APPENDIX G – MADISON TEMPERATURE STUDY DATA COLLECTION

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G1.0 PROJECT BACKGROUND

The Montana Department of Environmental Quality (DEQ) performed a temperature study in 2013 to 2014 for several stream segments of concern based on temperature impairment listings at the time of the DEQ investigation, input from stakeholders in the Madison watershed, and DEQ observations in the field (**Table G-1** and **Figure G-1**).

Table G-1. Stream Segments of Concern for Temperature TMDL development in the Madison TPA

Stream Segment (Assessment Unit)	Assessment Unit ID	Temperature related impairment identified in the 2018 Integrated Report
Cherry Creek – headwaters to mouth (Madison River)	MT41F002_010	Temperature[1]
Elk Creek – headwaters to mouth (Madison River)	MT41F002_020	Temperature[1]
Jack Creek - headwaters to mouth (Madison River, T5S R1W S23)	MT41F004_050	None
Madison River – Madison Dam to mouth (Missouri River)	MT41F001_010	Temperature[2]
Moore Creek – springs to mouth (Fletcher Channel), T5S R1W S15	MT41F004_130	Temperature[1]
West Fork Madison River – headwaters to mouth (Madison River)	MT41F004_100	Temperature[2]

[1] Temperature TMDL written

[2] No temperature TMDL written in this document

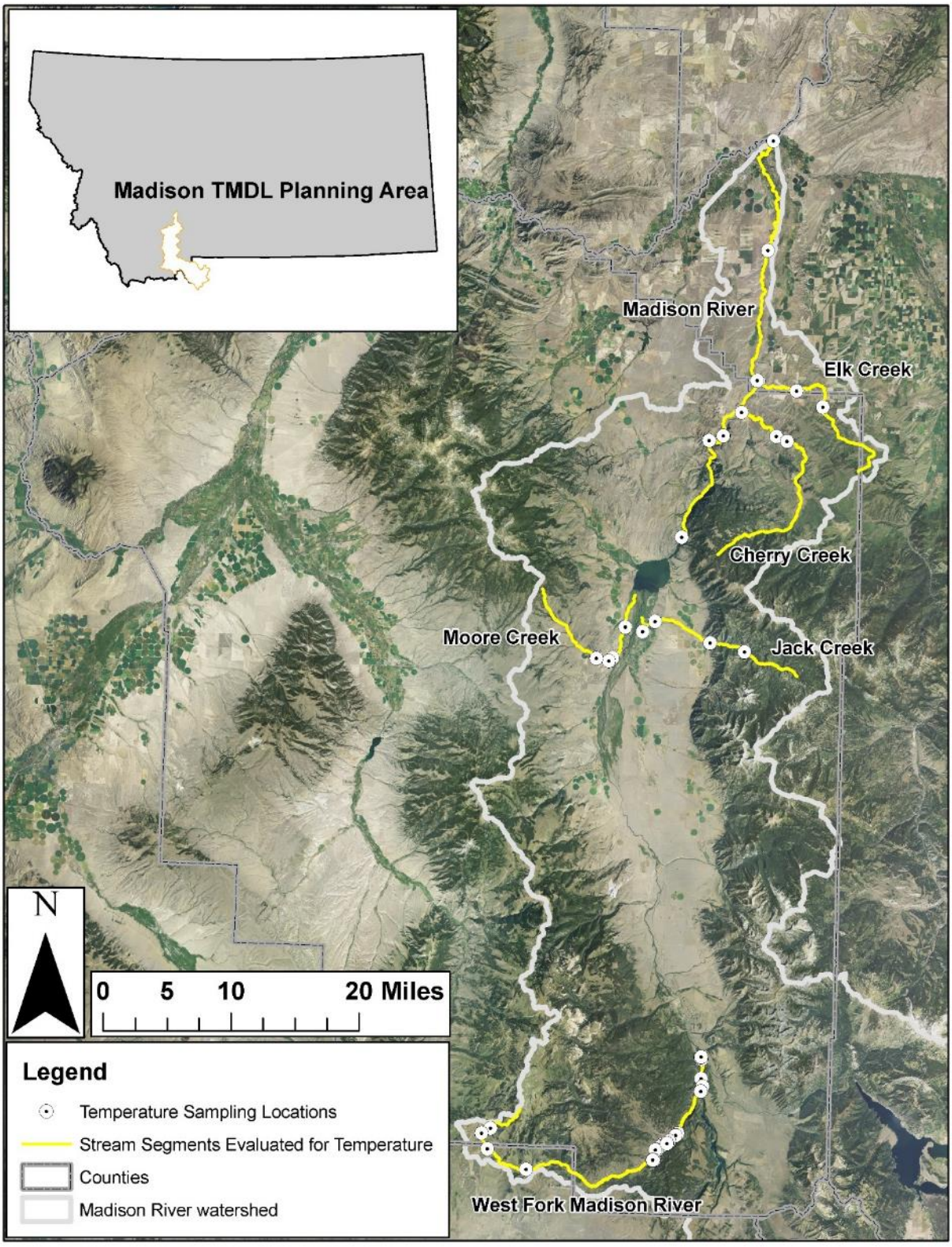

Figure G-1. Map of the Stream Segments Evaluated for Temperature in the Madison TPA

G2.0 DEQ MONITORING

Water temperature and shade data were collected by DEQ on Elk, Cherry, Jack, and Moore Creeks and on the West Fork Madison River in 2013. Additional data was collected in 2014 on the West Fork Madison and the lower Madison Rivers. A complete list of 2013 and 2014 DEQ temperature study sites can be found in **Section G.4.1** of this document. Streamflow data was collected by DEQ as part of the chemistry effort in 2012-2014. Channel geometry data was collected on the study streams in 2013-2014 as part of the sediment monitoring effort. Information regarding the lower segment of the Madison River was also provided by FWP and Northwestern Energy (formerly PPL Montana).

G2.1 TEMPERATURE MONITORING

Temperature monitoring was conducted by DEQ in 2013 and 2014 between June and September. The study examined stream temperatures during the period when streamflow tends to be the lowest and water temperatures the warmest, and thus when negative effects to the aquatic life beneficial use are likely most pronounced. Temperature monitoring consisted of placing temperature data loggers at multiple sites on each stream. Temperature monitoring sites were selected to bracket stream reaches with similar hydrology, riparian vegetation type, valley type, stream aspect, and channel width. Temperature data are summarized within **Section G.4.2** of this Appendix. For complete continuous temperature data, visit The National Water Quality Monitoring Council – Water Quality Portal - https://www.waterqualitydata.us/. FWP temperature monitoring data for the Madison River can be obtained by contacting DEQ's Monitoring and Assessment Section and site locations and a maximum temperature summary are found in **Section G.4.2.4** of this appendix.

G2.2 STREAMFLOW

Streamflow measurements were collected at multiple locations on each of the stream segments of concern for temperature by DEQ as part of chemistry sampling in 2012-2014.

G2.3 RIPARIAN SHADING

Characterization of riparian shade was based on a combination of field data collected at each site by DEQ in 2013 and aerial imagery analysis. Riparian shading was quantified using GIS tools and aerial imagery analysis to input variables into the Shade Tool, which is a model developed by the Washington Department of Ecology that calculates the percent effective shade and solar flux along a stream (Washington State Department of Ecology 2007). Field data were collected by DEQ to input into the Shade Tool, and Solar Pathfinder measured shade data were collected at multiple sites along each stream to verify and calibrate the Shade Tool outputs (See **Appendix F** for Shade Tool).

G2.4 CHANNEL GEOMETRY

Although not a direct measure of thermal effect on the stream, channel geometry can influence the rate of thermal loading. Wide, shallow streams transfer heat energy faster than narrow, deep streams. Therefore, channel geometry can be used to identify areas that may be destabilized, and may be more prone to rapid thermal loading, particularly in locations where shading is minimal. Channel geometry measurements were collected by DEQ in 2013 and 2014 as part of the sediment assessment for Elk, Cherry, Jack, and Moore Creeks and on the West Fork Madison River and can be found in **Sections**

6.4.2.1, 6.4.2.2, and **6.4.2.3** of this main TMDL document. Channel geometry was not collected by DEQ on the Madison River below Madison Dam.

G3.0 DATA COMPILATION FOR STREAM SEGMENTS OF CONCERN – SITE LIST, TEMPERATURE DATA, SOLAR PATHFINDER DATA, AND RIPARIAN VEGETATION SUMMARY

G3.1 DEQ TEMPERATURE MONITORING SITE LIST

Table G-2. Madison Temperature Study Sites

Site Number	Waterbody Name	Latitude	Longitude	2013	2014
1A	Elk Creek	45.6544	-111.5188	X	
1B	Elk Creek	45.6442	-111.4568	X	
1C	Elk Creek	45.6267	-111.4139	X	
1D	Elk Creek	45.5871	-111.3657	X	
2A	Cherry Creek	45.6184	-111.5448	X	
2B	Cherry Creek	45.5921	-111.4875	X	
2C	Cherry Creek	45.5870	-111.4702	X	
3A	Jack Creek	45.3672	-111.6948	X	
3X	Jack Creek	45.3789	-111.6750	X	
3D	Jack Creek	45.3565	-111.5859	X	
3F	Jack Creek	45.3472	-111.5299	X	
4A	Moore Creek	45.3719	-111.7227	X	
4D	Moore Creek	45.3363	-111.7420	X	
4E	Moore Creek	45.3329	-111.7478	X	
4F	Moore Creek	45.3354	-111.7679	X	
5A	West Fork Madison River	44.8872	-111.5833	X	X
5B	West Fork Madison River	44.8853	-111.5821	X	
5C	West Fork Madison River	44.8632	-111.5816	X	X
5D	West Fork Madison River	44.8490	-111.5813	X	X
5E	West Fork Madison River	44.8007	-111.6167	X	
5F	West Fork Madison River	44.7986	-111.6195	X	
5G	West Fork Madison River	44.7917	-111.6295	X	X
5H	West Fork Madison River	44.7888	-111.6331	X	X
5I	West Fork Madison River	44.7875	-111.6402	X	
5J	West Fork Madison River	44.7854	-111.6428	X	
5K	West Fork Madison River	44.7812	-111.6490	X	
5L	West Fork Madison River	44.7812	-111.6513	X	
5M	West Fork Madison River	44.7698	-111.6532	X	X
5N	West Fork Madison River	44.7697	-111.6556	X	X
5P	West Fork Madison River	44.7770	-111.9185		X

Table G-2. Madison Temperature Study Sites

Site Number	Waterbody Name	Latitude	Longitude	2013	2014
5Y	West Fork Madison River	44.8002	-111.9148		X
5X	West Fork Madison River	44.7944	-111.9287		X
7A	Elk River (West Fork Madison River project)	44.7898	-111.6333	X	X
8A	Freezeout Creek (West Fork Madison River project)	44.7983	-111.6198	X	
9A	Gazelle Creek (West Fork Madison River project)	44.8871	-111.5835	X	
12A	Lake Creek	44.8544	-111.5789		X
10A	Teepee Creek (West Fork Madison River project)	44.7698	-111.6550	X	X
6B	Madison River - Cobblestone	45.8023	-111.5089		X
6A	Madison River - Headwaters State Park	45.9264	-111.5044		X
6D	Madison River - Norris Rd.	45.5912	-111.5733		X
6C	Madison River -Black's Ford	45.6549	-111.5209		X
6E	Madison River-Beartrap Mouth	45.5856	-111.5958		X
6F	Madison River-Madison Dam	45.4752	-111.6357		X

Monitoring activities included continuous temperature loggers, instantaneous temperature data, and site notes at all stream segments of concern and their selected tributaries (Gazelle Creek, Teepee Creek, Lake Creek, Freezeout Creek, and the Elk River). Stream segments of concern additionally included channel morphology, photos, and shade data collection (Elk Creek, Cherry Creek, Jack Creek, Moore Creek, West Fork Madison River, and Mainstem Madison River sites).

G3.2 Temperature, Flow, Solar Pathfinder, and Riparian Vegetation Summary

Temperature, flow, solar pathfinder, and riparian vegetation data are summarized for the main study streams: Cherry, Elk, Jack, and Moore Creeks and the West Fork Madison and Lower Madison Rivers. For complete continuous temperature data, visit The National Water Quality Monitoring Council – Water Quality Portal - https://www.waterqualitydata.us/

G3.2.1 Cherry Creek

The following describe site location and maximum temperatures for 3 sites on Cherry Creek (**Table G-3 and Figures G-2** to **G-6**). Flow data are summarized in **Table G-4** and solar pathfinder data is summarized in **Table G-5**. Riparian vegetation summaries are found at the end of this appendix in **Table G-20**.

Table G-3. Cherry Creek DEQ Temperature Study Sites and Maximum Temperatures

Site	Site Description	River Mile	Tmax (°F)	MWAT/7-Day Avg Daily Max (°F)	Warmest Day of 7-Day Max
2A	Near the mouth	0.4	77.9	76.3	7/26/13
2B	At the bridge, above riparian restoration project	5.9	66.4	65.2	8/18/13
2C	Below Cowboy Canyon	7.1	66.3	65.3	7/3/13

Figure G-2. Cherry Creek DEQ Temperature Study Sites

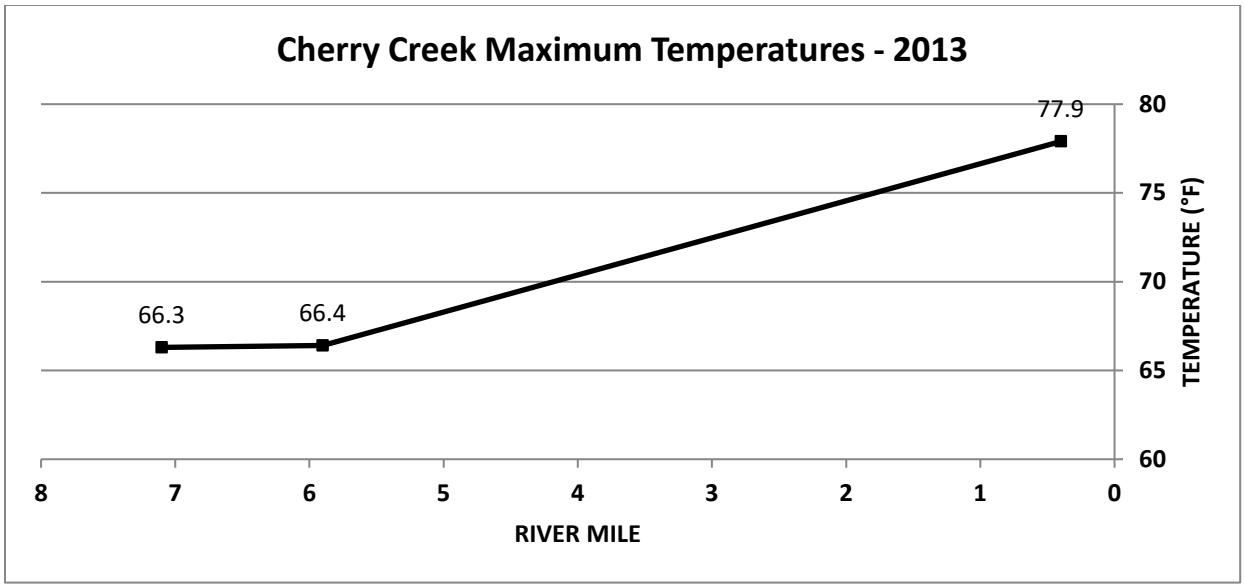

Figure G-3. Maximum temperature profile for three sites on Cherry Creek

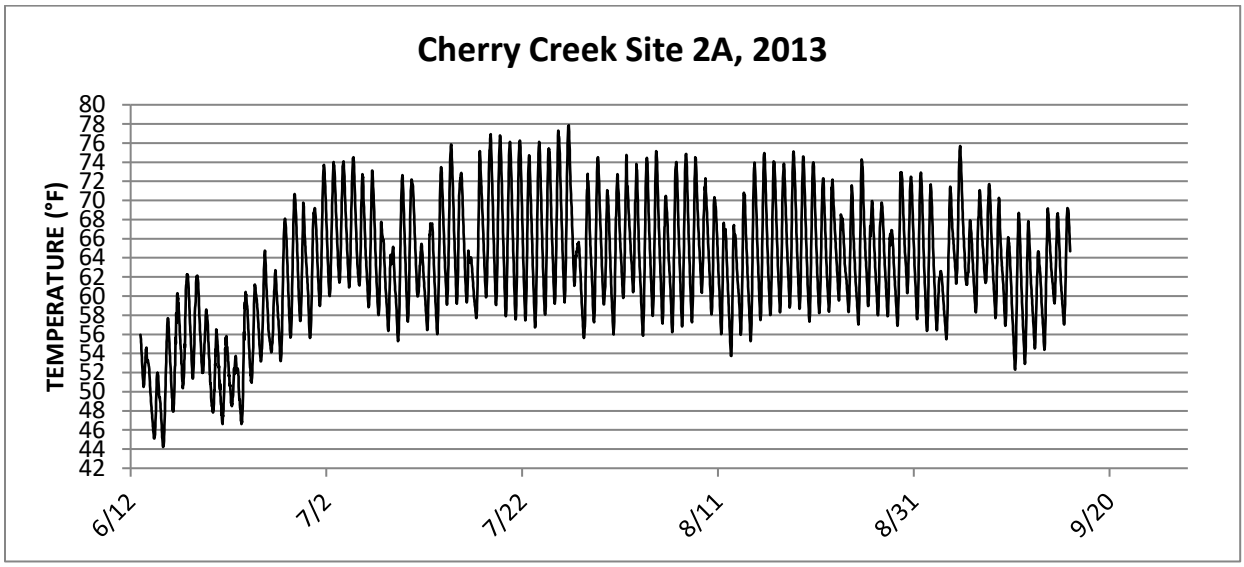

Figure G-4. Cherry Creek 2A Continuous Temperature 6/13/13 through 9/15/13

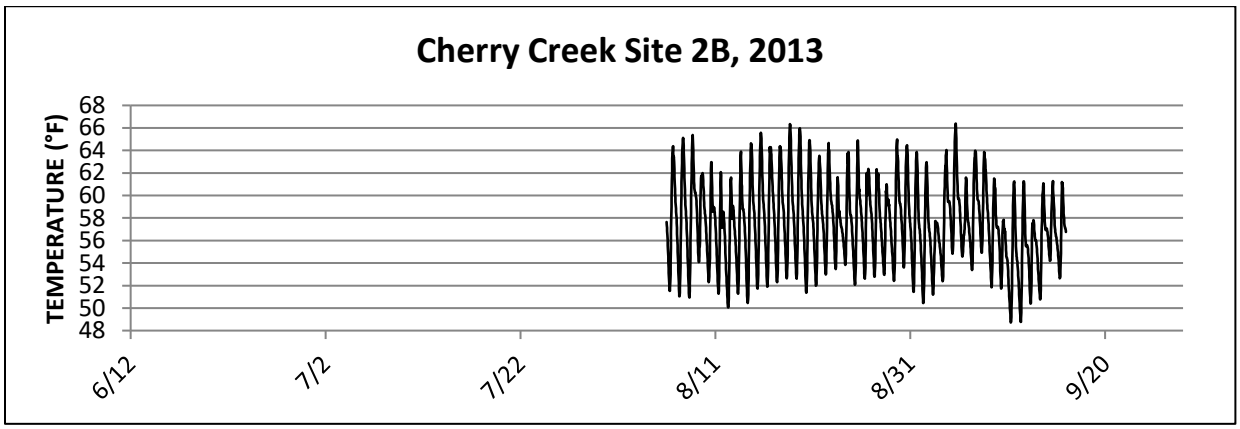

Figure G-5. Cherry Creek 2B Continuous Temperature 8/06/13 through 9/15/13

On 6/14, a high flow event swept the datalogger and brick anchor up onto riprap beneath the bridge where it was deployed. It remained dry until August 6, when discovered, and was then placed back in the channel

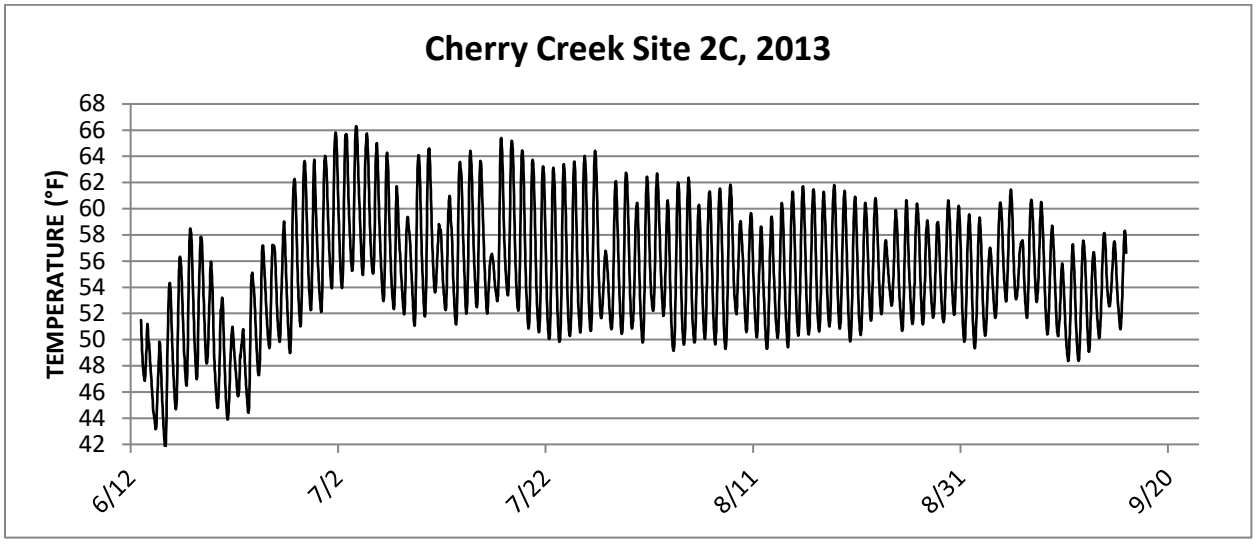

Figure G-6. Cherry Creek 2C Continuous Temperature 8/06/13 through 9/15/13

Table G-4. Cherry Creek DEQ Flow Measurements 2013

Date	Stream	STORET Site ID	Total Discharge (ft3/s)
8/6/2013	Cherry Creek	MDEQ_WQ_WQX-M06CHRYC01	14.59
8/5/2013	Cherry Creek	MDEQ_WQ_WQX-M06CHRYC02	18.05
8/5/2013	Cherry Creek	MDEQ_WQ_WQX-M06CHRYC03	17.4

Table G-5. Cherry Creek DEQ Solar Pathfinder Data 2013

Date	Stream Name	Transect Number	Solar Pathfinder Photo #s at 25%, 50%, 75% Wetted Width	Percent Shade at 25 % Wetted width	Percent Shade at 50 % Wetted width	Percent Shade at 75 % Wetted width
8/5/2013	Cherry Creek	2C-1	0536, 0537, 0538	83	69	65
8/5/2013	Cherry Creek	2B-1	0542, 0543, 0544	3	8	16
8/6/2013	Cherry Creek	2A-1	0565, 0566, 0567	6	3	2

Cherry Creek DEQ Riparian Vegetation Summary
See **Table G-20** at the end of this Appendix.

G3.2.2 Elk Creek

The following describe site location and maximum temperatures for 4 sites on Elk Creek (**Table G-6 and Figures G-7 to G12**). Flow data are summarized in **Table G-7** and solar pathfinder data is summarized in **Table G-8.** Riparian vegetation summaries are found at the end of this appendix in **Table G-20**.

Table G-6. Elk Creek Temperature Study Sites and Maximum Temperatures

Site	Site Description	River Mile	Tmax (°F)	7-Day Avg Daily Max (°F)	Warmest Day of 7-Day Max
1A	Near the mouth	0.2	84.7	75.8	6/26/13 (went dry)
1B	Upstream of an irrigated crop field and a different valley type than the site located u/s	3.9	80.6	78.3	7/2/13
1C	Located in a narrow valley dominated by conifer trees. It is u/s of pasture land and a wider valley type.	8.5	77.7	75.7	7/3/13
1D	Site is near the headwaters	12.8	77.8	76.0	7/3/13

Figure G-7. Elk Creek DEQ Temperature Study Sites

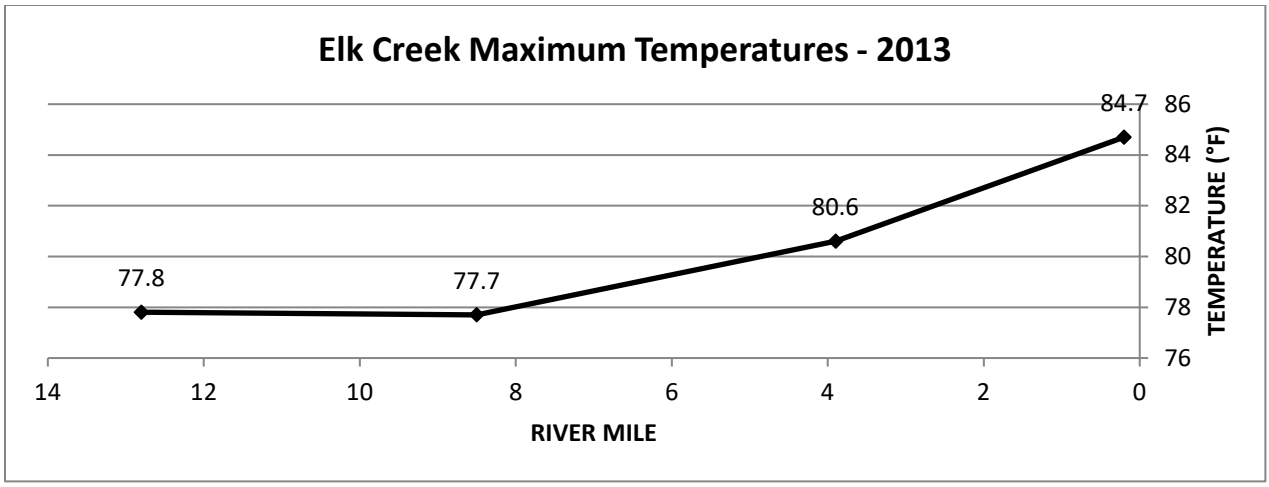

Figure G-8. Maximum temperature profile for four sites on Elk Creek

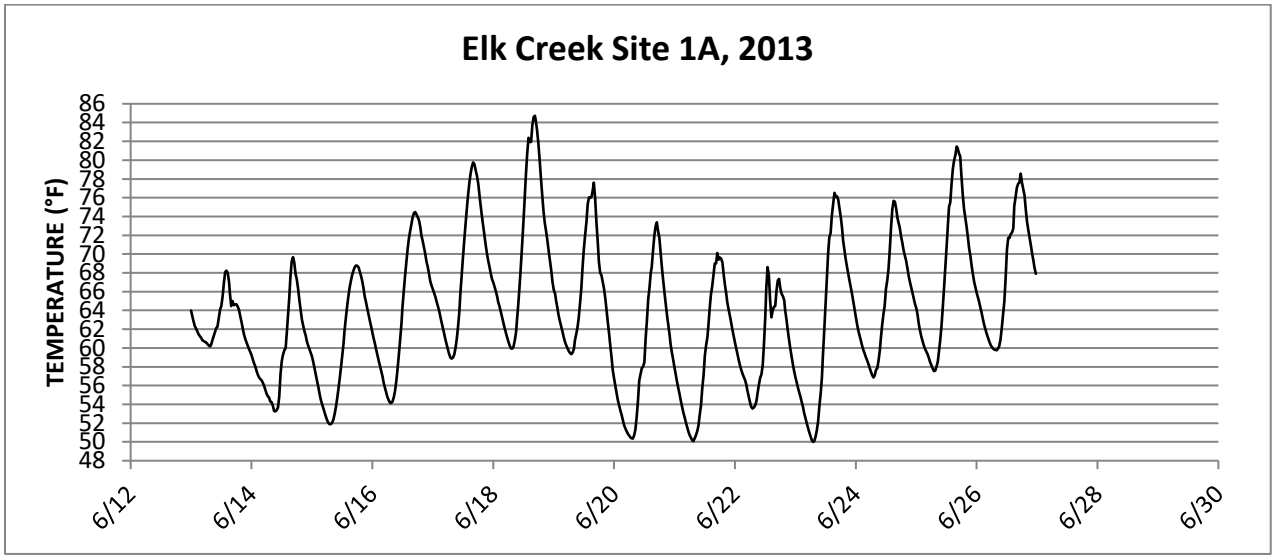

Figure G-9. Elk Creek 1A Continuous Temperature 6/13/13 through 6/26/13

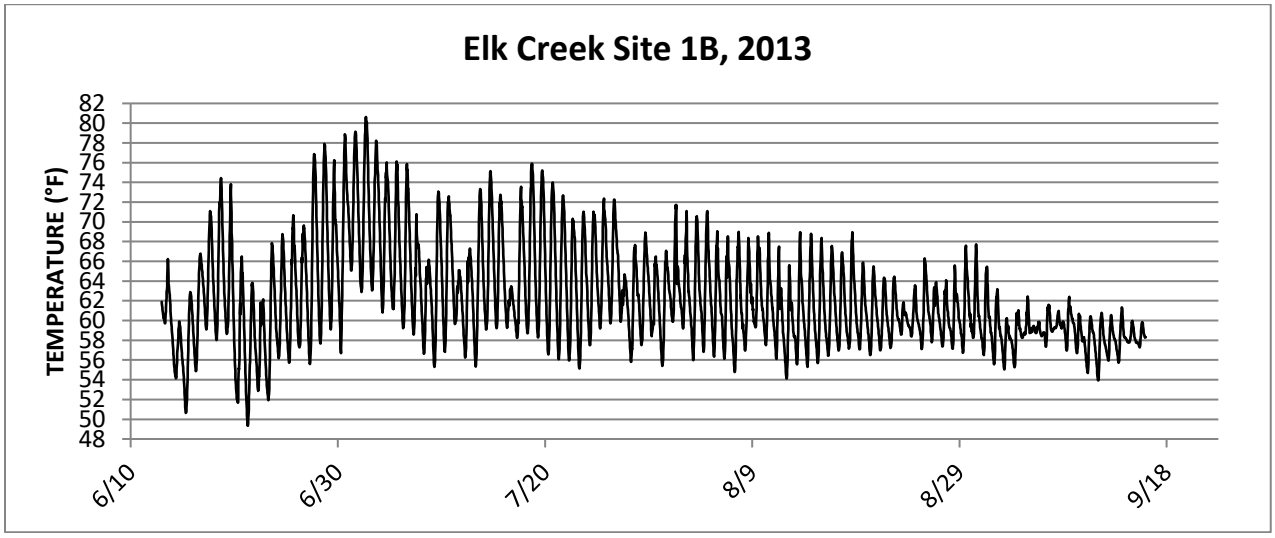

Figure G-10. Elk Creek 1B Continuous Temperature 6/13/13 through 9/15/13

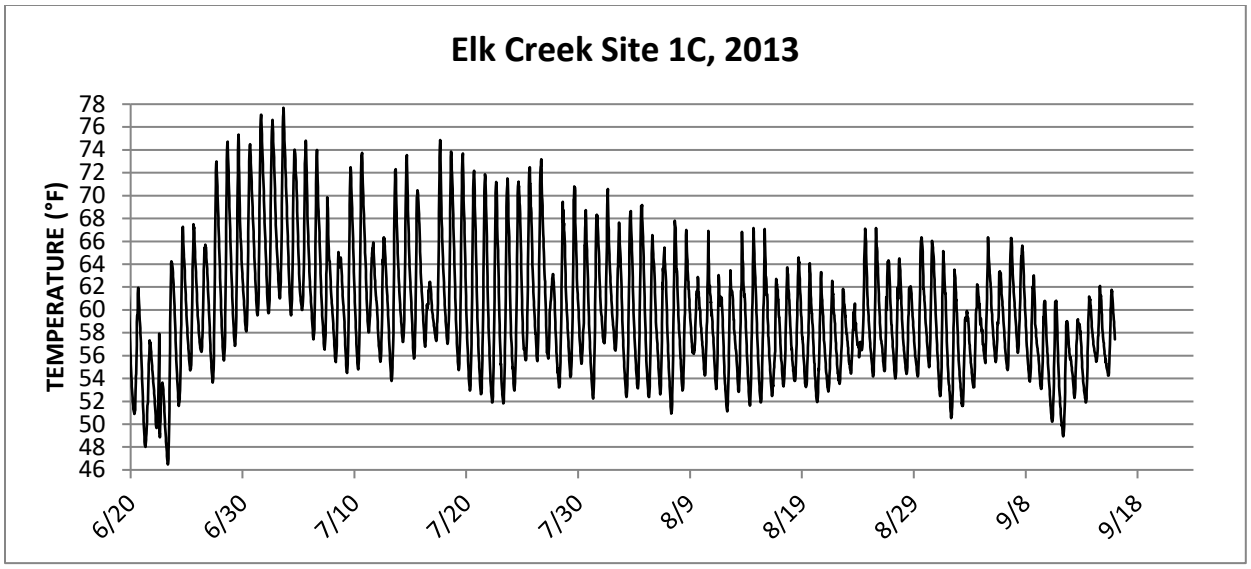

Figure G-11. Elk Creek 1C Continuous Temperature 6/13/13 through 9/15/13

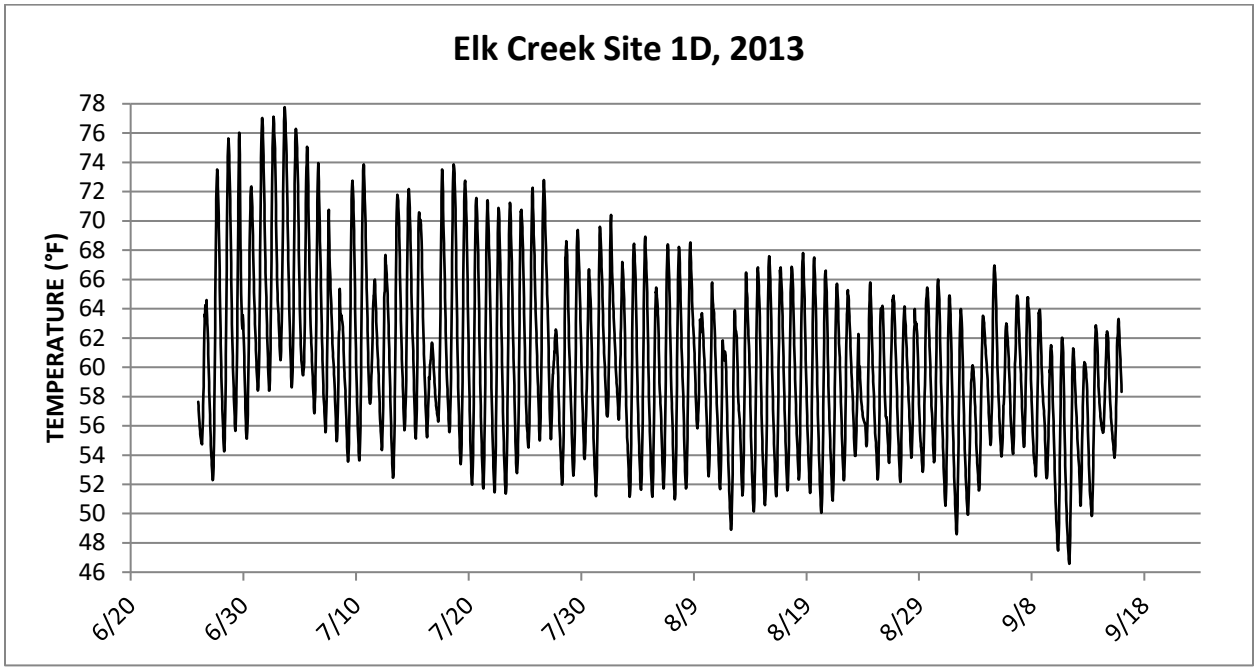

Figure G-12. Elk Creek 1D Continuous Temperature 6/26/13 through 9/15/13

Table G-7. Elk Creek DEQ Flow Measurements 2013

Date	Stream	Site ID	Total Discharge (ft^3/s)
6/19/2012	Elk Creek	MDEQ_WQ_WQX-M06ELKC03	2.03
7/25/2012	Elk Creek	MDEQ_WQ_WQX-M06ELKC03	0.46
8/28/2012	Elk Creek	MDEQ_WQ_WQX-M06ELKC03	0.11
6/19/2012	Elk Creek	MDEQ_WQ_WQX-M06ELKC04	2.97
7/25/2012	Elk Creek	MDEQ_WQ_WQX-M06ELKC04	0.47
8/28/2012	Elk Creek	MDEQ_WQ_WQX-M06ELKC04	0.05
8/6/2013	Elk Creek	MDEQ_WQ_WQX-M06ELKC02	0.14
9/16/2013	Elk Creek	MDEQ_WQ_WQX-M06ELKC02	0.23
6/12/2013	Elk Creek	MDEQ_WQ_WQX-M06ELKC03	2.71

Table G-7. Elk Creek DEQ Flow Measurements 2013

Date	Stream	Site ID	Total Discharge (ft^3/s)
8/2/2013	Elk Creek	MDEQ_WQ_WQX-M06ELKC03	0.05
8/15/2013	Elk Creek	MDEQ_WQ_WQX-M06ELKC03	0.05
9/16/2013	Elk Creek	MDEQ_WQ_WQX-M06ELKC03	0.001
8/2/2013	Elk Creek	MDEQ_WQ_WQX-M06ELKC04	0
8/5/2013	Elk Creek	MDEQ_WQ_WQX-M06ELKC05	0.11
9/16/2013	Elk Creek	MDEQ_WQ_WQX-M06ELKC05	0.21
8/23/2013	Elk Creek	MDEQ_WQ_WQX-M06ELKC06	0

Table G-8. Elk Creek Solar Pathfinder Data 2013

Date	Stream Name	Transect Number	Solar Pathfinder Photo #s at 25%, 50%, 75% Wetted Width	Percent Shade at 25 % Wetted width	Percent Shade at 50 % Wetted width	Percent Shade at 75 % Wetted width
8/2/2013	Elk Creek	1A	No measurement taken			
8/2/2013	Elk Creek	1B-1	0516, 0517, 0518	23	9	21
8/6/2013	Elk Creek	1C-1	0545, 0546, 0547	75	72	74
8/6/2013	Elk Creek	1C-2	0559, 0560, 0561	5	5	21
8/5/2013	Elk Creek	1D-1	0525, 0526, 0527	25	33	6

Elk Creek DEQ Riparian Vegetation Summary
See **Table G-20** at the end of this Appendix.

G3.2.3 Jack Creek

The following describe site location and maximum temperatures for 4 sites on Jack Creek (**Table G-9 and Figures G-13 to G-18**). Flow data are summarized in **Table G-10** and solar pathfinder data is summarized in **Table G-11.** Riparian vegetation summaries are found at the end of this appendix in **Table G-20**.

Table G-9. Jack Creek Temperature Study Sites and Maximum Temperatures

Site	Site Description	River Mile	Tmax (°F)	7-Day Avg Daily Max (°F)	Warmest Day of 7-Day Max
Jack Creek-3A	Near the mouth, at Jeffers Road	0.5	57.50	55.2	7/2/2013
Jack Creek 3X	At bridge on Jack Creek Road	1.5	72.00	70.5	8/19/2013
Jack Creek-3D	At gage station	6.5	63.10	61.8	7/17/2013
Jack Creek-3F	At CG, u/s of Aspen Cr.	9.7	59.80	58.9	7/18/2013

Figure G-13. Jack Creek DEQ Temperature Study Sites

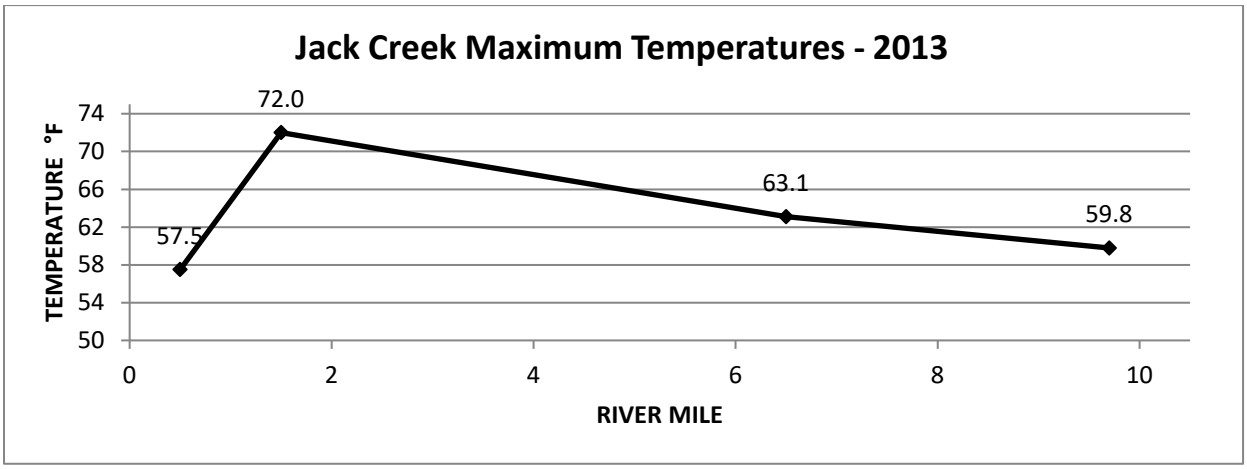

Figure G-14. Maximum temperature profile for four sites on Jack Creek

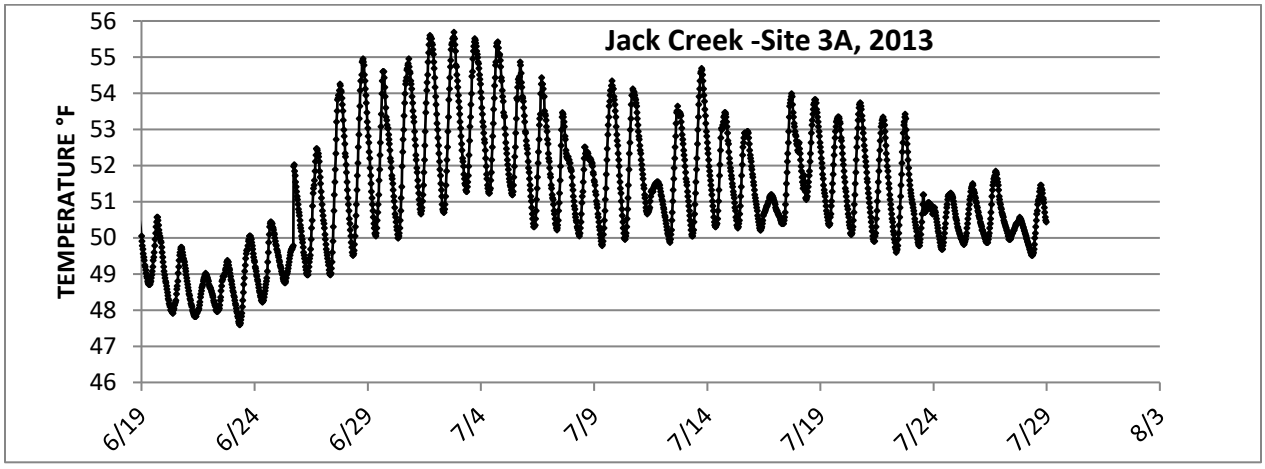

Figure G-15. Jack Creek 3A Continuous Temperature 6/12/13 through 7/28/13

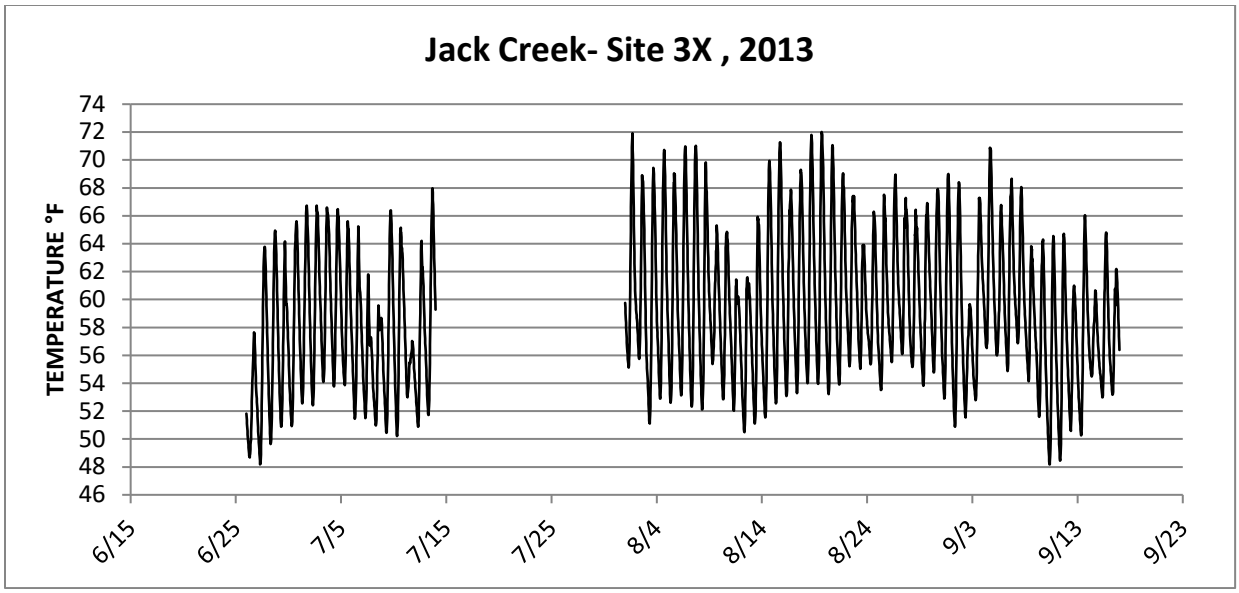

Figure G-16. Jack Creek 3X Continuous Temperature 6/26/13-7/13/13 and 8/1/13-9/16/13

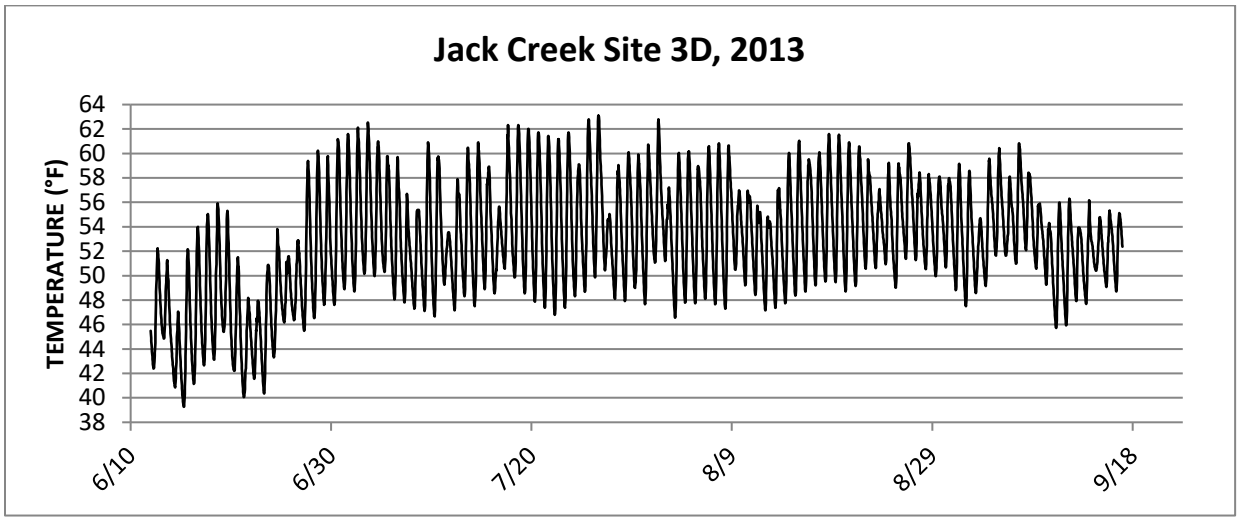

Figure G-17. Jack Creek 3D Continuous Temperature 6/12/13 through 9/16/13

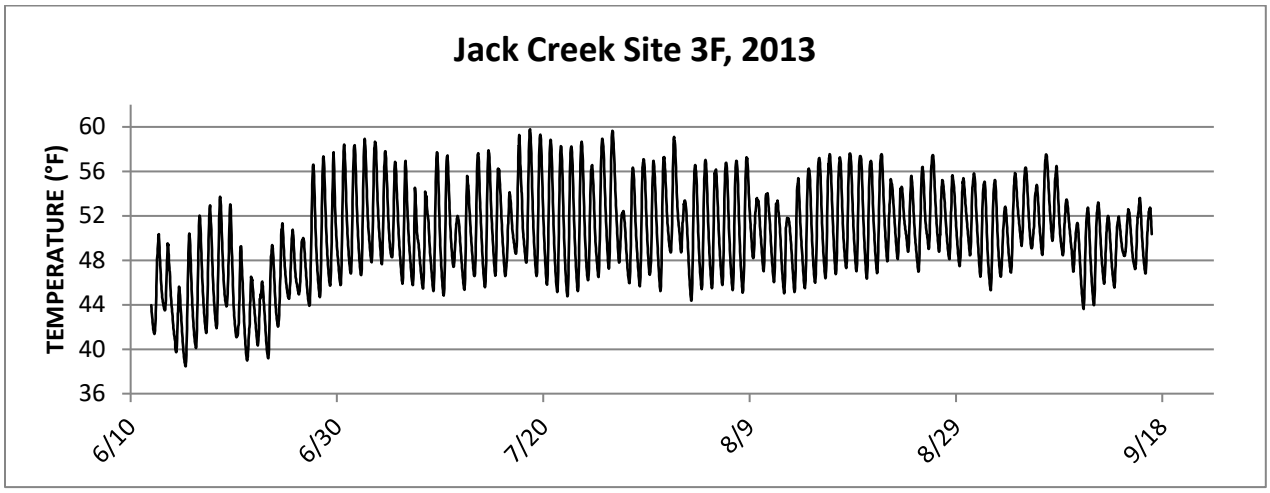

Figure G-18. Jack Creek 3F Continuous Temperature 6/12/13 through 9/16/13

Table G-10. Jack Creek DEQ Flow Measurements 2012 and 2013

Date	Stream	Site ID	Total Discharge (ft3/s)
7/29/2013	Jack Creek	MDEQ_WQ_WQX-M06JACKC01	30.98
8/1/2013	Jack Creek	MDEQ_WQ_WQX-M06JACKC03	8.51
8/1/2013	Jack Creek	MDEQ_WQ_WQX-M06JACKC04	14
8/21/2012	Jack Creek	MDEQ_WQ_WQX-M06JACKC01	27.16
8/22/2012	Jack Creek	MDEQ_WQ_WQX-M06JACKC02	10.51

Table G-11. Jack Creek Solar Pathfinder Data 2013

Date	Stream Name	Transect Number	Solar Pathfinder Photo #s at 25%, 50%, 75% Wetted Width	Percent Shade at 25 % Wetted width	Percent Shade at 50 % Wetted width	Percent Shade at 75 % Wetted width
7/29/2013	Jack Creek	3D-1	0421, 0422, 0423	90	45	46
7/29/2013	Jack Creek	3F-1	0412, 0413, 0414	15	19	57
7/29/2013	Jack Creek	3F-2	0418, 0419, 0420	71	67	53
8/1/2013	Jack Creek	3X-1	0468, 0469, 0470	47	54	37
8/1/2013	Jack Creek	3A-1	0476, 0477, 0478	13	12	13

Jack Creek DEQ Riparian Vegetation Summary
See **Table G-20** at the end of this Appendix.

G3.2.4 Madison River

The following describe FWP water temperature monitoring locations for 15 sites, from upstream of Hebgen Reservoir to the Mouth of the Madison River at Headwaters State Park (**Table G-12** and **Figure G-19**) and seasonal maximum temperature longitudinal profiles for Madison River FWP monitored sites from 2008-2013 (**Figure G-20**). DEQ shade monitoring locations and solar pathfinder data are summarized in **Figure G-21** and **Table G-13**.

Table G-12. FWP temperature monitoring site locations

Site	Approx. river mile	Latitude	Longitude
Hebgen Inlet	125.6	44.71602	-111.1024
Hebgen discharge	109	44.8649	-111.3377
Quake inlet	107	44.85318	-111.3531
Quake outlet	101.4	44.82975	-111.4236
Kirby	89.8	44.88888	-111.5799
Wall Ck Bridge	81.4	44.97582	-111.6469
McAtee	72.2	45.09721	-111.6624
Ennis Bridge	50.6	45.34794	-111.7224
Ennis Res Inlet	43.9	45.41301	-111.6942
Ennis Dam	40.3	45.46977	-111.6381
Beartrap Mouth	30.6	45.58558	-111.5958
Norris	28.2	45.59121	-111.5733
Black's Ford	23.7	45.6549	-111.5209
Cobblestone	11.4	45.80234	-111.5089
Headwaters State Park	0.1	45.92639	111.5044

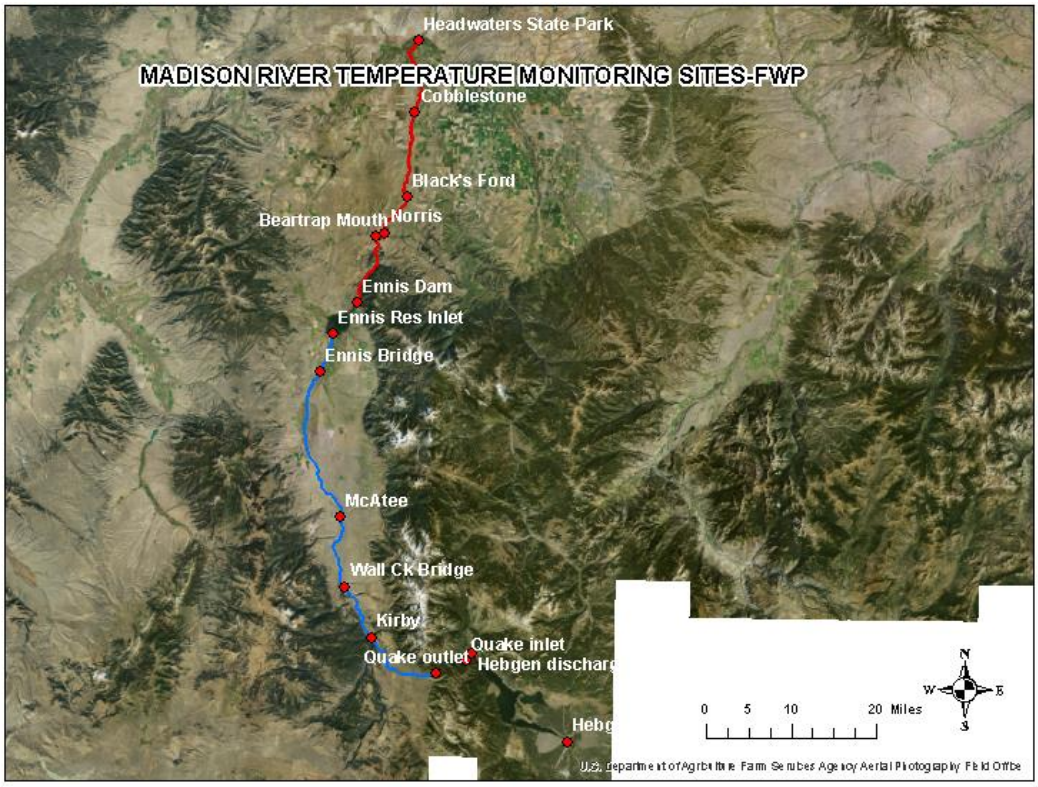

Figure G-19. FWP temperature monitoring site locations

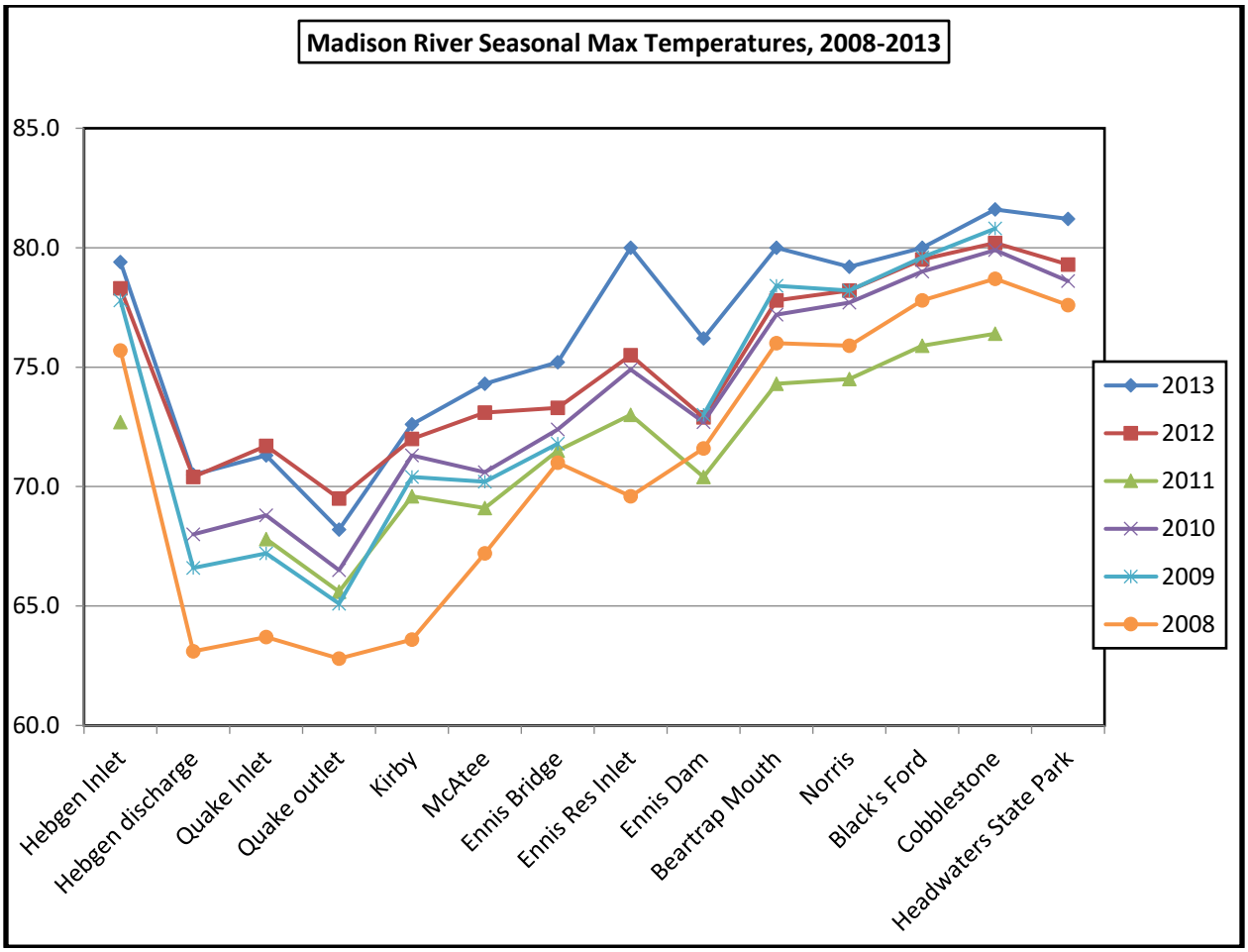

Figure G-20. Seasonal maximum temperature longitudinal profiles of the Madison River for 2008-2013 (FWP data)

Table G-13. Madison River Solar Pathfinder Data 2014

Date	Stream Name	Transect Number	Solar Pathfinder Photo #s at 25%, 50%, 75% Wetted Width	Percent Shade at 25 % Wetted width	Percent Shade at 50 % Wetted width	Percent Shade at 75 % Wetted width
7/22/2014	Madison River	6F	0942	22 (at L bank)	34 (at right bank)	
7/22/2014	Madison River	6E	0932	4 (at L bank)	46 (at right bank)	
7/22/2014	Madison River	6D	0928, 0919	7 (at L bank)	78 (at right bank)	
7/22/2014	Madison River	6C	0913	no data	5 (at right bank)	
7/22/2014	Madison River	6B	0904, 0905, 0909	2 (at L bank)	0 (at right bank)	
7/22/2014	Madison River	6A	0900, 0893	0 (at L bank)	2 (at right bank)	

Figure G-21. DEQ shade monitoring locations on the Madison River

G3.2.5 Moore Creek

The following describe site location and maximum temperatures for 4 sites on Moore Creek (**Table G-14 and Figures G-22 to G-27**). Flow data are summarized in **Table G-15** and solar pathfinder data is summarized in **Table G-16**. Riparian vegetation summaries are found at the end of this appendix in **Table G-20**.

Table G-14. Moore Creek Temperature Study Sites and Maximum Temperatures

Site ID	Site Description	River Mile	Tmax (°F)	7-Day Avg Daily Max/MWMT (°F)	Warmest Day of 7-Day Max
4A	Southern boundary of Valley Garden property	5.0	78.0	77.0	7/3/2013
4D	On Willow Ranch	7.9	72.1	70.9	7/3/2013
4E	Upstream of Madison Canal	8.3	65.7	64.9	7/3/2013
4F	Downstream of Maloney Pond	9.3	70.0	68.9	7/1/2013

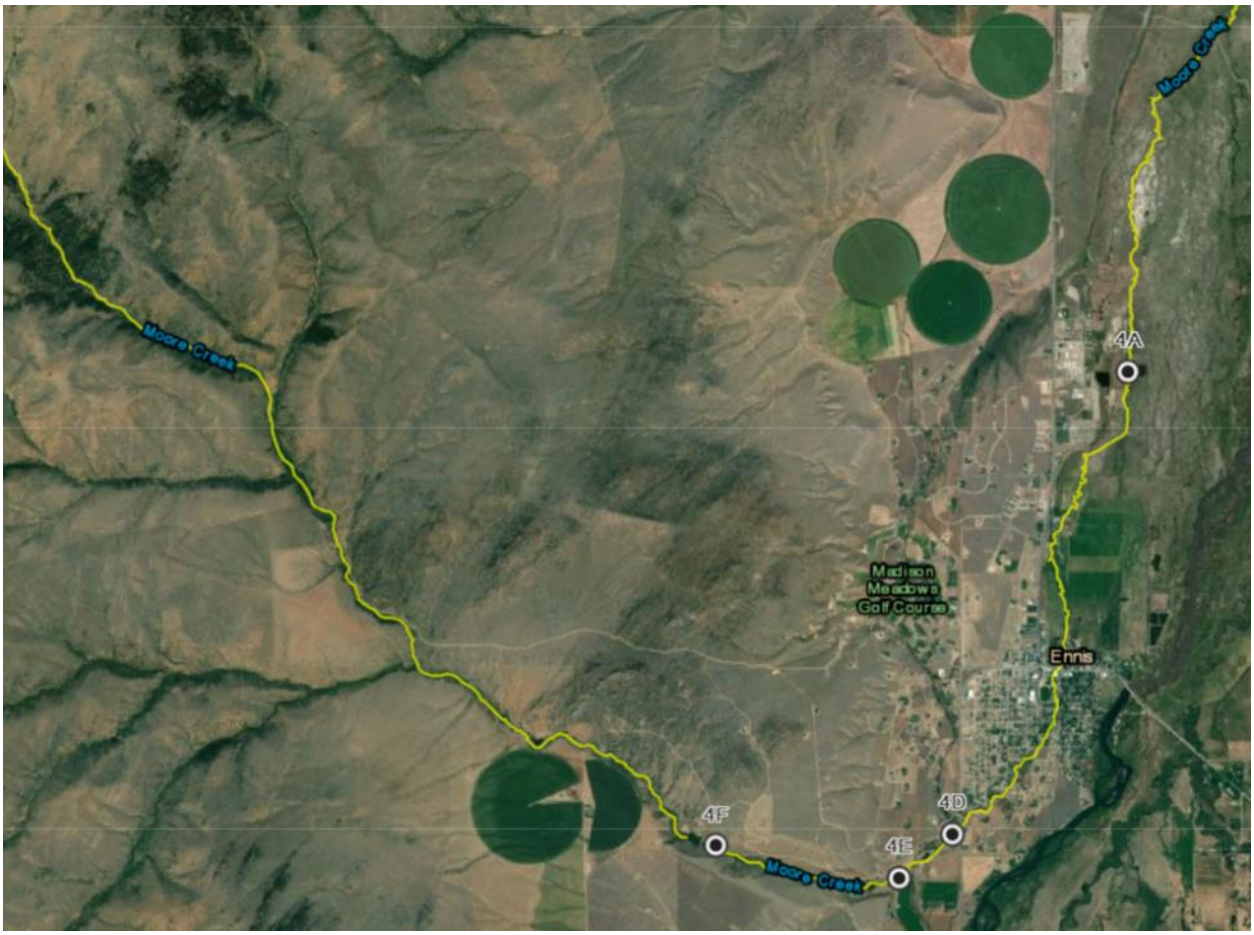

Figure G-22. Moore Creek DEQ Temperature Study Sites

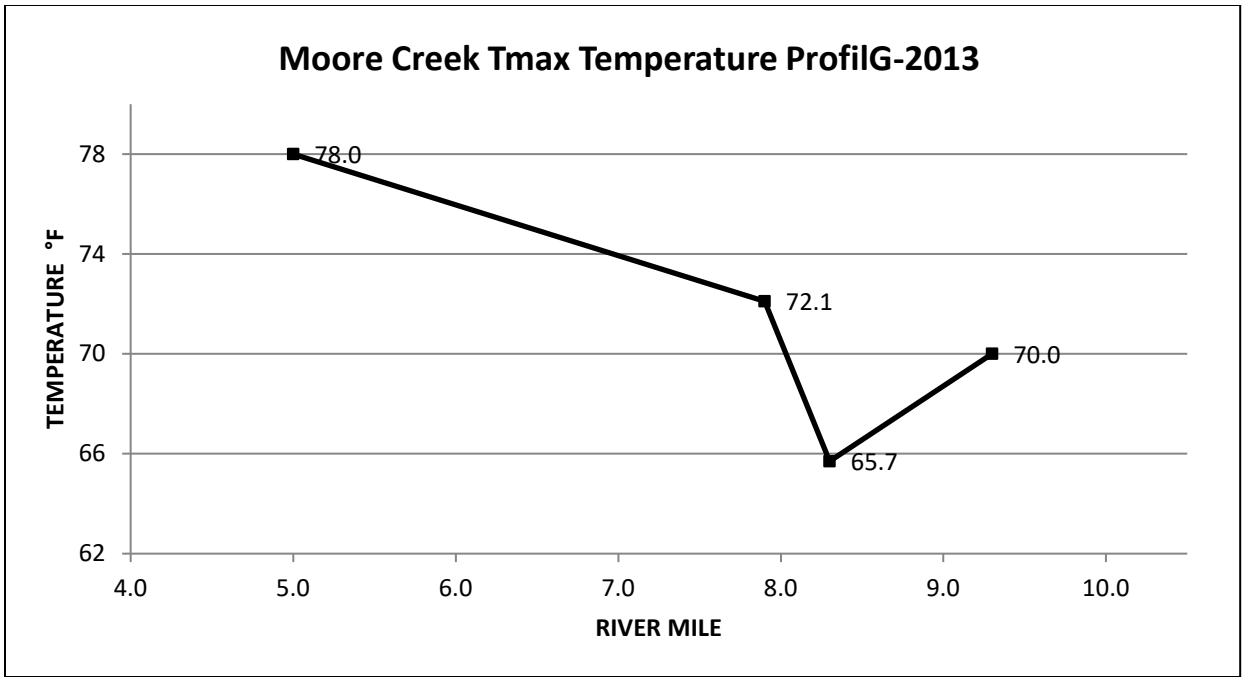

Figure G-23. Maximum temperature profile for four sites on Moore Creek

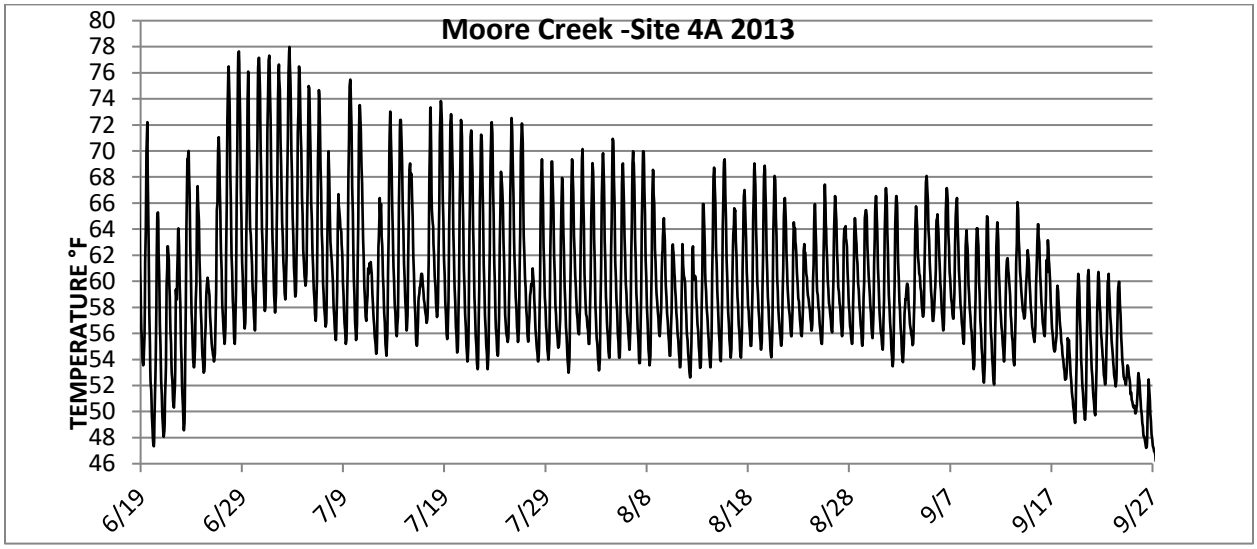

Figure G-24. Moore Creek 4A Continuous Temperature 6/19/13 through 9/27/13

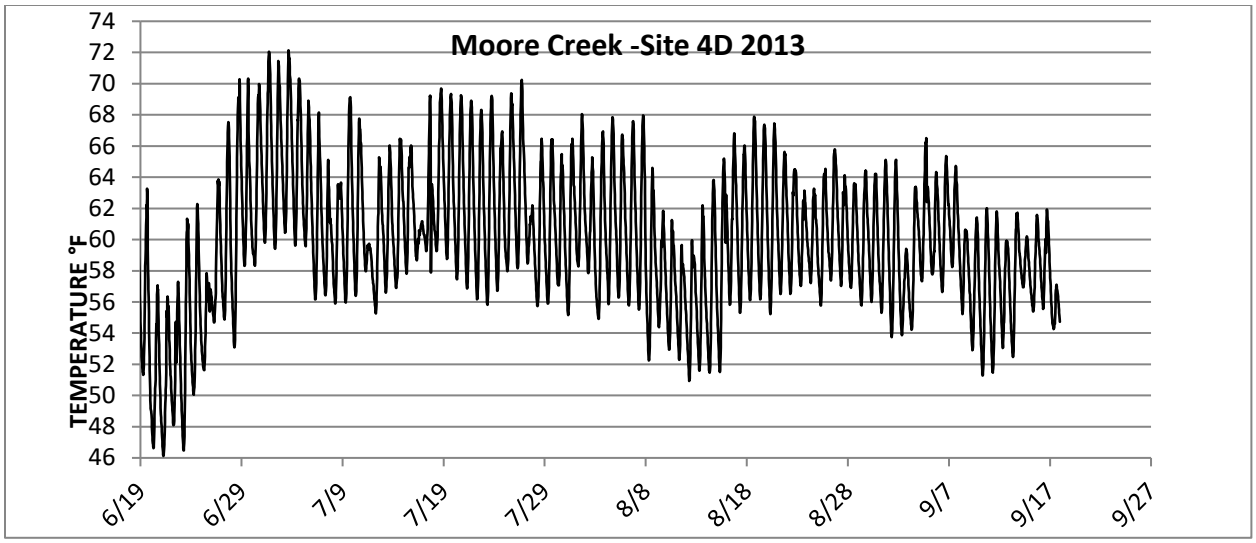

Figure G-25. Moore Creek 4D Continuous Temperature 6/12/13 through 9/17/13

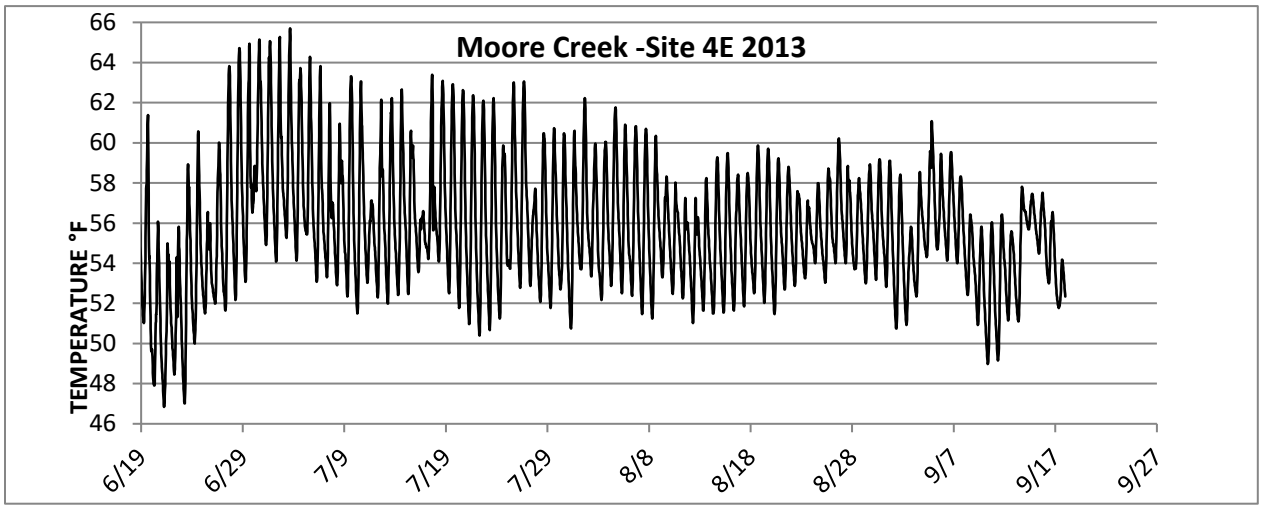

Figure G-26. Moore Creek 4E Continuous Temperature 6/12/13 through 9/17/13

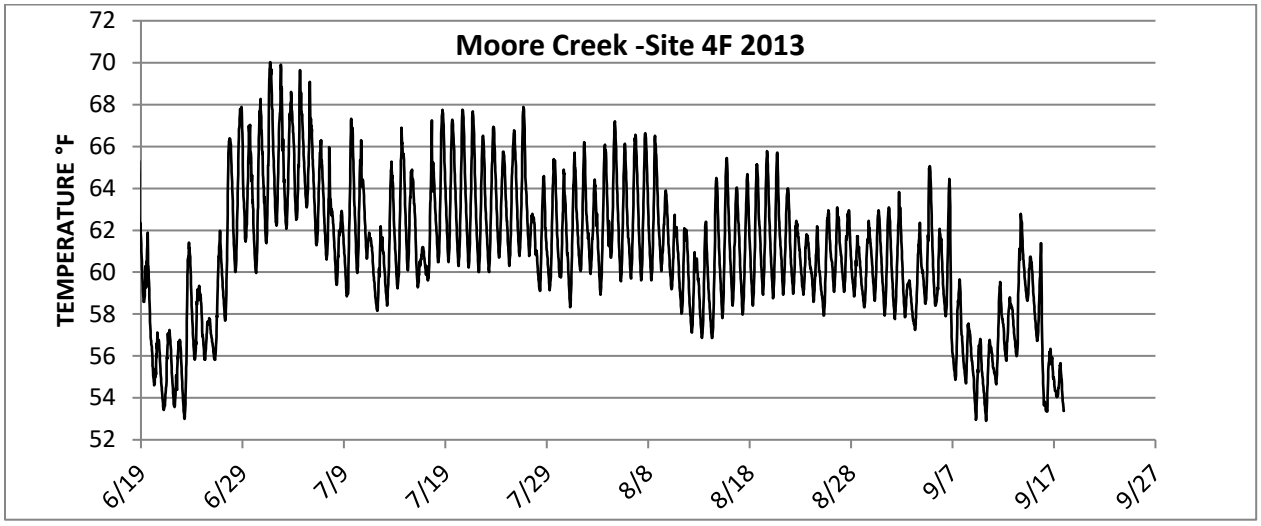

Figure G-27. Moore Creek 4F Continuous Temperature 6/12/13 through 9/17/13

Table G-15. Moore Creek DEQ Flow Measurements 2012-2014

Date	Stream	Site ID	Total Discharge (ft3/s)
8/1/2013	Moore Creek	MDEQ_WQ_WQX-M06MOREC01	0.26
8/1/2013	Moore Creek	MDEQ_WQ_WQX-M06MOREC02	1.15
8/1/2013	Moore Creek	MDEQ_WQ_WQX-M06MOREC03	0.58
8/1/2013	Moore Creek	MDEQ_WQ_WQX-M06MOREC06	0.52
6/20/2012	Moore Creek	MDEQ_WQ_WQX-M06MOREC01	0.72
7/20/2012	Moore Creek	MDEQ_WQ_WQX-M06MOREC01	2.06
8/22/2012	Moore Creek	MDEQ_WQ_WQX-M06MOREC01	0.38
6/20/2012	Moore Creek	MDEQ_WQ_WQX-M06MOREC02	1.18
7/19/2012	Moore Creek	MDEQ_WQ_WQX-M06MOREC02	0.9
8/22/2012	Moore Creek	MDEQ_WQ_WQX-M06MOREC02	0.84
6/20/2012	Moore Creek	MDEQ_WQ_WQX-M06MOREC03	0.84
7/19/2012	Moore Creek	MDEQ_WQ_WQX-M06MOREC03	0.85
8/22/2012	Moore Creek	MDEQ_WQ_WQX-M06MOREC03	0.77
7/20/2012	Moore Creek	MDEQ_WQ_WQX-M06MOREC05	1.78
9/5/2014	Moore Creek	MDEQ_WQ_WQX-M06MOREC07	2.5
9/5/2014	Moore Creek	MDEQ_WQ_WQX-M06MOREC08	2.89

Table G-16. Moore Creek Solar Pathfinder Data 2013

Date	Stream Name	Transect Number	Solar Pathfinder Photo #s at 25%, 50%, 75% Wetted Width	Percent Shade at 25 % Wetted width	Percent Shade at 50 % Wetted width	Percent Shade at 75 % Wetted width
8/1/2013	Moore Creek	4A-1	0484, 0485, 0486	27	26	29
8/1/2013	Moore Creek	4D-1	0493, 0494, 0495	95	90	89
8/1/2013	Moore Creek	4G-1	0500, 0501, 0502	61	71	89
8/1/2013	Moore Creek	4F-1	0506, 0507, 0508	100	100	100

Moore Creek DEQ Riparian Vegetation Summary
See **Table G-20** at the end of this Appendix.

G3.2.6 West Fork Madison River

The following describe site location and seasonal maximum temperatures for 16 sites on the West Fork Madison River and 5 sites on tributaries to the West Fork Madison River (**Table G-17 and Figures G-28 to G-59**). Flow data is summarized in **Table G-18** and solar pathfinder data is summarized in **Tables G-19.** Riparian vegetation summaries are found at the end of this appendix in **Table G-20.**

Table G-17. West Fork Madison River Temperature Study Sites and Maximum Temperatures

Site Number	Waterbody Name	Site Description	2013 Seasonal Maximum Temperature (°F)	2014 Seasonal Maximum Temperature (°F)
5A	West Fork Madison River	near mouth and serves as the d/s bracket for a trib, Gazelle Cr.	71.6	68.72

Table G-17. West Fork Madison River Temperature Study Sites and Maximum Temperatures

Site Number	Waterbody Name	Site Description	2013 Seasonal Maximum Temperature (°F)	2014 Seasonal Maximum Temperature (°F)
5B	West Fork Madison River	above the mouth of Gazelle Creek	72.68	
5C	West Fork Madison River	d/s of the mouth of Lake Cr. Reference riparian condition	72.14	69.44
5D	West Fork Madison River	u/s of the mouth of Lake Cr.	73.04	
5E	West Fork Madison River	Similar channel type, veg, and shade to site 5D, 5 miles u/s of 5D	69.8	
5F	West Fork Madison River	u/s of the mouth of Freezeout Creek	69.8	
5G	West Fork Madison River	d/s of the mouth of Elk River, a major trib; serves to help bracket the effects of the tributary. A shift from willow-dominated riparian veg to conifers and willows and alders occurs from here to the mouth	69.26	66.2
5H	West Fork Madison River	u/s of the mouth of Elk River, and is the lower extent of a Rosgen E/C channel type, with high sinuosity and willow/sedge-dominated riparian vegetation	77.9	
5I	West Fork Madison River	d/s of large warm spring	80.96	
5J	West Fork Madison River	u/s of large warm spring, beaver complex u/s of site	77	
5K	West Fork Madison River	near u/s extent of beaver colonies, u/s of cold spring, d/s of grazed pasture	75.38	
5L	West Fork Madison River	d/s of a small warm trib, in a beaver complex, 1.5mile d/s of site 5M, site tests the extent of the influence of the cold trib located u/s of site 5M	74.48	
5M	West Fork Madison River	d/s of Teepee Creek; serves to help bracket the effects of the trib. A geologic nick point here results in cobble channel material and conifers near the riparian area	73.94	73.04
5N	West Fork Madison River	u/s of Teepee Creek, a major trib to the West Fork Madison R., and is d/s of Meridian Cr.	79.52	77
5P	West Fork Madison River	100'downstream Anderson Cr. (7/23/14). Air Temp monitoring site here also. (7/23/14)		68.14
5X	West Fork Madison River	about 1- 1/4 mile d/s of Fox Cr.		70.34

Table G-17. West Fork Madison River Temperature Study Sites and Maximum Temperatures

Site Number	Waterbody Name	Site Description	2013 Seasonal Maximum Temperature (°F)	2014 Seasonal Maximum Temperature (°F)
7A	Elk River	Significant cold water trib to the West Fork Madison R results in an approximate six-fold increase to West Fork flows during baseflow conditions	66.56	63.5
8A	Freezeout Creek	Trib to West Fork Madison	71.6	
9A	Gazelle Creek	Trib to West Fork Madison	66.2	
12A	Lake Creek	Significant trib to the West Fork Madison R		71.06
10A	Teepee Creek	Significant cool water trib to the West Fork Madison R	67.82	

Figure G-28. All West Fork Madison River and Tributary Sites

Figure G-29. Upper West Fork Madison River and Tributary Sites

Figure G-30. Middle West Fork Madison River and Tributary Sites

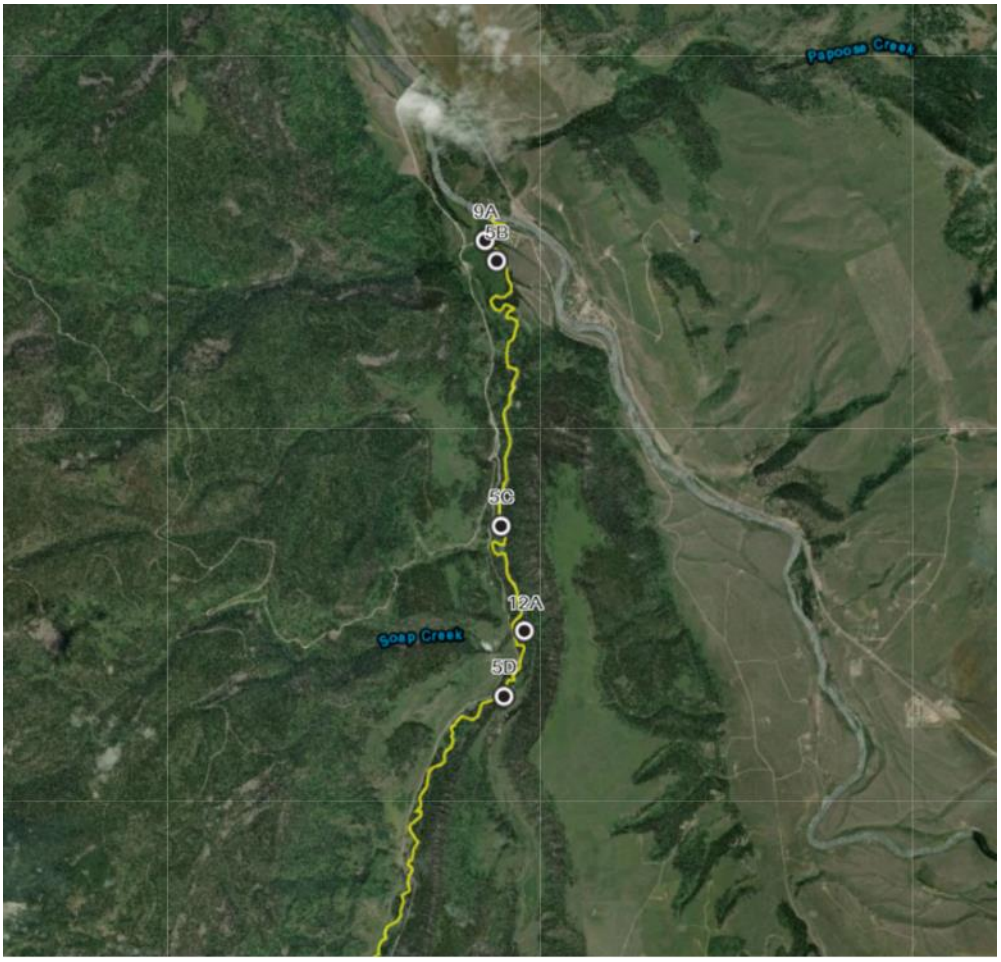

Figure G-31. Downstream West Fork Madison River and Tributary Sites

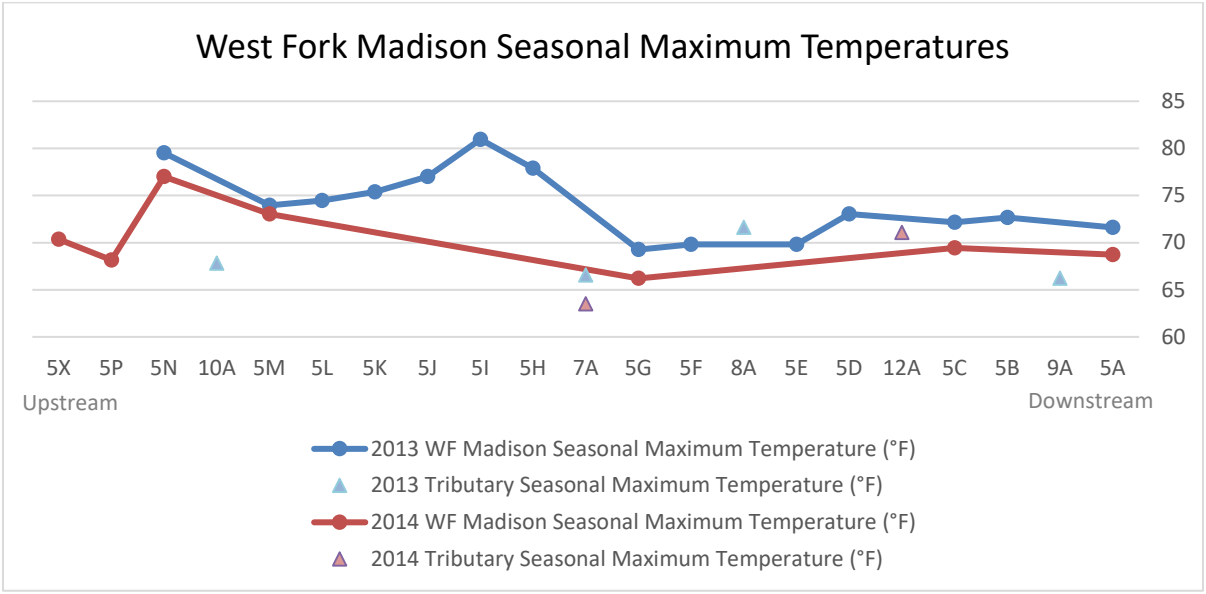

Figure G-32. West Fork Madison River Temperature Study Sites and Maximum Temperatures

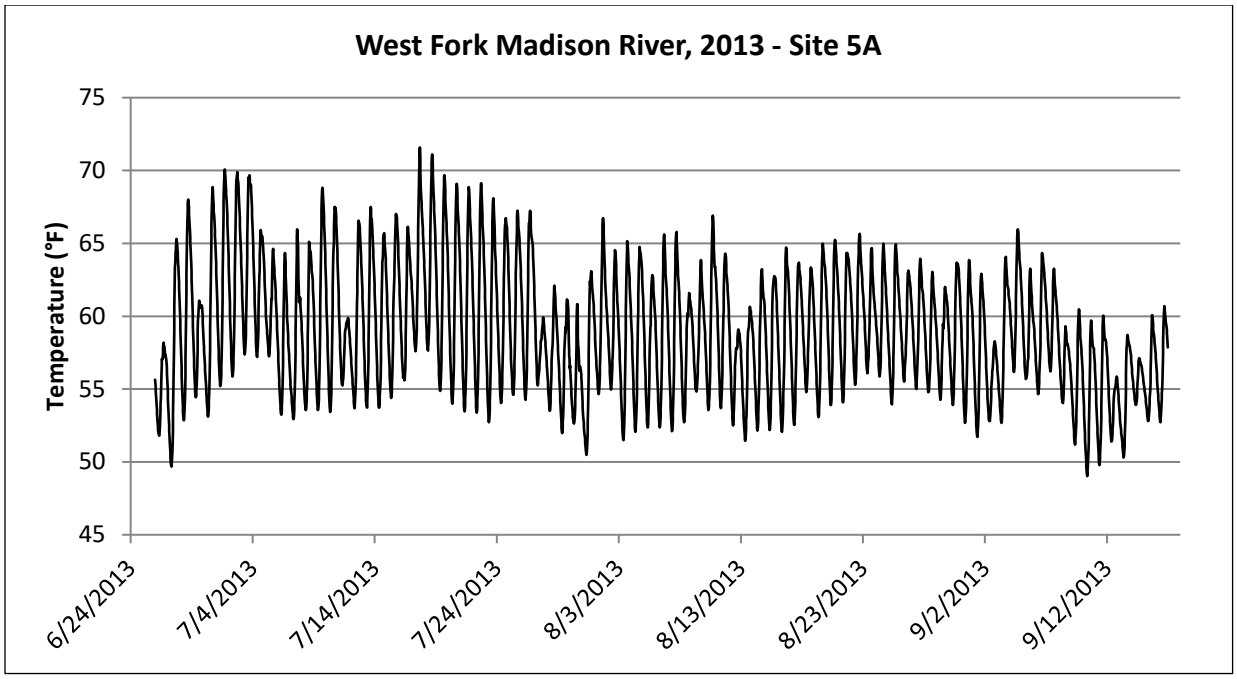

Figure G-33. WF Madison River 5A Continuous Temperature 6/26/13 through 9/16/13

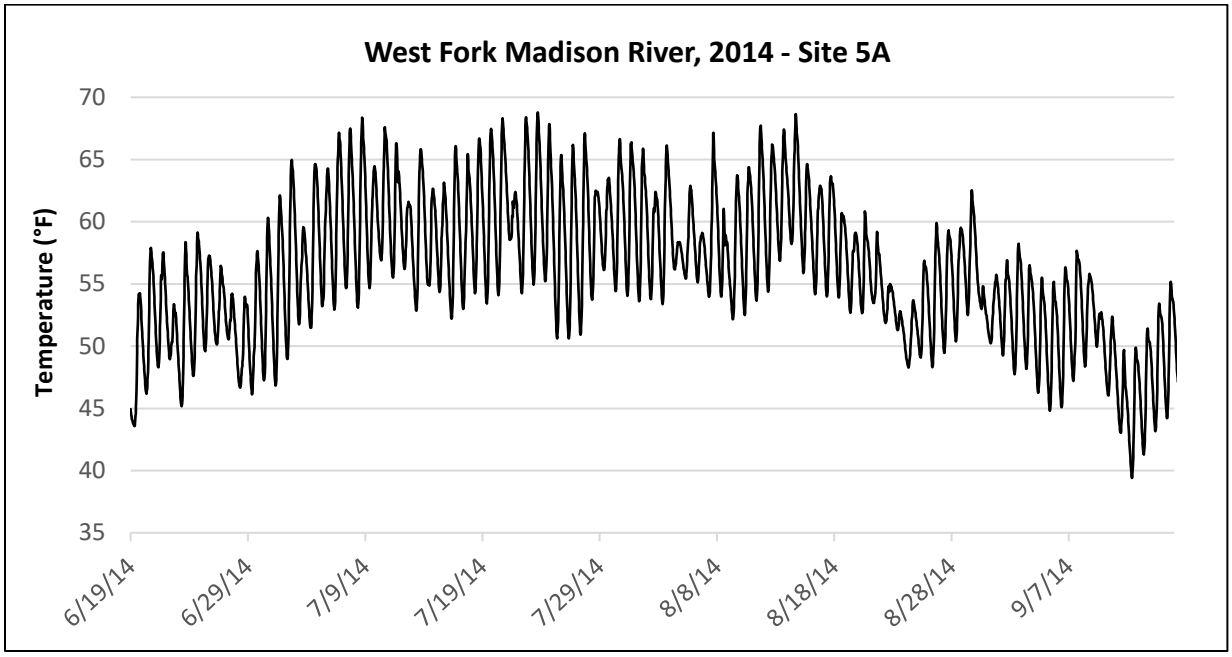

Figure G-34. WF Madison River 5A Continuous Temperature 6/19/14 through 9/16/14

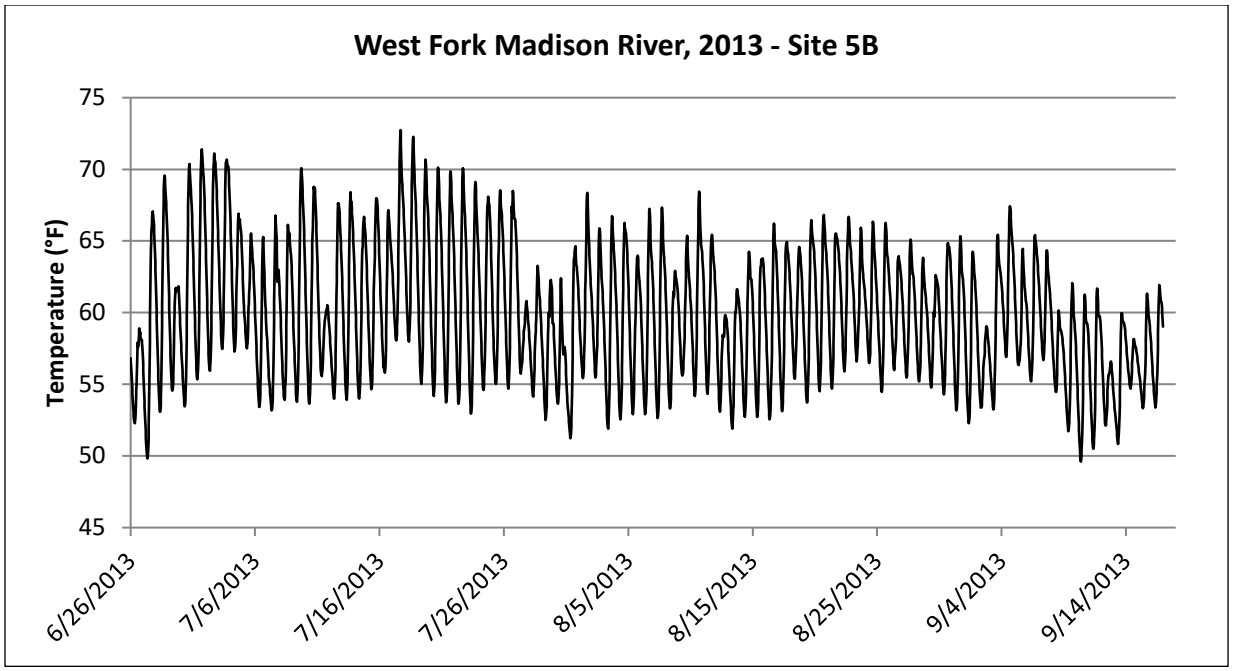

Figure G-35. WF Madison River 5B Continuous Temperature 6/26/13 through 9/16/13

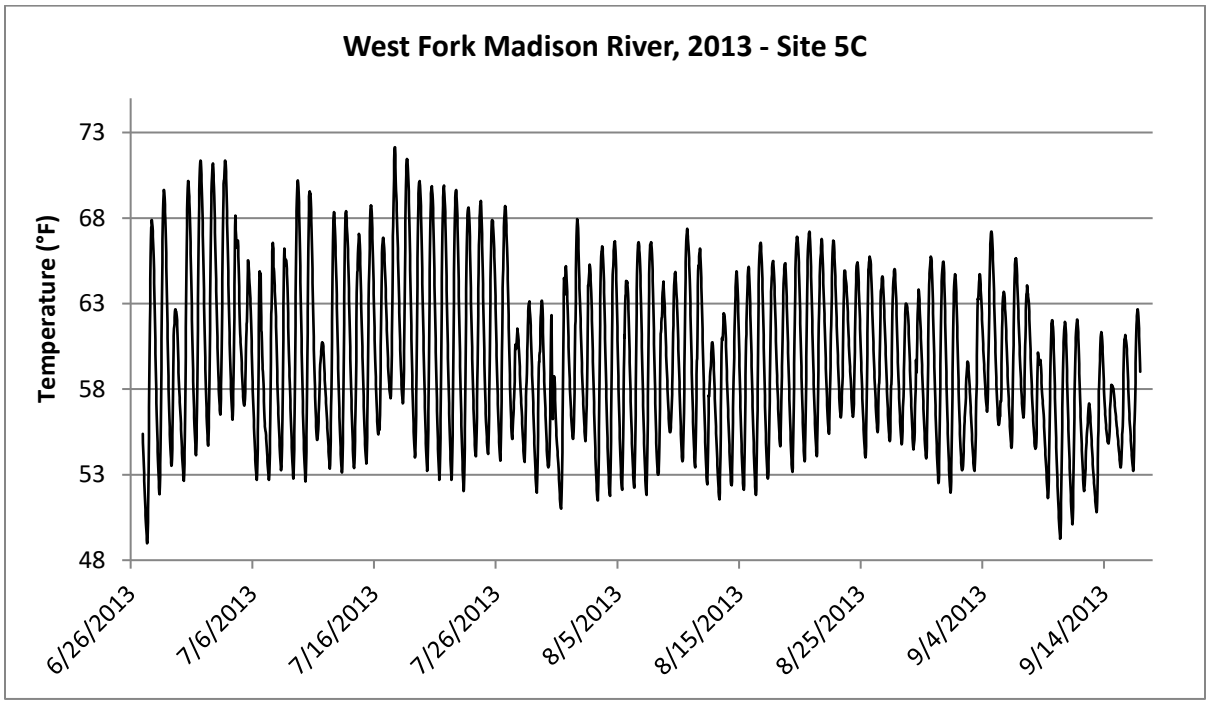

Figure G-36. WF Madison River 5C Continuous Temperature 6/27/13 through 9/16/13

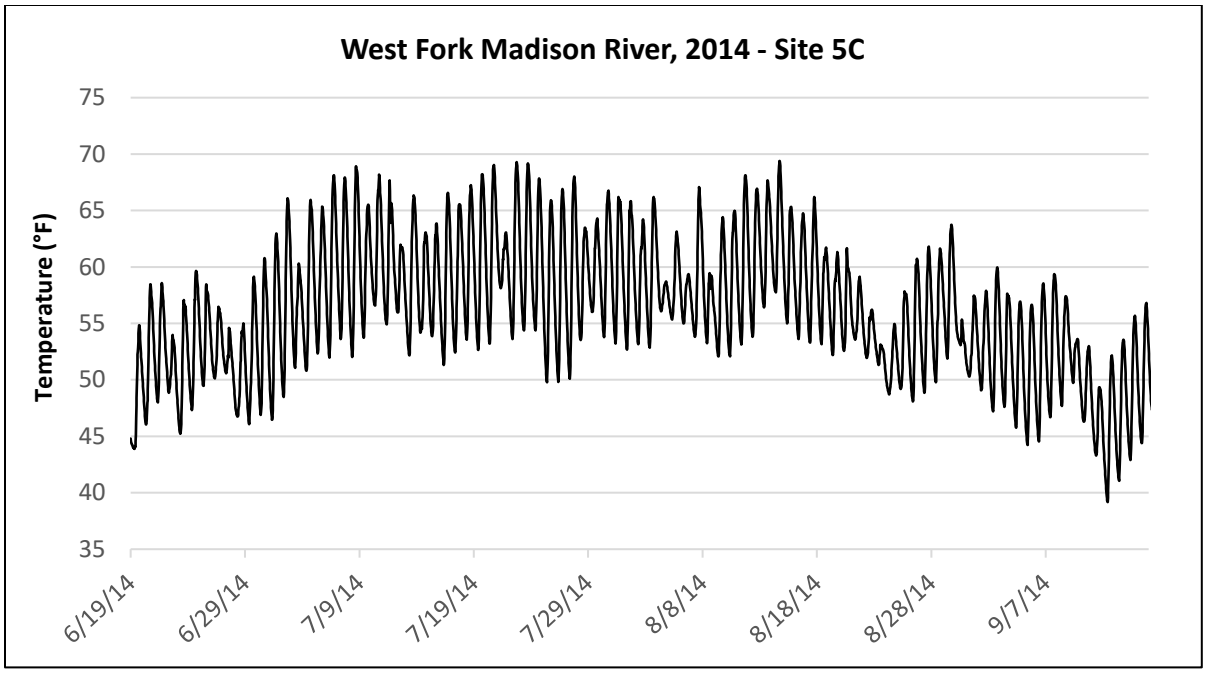

Figure G-37. WF Madison River 5C Continuous Temperature 6/19/14 through 9/16/14

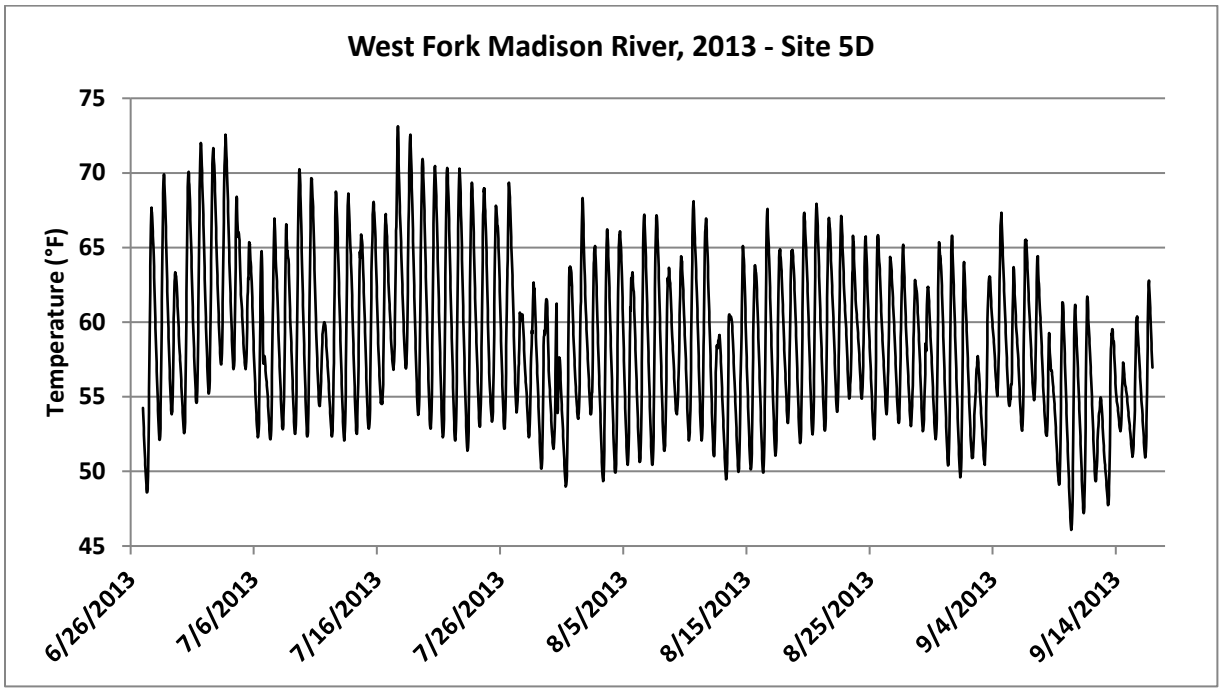

Figure G-38. WF Madison River 5D Continuous Temperature 6/27/13 through 9/16/13

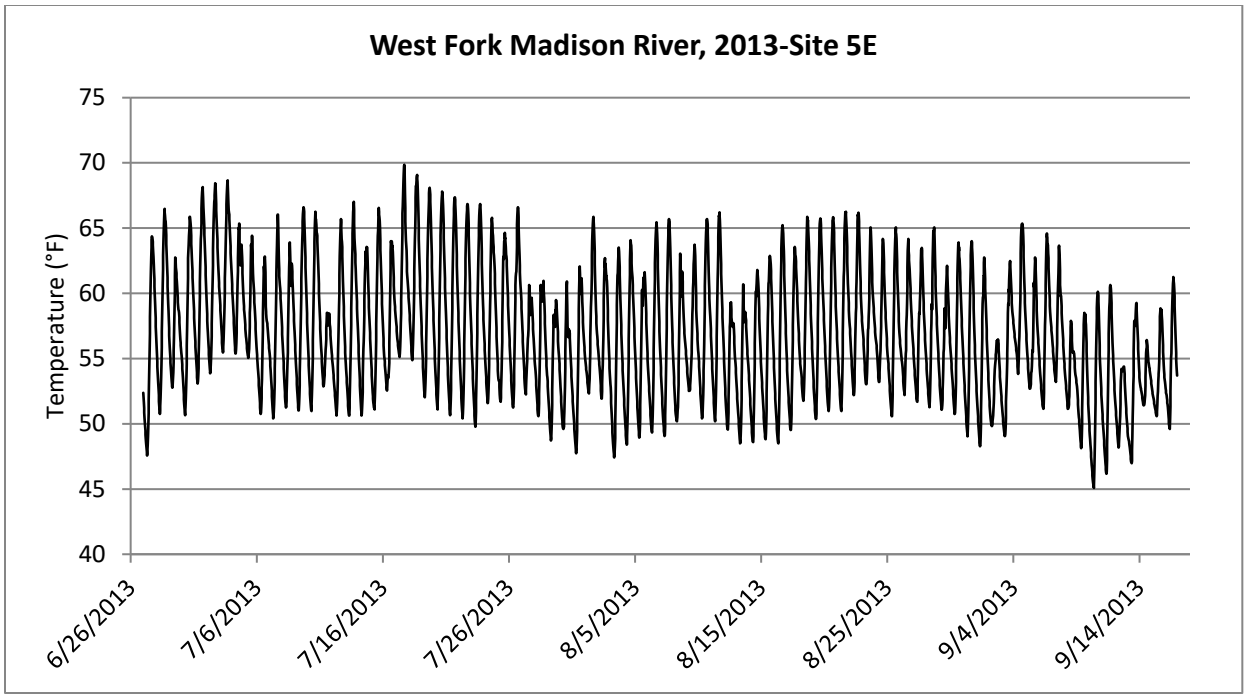

Figure G-39. WF Madison River 5E Continuous Temperature 6/27/13 through 9/16/13

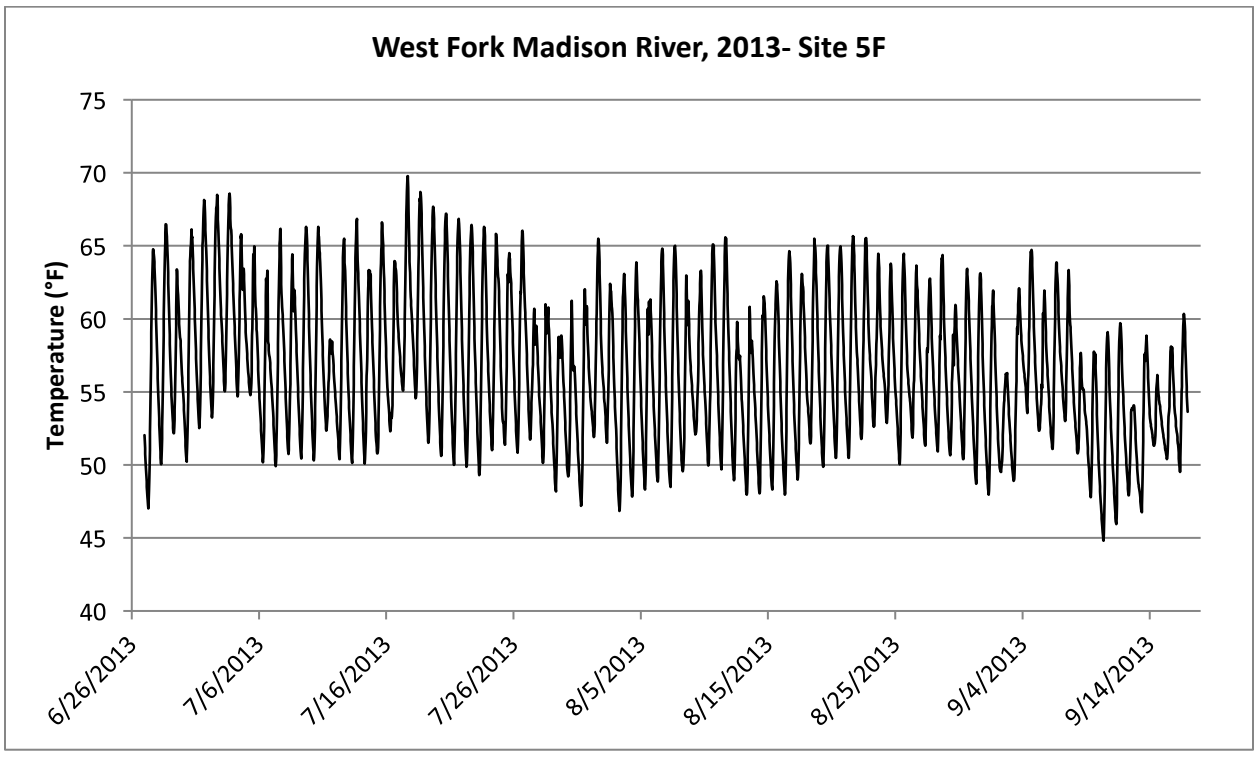

Figure G-40. WF Madison River 5F Continuous Temperature 6/27/13 through 9/16/13

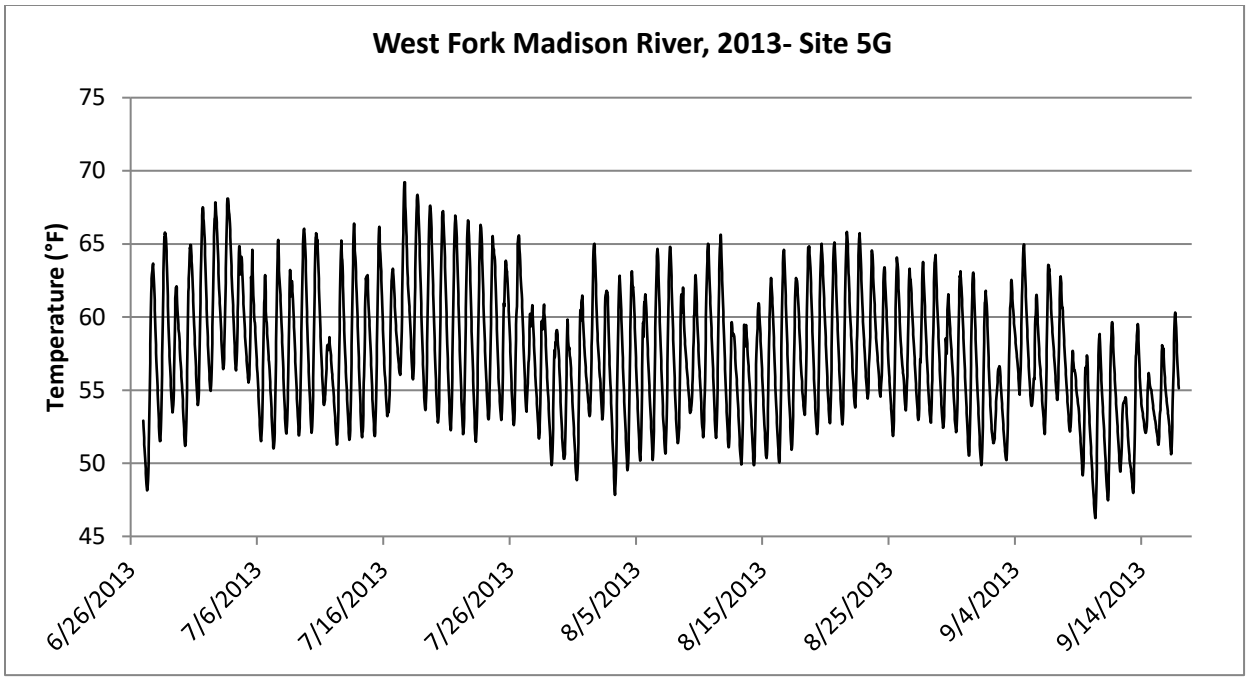

Figure G-41. WF Madison River 5G Continuous Temperature 6/27/13 through 9/16/13

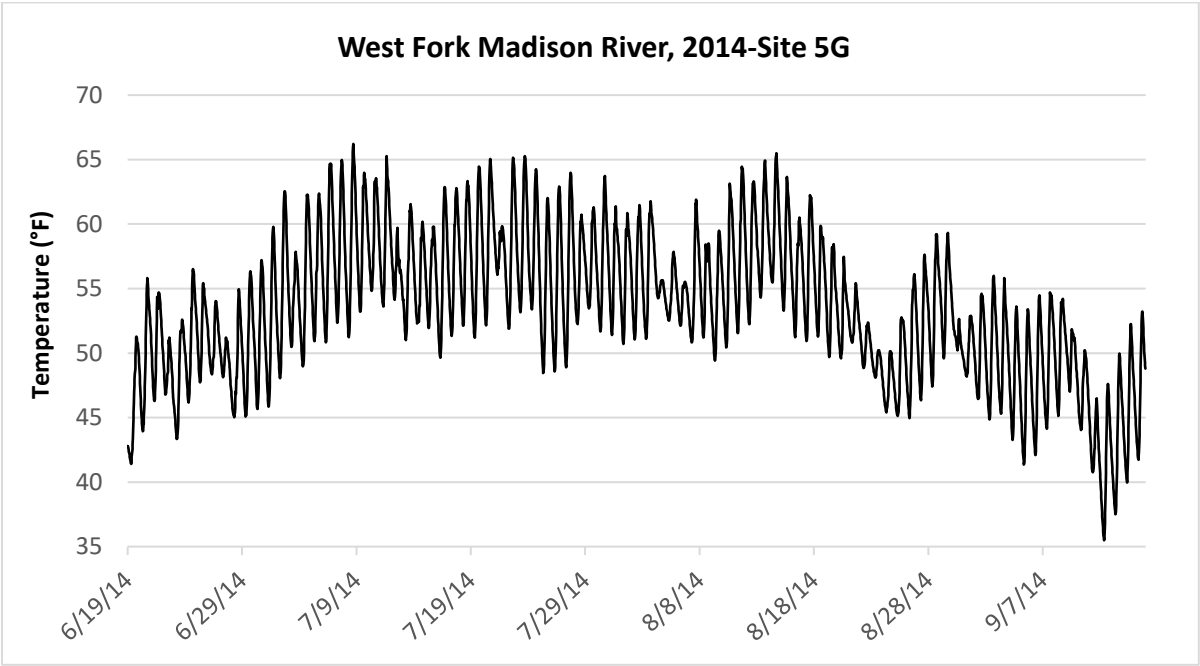

Figure G-42. WF Madison River 5G Continuous Temperature 6/19/14 through 9/15/14

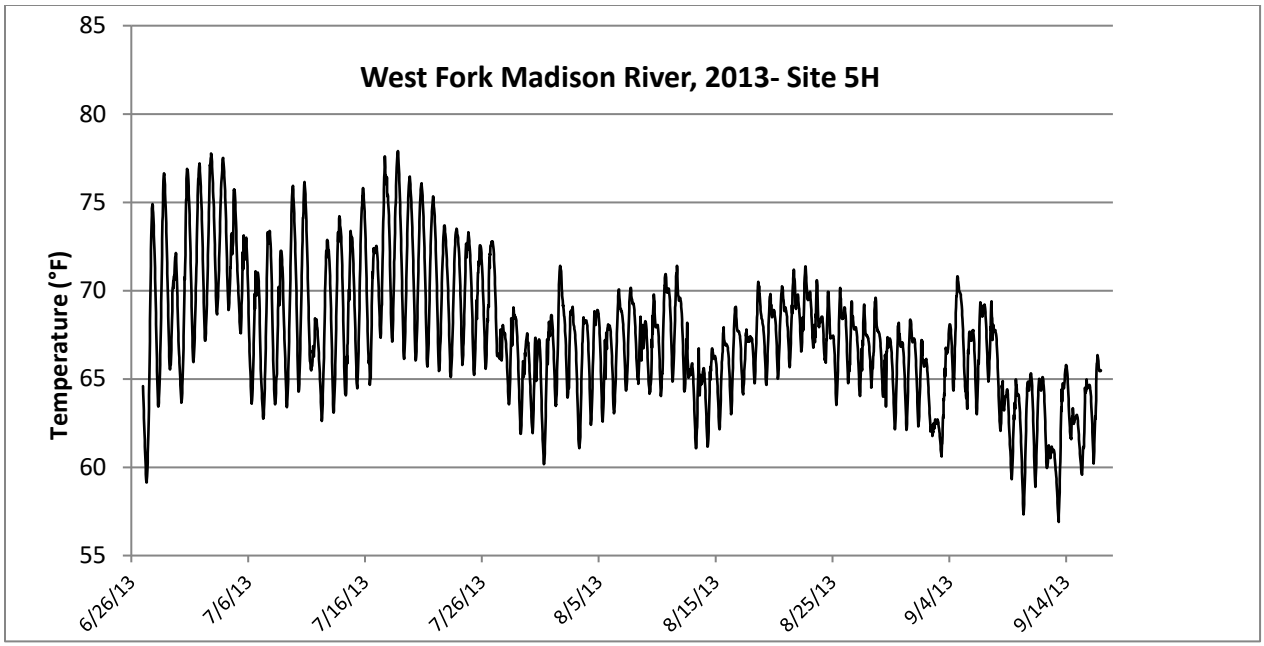

Figure G-43. WF Madison River 5H Continuous Temperature 6/27/13 through 9/16/13

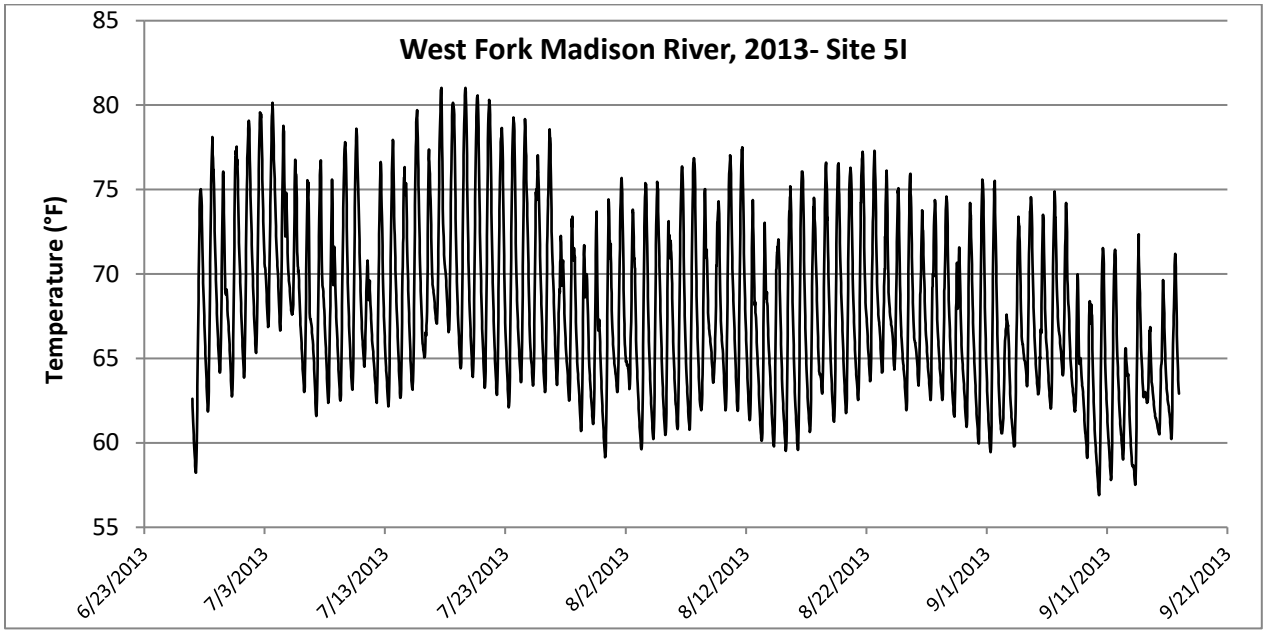

Figure G-44. WF Madison River 5I Continuous Temperature 6/27/13 through 9/16/13

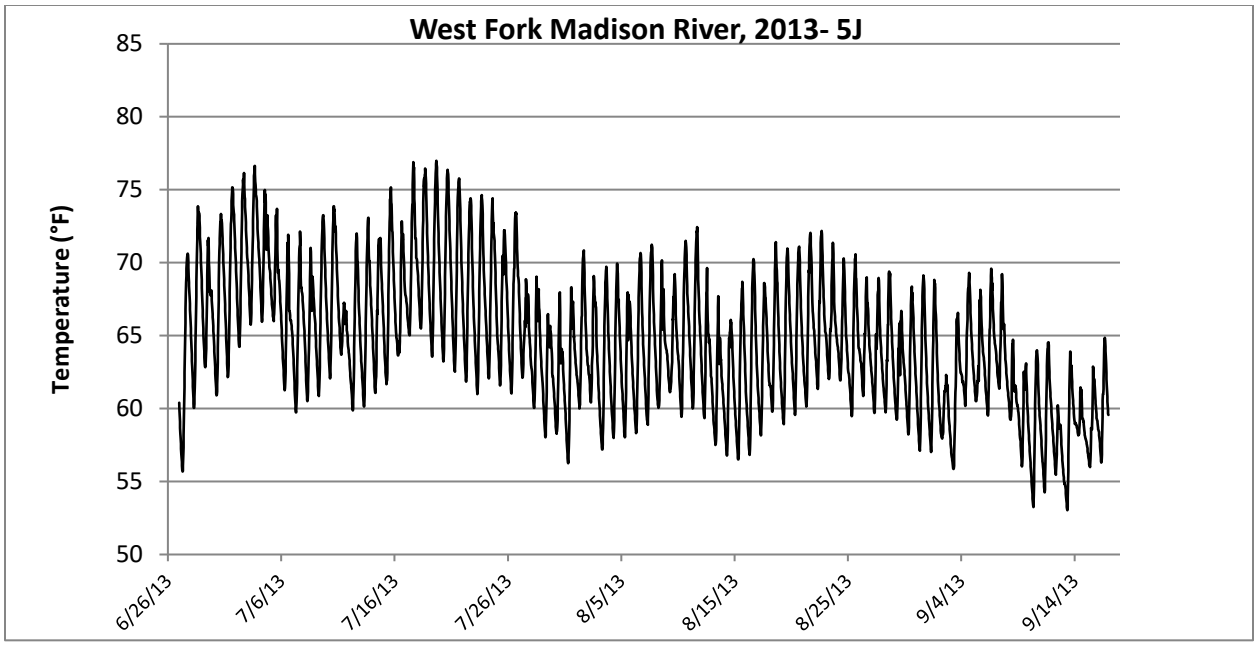

Figure G-45. WF Madison River 5J Continuous Temperature 6/27/13 through 9/16/13

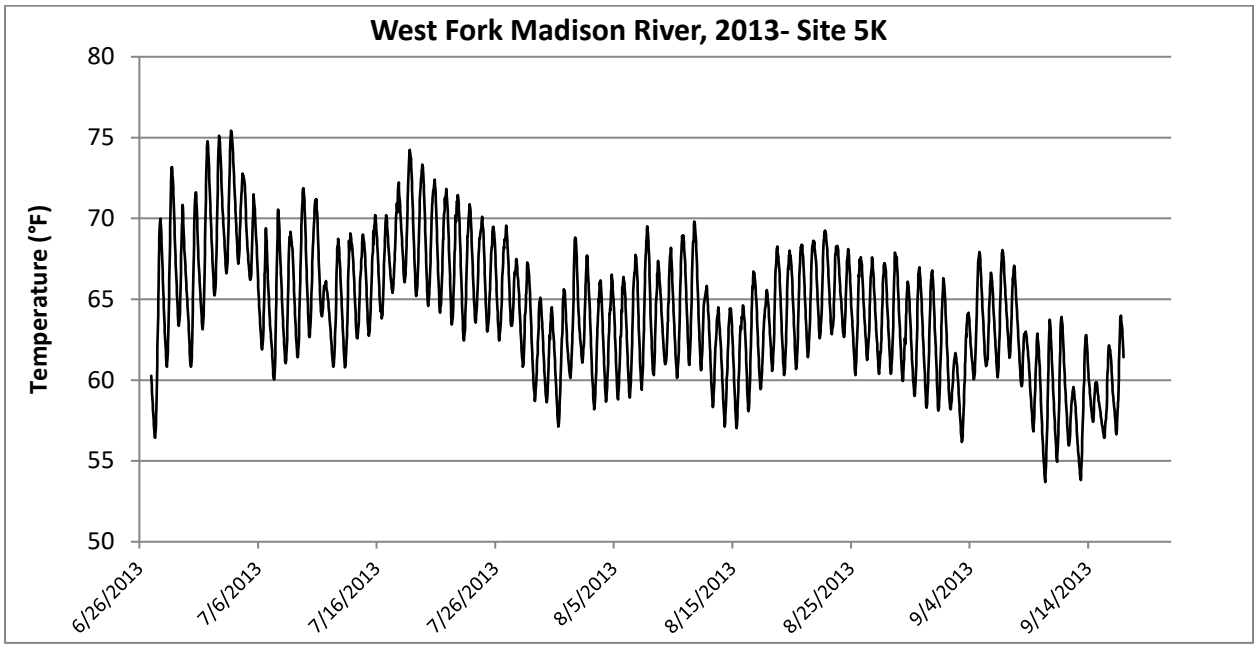

Figure G-46. WF Madison River 5K Continuous Temperature 6/27/13 through 9/16/13

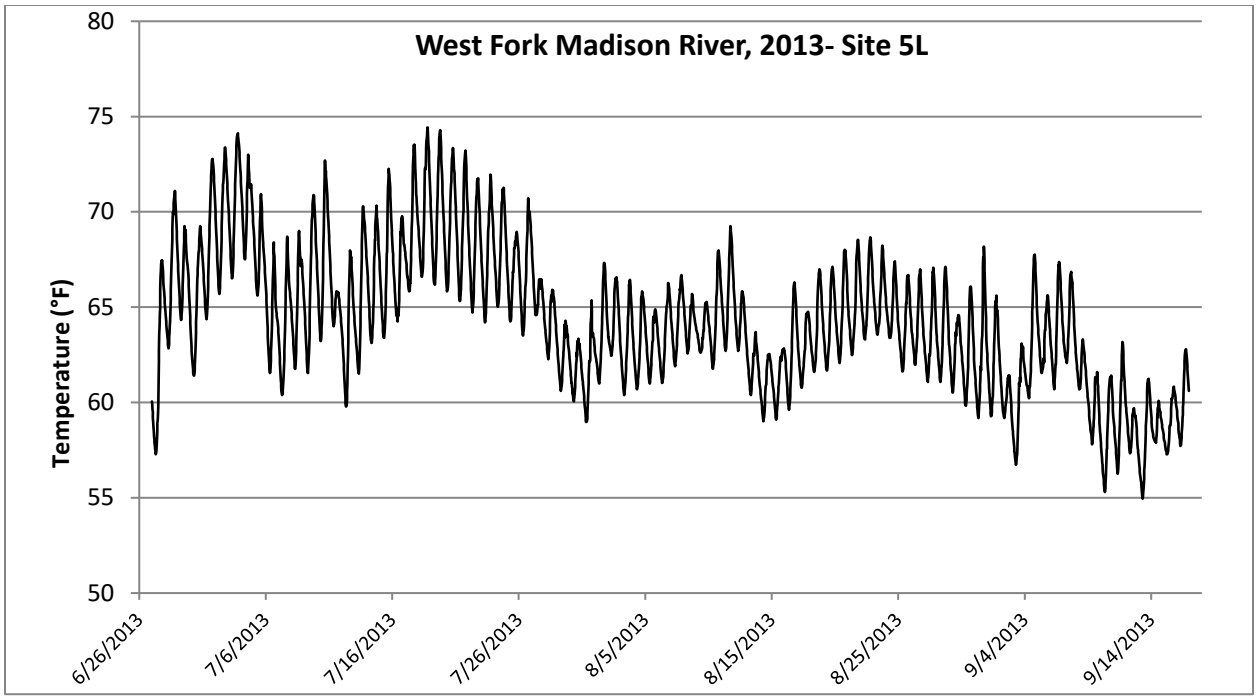

Figure G-47. WF Madison River 5L Continuous Temperature 6/27/13 through 9/16/13

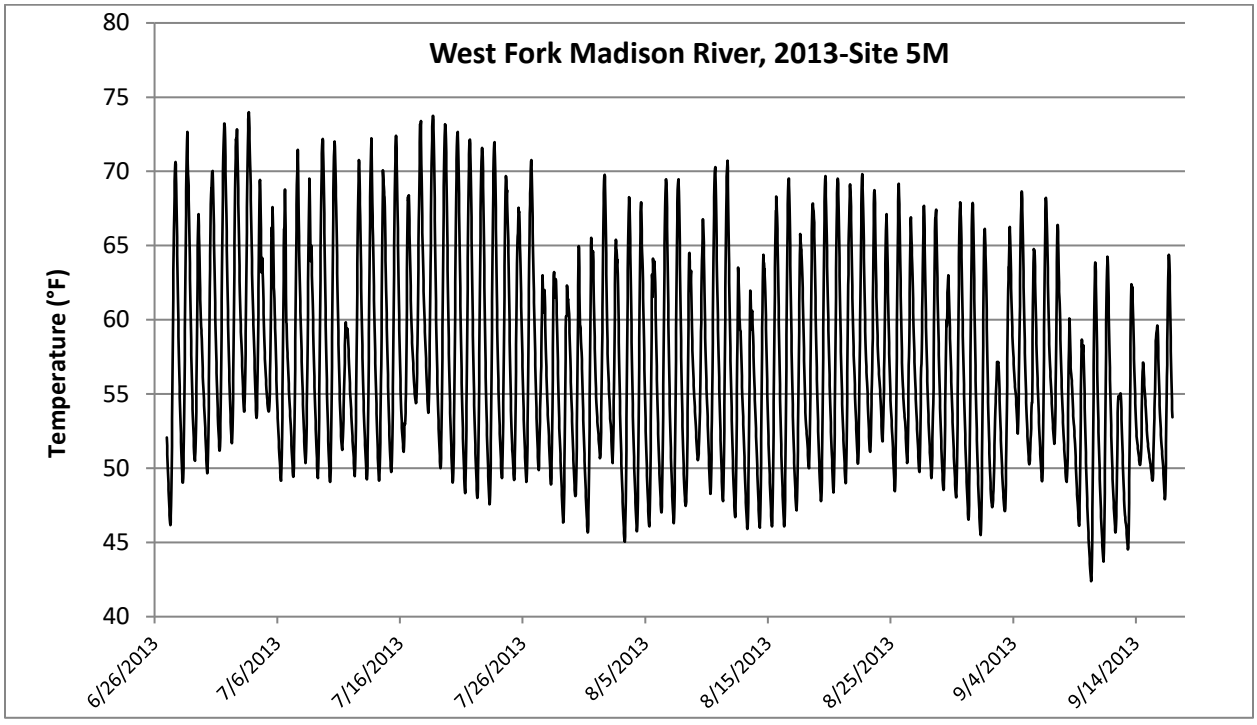

Figure G-48. WF Madison River 5M Continuous Temperature 6/27/13 through 9/16/13

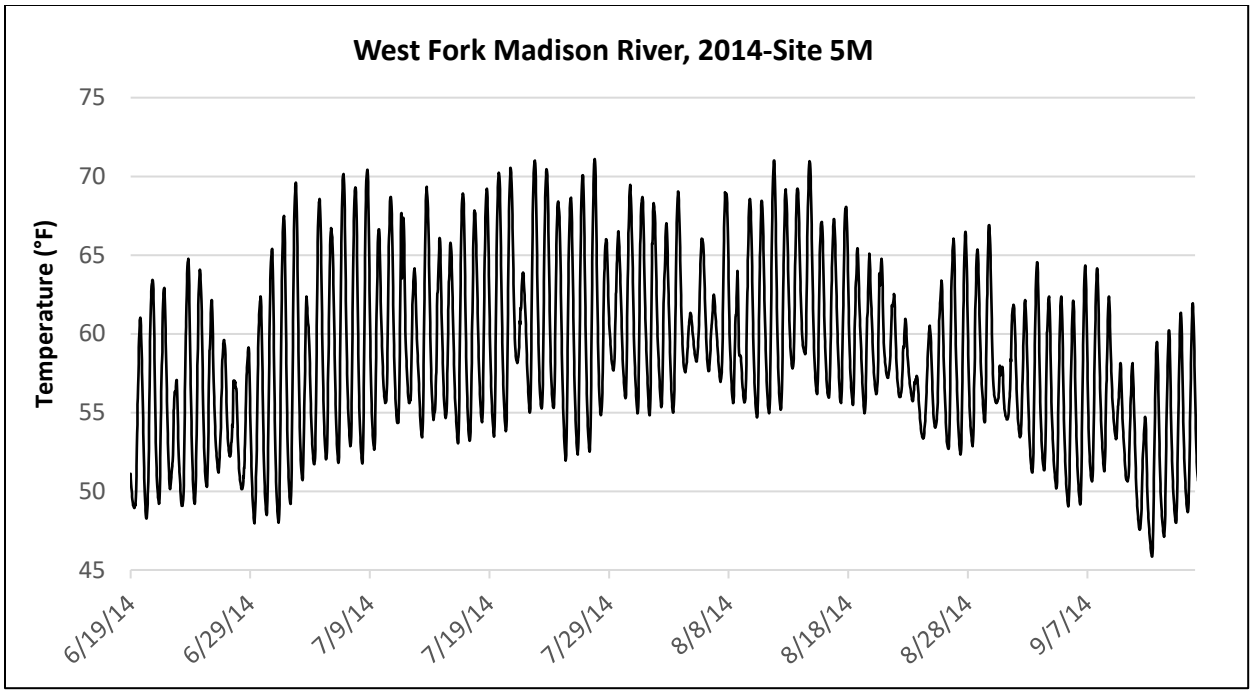

Figure G-49. WF Madison River 5M Continuous Temperature 6/19/14 through 9/16/14

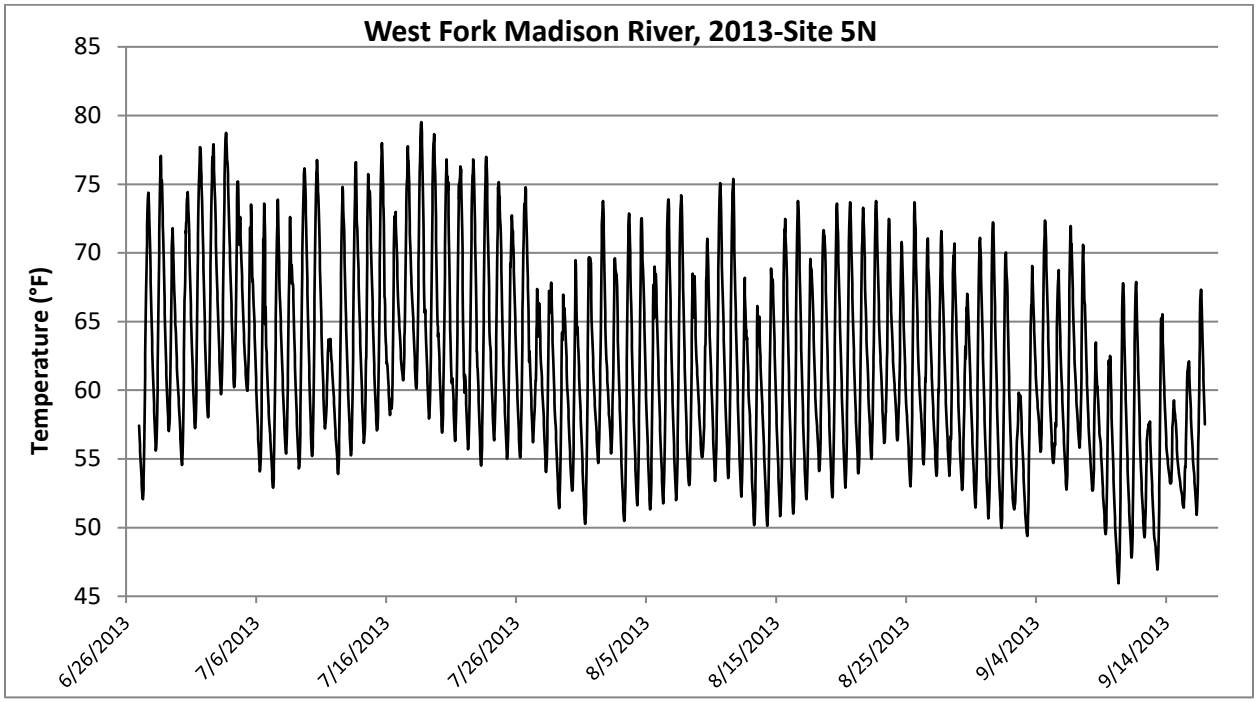

Figure G-50. WF Madison River 5N Continuous Temperature 6/27/13 through 9/16/13

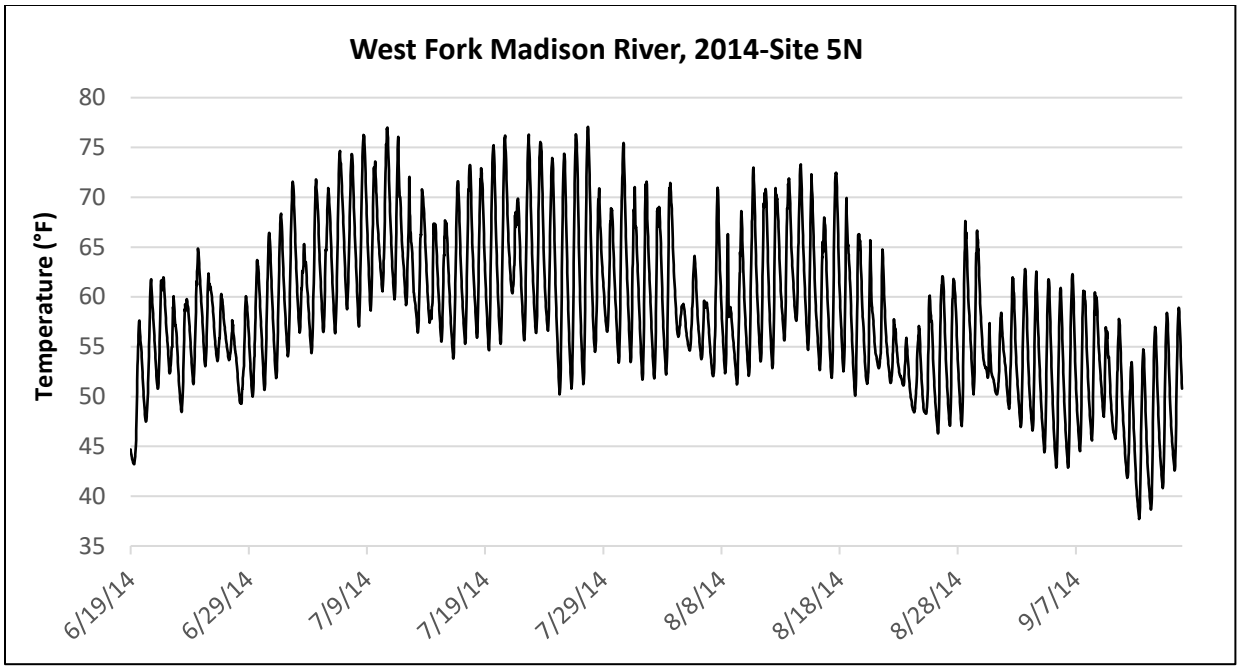

Figure G-51. WF Madison River 5N Continuous Temperature 6/19/14 through 9/15/14

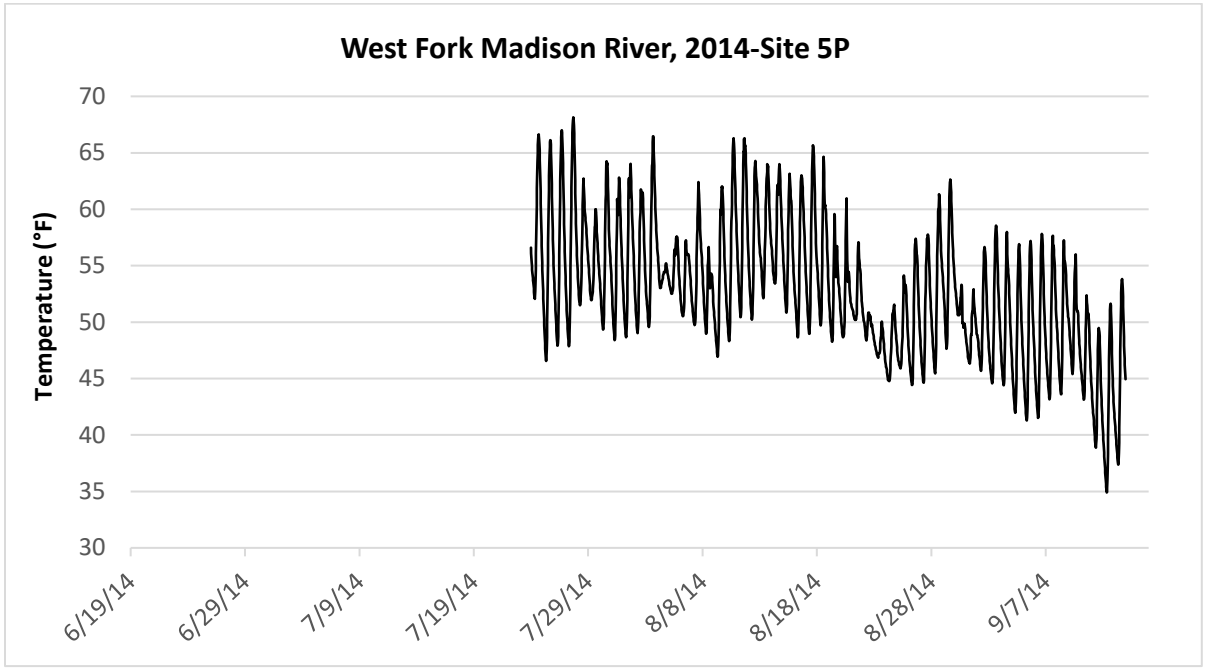

Figure G-52. WF Madison River 5P Continuous Temperature 7/24/14 through 9/14/14

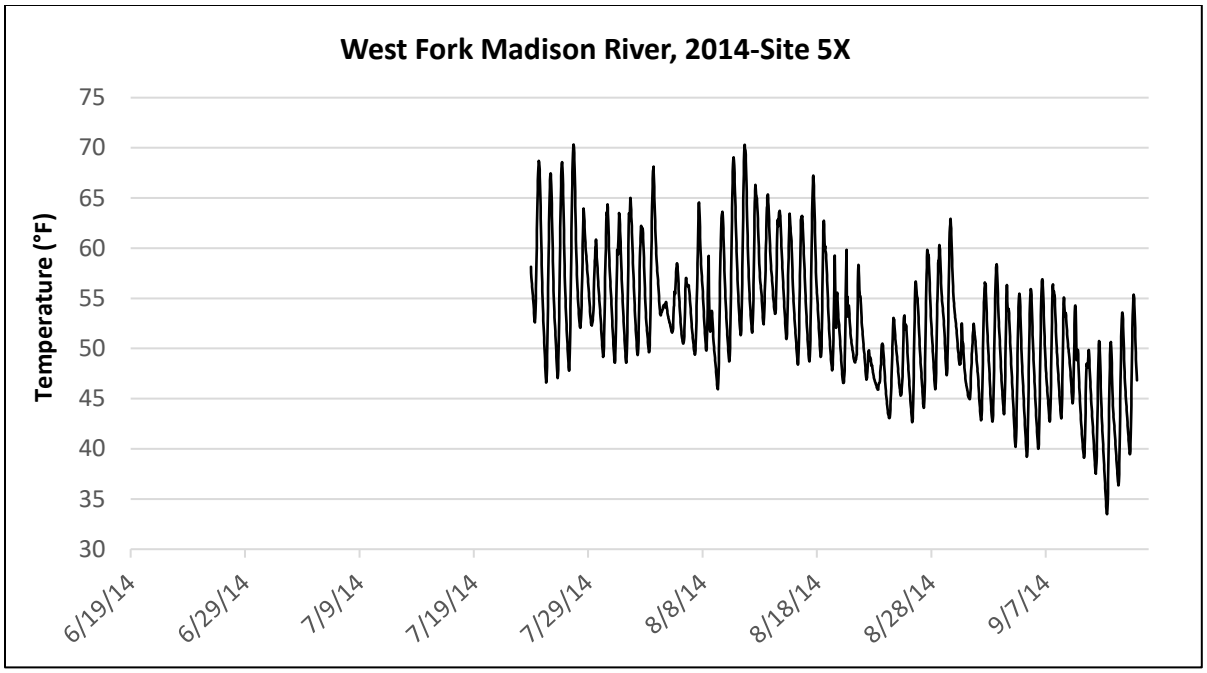

Figure G-53. WF Madison River 5X Continuous Temperature 7/24/14 through 9/14/14

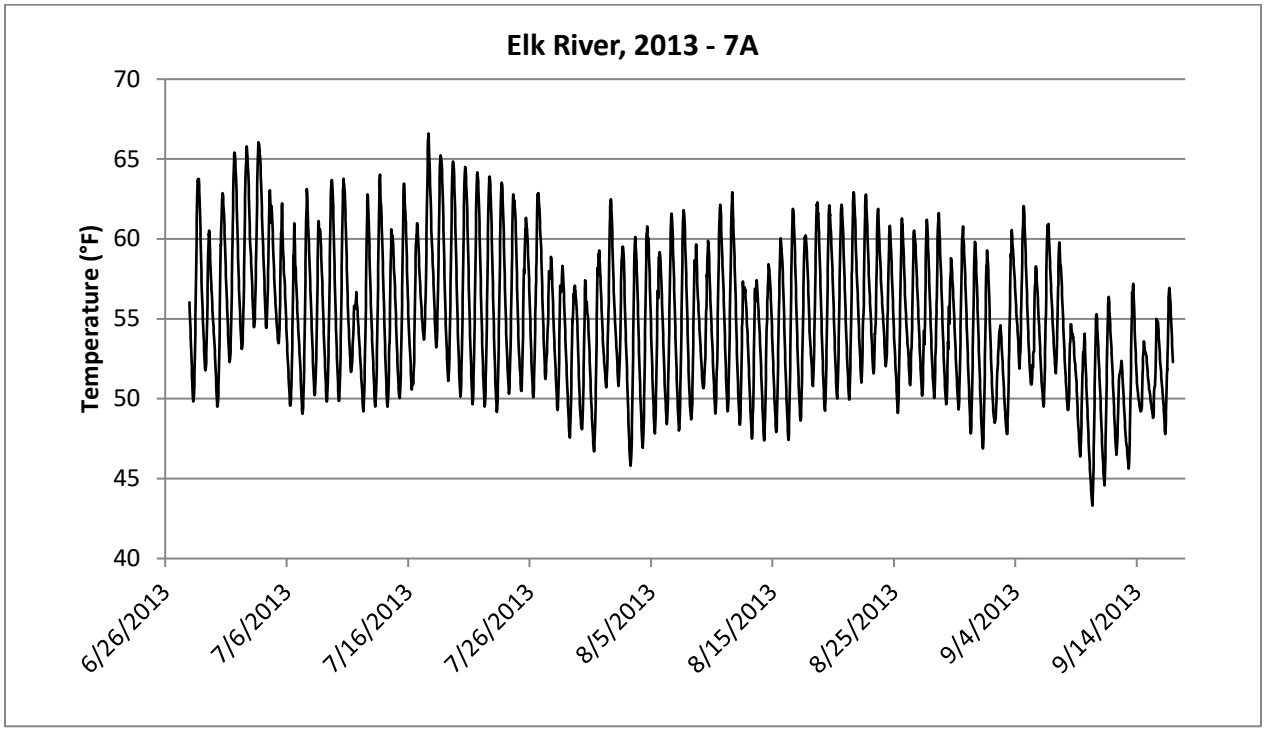

Figure G-54. Elk River 7A Continuous Temperature 6/28/13 through 9/16/13

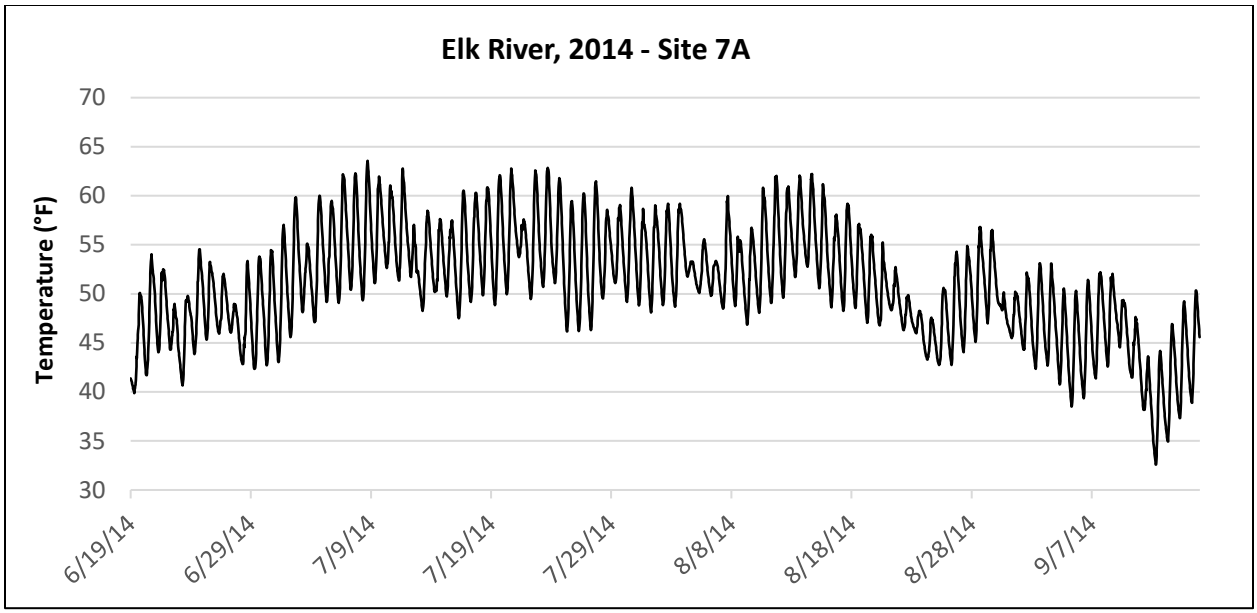

Figure G-55. Elk River 7A Continuous Temperature 6/19/14 through 9/15/14

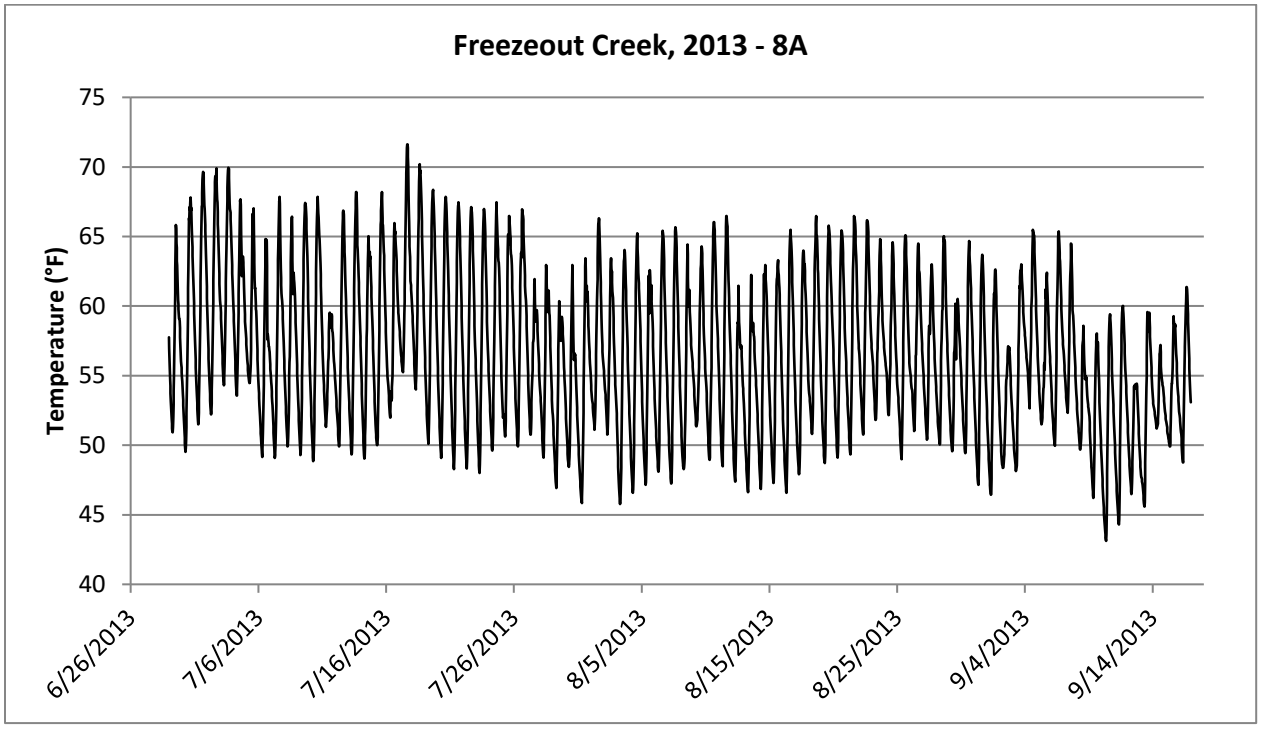

Figure G-56. Freezeout Creek 8A Continuous Temperature 6/29/13 through 9/16/13

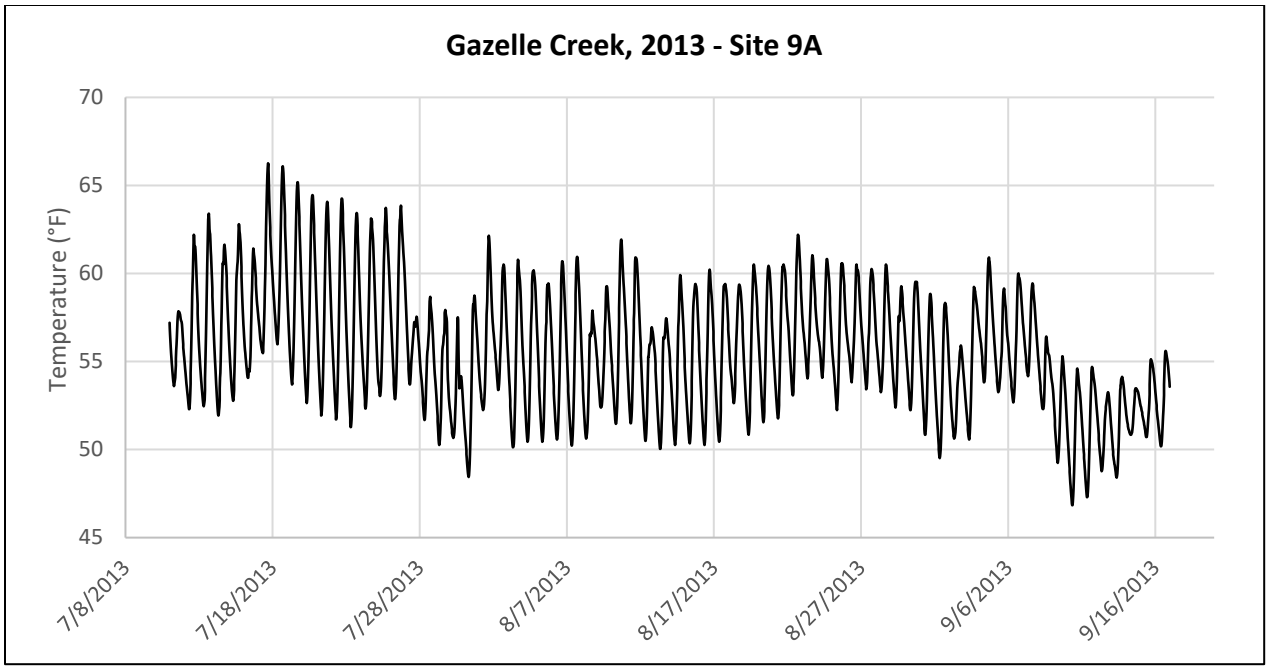

Figure G-57. Gazelle Creek 9A Continuous Temperature 7/11/13 through 9/16/13

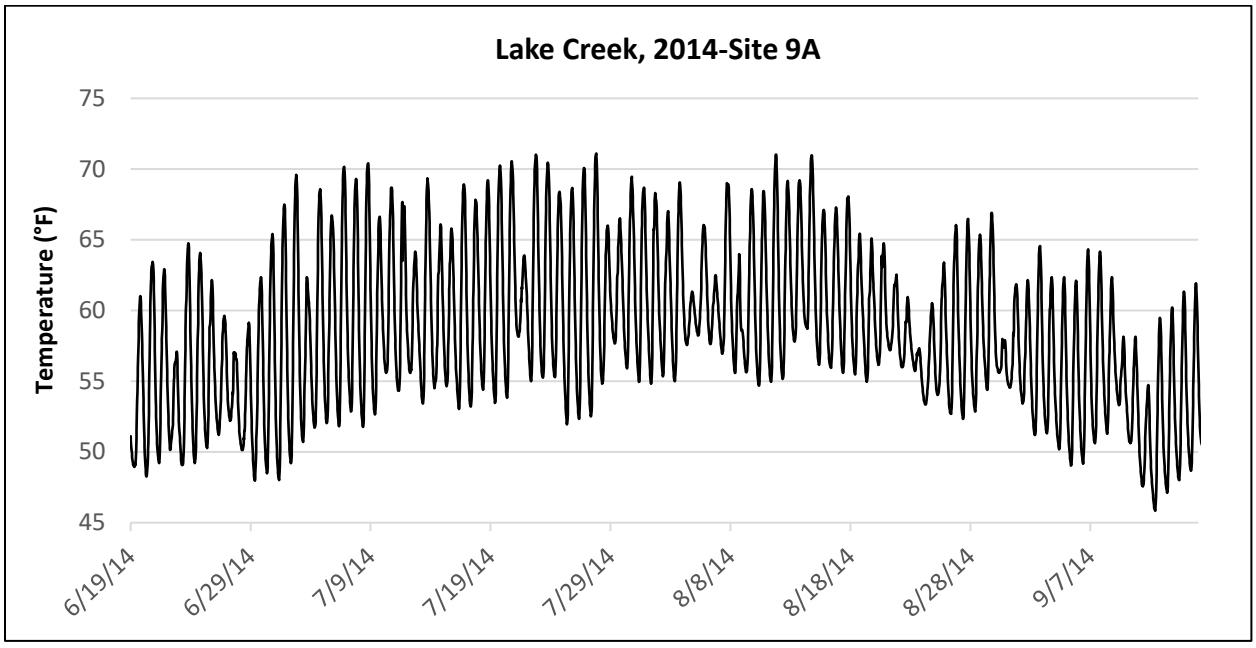

Figure G-58. Lake Creek 9A Continuous Temperature 6/19/13 through 9/16/13

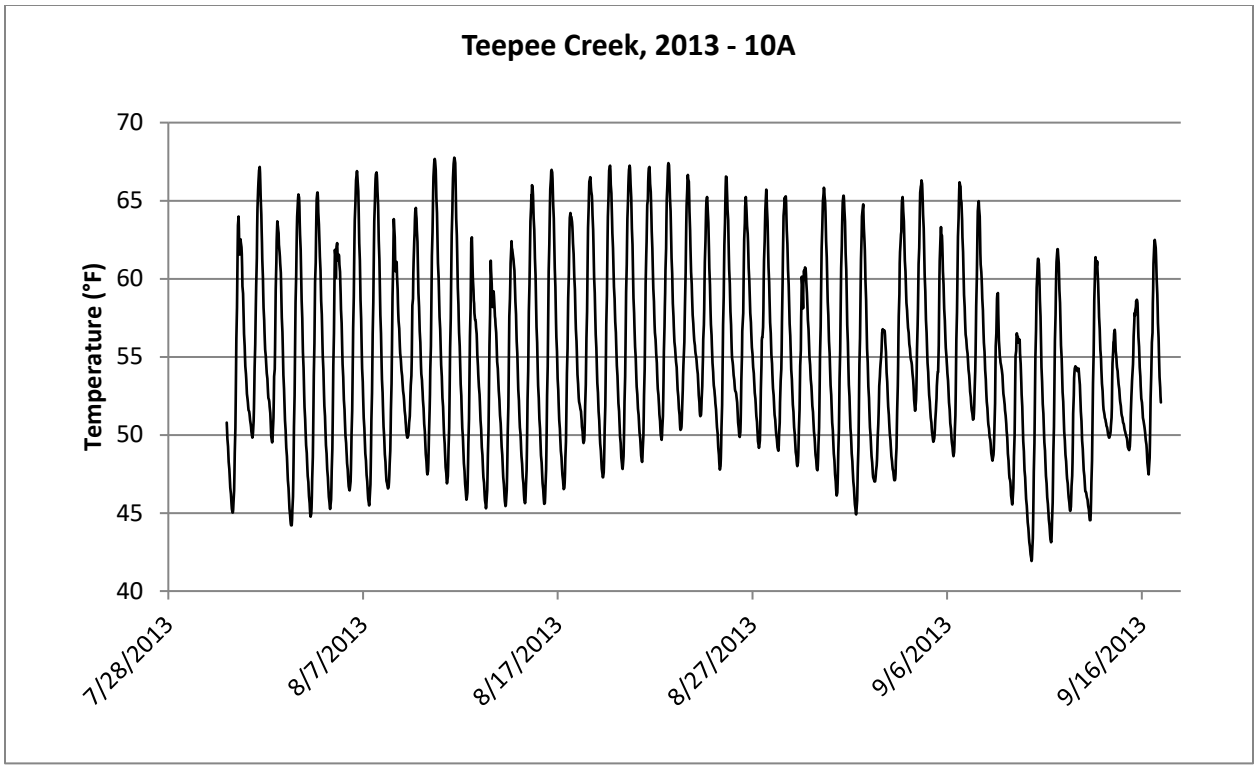

Figure G-59. Teepee Creek 10A Continuous Temperature 7/31/13 through 9/16/13

Table G-18. West Fork Madison River and Tributary DEQ Flow Measurements 2012 through 2014

Date	Stream	Site ID	Total Discharge (ft3/s)
7/9/2013	Elk River	MDEQ_WQ_WQX-M06ELKR01	25.71
6/12/2012	Elk River	MDEQ_WQ_WQX-M06ELKR03	87.56
7/23/2012	Elk River	MDEQ_WQ_WQX-M06ELKR03	26.32
8/25/2012	Elk River	MDEQ_WQ_WQX-M06ELKR03	15.78
6/12/2013	Elk River	MDEQ_WQ_WQX-M06ELKR03	220.18
6/27/2013	Elk River	MDEQ_WQ_WQX-M06ELKR03	40
7/8/2013	Elk River	MDEQ_WQ_WQX-M06ELKR03	24.06
8/13/2013	Elk River	MDEQ_WQ_WQX-M06ELKR03	13.15
9/16/2013	Elk River	MDEQ_WQ_WQX-M06ELKR03	12.82
7/30/2014	Elk River	MDEQ_WQ_WQX-M06ELKR03	21.95
9/16/2014	Elk River	MDEQ_WQ_WQX-M06ELKR03	16.09
6/27/2013	Freezeout Creek	MDEQ_WQ_WQX-M06FZOTC01	3.5
7/10/2013	Gazelle Creek	MDEQ_WQ_WQX-M06GAZLC03	7
7/23/2014	Gazelle Creek	MDEQ_WQ_WQX-M06GAZLC04	3
9/17/2014	Gazelle Creek	MDEQ_WQ_WQX-M06GAZLC04	4.6
6/18/2014	Lake Creek	MDEQ_WQ_WQX-M06LAKEC01	29
7/28/2014	Lake Creek	MDEQ_WQ_WQX-M06LAKEC01	19.2
9/17/2014	Lake Creek	MDEQ_WQ_WQX-M06LAKEC01	18.66
6/12/2012	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR01	316.49
7/26/2012	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR01	64.6
8/23/2012	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR01	52.03
7/10/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR01	62.22

Table G-18. West Fork Madison River and Tributary DEQ Flow Measurements 2012 through 2014

Date	Stream	Site ID	Total Discharge (ft3/s)
7/28/2014	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR01	61.91
9/17/2014	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR01	53.74
6/12/2012	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR02	370.74
7/26/2012	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR02	31.3
8/26/2012	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR02	28.35
7/11/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR02	37.04
8/13/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR02	23.84
9/16/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR02	17.03
7/28/2014	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR02	42.28
9/17/2014	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR02	29.28
6/12/2012	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR03	316.67
7/23/2012	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR03	33.05
8/23/2012	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR03	24.4
7/11/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR03	35.9
8/13/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR03	23.62
9/16/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR03	18.57
7/31/2012	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR04	0
9/16/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR05	45.71
7/11/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR06	58.67
7/11/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR07	58.91
7/28/2014	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR07	55.22
9/17/2014	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR07	50.58
7/12/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR08	38.66
7/12/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR09	33.68
9/16/2014	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR09	21.14
7/12/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR10	5.51
7/30/2014	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR10	4.49
9/16/2014	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR10	5.13
7/31/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR11	6.7
7/30/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR12	6.7
7/30/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR15	5.1
9/16/2014	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR15	4.17
6/26/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR16	6
7/30/2013	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR16	3.26
9/16/2014	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR16	1.26
7/23/2014	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR17	0.25
7/23/2014	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR18	0.5
9/15/2014	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR18	0.93
9/15/2014	West Fork Madison River	MDEQ_WQ_WQX-M06MDWFR19	1.58
7/30/2013	Tepee Creek	MDEQ_WQ_WQX-M06TEPEC01	3.3
9/16/2014	Tepee Creek	MDEQ_WQ_WQX-M06TEPEC01	2.01

Table G-19. West Fork Madison River Solar Pathfinder Data 2013 and 2014

Date	Stream Name	Transect Number	Solar Pathfinder Photo #s at 25%, 50%, 75% Wetted Width	Percent Shade at 25 % Wetted width	Percent Shade at 50 % Wetted width	Percent Shade at 75 % Wetted width
7/10/2013	WF Madison	5A-1	0064, 0065, 0066	2	4	10
7/11/2013	WF Madison	5B-1	0107, 0108, 0109	8	11	15
7/11/2013	WF Madison	5C-1	0089, 0090, 0091	35	37	43
7/11/2013	WF Madison	5C-2	0098, 0099, 0100	49	47	56
7/11/2013	WF Madison	5D-1	0071, 0072, 0073	11	26	50
7/11/2013	WF Madison	5D-2	0080, 0081, 0082	8	11	8
7/11/2013	WF Madison	5G-1	0122, 0123, 0124	36	42	55
7/12/2013	WF Madison	5F-1	0131, 0132, 0134	57	59	61
7/12/2013	WF Madison	5G-1	0135, 0136, 0137	59	54	62
7/12/2013	WF Madison	5H-1	0144, 0145, 0146	17	10	11
7/30/2013	WF Madison	5I-1	0454, 0455, 0456	4	4	24
7/31/2013	WF Madison	5J-1	0460, 0461, 0462	7	8	18
7/30/2013	WF Madison	5K-1	NonG-not wadeable			
7/30/2013	WF Madison	5M-1	0442, 0443, 0444	10	10	8
7/30/2013	WF Madison	5N-1	0432, 0433, 0434	4	1	1
7/23/2014	WF Madison	5P	0963, 0964, 0965	64	29	29
7/23/2014	WF Madison	5X	0954, 0955, 0956	21	14	3
7/23/2014	WF Madison	5Y	No data			

West Fork Madison River DEQ Riparian Vegetation Summary

See **Table G-20** at the end of this Appendix.

Table G-20. DEQ Riparian Vegetation Summary

Stream Name	Date	Transect Number	Reach Aspect °	Transect Aspect °	Bankfull Width	Existing Veg. Type	Potential Veg. Type	Shade Can. Topo	Shade Canopy Trees	Shade Canopy Shrubs	Shade Canopy Ground	Wetted Width	NSDZ	NSDZ Left to	Topographic Altitude ° W S E	Vegetation Height (ft)	Vegetation Crown (ft)	Vegetation Offset (ft)	Vegetation Density (densiometer %)	Vegetation Overhang (ft)	Bank Height (ft)	Bank Angle ° (opposite 120° is acute not obtuse)	Photos
Cherry Creek	8/5/2013	2C-1	80	60	40	cottonwood (CTWD), conifer (CNF), red osier dogwood (ROD), mountain maple	cottonwood, conifer, red osier dogwood, mountain maple	none	CNF/CTWD	ROD	none	29.5	40	23	L 4 30 18 R 5 18 15	L 70 80 CTWD CNF R 54 79 CTWD CNF	L 19 18 CTWD CNF R 19 20 CTWD CNF	L 10 R 8	L 58 94 CTWD CNF R 58 94 CTWD CNF	L 4 R 4	L 5 R 5	L 120 R 140	0533-0538
Cherry Creek	8/5/2013	2B-1	310	310	21.5	willow (W), sedge	willow, sedge	none	W	none	none	18.3	30	18	L 2 7 12 R 3 8 22	L 7 W R 7 W	L 8 W R 8 W	L 1 R 1	L 89 W R 77 W	L 1 R 3	L 3.5 R 4	L 150 R 90	0539-0544
Cherry Creek	8/6/2013	2A-1	140	120	26.5	young willow, grass (G), sedge (S)	cottonwood, willow (W), sedge (S)	banks	none	none	none	23	23	12	L 22 13 18 R 9 5 17	L 21 W G/S R 31 W G/S	L 0 W R 0 W	L 1 R 1	L 80 W/S/G R 83 W/S/G	L 1 R 0	L 5 R 4	L 100 R 130	0565-0572
Elk Creek	8/2/2013	1B-1	300	35	8.3	willow (W), juniper (J), snowberry (SB), sedge (S)	willow (W), juniper (J), snowberry (SB), sedge (S)	none	W/J	SB	S/G	8.3	12	11	L 17 8 8 R 9 5 10	L 5 R 12 W/J	L 3 W R 12	L 5-15 R 1	L 82 74 WS R 87 88 WJ	L 4 R 6	L 5 R 3	L 110 R 110	0516-0524
Elk Creek	8/5/2013	1D-1	50	60	5.8	willow (W), sedge (S)	willow (W), sedge (S)	none	W	none	S	2.5	5.9	3	L 2 12 5 R 2 12 5	L 8 W R 8 W	L 6 R 6	L 5 R 5	L 94 88 WS R 94 82 WS	L 1.5 R 1.5	L 2 R 2	L 80 R 80	0525-0530
Elk Creek	8/6/2013	1C-1	45	50	9	cottonwood (CTWD), conifer (CNF), willows (W), alders (A)	cottonwood (CTWD), conifer (CNF), willows (W), alders (A)	none	CTWD/CNF/A	none	none	5	14	8	L 16 79 23 R 14 22 23	L 45 28 CTWD CNF R 70 18 CTWD/CNFA	L 14 R 20 16 CTWD/CNFA	L 18 R 18	L 76 94 82 CTWD CNFA R 94 88 94 CTWD CNFA	L 4 R 1	L 2 R 2	L 130 R 90	0545-0553

Stream Name	Date	Transect Number	Reach Aspect °	Transect Aspect °	Bankfull Width	Existing Veg. Type	Potential Veg. Type	Shade Can. Topo	Shade Canopy Trees	Shade Canopy Shrubs	Shade Canopy Ground	Wetted Width	NSDZ	NSDZ Left to	Topographic Altitude ° W	S	E	Vegetation Height (ft)		Vegetation Crown (ft)		Vegetation Offset (ft)	Vegetation Density (densiometer %)		Vegetation Overhang (ft)	Bank Height (ft)	Bank Angle ° (opposite 120° is acute not obtuse)	Photos
Elk Creek	8/6/2013	1C-2	350	340	8	sedge (S), willow, alders (A), aspens (AP)	grass (G), sedge (S)	yes	A	none	S	4	20	14	L	8	8	9	L 1 18 18	S/G AP A	L 14		L 30	88 L 88 19	A AP G/S	L 1	L 4	L 110	
															R	10	10	11	R 1	G/S	R no trees on RB		R none	R 0.3	G/S	R 0	R 5	R 150,110	0559-0564
Jack Creek	8/1/2013	3X-1	20	0	17	cottonwood (CTWD), willow (W)	cottonwood (CTWD), willow (W)	none	CTWD/ CNF/ SB	none	none	12.5	23	14	L	10	2	8	L 50 5	CTWD W	L 22	CTWD	L 15	82 L 85 76	CTWD SB W	L 12	L 1.8	L 150	
															R	19	2	6	R 50 4	CTWD W	R 30	CTWD	R 2	R 76	W - very few	R 8	R 4	R 130	0468-0473
Jack Creek	7/29/2013	3F-1	100	95	35.8	cottonwood (CTWD), conifer (CNF), willows (W), alders (A)	cottonwood (CTWD), conifer (CNF), willows (W), alders (A)	none	CNF	none	none	32	36	18	L	25	24	14	L 110 18 15	CNF A W	L 20 12 8	CNF A W	L 15	98 L 82 98	CNF A W	L 3	L 1.5	L 140	
															R	23	23	10	R 102 21 60	CNF A CTWD	R 20 12 18	CNF A CTWD	R 12	98 R 95 84	CNF CTWD A	R 3	R 1	R 150	0406 - 0414
Jack Creek	7/29/2013	3F-2	100	90	33	conifer (CNF), alder (A), red osier dogwood (ROD)	conifer (CNF), alder (A), red osier dogwood (ROD)	yes	CNF, A, ROD	wild rose	grass /forb	30	34	18	L	14	22	14	L 80 14	CNF A	L 18 10 6	CNF A ROD	L 10	97 L 96 100	CNF A ROD	L	L 1	L 120	
															R	8	21	11	R 18	A	R 14 8	A ROD	R 1	R 97 98	A ROD	R 5	R 2	R 135	0415-0420
Jack Creek	7/29/2013	3D-1	35	30	29	cottonwood (CTWD), conifer (CNF), alder (A)	cottonwood (CTWD), conifer (CNF), alder (A)	steep hill	CNF, A, ROD	yes	grass /rush	19.7	29	15	L	8	37	20	L 60	CNF/CTWD	L 20 24	CTWD D CNF	L 2-35	84 10 L 0 100	CTWD D CNF A	L 1	L 8	L 105	
															R	10	35	10	R 63 40 14	CTWD CNF A	R 20 16 6	CTWD D A CNF	R 2-25	90 R 96 94	CTWD D CNF A	R 0	R 5	R 110	0421-0428
Jack Creek	8/1/2013	3A-1	145	95	22.5	willow (W), grass (G), birch (B)	willow (W), grass (G), sedge (S)	none	W, birch	none	none	17.5	24.5	13.5	L	3	18	4	L 18	W	L 9		L 8	62 L 84 85	W (small) W B	L 0	L 3.5	L 100	0476-0483

Stream Name	Date	Transect Number	Reach Aspect °	Transect Aspect °	Bankfull Width	Existing Veg. Type	Potential Veg. Type	Shade Can. Topo	Shade Canopy Trees	Shade Canopy Shrubs	Shade Canopy Ground	Wetted Width	NSDZ	NSDZ Left to	Topographic Altitude ° W S E	Vegetation Height (ft)	Vegetation Crown (ft)	Vegetation Offset (ft)	Vegetation Density (densiometer %)	Vegetation Overhang (ft)	Bank Height (ft)	Bank Angle ° (opposite 120° is acute not obtuse)	Photos
															R 10 13 5	R 23 W 22 B	R 16	R 6	R 94 W 88 B	R 2	R 3	R 90	
Madison River	7/22/2014	6A-1	320	320	180	willow (W), grass (G), cottonwood (CTWD)	willow (W), Grass (G), cottonwood (CTWD), sedge, rush	none	yes	none	none	148	0	0	L 30 25 1 R 3 1 2	L 12 W R 40	L 8 R 35	L 30 R 90	L 88 R 82 CTWD 46 G	L 0.5 R 0	L 3 R 5.5	L 30 R 35	0894-0899
Madison River	7/22/2014	6B-1	20	20	330	willow (W), cottonwood (CTWD)	willow (W), cottonwood (CTWD)	yes	yes	none	none	126	45	45	L 50 45 5 R 34 7 5	L 2 R 24	L 1 R 18	L 4 R 210	L 12 R 81 W/C 37 TWD NSD Z W	L 0 R 0	L 51 R 5	L 15 R 1	0901-0908
Madison River	7/22/2014	6C-1	345	345	332	willow (W), grass (G), sedge (S)	willow (W), grass (G), sedge (S)	yes	yes	yes	none	330	0	0	L - - - R 9 8 10	L - - R 5	L - R 3	L - R 1	L - R 78	L - R 1	L - R 1.5	L - R 90	0910-0915
Madison River	7/22/2014	6D-1	260	260	288	reed canary grass (RCG), juniper (J)	juniper (J), willow (W)	yes	none	yes	none	278	0	0	L 15 28 13 R 15 38 14	L 3 R 7	L - R 8	L 3 R 0	L 6 G R 93 RCG	L 0 R 2	L 5 R 3.5	L 35 R 30	0916-0918 0925-0927
Madison River	7/22/2014	6G-1	280	280	200	willow (W), grass (G)	willow (W), grass (G)	yes	none	yes	none	194	0	0	L 10 11 5 R 15 11 6	L 5 R 4.5	L 4 R 2	L 0 R 0	L 76 W R 88 W	L 0.5 R 2	L 2 R 2.5	L 20 R 15	0920 - 0922 0928-0931
Madison River	7/22/2014	6F-1	200	200	196	grass (G), red osier dogwood (ROD), juniper (J), rush (R), nightshade	willow (W), alder (A), grass, (G), rush (R)	yes	yes	none	none	186	0	-	L 30 12 32 R 28 10 50	L 75 R 50	L 22 R 18	L 25 R 50	L 56 R 80	L 1 R 0	L 2.5 R 6	L 30 R 30	0933-0935 0939-0941
Moore Creek	8/1/2013	4A-1	150	140	7	grass (G), Russian olive (RO)	willow (W), sedge (S)	stream bank	none	none	grass	6	6	3	L 18 40 30 R 18 30 40	L 2 R 2	L - dense G R - dense G	L 0 R 0	L 88 G R 87 G	L 1.5 R 1.5	L 1 R 1	L 90 R 90	0484-0492

Stream Name	Date	Transect Number	Reach Aspect °	Transect Aspect °	Bankfull Width	Existing Veg. Type	Potential Veg. Type	Shade Can. Topo	Shade Canopy Trees	Shade Canopy Shrubs	Shade Canopy Ground	Wetted Width	NSDZ	NSDZ Left to	Topographic Altitude ° W	S	E	Vegetation Height (ft)	Vegetation Crown (ft)	Vegetation Offset (ft)	Vegetation Density (densiometer %)	Vegetation Overhang (ft)	Bank Height (ft)	Bank Angle ° (opposite 120° is acute not obtuse)	Photos
Moore Creek	8/1/2013	4D-1	10	10	7	willow (W), grass (G)	willow (W), sedge (S)	none	yes	none	none	4.5	7	3.5	L 11	3	2	L 64 W	L 60	L 2	L 100	L 25	L 0.7	L 150	
															R 10	2	2	R 64 W	R 60	R 2	R 100	R 25	R 0.7	R 150	0493-0499
Moore Creek	8/1/2013	4G-1	130	120	10.7	alder (A), willow (W), sedge (S)	alder (A), willow (W), sedge (S)	none	A/W	none	G	7.5	12	7.5	L 8	10	8	L 20 W/A	L 16	L 2	L 9974 W/A G/S	L 12	L 6	L 95	
															R 10	7	10	R 20 W/A	R 16	R 3	R 9368 W/A G/S	R 12	R 5	R 110	0500-0505
Moore Creek	8/1/2013	4F-1	80	60	9.7	water birch (B), alder (A), conifer (CNF), sedge (S)	water birch (B), alder (A), conifer (CNF), sedge (S)	yes	yes	none	none	6	9.7	6.5	L 8	13	12	L 18 B/A	L 16 B/A	L 0	L 9971 A S/G	L 8	L 2	L 100	
															R 10	12	12	R 18 B/A 35 CNF	R 16 A/CNF	R 8	R 9988 A CNF	R 8	R 1.5	R 150	0506-0511
West Fork Madison River	7/10/2013	5A-1	40	100	50	willow (W), conifer (CNF)	willow (W), conifer (CNF)	none	CNF	none	none	34	52	34	L 12	10	13	L 75	L 24	L 10	L 9785 CNF W	L 8	L 1.8	L 300	0064-0066
															R 10	3	12	R 60	R 36	R 60	R 9381 CNF W	R 0	R 0.2	R 5	0069-0070
West Fork Madison River	7/11/2013	5D-1	70	85	56	willow (W), conifer (CNF)	willow (W), conifer (CNF)	none	CNF	none	none	50	56	25	L 8	15	23	L 72 CNF	L 14 CNF	L 5	L 9472 CNF W	L 12	L 1.7	L 70	
															R 12	18	24	R 78 CNF	R 16 CNF	R 7	R 97 CNF	R 12	R 1.2	R 120	0071-0079
West Fork Madison River	7/11/2013	5D-2	70	50	48	willow (W), conifer (CNF)	willow (W), conifer (CNF)	east	south, west	none	none	42	48	24	L 12	6	23	L 588 CNF W	L 164 CNF W	L 102	L 8685 CNF W	L 4	L 0.5	L 190	
															R 13	10	23	R 566 CNF W	R 184 CNF W	R 51	R 9390 CNF W	R 1	R 2	R 200	0080-0088
West Fork Madison River	7/11/2013	5C-1	150	110	34	willow (W), conifer (CNF)	willow (W), conifer (CNF)	none	CNF	none	none	25.5	42.5	36	L 22	6	32	L 78	L 20	L 50	L 8659 CNF W	L 0	L 1	L 160	
															R 20	26	35	R 68	R 18	R 10	R 81 CNF	R 1	R 5	R 50	0089-0097
West Fork Madison River	7/11/2013	5C-2	150	140	57	conifer (CNF)	conifer (CNF)	right hill	CNF	none	none	45	57	28.5	L 17	12	37	L 60	L 20	L 8	L 8659 CNF W	L 5	L 3	L 80	
															R 17	5	40	R 65	R 16	R 5	R 81 CNF	R 5	R 2	R 150	0098-0106
West Fork Madison River	7/11/2013	5B-1	320	360	32	conifer (CNF), alder (A), willow (W)	conifer (CNF), alder (A), willow (W)	none	yes	none	none	27	64	80	L 45	8	10	L 40 15 CNF W	L 12	L 81	L 8493 CNF W	L 6	L 1.8	L 70	
															R 8	7	15	R 60 4 CNF W	R 163 CNF W	R 351	R 9282 CNF W	R 0	R 1.8	R 150	0107-0115

Stream Name	Date	Transect Number	Reach Aspect °	Transect Aspect °	Bankfull Width	Existing Veg. Type	Potential Veg. Type	Shade Can. Topo	Shade Canopy Trees	Shade Canopy Shrubs	Shade Canopy Ground	Wetted Width	NSDZ	NSDZ Left to	Topographic Altitude ° W S E	Vegetation Height (ft)	Vegetation Crown (ft)	Vegetation Offset (ft)	Vegetation Density (densiometer %)	Vegetation Overhang (ft)	Bank Height (ft)	Bank Angle ° (opposite 120° is acute not obtuse)	Photos
West Fork Madison River	7/11/2013	5G-1	330	350	53.5	willow (W), conifer (CNF)	willow (W), conifer (CNF)	none	W/CNF	none	none	41	54	27	L 13 4 26 R 12 7 27	L 43 R 55	L 16 R 16	L 2 R 10	L 9984 CNFW R 9793 CNFW	L 8 R 1	L 2 R 1.8	L 90 R 170	0116-0124
West Fork Madison River	7/12/2013	5F-1	340	350	37.5	willow (W), conifer (CNF)	willow (W), conifer (CNF)	none	CNF	none	none	30.5	37.5	18.8	L 18 2 20 R 14 10 22	L 40 R 55	L 16 R 18	L 1 R 1	L 9797 CNFW R 100 93 CNFW	L 5 R 8	L 2 R 2	L 155 R 140	0125-0134
West Fork Madison River	7/12/2013	5G-1	330	340	36.5	willow (W), conifer (CNF)	willow (W), conifer (CNF)	none	CNF	none	none	34.8	36.5	18.2	L 11 16 28 R 9 17 35	L 57 R -	L 12 R -	L 4 R -	L 94 R 98	L 0 R 6	L 1.5 R 2	L 100 R 140	0137-0141
West Fork Madison River	7/12/2013	5H-1	40	340	16.7	willow (W), sedge (S)	willow (W), sedge (S)	none	W	none	none	15.5	16.7	8.3	L 12 18 15 R 6 18 15	L 9 R 9	L 9 R 9	L 2 R 1	L 9667 WS R 7897 WS	L 1-4 R 0-2	L 0.5 R 0.5	L 90 R 90	0144-0152
West Fork Madison River	7/30/2013	5N-1	60	70	21.7	willow (W), sedge (S)	willow (W), sedge (S)	none	yes	S	none	16	22.5	11.5	L 8 9 10 R 9 7 11	L 5 W R 6 W	L 4 W R 4 W	L 1 R 0	L 8557 WS R 8378 WS	L 1.5 R 1.5	L 2.5 R 1.5	L 110 R 150	0432-0437
West Fork Madison River	7/30/2013	5M-1	40	40	20	conifer (CNF), willow (W), sedge (S)	conifer (CNF), willow (W), sedge (S)	none	CNF/W	S	none	16.5	20	10.5	L 8 14 16 R 7 16 11	L 5 W R 968 CNFW	L 3 W R 5 W	L 1 R 505	L 9349 WS R 9893 CNFW	L - R 2	L 3.2 R 1.2	L 115 R 150	0442-0444
West Fork Madison River	7/30/2013	5K-1	60	80	48	willow (W), sedge (S)	willow (W), sedge (S)	none	W	S	none	46	48	24	L 8 5 10 R - - -	L 6 R 8	L 4 R 4	L 1 R 1	L 98 R 98	L 2 R 2	L 3.5 R 2	L 110 R 100	0449-0453
West Fork Madison River	7/30/2013	5I-1	65	60	22.5	willow (W), sedge (S)	willow (W), sedge (S)	none	W	none	none	22.5	22.5	11.3	L 10 9 13 R 10 10 11	L 7 R 7	L 6 R 4	L 0 R 0	L 88 R 94	L 3 R 3	L 1 R 1.5	L 100 R 80	0454-0459
West Fork Madison River	7/31/2013	5J-1	150	115	30	conifer (CNF), willow (W), sedge (S)	conifer (CNF), willow (W), sedge (S)	none	W/CNF	none	none	23	30	18.5	L 13 10 16 R 12 13 15	L 8 W R 862 WCNF	L 6 W R 618 WCNF	L 3 R 260	L 9574 WS R 9785 WCNFS	L 0 R 4	L 1 R 2	L 140 R 85	0460-0467

Stream Name	Date	Transect Number	Reach Aspect °	Transect Aspect °	Bankfull Width	Existing Veg. Type	Potential Veg. Type	Shade Can. Topo	Shade Canopy Trees	Shade Canopy Shrubs	Shade Canopy Ground	Wetted Width	NSDZ	NSDZ Left to	Topographic Altitude ° W S E	Vegetation Height (ft)	Vegetation Crown (ft)	Vegetation Offset (ft)	Vegetation Density (densiometer %)	Vegetation Overhang (ft)	Bank Height (ft)	Bank Angle ° (opposite 120° is acute not obtuse)	Photos
West Fork Madison River	7/23/2013	5X-1	40	60	7	willow (W), sedge (S), rush (R)	willow (W), sedge (S), rush (R)	yes	none	yes	none	7	0	0	L 2 16 7 R 5 10 9	L 5 W R 5 W	L 4 R 4	L 1 R 1	L 60 R 65	L 1.5 R 1.5	L 1 R 1.5	L 80 R 80	0951-0956
West Fork Madison River	7/23/2013	5P-1	280	270	11.5	willow (W), sedge (S), grass (G)	willow (W), sedge (S), grass (G)	yes	none	yes	none	10	0	0	L 11 8 8 R 11 8 6	L 6 W R 5 W	L 7 R 6	L 2 R 0	L 69 R 68	L 1 R 2	L 1.2 R 2	L 30 R 90	0960-0965

G4.0 REFERENCES

Washington State Department of Ecology. 2007. Shade (shade_ver31b02.xls in shade.zip) in Models for Total Maximum Daily Load Studies at http://www.ecy.wa.gov/programs/eap/models.html. Downloaded January, 24, 2017.