Ozarks Environmental and Water Resources Institute (OEWRI)
Missouri State University (MSU)

Hydrological Monitoring of the Big Barren Creek Watershed, Mark Twain National Forest, Southeast Missouri

Water Year 2016

SUMMARY REPORT

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WATER YEAR 2016 SUMMARY

This report summarizes the 2016 Water Year (WY2016) discharge results for the 10 stations that were installed in the Big Barren Creek watershed in 2015 and 2016. The 2016 Water Year runs from October 1, 2015 to September 30, 2016. Big Barren Creek is a tributary of the Current River Basin (8-digit Hydrological Unit Code (HUC) #11010008) located in portions of Ripley, Oregon and Carter Counties in southeast Missouri (Figure 1). Gaging station locations were selected along both the main stem of Big Barren Creek and distributed along smaller tributaries throughout the watershed (Figure 2). Drainage areas ranged from 1.59-47.8 km^2 and gage locations within the tributary watersheds drain forest service lands that have either been entirely burned as a land management technique or have remained unburned (Table 1). The majority of the streams within the Big Barren Creek watershed are ephemeral due to the underlying karst landscape where sinkholes, losing streams, and caves are common (Weary et al., 2014). Only the station just downstream of the Cowards Hollow Natural Area is perennial and appears to be associated with a series of northeast trending faults (Weary et al., 2014; Figure 2).

Stage data was recorded every 5-minutes using Hobo U20L-04 Water Level Loggers. The level loggers were installed inside a PVC pipe assembly and secured to 1-2 m staff gages installed at each site. An additional level logger was installed to measure barometric pressure used to compensate for atmospheric pressure changes. Raw data is downloaded periodically (≈ every 10 weeks) from the level loggers using the Hobo Waterproof Shuttle. Discharge rating curves were created at each site to estimate flows for each 5-minute stage reading over the monitoring period. Specific methods used to develop these rating curves can be seen in a separate report (Owen et al., 2020). A total of 289 days of records were collected at 6 of the 7 gages that were installed on December 17, 2015 in WY 2016 (Table 1). There was a total of 2 days of missing data over the year at SPC. Additional gages were installed at MBB and UBB on January 28, 2016 and 246 days of records were collected at these sites. The gage at Cowards Hollow initially installed on December 17, 2015 was lost during a flood and the new gage was moved upstream on July 22, 2016. Therefore, a discharge rating curve was not developed for the initial location and only 70 days of data were collected in WY 2016.

Rainfall

There was a total of 150.2 cm of rainfall in WY2016, which is 30.4 cm higher than the average annual rainfall for the area between 1956-2014 (Pavlowsky et al., 2016). Of that total, 49.2 cm (32.8%) of the total annual rainfall came in the summer from July to September (Figure 3). The second highest seasonal rainfall total occurred in the fall from October-December with 44.6 cm (29.7%) of the total annual rainfall. The highest rainfall totals recorded in WY 2016 occurred

between November 16-18, 2015 with >13 cm and August 14-16, 2016 were nearly 14 cm of rainfall fell. The lowest seasonal rainfall occurred in the winter from January-March with 14.7 cm (9.8%).

Discharge and Runoff

The range in discharge values for WY2016 were calculated for both perennial and ephemeral gaging stations in the Big Barren Creek watershed and runoff was calculated using the portion of rainfall for the timeframe the gages were installed. Average discharge for the only perennial site at CH was 0.025 m^3/s during the limited monitoring period at this location (Table 2). For ephemeral sites, average annual discharge ranged from 0.006 m^3/s at UBB to 0.09 m^3/s at SPC. Station BH only recorded partial flows as it was recently discovered a portion of the flow in the channel jumps to the road ditch upstream of the gaging station. Therefore, data produced at this site is far lower than the other gaging stations. Annual peak discharge ranged from 2.36 m^3/s at CH to 14.7 m^3/s at MBB. Minimum discharge at the perennial sites CH was 0.007 m^3/s.

References

Owen, M.R., S. Ahmed, and R.T. Pavlowsky (2020). Gaging Station Report for: Hydrological Monitoring of the Big Barren Creek Watershed, Mark Twain National Forest, Southeast Missouri, DRAFT REPORT. OEWRI EDR-20-00X. Completed for the U.S. Forest Service, November 24, 2020.

Weary, D.J., R.W. Harrison, R.C. Orndorff, R.E. Weems, J.S. Schindler, J.E. Repetski, and H.A. Pierce (2014) Bedrock Geologic Map of the Spring Valley, West Plains, and Parts of the Piedmont and Poplar Bluff 30'x60' Quadrangles, Missouri, Including the Upper Current River and Eleven Point River Drainage Basins. U.S. Geological Survey Scientific Investigations Map 3280.

TABLES

Table 1. WY2016 gaging station locations in the Big Barren Creek watershed.

Site Name	Site ID	Northing (m) NAD83, UTM15N	Easting (m) NAD83, UTM15N	Elevation (m)	Drainage Area (km^2)	Stream Type	Burn History	Start Date	Total Active Days
Tram Hollow	TH	4,080,612.536	660,800.255	257.10	1.59	Ephemeral	Unburned	12/17/2015	289
Cowards Hollow	CH	4,077,436.497	671,184.193	201.49	2.19	Perennial	Burned	7/22/2016	70
Upper Big Barren	UBB	4,082,297.631	660,727.701	253.46	2.51	Ephemeral	Burned	1/28/2016	246
Barnes Hollow	BH	4,080,152.539	660,963.250	258.76	2.67	Ephemeral	Unburned	12/17/2015	289
Upper Tributary	UT	4,081,698.540	660,910.259	247.92	4.19	Ephemeral	Burned	12/17/2015	289
Wolf Pond	WP	4,084,372.539	665,468.255	232.65	5.13	Ephemeral	Burned	12/17/2015	289
Polecat Hollow	PH	4,082,395.533	664,472.252	224.51	6.19	Ephemeral	Burned	12/17/2015	289
South Prong Cedar	SPC	4,078,550.511	666,420.219	209.96	7.28	Ephemeral	Burned	12/17/2015	287
Fools Catch	FC	4,081,865.521	669,811.222	196.79	7.82	Ephemeral	Unburned	12/17/2015	289
Middle Big Barren	MBB	4,081,306.806	667,938.252	191.57	47.8	Ephemeral	Mixed	1/28/2016	246

Table 2. WY2016 Big Barren Creek watershed gaging station data summary.

Site Name	Drainage Area (km^2)	Rainfall* Vol. (m^3)	Runoff Vol. (m^3)	Rainfall As Runoff (%)	Runoff Depth (cm)	Avg. Q (m^3/s)	Max Q (m^3/s)	10% Q** (m^3/s)	50% Q** (m^3/s)	90% Q** (m^3/s)	Min Q (m^3/s)
Tram Hollow	1.59	1,821,671	162,528	8.9	10.4	0.007	3.39	0.000	0.000	0.000	0.000
Cowards Hollow	2.19	830,720	150,405	18.1	6.8	0.025	2.36	0.029	0.012	0.009	0.007
Upper Big Barren	2.51	2,594,587	129,158	5.0	5.1	0.006	2.72	0.005	0.000	0.000	0.000
Barnes Hollow***	2.67	3,098,001	50,400	1.6	1.9	0.002	0.81	0.003	0.000	0.000	0.000
Upper Tributary	4.19	4,861,657	322,781	6.6	7.7	0.013	9.95	0.000	0.000	0.000	0.000
Wolf Pond	5.13	5,952,339	179,014	3.0	3.5	0.007	5.70	0.000	0.000	0.000	0.000
Polecat Hollow	6.19	7,182,257	315,945	4.4	5.1	0.013	8.99	0.000	0.000	0.000	0.000
South Prong Cedar	7.28	8,446,984	2,236,575	26.5	30.7	0.090	12.6	0.134	0.019	0.000	0.000
Fools Catch	7.82	9,073,546	334,190	3.7	4.3	0.013	9.07	0.000	0.000	0.000	0.000
Middle Big Barren	47.8	49,369,512	861,686	1.7	1.8	0.041	14.7	0.030	0.009	0.000	0.000

** Exceedance value

*** Poor site conditions, only receives a portion of the total watershed runoff.

FIGURES

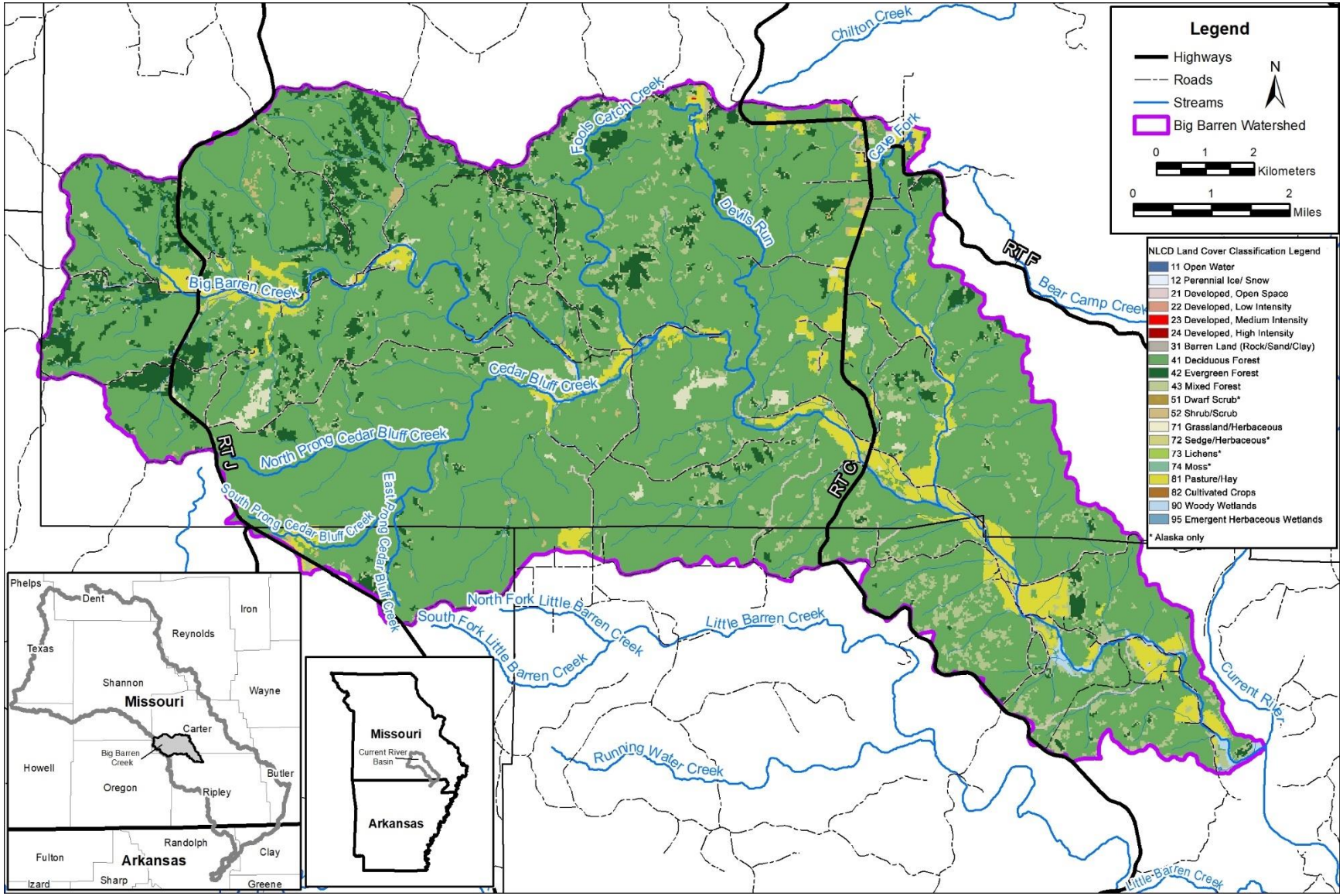

Figure 1. Location and land use of the Big Barren Creek watershed.

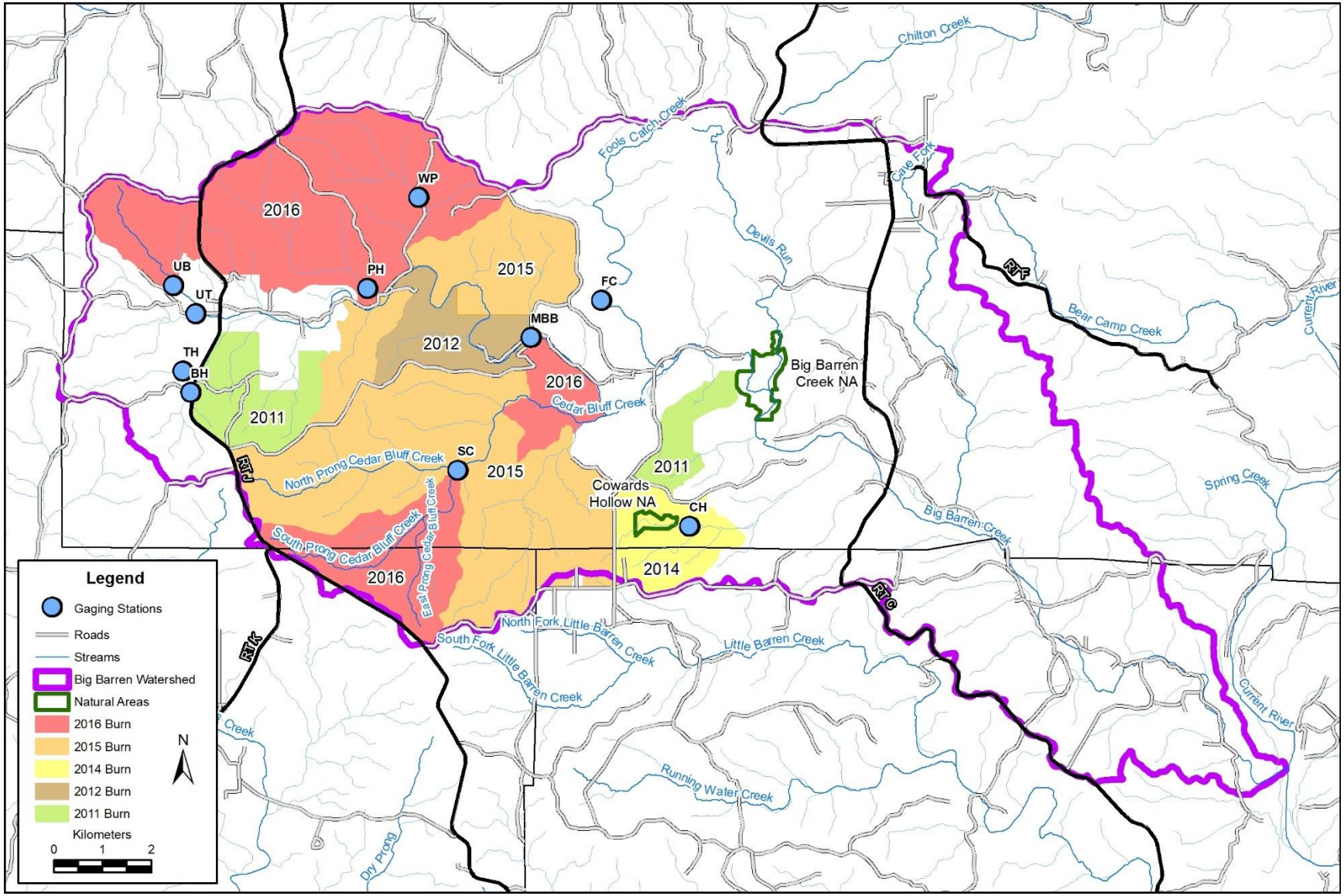

Figure 2. Hydrologic monitoring stations (WY2016) with burn history.

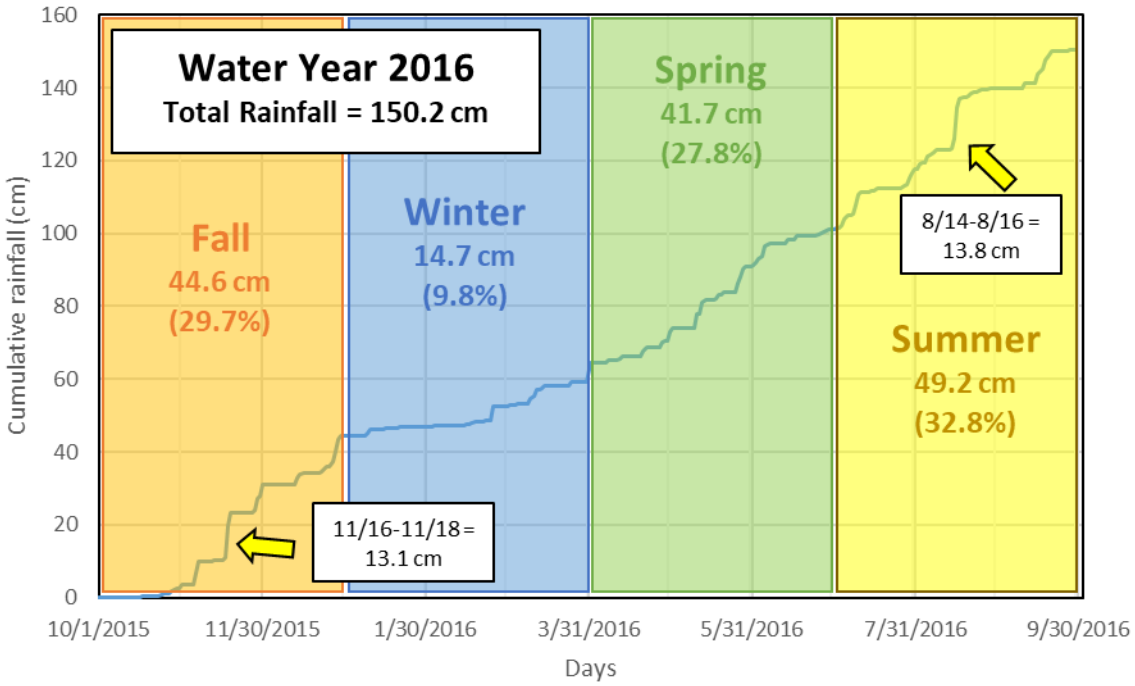

Figure 3. WY2016 cumulative rainfall by season.

WY2016 GAGING STATION RESULTS

Tram Hollow (1.59 km²)

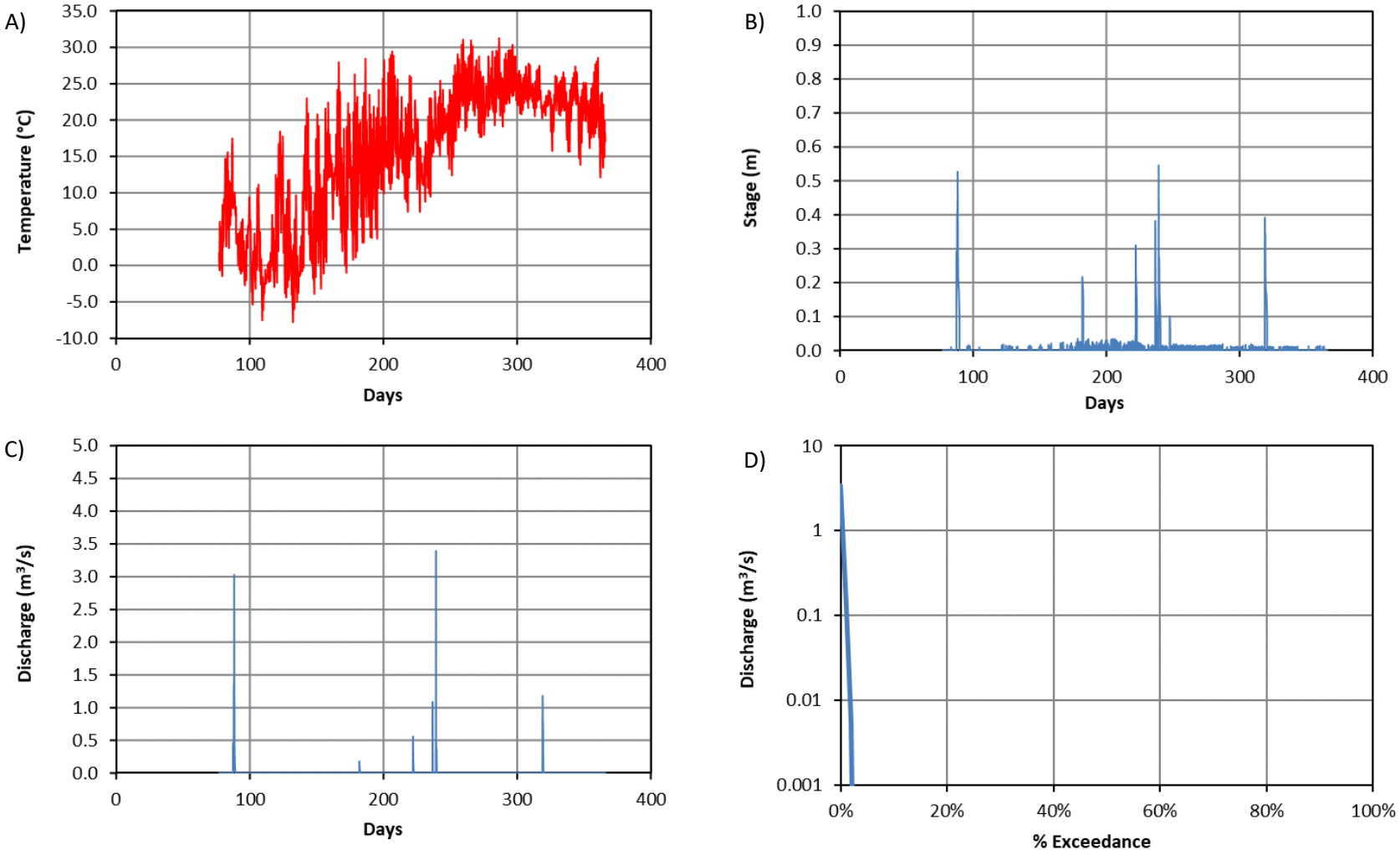

Figure 4. WY2016 A) temperature, B) stage, C) discharge, and D) flow duration curve collected from gaging station at Tram Hollow.

Table 3. Daily Mean Discharge (m^3/s) for WY 2016 at Tram Hollow.

Day	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016
1				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10				0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00
11				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
15				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.00
16				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24			0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00
25			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27			0.27	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.00
28			0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29			0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30			0.00	0.00		0.02	0.00	0.00	0.00	0.00	0.00	0.00
31			0.00	0.00		0.03		0.00		0.00	0.00	
Total			1.00	0.00	0.00	0.04	0.00	0.49	0.00	0.00	0.35	0.00
Mean			0.07	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.00
Max			0.72	0.00	0.00	0.03	0.00	0.28	0.00	0.00	0.32	0.00
Min			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Cowards Hollow (2.19 km^2)

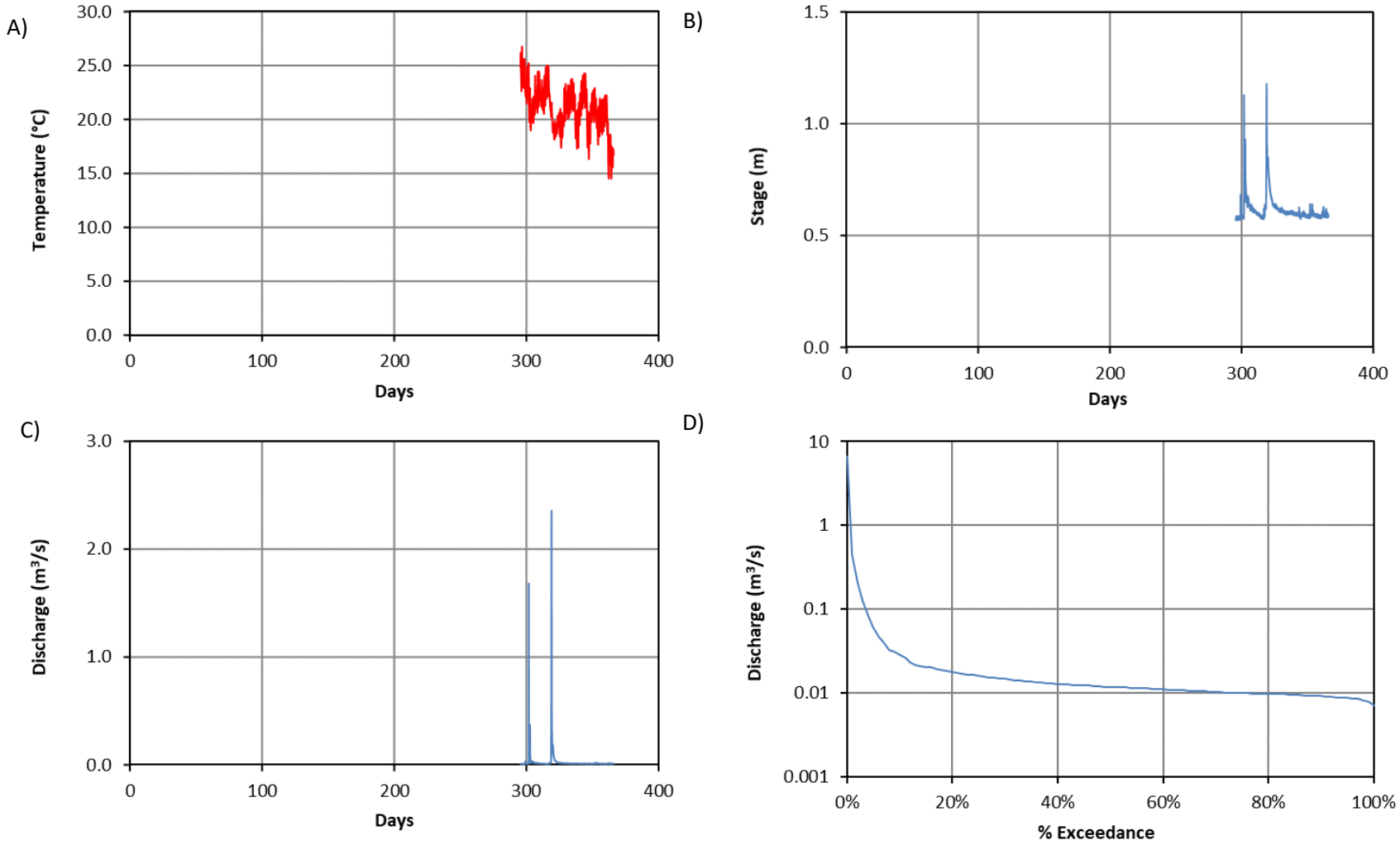

Figure 5. WY2016 A) temperature, B) stage, C) discharge, and D) flow duration curve collected from gaging station at Cowards Hollow.

Table 4. Daily Mean Discharge (m^3/s) for WY 2016 at Cowards Hollow (CH)

Day	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016
1											0.02	0.01
2											0.02	0.01
3											0.02	0.01
4											0.02	0.01
5											0.01	0.01
6											0.01	0.01
7											0.01	0.01
8											0.01	0.01
9											0.01	0.01
10											0.01	0.01
11											0.01	0.01
12											0.01	0.01
13											0.01	0.01
14											0.20	0.01
15											0.38	0.01
16											0.11	0.01
17											0.05	0.01
18											0.03	0.01
19											0.02	0.01
20											0.02	0.01
21											0.02	0.01
22										0.01	0.02	0.01
23										0.01	0.02	0.01
24										0.01	0.01	0.01
25										0.01	0.01	0.01
26										0.01	0.01	0.01
27										0.01	0.01	0.01
28										0.09	0.01	0.01
29										0.06	0.01	0.01
30										0.02	0.01	0.01
31										0.02	0.01	
Total										0.26	1.15	0.34
Mean										0.03	0.04	0.01
Max										0.09	0.38	0.01
Min										0.01	0.01	0.01

Upper Big Barren (2.51 km^2)

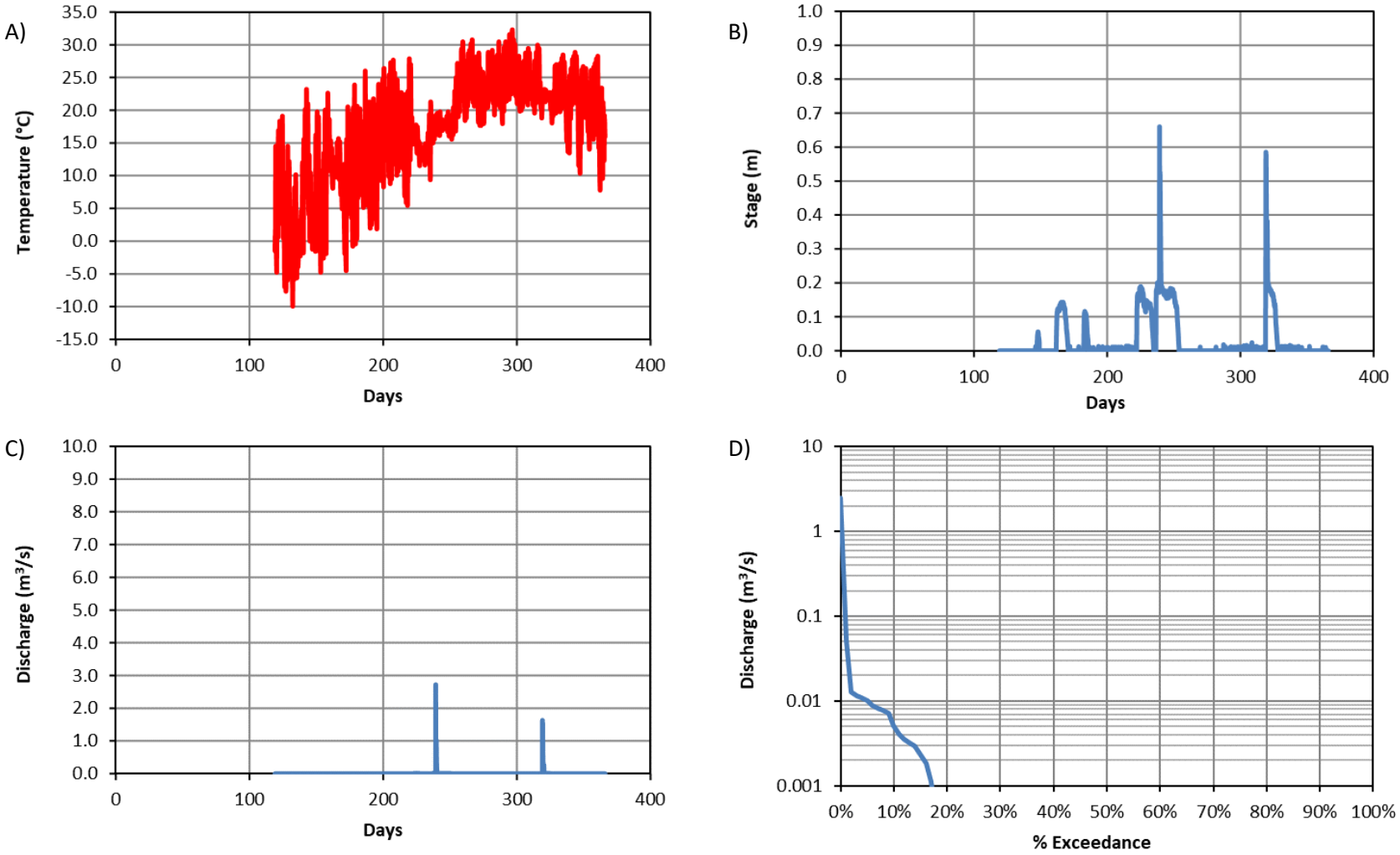

Figure 6. WY2016 A) temperature, B) stage, C) discharge, and D) flow duration curve collected from gaging station at Upper Big Barren.

Table 5. Daily Mean Discharge (m^3/s) for WY 2016 at Upper Big Barren.

Day	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016
1					0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
2					0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
3					0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
4					0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
5					0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
6					0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
7					0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
8					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11					0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
12					0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
13					0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
14					0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
15					0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.00
16					0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00
17					0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
18					0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
19					0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
20					0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
21					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25					0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
26					0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
27					0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00
28				0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00
29				0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
30				0.00		0.00	0.00	0.01	0.00	0.00	0.00	0.00
31				0.00		0.00		0.01		0.00	0.00	
Total				0.00	0.00	0.02	0.00	0.71	0.06	0.00	0.70	0.00
Mean				0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.00
Max				0.00	0.00	0.00	0.00	0.54	0.01	0.00	0.58	0.00
Min				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Barnes Hollow (2.67 km^2)

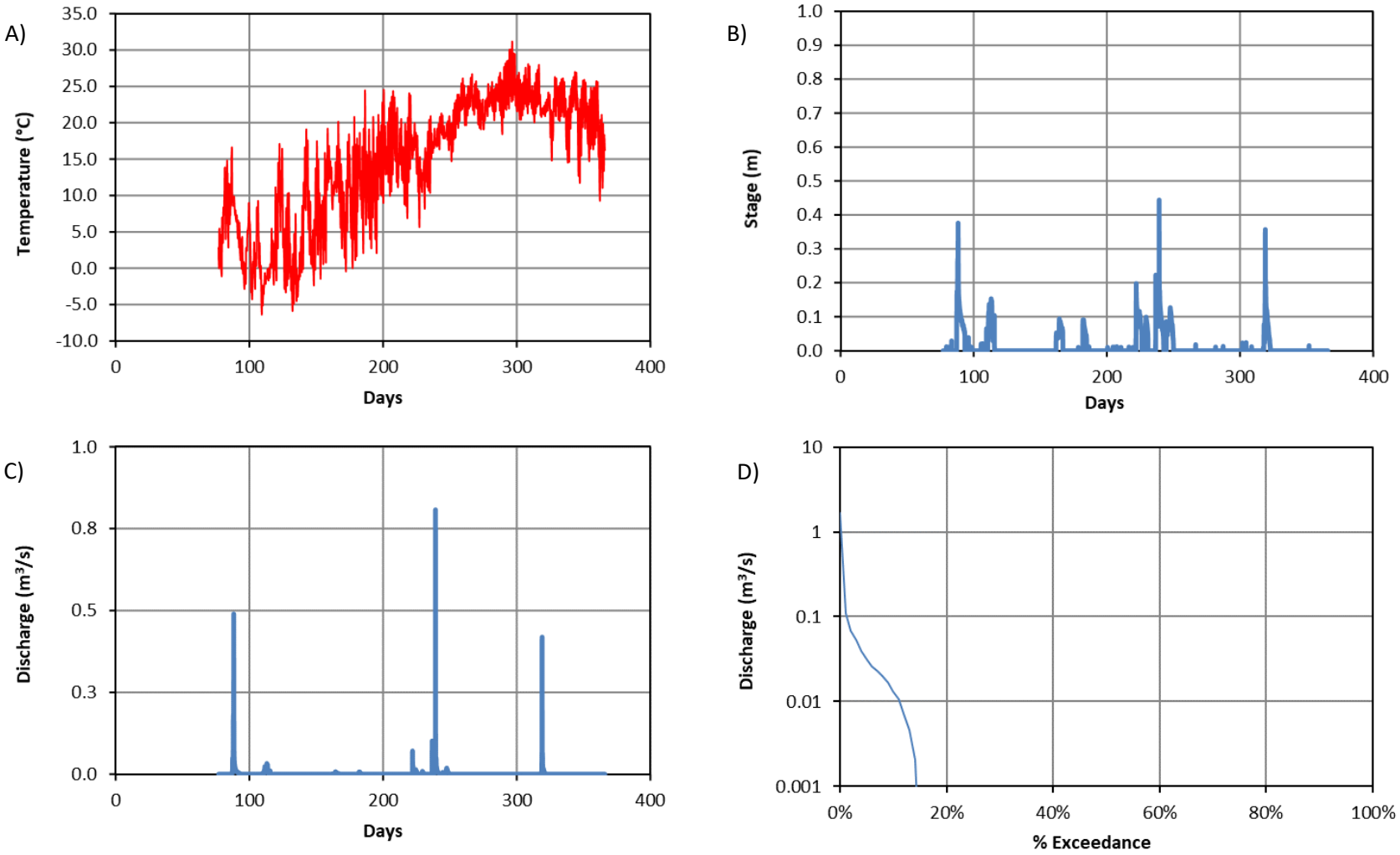

Figure 7. WY2016 A) temperature, B) stage, C) discharge, and D) flow duration curve collected from gaging station at Barnes Hollow.

Table 6. Daily Mean Discharge (m^3/s) for WY 2016 at Barnes Hollow (BH)

Day	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016
1				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4				0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
5				0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
6				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10				0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
11				0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
12				0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
13				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
15				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
16				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
17			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20			0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21			0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22			0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24			0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
25			0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
26			0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
27			0.04	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00
28			0.13	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
29			0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30			0.01	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
31			0.00	0.00		0.01		0.00		0.00	0.00	
Total			0.19	0.05	0.00	0.02	0.00	0.19	0.03	0.00	0.10	0.00
Mean			0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Max			0.13	0.02	0.00	0.01	0.00	0.09	0.01	0.00	0.07	0.00
Min			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Upper Tributary (4.19 km^2)

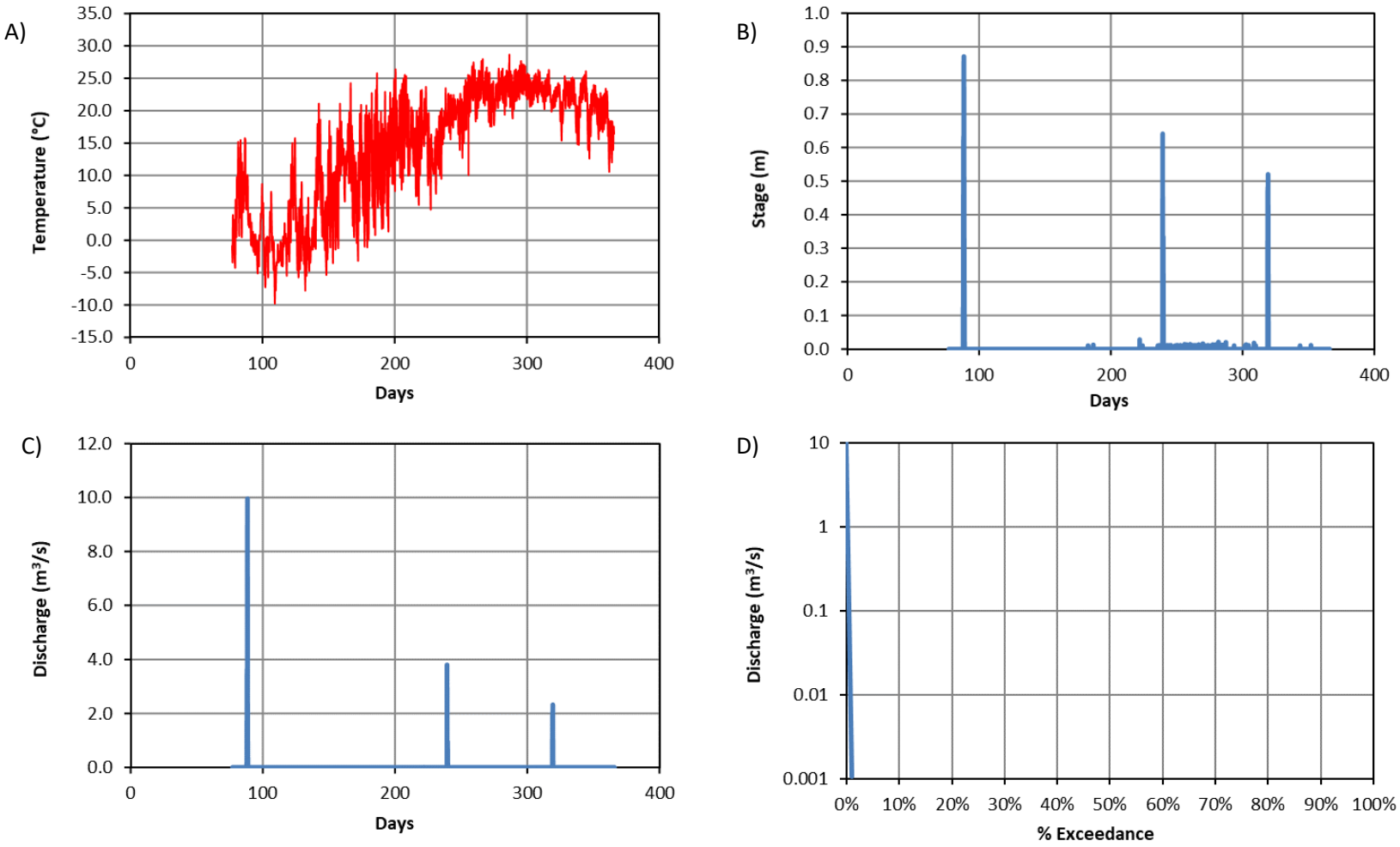

Figure 8. WY2016 A) temperature, B) stage, C) discharge, and D) flow duration curve collected from gaging station at the Upper Tributary.

Table 7. Daily Mean Discharge (m^3/s) for WY 2016 at Upper Tributary.

Day	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016
1				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.00
16				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27			0.20	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00
28			2.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30			0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
31			0.00	0.00		0.00		0.00		0.00	0.00	
Total			2.61	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.62	0.00
Mean			0.17	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.00
Max			2.42	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.62	0.00
Min			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Wolf Pond (5.13 km^2)

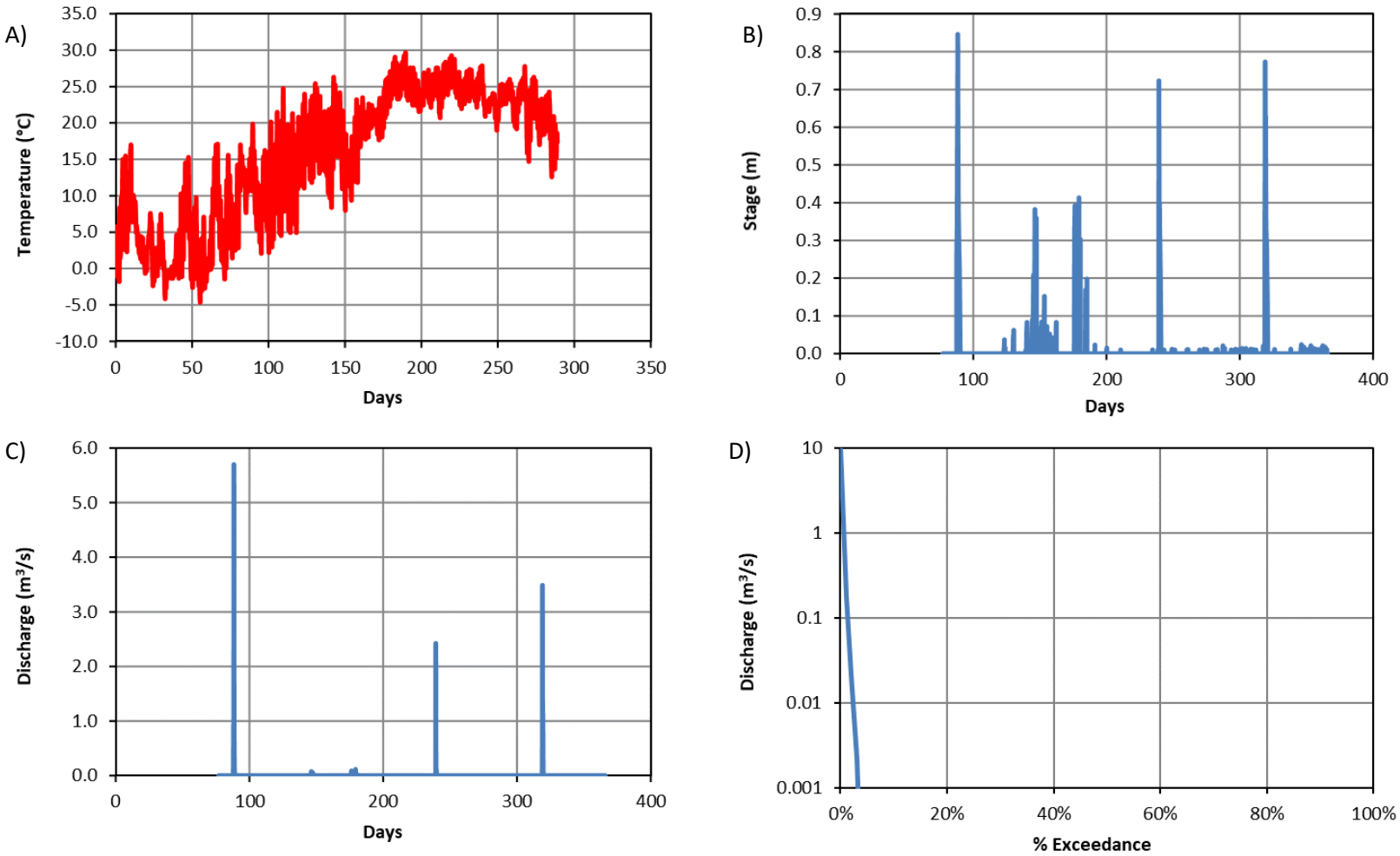

Figure 9. WY2016 A) temperature, B) stage, C) discharge, and D) flow duration curve collected from gaging station at the Wolf Pond Tributary.

Table 8. Daily Mean Discharge (m^3/s) for WY 2016 at Wolf Pond Tributary.

Day	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016
1				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00
15				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00
16				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
17			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24			0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25			0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
26			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27			0.03	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00
28			1.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29			0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30			0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
31			0.00	0.00		0.00		0.00		0.00	0.00	
Total			1.11	0.00	0.02	0.02	0.00	0.21	0.00	0.00	0.72	0.00
Mean			0.07	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00
Max			1.08	0.00	0.01	0.01	0.00	0.20	0.00	0.00	0.65	0.00
Min			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Polecat Hollow (6.19 km^2)

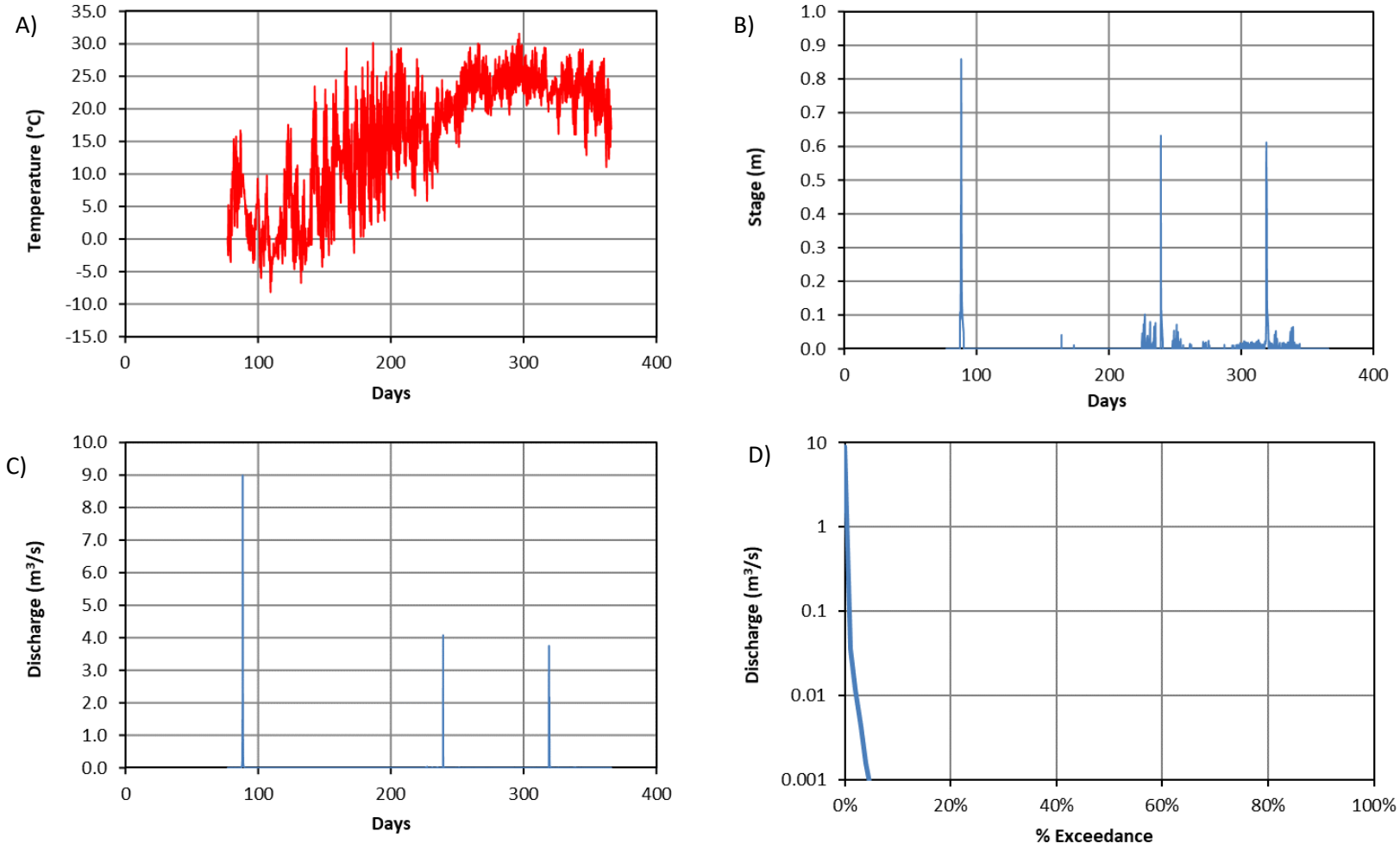

Figure 10. WY2016 A) temperature, B) stage, C) discharge, and D) flow duration curve collected from gaging station at Polecat Hollow.

Table 9. Daily Mean Discharge (m^3/s) for WY 2016 at Polecat Hollow

Day	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016
1				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14				0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.09	0.00
15				0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00
16				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
17			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27			0.04	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00
28			2.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29			0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30			0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
31			0.00	0.00		0.00		0.00		0.00	0.00	
Total			2.12	0.00	0.00	0.00	0.00	0.43	0.01	0.00	1.10	0.01
Mean			0.14	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.04	0.00
Max			2.06	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.99	0.00
Min			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

South Prong Cedar Bluff Creek (7.28 km^2)

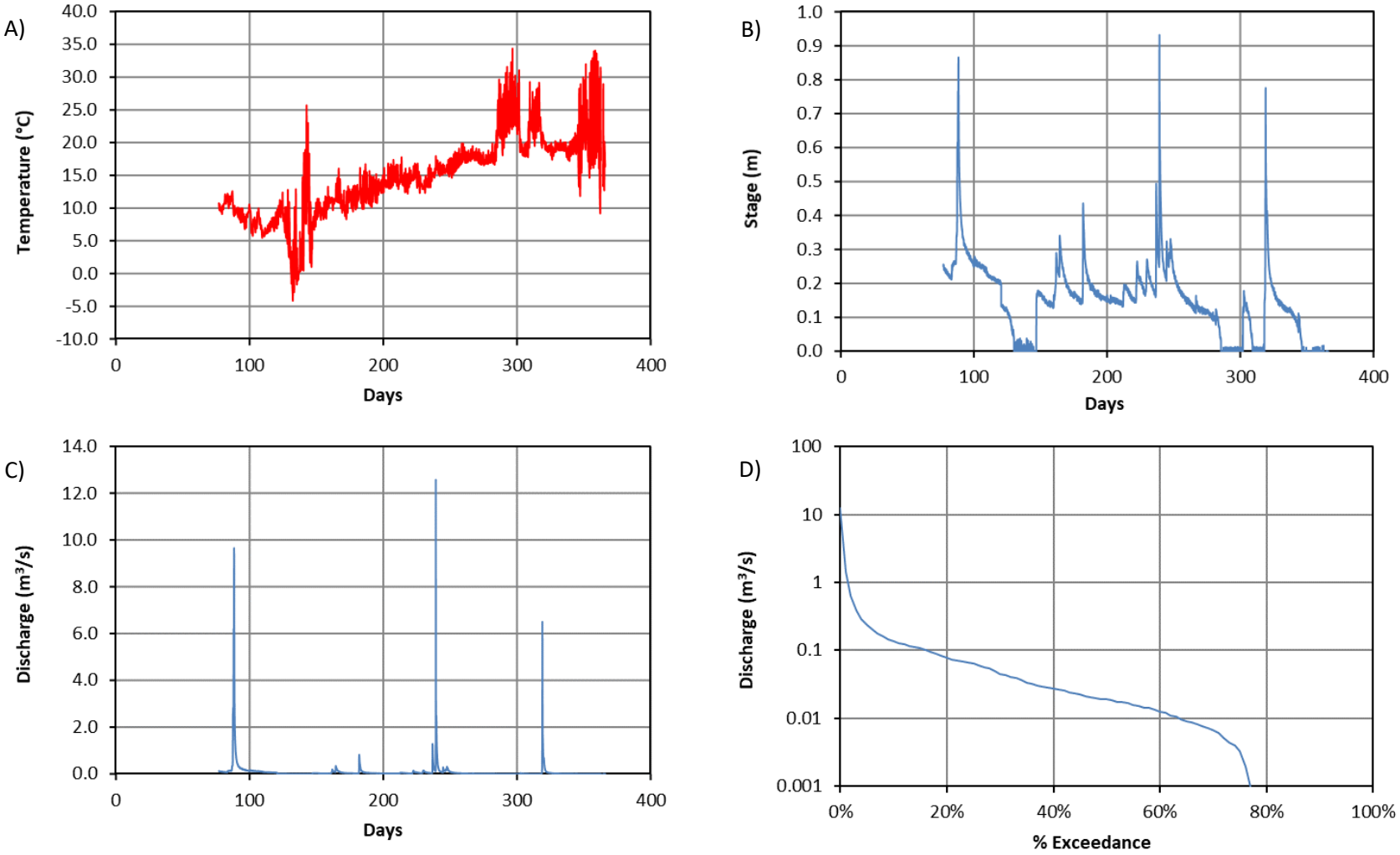

Figure 11. WY2016 A) temperature, B) stage, C) discharge, and D) flow duration curve collected from gaging station at South Prong Cedar Bluff Creek.

Table 10. Daily Mean Discharge (m^3/s) for WY 2016 at South Prong Cedar Bluff Creek.

Day	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016
1				0.27	0.01	0.02	0.15	0.04	0.13	0.01	0.01	0.01
2				0.23	0.01	0.02	0.09	0.04	0.15	0.01	0.01	0.01
3				0.20	0.01	0.02	0.07	0.03	0.15	0.01	0.00	0.01
4				0.18	0.00	0.01	0.05	0.03	0.23	0.01	0.00	0.01
5				0.17	0.00	0.01	0.04	0.03	0.19	0.00	0.00	0.00
6				0.15	0.00	0.01	0.04	0.02	0.11	0.00	0.00	0.00
7				0.14	0.00	0.01	0.04	0.02	0.07	0.00	0.00	0.00
8				0.12	0.00	0.01	0.03	0.02	0.06	0.00	0.00	0.00
9				0.14	0.00	0.02	0.03	0.02	0.05	0.00	0.00	0.00
10				0.13	0.00	0.09	0.03	0.10	0.04	0.00	0.00	0.00
11				0.12	0.00	0.12	0.03	0.07	0.03	0.00	0.00	0.00
12				0.12	0.00	0.08	0.02	0.06	0.03	0.00	0.00	0.00
13				0.11	0.00	0.23	0.02	0.05	0.03	0.00	0.00	0.00
14				0.11	0.00	0.17	0.02	0.04	0.02	0.00	0.37	0.00
15				0.11	0.00	0.11	0.02	0.03	0.02	0.00	1.67	0.00
16				0.10	0.00	0.08	0.02	0.03	0.02	0.00	0.41	0.00
17			0.10	0.10	0.00	0.06	0.02	0.07	0.02	0.00	0.12	0.00
18			0.09	0.09	0.00	0.05	0.02	0.11	0.02	0.00	0.07	0.00
19			0.09	0.07	0.00	0.04	0.02	0.07	0.01	0.00	0.05	0.00
20			0.08	0.07	0.00	0.03	0.02	0.06	0.01	0.00	0.04	0.00
21			0.07	0.07	0.00	0.03	0.02	0.04	0.01	0.00	0.03	0.00
22			0.07	0.06	0.00	0.03	0.02	0.04	0.01	0.00	0.02	0.00
23			0.09	0.06	0.00	0.02	0.02	0.03	0.01	0.00	0.02	0.00
24			0.12	0.06	0.00	0.03	0.02	0.26	0.01	0.00	0.02	0.00
25			0.13	0.06	0.03	0.02	0.02	0.46	0.01	0.00	0.01	0.00
26			0.19	0.06	0.03	0.02	0.02	0.16	0.01	0.00	0.01	0.00
27			1.99	0.05	0.03	0.02	0.01	2.35	0.01	0.00	0.01	0.00
28			4.83	0.05	0.03	0.02	0.01	0.64	0.01	0.00	0.01	0.00
29			1.03	0.03		0.02	0.01	0.20	0.01	0.01	0.01	M
30			0.51	0.01		0.14	0.03	0.11	0.01	0.02	0.01	0.00
31			0.34	0.01		0.42		0.08		0.01	0.01	
Total			9.72	3.26	0.14	1.96	0.96	5.31	1.46	0.09	2.91	0.04
Mean			0.65	0.11	0.01	0.06	0.03	0.17	0.05	0.00	0.09	0.00
Max			4.83	0.27	0.03	0.42	0.15	2.35	0.23	0.02	1.67	0.01
Min			0.07	0.01	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.00

Fools Catch (7.82 km^2)

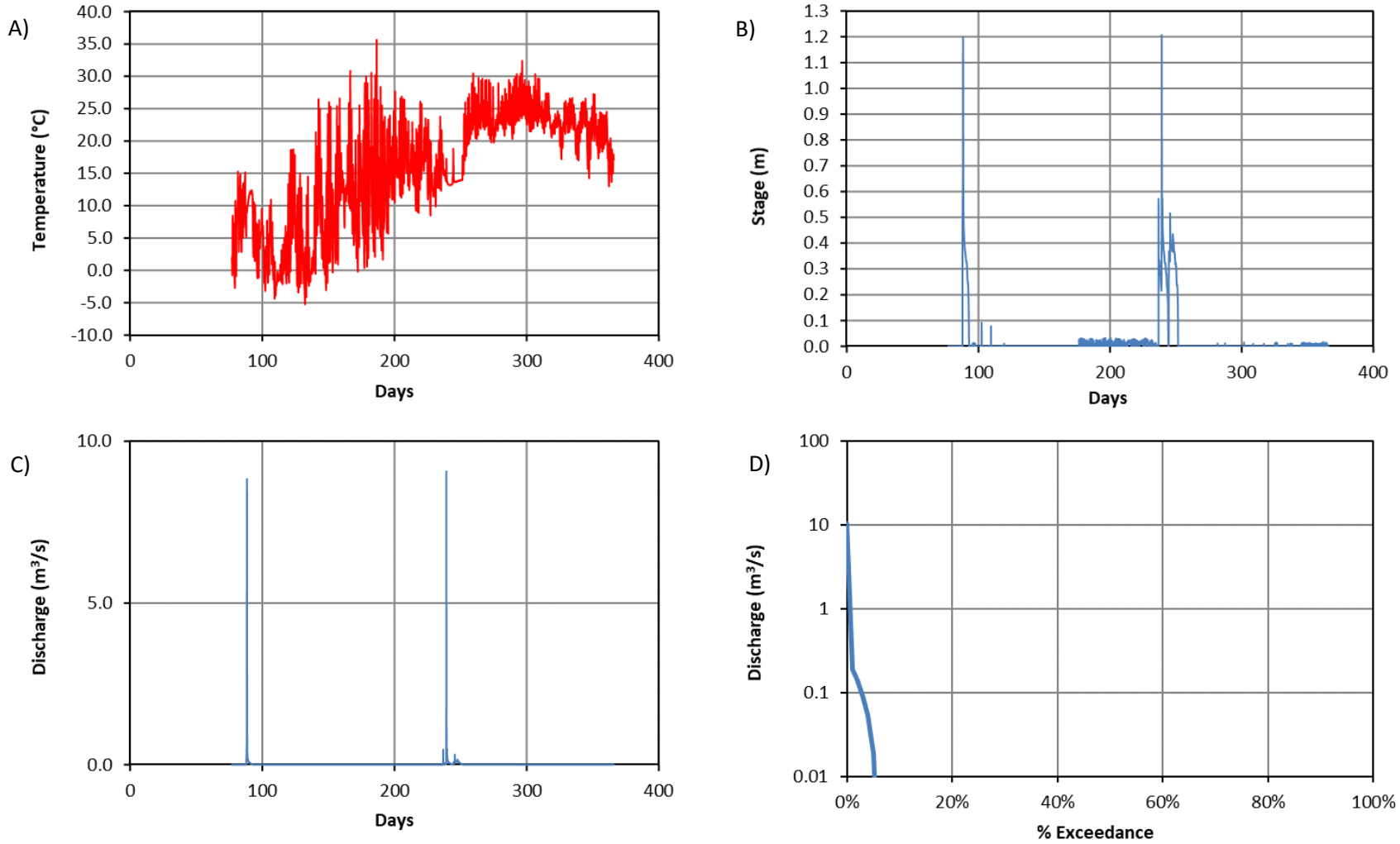

Figure 12. WY2016 A) temperature, B) stage, C) discharge, and D) flow duration curve collected from gaging station at Fools Catch.

Table 11. Daily Mean Discharge (m^3/s) for WY 2016 at Fools Catch

Day	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016
1				0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
2				0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00
3				0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00
4				0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00
5				0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
6				0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00
7				0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
8				0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
9				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24			0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
25			0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00
26			0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
27			0.02	0.00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	0.00
28			1.76	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00
29			0.11	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00
30			0.06	0.00		0.00	0.00	0.04	0.00	0.00	0.00	0.00
31			0.03	0.00		0.00		0.01		0.00	0.00	
Total			1.99	0.01	0.00	0.00	0.00	1.33	0.54	0.00	0.00	0.00
Mean			0.13	0.00	0.00	0.00	0.00	0.04	0.02	0.00	0.00	0.00
Max			1.76	0.01	0.00	0.00	0.00	1.01	0.11	0.00	0.00	0.00
Min			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Middle Big Barren Creek (47.76 km^2)

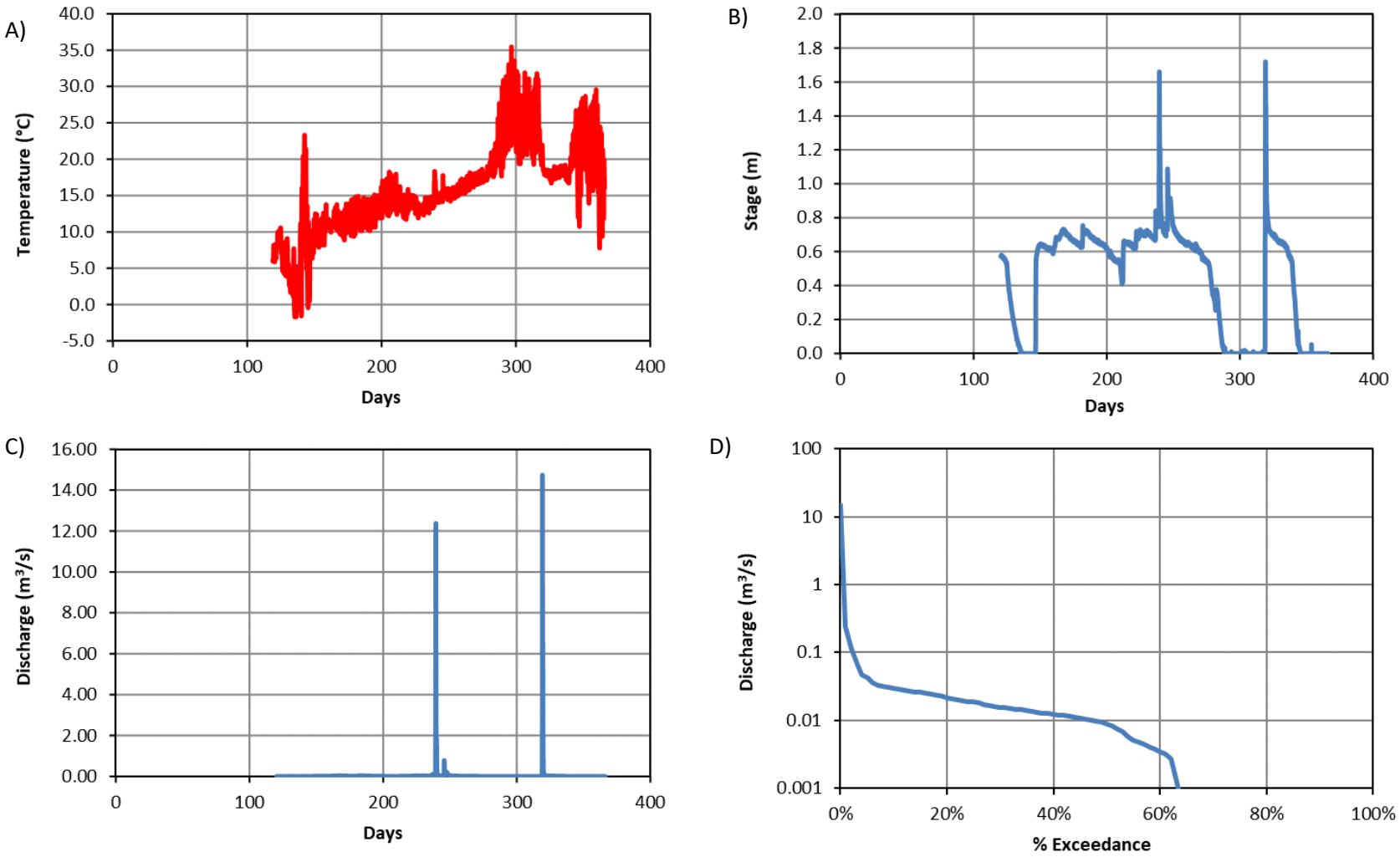

Figure 13. WY2016 A) temperature, B) stage, C) discharge, and D) flow duration curve collected from gaging station at Middle Big Barren.

Table 12. Daily Mean Discharge (m^3/s) for WY 2016 at Middle Big Barren.

Day	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016
1					0.00	0.01	0.03	0.01	0.03	0.00	0.00	0.01
2					0.00	0.01	0.03	0.01	0.20	0.00	0.00	0.00
3					0.00	0.01	0.03	0.01	0.16	0.00	0.00	0.00
4					0.00	0.01	0.03	0.01	0.14	0.00	0.00	0.00
5					0.00	0.01	0.02	0.01	0.10	0.00	0.00	0.00
6					0.00	0.01	0.02	0.01	0.05	0.00	0.00	0.00
7					0.00	0.01	0.02	0.01	0.04	0.00	0.00	0.00
8					0.00	0.01	0.02	0.01	0.03	0.00	0.00	0.00
9					0.00	0.01	0.02	0.01	0.03	0.00	0.00	0.00
10					0.00	0.02	0.02	0.02	0.02	0.00	0.00	0.00
11					0.00	0.02	0.02	0.02	0.02	0.00	0.00	0.00
12					0.00	0.02	0.01	0.03	0.02	0.00	0.00	0.00
13					0.00	0.02	0.01	0.03	0.02	0.00	0.00	0.00
14					0.00	0.03	0.01	0.03	0.02	0.00	0.02	0.00
15					0.00	0.03	0.01	0.03	0.01	0.00	3.94	0.00
16					0.00	0.03	0.01	0.02	0.01	0.00	0.10	0.00
17					0.00	0.03	0.01	0.03	0.01	0.00	0.04	0.00
18					0.00	0.03	0.01	0.03	0.01	0.00	0.03	0.00
19					0.00	0.02	0.01	0.03	0.01	0.00	0.03	0.00
20					0.00	0.02	0.01	0.03	0.01	0.00	0.03	0.00
21					0.00	0.02	0.01	0.02	0.01	0.00	0.02	0.00
22					0.00	0.02	0.00	0.02	0.01	0.00	0.02	0.00
23					0.00	0.02	0.00	0.02	0.01	0.00	0.02	0.00
24					0.00	0.02	0.00	0.04	0.01	0.00	0.02	0.00
25					0.01	0.02	0.00	0.05	0.01	0.00	0.02	0.00
26					0.01	0.01	0.00	0.04	0.01	0.00	0.02	0.00
27					0.01	0.01	0.00	2.55	0.01	0.00	0.01	0.00
28				0.01	0.01	0.01	0.00	0.29	0.01	0.00	0.01	0.00
29				0.01	0.01	0.01	0.00	0.05	0.00	0.00	0.01	0.00
30				0.01		0.02	0.01	0.03	0.00	0.00	0.01	0.00
31				0.00		0.03		0.03		0.00	0.01	
Total				0.02	0.06	0.54	0.39	3.54	1.03	0.01	4.36	0.02
Mean				0.01	0.00	0.02	0.01	0.11	0.03	0.00	0.14	0.00
Max				0.01	0.01	0.03	0.03	2.55	0.20	0.00	3.94	0.01
Min				0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00