WASHINGTON DEPARTMENT OF ECOLOGY

ENVIRONMENTAL ASSESSMENT PROGRAM

FRESHWATER MONITORING UNIT

STREAM DISCHARGE TECHNICAL NOTES

STATION ID: 19C060

STATION NAME: West Twin River

WATER YEAR: 2011

AUTHOR: Casey Clishe

Introduction

Watershed Description

The West Twin River station is a stand-alone, continuously recording gaging station that has been operating since June 2004 in Water Resource Inventory Area (WRIA) 19. Like the other two drainages within the Strait of Juan de Fuca complex (East Twin River and Deep Creek) , West Twin River is very dynamic and carries substantial loads of bed material and large woody debris during precipitation--driven storm events which typically occur from November through February. The basin geology is composed of Crescent Formation volcanic rock in the upper watershed, marine sedimentary rock in the lower watershed, and terraces of glacial deposits in the lower floodplain (ONF 2002).

Gage Location

The gaging station is located in Clallam County, Washington approximately 20 miles west of Port Angeles. The station is on the left bank approximately 0.2 miles upstream from the mouth.

Table 1. Basin Area and Legal Description

Drainage Area (square miles)	12.7
Latitude (degrees, minutes, seconds)	48 09 47
Longitude (degrees, minutes, seconds)	123 57 10

Table 2. Discharge Statistics.

Mean Annual Discharge (cfs)	60
Median Annual Discharge (cfs)	51
Maximum Daily Mean Discharge (cfs)	294
Minimum Daily Mean Discharge (cfs)	3.2
Maximum Instantaneous Discharge (cfs)	385
Minimum Instantaneous Discharge (cfs)	2.8
Discharge Equaled or Exceeded 10 % of Recorded Time (cfs)	154
Discharge Equaled or Exceeded 90 % of Recorded Time (cfs)	4.0
Number of Days Discharge is Greater Than Range of Ratings	17
Number of Days Discharge is Less Than Range of Ratings	0
Number of Un-Reported Days	17
Number of Days Qualified as Estimates	71
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)

Seventeen total days were not factored into the discharge statistics reported in Table 2. These 17 days were some of the highest discharge values recorded during the water year, so actual values were higher than those reported in the table. A high number of days were quality coded estimated due to exceedances of the logger drift error thresholds. Interestingly, the large amount of estimated data appears due to a pronounced evapotranspiration signal in the stage record throughout much of the summer. The largest hydrologic event of the year peaked on December 12, 2010. Moderate fall events preceded this largest storm of the season. The remainder of the typical wet season was marked by a series of small to moderate events. The steady decline to baseflow conditions began in mid-May 2011.

Table 3. Error Analysis Summary.

Potential Logger Drift Error (% of discharge)	34.1
Potential Weighted Rating Error (% of discharge)	8.2
Total Potential Error (% of discharge)	42.3

Table 3 Discussion (Error Analysis)

Total Potential Error (TPE) is the cumulative value of the potential logger drift error and the potential weighed rating error. Error surrounding any predicted discharge value is acquired in a number of ways, ranging from variability in the quality of any particular discrete discharge measurement to the operational performance of a datalogger and the sonde measuring stage. Total Potential Error defines the expected range for any predicted discharge value. For example, if the TPE is 10.0 % and the predicted discharge value is 100 cfs, the range in which the actual predicted value lies is 90 to 110 cfs. For 32 of the recorded days, the agreement between the stage on the logger and discrete observations of the primary gage index met standards defining stable drift. Seventy--one days were quality coded as estimated due to logger drift error exceedances. The average potential logger drift error is unusually large and is due to the unusual signal in the stage record apparently caused by evapotranspiration. This phenomenon occurred during the late summer/baseflow period.

Table 4. Stage Record Summary

Minimum Recorded Stage (feet)	2.72
Maximum Recorded Stage (feet)	8.24
Range of Recorded Stage (feet)	5.52

Table 4 Discussion (Stage Record)

While the stage record for WY2011 is continuous and complete, two unusual circumstances resulted in compromising data quality for a significant portion of the year. The first problem occurred in February 2011 when the pressure transducer became completely buried by substrate. The differences between the observed value of the primary gage index and the logged stage values became so great that, during the review process, it was agreed upon that this entire period would be replaced with regressed, well-correlated stage data from an adjacent station. The second circumstance which compromised stage data quality was the very unusual period of evapotranspiration which began in late July and persisted through the remainder of the water year. While the recorded signal appears to be accurate, the small differences between the observed primary gage index and the logged stage value resulted in large differences in the percentage of discharge. These two factors combined resulted in large periods of compromised data quality for WY2011.

Table 5. Rating Table Summary

Rating Table No.	101	111	901
Period of Ratings	10/01-12/13	12/07-03/14	03/08-05/17
Range of Ratings (cfs)	0.001-397	0.001-331	0.001-381
No. of Defining Measurements	7	7	12
Rating Error (%)	9.0	11.4	8.9

Rating Table No.	12	112	
Period of Ratings	04/14-09/28	09/26-09/30	
Range of Ratings (cfs)	2.8-331	0.001-331	
No. of Defining Measurements	4	7	
Rating Error (%)	5.5	11.4	

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

Table 5 Discussion (Rating Tables)

Five ratings were required to predict discharge for the water year. The large number of ratings required to predict discharge at West Twin River speaks to the extremely dynamic nature of the channel geometry. Substrate and large woody debris is mobilized during virtually all moderate and large storm events. During the water year, the ratings shifted primarily back and forth between pre-existing curves. A new rating, rating Table 12, was created following a series of smaller events in the spring which filled the control.

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	

Table 6 Discussion (Modeled Data)

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

Type	Date

Table 7 Discussion (Surveys)

Activities Completed

Slant pipes housing the pressure transducer and MS5 Hydrolab were exhumed and repositioned on July 13, 2011.