

North Platte Focus Study – Sutherland Gage Assessment

To: COHYST Technical and Sponsor Group	
From: John Engel	Project:
CC: File	
Date: January 31 2012	Job No:

RE: North Platte Focus Study – Sutherland Gage Assessment

Background

At the November 2011 workshop, questions were raised about the integrity of the North Platte River near Sutherland (6691000) gage in the context of calibration targets for total flow, baseflow estimates, and reach gain/loss computations. This technical memorandum documents the investigation into the Sutherland gage data to identify any inconsistencies or data gaps in the data record; use of adjacent historic data to synthesize Sutherland gage flows; and a final recommendation for modifying the historic record of the Sutherland gage.

Gage Data Review

The North Platte River near Sutherland (6691000) gage was maintained by the USGS from 1930 through 1991, with the DNR assuming operation of the gage in 1991. Missing data was found in the record during the non-irrigation season for all or portions of WY 1993-1999, as shown in Table 1.

Table 1. Historic Sutherland Gage Monthly Flows (WY 1991-2004)

NORTH PLATTE RIVER NEAR SUTHERLAND, NE													
1936-1991 USGS; 1991-2009 DNR													
Monthly Flow Acre-feet													
Year	January	February	March	April	May	June	July	August	September	October	November	December	Annual
1991										9080	9100	7960	
1992	7560	7490	10940	7400	9650	16100	29300	35200	10910	10170	7650	7830	
1993					7410	8320	17320	12660	5920				
1994					5480	14610	60410	53720	4750				
1995					9840	29650	102300	81980	38110				
1996					8220	11840	82250	36470	23120				
1997					12200	52400	98000	52720	71520				
1998					12840	23670	123200	54210	12900				
1999					8880	16310	81470	50330	57870	15840	13330	13950	
2000	9340	10310	10520	10400	29090	91950	108800	87240	8030	10080	9370	7180	
2001	8580	5820	6780	9350	5940	23670	109900	71750	7990	9270	7460	8190	
2002	8560	6910	6780	5220	4000	21560	161600	38570	8550	7620	6910	6610	
2003	5770	5840	5870	7120	2620	5650	57320	42060	5520	5140	6130	6290	
2004	6050	5950	5820	3570	1510	4890	26700	6070	5580				
Mean	7640	7050	7790	7180	9050	24660	81430	47920	20060	9600	8570	8290	239200

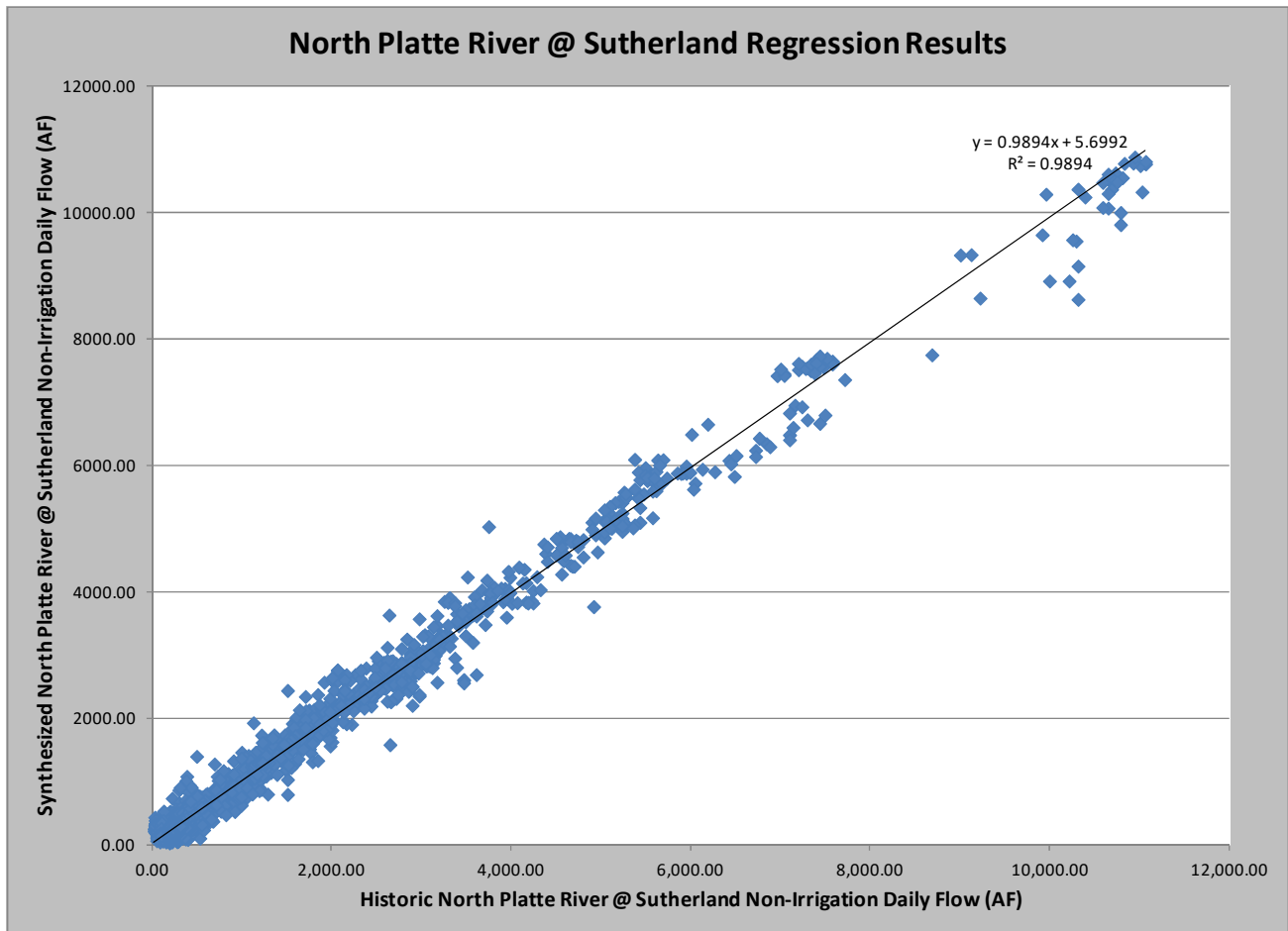
Sutherland Gage Synthesis

To synthesize the missing data at the Sutherland Gage, a multiple linear regression was performed. The historic daily non-irrigation season flows for the North Platte River at Keystone (6690500), the North Platte River at North Platte (6693000), and Birdwood Creek near Hershey, NE (6692000) were used in the regression analysis. The following equation was derived to synthesize the Sutherland gage flows (all values in acre-feet):

$$\text{Sutherland} = 42.68 + 0.48(\text{NP@Keystone}) + 0.52 [(\text{NP@North Platte} - \text{Birdwood})].$$

The resulting Nash-Sutcliffe coefficient for the regression is 0.989 (the closer to 1, the more accurate the model). Figure 1 illustrates the results of the regression.

Figure 1. North Platte River at Sutherland Regression Results



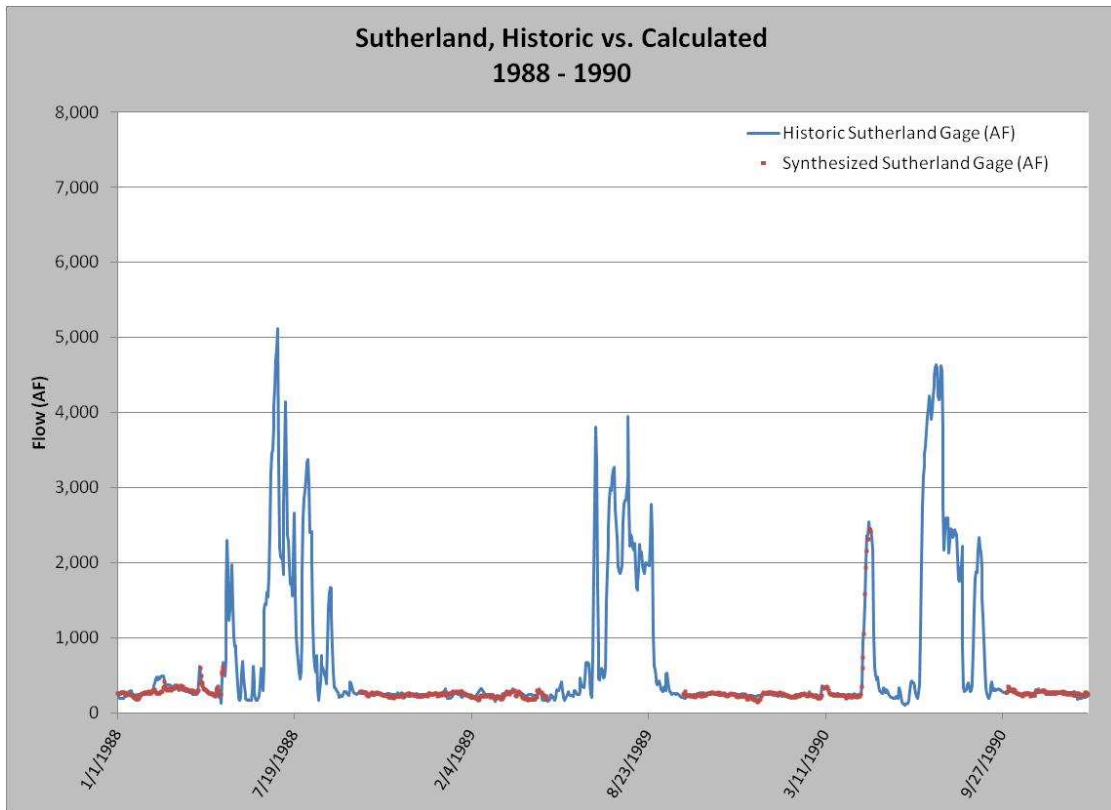
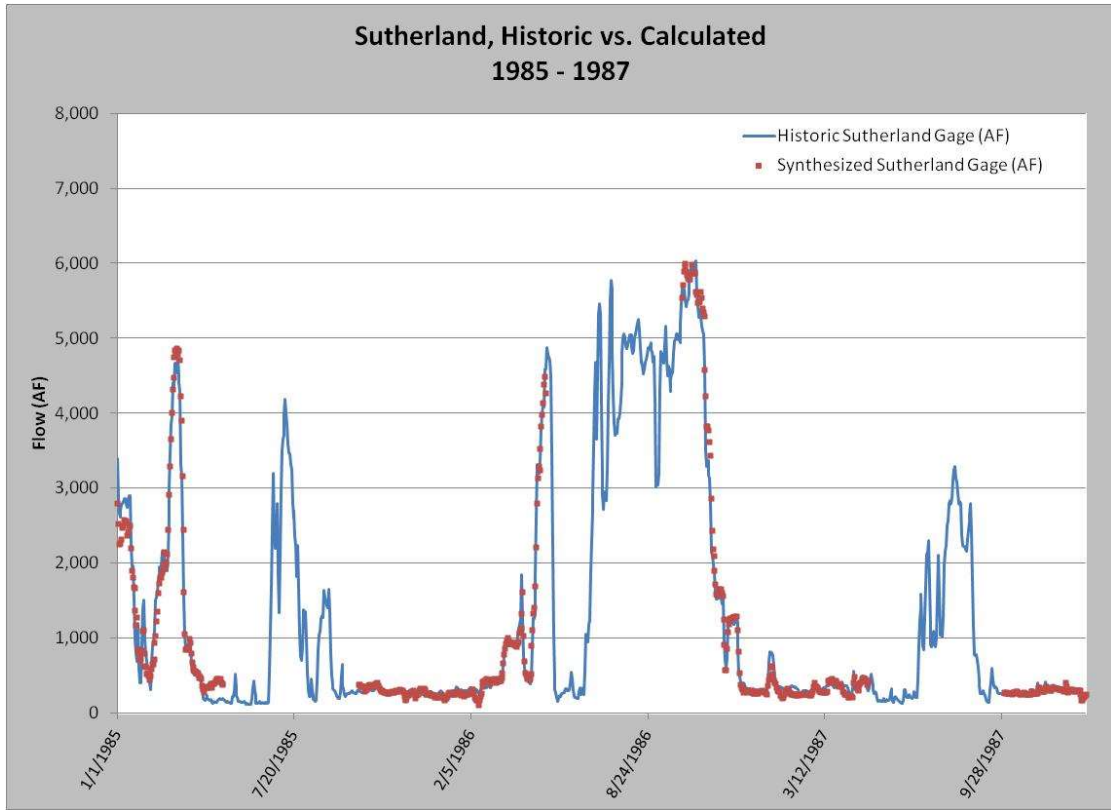
Plots comparing the synthesized Sutherland gage in the non-irrigation season to the historical Sutherland gage (when available) for the 1985 through 2006 period are attached.

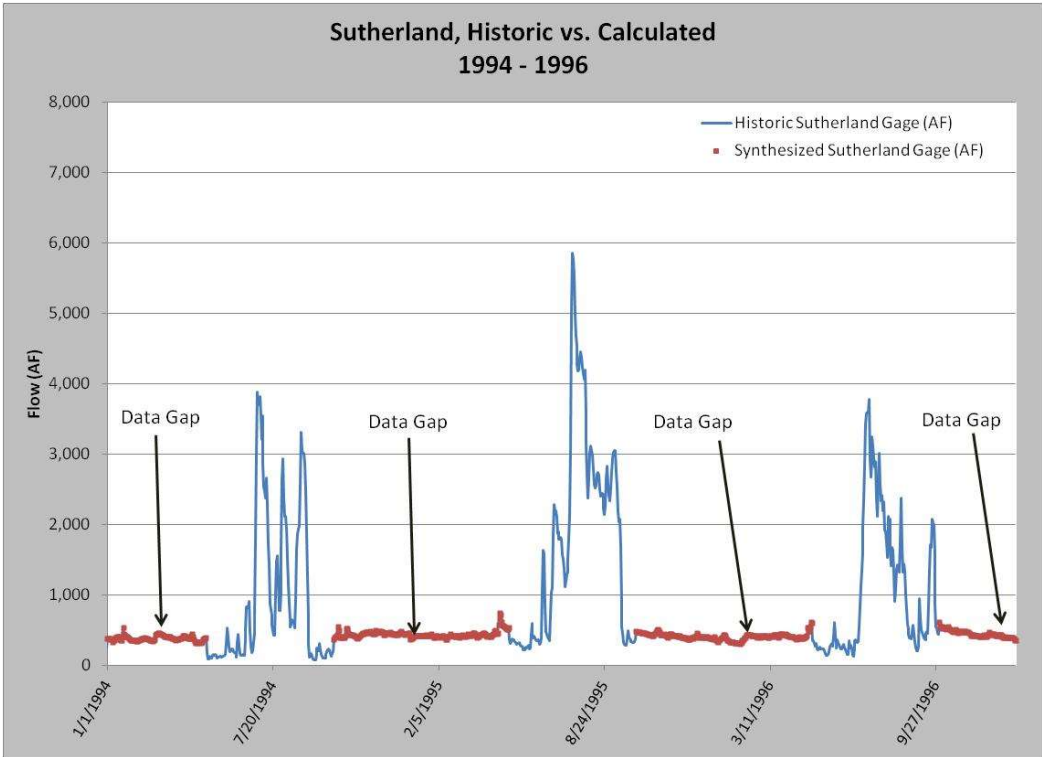
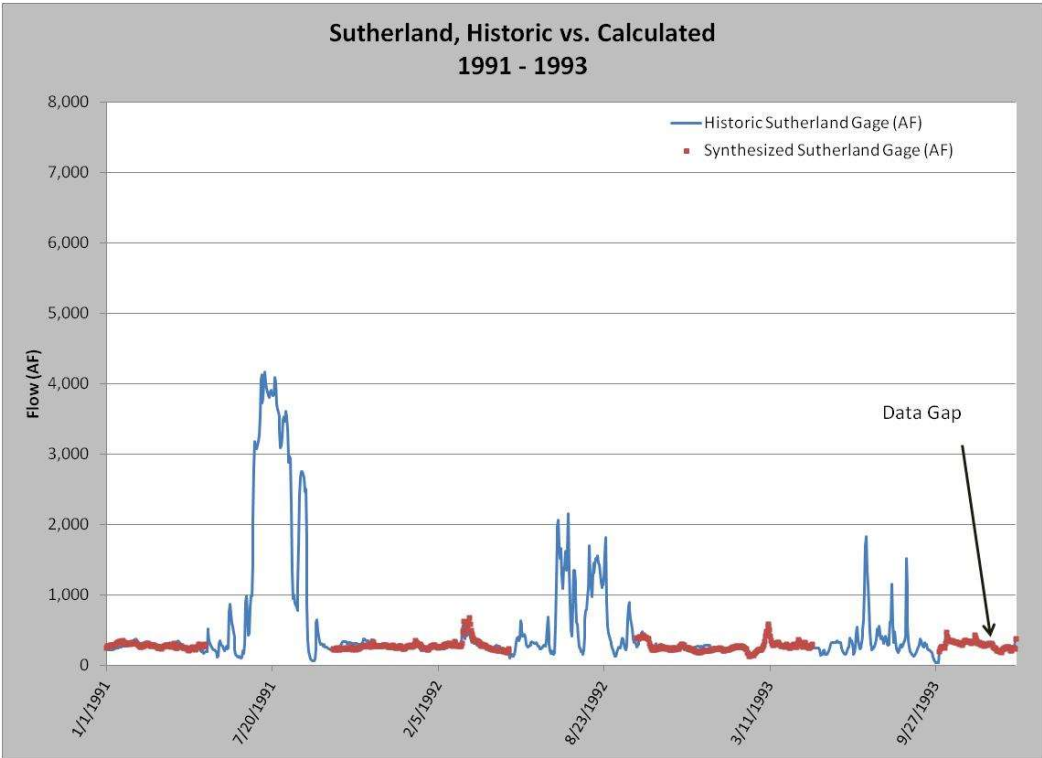
Recommendation

The multiple linear regression model performs very well, as measured by statistical analysis and visual comparison of historic and synthesized flow values at the Sutherland gage. It is recommended that the synthesized flow data be used to fill in missing data in the historic Sutherland gage record. While the regression yields very good results, it is recommended that during calibration should a discrepancy in calibration targets arise, preference be given to the North Platte River at Keystone and the North Platte River at North Platte calibration target datasets.

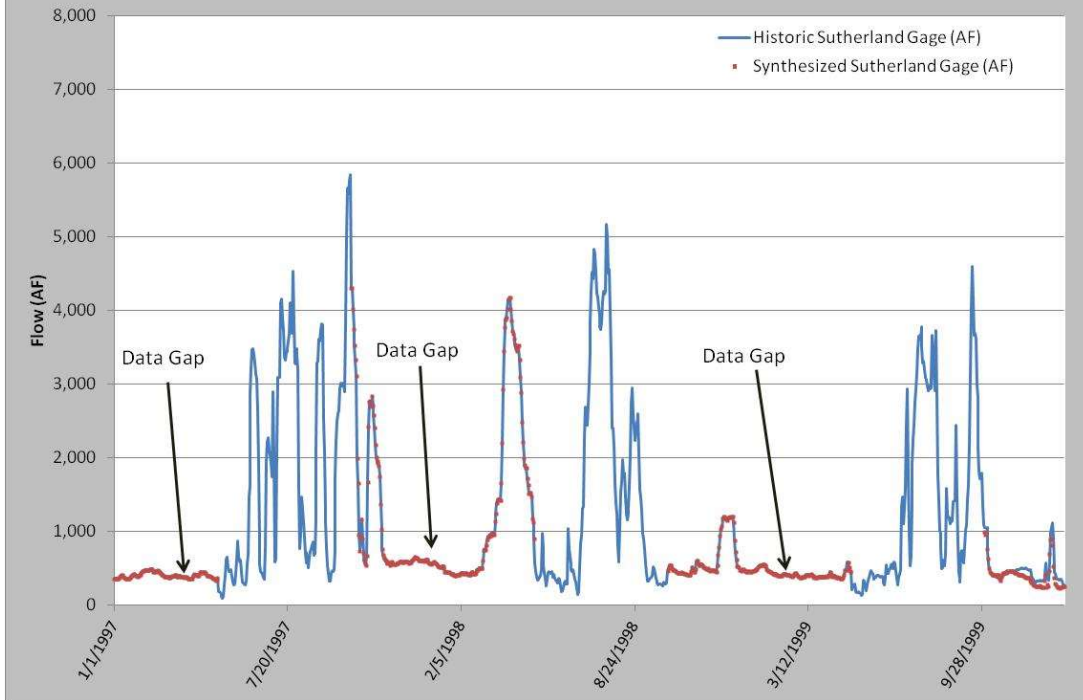
ATTACHMENT I

Historic and Synthesized North Platte River at Sutherland Daily Flow (1985-2006)

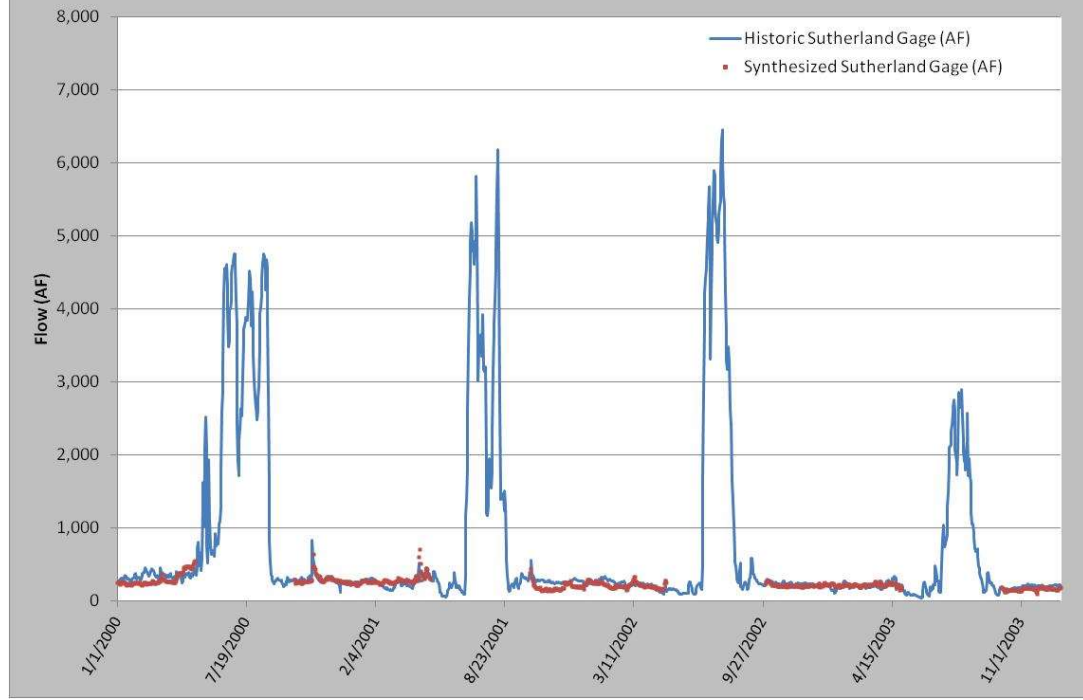




Sutherland, Historic vs. Calculated
1997 - 1999



Sutherland, Historic vs. Calculated
2000 - 2003



Sutherland, Historic vs. Calculated 2004 - 2006

