Note: This document describes the data inputs, methodology and limitations regarding data sets that were used to generate synthesized and composite stream flow records. Raw data files are available upon request from the Conservation District; due to the size and number of files they were not included on the Final Draft WRIA 46 Plan CD.

V1.0

DATA SUMMARY SHEET
ENTIAT WATER RESOURCES

PARAMETER: MONTHLY PRECIPITATION AT CHELAN, WA

Time Period: October, 1892 to present (9/2000)

PRIMARY DATA FILE NAME: MONTHLY_PRECIP_CHELAN_1892-2000_4-27-02

Rhodus File Name: FFF_CHELAN_WX_PPT_WY1892-CURRENT_02182002_4-27-02

DATA FILE LOCATION: ENTIATWR1_0

ORIGINAL DATA SOURCE(S): Raw data obtained via excel spreadsheet from Randy Niman, Chelan Ranger District; Station description information obtained from personnel at the Lake Chelan Boat Company Office (June 2002).

NOAA - National Weather Service Cooperative Weather Station #4S-1350 at Chelan, WA (ROSA Station). The Lake Chelan Boat Company has operated this station since 1944. Prior to 1944, the station was maintained by a number of individual cooperators (see hard copy of station history attached). The station was first established at Lakeside on July 1, 1891 and data were published as "Lakeside" prior to changing the name of the station to "Chelan" in 1958. This incredibly complete precipitation record has been consistently maintained at the lower end of the Lake in the immediate vicinity of Chelan, WA since it was first established.

The current station consists of a 3-foot storage bucket mounted on the dock railing behind the Boat Company office. Precipitation, air temperature and lake level are recorded daily at 0700. These data are still being collected.

DESCRIPTION OF ANY MODIFICATION/SUPPLEMENTATION OF ORIGINAL DATA: This data set appears to be complete and of high quality. No modifications were made to the original spreadsheet obtained from Niman. However, no crosschecking of the data transcription from NOAA records to Niman's spreadsheet was conducted.

INTENDED USE OF DATA: Illustrate cyclical variations in annual precipitation over time, etc.

LIMITATIONS REGARDING USE OF DATA SET: Precipitation gage located in the vicinity of Chelan, WA at 1,110 feet msl (actual gage location varied between 985-1,136 feet msl prior to 1944). This is a valley location at the foot of the Cascade Range. The Entiat watershed, to the southwest of this location, is characterized by a wide range in precipitation zones. Data from this Chelan valley site best represent conditions at/near Entiat, WA at the mouth of the Entiat watershed. These Chelan data do not reflect variability in precipitation with change in elevation. However, these data do provide an indication of the cyclic variation in precipitation amounts over the long-term in the area.

DESCRIPTION OF ANY ASSOCIATED GRAPHICS:

1) **Bar graph with median precipitation line (10.71" POR median annual precipitation)**

COMMENTS: This is a very unique set of precipitation data as there are NO missing months since 10/1892 – approximately 108 years of continuous record. Missing data are the norm in the record of almost all other stations in the area—including sites associated with cities much larger than Chelan.

PREPARED BY: Gran Rhodus **LAST UPDATED: 10/29/02**

V1.0

DATA SUMMARY SHEET
ENTIAT WATER RESOURCES

PARAMETER: SNOW WATER EQUIVALENT AT POPE RIDGE SNOW COURSE/SNOTEL SITE
Snow Water Equivalent (SWE in inches of water) as of April 1st each year
[Also with April 1st WY Precipitation at Pope Ridge from 1967-1978 & corresponding annual water yield for Entiat near Ardenvoir (USGS Gage #12452800)]

Time Period: Water years 1966-1978 and 1982-2002

PRIMARY DATA FILE NAME: SWE_POPERIDGE_1966-1978_1982-2002_5-8-02

Rhodus File Name: 1A_AA_POPERIDGESWE_1966-77_1982-2002_5_8_02_V1.1

DATA FILE LOCATION: ENTIATWR1_0

ORIGINAL DATA SOURCES: Snow course data for the period January 1966 through June 1978 were obtained from the files of the USDA Forest Service's Barometer Watershed program (station established in fall 1965). These Barometer Watershed data were adopted and published by the USDA-SCS (Summary of Snow Survey Measurements for Washington 1915-1969, USDA-SCS and WDOE). Art Johnson (FS Barometer Hydrographer) and later Les Julian (FS Recreation/Range) were the primary observers. Snow pillow data from the Barometer program are incomplete and were not included in this data file (See Hydrometeorological Records – Entiat Barometer Watershed 1966-1978, USDA-FS).

The snowfall records for the period 1982-2002 for the Pope Ridge SNOTEL site (snow pillow data) were obtained from the USDA-NRCS website. The status of the Pope Ridge station after shutdown of the Barometer Watershed Program and before SCS adoption of the site (June 1978 - January 1982) is not known—no data appear to be available and it is assumed that the site was abandoned during this period. Ranger District records suggest that the aerial snow marker network was not flown in 1979-1981, but was flown in June 1982 (see companion data summary for Barometer Watershed aerial snow course data).

WY precipitation data are from Barometer Watershed Records (See page 17 of Hydrometeorological Records-Entiat Barometer Watershed). Annual water yield data are from USGS records for the 12452800 gage site (Entiat River near Ardenvoir; see companion data file).

DESCRIPTION OF ANY MODIFICATION/SUPPLEMENTATION OF ORIGINAL DATA: The snow course data from the Barometer Watershed program are considered to be of high quality (1966-1978). The SNOTEL data from the USDA-NRCS are also considered to be of high quality (1982-2002). No modifications have been made to these data.

INTENDED USE OF DATA: Illustrate variations in snow water equivalent (SWE) over time. Forecast of annual runoff volume as a function of snow pack to facilitate implementation of instream flow contingency plans, etc.

LIMITATIONS REGARDING USE OF DATA SET: Pope Ridge is a relatively low elevation site (3,540 feet msl) relative to the westerly portion of the Entiat watershed. The Pope Ridge site may not be truly representative of snow density at higher elevations.
DESCRIPTION OF ANY ASSOCIATED GRAPHICS: Bar graph of snow water equivalent

COMMENTS: During the period 1966 to 1978, determination of snow pack depth at various elevations (3,540 feet at Pope Ridge to 6,800 feet at Fourmile Ridge) in the Barometer Watershed was achieved by use of eight (8) aerial snow markers (See data summary sheet for aerial snow course data). The snow course data obtained at Pope Ridge provided the snow pack density. This is valuable information since local snow pack levels can change by location/elevation, which may significantly affect runoff volumes. Equipment at the Pope Ridge Snotel site was upgraded by the NRCS in 2002.

PREPARED BY: Gran Rhodus **LAST UPDATED: 10/29/02**

V1.0

DATA SUMMARY SHEET
ENTIAT WATER RESOURCES

PARAMETER: MEAN DAILY FLOWS FOR ENTIAT RIVER AT ENTIAT, WA (USGS STATION NO. 12453000)

Time Period: 11/1/1910 to 9/30/1925 and 6/1/1951 to 9/30/58

PRIMARY DATA FILE NAME: MEAN_DAILY_FLOWS_12453000_1910-1925_1951-1958_7-15-01

Rhodus File Name: AA_AA_MEANDAILYQ_BY_WY_12453000_1910_1958_7-15-01

DATA FILE LOCATION: ENTIATWR1_0

ORIGINAL DATA SOURCE(S): These mean daily discharge data were downloaded from official USGS stream discharge gaging records. Approximate date of most recent download: 7/15/2001.

DESCRIPTION OF ANY MODIFICATION/SUPPLEMENTATION OF ORIGINAL DATA: No modifications have been made to this data set. The records are considered to be of high quality.

INTENDED USE OF DATA: To determine the cyclic volume of runoff over time so as to assist in estimating instream flow requirements for the basin. This data set provides the earliest quantitative record of the flow regime of the Entiat.

LIMITATIONS REGARDING USE OF DATA SET: No known limitations other than standard warnings from USGS regarding published data.

DESCRIPTION OF ANY ASSOCIATED GRAPHICS: Standard hydrograph plots.

COMMENTS: We speculate that the 1910-1925 gaging effort was initiated to provide data to support the hydropower plant located on the lower Entiat (at Keystone gage site). The 1951-1958 gaging effort was initiated to provide data to support operation of the Rocky Reach dam.

This station was inundated by the pool behind Rocky Reach dam in 1958-59. One year of overlap data were collected in WY1958 with the new USGS gage installed upstream near the mouth of Stormy Creek (Entiat River near Ardenvoir, WA, USGS Station No. 12452800)

PREPARED BY: Gran Rhodus **LAST UPDATED: 10/29/02**

V1.0

DATA SUMMARY SHEET
ENTIAT WATER RESOURCES

PARAMETER: MEAN DAILY FLOWS FOR ENTIAT RIVER NR ENTIAT, WA (USGS STATION NO. 12542990) (a.k.a. "KEYSTONE" Gage)

Time Period: 3/15/1996 to present (9-30-01)

PRIMARY DATA FILE NAME: MEAN_DAILY_FLOWS_12452990_3-15-96TO9-30-01_3-22-02

Rhodus File Name: A1-AA_AA_MEANDAILY_Q_12452990_KEYSTONE_POR_6-13-02

DATA FILE LOCATION: ENTIATWR1_0

ORIGINAL DATA SOURCE(S): These data were electronically downloaded from official USGS stream discharge records. Approximate date of most recent download: 3/22/02.

DESCRIPTION OF ANY MODIFICATION/SUPPLEMENTATION OF ORIGINAL DATA: No modifications have been made to this data set—other than elimination of any leap year days.

INTENDED USE OF DATA: These data have a variety of water use management applications—flow regime characterization, instream flow determination, etc.

LIMITATIONS REGARDING USE OF DATA SET(S): No known limitations other than standard warnings from USGS regarding published data. The magnitude of winter icing interfering with stage readings is not known because of the short period of record (see comment below). The gaging records are of high quality.

DESCRIPTION OF ANY ASSOCIATED GRAPHICS: Standard hydrograph plots

COMMENTS: This continuous recording station was established in 3/96 through a multi-agency coop with USGS (CCCD, USFS, Chelan County PUD and WDOE). Chelan County PUD supports the station by donation of electricity and provision of site occupancy rights. The station is located on lands owned by the PUD—the former site of a small hydroelectric plant.

The Keystone site is a WDOE Ambient Water Quality Monitoring Station. Prior to 3/96, this site was operated as a miscellaneous measurement site under multi-agency coop (originally USGS and WDOE; in 1990's, the CCCD and USGS were also partners). Tape down measurements are made off a reference point on the upstream side of the Keystone Bridge approx. 25' from the right bank (piece of aluminum angle bolted to steel bridge member).

A heat lamp is installed within the stilling well in winter to reduce the potential for icing. High flow measurements for the station--made from Keystone Bridge--are difficult due to the split channel, with gabions/woody debris at the mid section bridge pier.

Records from this station correlate very well with #12452800 (Entiat River near Ardenvoir, located near the mouth of Stormy Creek).

PREPARED BY: Gran Rhodus **LAST UPDATED: 10/29/02**

V1.0

DATA SUMMARY SHEET
ENTIAT WATER RESOURCES

PARAMETER: COMPOSITE MEAN DAILY FLOWS FOR ENTIAT RIVER NR ENTIAT, WA
(USGS STATION NO. 12542990, a.k.a. "KEYSTONE" Gage)

Time Period: 10/1/1957 to 9/30/2001

PRIMARY DATA FILE NAME: COMPOSITE_MEAN_DAILY_FLOWS_12452990_WY1958-2001_10-27-02

Rhodus File Name: 1A-1A-1A_COMPOSITE_MEAN_DAILY_FLOWS_12452990_WY1958-2001_10-27-02

DATA FILE LOCATION: ENTIATWR1_0

ORIGINAL DATA SOURCE(S): This file is a COMPOSITE of both measured and synthesized flow data for the Keystone gage site---see companion data sets, as follows:

For 10/1/57-9/30/58: Measured mean daily flows for the 12453000 gage
[Data File: MEAN_DAILY_FLOWS_12453000_1910-1925_1951-1958_7-15-01]

For 10/1/58-3/14/96: Synthesized mean daily flows for the Keystone site (from 6 year overlap data set)
[Data File: SYN_MEAN_DAILY_FLOWS_12452990_10-01-58TO3-14-96_10-21-02]

For 3/15/96-9/30/01: Measured mean daily flows for the 12452990 gage
[Data File: MEAN_DAILY_FLOWS_12452990_3-15-96TO9-30-01_3-22-02]

No adjustments were made in the synthesized data to "smooth" the transition between measured and synthesized data at the end of WY1958 and between 3/14/96 and 3/15/96.

DESCRIPTION OF ANY MODIFICATION/SUPPLEMENTATION OF ORIGINAL DATA: Refer to the three companion data sets identified above.

INTENDED USE OF DATA: These data have a variety of water use management applications—flow regime characterization, instream flow determination, etc.

LIMITATIONS REGARDING USE OF DATA SET(S): No known limitations other than standard warnings from USGS regarding published data and recognition that a significant portion of this data set has been synthesized. The gaged records are of high quality.

DESCRIPTION OF ANY ASSOCIATED GRAPHICS: Standard hydrograph plots

COMMENTS: See comments made for the three companion data sets.

PREPARED BY: Gran Rhodus **LAST UPDATED: 10/29/02**

V1.0

DATA SUMMARY SHEET
ENTIAT WATER RESOURCES

PARAMETER: SYNTHESIZED MEAN DAILY FLOWS FOR THE ENTIAT RIVER NR ENTIAT, WA.
(USGS STATION No. 12452990; a.k.a. "KEYSTONE" Gage)

Time Period: Synthesized data for Station #12452990 from 10/1/57 to 3/14/96
[This synthesized record is based on SIX YEARS of gage overlap data—see below]

PRIMARY DATA FILE NAME: SYN_MEAN_DAILY_FLOWS_12452990_10-01-58TO3-14-96_10-21-02

Rhodus File Name: Same as primary file name above

DATA FILE LOCATION: ENTIATWR1_0

ORIGINAL DATA SOURCE(S): These data were electronically synthesized (estimated) using a regression equation. This equation was developed from overlapping actual mean daily flows for the 12452800 and 12453000 gages for WY 1958 and for the 12452800 and 12452990 gages for WYs 1997-2001. The resulting equation used had an intercept of 41.64199 and a slope of 1.151026 (see data spreadsheet).

This data synthesis using 6 years of overlap data is considered superior to the estimation based only on the one year relationship between 12453000 and 12452800. The "six year" overlap data set was used to develop a composite flow record for the Keystone gage (see companion data set).

DESCRIPTION OF ANY MODIFICATION/SUPPLEMENTATION OF ORIGINAL DATA: No modifications were made to the original (measured) data sets for 12453000, 12452990 and 12452800 other than elimination of leap year days.

INTENDED USE OF DATA: The Keystone station is a very significant location for water resource management in the Entiat. These synthesized data have a variety of water use management applications—flow regime characterization, instream flow analysis and plan development, etc.

LIMITATIONS REGARDING USE OF DATA SET(S): The user must keep in mind that this data set has been synthesized using a regression equation based on six years of overlap data for 12453000 and 12452990. No adjustments were made in the synthesized data to "smooth" the transition between measured and synthesized data at the end of WY1958 and between 3/14/96 and 3/15/96.

DESCRIPTION OF ANY ASSOCIATED GRAPHICS: Standard hydrograph plots

COMMENTS: Continuous gaging at the Keystone site (Entiat River near Entiat; 124452990) began on 3/15/96. This "Keystone" gage replaces the "Entiat River at Entiat, WA" (USGS #12453000), which went out of service at the end of WY 1958.

The lower confidence interval regression equation was selected for this synthesis in order to provide a conservative estimate. The mid range (51.3449;1.166293) and upper range (61.04781;1.18156) equations were considered but not employed here.

PREPARED BY: Gran Rhodus **LAST UPDATED: 10/29/02**

V1.0

DATA SUMMARY SHEET
ENTIAT WATER RESOURCES

PARAMETER: SYNTHESIZED MEAN DAILY FLOWS FOR THE ENTIAT RIVER NR ENTIAT, WA.
(USGS STATION No. 12452990; a.k.a. "KEYSTONE" Gage)

Time Period: Synthesized data for Station #12452990 from 10/1/57 to 3/14/96
[This synthesized record is based on ONLY ONE YEAR of overlap data from WY 1958]

NOTE: This data set was NOT used to develop the composite flow record file. The regression based on six years of overlap data was used in developing the composite flow record (see companion data files).

PRIMARY DATA FILE NAME: SYN_MEANDAILY_FLOWS_12452990_10-01-57TO3-14-96_6-14-02

Rhodus File Name: A1_AA_AA_SYNTHESISCALC_1245299012452800_KEYSTONE_WY58-2001_6-14-02

DATA FILE LOCATION: ENTIATWR1_0

ORIGINAL DATA SOURCE(S): These data were electronically synthesized (estimated) using a regression equation. This equation was developed from overlapping actual mean daily flows from 12453000 and 12452800 for WY 1958. The resulting equation had an intercept of 35.59987 and a slope of 1.147886 (see data spreadsheet).

This data synthesis using only one year of overlap data is considered to be inferior to the estimation based on WY1958 + WYs 1997-2001. This "one-year" data set was not used to develop a composite flow record for the Keystone site. The "six year" overlap data set was used to develop the composite flow record for the Keystone gage (see companion data set).

DESCRIPTION OF ANY MODIFICATION/SUPPLEMENTATION OF ORIGINAL DATA: No modifications were made to the original (measured) data sets for 12453000 and 12452800 other than elimination of leap year days.

INTENDED USE OF DATA: The Keystone station is a very significant location for water resource management in the Entiat. These synthesized data have a variety of water use management applications— flow regime characterization, instream flow analysis and plan development, etc.

LIMITATIONS REGARDING USE OF DATA SET(S): The user must keep in mind that this data set has been synthesized using a simple regression equation based on one year of overlap data for the 12453000 and 12452800 gages (WY1958).

DESCRIPTION OF ANY ASSOCIATED GRAPHICS: Standard hydrograph plots

COMMENTS: Continuous gaging at the Keystone site (Entiat River near Entiat; 124452990) began on 3/15/96. This "Keystone" gage replaces the "Entiat River at Entiat, WA" (USGS #12453000), which went out of service at the end of WY 1958.

PREPARED BY: Gran Rhodus **LAST UPDATED: 10/29/02**

V1.0

DATA SUMMARY SHEET
ENTIAT WATER RESOURCES

PARAMETER: MEAN DAILY FLOWS - ENTIAT RIVER NR ARDENVOIR, WA. (USGS STATION #12452800)
(a.k.a., "Ardenvoir Gage")

Time Period: 10/1/1957 to present (9-30-2001)

PRIMARY DATA FILE NAME: MEAN_DAILY_FLOWS_12452800_1957TO2001_3-13-02

Rhodus File Name: AAA_MEANDAILYDISCH_ENTIATRV_12452800_10-01-57TO9-30-2000

DATA FILE LOCATION: ENTIATWR1_0

ORIGINAL DATA SOURCE(S): These data were electronically downloaded from official USGS stream gaging records. Approximate date of most recent download: 3/13/02

DESCRIPTION OF ANY MODIFICATION/SUPPLEMENTATION OF ORIGINAL DATA: No modifications have been made to this data set other than deletion of leap year days. The records are considered to be of high quality.

INTENDED USE OF DATA: This is the longest, continuous record available for the Entiat. These data have a variety of water use management applications—flow regime characterization, instream flow analysis and plan development/implementation, etc.

LIMITATIONS REGARDING USE OF DATA SET(S): No known limitations other than standard warnings from USGS regarding published data.

DESCRIPTION OF ANY ASSOCIATED GRAPHICS: Standard hydrograph plots

COMMENTS: These gaging records are of high quality. The station has been active since WY1958, providing an extensive flow record. There is a one water year overlap with the former Entiat River at Entiat, WA gage(USGS Station #12453000).

Although the gaging records are of high quality, ice can affect the stage reading at this location. Also, during periods of extreme low flow, discharge may also be estimated.

PREPARED BY: Gran Rhodus **LAST UPDATED: 10/29/02**

V1.0

DATA SUMMARY SHEET
ENTIAT WATER RESOURCES

PARAMETER: MEAN ANNUAL RUNOFF (in AC-FT) FOR THE ENTIAT RIVER NR ARDENVOIR, WA. (USGS STATION #12452800, a.k.a., "Ardenvoir Gage")

Time Period: WY1958-WY2001

PRIMARY DATA FILE NAME: MEAN_ANNUAL_RUNOFF_12452800_WY1958-2001_10-27-02

Rhodus File Name: QQ_ANNUALACFT12452800_1958_1999

DATA FILE LOCATION: ENTIATWR1_0

ORIGINAL DATA SOURCE(S): These annual water yield estimates are from USGS stream gaging records for this station.

DESCRIPTION OF ANY MODIFICATION/SUPPLEMENTATION OF ORIGINAL DATA: No modifications have been made to this data set. The records are considered to be of high quality.

INTENDED USE OF DATA: This is the longest, continuous record available for the Entiat. These data have a variety of water use management applications—flow regime characterization, instream flow analysis and plan development/implementation, etc.

LIMITATIONS REGARDING USE OF DATA SET(S): No known limitations other than standard warnings from USGS regarding published data.

DESCRIPTION OF ANY ASSOCIATED GRAPHICS: Bar graph with median yield line

COMMENTS: These data are of high quality. The station has been active since WY1958, providing an extensive flow record. See comments for companion data set for mean daily flow record at this gage site.

PREPARED BY: Gran Rhodus **LAST UPDATED: 10/29/02**

V1.0

DATA SUMMARY SHEET
ENTIAT WATER RESOURCES

PARAMETER: MEAN DAILY FLOWS FOR ENTIAT RIVER AT ENTIAT FALLS
(USFS Barometer Watershed gage)

Time Period: 10/1/1966 to 9/30/1978

PRIMARY DATA FILE NAME: MEAN_DAILY_FLOWS_ENTIATFALLS_1966TO1978_1-08-02

Rhodus File Name: AA_AA_MEANDAILYQ_ENTIATFALLS_USFS_10-01-1966TO9-30-1978

DATA FILE LOCATION: ENTIATWR1_0

ORIGINAL DATA SOURCE(S): These measured data were converted to electronic format from hard copy tables in the following report: Hydrometeorological Records, ENTIAT BAROMETER WATERSHED, 1966-1978, Entiat Ranger District, Wenatchee National Forest. Scanned from hard copies of tables on 1/8/02.

DESCRIPTION OF ANY MODIFICATION/SUPPLEMENTATION OF ORIGINAL DATA: No modifications have been made to these data.

INTENDED USE OF DATA: Determination of flow volumes originating from the headwaters and flow contribution from the North Fork Entiat River. These data have a variety of water use management applications—flow regime characterization, instream flow analysis and plan development/implementation, etc.

LIMITATIONS REGARDING USE OF DATA SET(S): This USFS stream gaging record is of high quality as reflected by the high correlation with data from the USGS gaging station #12452800 (Entiat River nr. Ardenvoir, WA). No known limitations except for limited period of record (see companion data summary for synthesized flow record for Entiat Falls).

DESCRIPTION OF ANY ASSOCIATED GRAPHICS: Standard hydrograph plots

COMMENTS: This continuous recording gage was part of the U. S. Forest Service's Entiat Barometer Watershed program established in 1966. The program was part of a national watershed scheme to characterize water resources and evaluate the impact of resource management on water quantity and quality. The gage was operated from 10/1/66 thru 9/30/1978 and then deactivated with the termination of the Barometer Watershed program.

The Entiat Falls gaging station has been reactivated via the expanded gaging program initially funded with a BPA grant passed through the DOE and CCCD. The gage house is being used to shelter the DOE instrument panel. The stage control at this station remained very stable during the previous years of operation and appears to be quite stable now.

PREPARED BY: Gran Rhodus **LAST UPDATED: 10/29/02**

V1.0

DATA SUMMARY SHEET
ENTIAT WATER RESOURCES

PARAMETER: COMPOSITE MEAN DAILY FLOWS FOR ENTIAT RIVER AT ENTIAT FALLS
(USFS Barometer Watershed gage)

Time Period: **WY1958-1966---Synthesized data**
WY1967-1978---Gaged data
WY1979-2001---Synthesized data

PRIMARY FILE NAME: COMPOSITE_MEAN_DAILY_FLOWS_ENTIATFALLS_10-01-57TO9-30-01_10-17-02

Rhodus File Name: **AA_AA_ENTIATFALLS_POR_GAGED_AND_SYNTHESIZED_5-18-02**

DATA FILE LOCATION: ENTIATWR1_0

ORIGINAL DATA SOURCE(S): This file is a composite of both measured and synthesized flow data for the Keystone gage site---see companion data sets, as follows:

For 10/1/57-9/30/66: Synthesized mean daily flows for the Entiat Falls gage
[Data File: SYN_MEAN_DAILY_FLOWS_ENTIATFALLS_10-1-57to9-30-01_10-17-02

For 10/1/66-9/30/78: Measured mean daily flows for the Entiat Falls gage
[Data File: MEAN_DAILY_FLOWS_ENTIATFALLS_1966TO1978_1-08-02

For 10/1/78-9/30/01: Synthesized mean daily flows for the Entiat Falls gage
[Data File: SYN_MEAN_DAILY_FLOWS_ENTIATFALLS_10-1-57to9-30-01_10-17-02

No adjustments were made in the synthesized data to "smooth" the transition between measured and synthesized data.

DESCRIPTION OF ANY MODIFICATION/SUPPLEMENTATION OF ORIGINAL DATA: Refer to the two companion data sets identified above.

INTENDED USE OF DATA: These data have a variety of water use management applications—flow regime characterization, instream flow determination, etc.

LIMITATIONS REGARDING USE OF DATA SET(S): No known limitations other than standard warnings from regarding non-USGS published data and recognition that a significant portion of this data set has been synthesized.

DESCRIPTION OF ANY ASSOCIATED GRAPHICS: Standard hydrograph plots

COMMENTS: See comments made for the two companion data sets.

PREPARED BY: Gran Rhodus **LAST UPDATED: 10/29/02**

V1.0

DATA SUMMARY SHEET
ENTIAT WATER RESOURCES

PARAMETER: SYNTHESIZED MEAN DAILY FLOWS FOR ENTIAT RIVER AT ENTIAT FALLS (USFS Barometer Watershed gage)

Time Period: WY1958-1966---Synthesized data
WY1967-1978---Gaged data (see companion data sets)
WY1979-2001---Synthesized data

PRIMARY DATA FILE NAME: SYN_MEAN_DAILY_FLOWS_ENTIATFALLS_10-01-57TO9-30-01_10-17-02

Rhodus File Name: AA_AA_ENTIATFALLS_POR_GAGED_AND_SYNTHESIZED_5-18-02

DATA FILE LOCATION: ENTIATWR1_0

ORIGINAL DATA SOURCE(S): Data for water years 1958-1966 and 1979-2000 were electronically synthesized (constructed) using a regression equation. This equation was developed from overlapping actual mean daily flows between 12452800 and the Entiat Falls gages for WYs 1967-1978. The resulting equation had an intercept of –17.4619 and a slope of 0.797544 (see data spreadsheet).

The original gaged data (1967-1978) used in this synthesis were converted from hard copy to electronic format (Hydrometeorological Records, ENTIAT BAROMETER WATERSHED, 1966-1978, Entiat Ranger District, Wenatchee National Forest).

DESCRIPTION OF ANY MODIFICATION/SUPPLEMENTATION OF ORIGINAL DATA: The original twelve water years of gaged record between 10/1/1966 and 9/30/1978 were used to estimate flows from 1958-1966 and 1979 to 2000 by correlation with Entiat River near Ardenvoir (USGS Gage #12452800). The correlation between the Entiat at Entiat Falls and Entiat River nr Ardenvoir, WA was excellent.

INTENDED USE OF DATA: Determine flow volumes originating from the headwaters and flow contribution of the North Fork Entiat River. These data have a variety of water use management applications—flow regime characterization, instream flow analysis and plan development/implementation, etc.

LIMITATIONS REGARDING USE OF DATA SET(S): Synthesized data are subject to the error introduced by correlation equations with varying accuracy. The gaged data (1966-1978) are considered to be of high quality as verified by the high correlation with the USGS gaging station #12452800 (Entiat River nr. Ardenvoir, WA).

DESCRIPTION OF ANY ASSOCIATED GRAPHICS: Standard hydrograph plots

COMMENTS: This continuous recording gage was part of the U. S. Forest Service's Entiat Barometer Watershed program established in 1966. The program was part of a national watershed scheme to characterize water resources and evaluate the impact of resource management on water quantity and quality. The gage was operated from 10/1/66 thru 9/30/1978 and then deactivated with the termination of the Barometer Watershed program.

The Entiat Falls gaging station has been reactivated via the expanded gaging program initially funded with a BPA grant passed through the DOE and CCCD. The gage house is being used to shelter the DOE instrument panel. The stage control at this station remained very stable during the previous years of operation and appears to be quite stable now.

PREPARED BY: Gran Rhodus **LAST UPDATED: 10/29/02**

V1.0

DATA SUMMARY SHEET
ENTIAT WATER RESOURCES

PARAMETER: MEAN DAILY FLOWS FOR MAD RIVER AT ARDENVOIR, WA (USGS Station #12452890)

Time Period: 4/26/2002 to present (9/30/2002)

PRIMARY DATA FILE NAME: MEAN_DAILY_FLOWS_12452890_4-26-02TO9-30-02_10-17-02

Rhodus File Name: Same as primary file name above

DATA FILE LOCATION: ENTIATWR1_0

ORIGINAL DATA SOURCE(S): These are WORKING RECORD mean daily flow data for the new USGS gage for the Mad River at Ardenvoir (at Mill Camp Bridge). They were obtained from Bill Taylor (USGS Hydrographer) on 10-17-02 (These are pre-provisional data NOT having been reviewed for adjustments).

DESCRIPTION OF ANY MODIFICATION/SUPPLEMENTATION OF ORIGINAL DATA: No modifications have been made to this WORKING RECORD data set.

INTENDED USE OF DATA: The Mad River station is an important factor in the IFIM scheme. This is the beginning of the official, continuous flow record for this significant Entiat tributary. These data have a variety of water use management applications—flow regime characterization, instream flow analysis and plan development, etc.

LIMITATIONS REGARDING USE OF DATA SET(S): These are WORKING RECORD USGS data obtained informally from USGS on 10-17-02. This record has limited application until preliminary review is completed by USGS and provisional status is applied to the information. However, the data are considered to be of sufficient quality for use in synthesizing a flow record for the Mad River.

DESCRIPTION OF ANY ASSOCIATED GRAPHICS: Standard hydrograph plot

COMMENTS: On 4/25/2002, the USGS installed a continuous recording gaging station at this location. Prior to this date, the site was operated by USGS as a miscellaneous measurement site (USGS staff gage installed on 4/14/1999). See companion data summary for miscellaneous flow record associated with this site.

Synthesis of estimated mean daily flows for the Mad River has been difficult at best (see companion data summary for synthesized flow data for the Mad River—still being finalized as of 10-29-02). The continuous record obtained at this station over time will be invaluable in improving these results and in implementation of instream flow strategies.

PREPARED BY: Gran Rhodus **LAST UPDATED: 10/29/02**

V1.0

MAD RIVER FLOW SYNTHESIS STILL BEING FINALIZED AS OF 10/29/02
CORRESPONDING DATA FILE NOT YET AVAILABLE – SHOULD BE COMPLETED BY 11/5/02

DATA SUMMARY SHEET
ENTIAT WATER RESOURCES

PARAMETER: SYNTHESIZED MEAN DAILY FLOWS FOR THE MAD RIVER AT ARDENVOIR, WA
(USGS Station #12452890; a.k.a. "Mad River at Mill Camp Bridge")

Time Period: Synthesized data for 12452990 for Water Years _____

PRIMARY DATA FILE NAME:

Rhodus File Name: **AA_AA_AA_MEANDAILYQ_#12452890_MADRIVER_SYNTHESIS_10-01-57TO9-30-2001_6-14-02**

DATA FILE LOCATION: ENTIATWR1_0 (this data file not yet included on the V1.0 data CD)

ORIGINAL DATA SOURCE(S): The continuous flow records for Entiat near Ardenvoir (#12452800) and Mad River at Ardenvoir (12452890) were used to develop this synthesized flow record for the Mad River. The continuous record for the Mad River obtained for 4/26/02-9/30/02 was critical to development of a regression relationship between the Mad River and the 12452800 gage.

DESCRIPTION OF ANY MODIFICATION/SUPPLEMENTATION OF ORIGINAL DATA: No modifications were made to the original (measured) data sets for 12452800 and 12452890 other than elimination of leap year days from the 12452800 record. The WY2002 data set for the 12452890 gage is a WORKING RECORD only---pre-provisional status---provided to us by the USGS for limited use only (e.g., record synthesis).

INTENDED USE OF DATA: The Mad River drains a 92 square mile watershed, contributing approximately 30% of flow volume at the mouth of the Entiat Valley. This drainage provides quality habitat for bull trout and steelhead populations. These synthesized data have a variety of water use applications---flow regime characterization, instream flow analysis and plan development, etc.

LIMITATIONS REGARDING USE OF DATA SET(S): The user must keep in mind that this data set has been synthesized. The continuous flow record being collected at this site is critical to the characterization of the Mad River flow regime.

DESCRIPTION OF ANY ASSOCIATED GRAPHICS: Standard hydrograph plot

COMMENTS: Synthesis of estimated mean daily flows for the Mad River has been difficult at best. The paired watershed scheme has been analyzed as well as correlation formulas utilizing the Ardenvoir and Keystone sites. The timing and volume of runoff for the Mad River differs just enough to provide less than quality results.

PREPARED BY: Gran Rhodus **LAST UPDATED: 10/29/02**

V1.0

DATA SUMMARY SHEET
ENTIAT WATER RESOURCES

PARAMETER: MISCELLANEOUS INSTANTANEOUS FLOW RECORDS for MAD RIVER AT/NEAR MILL CAMP BRIDGE

Time Period: Miscellaneous instantaneous measurements from 9/27/1912 to 10/8/2002

PRIMARY DATA FILE NAME: MISC_FLOWS_MADRIVER_1912TO2002_10_26_02

Rhodus File Name: AB_MADRIVERDISCHARGE_USFS_USGS_1912_TO_2001_4_13_02

DATA FILE LOCATION: ENTIATWR1_0

ORIGINAL DATA SOURCE(S): Flow data and information for this site were compiled from records from USFS, USGS and other sources. The agency/individual involved with each instantaneous measurement are identified in the data file. On 4/14/1999, the site became an official USGS miscellaneous measurement site. On 4/25/02, USGS installed a continuous recording gage at this location [Mad River at Ardenvoir; USGS Station #12452890]—see companion data summary.

DESCRIPTION OF ANY MODIFICATION/SUPPLEMENTATION OF ORIGINAL DATA: No modifications have been made to this data set.

INTENDED USE OF DATA: Begin establishing a flow record for the Mad River—the most significant Entiat River tributary. Provide reference data for flow synthesis; development of rating curves for the Mill Camp Bridge gage site.

LIMITATIONS REGARDING USE OF DATA SET(S): The quality of individual measurements in this record varies widely. Most of the data were derived from actual flow measurements; however, some are simply flow estimates based on staff gage readings. Staff gage data derived from the USGS staff gage (post 4/14/99) are considered to be of high quality; whereas flow estimates from the USFS staff gage vary in quality. The USFS staff gage was installed on 11/6/92; however it was damaged and reset (without re-surveying reference points) on 7/18/1995.

DESCRIPTION OF ANY ASSOCIATED GRAPHICS: None

COMMENTS: Miscellaneous discharge measurements made at this site date back to 1912. Flow measurements have been obtained primarily by the USGS and USFS. The Forest Service actively started measurements in the spring of 1971 to measure flow responses to 1970 NCW wildfires (Art Johnson installed a staff gage at the Mill chlorinator site, approx. 0.25 mile below Tillicum Bridge). Around 1980, several employees performed discharge measurements. The USFS installed a staff gage at the Mill Camp Bridge site in 1992. The USGS established an official miscellaneous measurement site (with a new staff gage) near the Mill Bridge site in 4/99. On 4/25/2002, the USGS installed a continuous recording gaging station at this location (see companion data summary).

Synthesis of estimated mean daily flows for the Mad River has been difficult at best. The paired watershed scheme has been analyzed as well as correlation formulas utilizing the Ardenvoir and Keystone sites. The timing and volume of runoff for the Mad River differs just enough to provide less than quality results.

PREPARED BY: Gran Rhodus **LAST UPDATED: 10/29/02**