor tailwater (IDSW), Anatone (ANQW) and Dworshak (DWQI) did not achieve 100 percent completeness using the EDL corrected dataset (Table J-16). DCP failure, missing transmission and defective sondes were primarily responsible for these four stations failing to achieve 100 percent completeness (Table J-15). All fifteen stations were above 97 percent after EDL data correction.

4.4 Pasco, Lewiston, Peck, and Anatone Deployment Pipe Cleanouts

Performance of the sondes at the PAQW station have deteriorated during the past two years. After initial equilibration of the QA sonde, the deployment sonde in the delivery tube would take longer than anticipated to re-equilibrate. The USGS and CENWW used a District pipe camera to inspect the pipe and determined that there was a build-up of debris and silt near the end of the pipe. This build-up of material reduced both the quality and the quantity of flow across the instruments. Walla Walla District subsequently contracted Resource Management Group to blow out the siltation in the deployment pipe using a large commercial air compressor and ¾-inch PEX pipe (Figure J-9). The performance of the sondes improved after the pipe was cleared.

This procedure was also conducted at Anatone (ANQW), Lewiston (LEWI), and Peck (PEKI) with similar results. The procedure will be incorporated into a regular maintenance schedule at all ten sites with deployment pipes.

4.5 Dworshak Deployment Pipe Extension

The DWQI station is located on the North Fork Clearwater River at the northeastern side of the Dworshak National Fish Hatchery. The existing deployment pipe is made of 8-inch diameter SDR 17 black high density polyethylene (HDPE) and extended approximately 40-ft into the river in the upstream direction. It terminated at a depth of eight to nine feet in a scour hole directly downstream from a very large rock outcrop. During the unusually low-flow conditions experienced this year, the diminished water exchange in this scour hole led to a delayed response of the TDG probe housed in the pipe. As such, Resource Management Group was contracted to weld a 30-ft extension to the deployment pipe so the sonde will be in an area with better water circulation.

4.6 Vandalism

Two stations were vandalized during the 2010 data collection season. The Pasco station (PAQW) was vandalized on 14 August 2010 at 04:00 hrs and was repaired 17 August 2010 at 11:00 hrs. A total of 80 hours of missing data were attributed to vandalism at this site. The Ice Harbor tailwater station (IDSW) was vandalized on 22 August 2010 at 04:00 hrs and was repaired on 23August 2010 at 09:00 hrs. A total of 30 hours of missing data were attributed to vandalism at this site. In both cases, the locks were cut and the 12-volt batteries were stolen. No other equipment was stolen or vandalized.

4.7 Problems With Hydrolab® MS5 Sondes

Walla Walla District and the Kennewick office of the USGS purchased new mini-sondes from the Hach Company in the fall of 2008. The new Hydrolab® MS5 units sold by Hach are replacements for the older model MS4a's. The newMS5 units were deployed using established USACE/USGS standard procedures, but laboratory observations demonstrated that equilibration of the MS5 TDG sensor took up to two times longer than it had for the MS4a's. During pre- and post-deployment tests, it was also observed that the MS5's were taking considerably longer than the MS4a's to perform the tests, and in some cases were not meeting the established QA/QC standards. Early into the 2009 spill season, analysis of the TDG field data was conducted and the comparisons of the performance of the MS5 and MS4a units were made. The data showed that the performance of the MS5 was markedly inferior to the MS4a. Response times were slower and not as dynamic. The MS5's were not responsive enough to catch fast rising peaks and fast recessions when compared to the MS4a's. The MS5's were taken out of field rotation. Conversations with the manufacturer about the performance of the MS5 were initiated.

Eventually it was determined that the manufacturing process of the TDG membrane port had changed and the port chamber of the MS5 was slightly larger than that of the MS4a. This defect compromised the performance of the MS5 TDG sensor. The manufacturer agreed to fix the problem and retrofit the USACE/USGS inventory of MS5's. After several attempts, the manufacturing process was solved and Hach developed an acceptable retrofit. Late in summer 2010, the Kennewick USGS office conducted a three day side by side TDG field comparison test with retrofitted MS5 units and in service MS4a units. Test results were satisfactory, and this information was passed on to the manufacturer. Retrofitting of the MS5's has begun. Further field tests will be conducted upon receipt of the new retrofitted sondes.

5.0 SUMMARY

Hourly TDG, temperature, and barometric data recorded during the 2010 water year at fifteen FMS stations were evaluated. Six tailwater sites were maintained throughout the year and nine were monitored from 1 April through 31 August.

The combined data from all stations exceeded the 95 percent criterion. The EDL corrected data set had a higher percent rating than the real-time DCP data for all parameters.

The USGS Kennewick field office was contracted to perform routine station maintenance, complete emergency repairs, and operate the DCPs. Their pre-deployment QA/QC checks showed a mean difference of -0.11 mmHg when the TDG sensors were compared to barometric pressure and -0.01 percent when 300 mmHg of pressure was added. The post-deployment evaluations had mean differences of 0.01 mmHg and -0.01 percent when the TDG sensors were compared to barometric pressure and barometric pressure plus 100 mmHg, respectively. The calculated mean temperature difference was -0.02 °C for pre-deployment and -0.03 °C for post-calibration.

The 29 instruments used to perform this years monitoring met the manufacturers' specifications. Field checks during routine maintenance demonstrated that the air barometric pressure, percent TDG, and temperature averaged 0.01 mmHg, -0.1 percent, and -0.01 °C, respectively, when compared to the secondary standards.

The preventative maintenance schedule provided for calibration and routine maintenance at three week intervals during the fish spill season and once every four weeks during the rest of the year. Station performance was hampered primarily by vandalism, faulty DCPs, and defective sondes.

A commercial air compressor was used to clean out the deployment pipes at Pasco (PAQW), Lewiston (LEWI), Peck (PEKI), and Anatone (ANQW). This activity will become part of routine maintenance at all stations having deployment pipes in the future.

The deployment pipe at Dworshak (DWQI) was extended approximately 30-ft to facilitate water circulation around the TDG sensor.

In the winter 2010 and 2011, the MS5 sondes will be retrofitted with the redesigned TDG sensors by the Hach Company. This action will effectively increase the number of instruments available for field use by ten.

FIGURES

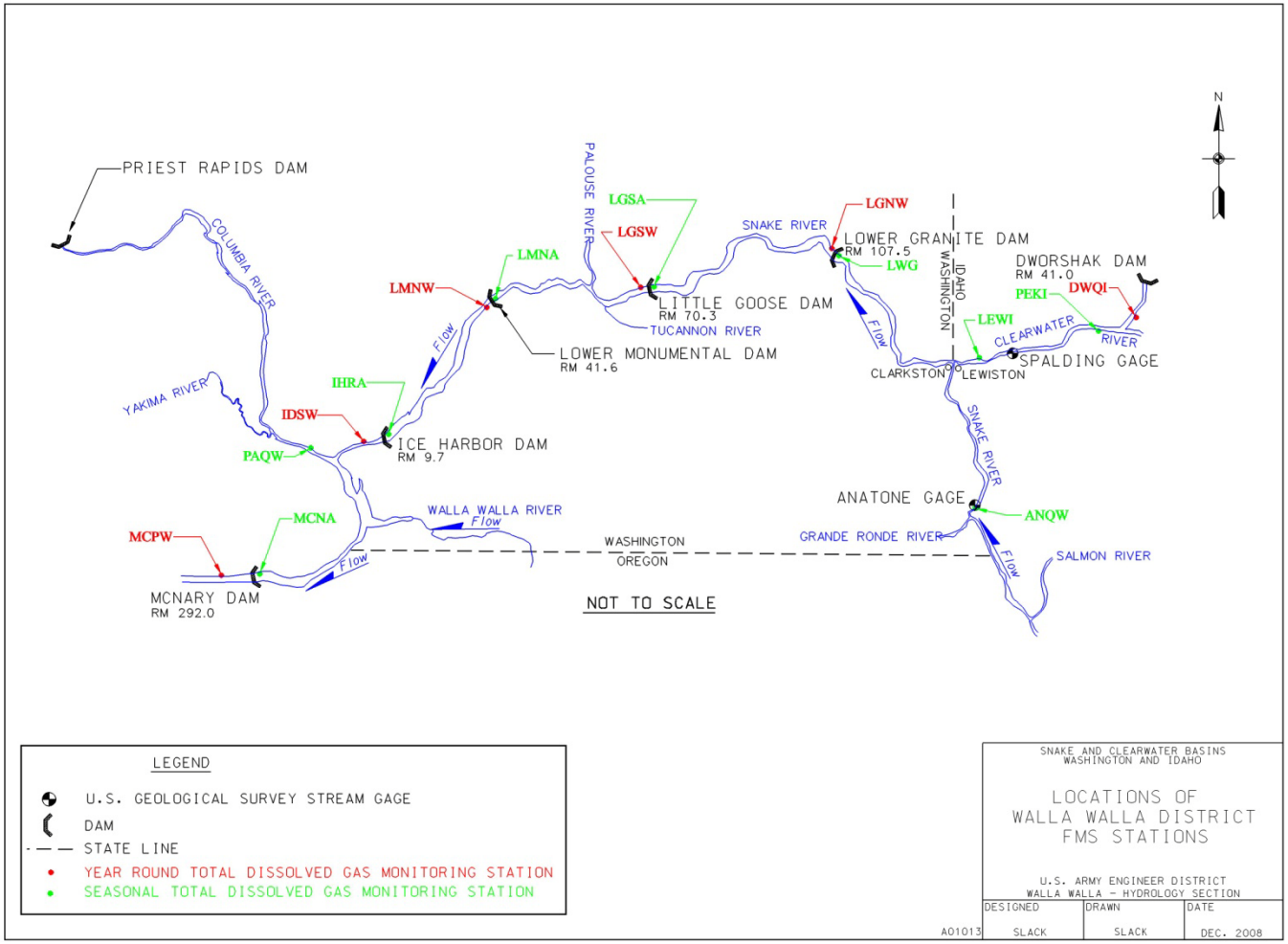

Figure J-1. Locations of Walla Walla District's FMS stations.

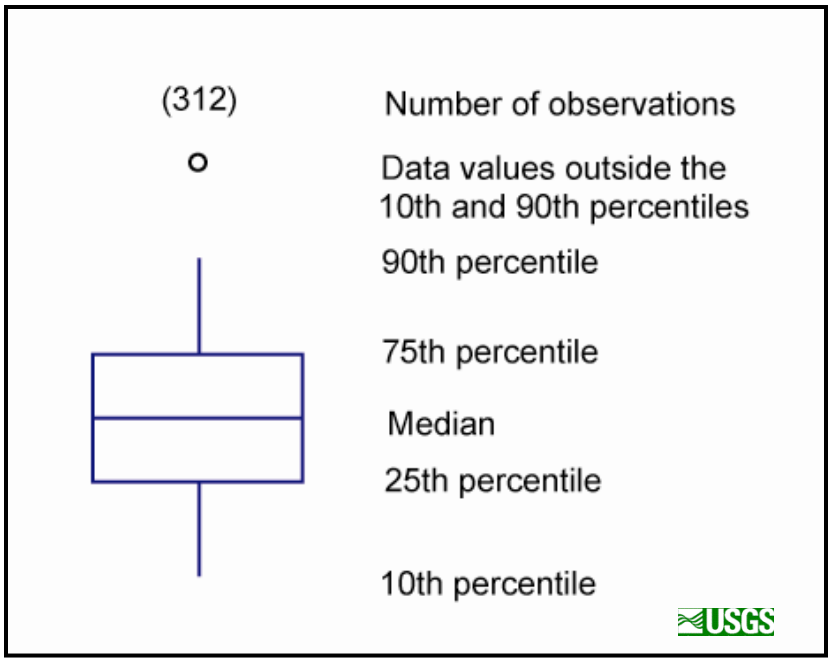

Figure J-2. Explanation key for the box plot information.

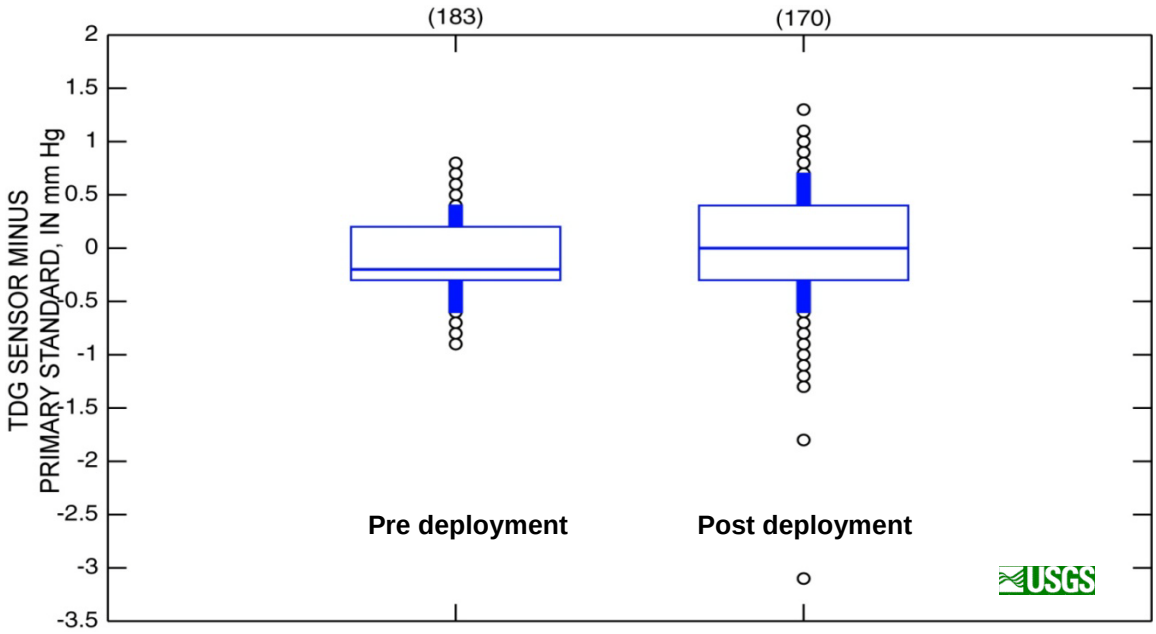

Figure J-3. Summary box plots of the pre-and post-deployment check of the barometric pressure versus the primary standard during the 2010 monitoring season.

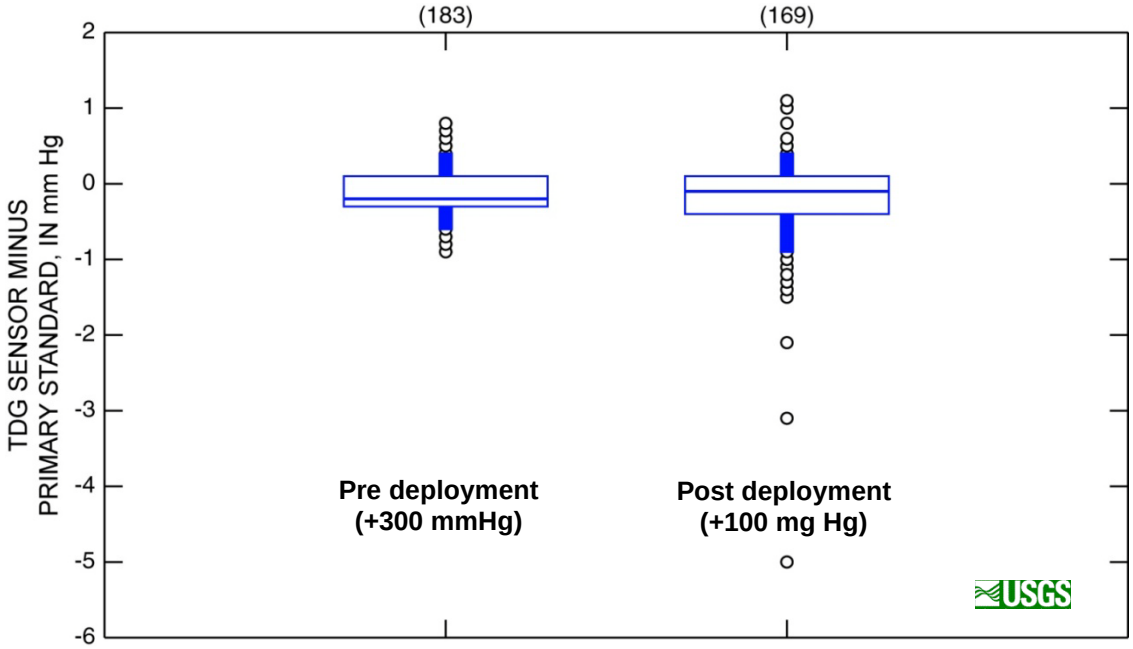

Figure J-4. Summary box plots of the pre-and post-deployment check of the Hydrolab® TDG sensors with the addition of 100 and 300 mmHg during the 2010 monitoring season.

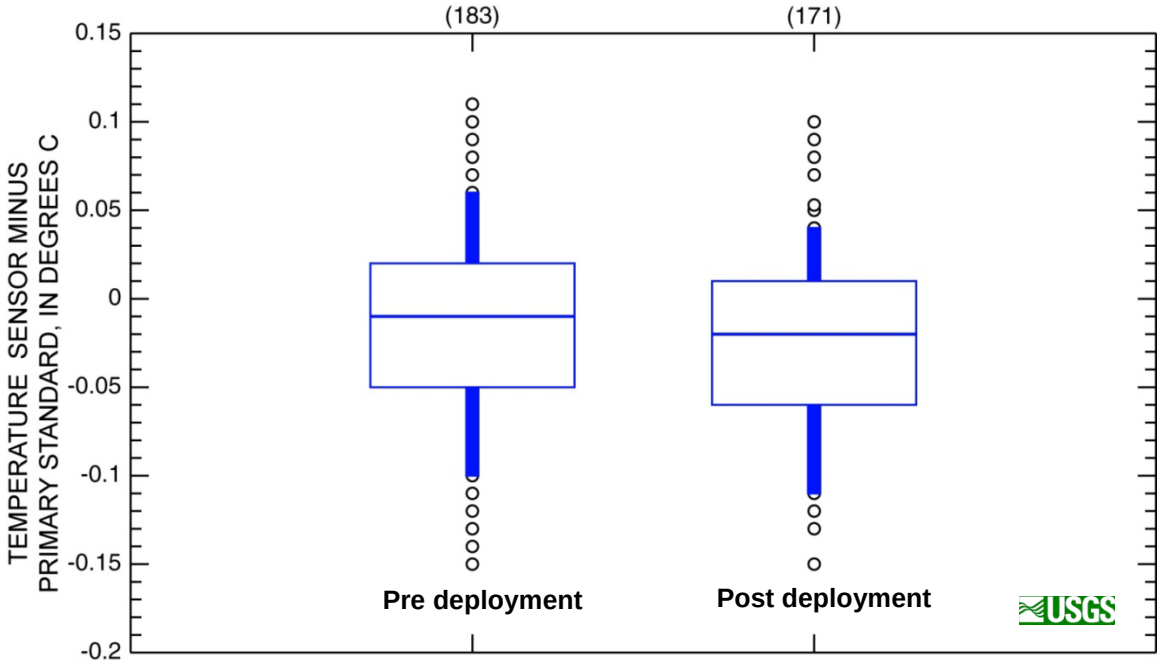

Figure J-5. Summary box plots of the pre- and post-deployment check of the Hydrolab® temperature sensors during the 2010 monitoring season.

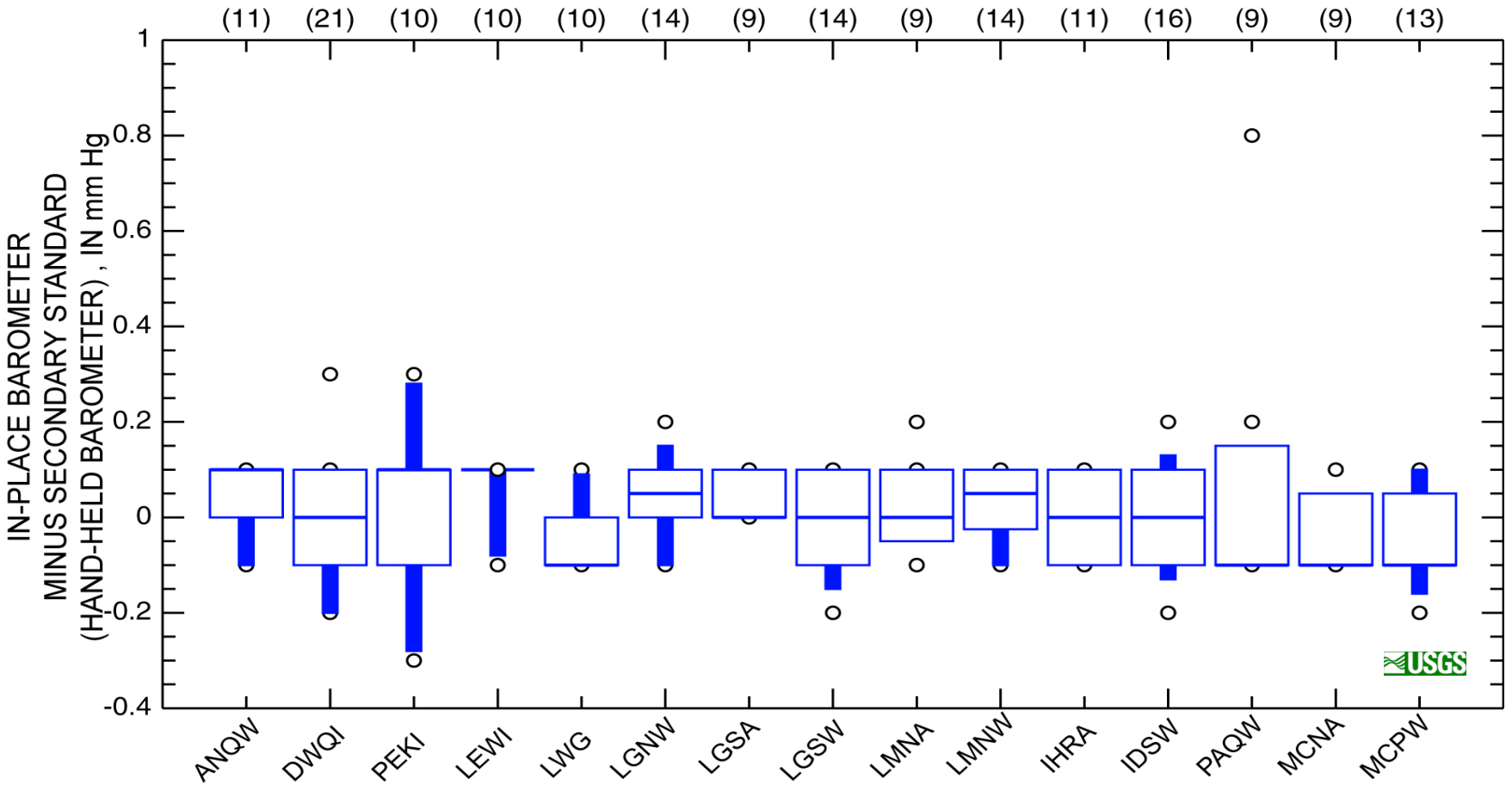

Figure J-6. Box plots of the field barometric pressure check in mm Hg by site during the 2010 monitoring season.

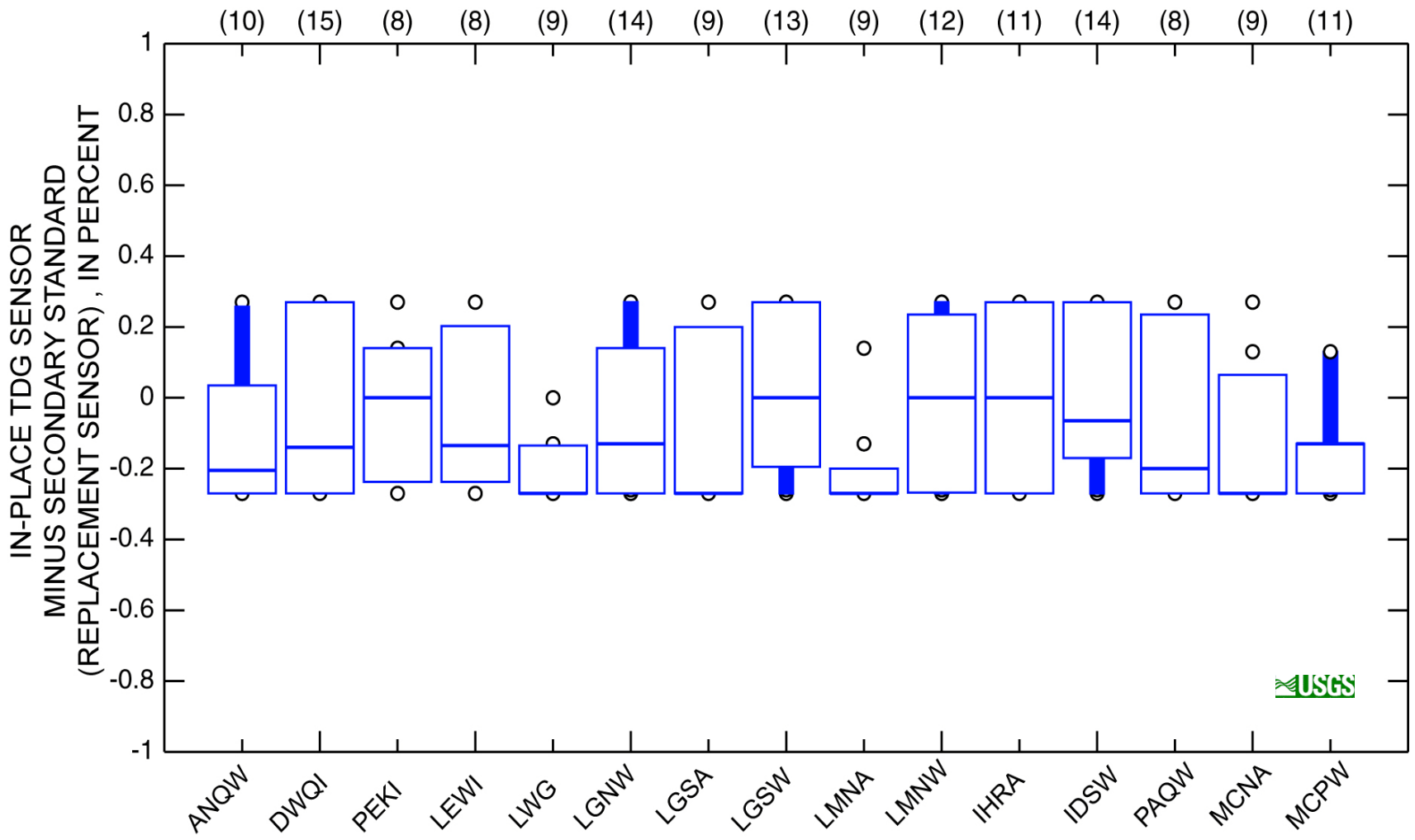

Figure J-7. Box plots of the field total dissolved gas sensor check verses secondary standard in percent saturation by site during the 2010 monitoring season.

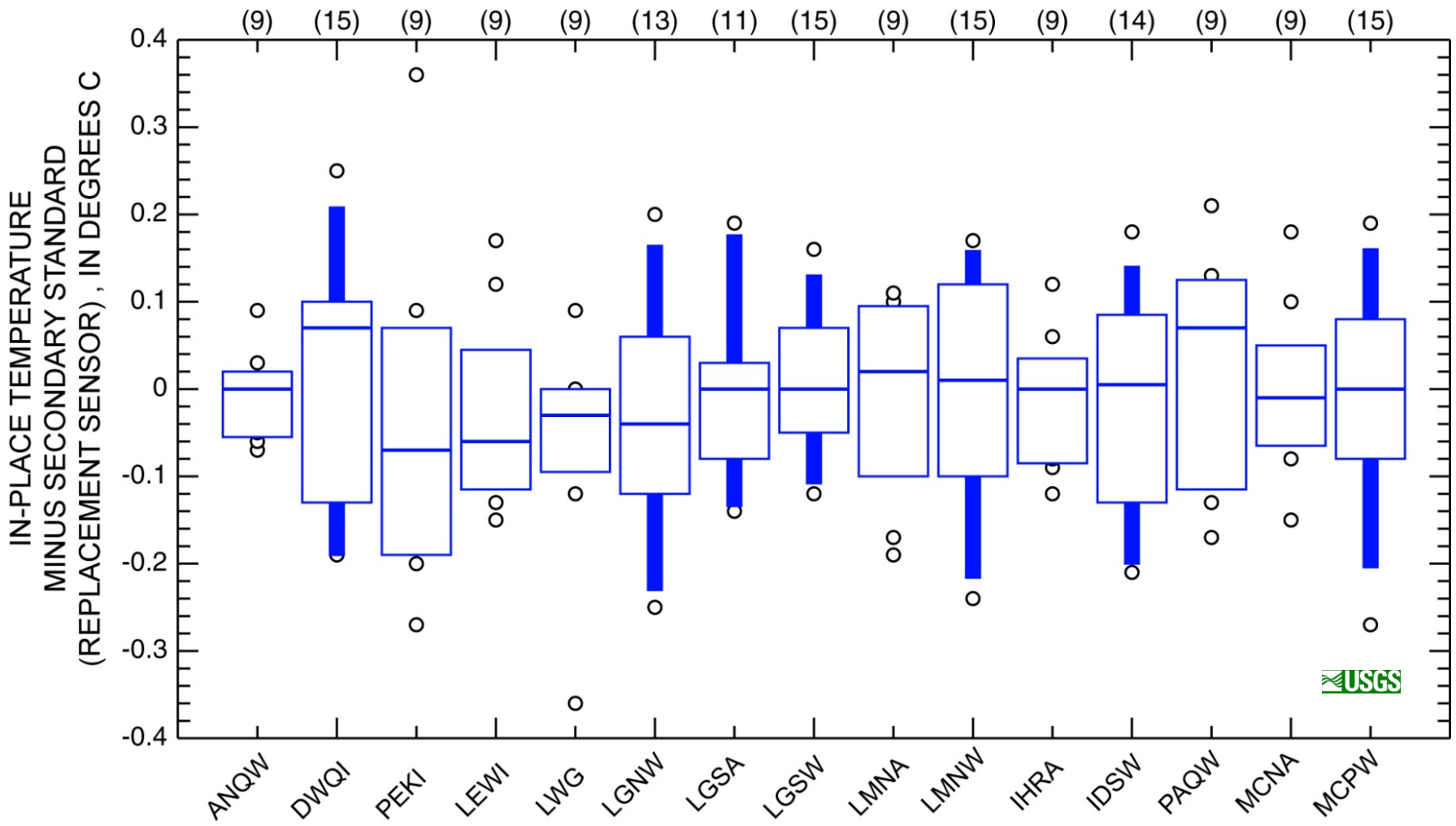

Figure J-8. Box plots of the field temperature sensor check verses secondary standard in degrees C by site during the 2010 monitoring season.

Figure J-9. Resource Management Group employee using a ¾ inch PEX pipe connected to a large commercial air compressor to blow out the silt in the deployment pipe of the Pasco, WA (PAQW) site.

TABLES

Table J-1. CENWW FMS station identification and location information.

Station Number	Station Name	Station ID	Latitude (NAD 83)	Longitude (NAD 83)	Elevation (NGVD 29)	River Mile	DCP ID	XMIT Time
12514400	Columbia River at Pasco, WA	PAQW	46 13 26.2851 N	119 06 57.3388 W	345	329.1	17D6E32C	0:27:10
13334300	Snake River Near Anatone, WA	ANQW	46 05 50.7579 N	116 58 41.2382 W	807	167.5	17D63544	0:16:10
13341000	N.F. Clearwater River at Dworshak Hatchery, ID	DWQI	46 30 11.6464 N	116 19 16.4090 W	1,150	0.5	17D600DE	0:13:10
13341050	Clearwater River Near Peck, ID	PEKI	46 30 00.9396 N	116 23 32.4163 W	930	37.4	17D613A8	0:14:10
13343000	Clearwater River Near Lewiston, ID	LEWI	46 25 52.0867 N	116 56 43.9589 W	750	5.0	17D62632	0:15:10
13343590	Lower Granite Dam Forebay, WA	LWG	46 39 34.1727 N	117 25 34.8564 W	738	107.5	17D643D4	0:17:10
13343595	Lower Granite Dam Tailwater, WA	LGNW	46 39 58.0726 N	117 26 19.2595 W	645	106.7	17D650A2	0:18:10
13343855	Little Goose Dam Forebay, WA	LGSA	46 34 58.3188 N	118 01 32.9831 W	638	70.3	17D66538	0:19:10
13343860	Little Goose Dam Tailwater, WA	LGSW	46 35 00.5280 N	118 02 37.4186 W	560	69.6	17D6764E	0:20:10
13352595	Lower Monumental Dam Forebay, WA	LMNA	46 33 44.6559 N	118 32 08.3477 W	540	41.6	17D686CA	0:21:10
13352600	Lower Monumental Dam Tailwater, WA	LMNW	46 33 04.5051 N	118 32 58.9500 W	445	40.4	17D695BC	0:22:10
13352950	Ice Harbor Dam Forebay, WA	IHRA	46 15 05.2792 N	118 52 43.0096 W	440	10.0	17D6A026	0:23:10
13353010	Ice Harbor Dam Tailwater, WA	IDSW	46 14 27.5868 N	118 57 13.7130 W	340	6.1	17D6B350	0:24:10
14019220	McNary Dam Forebay, WA	MCNA	45 56 28.4473 N	119 17 39.5990 W	340	292.0	17D6D6B6	0:26:10
14019240	McNary Dam Tailwater, WA	MCPW	45 56 02.7775 N	119 19 35.4628 W	240	290.7	17D5F754	0:12:10

Table J-2. Summary of the laboratory results evaluating the overall differences between laboratory standards and the sondes pre and post deployment during the 2010 water year.

Deployment	Statistic	Δ (BP) (mm Hg)	Δ [(BP+300)-PT] (%)	Δ [(BP+100)-PT] (%)	Δ T (^{o}C)
Pre	Number	183	183	----	183
	Minimum	-0.90	-0.10	----	-0.17
	25 percentile	-0.30	-0.03	----	-0.05
	Median	-0.20	-0.02	----	-0.01
	75 percentile	0.15	0.02	----	0.02
	Maximum	0.80	0.10	----	0.11
	Mean	-0.11	-0.01	----	-0.02
Post	Number	170	----	170	170
	Minimum	-5.00	----	-0.40	-0.15
	25 percentile	-0.35	----	-0.04	-0.06
	Median	0.00	----	-0.01	-0.02
	75 percentile	0.25	----	0.03	0.01
	Maximum	1.30	----	0.10	0.10
	Mean	0.01	----	-0.01	-0.03

Table J-3. Pre-deployment quality assurance data for the individual sondes utilized at the FMS stations during the 2010 water year.

	Δ (PT – BP)			Δ [(BP+300) – PT]			Δ (Water Temperature)		
Sonde ID	**# Obs**	**Range (mm Hg)**	**Median (mm Hg)**	**# Obs**	**Range (mm Hg)**	**Median (mm Hg)**	**# Obs**	**Range (^{o}C)**	**Median (^{o}C)**
5	5	-0.1 to 0.5	0.20	5	-0.1 to 0.5	0.20	5	-0.03 to -0.01	-0.02
8	8	-0.3 to 0.5	0.05	8	-0.3 to 0.5	0.05	8	-0.17 to -0.13	-0.15
14	8	-0.6 to 0.8	-0.15	8	-0.6 to 0.8	-0.15	8	-0.11 to -0.05	-0.08
18	6	-0.7 to -0.1	-0.40	6	-0.7 to -0.1	-0.40	6	-0.15 to -0.09	-0. 11
23	7	-0.4 to 0.4	-0.20	7	-0.4 to 0.4	-0.20	7	-0.02 to 0.01	0.01
26	7	-0.7 to 0.4	-0.30	7	-0.7 to 0.4	-0.30	7	-0.05 to 0.00	-0.03
27	6	-0.8 to 0.3	-0.40	6	-0.8 to 0.3	-0.04	6	-0.05 to 0.02	0.00
29	8	-0.8 to -0.2	-0.30	8	-0.8 to -0.2	-0.30	8	-0.04 to -0.01	-0.02
30	6	-0.4 to 0.8	0.25	6	-0.4 to 0.6	0.00	6	-0.13 to -0.06	-0.08
31	8	-0.3 to 0.6	0.05	8	-0.3 to 0.6	0.05	8	-0.10 to 0.00	-0.02
32	7	-0.6 to 0.1	-0.40	7	-0.6 to 0.1	-0.40	7	-0.11 to 0.05	-0.07
33	9	-0.5 to 0.3	0.10	9	-0.5 to 0.3	0.10	9	-0.12 to -0.02	-0.09
34	10	-0.7 to 0.8	0.40	10	-0.7 to 0.8	0.40	10	-0.05 to 0.02	0.00
35	6	-0.2 to 0.6	0.40	6	-0.5 to 0.6	0.30	6	0.01 to 0.07	0.04
36	3	0.1 to 0.4	0.20	3	0.1 to 0.4	0.20	3	0.03 to 0.06	0.04
37	8	-0.9 to 01	-0.30	8	-0.9 to 0.1	-0.30	8	-0.01 to 0.06	0.04
39	7	-0.5 to 0.2	-0.20	7	-0.5 to 0.2	-0.20	7	-0.03 to 0.04	0.00
40	6	-0.7 to 0.4	-0.15	6	-0.7 to 0.4	-0.15	6	-0.04 to 0.02	-0.02
41	7	-0.5 to 0.3	-0.20	7	-0.5 to 0.3	-0.20	7	-0.04 to 0.01	-0.01
44	1	-0.3 to -0.3	-0.30	1	-0.3 to -0.3	-0.30	1	0.06 to 0.60	0.06
48	2	-0.4 to 0.1	-0.15	2	-0.4 to 0.1	-0.15	2	0.07 to 0.08	-0.15
USGS 1	8	-0.4 to 0.5	-0.10	8	-0.4 to 0.5	-0.10	8	-0.06 to 0.03	-0.01
USGS 2	8	-0.3 to 0.8	0.30	7	-0.3 to 0.8	0.30	7	-0.03 to 0.04	-0.01
USGS 3	8	-0.6 to 0.4	-0.05	8	-0.6 to 0.4	-0.05	8	-0.03 to 0.08	0.03
USGS 4	8	0.6 to 0.1	-0.25	8	-0.6 to 0.1	-0.25	8	0.07 to 0.11	0.09
USGS 5	8	-0.6 to 0.5	-0.25	8	-0.6 to 0.5	-0.25	8	-0.03 to 0.04	0.03
USGS 6	1	-0.3 to -0.3	-0.30	1	-0.3 to -0.3	-0.30	1	-0.02 to -0.02	-0.02
USGS 7	2	-0.7 to 0.0	-0.35	2	-0.7 to 0.0	-0.35	2	-0.02 to -0.02	-0.02
USGS 8	1	-0.7 to -0.7	-0.70	1	-0.7 to -0.7	-0.70	1	0.02 to 0.02	0.02

Table J-4. Post-deployment quality assurance data for the individual sondes utilized at the FMS stations during the 2010 water year.

	Δ (BP – PT)			Δ [(BP+100) – PT]			Δ (Water Temperature)		
Sonde ID	**# Obs**	**Range (mm Hg)**	**Median (mm Hg)**	**# Obs**	**Range (mm Hg)**	**Median (mm Hg)**	**# Obs**	**Range (°C)**	**Median (°C)**
5	5	-1.0 to 1.0	0.10	5	-0.1 to 1.0	0.10	5	-0.06 to -0.05	-0.05
8	8	-1.2 to 1.0	0.25	8	-0.7 to 0.3	-0.10	8	-0.15 to -0.12	-0.13
14	7	-0.4 to 1.1	-0.10	7	-1.1 to 0.3	-0.20	7	-0.12 to -0.06	-0.08
18	5	-0.4 to 1.3	-0.30	5	-0.4 to 0.4	-0.30	5	-0.13 to -0.10	-0.12
23	7	-1.8 to 0.3	-0.20	7	-0.9 to 0.1	-0.70	7	-0.05 to 0.02	-0.01
26	6	-0.4 to 0.1	-0.05	6	-1.0 to 0.1	-0.35	7	-0.04 to 0.00	-0.02
27	6	-0.6 to 0.4	0.10	5	-1.3 to 0.0	-0.50	6	-0.07 to -0.02	-0.05
29	8	-1.3 to 0.4	-0.20	8	-1.3 to 0.0	-0.50	8	-0.06 to -0.02	-0.03
30	7	0.0 to 1.0	0.80	7	-5.0 to 0.8	0.00	7	-0.13 to 0.10	-0.11
31	8	-0.2 to 0.9	0.55	8	-1.2 to 0.4	-0.20	8	-0.08 to -0.01	-0.02
32	7	-0.6 to 0.4	0.00	7	-0.5 to 0.4	0.00	7	-0.13 to -0.09	-0.05
33	9	-1.1 to 1.1	0.00	9	-1.1 to 1.1	0.00	9	-0.13 to 0.01	-0.04
34	9	-0.4 to 1.0	0.10	9	-2.1 to 1.0	-0.30	9	-0.07 to 0.02	-0.04
35	6	-0.1 to 0.6	0.15	6	-0.1 to 0.6	0.15	6	-0.03 to 0.07	0.02
36	3	-0.3 to 0.8	-0.30	3	-0.3 to -0.2	-0.30	3	-0.02 to 0.08	0.03
37	8	-1.3 to 0.7	-0.20	8	-0.6 to 0.2	-0.30	8	-0.02 to 0.05	0.01
39	5	-0.4 to 0.0	-0.20	5	-0.4 to 0.0	-0.20	5	-0.01 to 0.02	0.00
40	7	-0.9 to 0.1	-0.30	7	-1.5 to 0.0	-0.90	7	-0.03 to 0.03	0.00
41	7	-0.8 to 0.4	0.20	7	-0.9 to 0.4	0.00	7	-0.04 to 0.01	-0.02
44	1	-3.1 to -3.1	-3.10	1	-3.1 to -3.1	-3.10	1	0.04 to 0.04	0.04
48	1	-0.2 to -0.2	-0.20	1	-0.2 to -0.2	-0.20	1	0.07 to 0.07	0.07
USGS 1	7	-0.7 to 0.5	-0.10	7	-0.5 to 0.5	0.00	7	-0.03 to 0.04	0.02
USGS 2	8	-0.9 to 0.9	-0.25	8	-100.1 to 0.2	-0.25	8	-0.07 to 0.01	-0.03
USGS 3	7	-0.3 to 0.5	-0.10	7	-0.3 to 0.5	-0.10	7	0.01 to 0.05	0.05
USGS 4	8	0.0 to 0.8	0.35	8	-0.6 to 0.8	0.20	8	-0.11 to 0.10	0.09
USGS 5	9	-1.0 to 0.7	0.00	9	-0.6 to 0.1	-0.10	9	-0.04 to 0.03	0.00
USGS 6	1	-0.3 to -0.3	-0.30	1	-0.3 to -0.3	-0.30	1	-0.03 to -0.03	-0.03
USGS 7	1	0.7 to 0.7	0.70	1	0.7 to 0.7	0.70	1	-0.02 to -0.02	-0.02
USGS 8	1	-0.6 to -0.6	-0.60	1	-0.6 to -0.6	-0.60	1	-0.01 to -0.01	-0.01

Table J-5. Summary of the field results for the differences between the in-place and replacement sondes during 2010 water year.

Statistic	Δ BP[1] (mm Hg)	ΔTDG[2] (% sat)	Δ T[2] (^{o}C)
Number	180	160	160
Minimum	-0.30	-0.3	-0.28
Maximum	0.80	0.3	0.29
Mean	0.01	-0.1	-0.01
Median	0.00	-0.1	-0.01

Footnotes:

[1] Field – laboratory sonde

[2] Replacement – In-place sonde

Table J-6. Summary of the field results for the differences between the in-place and replacement sondes by station during 2010 water year.

	Δ Barometric Air Pressure			Δ Total Dissolved Gas					Δ Water Temperature		
Station ID	# Obs	Range (mm Hg)	Median (mm Hg)	# Obs	Range (mm Hg)	Median (mm Hg)	Range (% Sat)	Median (% Sat)	# Obs	Range (^{o}C)	Median (^{o}C)
MCPW	13	-0.2 to 0.1	-0.04	11	-2 to 1	-1.09	-0.3 to 0.1	-0.1	11	-0.28 to 0.26	0.00
MCNA	9	-0.1 to 0.1	-0.10	9	-2 to 2	0.02	-.03 to 0.3	-0.2	9	-0.13 to 0.09	0.02
PAQW	9	-0.1 to 0.8	-0.10	8	-2 to 2	-1.50	-0.2 to 0.3	-0.2	8	-0.14 to 0.12	0.01
IDSW	16	-0.2 to 0.2	0.00	14	-2 to 2	0.00	-0.3 to 0.2	-0.1	14	-0.10 to 0.06	-0.03
IHRA	11	-0.1 to 0.1	0.00	11	-2 to 2	0.00	-0.3 to 0.3	0.0	11	-0.14 to 0.13	-0.02
LMNW	14	-0.1 to 0.1	0.05	12	-2 to 2	0.00	-0.3 to 0.3	0.0	12	-0.20 to 0.09	-0.05
LMNA	9	-0.1 to 0.2	0.00	9	-2 to 1	0.04	-0.3 to -.1	-0.2	9	-0.28 to 0.12	0.04
LGSW	14	-0.2 to 0.1	0.00	13	-2 to 2	0.00	-0.3 to 0.3	0.0	13	-0.12 to 0.29	0.01
LGSA	9	0.0 to 0.1	0.00	9	-2 to 2	-1.00	-0.3 to 0.2	-0.2	9	-0.10 to 0.09	0.00
LGNW	14	-0.1 to 0.2	0.05	14	-2 to 2	-1.00	-0.3 to -.2	-0.1	14	-0.16 to 0.14	-0.02
LWG	10	-0.1 to 0.1	-0.10	9	-2 to 0	-2.00	-0.2 to 0	-0.3	9	-0.10 to 0.06	0.01
ANQW	11	-0.1 to 0.1	0.10	10	-2 to 2	-1.50	-0.3 to 0.3	-0.2	10	-0.18 to 0.23	-0.03
LEWI	10	-0.1 to 0.1	-0.10	8	-2 to 2	-1.00	-0.3 to 0.3	-0.1	8	-0.16 to 0.04	-0.02
PEKI	10	-0.3 to 0.03	0.10	8	-2 to 2	0.00	-0.3 to 0.3	0.0	8	-0.13 to 0.10	-0.01
DWQI	21	-0.2 to 0.3	0.00	15	-2 to 2	-1.00	-0.3 to 0.3	-0.1	15	-0.19 to 0.24	0.00

Table J-7. Database completeness with the number and percent of all missing or invalid barometric pressure, total dissolved gas, and temperature points for each FMS station during the 2010 water year as reported by the provisional real-time DCP system

Station ID	Monitoring Period	Barometric Pressure		Total Dissolved Gas		Temperature	
		Number Missing/ Anomalous	% Complete	Number Missing/ Anomalous	% Complete	Number Missing/ Anomalous	% Complete
MCPW	1 Oct – 30 Sep	0	100.00	**43**	**99.51**	**21**	**99.76**
MCNA	1 Apr – 31 Aug	**1**	**99.97**	**2**	**99.95**	**1**	**99.97**
PAQW	1 Apr – 31 Aug	**80**	**97.82**	**80**	**97.82**	**80**	**97.82**
IDSW	1 Oct – 30 Sep	**30**	**99.66**	**208**	**97.63**	**33**	**99.62**
IHRA	1 Apr – 31 Aug	0	100.00	0	100.00	**26**	**99.29**
LMNW	1 Oct – 30 Sep	0	100.00	**36**	**99.97**	**3**	**99.97**
LMNA	1 Apr – 31 Aug	**1**	**99.97**	**1**	**99.97**	**1**	**99.97**
LGSW	1 Oct – 30 Sep	0	100.00	**97**	**98.89**	0	100.00
LGSA	1 Apr – 31 Aug	0	100.00	0	100.00	0	100.00
LGNW	1 Oct – 30 Sep	0	100.00	0	100.00	0	100.00
LWG	1 Apr – 31 Aug	**1**	**99.97**	**3**	**99.92**	**1**	**99.97**
ANQW	1 Apr – 31 Aug	0	100.00	**9**	**99.76**	**8**	**99.78**
LEWI	1 Apr – 31 Aug	0	100.00	**2**	**99.95**	**1**	**99.97**
PEKI	1 Apr – 31 Aug	**6**	**99.84**	**6**	**99.84**	**6**	**99.84**
DWQI	1 Oct – 30 Sep	**154**	**98.24**	**154**	**98.24**	**154**	**98.24**

Table J-8. Database completeness with the number and percent of all missing or invalid barometric pressure, total dissolved gas, and temperature points for each FMS station during the 2010 water year as determined after EDL correction.

Station ID	Monitoring Period	Barometric Pressure		Total Dissolved Gas		Temperature	
		Number Missing/ Anomalous	% Complete	Number Missing/ Anomalous	% Complete	Number Missing/ Anomalous	% Complete
MCPW	1 Oct – 30 Sep		100.00	**1**	**99.99**		100.00
MCNA	1 Apr – 31 Aug		100.00		100.00		100.00
PAQW	1 Apr – 31 Aug	**80**	**97.82**	**80**	**97.82**	**80**	**97.82**
IDSW	1 Oct – 30 Sep		100.00	**157**	**98.21**	**1**	**99.99**
IHRA	1 Apr – 31 Aug		100.00		100.00		100.00
LMNW	1 Oct – 30 Sep		100.00		100.00		100.00
LMNA	1 Apr – 31 Aug		100.00		100.00		100.00
LGSW	1 Oct – 30 Sep		100.00		100.00		100.00
LGSA	1 Apr – 31 Aug		100.00		100.00		100.00
LGNW	1 Oct – 30 Sep		100.00		100.00		100.00
LWG	1 Apr – 31 Aug		100.00		100.00		100.00
ANQW	1 Apr – 31 Aug		100.00	**8**	**99.78**	**8**	**99.78**
LEWI	1 Apr – 31 Aug		100.00		100.00		100.00
PEKI	1 Apr – 31 Aug		100.00		100.00		100.00
DWQI	1 Oct – 30 Sep	**82**	**99.04**	**82**	**99.04**	**82**	**99.04**

Table J-9. Summary of the total hours of barometric pressure, total dissolved gas, and temperature data that were missing or considered invalid in the 2010 water-year provisional real-time DCP data set.

	BP		TDG		BP+TDG			Temperature		All	
Reason	**hours**	**%**	**hours**	**%**	**hours**	**% of hours**	**% of bad data**	**hours**	**%**	**hours**	**%**
Too low	0		0		0			0		0	
Vandalism	110	0.13%	110	0.13%	220	0.26%	23.50%	110	0.13%	330	0.39%
Missing data	10	0.01%	10	0.01%	20	0.02%	2.14%	10	0.01%	30	0.04%
Spike	0		14	0.02%	14	0.02%	1.50%	6	0.01%	20	0.02%
Inspection	1	0.00%	24	0.03%	25	0.03%	2.67%	2	0.00%	27	0.03%
Defective membrane	0		166	0.19%	166	0.19%	17.74%	0		166	0.19%
Defective sonde	0		188	0.22%	188	0.22%	20.09%	56	0.07%	244	0.28%
DCP failure	151	0.18%	151	0.18%	302	0.35%	32.26%	151	0.18%	453	0.53%
Cable failure	0		0		0			0		0	
Totals	**273**	**0.32%**	**662**	**0.77%**	**935**	**1.09%**	**99.89%**	**335**	**0.39%**	**1270**	**1.48%**

Table J-10. Summary of the total hours of barometric pressure, total dissolved gas, and temperature data that were missing or considered invalid in the 2010 water-year EDL corrected data set.

	BP		TDG		BP+TDG			Temperature		All	
Reason	**hours**	**%**	**hours**	**%**	**hours**	**% of hours**	**% of bad data**	**hours**	**%**	**hours**	**%**
Too low	0		0		0			0		0	
Missed xmit	110	0.13%	110	0.13%	220	0.26%	34.38%	110	0.13%	330	0.39%
Missing data	0		0		0			0		0	
Spike	0		1	0.00%	1	0.00%	0.16%	1	0.00%	2	0.00%
Inspection	0		0		0			0		0	
Defective membrane	0		88	0.10%	88	0.10%	13.75%	0		88	0.10%
Defective sonde	0		165	0.19%	165	0.19%	25.28%	8	0.01%	173	0.20%
DCP failure	85	0.10%	84	0.10%	169	0.20%	26.40%	82	0.10%	251	0.29%
Cable failure	0		0		0			0		0	
Totals	**192**	**0.22**	**448**	**0.52**	**580**	**0.75**	**100.47**	**201**	**0.23**	**840**	**0.98**

Table J-11. Number and percent of all missing or invalid barometric pressure data for each FMS station during the 2010 water year based on the provisional real-time DCP data set, along with the reasons for those designations.

Station ID	Cable Failure		Vandalism		Too Low Value		Spike		Routine Maintenance		Defective Membrane		Defective Sonde		DCP Failure		Missing DCP Data	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
MCPW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MCNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.03	-	-
PAQW	-	-	80	2.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IDSW	-	-	30	0.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IHRA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMNW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGSW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGSA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGNW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LWG	-	-	-	-	-	-	-	-	1	0.03	-	-	-	-	-	-	-	-
ANQW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEWI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PEKI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	0.16
DWQI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	154	1.76	3	0.03

Table J-12. Number and percent of all missing or invalid barometric pressure data for each FMS station during the 2010 water year based on the EDL corrected data set, along with the reasons for those designations.

Station ID	Cable Failure		Vandalism		Too Low Value		Spike		Routine Maintenance		Defective Membrane		Defective Sonde		DCP Failure		Missing DCP Data	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
MCPW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MCNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PAQW	-	-	**80**	**2.18**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IDSW			**30**	**0.34**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IHRA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMNW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGSW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGSA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGNW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LWG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANQW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEWI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PEKI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DWQI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**82**	**0.06**	-	-

Table J-13. Number and percent of all missing or invalid total dissolved gas data for each FMS station during the 2010 water year based on the provisional real-time DCP data set, along with the reasons for those designations.

Station ID	Cable Failure		Vandalism		Too Low Value		Spike		Routine Maintenance		Defective Membrane		Defective Sonde		DCP Failure		Missing DCP Data	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
MCPW	-	-	-	-	-	-	2	0.02	-	-	20	0.23	21	0.24	-	-	-	-
MCNA	-	-	-	-	-	-	-	-	-	-	-	-	2	8.05	-	-	-	-
PAQW	-	-	80	2.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IDSW	-	-	30	0.34	-	-	3	0.03	1	0.01	17	0.19	157	1.79	-	-	-	-
IHRA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMNW	-	-	-	-	-	-	5	0.06	-	-	31	0.35	-	-	-	-	-	-
LMNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.03
LGSW	-	-	-	-	-	-	2	0.02	7	0.08	88	1.00	-	-	-	-	-	-
LGSA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGNW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LWG	-	-	-	-	-	-	2	0.05	1	0.03	-	-	-	-	-	-	-	-
ANQW	-	-	-	-	-	-	-	-	1	0.03	-	-	8	0.22	-	-	-	-
LEWI	-	-	-	-	-	-	-	-	2	0.05	-	-	-	-	-	-	-	-
PEKI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	0.16
DWQI	-	-	-	-	-	-	-	-	12	0.14	10	0.11	-	-	151	1.72	3	0.03

Table J-14. Number and percent of all missing or invalid total dissolved gas data for each FMS station during the 2010 water year based on the EDL corrected data set, along with the reasons for those designations.

Station ID	Cable Failure		Vandalism		Too Low Value		Spike		Routine Maintenance		Defective Membrane		Defective Sonde		DCP Failure		Missing DCP Data	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
MCPW	-	-	-	-	-	-	1	0.01	-	-	-	-	-	-	-	-	-	-
MCNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PAQW	-	-	80	2.18	-	-	-	-	-	-	-	-			-	-	-	-
IDSW	-	-	30	0.34	-	-	-	-	-	-	-	-	157	1.79	-	-	-	-
IHRA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMNW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGSW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGSA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGNW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LWG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANQW	-	-	-	-	-	-	-	-	-	-	-	-	8	0.22	-	-	-	-
LEWI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PEKI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DWQI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	84	0.96	-	-

Table J-15. Number and percent of all missing or invalid temperature data for each FMS station during the 2010 water year based on the provisional real-time DCP data, along with the reasons for those designations.

Station ID	Cable Failure		Vandalism		Too Low Value		Spike		Routine Maintenance		Defective Membrane		Defective Sonde		DCP Failure		Missing DCP Data	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
MCPW	-	-	-	-	-	-	-	-	-	-	-	-	21	0.24	-	-	-	
MCNA	-	-	-	-	-	-	-	-	-	-	-	-	1	0.03	-	-	-	-
PAQW	-	-	80	2.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IDSW	-	-	30	0.34	-	-	3	0.03	-	-	-	-	-	-	-	-	-	-
IHRA	-	-	-	-	-	-	-	-	-	-	-	-	26	0.71	-	-	-	-
LMNW	-	-	-	-	-	-	3	0.03	-	-	-	-	-	-	-	-	-	-
LMNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.03
LGSW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGSA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGNW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LWG	-	-	-	-	-	-	-	-	1	0.3	-	-	-	-	-	-	-	-
ANQW	-	-	-	-	-	-	-	-	-	-	-	-	8	0.22	-	-	-	-
LEWI	-	-	-	-	-	-	-	-	1	0.03	-	-	-	-	-	-	-	-
PEKI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	0.16
DWQI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	151	1.72	3	0.03

Table J-16. Number and percent of all missing or invalid temperature data for each FMS station during the 2010 water year based on the EDL corrected data set, along with the reasons for those designations.

Station ID	Cable Failure		Vandalism		Too Low Value		Spike		Routine Maintenance		Defective Membrane		Defective Sonde		DCP Failure		Missing DCP Data	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
MCPW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MCNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PAQW	-	-	80	2.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IDSW	-	-	30	0.34	-	-	1	0.01	-	-	-	-	-	-	-	-	-	-
IHRA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMNW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGSW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGSA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGNW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LWG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANQW	-	-	-	-	-	-	-	-	-	-	-	-	8	0.22	-	-	-	-
LEWI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PEKI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DWQI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	82	0.94	-	-