Memorandum

Aquatic Settlement Work Group



Date: August 3rd, 2009

To:	Aquatic Settlement Work Group and USFWS
From:	Douglas PUD and Columbia Basin Environmental
cc:	
re:	2009 Turbidity Monitoring on the Okanogan River

Columbia Basin Environmental was contracted to monitor turbidity in the Okanogan River and the Wells Forebay during the spring of 2009. These data were collected to supplement results from the turbidity monitoring conducted in 2008, in which data gaps occurred on occasion due to log jams, battery failure, and location of instrumentation. Specifically, Douglas was requested to implement an additional season of data collection to demonstrate that turbidity did not increase in the Okanogan River as a result of Project effects. The Washington State water quality standard (WQS) is that turbidity shall not exceed 5 NTU over background when the background is 50 NTU or less; or a 10% increase in turbidity when the background turbidity is more than 50 NTU.

Hourly data were collected with a Hydrolab equipped with Hach's Self-Cleaning Turbidity Sensor¹ at Malott (RM 17.0, above Project boundary), Monse (RM 5.0), and the Highway 97 Bridge (RM 1.3; Figure 1). Instrument housing at Monse created a condition in which sediments were collecting in the Hydrolab and negating results for portions of the 2009 monitoring season (Figure 2; data not available between May 28th and June 10th, and between June 12th and 25th). Instrumentation was cleaned, calibrated, and re-deployed on June 25th. A 2100P IS Portable Turbidimeter² was subsequently used to conduct weekly grab samples beginning June 25th as an additional measure to compare turbidity between Malott and Monse.

Daily turbidity at Wells Dam Forebay was negligible, ranging from 0.00 to 2.42 NTUs (median 0.00 NTUs, average 0.29 NTUs, standard error \pm 0.09 NTUs), and therefore not included in the attached graphs. There were no instances where turbidity at the Wells Dam Forebay exceeded measurements at Malott, Monse, or the Highway 97 Bridge (43, 17, and 42 comparable days between May 27th and July 8th, respectively). Compliance with the WQS numeric criteria for turbidity was demonstrated during all periods in the Wells Forebay.

¹ Accuracy: ± 1% up to 100 NTU, ± 3% from 100-400 NTU, ± 5% from 400-3000 NTU

² Accuracy: ± 2% of reading plus stray light from 0 to 1000 NTU (stray light: <0.02 NTU)

Turbidity in the Okanogan River decreased significantly from above the Project Boundary at Malott to Monse, and as waters reached the confluence with the Columbia River (Highway 97; Figure 3). There were no instances where turbidity at the Highway 97 Bridge exceeded measurements at Malott (background) out of 42 comparable days (May 28th – July 8th, 2009). Compliance with the WQS numeric criteria was demonstrated during all periods at the Highway 97 Bridge.

Turbidity was also examined between Monse and the background (Malott) since Columbia River water is known to influence the lowermost portions of the Okanagan River. Measurements collected at Monse (RM 5.0) supported the abovementioned trend of decreasing turbidity throughout the Okanogan and Columbia rivers. Average turbidity at Monse was typically lower than values collected at Malott. Despite the loss of data during periods of instrument blockage, 17 comparable days were collected at Monse. On only one of these days (June 11th) did turbidity at Monse exceed those observed at Malott, but only by 3.2 NTUs – well within the numeric criteria for turbidity (33.1 and 29.9 NTUs, respectively). Grab samples supported these findings that turbidity decreased between Malott and Monse (Table 1, Figure 4). On only one of the weekly grab samples (collected July 14th) did the turbidity at Monse exceed those observed at Malott, but only by 0.7 NTUs, also within the numeric criteria for turbidity (2.6 and 1.9 NTUs, respectively). Data collected in 2008 showed similar patterns between Malott and Monse, with turbidity generally lower at Monse and less deviation around the mean (Table 2, Figure 5).

Collectively, results from both the Hydrolab and grab samples indicate that the Wells Project is in compliance for turbidity at all locations, including Monse, Highway 97, and the Wells Dam Forebay. There were no instances where turbidity at Monse or Highway 97 exceeded turbidity at Malott by more than 5 NTU, and values were generally lesser at downstream locations. These results are consistent with limnological processes.



Figure 1. Location of CBE monitoring stations on the Okanogan River, 2009.



Figure 2. Hyrdolab and sediment blockage after retrieval from Monse on the Okanogan River, 2009.



Figure 3. Turbidity (NTUs) collected by Hydrolabs in the Okanogan River at Malott, Monse, and Highway 97, 2009.

Site	Date	Sample	NTU	Site	Date	Sample	NTU
Malott	06/25/09	19:15	7.0	Monse	06/25/09	19:55	5.2
Malott	06/25/09	19:15	7.1	Monse	06/25/09	19:55	5.5
Malott	06/25/09	19:15	8.2	Monse	06/25/09	19:55	6.0
Malott	07/01/09	15:25	4.2	Monse	07/01/09	15:10	3.7
Malott	07/01/09	15:25	4.8	Monse	07/01/09	15:10	3.9
Malott	07/01/09	15:25	5.2	Monse	07/01/09	15:10	3.5
Malott	07/08/09	9:30	3.3	Monse	07/08/09	11:20	3.4
Malott	07/08/09	9:30	3.9	Monse	07/08/09	11:20	2.5
-	-	-	-	Monse	07/08/09	11:20	2.7
Malott	07/14/09	15:05	2.1	Monse	07/14/09	15:20	2.5
Malott	07/14/09	15:05	1.9	Monse	07/14/09	15:20	2.7
Malott	07/14/09	15:05	1.6	-	-	-	-

Table 1. Grab samples collected from the Okanogan River at Malott and Monse, 2009.



Figure 4. Mean turbidity values (NTUs, ± standard error) collected by a 2100P IS Portable Turbidimeter from the Okanogan River at Malott and Monse (dashed line), 2009.

Location	Malott	Monse					
Quantiles							
Maximum	546.0	53.7					
75% Quartile	15.7	8.5					
Median	5.6	4.9					
25% Quartile	2.8	1.2					
Minimum	0.3	0.1					
Moments							
Mean	26.4	8.4					
Std Dev	81.8	11.6					
Std Err Mean	7.8	1.2					
upper 95% Mean	41.8	10.7					
lower 95% Mean	11.0	6.0					
Ν	111	97					

Table 2. Quantiles and Moments of Hydrolab turbidity data collected at Malott and Monse on the Okanogan River,2008.



Figure 5. Overlapping Hydrolab turbidity data (NTUs) collected at Malott and Monse on the Okanogan River in 2008.