

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

STATION ID: 05H070
STATION NAME: Squire Creek at Squire Creek Park
WATER YEAR: 2005
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Introduction

Watershed Description

Squire Creek drains a steep, north-facing basin covering about 20 square miles upstream of the gage at Squire Creek Park. Much of the basin lies in the Boulder River Wilderness as the stream drains the flanks of Three Fingers South and Whitehorse Mountain. Elevation in the basin ranges from 460 ft at the gage to more than 6800 ft on the higher peaks. Mean basin elevation is 2590 ft. Average basin slope is 57 percent. Over 60 percent of the area is covered in forest canopy. Mean annual precipitation is about 93 inches. Squire Creek and its tributaries provide more than 13 miles of spawning habitat for Chinook, Coho, pink and chum salmon, as well as for steelhead and resident trout.

Gage Location

The gage is on the right bank of Squire Creek, north of the Highway 530 bridge. Access for gage maintenance is through Squire Creek Park property.

Table 1. Basin Area and Legal Description

Drainage Area (square miles)	19.8 square miles
Latitude (degrees, minutes, seconds)	48, 16, 13 (NAD83)
Longitude (degrees, minutes, seconds)	-121, 40, 19(NAD83)

Table 2. Discharge Statistics.

Mean Annual Discharge (cfs)	154 cfs
Median Annual Discharge (cfs)	92 cfs
Maximum Daily Mean Discharge (cfs)	3950 cfs
Minimum Daily Mean Discharge (cfs)	0.2 cfs
Maximum Instantaneous Discharge (cfs)	6420 cfs
Minimum Instantaneous Discharge (cfs)	0.09 cfs
Discharge Equaled or Exceeded 10 % of Recorded Time (cfs)	247 cfs
Discharge Equaled or Exceeded 90 % of Recorded Time (cfs)	7.3 cfs
Number of Days Discharge is Greater Than Range of Ratings	None
Number of Days Discharge is Less Than Range of Ratings	None
Number of Un-Reported Days	None
Number of Days Qualified as Estimates	171 days
Number of Modeled Days	13 days

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)

At Squire Creek, 2005 was the second driest water year during the period of record from 2005 through 2013 in terms of mean annual discharge and median annual discharge. A discharge measurement of 0.17 cfs on September 28 documented the flow near the end of the late summer dry spell. Damage to the staff gage during parts of December and January, and problems with the automated gaging system, combined to produce the high number of days qualified as estimates in water year 2005. In addition to the 13 days in which modeled data were used to estimate high flows, there were 11 days in which estimates based on data from nearby stations were used to fill gaps in the discharge record at Squire Creek.

Table 3. Error Analysis Summary.

Potential Logger Drift Error (% of discharge)	5 %
Potential Weighted Rating Error (% of discharge)	12 %
Total Potential Error (% of discharge)	17%

Table 3 Discussion (Error Analysis)

The potential logger drift error of 5 percent of discharge refers to longer term instrument drift that is corrected using a time-weighted adjustment to the stage record. Another instrument problem introduced more variable temperature-related errors that could not be corrected using this method. Days in which these temperature-related variations created errors exceeding 10 percent of discharge are qualified as estimates.

Table 4. Stage Record Summary

Minimum Recorded Stage (feet)	3.04 ft
Maximum Recorded Stage (feet)	11.83 ft
Range of Recorded Stage (feet)	8.79 ft

Table 4 Discussion (Stage Record)

Out of the 171 days qualified as estimates, more than 160 days had some uncertainty concerning the recorded stage. Damage to the staff gage, which was the Primary Gage Index, left the period from late November through the end of January without quality assurance gage height observations for validation of the automated stage record. The temperature related instrument problem mentioned above affected 84 days, mostly during the warmer months of the year.

Gaps in the data record in which the automated stage record was missing or was flawed affected 20 days during the year. Shorter gaps of a few hours or less were filled using linear interpolation. Gaps longer than a few hours were filled using data from nearby reference stations scaled by linear regression to approximate the missing stage record.

Table 5. Rating Table Summary

Rating Table No.	1	2	3
Period of Ratings	10/1/2004 - 1/31/2005	10/9/2004 - 9/7/2005	8/2/2005 - 9/30/2005
Range of Ratings (cfs)	13.7 to 9370 cfs	0.01 to 9370 cfs	0.09 to 9370 cfs
No. of Defining Measurements	7 Mmt's	41 Mmt's	31 Mmt's
Rating Error (%)	11 %	12 %	11 %

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

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Period of Ratings			
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Rating Error (%)			

Table 5 Discussion (Rating Tables)

Channel geometry in the gage reach at Squire Creek has been relatively stable through the period of record for this station. A series of high flow events in late fall and early winter caused the shift for scour from Rating 1 to Rating 2. Scour continued in the summer and fall of 2005 causing the shift to Rating 3.

Table 6. Model Summary

Model Type (Slope conveyance, other, none)	Slope Conveyance
Range of Modeled Stage (feet)	8.4 ft to 13.5 ft
Range of Modeled Discharge (cfs)	1900 cfs to 9370 cfs
Valid Period for Model	Oct. 1 thru Sept. 30
Model Confidence	+/- 5%

Table 6 Discussion (Modeled Data)

The slope conveyance model for Squire Creek is based on a cross-section and longitudinal survey taken on September 16, 2010, and on data from nine channel-control discharge measurements taken between December 2006 and November 2012. Results from this model are applied throughout the period of record for the station because of the overall stability of the channel geometry.

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

Type	Date
Cross Section and Station	9/30/2004 & 2/2/2005

Table 7 Discussion (Surveys)

The cross section and station surveys made at Squire Creek during water year 2005 were not performed according to the improved standards used for surveys done in 2010 and 2012.

Activities Completed

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