September 16, 2016

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Re: Response to April 28, 2016 DuaneMorris Comments on the September 16, 2014 Draft Instream Flow Regime Recommendations for the Big Sur River, Monterey County, California

This letter provides a response to the April 28, 2016 comments provided by DuaneMorris on behalf of El Sur Ranch (ESR) on the California Fish and Wildlife (CDFW) Draft Instream Flow Regime Recommendations for the Big Sur River, dated September 16, 2014 (publically released March 25, 2016). The information provided below address two specific comments:

1. The proposed adjustment of flows using the maximum observed flow loss of 7 to 8 cubic feet per second (cfs) between the upper Big Sur gauge, USGS #11143000, and ESR's point of diversion in the Lower Molera Reach, and
2. Whether the river reach below (downstream) from the Lower Molera gauge, USGS #11143010, is a gaining reach and therefore the proposed flow adjustment doesn't properly account for an increase in river flow.

The Draft Instream Flow Regime Recommendations report for the Big Sur River provides monthly and water year type recommendations for three sections of the river below the US Geological Survey (USGS) Big Sur gauge #11143000 at river mile 7.5. The point of diversion for ESR's water rights applications A030166-01 and -02 is located in the lowermost section of the Big Sur River, herein named the Lower Molera Reach, where it discharges to the Pacific Ocean. Implementation of an instream flow regime study on the Big Sur River requires that the flow measurements taken at gauge #11143000 be adjusted for losses in flow below the gauge in order to fully protect the public trust resources. CDFW had the USGS install and monitor from October 22, 2010 to March 30, 2014 a Lower Molera Reach river gauge, USGS #11143010, as part of the Big Sur River instream flow study to provide an accurate measure of flows during the study period; see Attachment 1 for gauge location. This temporary gauge allows for the comparison of daily flows between the upper Big Sur gauge, #11143000, and the Lower Molera Reach gauge, #11143010. This comparison is needed to determine the range of flow differences and the maximum flow loss adjustment to the upper gauge #11143000 measurements needed for the Lower Molera Reach instream flow regime recommendations.

The Draft Big Sur River Instream Flow Regime recommended that flows measured at the upper gauge #11143000 be reduced by either 7 or 8 cfs depending on the month for the Lower Molera Reach based on the observed flow differences between the two gauges. The recommended flow adjustment was based on selecting the maximum observed values of the differences that commonly occur between the two gauges and then adjusting for losses in flow downstream of the lower gauge, #11143010 to ESR's point of diversion (POD). Adjusting the upper gauge measurements for the maximum flow loss value was selected because the purpose for the instream flow regime is to provide continuous protection for the fisheries resource to meet the CDFW mandate as outlined in the Public Resources Code (PRC) 10000-10005 to identify protective instream flow requirements for fish and wildlife and the habitats they depend upon. Achieving this level of protection requires that the adjustment value be set at the maximum anticipated value of flow loss, otherwise protection of the fisheries wouldn't be continuous. This conservative approach to adjusting flow losses is similar to the "Margin of Safety" used by the US Environmental Proctection Agency when establishing a Total Maximum Daily Loads (TMDL), and the "Factor of Safety," a standard of practice used in geotechnical investigations. The purpose of both these safety factors is to account for the variation in measurements and limited sampling information to ensure that the objective of the study is met. In the case of the instream flow regime, the use of a maximum anticipated value of flow loss is necessary so that there is no reduction in beneficial uses of the Big Sur River and continual protection of public trust resources including the fisheries.

DuaneMorris comments provided an alternative method of analysis for selecting the appropriate flow loss adjustment value. The use of the non-parametric Kendall-Theil Robust Line method (KTR method) software (KTRLine-version 1.0) developed by the USGS (2006) was recommended with Figure 1 provided as a plot the flow differences with three KTR lines segments. DuaneMorris indicated that Figure 1 was prepared by consultants for ESR, but didn't provide any technical report that documents the method of the study or provide the output from the KTR method analysis. Therefore, my response to ESR comments on the Draft Instream Flow Regime is based on my interpretation of the information presented in Figure 1.

<u>Discussion of DuaneMorris Figure 1</u>

Figure 1 in the DuaneMorris comments is a scatter-plot graph of the flow values from USGS gauge #11143000 on the x-axis against values from gauge #11143010 on the y-axis. Both axes for Figure 1 are logarithmic, which makes interpretation of the values between the labeled axes difficult. To overcome this problem, I've overlain a standard 3-cycle by 3-cycle log-log graph (Graphic Control Corp. GFR-AL0953-GD) on top of Figure 1; see Attachment 2. I have the following comments on Figure 1:

- The three straight red colored KTR line segments on the graph appear to follow middle or median values. This is consistent with the KTRLine software because the software calculates coefficients for a median regression line.
- The example calculation of flow loss shown on Figure 1 for 25.6 cfs upstream at gauge #11143000 and 22 cfs downstream at gauge #11143010, a loss of 3.6 cfs, appears to also be a median value.
- Figure 1 has a diagonal dashed line that runs from points (0,0) to (400,400) that represents line of no change between upstream and downstream flows, a 1-to-1 line.
- Many of the data points representing less than 60 cfs at the upper gauge #11143000 fall below the 1-to-1 line. This is likely the reason that DuaneMorris suggests that the Big Sur River is a gaining reach when flows exceed 59 cfs.
- Many of the data points lie below the red KTR lines, likely 50 percent of the values assuming the lines represent median values. The number of data points below the red KTR lines is greater when flow at the upper gauge is below 60 cfs. This is consistent with the data set because 77% of the values measured at the upper gauge #11143000 when there was a corresponding value at the lower gauge #11143010 were below 60 cfs.
- On my Attachment 2, I've marked with a red circle and labeled the flow loss values for several lowest plotted points. I've also added as green squares three historical data points that were taken before the lower gauge was installed. The river flow measurements were taken in the area of ESR's POD. The dates and flow loss values are listed on Figure 1.
- I've included my Tables 1A and 1B as my Attachments 3A and 3B that list the date of measurement, gauge values, and flow differences between the two gauges that measured less than -6.0 cfs for two seasons, November to April and May to October. I was able to identify and label many of these values listed in my Tables 1A and 1B on my revised Figure 1. Not all Table 1A and 1B values were identified due to the scale of the plot and overlap of data points.
- A review of my labeled data points on Figure 1 shows that many of the flow loss values are equal to or less than -7 cfs.
- Labeled maximum flow loss values when the upper gauge value is less than 60 cfs range from -16 cfs to -7 cfs with -9 cfs to -7 cfs values being common. This is consistent with the flow loss values listed in Tables 1A and 1B.
- There are fewer labeled maximum flow loss values in my revised Figure 1 when the upper gauge is greater than 60 cfs, but the losses are greater ranging from -26 cfs to -9 cfs. Again consistent with Tables 1A and 1B.

Discussion of Flow Losses Between USGS #11143010 and ESR's Point of Diversion

Studies undertaken by ESR for water rights applications A030166-01 and -02 CEQA analysis included establishing several cross-section transects for measuring channel flows in the Lower Molera Reach of the Big Sur River. The locations of three transects, VT-1, VT-2 and VT-3, are shown on my Attachment 1. Differences in flow between the transects were measured on several days in 2004, 2006 and 2007. In addition, earlier river flow measurements were done at ESR's POD by Jones and Stokes in 1997 and 1998 as part of the initial CEQA analysis (Jones and Stokes, 1999). My Attachments 4 and 5 are tables that list the dates, flow measurements and flow differences taken on transect VT-1, the upper gauge #11143000, and the VT-2 and VT-3 transects at ESR's POD. Attachments 4 and 5 were submitted by CDFW (formerly DFG) as exhibits DFG-C15 and DFG-C-16 for the June 2011 State Water Resource Control Boards' water rights hearing on ESR's applications A030166-01 and -02.

Attachment 4 lists flow measurements and losses taken several times in 1997 and 1998 by Jones and Stokes between the upper gauge #11143000 and ESR's POD. A flow loss of 8.9 cfs was measured on August 22, 1997. This data point is plotted as one of the green squares on my revised Figure 1. The flow losses listed in Attachments 4 and 5 shows that flow at ESR's POD is generally less than the flow measured at upper gauge #11143000. Attachment 5 does show that in the summer of 2007 flows between VT3 and VT2 often increased. However, this increase was likely due to local effects of hyporheic zone flow and doesn't provide sufficient inflow to mitigate the overall loss below gauge #11143000. For a more detailed discussion of this issue see my testimony regarding exhibits DFG-C-50 and DFG–C-51 for the June 2011 ESR water right hearing, and my June 28, 2006 comments on the water rights Application 30166 Notice of Intent and Initial Study.[1] Flow losses in July through October in 2004, 2006 and 2007 between the upper gauge #11143000 and VT-1 were consistent with those measured between the upper and lower gauges in 2010 to 2014. The greatest flow loss in the summer of 2004 was 5.68 cfs.

Attachment 5 lists flow measurements and losses taken in August, September and October 2007 by ESR's consultant. The table also lists whether or not the ESR wells were pumping and the pumping rates. The flow losses between the upper gauge #11143000 and the transects in ESR's point of diversion, VT-2 and VT-3, are consistent with those measured between the upper and lower gauges in 2010 to 2014. One column in Attachment 5 is highlighted and outlined because it lists the loss between transect VT-1 and ESR's POD at transect VT-3. Seven of the VT-1 and VT-3 measurements were taken when both of ESR's wells were off. The change in

[1] Document available at: http://www.swrcb.ca.gov/waterrights/water_issues/programs/hearings/elsur_ranch/docs/deircomments/dfg_attach3a.pdf

flow from VT-1 to VT-3 ranged from -1.32 cfs to -4.09 cfs. The median of these seven flow differences is -3.4 cfs. Also see the July 11, 2011 testimony of Mr. Paul Horton on page 33 lines 13 to 17 given at ESR's SWRCB hearing for his statement on a natural loss of 3 cfs below VT-1.[2]

The lower gauge #11143010 is located in the Lower Molera Reach between transects VT-1 and VT-3, which are separated by approximately 3,000 feet of river. The lower gauge #1143010 is approximately 2,000 upstream of VT-3, or about two-thirds the distance between VT-1 and ESR's POD. The wide alluvium filled valley mouth of the Big Sur River that's the Lower Molera Reach is significantly greater than the upstream channel and is often 1,200 feet or more wide. The widening of the valley alluvium likely causes an increase in volume of groundwater stored in the alluvium. This increase in groundwater storage volume is filled by seepage from the river and is likely the source of the observed natural river losses within the Lower Molera Reach. Also see the July 11, 2011 testimony of Mr. Paul Horton on page 34 lines 4 to 11 given at ESR's SWRCB hearing for his statement about natural infilling of the aquifer.[3] If it is assumed that flow changes uniformly between VT-1 and VT-3, then the median loss of flow between gauge #11143010 and ESR's POD is two-thirds of -3.4 cfs or a loss of approximately -2.3 cfs. The -2.3 cfs loss in flow needs to be included with the maximum flow losses measured between the two gauges during 2010 to 2014 to properly adjustment to the flows measured at gauge #11143000 for the CDFW Lower Molera Reach Instream Flow Regime recommendation.

<u>Analysis of Flow Loss Using the Kendall-Theil Robust Line Method</u>

The straight-line segments in Figure 1 of the DuaneMorris comments were apparently generated using USGS Kendall-Theil Robust Line software KTRLine-version 1.0 (USGS, 2006). The Kendall-Theil robust line (KTRLine) statistical analysis is a nonparametric method that is resistant to the effects of outliers and non-normality in residuals that commonly occur in hydrologic data (USGS, 2006).

The slope of the line is calculated as the median of all possible pairwise slopes between points. The intercept is calculated so that the line will run through the median of input data. A single-line model or a multisegment model may be specified (USGS, 2006).

The Kendall-Theil robust line is a median line and, therefore, may underestimate total mass, volume, or loads unless the error component or a bias correction factor is incorporated into the estimate. Regression statistics such as the median error, the median absolute deviation, the prediction error sum of squares, the root mean square

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[2] Document available at:
http://www.swrcb.ca.gov/waterrights/water_issues/programs/hearings/elsur_ranch/

[3] Document available at:
http://www.swrcb.ca.gov/waterrights/water_issues/programs/hearings/elsur_ranch/docs/transcript071111.pdf

error, the confidence interval for the slope, and the bias correction factor for median estimates are calculated by use of nonparametric methods. These statistics, however, may be used to formulate estimates of mass, volume, or total loads. (USGS, 2006).

The median absolute deviation (MAD) is the median of the absolute value of all residual error values, is an estimator of the spread of the population of residual errors, and is analogous to the standard deviation. The MAD is equal to approximately two-thirds the estimated standard deviation of the residual error (page 8 in USGS, 2006).

The USGS KTRLine program was used to analyze the October 22, 2010 to March 30, 2014 average daily flow losses on the Big Sur River between the upper Big Sur gauge USGS #11143000 and lower Andrew Molera gauge USGS #11143010. Flows greater than approximately 400 cfs are not in the data set because that was the upper limit of the rating curve for the lower Andrew Molera gauge. Days without lower gauge values were therefore excluded from the analysis.

The measured flow losses were divided into two groups, November to April and May to October, to evaluate seasonal affects. KTRLine program analyses were done for a one-segment model and for a two-segment model. The lines in the two-segment model were overlapped by 5 cfs to provide a better transition between the two KTR lines. The November to April data were overlapped from 35 cfs to 40 cfs because the program generated an error message that the analysis generated some lines pairs that were out of bounds whenever a break point between the KTR lines was set at a higher value. The May to October data were overlapped from 55 cfs to 60 cfs because that break point lies near the upper end of the CDFW's Lower Molera Reach flow regime recommendation and break corresponds to the 59 cfs transition from a losing to gaining noted by DuaneMorris in Figure 1.

The KTRLine regression equation provides <u>median</u> values for the loss between the two Big Sur River gauges. Therefore adjustments are necessary to determine the flow loss adjustment value needed to be protective of public trust resources. The lower 95% confidence interval was selected as the appropriate flow adjustment value for protection of public trust resources because it would ensure that flow in the Lower Molera Reach was almost always at or above the CDFW Instream Flow Regime recommendation.

To determine the lower 95% confidence interval, the KTRLine program generated MAD value, which is analogous to the standard deviation, was divided by 2/3 to obtain an estimate of the standard deviation (page 8 in USGS, 2006). The standard deviation was multiplied by a Z–value of 1.96, the same value used by the KTRLine program for the confidence interval of the slope (page 8 in USGS, 2006) to calculate the value needs to be subtracted from the KTR line median to obtain the value of lower 95% confidence interval. The lower 95% confidence interval value is then adjusted to account for the losses downstream of the lower Andrew Molera gauge #11143010 to ESR's POD. As discussed above, the median flow loss between the upstream ESR transect VT-1 and the ESR POD is -3.4 cfs. Because the distance between the Andrew Molera gauge and the ESR POD is approximately two-thirds the distance between VT-1 and ESR's POD, a value of -2.3 cfs (-3.4 * 0.667 = -2.278) was used to further adjust the lower 95% confidence interval to estimate the flow loss adjustment value. The final flow loss adjustment value is the sum of the KTR regression line median and the losses for the lower 95% confidence interval and losses below gauge #11143010 to ESR's POD.

Attachment 6 provides graphs of the October 22, 2010 to March 30, 2014 flow losses for the November to April period on the Big Sur River between the upper Big Sur gauge #11143000 and lower Andrew Molera gauge #11143010. Attachment 7 is the output file from the USGS KTRLine program for the November to April analysis. Attachment 8 provides graphs of the October 22, 2010 to March 30, 2014 flow losses for May to October period on the Big Sur River between the upper Big Sur gauge #11143000 and lower Andrew Molera gauge #11143010. Attachment 9 is the output file from the USGS KTRLine program for the May to October analysis. The one-segment and two-segment KTR regression lines are plotted over the data along with the regression equations and the lower 95% confidence intervals for the 2-segment lines.

Attachment 10 is my Table 2 that lists the lower 95% confidence interval flow loss values from the upper gauge #11143000 for flow ranging from 10 to 100 cfs, flow within the range of the instream flow regime recommendations, with adjustment for losses between gauge #11143010 and ESR's POD. One-segment and two-segment KTR lines for both seasons are provided. The median values of the resultant adjusted flow losses from ranges 0 to 60 cfs, 0 to 70 cfs and 0 to 80 cfs are also calculated. Attachment 11 provides graphs of the flow losses for the two seasons along with the DuaneMorris Figure 1 recommended loss of -3.6 cfs shown as a red straight line, and the range of the adjusted medians of the lower 95% KTR lines from Attachment 10 shown as shaded areas.

Attachment 11 shows that several of the flow losses measured November to April fall within or below the adjusted KTR line lower 95% confidence interval zone. More data points would lie in the shaded zone if raw values were adjusted for the 2.3 cfs flow loss between gauge #11143010 and ESR's POD. Table 1A in Attachment 3A lists 52 days when the flow loss between the upper and lower gauges for November to April was between -6 and -8 cfs. If the 2.3 cfs flow loss between gauge #11143010 and the ESR POD were subtracted, then the loss on these days would equal or exceed the CDFW recommended instream flow regime correction factor of -7 cfs. Table 1B in Attachment 3B lists 64 days when the flow loss between the upper and lower gauges for May to October was between -6 and -8 cfs. If the 2.3 cfs flow loss between gauge #11143010 and the ESR POD were subtracted, then the loss on these days would equal or exceed the CDFW recommended instream flow regime correction factor of -8 cfs. The May to October graph in Attachment 11 has three historical data points that fall within the shaded adjusted KTR line lower 95% confidence interval zone. These points were measure at ESR's POD by ESR's consultants (Attachment 5, Hanson, 2008), the SWRCB (Attachment 4, Jones and Stokes 1999), or CDFW staff (Table 8 in CDFW, 2014). These historical measurements confirm that the adjusted KTR line lower 95% confidence interval zone is a reasonable estimate of the anticipated maximum flow loss.

Conclusions

My conclusions from a review of DuaneMorris' Figure 1 and my analysis of the change in flow between the upper Big Sur River gauge #11143000 and the lower Andrew Molera gauge #11143010 are:

1. The DuaneMorris Figure 1 calculated flow loss of 3.6 cfs is a median value and doesn't represent a value that is protective of public trust resources. Flow loses of 6 cfs or more were commonly measured at the lower gauge #11143010 when flows at the upper gauge #11143000 were 40 cfs or less.
2. The river below the lower gauge #11143010 to the ESR POD is generally a losing reach. The localized gains from hyporheic flow are insufficient to mitigate the overall loss in flow.
3. The maximum flow loss between the upper gauge #11143000 and the lower gauge #11143010 are commonly 7 cfs or greater (28 days of the study period).
4. Maximum flow losses plotted on Figure 1 don't include losses that occur between the lower gauge #11143010 and the ESR POD. These losses can be significant with a median measured flow loss of approximately 2.3 cfs.
5. If the flow losses from the upper gauge #11143000 to the lower gauge #11143010 were adjusted by the median flow loss of approximately 2.3 cfs between the lower gauge and the ESR POD, the number of days of flow loss from the upper gauge to the ESR POD that exceed 8 cfs would increase significantly (130 days of the study period).
6. The recommendation for adjusting the flow regime criteria at the Lower Molera Reach for a loss of 7 cfs to 8 cfs is consistent with the flow losses measured between gauges #11143000 and #11143010 when the flows are adjusted for the loss between gauge #11143010 and the mouth of the river near the ESR POD.
7. The CDFW recommended flow adjustments to the upper gauge #11143000 measurements for the Lower Molera Reach of -7 cfs to -8 cfs are appropriate and necessary to protect the public trust resources of the Big Sur River.

References Cited

Hanson Environmental, Inc., 2008, Assessment of the Potential Effects of El Sur Ranch Well Operations on Aquatic Habitat within the Big Sur River and Swiss

Canyon during Late Summer and Early Fall – 2007. Prepared for El Sur Ranch.

California Department of Fish and Wildlife, 2014, Instream Flow Evaluation Steelhead Passage and Connectivity of Riverine and Lagoon Habitats, Big Sur River, Monterey County, July 2014, 84 pages.

Jones and Stokes, April 1999, El Sur Ranch Hydrologic Investigation, prepared for the State Water Resources Control Board, Sacramento, CA.

USGS, 2006, Kendall-Theil Robust Line (KTRLine—version 1.0)—A Visual Basic Program for Calculating and Graphing Robust Nonparametric Estimates of Linear-Regression Coefficients Between Two Continuous Variables, by Gregory E. Granato, *in* Chapter 7, Section A, Statistical Analysis, Book 4, Hydrologic Analysis and Interpretation, U.S. Geological Survey Techniques and Methods 4-A7, 31 pages.

Exhibit DFG-C-57

Attachment 1

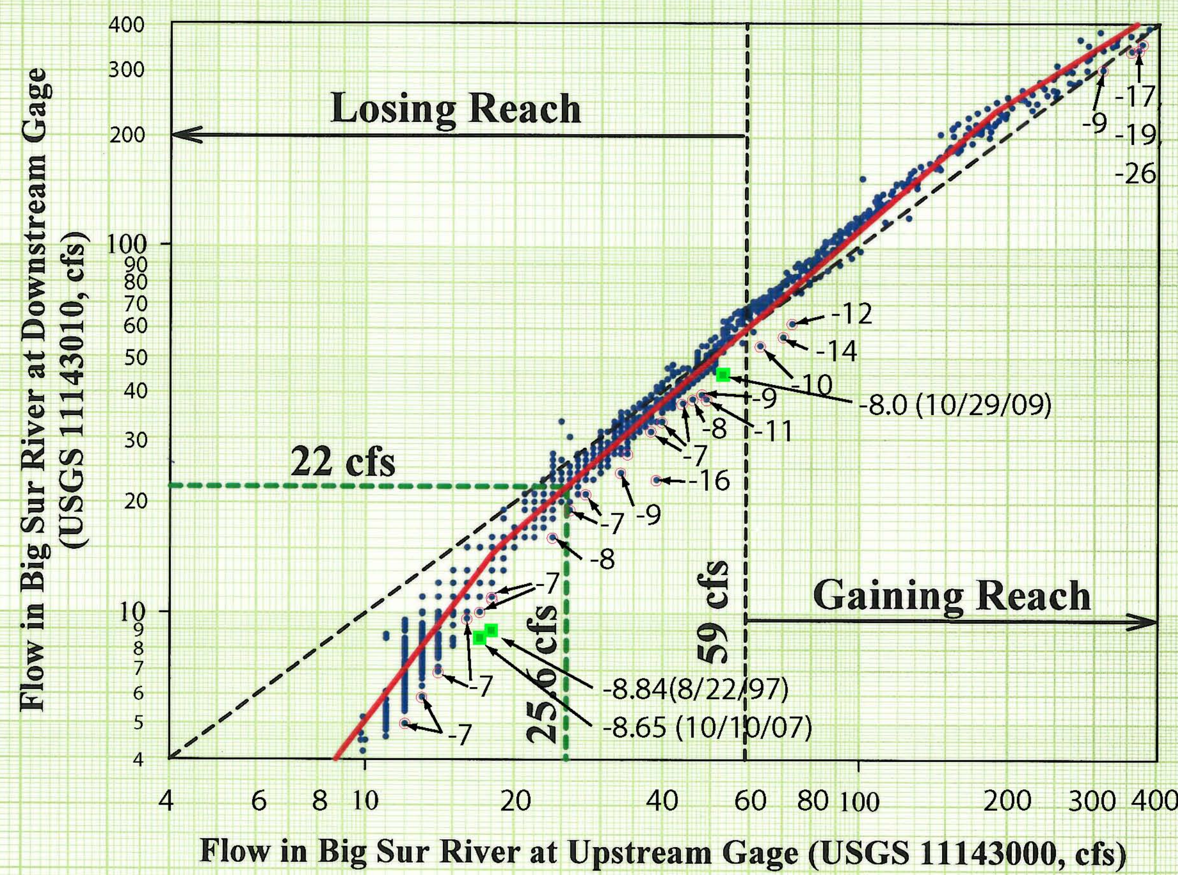


Figure 1. Comparison of flows in the Big Sur River at USGS Gage 11143000 (upstream gage with flows in the Big Sur River at USGS Gage 11143010 (downstream gage).

Attachment 2

Attachment 3A

Table 1A
Maximum Losses Between Big Sur River Gauges
#1114300 to #11143010
October 22, 2010 to March 30, 2014

November to April

Date	#11143100	#11143000	Loss, cfs	Date	#11143100	#11143000	Loss, cfs
2/22/11	338	364	-26	12/19/13	7.7	14	-6.3
12/22/10	351	370	-19	1/17/14	6.8	13	-6.2
1/5/11	336	353	-17	1/8/14	7.8	14	-6.2
2/26/14	23	39	-16	1/10/14	7.8	14	-6.2
2/29/12	56	70	-14	12/30/13	7.9	14	-6.1
11/21/10	61	73	-12	1/2/14	7.9	14	-6.1
12/17/10	38	49	-11	1/9/14	7.9	14	-6.1
11/20/11	53	63	-10	1/11/14	7.9	14	-6.1
11/28/12	24	33	-9	1/16/14	7	13	-6.0
11/23/10	39	48	-9	12/29/13	8	14	-6.0
2/23/11	299	308	-9	12/31/13	8	14	-6.0
12/7/13	16	24	-8	1/1/14	8	14	-6.0
3/14/12	38	46	-8	3/21/14	17	23	-6.0
12/17/13	6.9	14	-7.1	3/22/14	17	23	-6.0
3/18/14	19	26	-7.0	3/20/14	18	24	-6.0
3/26/14	21	28	-7.0	3/17/14	20	26	-6.0
1/20/12	27	34	-7.0	3/16/14	21	27	-6.0
11/11/11	31	38	-7.0	3/15/14	23	29	-6.0
11/6/11	33	40	-7.0	2/26/12	24	30	-6.0
11/20/10	37	44	-7.0	2/24/12	25	31	-6.0
12/18/13	7.1	14	-6.9	2/25/12	25	31	-6.0
12/27/13	8.1	15	-6.9	2/28/12	25	31	-6.0
12/28/13	8.1	15	-6.9	3/14/14	25	31	-6.0
12/26/13	8.3	15	-6.7	3/31/14	25	31	-6.0
12/25/13	8.4	15	-6.6	2/21/12	27	33	-6.0
1/6/14	7.5	14	-6.5	3/11/12	27	33	-6.0
12/24/13	8.5	15	-6.5	3/12/12	27	33	-6.0
1/18/14	6.6	13	-6.4	3/13/14	27	33	-6.0
1/19/14	6.6	13	-6.4	2/19/12	28	34	-6.0
1/3/14	7.6	14	-6.4	3/10/12	28	34	-6.0
1/4/14	7.6	14	-6.4	3/5/12	33	39	-6.0
1/5/14	7.6	14	-6.4	2/13/12	36	42	-6.0
1/7/14	7.6	14	-6.4	12/6/10	45	51	-6.0

Attachment 3B

Table 1B
Maximum Losses Between Big Sur River Gauges
#1114300 to #11143010
October 22, 2010 to March 30, 2014

May to October

Date	#11143100	#11143000	Loss, cfs	Date	#11143100	#11143000	Loss, cfs
10/16/13	5.9	13.0	-7.1	6/30/13	7.8	14.0	-6.2
10/7/13	5.0	12.0	-7.0	7/2/13	7.8	14.0	-6.2
6/22/13	10.0	17.0	-7.0	8/31/13	4.9	11.0	-6.1
6/23/13	10.0	17.0	-7.0	10/6/13	4.9	11.0	-6.1
6/17/13	11.0	18.0	-7.0	8/14/13	5.9	12.0	-6.1
6/18/13	11.0	18.0	-7.0	9/27/13	5.9	12.0	-6.1
10/24/10	31.0	38.0	-7.0	10/2/13	5.9	12.0	-6.1
5/18/11	118.0	125.0	-7.0	10/13/13	6.9	13.0	-6.1
10/15/13	6.3	13.0	-6.7	10/14/13	6.9	13.0	-6.1
8/18/13	5.4	12.0	-6.6	9/2/13	5.0	11.0	-6.0
8/26/13	5.4	12.0	-6.6	9/5/13	5.0	11.0	-6.0
8/27/13	5.4	12.0	-6.6	9/6/13	5.0	11.0	-6.0
9/30/13	5.4	12.0	-6.6	9/7/13	5.0	11.0	-6.0
10/8/13	5.4	12.0	-6.6	10/5/13	5.0	11.0	-6.0
9/29/13	5.5	12.0	-6.5	8/23/13	6.0	12.0	-6.0
10/1/13	5.5	12.0	-6.5	10/9/13	6.0	12.0	-6.0
9/19/13	4.6	11.0	-6.4	10/19/13	6.0	12.0	-6.0
9/25/13	5.6	12.0	-6.4	10/21/13	6.0	12.0	-6.0
9/26/13	5.6	12.0	-6.4	10/27/13	6.0	12.0	-6.0
9/28/13	5.6	12.0	-6.4	8/10/13	7.0	13.0	-6.0
7/1/13	7.6	14.0	-6.4	10/28/13	7.0	13.0	-6.0
10/19/12	9.6	16.0	-6.4	10/20/12	10.0	16.0	-6.0
8/21/13	5.7	12.0	-6.3	8/1/12	11.0	17.0	-6.0
8/24/13	5.7	12.0	-6.3	8/2/12	11.0	17.0	-6.0
10/3/13	5.7	12.0	-6.3	6/19/13	11.0	17.0	-6.0
9/22/13	7.7	14.0	-6.3	6/20/13	11.0	17.0	-6.0
9/1/13	4.8	11.0	-6.2	6/21/13	11.0	17.0	-6.0
9/20/13	4.8	11.0	-6.2	6/14/13	12.0	18.0	-6.0
8/22/13	5.8	12.0	-6.2	6/15/13	12.0	18.0	-6.0
10/17/13	5.8	12.0	-6.2	6/16/13	12.0	18.0	-6.0
10/18/13	5.8	12.0	-6.2	6/13/13	13.0	19.0	-6.0
10/10/13	6.8	13.0	-6.2	5/21/13	16.0	22.0	-6.0

Attachment 4

Exhibit DFG-C-15

Table 3

Summary of Data on Changes in Flow on Big Sur River Between USGS Gage # 11143000 and VT1

Table 3 of Jones and Stokes, 1999

Date	USGS	S1 Andrew Molera SP	Change in Flow USGS to S1
8/22/97	19	10.1	**-8.9**
11/11/97	18	15.4	-2.6
9/16/98	29	27.4	-1.6
9/23/98	32	29.3	-2.7
9/25/98	32	29.5	-2.5

Table 3-1 of SGI, 2005

Date	Time	USGS	VT1	Change in Flow USGS to VT1
7/23/04	Morning	14	10.29	-3.71
8/5/04	Afternoon	14	8.87	-5.13
8/6/04	Morning	13	8.77	-4.23
8/19/04	Morning	12	7.95	-4.05
8/19/04	Afternoon	12	7.21	-4.79
8/30/04	Afternoon	12	8.25	-3.75
8/31/04	Morning	11	8.20	-2.80
8/31/04	Afternoon	12	8.31	-3.69
8/31/04	Afternoon[1]	12	8.83	-3.17
9/1/04	Morning	11	8.40	-2.60
9/1/04	Afternoon	12	10.21	-1.79
9/1/04	Afternoon[1]	12	9.91	-2.09
9/2/04	Morning	11	7.22	-3.78
9/2/04	Afternoon	11	10.88	-0.12
9/15/04	Afternoon	12	6.32	**-5.68**
9/16/04	Morning	12	7.26	-4.74
9/30/04	Afternoon	13	8.18	-4.82
10/1/04	Morning	13	9.07	-3.93
10/14/04	Afternoon	10	9.83	-0.17
10/15/04	Morning	10	11.75	1.75
10/28/04	Morning	48	44.00	-4.00
10/28/04	Afternoon	45	40.66	-4.34

1- Second reading

Table 3 - Continued

Table 3-1 of Hanson, 2007

Date	USGS, cfs	VT1, cfs	Change in Flow USGS to VT1	Pump Status
9/1/06	21	21.92	0.92	9/01/06 Both off
9/6/06	20	19.21	-0.79	
9/11/06	23	20.54	-2.46	9/09/06 Both on
9/14/06	22	18.66	-3.34	
9/18/06	21	18.98	-2.02	9/15/06 Both off
9/21/06	20	18.48	-1.52	
9/25/06	20	18.17	-1.83	9/22/06 Old on
9/28/06	21	18.38	-2.62	
10/2/06	22	19.81	-2.19	9/29/06 both off
10/5/06	24	21.34	-2.66	
10/10/06	21	18.84	-2.16	10/06/06 New on
10/12/06	22	18.38	**-3.62**	10/12/06 both off

Table 17 - Transect 11 of Hanson, 2008

Date	USGS, cfs	VT1, cfs	Change in Flow USGS to VT1
8/30/07	7.3	2.40	-4.90
8/31/07	7.1	2.58	-4.52
9/5/07	6.4	1.62	-4.78
9/6/07	6.5	1.97	-4.53
9/12/07	7.0	5.03	-1.97
9/13/07	7.1	5.28	-1.82
9/19/07	7.2	5.06	-2.14
9/20/07	7.4	5.09	-2.31
9/26/07	8.2	5.27	-2.93
9/27/07	8.2	5.36	-2.84
10/3/07	8.2	5.30	-2.90
10/4/07	8.1	5.36	-2.74
10/10/07	12.0	6.93	**-5.07**
10/11/07	10.0	8.44	-1.56

Attachment 5

El Sur Ranch Change in River Flows from Pumping

(Data on Velocity Transects from Hanson, 2008)

Exhibit DFG-C-16

River Flow Data

Date	USGS	VT1	VT2	VT3	Status	Pump Rate[1], cfs
8/30/07	7.3	2.40	2.08	1.08	Both off	
8/31/07	7.1	2.58	1.66	1.18	New on[2]	2.37
9/5/07	6.4	1.62	1.34	0.35	New on	
9/6/07	6.5	1.97	1.47	0.46	New on	
9/7/07	New Well pump test ends					
9/12/07	7.0	5.03	3.04	1.62	Both off	
9/13/07	7.1	5.28	2.92	1.76	Both off	
9/19/07	7.2	5.06	1.73	1.36	Old on[3]	2.26
9/20/07	7.4	5.09	1.63	1.85	Old on	
9/21/07	Old Well pump test ends					
9/26/07	8.2	5.27	3.08	2.41	Both off	
9/27/07	8.2	5.36	2.37	2.16	Both off	
10/3/07	8.2	5.30	1.46	1.96	Both on[4]	5.02
10/4/07	8.1	5.36	1.41	1.56	New on	2.37
10/5/07	Old Well stopped on 10/3/07; New Well stops pumping on 10/5/07					
10/10/07	12.0	6.93	3.16	3.35	Both off	
10/11/07	10.0	8.44	4.19	4.35	Both off	

Change in River Flow

Date	USGS -VT2	USGS -VT1	USGS -VT3	VT1-VT3	VT3-VT2	
8/30/07	-5.22	-4.90	-6.22	-1.32	1.00	Both off
8/31/07	-5.44	-4.52	-5.92	-1.40	0.48	New on[2]
9/5/07	-5.06	-4.78	-6.05	-1.27	0.99	New on
9/6/07	-5.03	-4.53	-6.04	-1.51	1.01	New on
9/7/07	New Well pump test ends					
9/12/07	-3.96	-1.97	-5.38	-3.41	1.42	Both off
9/13/07	-4.18	-1.82	-5.34	-3.52	1.16	Both off
9/19/07	-5.47	-2.14	-5.84	-3.70	0.37	Old on[3]
9/20/07	-5.77	-2.31	-5.55	-3.24	-0.22	Old on
9/21/07	Old Well pump test ends					
9/26/07	-5.12	-2.93	-5.79	-2.86	0.67	Both off
9/27/07	-5.83	-2.84	-6.04	-3.20	0.21	Both off
10/3/07	-6.74	-2.90	-6.24	-3.34	-0.50	Both on[4]
10/4/07	-6.69	-2.74	-6.54	-3.80	-0.15	New on
10/5/07	Old Well stopped on 10/2/07; New Well stops pumping on 10/5/07					
10/10/07	**-8.84**	-5.07	-8.65	-3.58	-0.19	Both off
10/11/07	-5.81	-1.56	-5.65	-4.09	-0.16	Both off

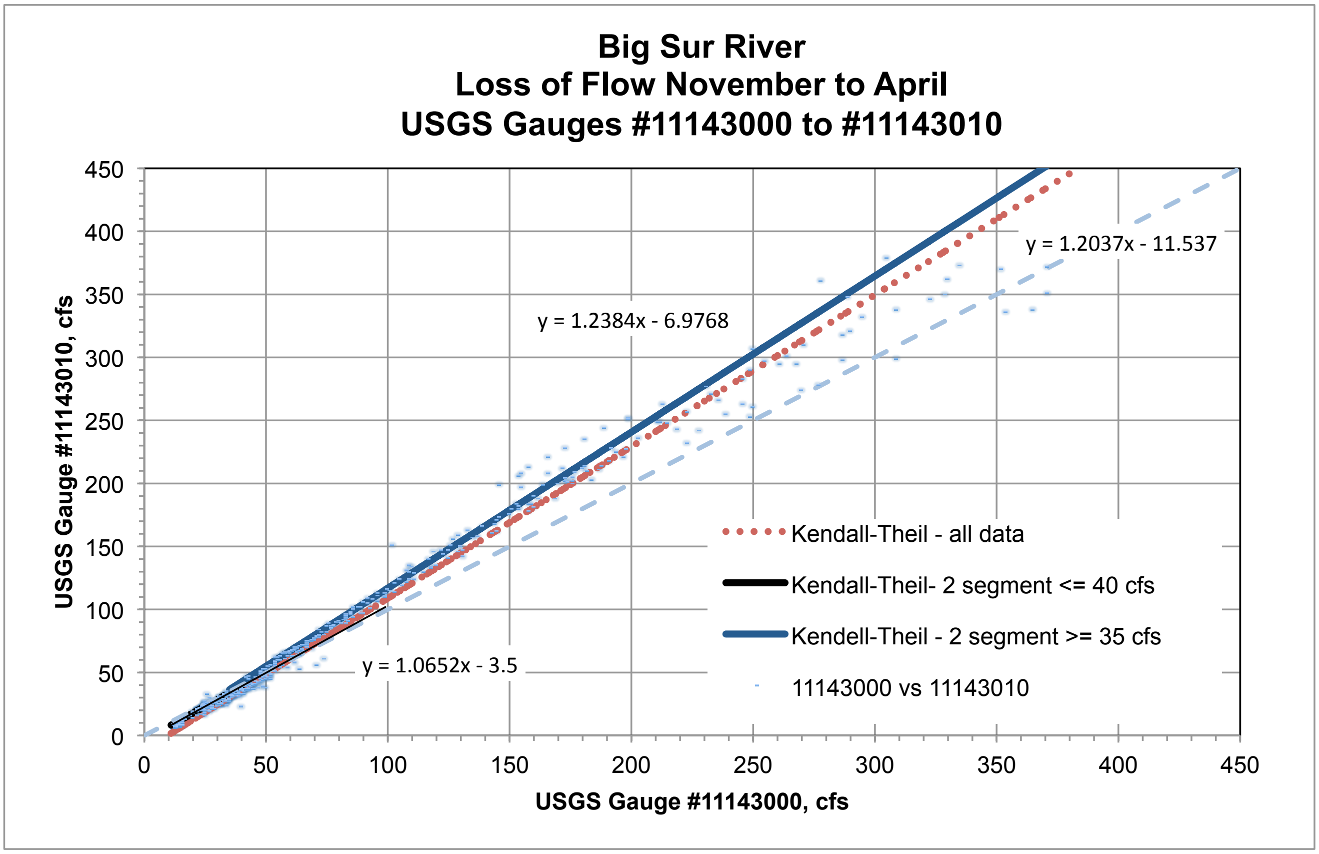
1- Pump rates from section 3.1 of Volume III - SGI, 2008

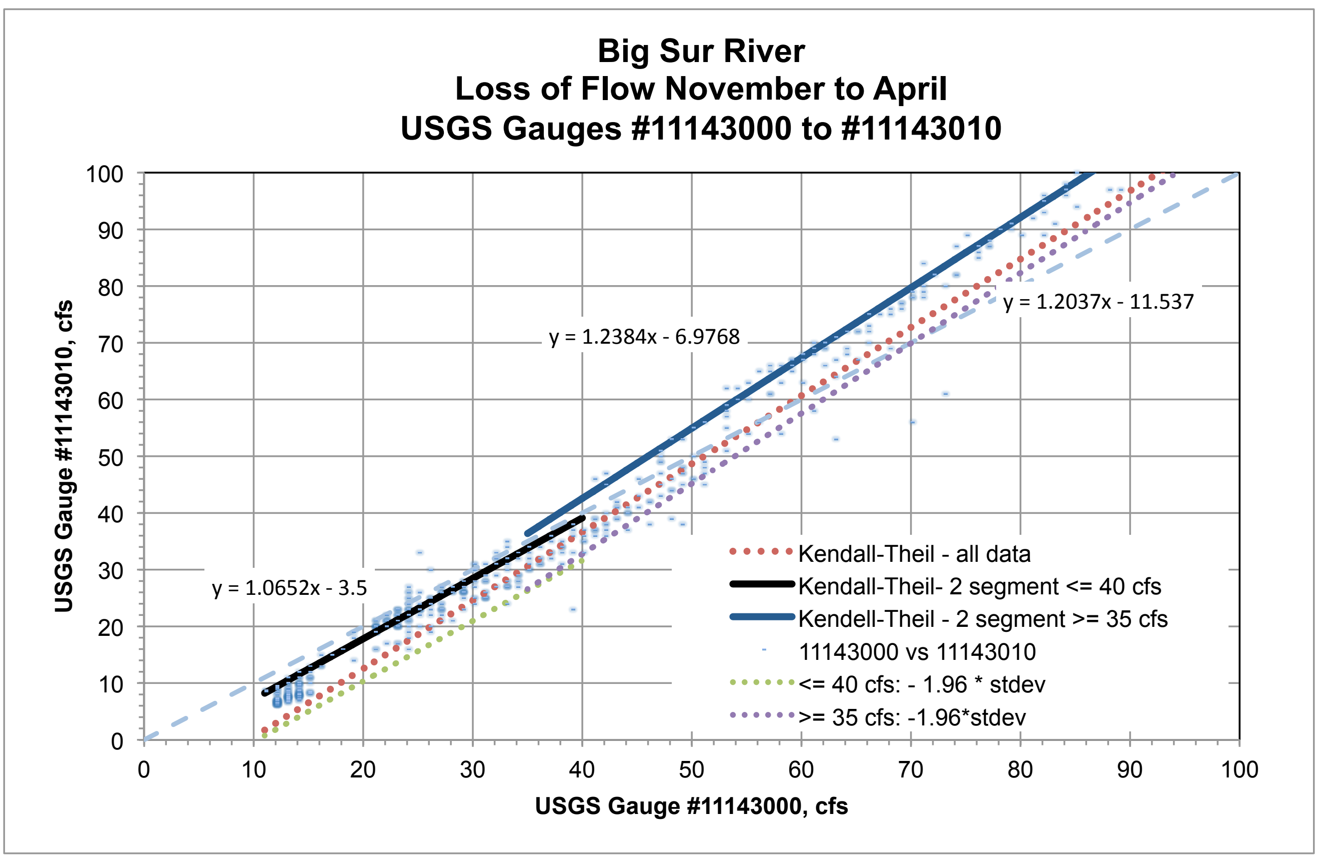
2- Both wells started pumping on Aug. 31; on Sept. 2 Old well stopped due to high conductivity - pg. 3-1, SGI, 2008

3 - Old well pump test started Sept. 14 - pg. 3-1 SGI, 2008

4- Both wells started pumping on Sept. 28; Old well stopped after 5 days due to high conductivity - pg. 3-1, SGI, 2008

Attachment 6

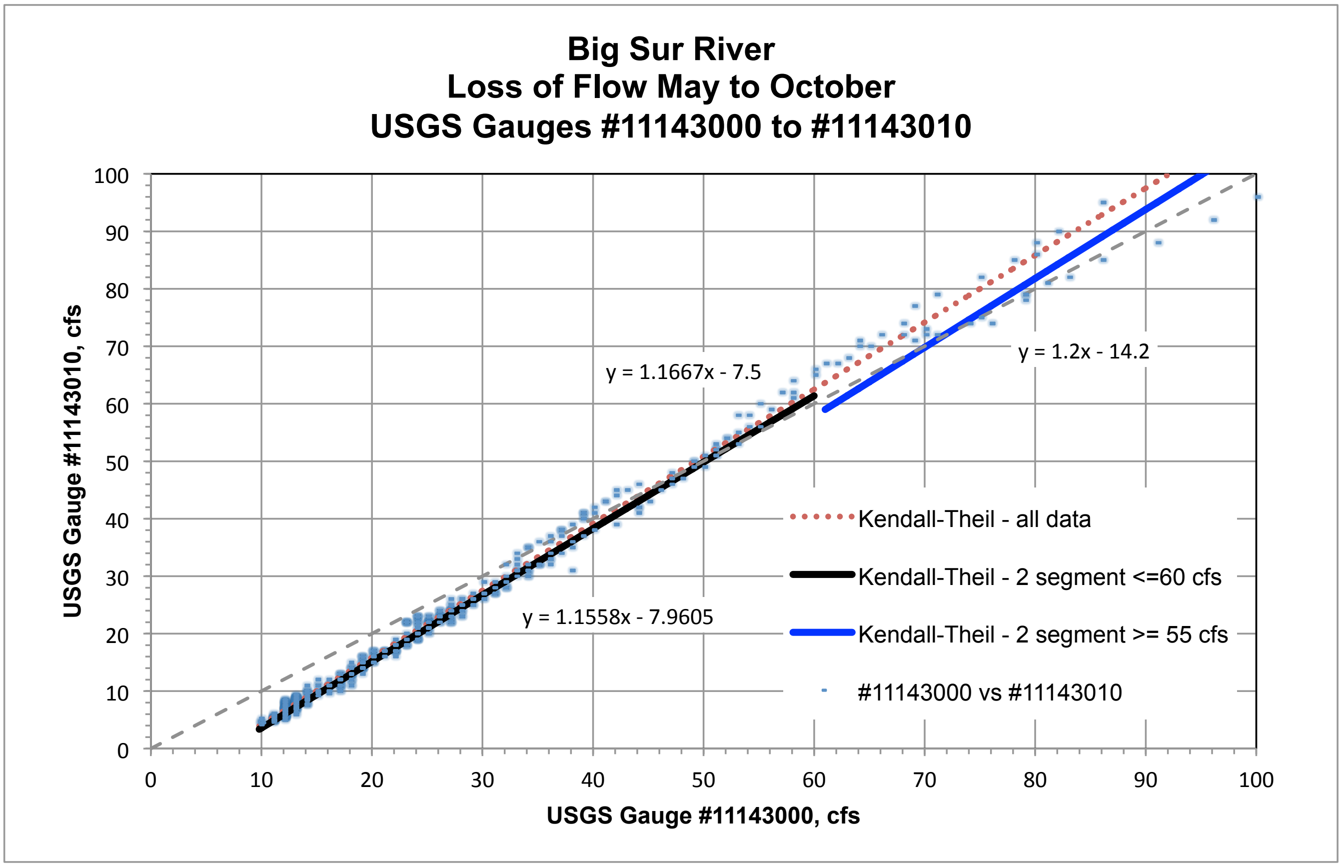


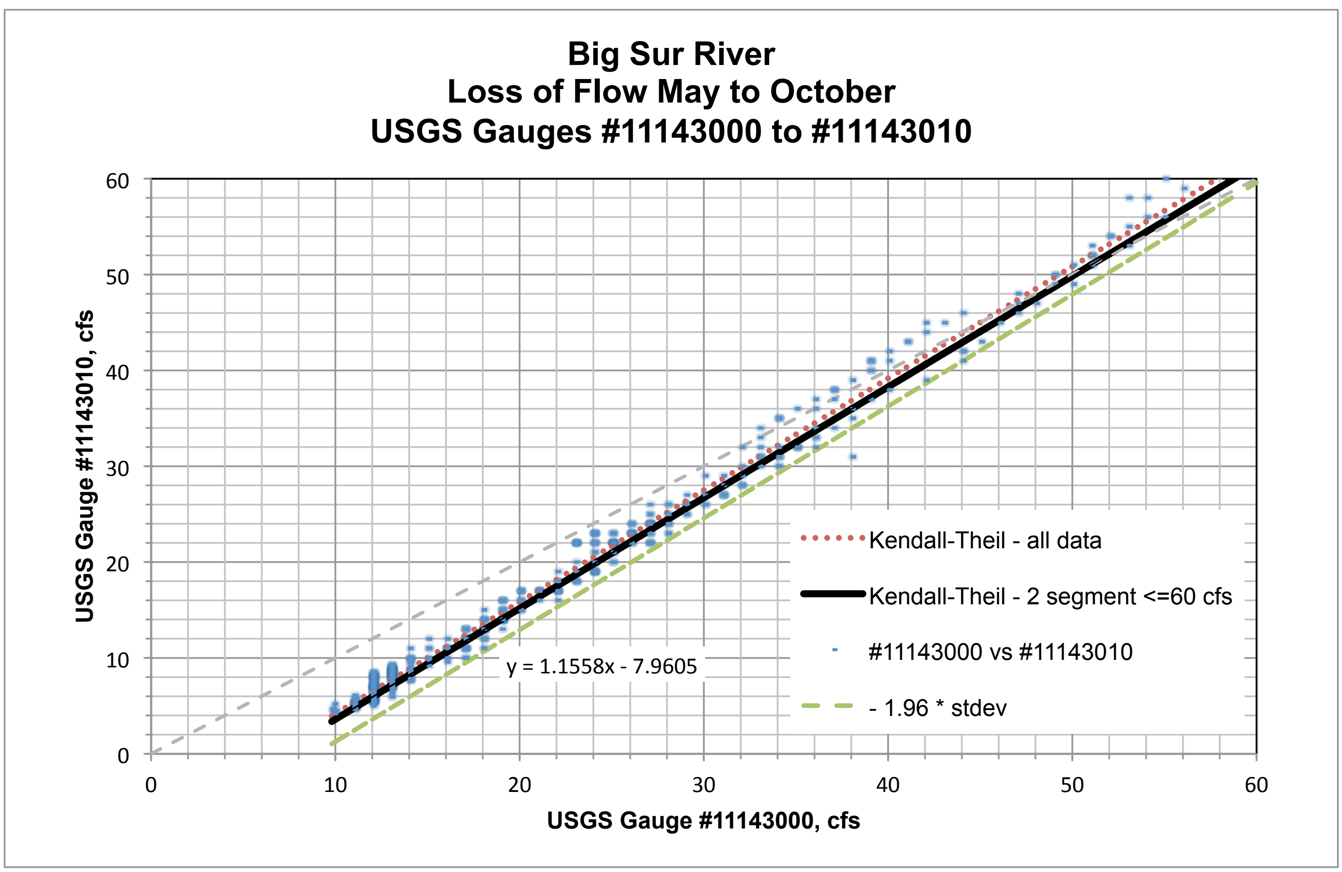


Attachment 7

```
Kendall-Theil Robust Line (KTRLine--version 1.0) Output
Analysis done on: 2016-08-16 12:13:03
Input File Name: C:\Users\Kit Custis\El Sur 2016\BigSur Andrew Molera gauge data nov-apr   8_9_2016.txt
Independent Variable (X): 11143000
Dependent Variable (Y): 1114310
********************
Linear model all data:
 Number of points: 646 Number of pairs: 208335
 Number of ties in X:        465
 Minimum X:    11
 Maximum X:    382
 Minimum Y:    6.1
 Maximum Y:    387
 Median of X's: 37
 Median of Y's: 33
 Median of Slopes: 1.203704
  Upper 95th percent confidence interval of slope (large sample approximation): 1.213115
  Lower 95th percent confidence interval of slope (large sample approximation): 1.195122
 Linear intercept: -11.53704
 Kendall-Theil Line for all linear data: Y = -11.53704 + 1.203704 * X
Information on independent random errors (deviations from line):
 Median Deviation (error):   3.892594
 Median Absolute Deviation (error) (MAD):               4.444445
 Root Mean Square Error (RMSE):            11.11143
 NonParametric PRediction Error Sum of Squares (NPPRESS):              82181.19
 Bias Correction Factor (BCF):            2.907176
Note: This is a Duan (1983) smearing estimator.
********************
  ********************
  Model all data with: X & Y with 2 segment(s)
  ***
  Segment: 1 of 2
  Number of points in calculated interval (used for regression coefficients): 344
  Number of ties in X: 315
  Specified minimum X value of interval: 11
  Specified maximum X value of interval: 40
  Calculated maximum X value of interval (based on intersection of regression lines): 20.07481
  Number of points in calculated interval (used for residual statistics): 134
  Median of X: 23
  Median of Y: 21
  Median of Slopes: 1.065217
  Upper 95th percent confidence interval of slope (large sample approximation): 1.1
  Lower 95th percent confidence interval of slope (large sample approximation): 1.026316
  Linear intercept: -3.5

  Kendall-Theil Line for data: Y = -3.5 + 1.065217 * X

  Information on independent random errors (deviations from line):
  Median Absolute Deviation (error) (MAD): 2.547826
  Bias Correction Factor (BCF): -2.172616
  Note: This is a Duan (1983) smearing estimator.
  ***
  ***
  Segment: 2 of 2
  Number of points in calculated interval (used for regression coefficients): 332
  Number of ties in X: 174
  Specified minimum X value of interval: 35
  Specified maximum X value of interval: 382
  Calculated maximum X value of interval (based on intersection of regression lines): 382
  Number of points in calculated interval (used for residual statistics): 512
  Median of X: 77.5
  Median of Y: 89
  Median of Slopes: 1.238411
  Upper 95th percent confidence interval of slope (large sample approximation): 1.255814
  Lower 95th percent confidence interval of slope (large sample approximation): 1.222222
  Linear intercept: -6.976821

  Kendall-Theil Line for data: Y = -6.976821 + 1.238411 * X

  Information on independent random errors (deviations from line):
  Median Absolute Deviation (error) (MAD): 3.331129
  Bias Correction Factor (BCF): -4.764138
  Note: This is a Duan (1983) smearing estimator.
  ***
  Total Model Fit Information:
  Median Deviation (error): -2.523913
  Root Mean Square Error (RMSE): 12.58321
  NonParametric PRediction Error Sum of Squares (NPPRESS): 106122.3
  **********************

  Tab Delimited information for Export:

  Yvar      XVar  Segments    Line  Intercept   Slope MAD   MaxX  Number of Points
  Y   X     2     1     -3.5  1.065217    2.547826    20.07481    134
  Y   X     2     2     -6.976821   1.238411    3.331129    382   512
  *********************
```

Attachment 8





Attachment 9

```
Kendall-Theil Robust Line (KTRLine--version 1.0) Output
Analysis done on: 2016-08-09 12:05:55
Input File Name: C:\Users\Kit Custis\El Sur 2016\BigSur Andrew Molera gauge data may-oct  8_9_2016.txt
Independent Variable (X): 11143000
Dependent Variable (Y): 11143010
*******************
Linear model all data:
 Number of points: 561 Number of pairs: 157080
 Number of ties in X:        463
 Minimum X:    9.8
 Maximum X:    264
 Minimum Y:    4.2
 Maximum Y:    276
 Median of X's: 21
 Median of Y's: 17
 Median of Slopes: 1.166667
  Upper 95th percent confidence interval of slope (large sample approximation): 1.18
  Lower 95th percent confidence interval of slope (large sample approximation): 1.155556
 Linear intercept: -7.499999
 Kendall-Theil Line for all linear data: Y = -7.499999 + 1.166667 * X
Information on independent random errors (deviations from line):
 Median Deviation (error):   6.666613E-02
 Median Absolute Deviation (error) (MAD):                0.9000006
 Root Mean Square Error (RMSE):             2.809663
 NonParametric PRediction Error Sum of Squares (NPPRESS):              4742.361
 Bias Correction Factor (BCF):             0.1633394
Note: This is a Duan (1983) smearing estimator.
********************
  ********************
  Model all data with: X & Y with 2 segment(s)
  ***
  Segment: 1 of 2
  Number of points in calculated interval (used for regression coefficients): 501
  Number of ties in X: 449
  Specified minimum X value of interval: 9.8
  Specified maximum X value of interval: 60
  Calculated maximum X value of interval (based on intersection of regression lines): 141.2104
  Number of points in calculated interval (used for residual statistics): 558
  Median of X: 19
  Median of Y: 14
  Median of Slopes: 1.155814
  Upper 95th percent confidence interval of slope (large sample approximation): 1.166667
  Lower 95th percent confidence interval of slope (large sample approximation): 1.142857
  Linear intercept: -7.960464

  Kendall-Theil Line for data: Y = -7.960464 + 1.155814 * X

  Information on independent random errors (deviations from line):
  Median Absolute Deviation (error) (MAD): 1
  Bias Correction Factor (BCF): 1.00201
  Note: This is a Duan (1983) smearing estimator.
  ***
  ***
  Segment: 2 of 2
  Number of points in calculated interval (used for regression coefficients): 62
  Number of ties in X: 15
  Specified minimum X value of interval: 60
  Specified maximum X value of interval: 264
  Calculated maximum X value of interval (based on intersection of regression lines): 264
  Number of points in calculated interval (used for residual statistics): 3
  Median of X: 86
  Median of Y: 89
  Median of Slopes: 1.2
  Upper 95th percent confidence interval of slope (large sample approximation): 1.3
  Lower 95th percent confidence interval of slope (large sample approximation): 1.1
  Linear intercept: -14.2

  Kendall-Theil Line for data: Y = -14.2 + 1.2 * X

  Information on independent random errors (deviations from line):
  Median Absolute Deviation (error) (MAD): 9.199997
  Bias Correction Factor (BCF): -11.86667
  Note: This is a Duan (1983) smearing estimator.
  ***
  Total Model Fit Information:
  Median Deviation (error): 0.7906971
  Root Mean Square Error (RMSE): 3.047354
  NonParametric PRediction Error Sum of Squares (NPPRESS): 5569.413
  *********************

  Tab Delimited information for Export:

  Yvar      XVar  Segments    Line  Intercept    Slope MAD    MaxX  Number of Points
  Y   X     2     1     -7.960464   1.155814    1      141.2104    558
  Y   X     2     2     -14.2 1.2   9.199997    264    3
  ********************
```

Attachment 10

Table 2
Big Sur River Gauges #11143000 to #11143010
Flow Losses Using Kindall-Theil Regression Equations

		November to April		
#11143000-cfs	**1 - Segment**	**Flow Loss* at lower 95%**	**2 - Segments**	**Flow Loss* at lower 95%**
10	-14.8	-10.0	-2.6	-10.0
20	-2.8	-20.0	8.0	-12.0
30	9.2	-20.8	18.7	-11.3
40	21.3	-18.7	29.3	-10.7
50	33.3	-16.7	42.9	-7.1
60	45.4	-14.6	55.3	-4.7
70	57.4	-12.6	67.6	-2.4
80	69.4	-10.6	80.0	0.0
90	81.5	-8.5	92.4	2.4
100	93.5	-6.5	104.8	4.8
0 to 60 cfs median at -95%		***-17.7***		***-10.3***
0 to 70 cfs median at -95%		***-16.7***		***-10.0***
0 to 80 cfs median at -95%		***-15.7***		***-8.6***

1 - Segment = (1.203*X - 11.537) - (1.96* stdev) - (#11143010 to ESR POD)
MAD = 4.444445; (2/3) * (-3.4 cfs) = #11143010 to ESR POD

2 - Segments
<=40 cfs = (1.0652*X - 3.5) - (1.96*stdev) - (#11143010 to ESR POD)
MAD = 2.547826; (2/3) * (-3.4 cfs) = #11143010 to ESR POD
>=35 cf = (1.238*X - 6.977) - (1.96*stdev) - (#11143010 to ESR POD)
MAD = 3.331129; (2/3) * (-3.4 cfs) = #11143010 to ESR POD

		May to October		
#11143000-cfs	**1 - Segment**	**Flow Loss* at lower 95%**	**2 - Segments**	**Flow Loss* at lower 95%**
10	-0.8	-10.0	-1.6	-10.0
20	10.9	-9.1	10.0	-10.0
30	22.6	-7.4	21.5	-8.5
40	34.2	-5.8	33.1	-6.9
50	45.9	-4.1	44.6	-5.4
60	57.6	-2.4	56.2	-3.8
70	69.2	-0.8	41.0	-29.0
80	80.9	0.9	49.7	-30.3
90	92.6	2.6	61.7	-28.3
100	104.2	4.2	73.7	-26.3
0 to 60 cfs median at -95%		***-6.6***		***-7.7***
0 to 70 cfs median at -95%		***-5.8***		***-8.5***
0 to 80 cfs median at -95%		***-4.1***		***-10.0***

1 - Segment = (1.167*X - 7.499) - (1.96* stdev) - (#11143010 to ESR POD)
MAD = 0.9000006 - (2/3) * (-3.4 cfs) = #11143010 to ESR POD

2 - Segments
<=60 cfs = (1.1558*X - 7.96) - (1.96*stdev) - (#11143010 to ESR POD)
MAD = 0.9906974 - (2/3) * (-3.4 cfs) = #11143010 to ESR POD
>= 55 cfs = (1.2*X - 12.3) - (1.96*stdev) - (#11143010 to ESR POD)
MAD = 10.1 - (2/3) * (-3.4 cfs) = #11143010 to ESR POD

* Flow loss adjusted to that it's no greater than total flow at guage #11143000
std.dev. = (2/3) * MAD; #11143010 to V3 = (2/3) * median from gauge to V3

Attachment 11