

Carson River Special Dissolved Oxygen and Temperature Monitoring Project - 2005

A supporting document for the Carson River Report Card

March 2006



East Fork Carson River at Muller Lane (looking upstream)



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Introduction

In support of our Clean Water Act responsibilities, the Nevada Division of Environmental Protection (NDEP) – Bureau of Water Quality Planning (BWQP) is developing a Carson River Watershed Assessment or Report Card. Drawing upon numerous studies and monitoring efforts, the Report Card will provide a compilation of current knowledge about the chemical, physical and biological health of the Carson River watershed with a focus on aquatic life uses from the Nevada/California stateline to Lahontan Reservoir. It is hoped that the Report Card will be a valuable tool for educating the public, agencies and decisionmakers on the state of the river (from a Clean Water Act perspective), thereby providing direction for their future actions and decisions. The Report Card will also be a key planning tool for BWQP in possible future steps, such as standards revisions, comprehensive Total Maximum Daily Loads (TMDLs), watershed plan development and restoration projects.

The purpose of this report is to present the results of special dissolved oxygen (DO) and temperature monitoring of the East and West forks of the Carson River and Brockliss Slough. These data will ultimately be used in followup nutrient and temperature assessment documents.

Methods

The daily fluctuations of DO and temperature are well documented with low values generally occurring in the morning around sunrise (critical period for DO) and high values around mid-afternoon (critical period for temperature). One way to monitor for these highs and lows is with continuous monitoring devices. However when monitoring DO levels, these installations can be very labor intensive and expensive. Another method, which was used for this project, is to take early morning and mid-afternoon readings with hand-held DO and temperature instruments. This simpler approach allowed for the evaluation of several sites using limited resources.

Using a YSI Model 550 instrument, NDEP measured DO levels and temperature at 10 monitoring sites (Table 1, Figure 1) on the East and West forks of the Carson River and Brockliss Slough. In general, measurements were taken in the early morning and mid-afternoon for one day a week for a six week period beginning in early August 2005.

Table 1. Monitoring Sites

Station ID	Waterbody	Description
C16*	East Fork Carson River	At Highway 88
C15*		At Muller Lane
EF1		At confluence
WF1	West Fork Carson River	At Centerville Lane
WF2		At Mottsville Lane
C14*		At Muller Lane
WF3		At confluence
BS1	Brockliss Slough	At Highway 88
BS2		At Centerville Lane
BS3		At Mottsville Lane
EB1		East Branch at Muller Lane
C5*		West Branch at Muller Lane
EB2		East Branch at Genoa Lane
WB1		West Branch at Genoa Lane

*Stations are part of NDEP ongoing ambient water quality monitoring network

Flow and Weather Conditions

DO and temperature levels can vary greatly with time and location throughout the Carson system with both flow and weather conditions playing a significant role. Therefore an understanding of these conditions is valuable in interpreting the DO/temperature data.

During the August/September 2005, flows overall were above the historic median on the East Fork Carson River as it enters Carson Valley (Figure 2), and were at or just below the historic median on the West Fork Carson River at the south end of Carson Valley (Figure 3). It must be noted that there are significant diversions between these USGS flow gages and the 2005 monitoring sites; and the actual flows at the 2005 monitoring sites were lower (significantly lower in some cases) than indicated by the gages. For example, a few miles after entering Carson Valley the waters of the West Fork Carson River actually “flow into” the Brockliss Slough leaving little water in the West Fork (Pugsley, August 23, 2004). However, West Fork Carson River flows increase downstream as return flows and water conveyed from the East Fork enter the West Fork.

Daily low and high air temperatures at Minden (from National Weather Service website - http://www.wrcc.dri.edu/state_climate.html) were predominately above average during the monitoring period August 4 through September 9, 2005 (Figure 4).

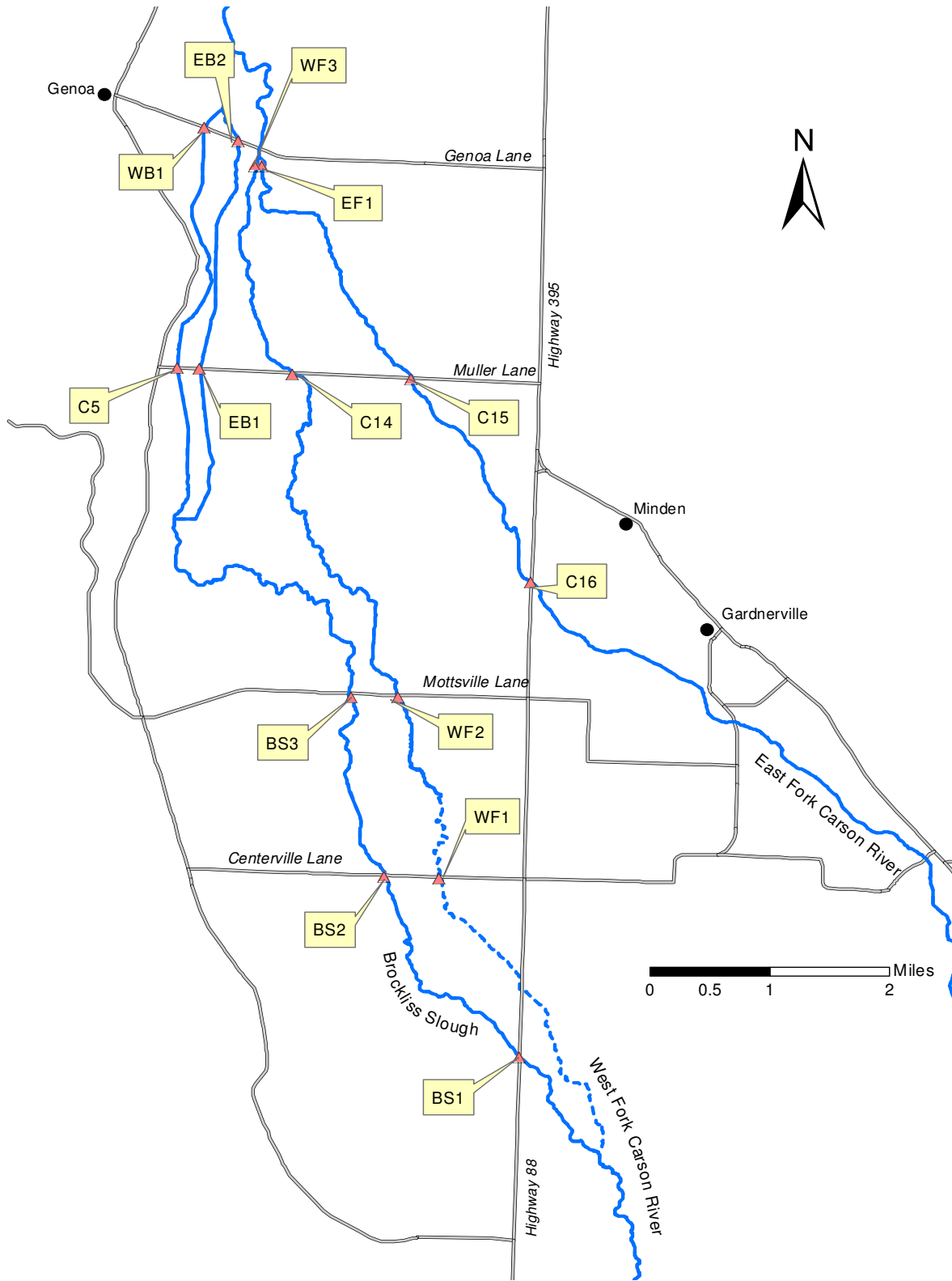


Figure 1. Special Monitoring Sites

Figure 2. USGS Gage 10309000: East Fork Carson River near Gardnerville, NV - 2005 Flows and Flow Statistics

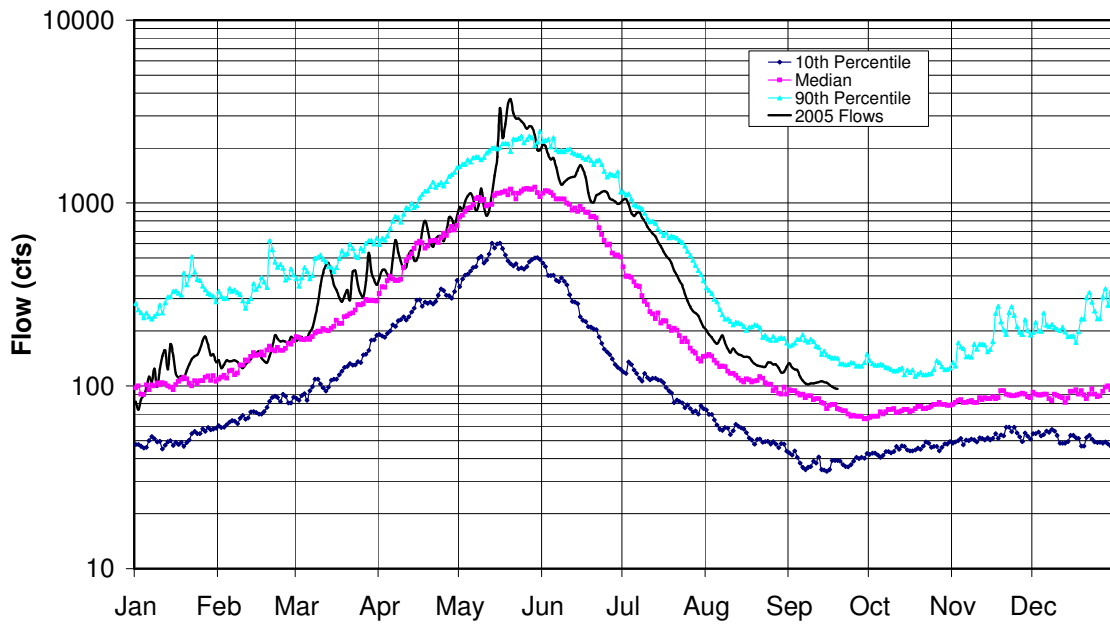


Figure 3. USGS Gage 10310000: West Fork Carson River at Woodfords, CA - 2005 Flows and Flow Statistics

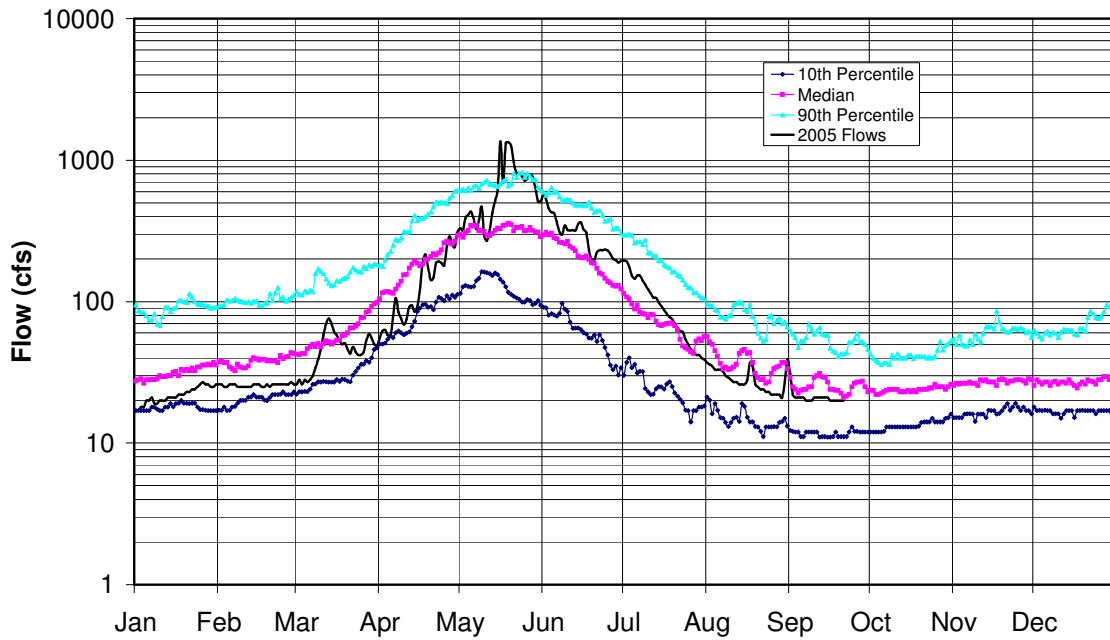
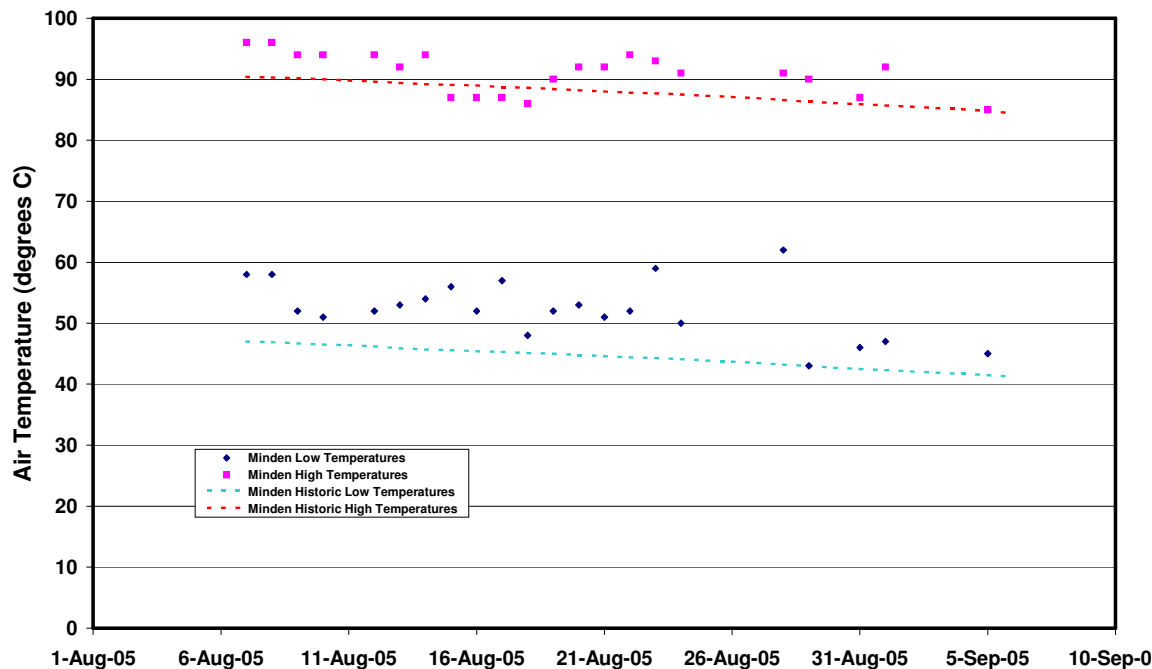


Figure 4. Historic and 2005 Air Temperatures at Minden, NV



Results

The DO and temperature data compiled during this project are tabulated in Appendix A. Also, plots of the DO and temperature data are given in Appendices B through D. In the tables and plots, the data are compared to the applicable water quality standards shown in Table 2. Overall, the most frequent violations of the DO standards occurred at the following sites:

- EF Carson River at Muller Lane
- WF Carson River – from Brockliss Slough to Muller Lane
- Brockliss Slough – from Muller Lane to Genoa Lane

The most frequent violations of the temperature standards occurred at these sites:

- EF Carson River – Highway 88 to confluence
- WF Carson River – at Centerville Lane; from Muller Lane to confluence

During the summer of 2001, NDEP performed a similar monitoring project (Pahl, 2002) which included several of the same sites monitored in 2005. Even though flows were generally higher during the 2005 study than the 2001 study, this project yielded results comparable to those found during the 2001 study. Without gages on the lower West Fork Carson River and Brockliss Slough, it was not possible to determine how 2005 flows compared to historic flows for these waters.

Table 2. DO and Temperature Water Quality Standards Applicable During the Monitoring Period

Waterbody	Reach	Applicable DO Standard (mg/l)	Applicable Temperature Standard (degrees C)
East Fork Carson River	Stateline to Muller Lane	5	23
	Muller Lane to confluence	5	22
West Fork Carson River	Stateline to confluence	5	23
Brockliss Slough*	Entire reach	5	23

* While no specific standards have been set for Brockliss Slough, standards for the Carson River at Cradlebaugh Bridge (Nevada Administrative Code [NAC] 445A.153) can be applied to the Slough under the “tributary rule” (NAC 445A. 145).

East Fork Carson Results: Of the three locations monitored on the East Fork Carson River, only the Muller Lane site experienced DO levels below the water quality standard with a low of 3.7 mg/l. By late August 2005, the algae growth just upstream of Muller Lane had become significant (Figure 5) resulting in the low early morning DO levels. During the 2001 monitoring project (Pahl, 2002), even thicker algal mats were observed with DO levels below 2 mg/l.

All three sites experienced afternoon temperatures greater than the water quality standards every day that measurements were taken.

West Fork Carson Results: Frequent DO standard excursions were measured at three of the four WF Carson sites: Centerville Lane, Mottsville Lane and Muller Lane, with the lowest levels at the Centerville Lane site. As described earlier, the flows of the West Fork Carson River are “re-directed” into the Brockliss Slough leaving very little flow in the West Fork at this point (Figure 6). Below this point, the West Fork Carson River channel conveys East Fork Carson River water for irrigation and also serves as a catchment for return flows from land irrigated with East Fork Carson River water (Hess, 1996).

The temperature standards were frequently violated at all of the West Fork monitoring sites except for the Mottsville Lane location where temperature levels were significantly cooler than the other sites. It is likely that this is due to the inflow of cooler East Fork water conveyed by Rocky Slough.

Brockliss Slough Results: DO standard excursions frequently occurred on the Brockliss Slough branches at both the Muller Lane and Genoa Lane sites with the worst levels occurring at Genoa Lane. This is not surprising considering the stagnant conditions and extensive aquatic plant growth at Genoa Lane (Figures 7, 8).

High temperatures consistently occurred at the east and west branch sites on Muller Lane, and periodically occurred at the other locations.



Figure 5. Algae in the East Fork Carson River – between Highway 88 and Muller Lane – Late August 2005



Figure 6. West Fork Carson River at Highway 88 – August 2005 (looking downstream)



Figure 7. West Branch Brockliss Slough at Genoa Lane – August 2005 (looking upstream)



Figure 8. East Branch Brockliss Slough at Genoa Lane – August 2005 (looking upstream)

References

Hess, G.W. Progress Report on Daily-Flow Routing Simulation for the Carson River, California and Nevada. U.S. Geological Survey Open-File Report 96-211. 1996.

Pahl, R. Carson River Special Monitoring Project – 2001. Nevada Division of Environmental Protection. August 2002.

Pugsley, P. Personal Communication. Carson Valley Conservation District. August 23, 2004.

APPENDIX A – Monitoring Data

Table A-1: Summary of Spot Readings on Carson River - Summer of 2005

Site ID	Location	Date/Time	DO (mg/l)	Water Temp (C)	Comments
C16	EF Carson at Hwy 88	8/4/05 6:05	6.1	15.3	
		8/4/05 14:10	11.5	25.4	
		8/10/05 6:12	6.1	13.9	
		8/10/05 14:20	12.9	25.0	
		8/18/05 6:50	5.5	14.5	
		8/18/05 14:25	10.8	24.4	
		8/24/05 6:30	5.3	13.8	
		8/24/05 14:50	13.4	24.5	
		9/2/05 6:45	5.8	13.1	
		9/2/05 14:30	14.7	23.1	
9/9/05 7:15	6.1	12.9			
C15	EF Carson at Muller Lane	8/4/05 5:55	4.9	15.5	No evidence yet of excess algae growth between Hwy 88 and Muller like was seen in 2004
		8/4/05 14:25	15.3	25.1	
		8/10/05 6:20	4.5	14.9	
		8/10/05 14:30	16.5	25.1	
		8/18/05 7:00	4.7	14.8	Algae growth upstream getting more significant - still not to the level seen in 2004
		8/18/05 14:35	13.7	24.3	
		8/24/05 6:38	3.7	14.3	
		8/24/05 15:00	17.6	24.2	
		9/2/05 6:50	4.7	14.3	
		9/2/05 14:40	14.4	23.1	
9/9/05 6:30	4.1	13.5			
EF1	EF Carson at Confluence	8/4/05 7:05	6.0	16.2	
		8/10/05 7:05	5.0	17.2	
		8/10/05 15:10	7.0	25.0	
		8/18/05 7:35	5.5	14.9	
		8/18/05 15:15	8.4	26.6	
		8/24/05 7:10	5.6	13.9	
		8/24/05 15:30	9.0	25.8	
		9/2/05 7:20	6.4	13.3	
		9/2/05 15:10	9.0	24.1	
		WF1	WF Carson at Centerville	8/10/05 5:45	2.1
8/10/05 13:43	4.9			24.9	
8/18/05 6:15	2.3			14.9	
8/18/05 13:55	5.6			23.9	
8/24/05 6:08	1.4			13.5	
8/24/05 14:10	6.5			23.9	
9/2/05 6:20	1.9			11.9	
9/2/05 14:15	5.8	23.3			
WF2	WF Carson at Mottsville Lane	8/4/05 13:44	9.8	20.5	
		8/10/05 6:01	4.1	17.2	
		8/10/05 14:04	9.0	20.4	
		8/18/05 6:35	4.0	15.5	
		8/18/05 14:10	8.0	19.9	
		8/24/05 6:20	3.9	13.9	
		8/24/05 14:30	9.1	19.1	Quite a few aquatic plants
		9/2/05 6:40	5.1	12.6	
		9/2/05 14:25	8.5	18.6	Very murky conditions
9/9/05 7:05	5.8	12.8			
C14	WF Carson at Muller Lane	8/4/05 6:30	2.1	15.3	
		8/4/05 14:35	9.5	27.9	
		8/10/05 6:25	5.1	17.7	Much more flow than on 8/4/05
		8/10/05 14:34	7.3	25.4	
		8/18/05 7:05	4.2	14.1	lower flows again
		8/18/05 14:50	9.7	26.0	
		8/24/05 6:42	4.0	13.2	
		8/24/05 15:11	10.1	27.2	
		9/2/05 6:55	3.8	11.8	
		9/2/05 14:45	9.7	25.6	
9/9/05 6:40	5.6	10.7			
WF3	WF Carson at Confluence	8/4/05 7:00	4.8	17.3	
		8/10/05 7:05	4.4	16.6	
		8/10/05 15:10	10.0	24.8	
		8/18/05 7:35	5.4	14.9	
		8/18/05 15:15	8.6	25.5	
		8/24/05 7:10	5.6	13.9	
		8/24/05 15:30	9.0	26.3	
		9/2/05 7:20	6.4	12.5	
		9/2/05 15:10	8.9	25.7	





 Does not meet DO standards
 Does not meet temperature standards

Table A-1: Summary of Spot Readings on Carson River - Summer of 2005 (cont'd)

Site ID	Location	Date/Time	DO (mg/l)	Water Temp (C)	Comments
BS1	Brockliss at Hwy 88	8/10/05 13:35	14	22	
		8/18/05 6:06	5.1	15.9	
		8/18/05 13:49	10.3	20.2	
		8/24/05 6:00	2.7	16.3	Water moving very slow - backed up by diversion dam downstream
		8/24/05 14:05	17	23.2	
		9/2/05 6:15	5.1	14.3	Conditions have improved since
		9/2/05 14:05	13	19.9	8/24/05 with more water movement.
BS2	Brockliss at Centerville	8/10/05 5:50	4.8	19.7	Water moving slow
		8/10/05 13:50	6.4	22.3	
		8/18/05 6:20	4.2	18.2	
		8/18/05 14:00	6.9	20.6	
		8/24/05 6:12	5	18	
		8/24/05 14:15	5.2	20.8	
		9/2/05 6:25	5.2	16.7	
		9/2/05 14:15	8.2	19.9	
BS3	Brockliss at Mottsville Lane	8/4/05 13:50	7.1	25.4	Diversion dam downstream, flow very slow
		8/10/05 6:04	5.6	20.6	
		8/10/05 14:08	5.5	24.3	
		8/18/05 6:40	4.7	20.6	
		8/18/05 14:15	4.6	22.7	
		8/24/05 6:25	4.7	18.5	No visible water movement
		8/24/05 14:25	6.4	22.0	
		9/2/05 6:35	5.7	17.6	
		9/2/05 14:20	7.4	22.0	
		9/9/05 7:00	7.0	17.0	
EB1	East Brockliss at Muller Lane	8/4/05 6:35	4.3	16.6	
		8/4/05 14:38	8.3	26.3	
		8/10/05 6:30	4.8	15.4	
		8/10/05 14:38	8.0	25.9	
		8/18/05 7:10	4.6	15.0	
		8/18/05 14:45	9.3	24.6	
		8/24/05 6:45	4.1	14.5	
		8/24/05 15:08	7.8	23.8	
		9/2/05 7:00	3.0	12.3	
		9/2/05 14:50	6.4	22.3	
C5	West Brockliss at Muller Lane	8/4/05 6:40	5.0	17.2	
		8/4/05 14:40	10.6	29.5	
		8/10/05 6:35	4.6	16.2	
		8/10/05 14:43	9.6	29.1	
		8/18/05 7:15	3.9	15.3	
		8/18/05 14:50	9.2	26.2	
		8/24/05 6:50	4.2	15.2	
		8/24/05 15:11	10.1	27.2	
		9/2/05 7:05	2.7	14.7	
		9/2/05 14:55	9.6	22.3	
EB2	East Brockliss at Genoa Lane	8/4/05 6:50	3.4	20.0	From downstream side of bridge in the shade - no visible water movement
		8/4/05 15:00	5.1	26.5	
		8/10/05 6:46	4.1	20.1	
		8/10/05 15:00	5.9	25.0	
		8/18/05 7:30	4.1	18.5	
		8/18/05 15:05	5.5	23.2	
		8/24/05 7:05	4.1	19.4	
		8/24/05 15:25	7.5	22.8	
		9/2/05 7:15	4.9	17.8	
9/2/05 15:05	8.2	22.2			
WB1	West Brockliss at Genoa Lane	8/4/05 6:45	1.1	19.9	From downstream side of bridge in the shade - no visible water movement
		8/4/05 14:50	2.1	22.3	
		8/10/05 6:40	1.0	19.0	
		8/10/05 14:57	1.6	21.8	
		8/18/05 7:25	0.6	19.0	
		8/18/05 15:00	1.1	19.4	
		8/24/05 6:58	1.1	18.1	
		8/24/05 15:20	2.1	20.2	
		9/2/05 7:10	0.7	17.6	
9/2/05 15:00	1.4	19.9			

 Does not meet DO standards
 Does not meet temperature standards

**APPENDIX B – East Fork Carson River Dissolved Oxygen
and Temperature Plots**

Figure B-1: EF Carson River - Dissolved Oxygen, 8/04/2005

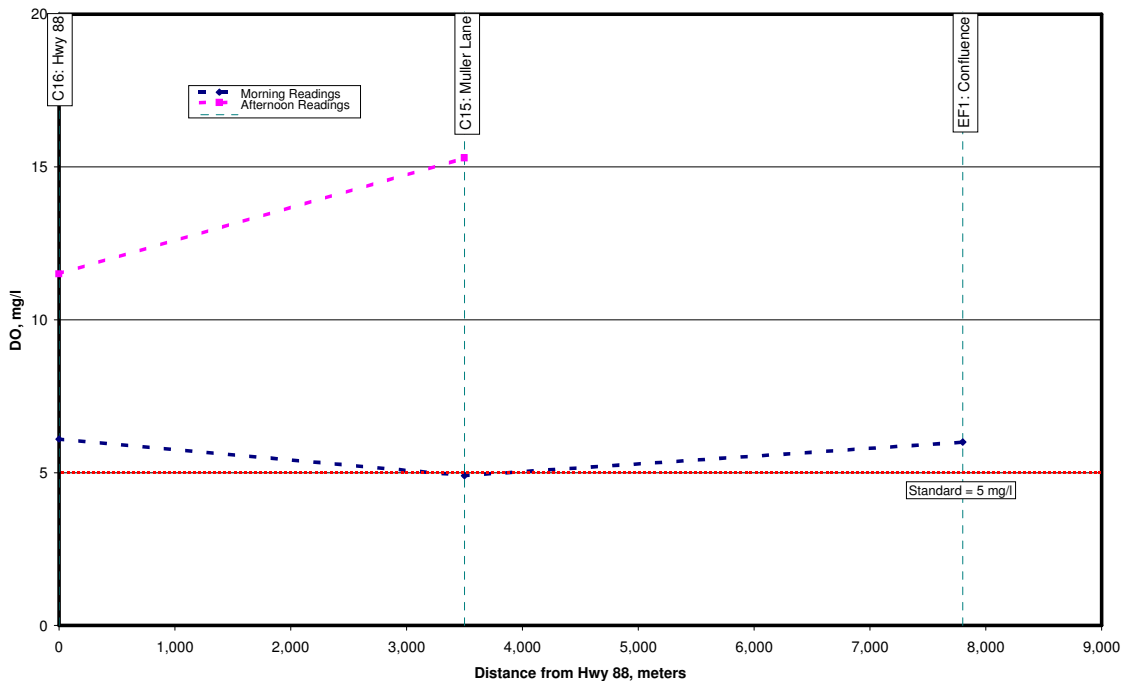


Figure B-2: EF Carson River - Dissolved Oxygen, 8/10/2005

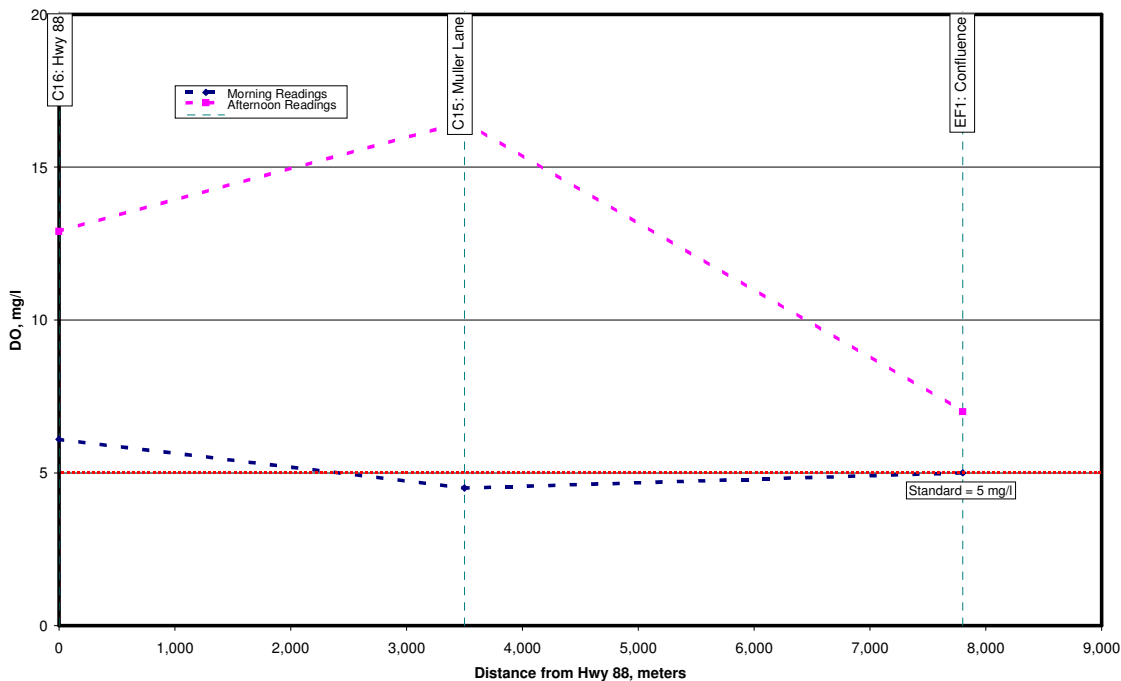


Figure B-3: EF Carson River - Dissolved Oxygen, 8/18/2005

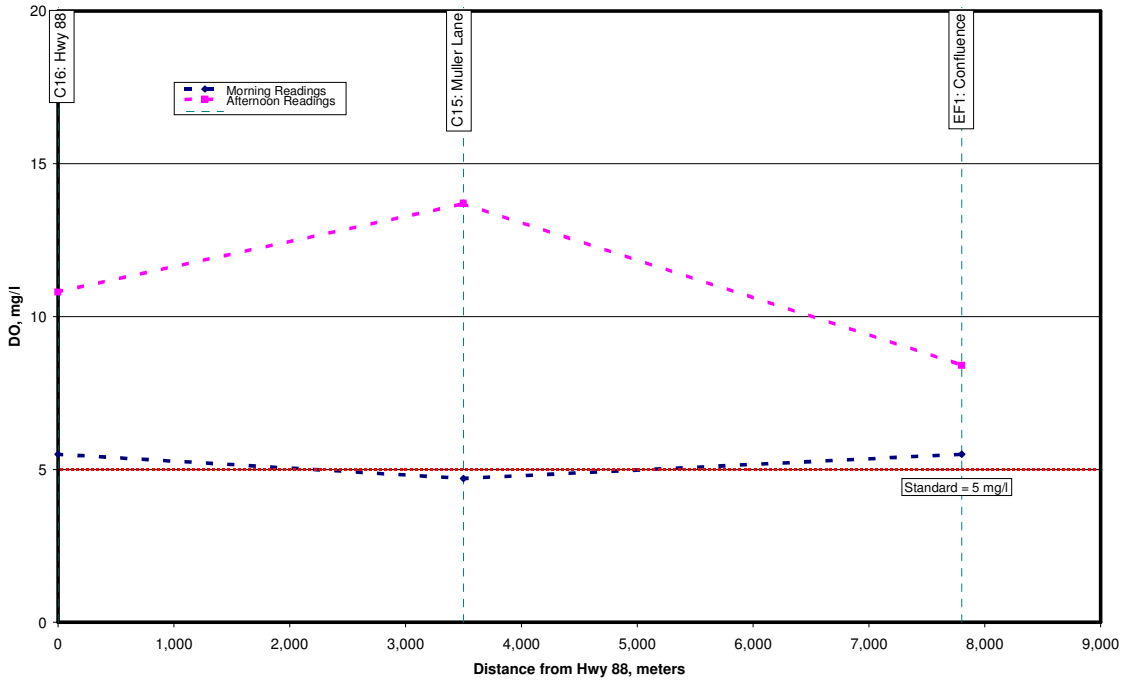


Figure B-4: EF Carson River - Dissolved Oxygen, 8/24/2005

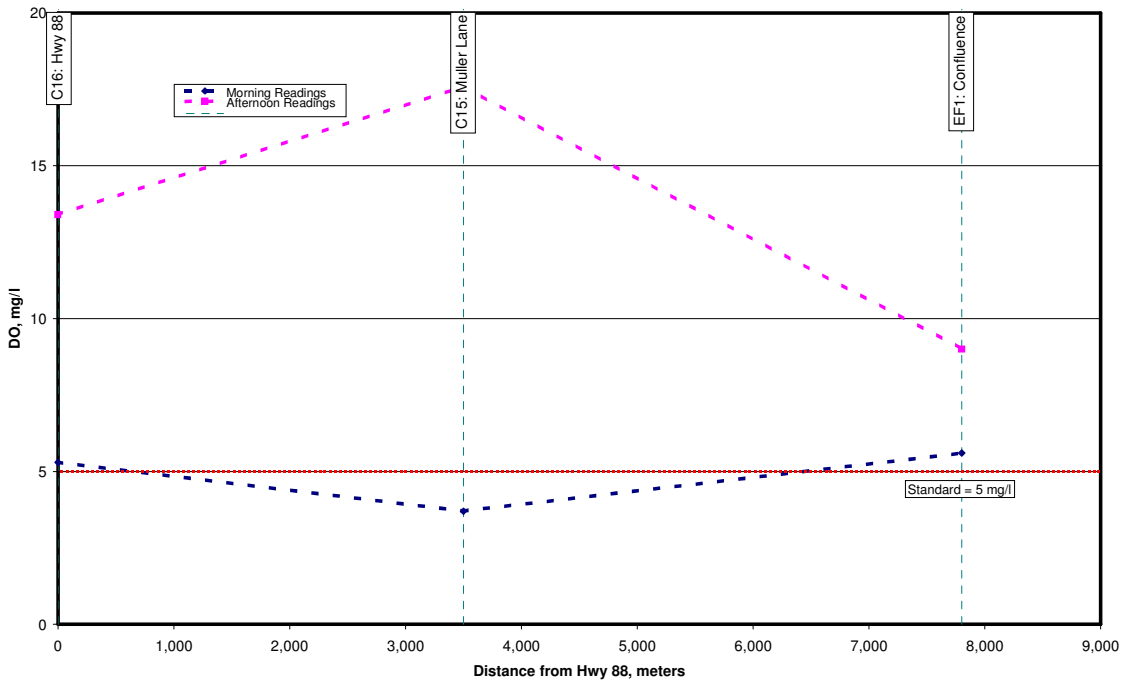


Figure B-5: EF Carson River - Dissolved Oxygen, 9/2/2005

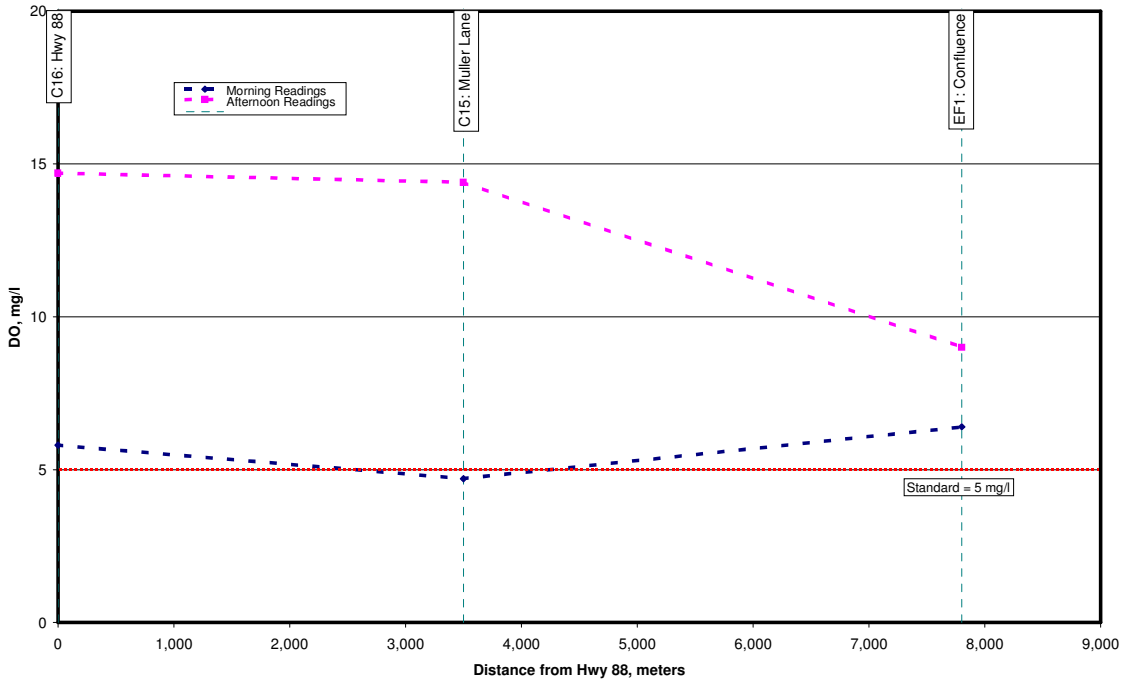


Figure B-6: EF Carson River - Temperature, 8/04/2005

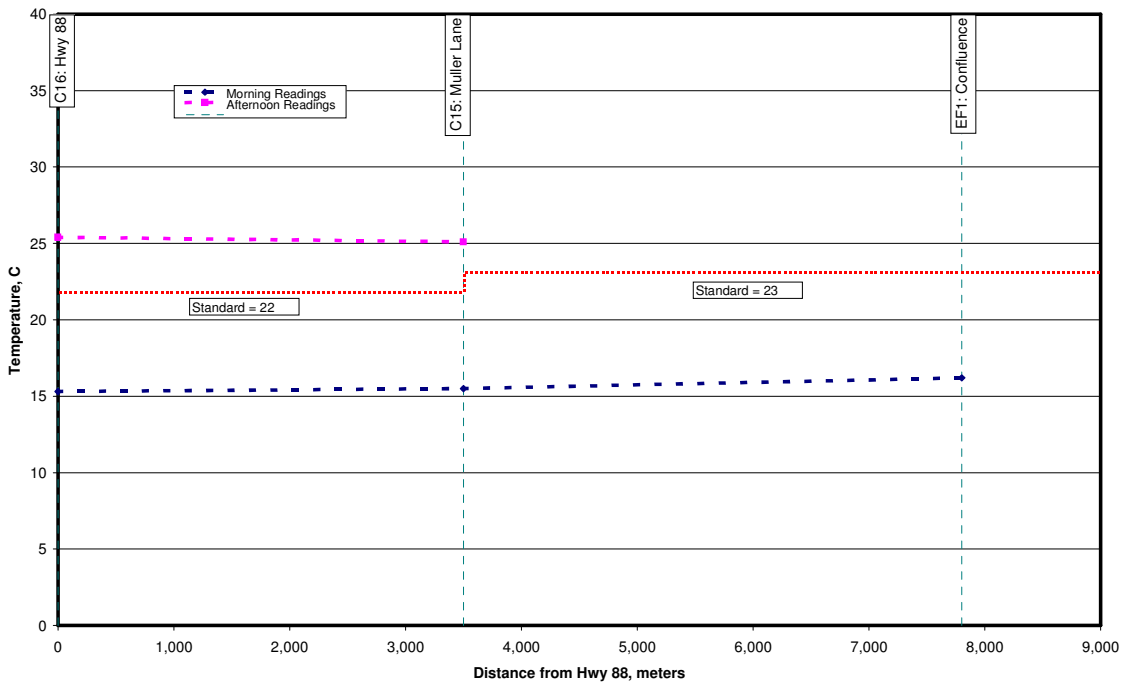


Figure B-7: EF Carson River - Temperature, 8/10/2005

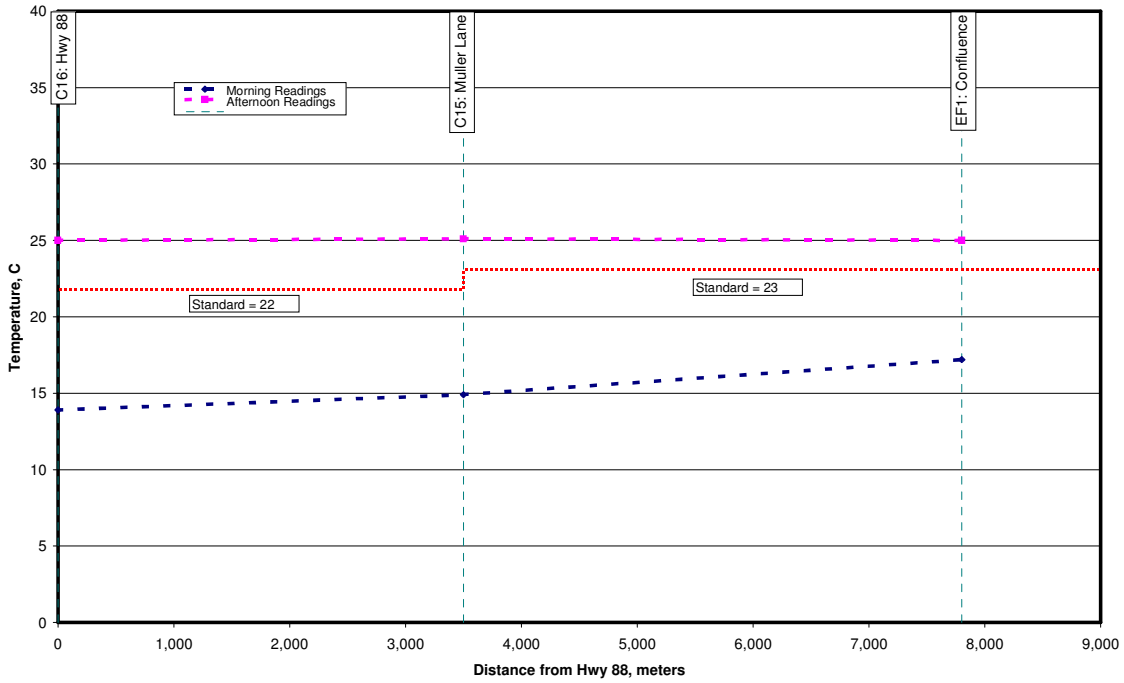


Figure B-8: EF Carson River - Temperature, 8/18/2005

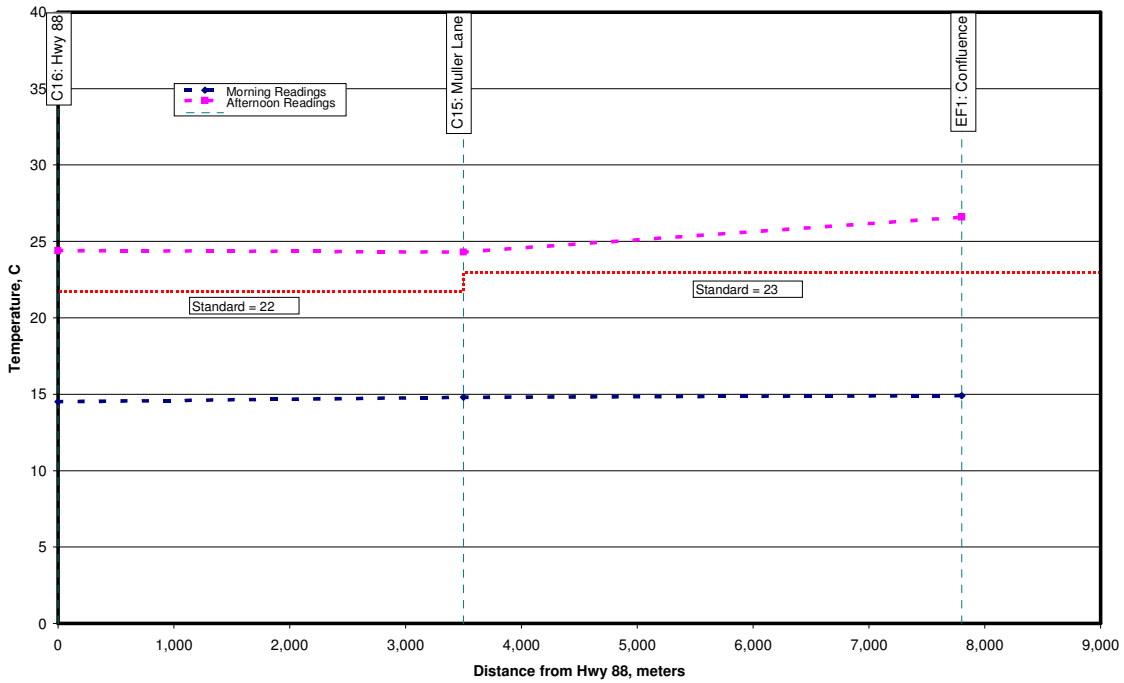


Figure B-9: EF Carson River - Temperature, 8/24/2005

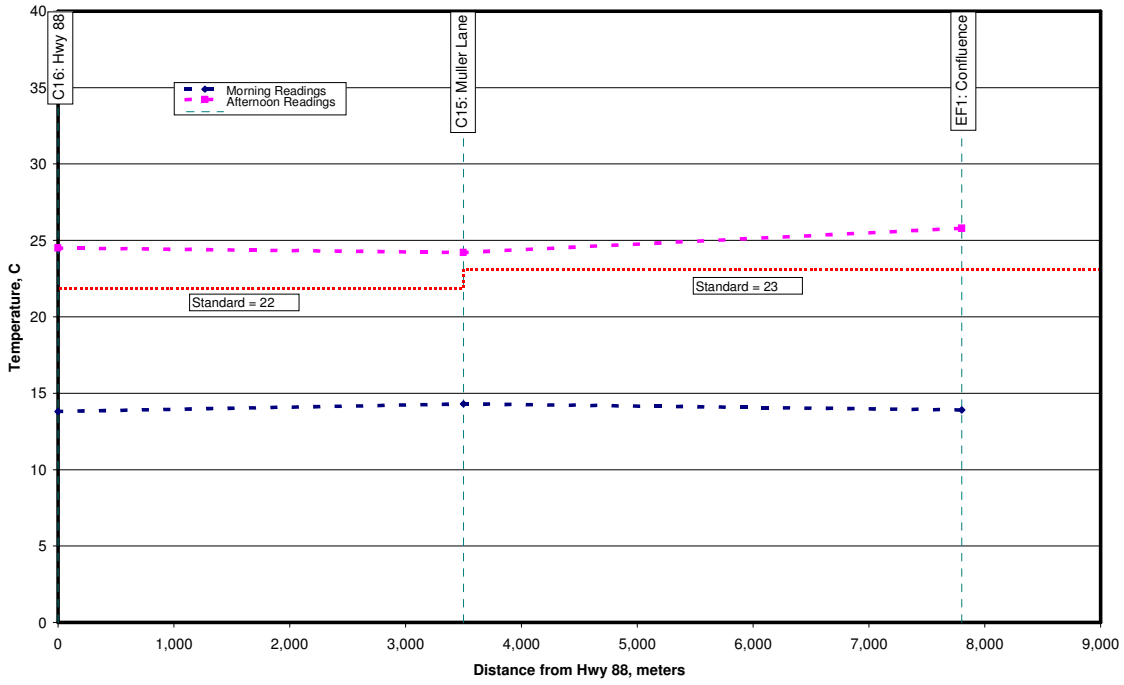
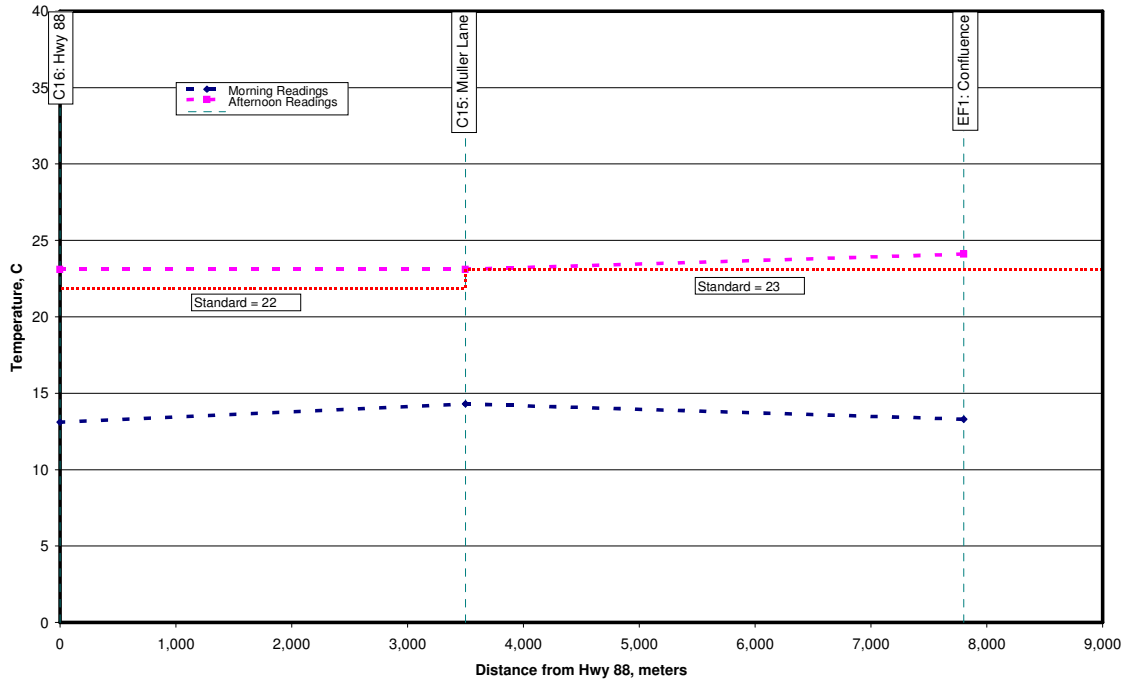


Figure B-10: EF Carson River - Temperature, 9/2/2005



**APPENDIX C – West Fork Carson River Dissolved Oxygen
and Temperature Plots**

Figure C-1: WF Carson River - Dissolved Oxygen, 8/4/2005

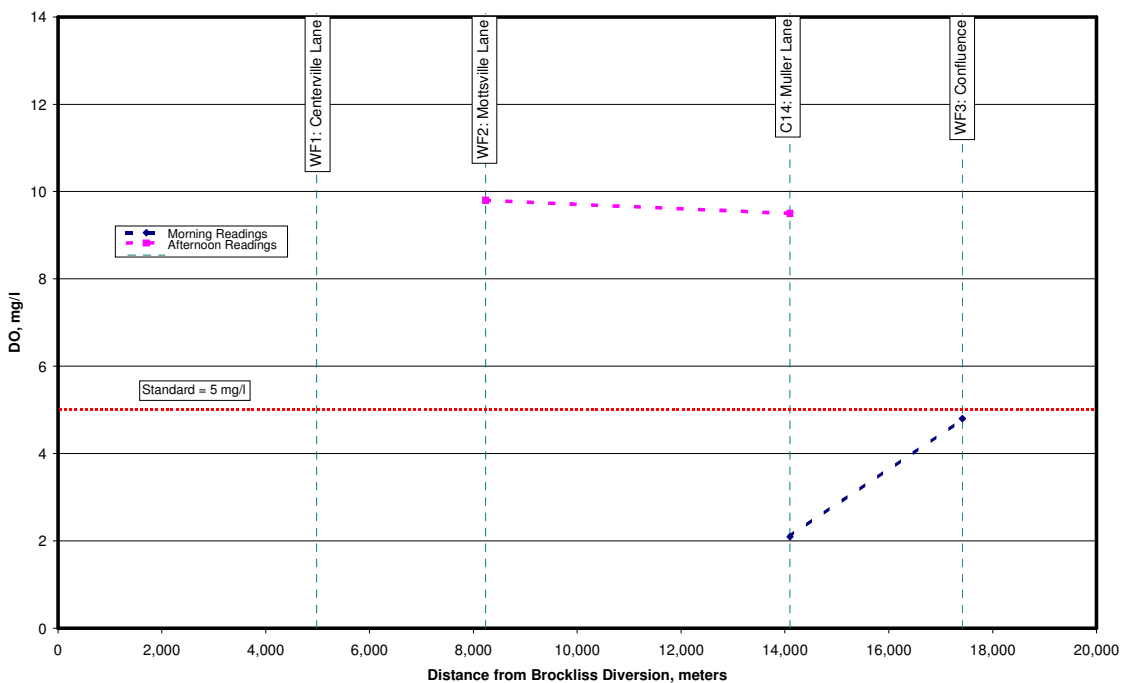


Figure C-2: WF Carson River - Dissolved Oxygen, 8/10/2005

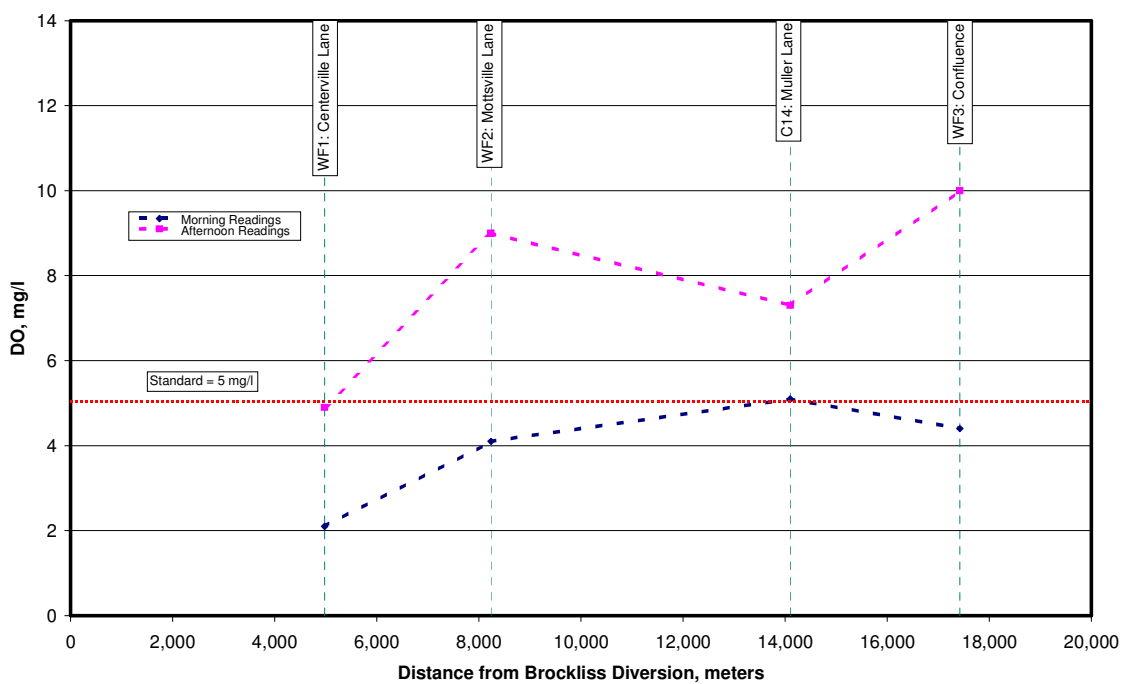


Figure C-3: WF Carson River - Dissolved Oxygen, 8/18/2005

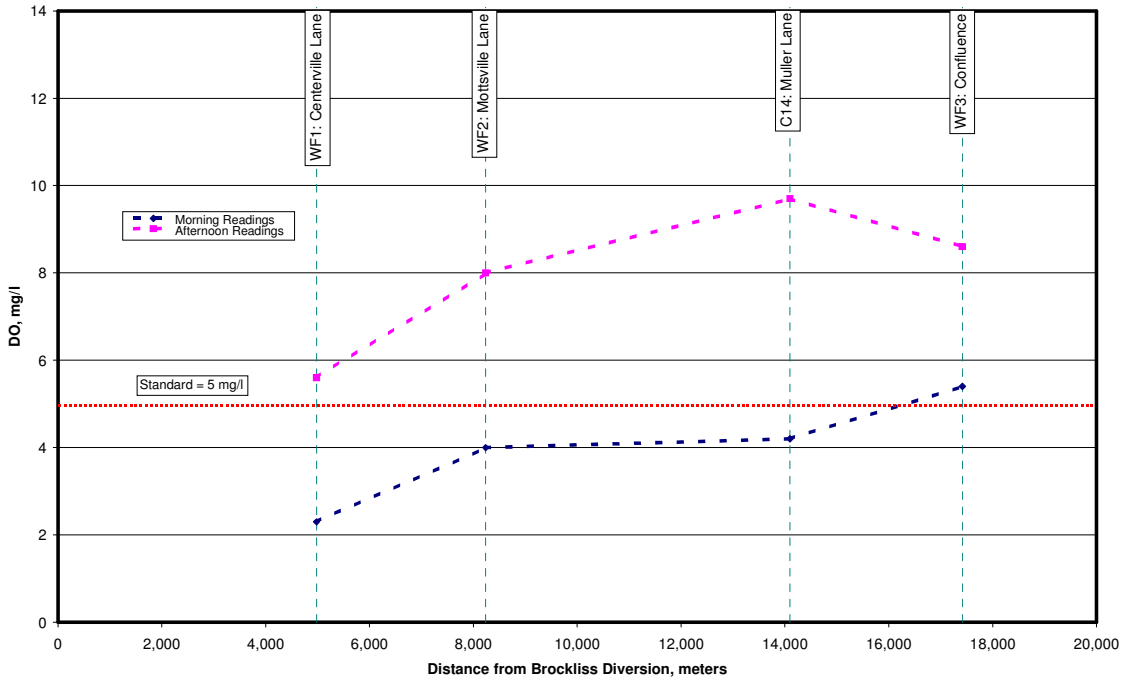


Figure C-4: WF Carson River - Dissolved Oxygen, 8/24/2005

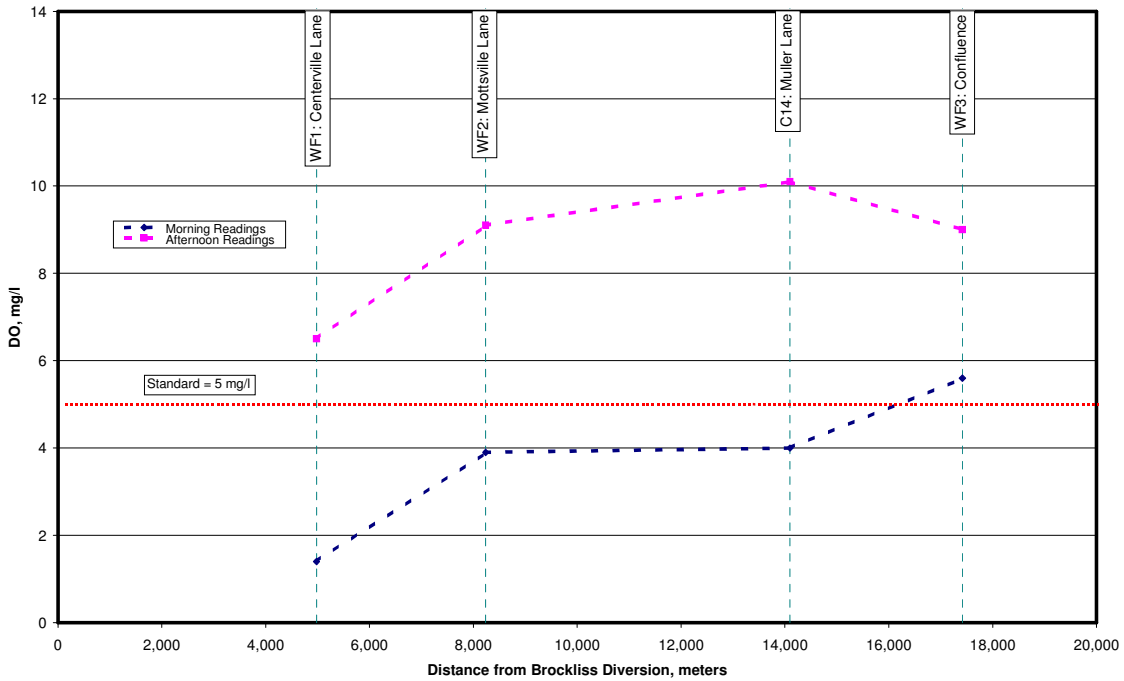


Figure C-5: WF Carson River - Dissolved Oxygen, 9/2/2005

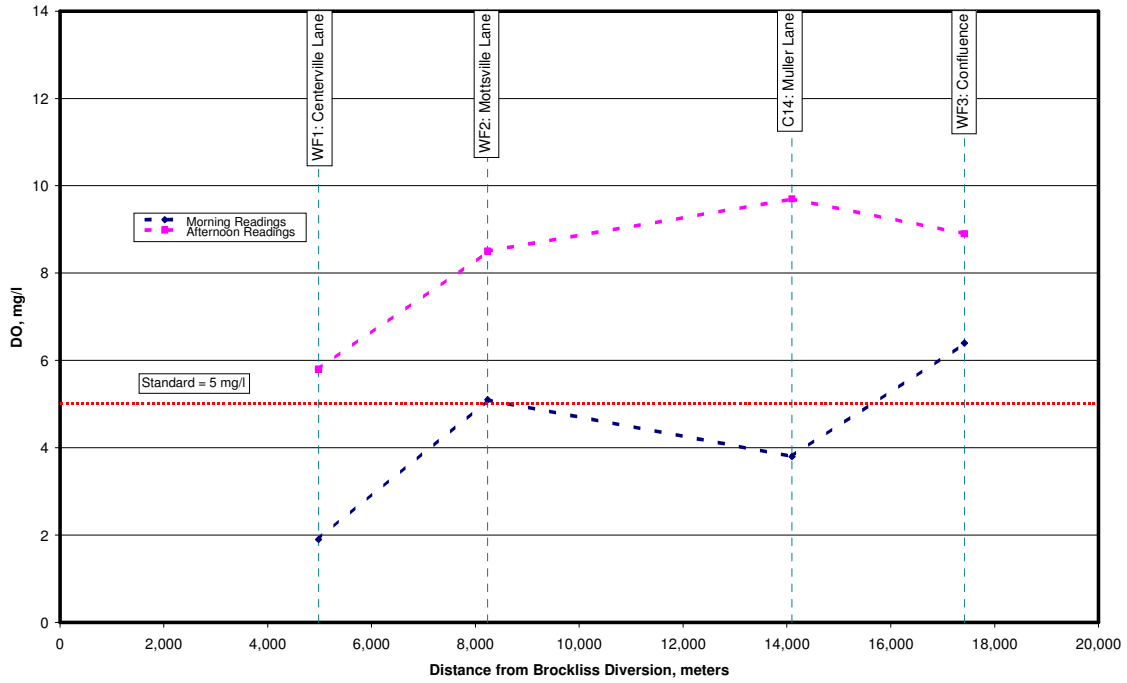


Figure C-6: WF Carson River - Temperature, 8/4/2005

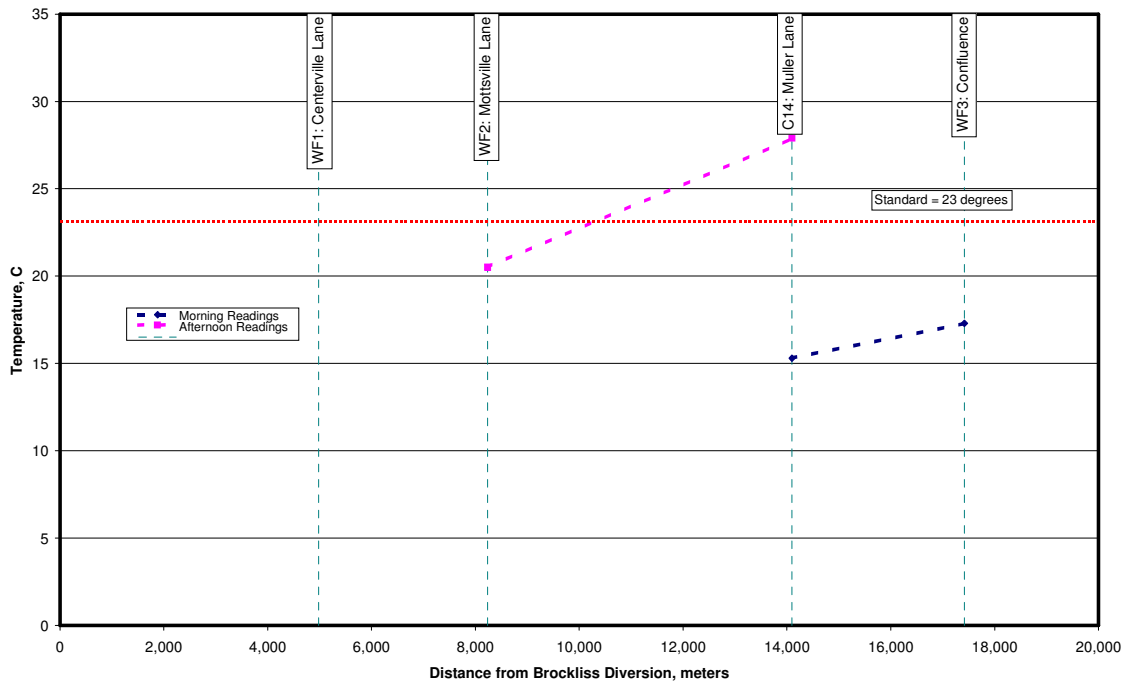


Figure C-7: WF Carson River - Temperature, 8/10/2005

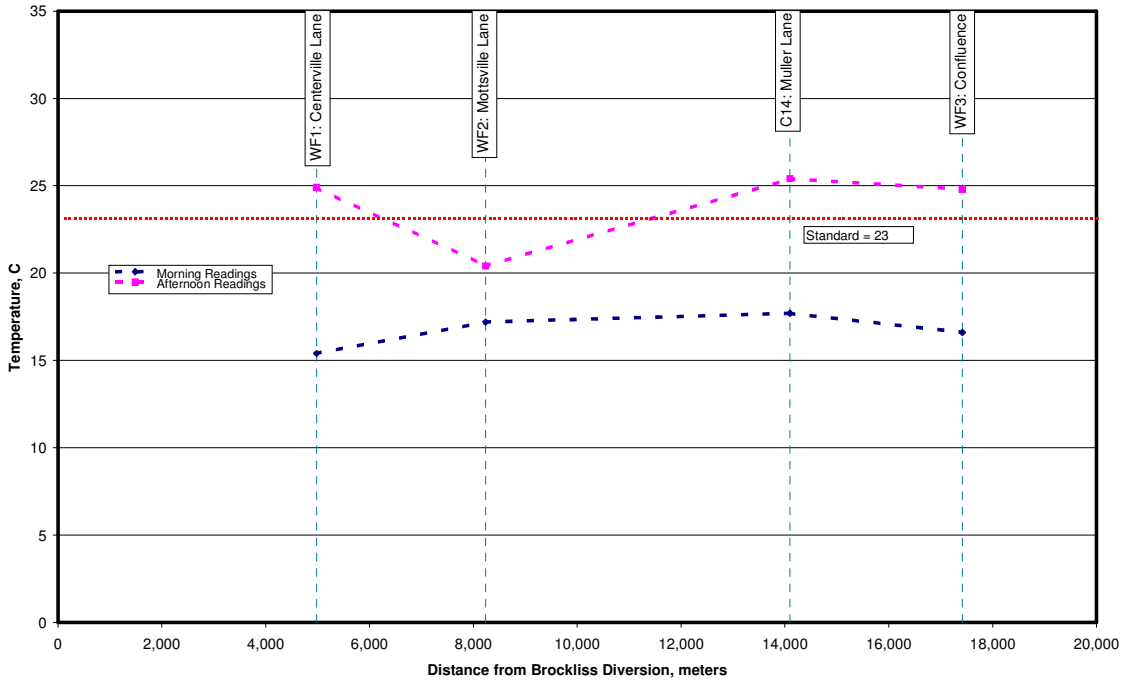


Figure C-8: WF Carson River - Temperature, 8/18/2005

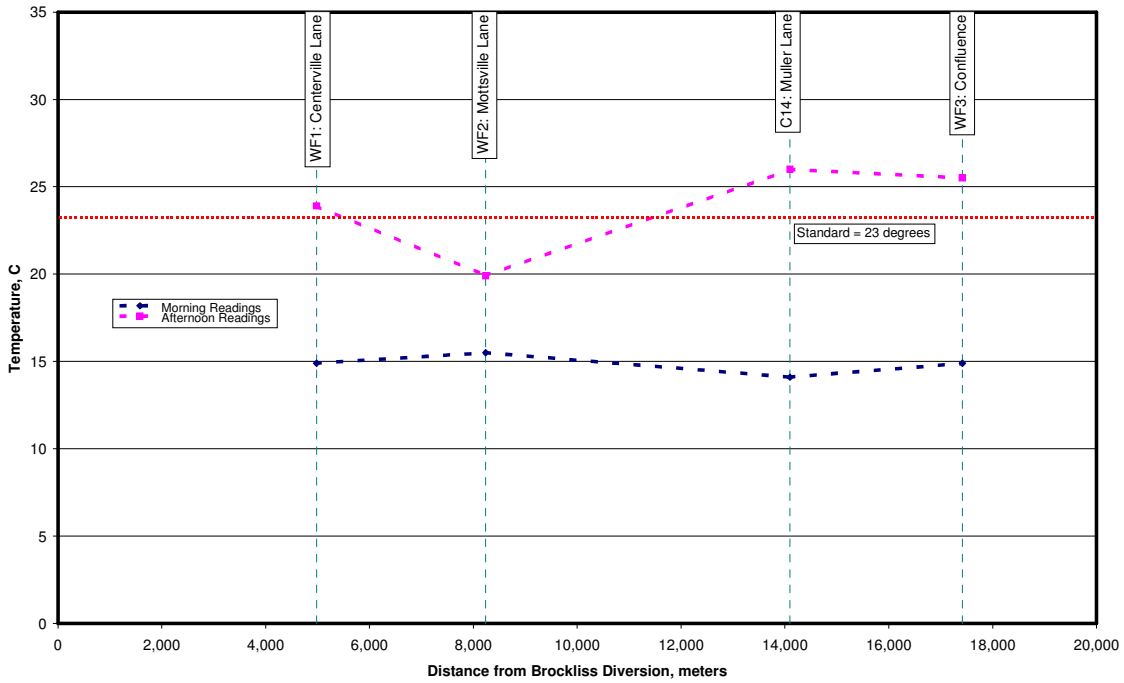


Figure C-9: WF Carson River - Temperature, 8/24/2005

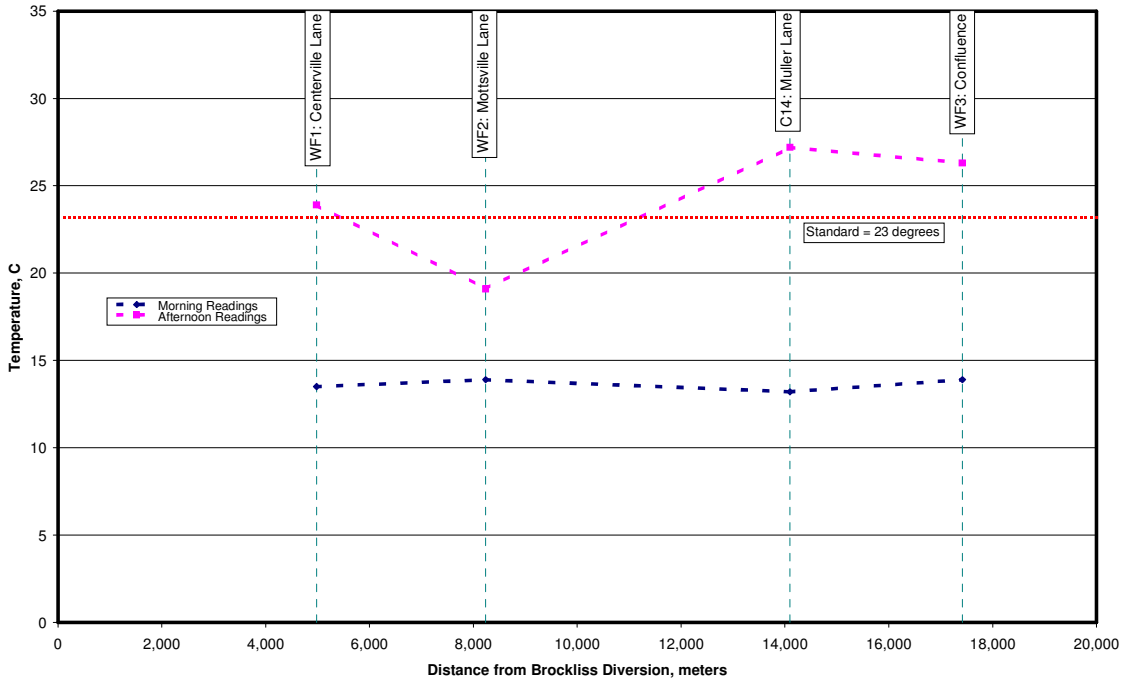
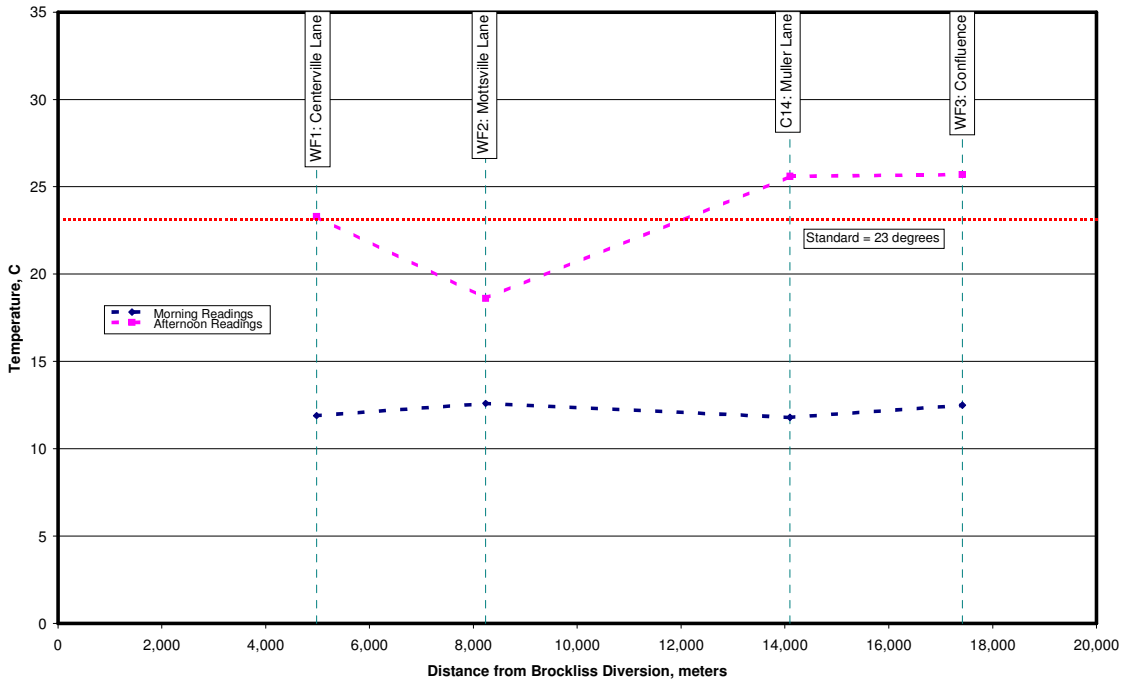


Figure C-10: WF Carson River - Temperature, 9/2/2005



**APPENDIX D – Brockliss Slough Dissolved Oxygen
and Temperature Plots**

Figure D-1: Brockliss Slough - Dissolved Oxygen, 8/4/2005

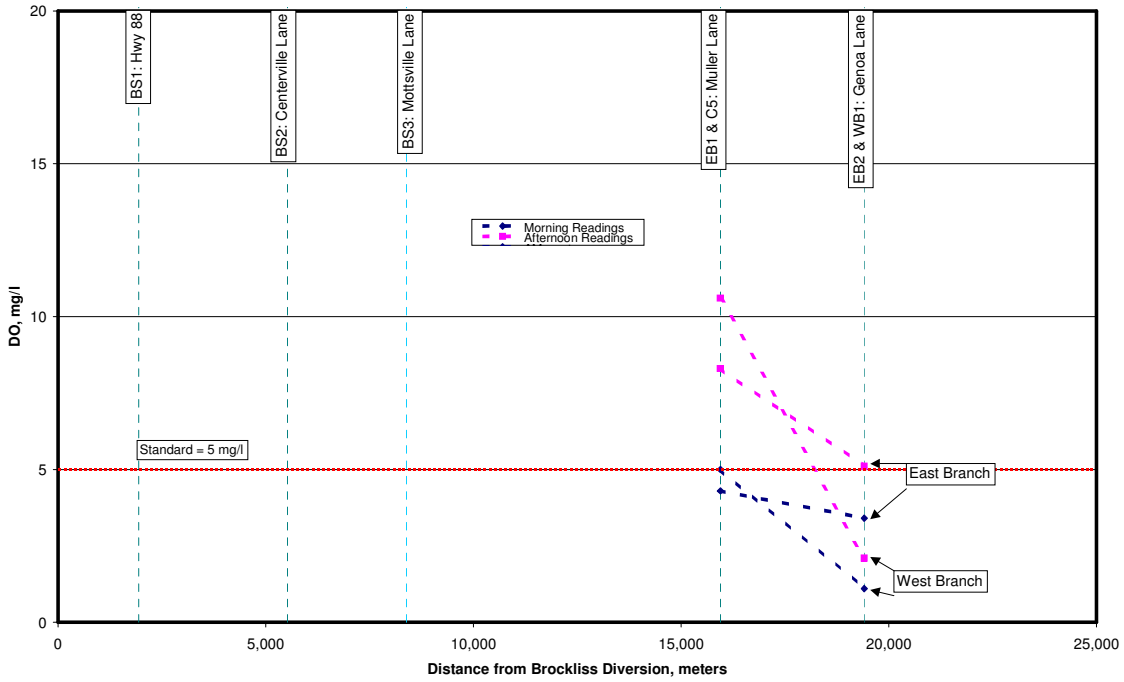


Figure D-2: Brockliss Slough - Dissolved Oxygen, 8/10/2005

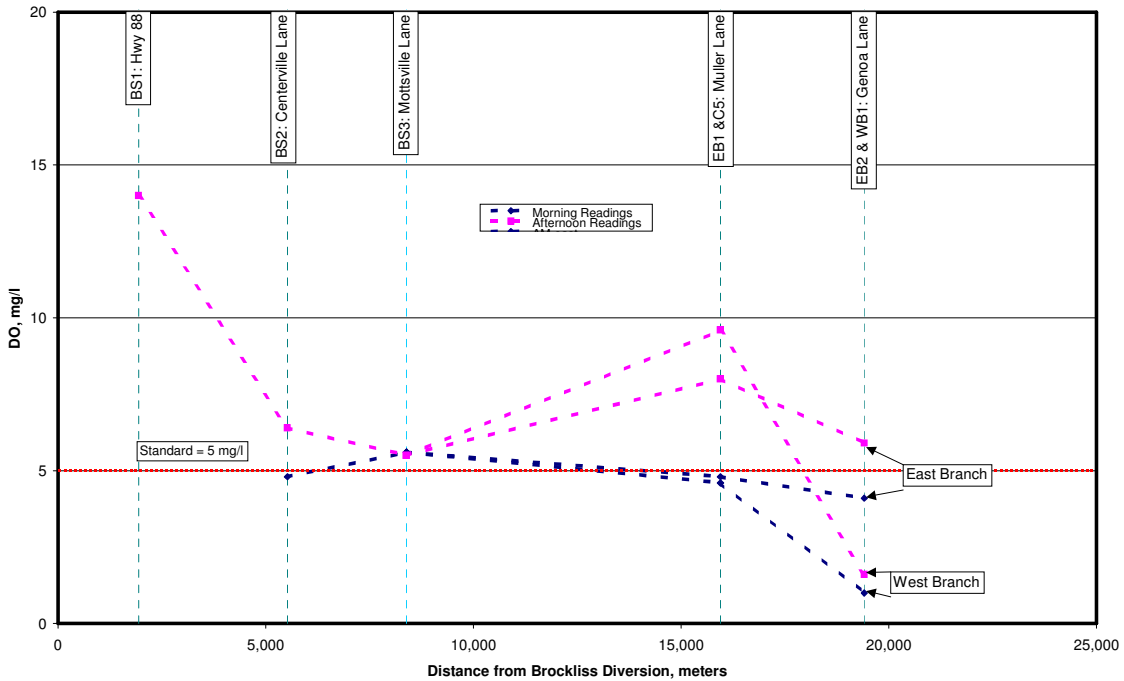


Figure D-3: Brockliss Slough - Dissolved Oxygen, 8/18/2005

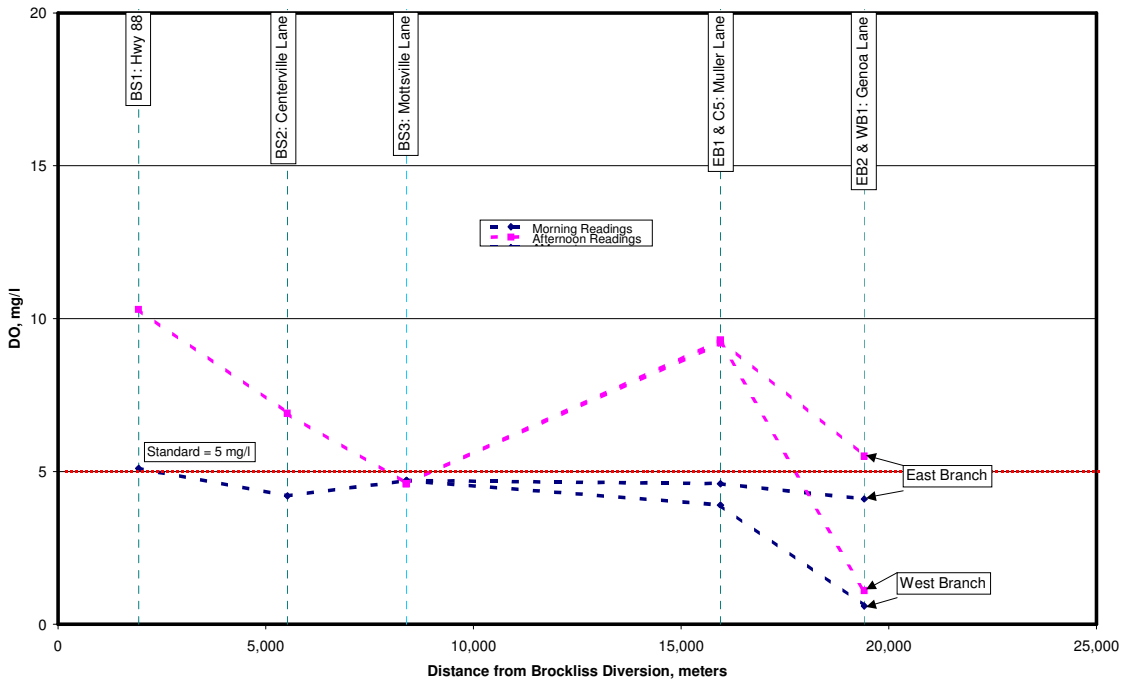


Figure D-4: Brockliss Slough - Dissolved Oxygen, 8/24/2005

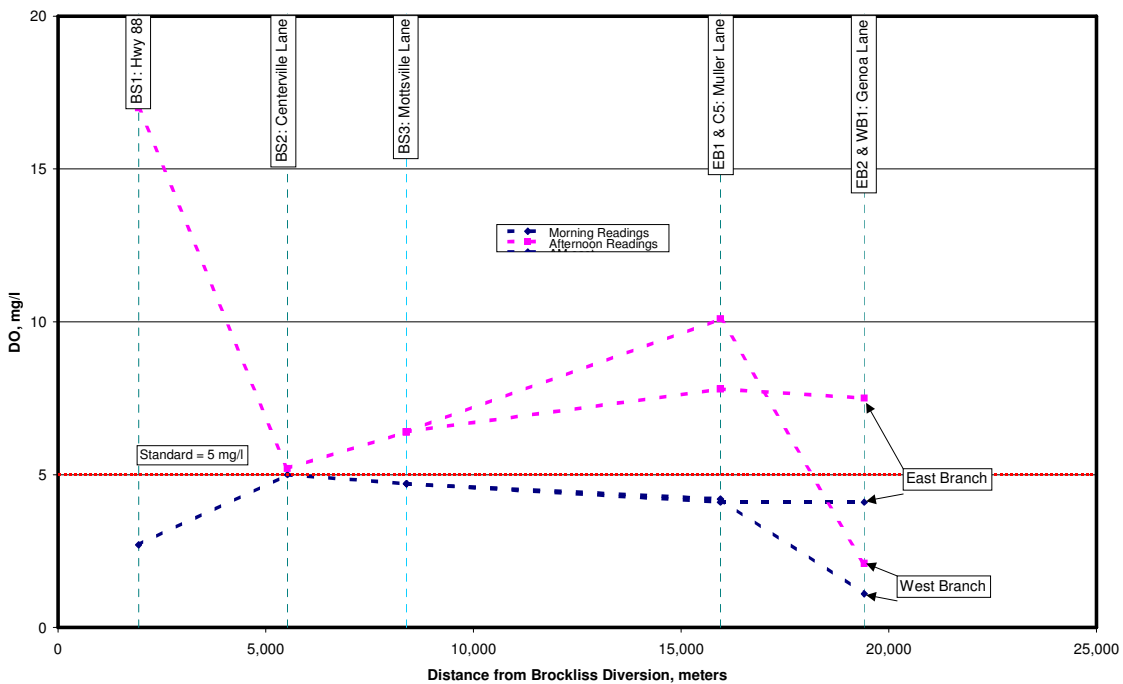


Figure D-5: Brockliss Slough - Dissolved Oxygen, 9/2/2005

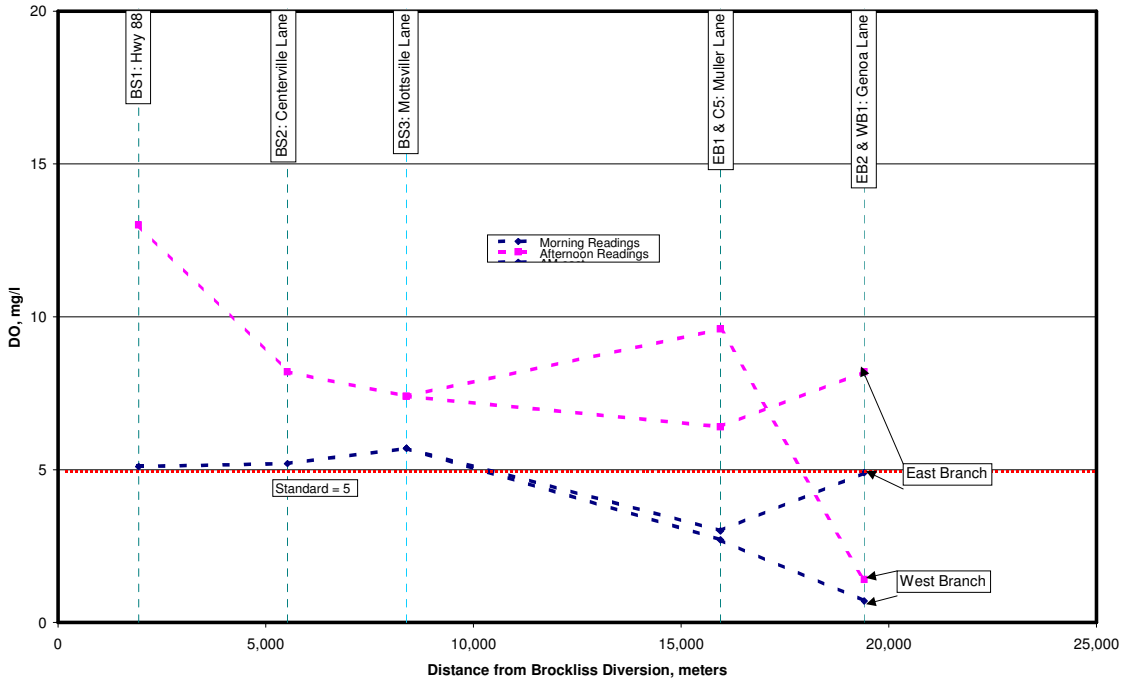


Figure D-6: Brockliss Slough - Temperature, 8/4/2005

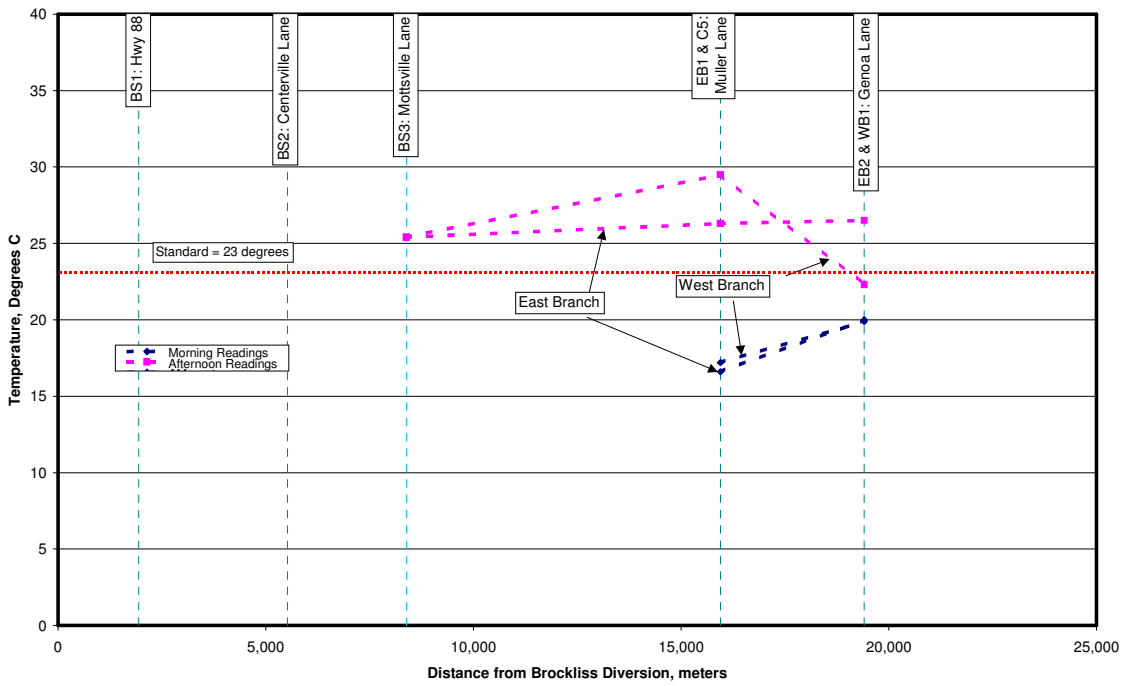


Figure D-7: Brockliss Slough - Temperature, 8/10/2005

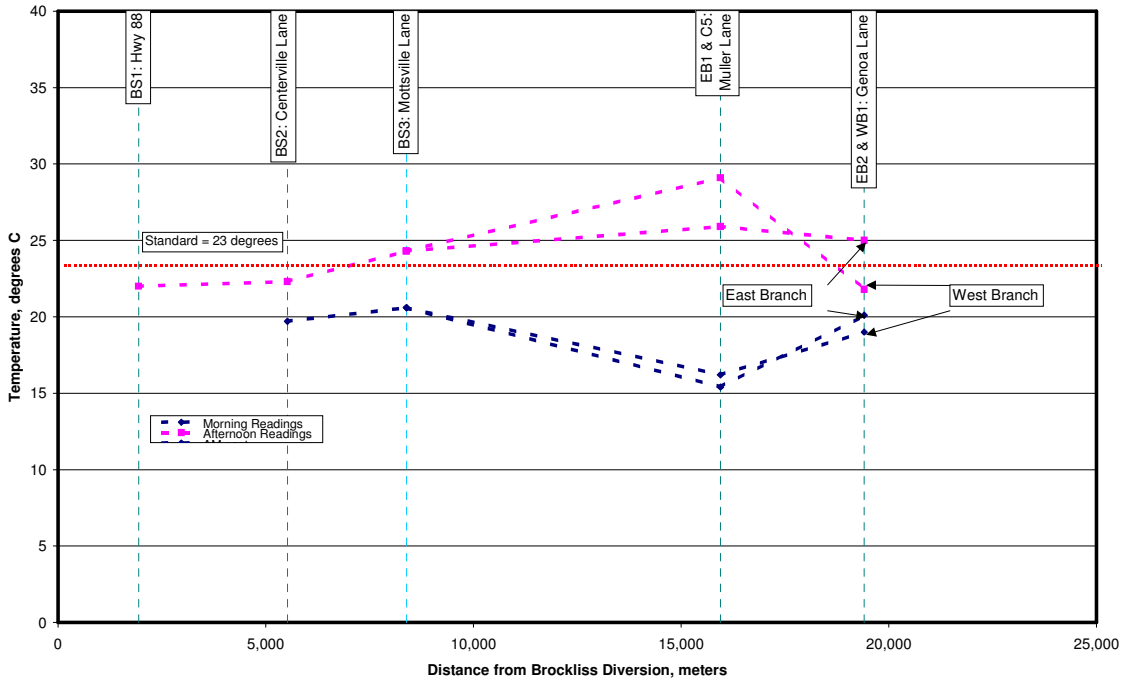


Figure D-8: Brockliss Slough - Temperature, 8/18/2005

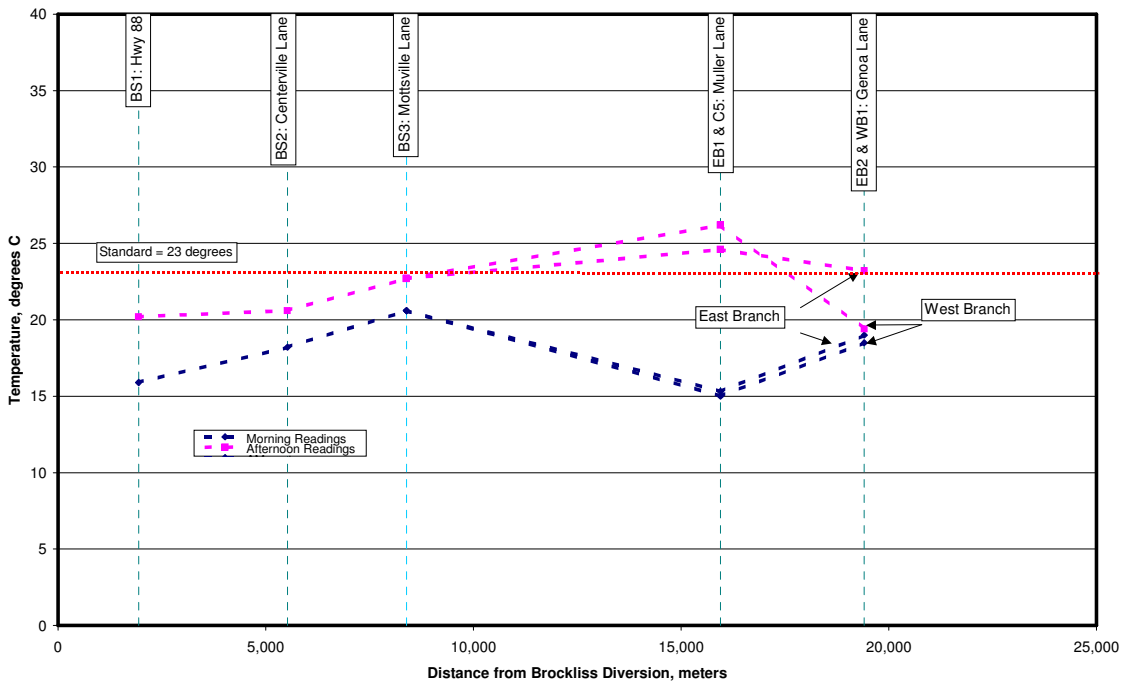


Figure D-9: Brockliss Slough - Temperature, 8/24/2005

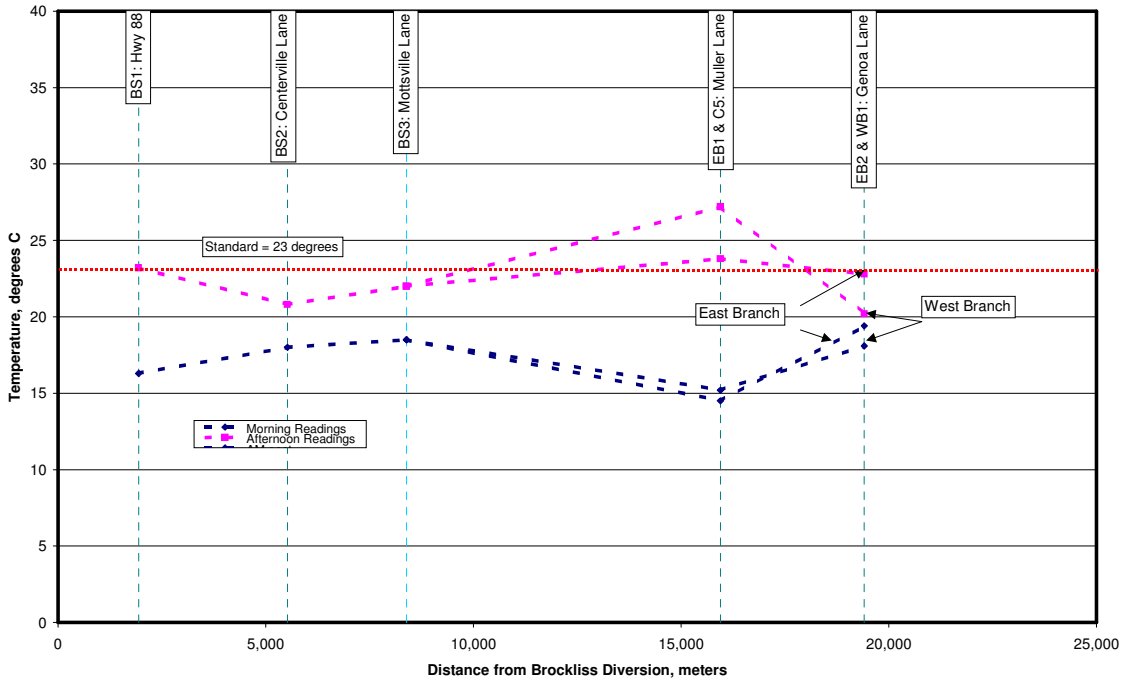


Figure D-10: Brockliss Slough - Temperature, 9/2/2005

