

WASHINGTON DEPARTMENT OF ECOLOGY
ENVIRONMENTAL ASSESSMENT PROGRAM
FRESHWATER MONITORING UNIT
STREAM DISCHARGE TECHNICAL NOTES

STATION ID: 45B070
STATION NAME: Icicle Creek near Leavenworth, WA
WATER YEAR: 2016
AUTHOR: Michael S. Anderson

Introduction

Watershed Description

Icicle Creek originates in the snowfields of the eastern slopes of the central Cascade Mountain range and flows into the Wenatchee River at the City of Leavenworth. The watershed is bounded by both the Stuart Range and the Chiwaukum Mountains. Land cover above the gage consists of predominantly coniferous forest but also includes alpine shrubland, montane grassland, bedrock/talus slopes, and riparian woodlands of the Wenatchee National Forest and Alpine Lakes Wilderness Area. Mean annual precipitation across the watershed above this gage location is approximately 82 inches.

Gage Location

The gage is located at the East Leavenworth Road bridge on the right bank, approximately ½ mile downstream of the Leavenworth National Fish Hatchery Complex at river mile 2.5.

Table 1. Basin Area and Legal Description

Drainage Area (square miles)	211
Latitude (degrees, minutes, seconds)	47° 33' 49" N
Longitude (degrees, minutes, seconds)	120° 40' 04" W

Table 2. Discharge Statistics.

Mean Annual Discharge (cfs)	764
Median Annual Discharge (cfs)	498
Maximum Daily Mean Discharge (cfs)	4,200
Minimum Daily Mean Discharge (cfs)	56
Maximum Instantaneous Discharge (cfs)	7,910
Minimum Instantaneous Discharge (cfs)	53
Discharge Equaled or Exceeded 10 % of Recorded Time (cfs)	1,846
Discharge Equaled or Exceeded 90 % of Recorded Time (cfs)	106
Number of Days Discharge is Greater Than Range of Ratings	0
Number of Days Discharge is Less Than Range of Ratings	0
Number of Un-Reported Days	7
Number of Days Qualified as Estimates	27
Number of Modeled Days	0

Note: Statistics displayed in Table 2 may not include values in which the predicted discharge exceeds the range of ratings.

Table 2 Discussion (Discharge Statistics)

Seven discharge measurements were conducted at this site during Water Year (WY) 2016, ranging from 2,714 cfs measured on May 5 to 107 cfs on September 12. Peak flows occurred during a series of strong storm events in November and December, though the bulk of the annual discharge still occurred during spring runoff. Minimum discharges were observed in October as the WY 2015 drought continued into early WY 2016.

Seven days of discharge were unreported due to ice in the channel affecting the stage-discharge relationship. Of the 27 days qualified as estimates, four were between an ice-impacted period and verified ice-free conditions. The remaining 23 estimated days were qualified as estimated based on logger drift error assessment.

Table 3. Error Analysis Summary.

Potential Logger Drift Error (% of discharge)	4.8
Potential Weighted Rating Error (% of discharge)	9.3
Total Potential Error (% of discharge)	14.1

Table 3 Discussion (Error Analysis)

The majority of the uncertainty in the reported discharge for this water year is from potential rating error. Potential rating error is based on the difference between the discharge predicted by the rating table and the measured discharge adjusted to the maximum degree of possible error based on the measurement quality. The potential error at this site is a result of some measurements being assigned "fair" or "poor" quality ratings based on quality assurance/quality control data and professional judgement. At this station, fair and poor rated measurements are usually due to an eddy near the right edge making edge extrapolation difficult. Less than ideal velocity at lower flows also contributes to less than ideal measurement conditions at times.

Table 4. Stage Record Summary

Minimum Recorded Stage (feet)	1.78
Maximum Recorded Stage (feet)	13.4
Range of Recorded Stage (feet)	6.86

Table 4 Discussion (Stage Record)

Peak stage occurred during the runoff from an autumn storm event on November 18, 2014. The November 28 storm event was the strongest of three major storm events that occurred between late October and mid-December. During the November 28 event, evidence was observed that at peak stage, the water was above the bottom of the bridge. This was the highest stage that has been observed since continuous recording started at this station in 2010. The other two events in the fall of 2015 had the second and fourth highest peak stages recorded at this station.

The lowest recorded stage was observed on Oct 6, 2015.

Table 5. Rating Table Summary

Rating Table No.	2	101	
Period of Ratings	10/01/2015-11/17/2015	11/12/2015-11/17/2015	
Range of Ratings (cfs)	0.1-9,230	0.1-9,230	
No. of Defining Measurements	40	61	
Rating Error (%)	9.2	9.3	

Rating Table No.			
Period of Ratings			
Range of Ratings (cfs)			
No. of Defining Measurements			
Rating Error (%)			

Rating Table No.			
Period of Ratings			
Range of Ratings (cfs)			
No. of Defining Measurements			
Rating Error (%)			

Table 5 Discussion (Rating Tables)

Rating Table 2 is a variant of Rating Table #1 that was developed to account for a fill affecting the lower end of the range of flows. Above 250 cfs, Rating Table 1 and Rating Table 2 are identical.

Rating Table 101 is the first clone of Rating Table 1. It describes the stage-discharge relationship following a scour that occurred during a series of autumn storm events.

Table 6. Model Summary

Model Type (Slope conveyance, other, none)	None
Range of Modeled Stage (feet)	N/A
Range of Modeled Discharge (cfs)	N/A
Valid Period for Model	N/A
Model Confidence	N/A

Table 6 Discussion (Modeled Data)

N/A

Table 7. Survey Type and Date (station, cross section, longitudinal)

Type	Date
None	N/A

Table 7 Discussion (Surveys)

N/A

Activities Completed

None

Appendix