

APPENDIX C
ESTIMATED 4Q3 FLOW FOR THE RIO HONDO

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It is often necessary to calculate a critical flow for a portion of a watershed where there is no stage gage. This can be accomplished by applying one of two formulas developed by the USGS. One formula (Thomas, 1993) is recommended when the ratio between the two watershed areas is between 0.5 and 1.5. The other formula, to be used when the watershed ratio is outside this range, is a regression formula also developed by the USGS (Borland, 1970).

1. 4Q3 flow at USGS Streamflow Gage 08267500 (Rio Hondo near Valdez) in cubic feet per second

a. Annual 4Q3 Flow Using Log-Pearson Type III Statistics (SWSTAT 4.1)
(based on USGS Program A193)

08267500 Rio Hondo near Valdez, NM

April 1 - start of season
 March 31 - end of season
 1936 - 2002 - time period
 4-day low – parameter

The following 7 statistics are based on non-zero values:

Mean (logs)	0.928
Variance (logs)	0.011
Standard Deviation (logs)	0.104
Skewness (logs)	-0.804
Standard Error of Skewness (logs)	0.293
Serial Correlation Coefficient (logs)	-0.010
Coefficient of Variation (logs)	0.112

Non-exceedance Probability	Recurrence Interval	Parameter Value
-----	-----	-----
0.0100	100.00	4.243
0.0200	50.00	4.713
0.0500	20.00	5.460
0.1000	10.00	6.160
0.2000	5.00	7.038
0.3333	3.00	7.865
0.5000	2.00	8.755
0.8000	1.25	10.410
0.9000	1.11	11.209
0.9600	1.04	11.990
0.9800	1.02	12.450
0.9900	1.01	12.831

b. Winter 4Q3 Flow Using Log-Pearson Type III Statistics (SWSTAT 4.1)
 (based on USGS Program A193)

08267500 Rio Hondo near Valdez, NM

November 1 - start of season
 April 30 - end of season
 1935 - 2002 - time period
 4-day low – parameter

The following 7 statistics are based on non-zero values:

Mean (logs)	0.923
Variance (logs)	0.013
Standard Deviation (logs)	0.112
Skewness (logs)	-1.005
Standard Error of Skewness (logs)	0.291
Serial Correlation Coefficient (logs)	-0.027
Coefficient of Variation (logs)	0.122

Non-exceedance Probability -----	Recurrence Interval -----	Parameter Value -----
0.0100	100.00	3.835
0.0200	50.00	4.343
0.0500	20.00	5.158
0.1000	10.00	5.926
0.2000	5.00	6.890
0.3333	3.00	7.788
0.5000	2.00	8.742
0.8000	1.25	10.439
0.9000	1.11	11.208
0.9600	1.04	11.916
0.9800	1.02	12.308
0.9900	1.01	12.616

c. **Spring 4Q3 Flow Using Log-Pearson Type III Statistics (SWSTAT 4.1)**
 (based on USGS Program A193)

08267500 Rio Hondo near Valdez, NM

May 1 - start of season
 June 30 - end of season
 1935 - 2002 - time period
 4-day low – parameter

The following 7 statistics are based on non-zero values:

Mean (logs)	1.602
Variance (logs)	0.061
Standard Deviation (logs)	0.248
Skewness (logs)	-0.149
Standard Error of Skewness (logs)	0.291
Serial Correlation Coefficient (logs)	-0.024
Coefficient of Variation (logs)	0.155

Non-exceedance Probability	Recurrence Interval	Parameter Value
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0.0100	100.00	9.967
0.0200	50.00	11.844
0.0500	20.00	15.279
0.1000	10.00	19.080
0.2000	5.00	24.842
0.3333	3.00	31.556
0.5000	2.00	40.523
0.8000	1.25	64.794
0.9000	1.11	82.161
0.9600	1.04	105.219
0.9800	1.02	123.057
0.9900	1.01	141.371

d. Summer 4Q3 Flow Using Log-Pearson Type III Statistics (SWSTAT 4.1)
 (based on USGS Program A193)

08267500 Rio Hondo near Valdez, NM

July 1 - start of season
 August 31 - end of season
 1935 - 2002 - time period
 4-day low – parameter

The following 7 statistics are based on non-zero values:

Mean (logs)	1.315
Variance (logs)	0.027
Standard Deviation (logs)	0.165
Skewness (logs)	-0.576
Standard Error of Skewness (logs)	0.291
Serial Correlation Coefficient (logs)	0.080
Coefficient of Variation (logs)	0.126

Non-exceedance Probability	Recurrence Interval	Parameter Value
-----	-----	-----
0.0100	100.00	7.283
0.0200	50.00	8.450
0.0500	20.00	10.441
0.1000	10.00	12.457
0.2000	5.00	15.213
0.3333	3.00	18.054
0.5000	2.00	21.398
0.8000	1.25	28.584
0.9000	1.11	32.615
0.9600	1.04	37.025
0.9800	1.02	39.893
0.9900	1.01	42.461

e. Fall 4Q3 Flow Using Log-Pearson Type III Statistics (SWSTAT 4.1)
 (based on USGS Program A193)

08267500 Rio Hondo near Valdez, NM

September 1 - start of season
 October 31 - end of season
 1935 - 2001 - time period
 4-day low – parameter

The following 7 statistics are based on non-zero values:

Mean (logs)	1.176
Variance (logs)	0.013
Standard Deviation (logs)	0.115
Skewness (logs)	0.074
Standard Error of Skewness (logs)	0.293
Serial Correlation Coefficient (logs)	0.089
Coefficient of Variation (logs)	0.098

Non-exceedance Probability -----	Recurrence Interval -----	Parameter Value -----
0.0100	100.00	8.225
0.0200	50.00	8.806
0.0500	20.00	9.763
0.1000	10.00	10.709
0.2000	5.00	11.993
0.3333	3.00	13.334
0.5000	2.00	14.944
0.8000	1.25	18.708
0.9000	1.11	21.077
0.9600	1.04	23.969
0.9800	1.02	26.065
0.9900	1.01	28.122

2. 4Q3 flow at South Fork (ungaged site)

- 1) The nearest gage to the point of interest (i.e. 2.4 miles below STP) is the Rio Hondo near Valdez (USGS Gage 08267500). The drainage area above this gage (A_g) is 36.2 mi². The watershed size above the point of interest (A_u) is 20.9 mi². The ratio of watershed size (20.9/36.2) is 0.58. Using the guidelines recommended by the USGS, when this value is between 0.5 and 1.5 we apply **Equation 1**. (*Latitude and longitude of the point of interest were input into GIS Weasel to determine the basin characteristics necessary for these computations.*)

Equation 1

$$4Q3_{(u)} = 4Q3_{(g)} * (A_u / A_g)^{0.566} \quad \text{(Reference: USGS, 1993)}$$

Where:

- $4Q3_{(u)}$ = weighted 4Q3 flow estimate at ungaged site, in cubic feet per second
 $4Q3_{(g)}$ = Log-Pearson Type III 4Q3 flow at gaged site, in cubic feet per second
 A_g = Drainage area above the gage in question, in square miles
 A_u = Drainage area above the ungaged site, in square miles

- 2) Multiplying the Log-Pearson Type III 4Q3 low flow at the gaged site (refer to seasonal tables in the beginning of Appendix C) by the ratio of watershed size (A_u/A_g) to the 0.566th power, we get:

4Q3 CRITICAL LOW FLOW		
	R.Hondo near Valdez (gage site) SWSTAT 4.1 (1935-2002) 4Q3 in cfs	R.Hondo @ S. Fork (ungaged site) USGS (1993) Method 4Q3 in cfs
<i>January</i>	7.79	5.71
<i>February</i>	7.79	5.71
<i>March</i>	7.79	5.71
<i>April</i>	7.79	5.71
<i>May</i>	31.6	23.2
<i>June</i>	31.6	23.2
<i>July</i>	18.1	13.2
<i>August</i>	18.1	13.2
<i>September</i>	13.3	9.78
<i>October</i>	13.3	9.78
<i>November</i>	7.79	5.71
<i>December</i>	7.79	5.71
Annual	7.87	5.77

3) Converting to million gallons per day:

	R.Hondo @ S. Fork (ungaged site) <i>4Q3 in mgd</i>
<i>January</i>	3.69
<i>February</i>	3.69
<i>March</i>	3.69
<i>April</i>	3.69
<i>May</i>	15.0
<i>June</i>	15.0
<i>July</i>	8.56
<i>August</i>	8.56
<i>September</i>	6.32
<i>October</i>	6.32
<i>November</i>	3.69
<i>December</i>	3.69
<i>Annual</i>	3.73

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