

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

STATION ID: 19E060
STATION NAME: Deep Creek
WATER YEAR: 2008
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Introduction

Watershed Description

The Deep Creek watershed contains one of three stations in the Intensively Monitored Watersheds (IMW) project Strait of Juan de Fuca complex. The stream is approximately 7.9 miles long, the basin area is 17.3 square miles. Watershed elevations range from sea level to 3,020 feet. Precipitation falls primarily as rain between October and May, averaging 86 inches annually. Crescent formation volcanic rocks in the upper watershed, and marine sedimentary rock overlain by terraces of glacial deposits in the lower watershed, coarsely define the complex geology of the watershed. The primary land use for the last century has been commercial forestry. Three vegetation zones define the basin--Sitka spruce in the valley bottoms, Western hemlock in the low to mid elevations, and Silver fir in the headwaters. The fish species present include Coho salmon, chum salmon, steelhead or rainbow trout, cutthroat trout, Pacific lamprey, western brook lamprey, torrent sculpin, and reticulate sculpin.

Gage Location

The gaging station for Deep Creek is located in Clallam County, Washington, approximately 27 miles west of Port Angeles. Deep Creek is a tributary to the Strait of Juan de Fuca. The gage, placed on the left bank, is on the downstream side of the Highway 112 bridge at approximately river mile 0.2. The stage record is tidally influenced. Tidal spikes in the stage record are removed.

Table 1.

Drainage Area (square miles)	17.3
Latitude (degrees, minutes, seconds)	48 10 21 N
Longitude (degrees, minutes, seconds)	124 01 36 W

Discharge

Table 2. Discharge Statistics.

Mean Annual Discharge (cfs)	60.9
Median Annual Discharge (cfs)	40.4
Maximum Daily Mean Discharge (cfs)	477
Minimum Daily Mean Discharge (cfs)	3.7
Maximum Instantaneous Discharge (cfs)	575
Minimum Instantaneous Discharge (cfs)	3.7
Discharge Equaled or Exceeded 10 % of Recorded Time (cfs)	145
Discharge Equaled or Exceeded 90 % of Recorded Time (cfs)	5.6
Number of Days Discharge is Greater Than Range of Ratings	2
Number of Days Discharge is Less Than Range of Ratings	8

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

Narrative

2 of the highest days in the predicted discharge record were excluded from some statistics in Table 2. The mean annual discharge, median annual discharge, maximum daily mean discharge, and maximum instantaneous discharge in Table 2 are less than the actual values. During the last 8 days in September of 2008, a protracted rating shift during baseflow conditions resulted in the over prediction of the actual discharge values. The result is that the minimum daily mean discharge and the minimum instantaneous discharge values are less than the actual values reported. Discharge during wy2008 remained relatively moderate throughout except for one exceptionally large, rapidly developing storm which peaked on December 3, 2007. Following the large December event, a series of much smaller storms elevated discharge to moderate flows through February 2008. Even smaller events during the spring finally ceased in mid-June 2008. Discharge declined toward baseflow until mid-August 2008 at which point a series of small events, and one still small but larger event interrupted declining flows.

Error Analysis

Table 3. Error Analysis Summary.

Logger Drift Error (% of discharge)	d/n/a
Weighted Rating Error (% of discharge)	8.8
Total Potential Error (% of discharge)	d/ n/a

Rating Table(s)

Table 4. Rating Table Summary

Rating Table No.	5	6	7
Period of Ratings	10/01-12/06	12/01-01/05	01/01-09/30
Range of Ratings (cfs)	2.8-988	17-988	0-988
No. of Defining Measurements	7	3	19
Rating Error (%)	6.6	9.7	9.2

Rating Table No.	601		
Period of Ratings	09/23-09/30		
Range of Ratings (cfs)	17-988		
No. of Defining Measurements	3		
Rating Error (%)	9.7		

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

Narrative

Rating 5 predicted discharge for the beginning of WY2008. The large storm event in early December 2007 resulted in filling of the control at all but the very highest points of the rating curves. The discharge measurement in December 2007 conducted during the falling limb of this event essentially defined rating 6, a short-lived and relatively poorly-developed rating. During and after January 2008, additional discharge measurements indicated smaller events had scoured the control slightly resulting in the shift from Rating 6 to Rating 7, a more robust and well developed rating. Rating 7 persisted throughout WY2008 however a difficult-to-define, long-phased period in late summer from rating 7 to a replica of rating 6 (601) slightly confounded end of September discharge predictions.

Stage Record

Table 5. Stage Record Summary

Minimum Recorded Stage (feet)	0.61
Maximum Recorded Stage (feet)	8.44
Range of Recorded Stage (feet)	7.83
Number of Un-Reported Days	2
Number of Days Qualified as Estimates	0
Number of Days Qualified as Unreliable Estimates	0

Narrative

The stage record for WY2008 was continuous and complete. Two days in the record were excluded from discharge record predictions because portions of those days recorded stage values which exceeded rating curve thresholds. Equipment/power supply failures on three separate instances during the water year resulted in gaps in the stage record. These gaps were filled using regressed, well-correlated stage data from an adjacent station. Relatively minor differences between the recorded stage value and the observed value of the primary gage index were reconciled by manually adjusting the stage record. Tidal spikes were manually edited.

Modeled Discharge

Table 6. Model Summary

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

Surveys

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

Type	Date

Activities Completed

Telemetry was added to the station in July 2008, greatly improving the ability of staff to track equipment status as well as posting data to the World Wide Web.