REBUTTAL REPORT
OF EXPERT REPORT AND DIRECT TESTIMONY BY
CHARLES BRENDECKE FOR IGWA

In The Matter of Distribution of Various Water Rights Held by or for the Benefit of A&B, AFRD2, BID, MID, MIL, MID, NSCC and TFCC

November 7, 2007

INTRODUCTION

This is a rebuttal of the Expert Report and Direct Testimony by Charles Brendecke of Hydrosphere Resource Consultants for Idaho Ground Water Appropriators, Inc. (IGWA). This rebuttal report was prepared by John Koreny and Steve Thurin of HDR Engineering, Inc., Norm Young of ERO Resources, Inc. and Charles Brockway of Brockway Engineering, Inc at the request of the Surface Water Coalition (SWC). The following opinions by Dr. Brendecke are addressed in this report.

Brendecke Opinion 1: Annual average reach gain data show no sign of decline in the Blackfoot to Neeley reach (*Expert Report, pg. 7, 4th para.*). Declines are observed in this reach from 1950s to 2006 during the months of July but not during any other months (declines in August are a result of 2000s drought) (*Direct Testimony, pg. 12, lines 14-22*).

Brendecke Opinion 2: Ground water pumping has not reduced reach gains in the near Blackfoot to Neeley reach (*Expert Report, pg. 8, last paragraph*).

Brendecke Opinion 3: The amount of natural flow available to the SWC during recent dry periods is as much or more than was available during other comparable historic drought periods- like the 1930s drought and more than the natural flow at the time the water rights were established (*Direct Testimony, pgs. 14 to 22; Expert Report, pgs. 7 and 9*).

Brendecke Opinion 4: The planning reports for the SWC projects (such as the Palisades Reservoir Project Planning Report, the American Falls Reservoir Rehabilitation Planning Report and the Gooding Project Planning Report) show that the shortages that occurred during the 2000s were expected by the SWC entities. (*Expert Report, pgs. 12 to 13; Direct Testimony, pgs. 24 to 26*).

Brendecke Opinion 5: If curtailment did increase natural flow this would be an "enhancement" of the SWC supply compared to the supply available at the time the rights were established. (*Direct Testimony, pg. 14, lines 12 to 15*). The SWC is not entitled to be provided "reasonable carryover" because the Palisades Reservoir Project Planning Report projected that on the SWC irrigation projects all storage would be used to meet irrigation demands during two of 46 years with no remaining storage for carryover (*Expert Report, pgs. 12 to 13; Direct Testimony, pgs. 30 and 31*).

Brendecke Opinion 6: The ESPA ground water model failed to accurately represent some of the features of the aquifer that influence the simulation of distribution of the pumping impacts on reaches, such as anisotropy in the aquifer (*Direct Testimony, pgs. 28 to 30*).

Brendecke Opinion 7: The "Curtailment Scenario" run using the ESPAM model over-predicts the amount of the increase in reach gains that would occur in the Blackfoot to Milner reach if ground water was curtailed because the historical records of reach gains don't show a decline similar to the decline predicted by the "Curtailment Scenario" (*Direct Testimony, pgs. 27 to 28*).

Brendecke Opinion 8: Curtailment of ground water pumping would not be effective because only a small percentage of the amount of ground water not pumped would accrue to the Blackfoot to Milner reach (*Expert Report, pg. 21 to 22*). Further, this curtailment of ground water users and the time it takes for any resulting reach gains in usable quantity by the Surface Water Coalition would deem the delivery call futile (*No. 124, pg. 36-36 of Exhibit 4000*).

Brendecke Opinion 9: If reach gains did increase as a result of curtailment of ground water pumping, the reach gains would not be useable by the SWC, as demonstrated by the 888 cfs Scenario run on the IDWR Planning Model (*Direct Testimony, pgs. 14 to 22; Expert Report pgs. 22 to 23*).

Brendecke Opinion 10: The minimum full supply established by the Director in the May 2, 2005 Order is not appropriate and too large for the following reasons. The minimum full supply set in the Order did not appropriately consider the headgate delivery criteria set forth in operational policies (*Direct Testimony, pg 30; Expert Report, pg. 25 to 26*). The minimum full supply is too large compared to the amount of supply available during other drought periods (*Expert Report, pg. 26 to 27*). The minimum full supply did not consider actual irrigation requirements (*Expert Report, pg. 27 of Report*). These errors have unduly increased the material injury determined by the Director (*Direct Testimony, pg. 33*).

The exhibits in this report are from the tables and figures from the SWC Expert Report dated September 26, 2007. These exhibits include a parenthetical reference to the table and figure number in the SWC Expert Report.

BRENDECKE OPINION 1

Annual average reach gain data show no sign of decline in the Blackfoot to Neeley reach (*Expert Report, pg. 7, 4th para., pg. 8, last paragraph*). Declines are observed in this reach from 1950s to 2006 during the months of July but not during any other months (declines in August are a result of 2000s drought) (*Direct Testimony, pg. 12, lines 14-22*).

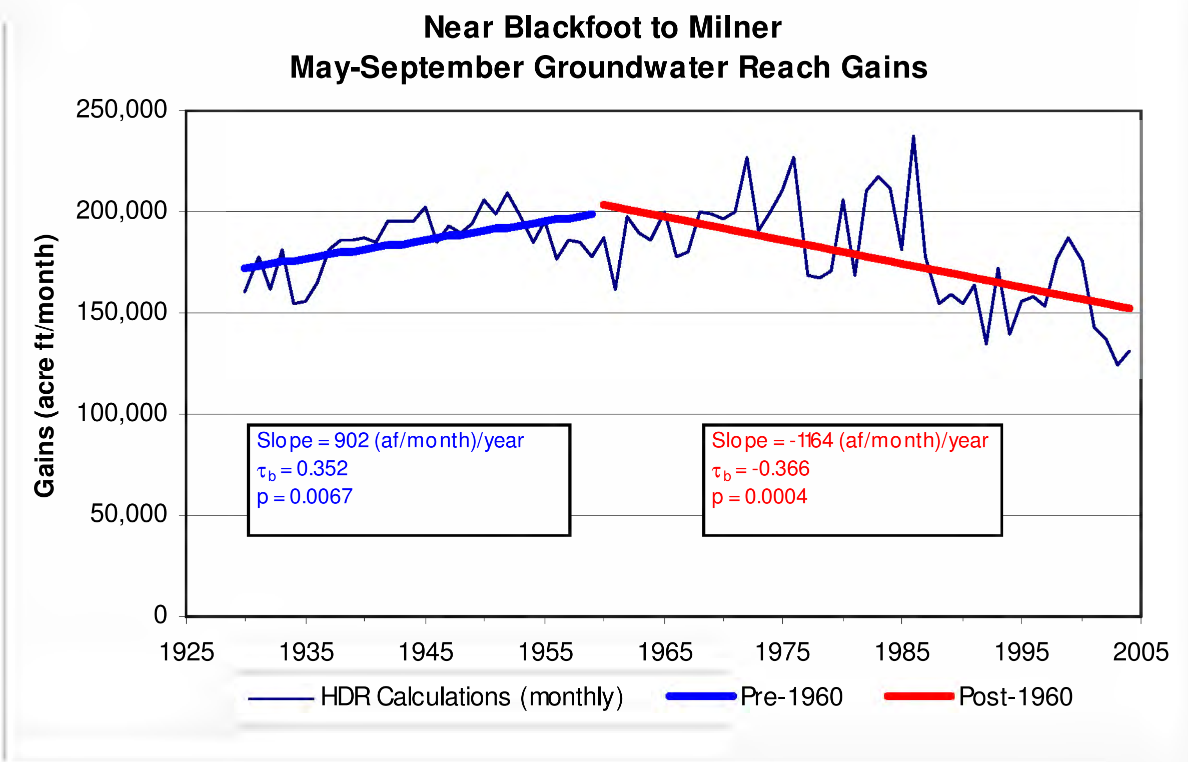
REBUTTAL

Dr. Brendecke's opinion implies that the reach gains that provide a source of supply to the SWC have not declined. This is not correct. In his report, Dr. Brendecke has relied on the Blackfoot to Neeley reach gain data and has not evaluated the reach gain in the entire reach from Blackfoot to Milner. Dr. Brendecke should use the Blackfoot to Milner reach data to evaluate the effects of reach gain decline on the SWC water supply, because the SWC diverts the reach gains that accrue in the entire Blackfoot to Milner reach. The reach above Milner Dam has now transitioned to a losing reach because the ground water table in this reach has declined (partially as a result of ground water pumping). By only considering gains in the Blackfoot to Neeley reach Dr. Brendecke does not account for the effects of the declines in the lower part of the reach on the SWC water supply.

Dr. Brendecke also uses average annual reach gain data to make his conclusion that there is no reach gain decline and no impacts from the decline to the SWC water supply. The annual average reach gains are not a good indicator of the amount of natural flow available to the SWC for use during the irrigation season- mainly because the SWC diverts natural flow during the irrigation season and not during the entire year. Dr. Brendecke does reference monthly declines, but only does so for the Blackfoot to Neeley reach instead of the Blackfoot to Milner reach and states that the only month with a decline caused by ground water pumping is July.

The monthly Blackfoot to Milner reach gains are the most reliable and appropriate data to evaluate whether reach gains that supply the SWC have declined. A review of the monthly Blackfoot to Milner reach gain data shows that Dr. Brendecke's opinion that reach gains are not declining is incorrect. The Blackfoot to Milner reach gains for the period from May to September and for the individual months during June, July and August show significant declines (**Exhibits 8211 and 8212)**. The average decline from the 1950-1960 period to the 2000s for May to September is about 67,000 AF/month and the maximum monthly decline is about 106,000 AF/month during July (**Exhibit 8213**).

The decline in reach gains in the Blackfoot to Milner reach is further confirmed by an examination of the Twin Falls Canal Company (TFCC) natural flow diversions in the middle of the irrigation season. TFCC diverts almost all of the reach gains accruing in this reach in the middle of the irrigation season during average and dry years when there is no natural flow coming from above Blackfoot. The reach gain calculations and the TFCC natural flow diversions show a very similar pattern of decline (**Exhibit 8214**).



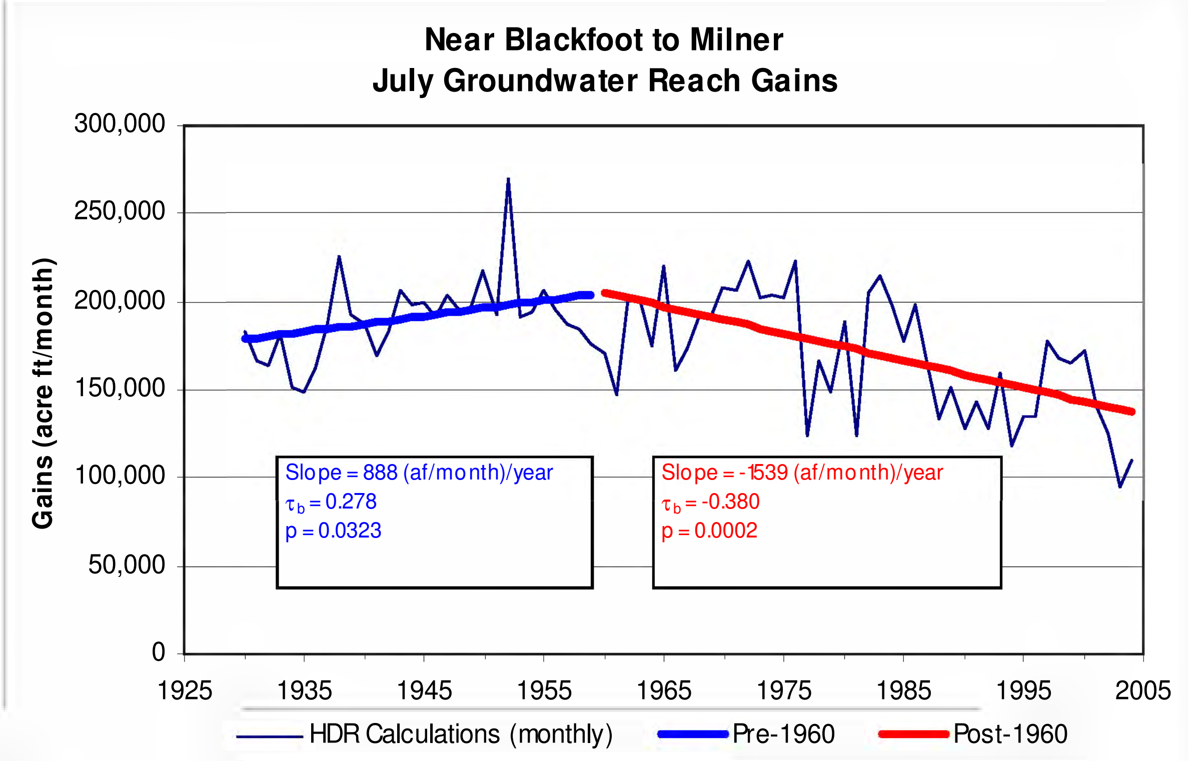


Exhibit 8211 (Figure 7-31) Reach gain decline in the near Blackfoot to Milner reach

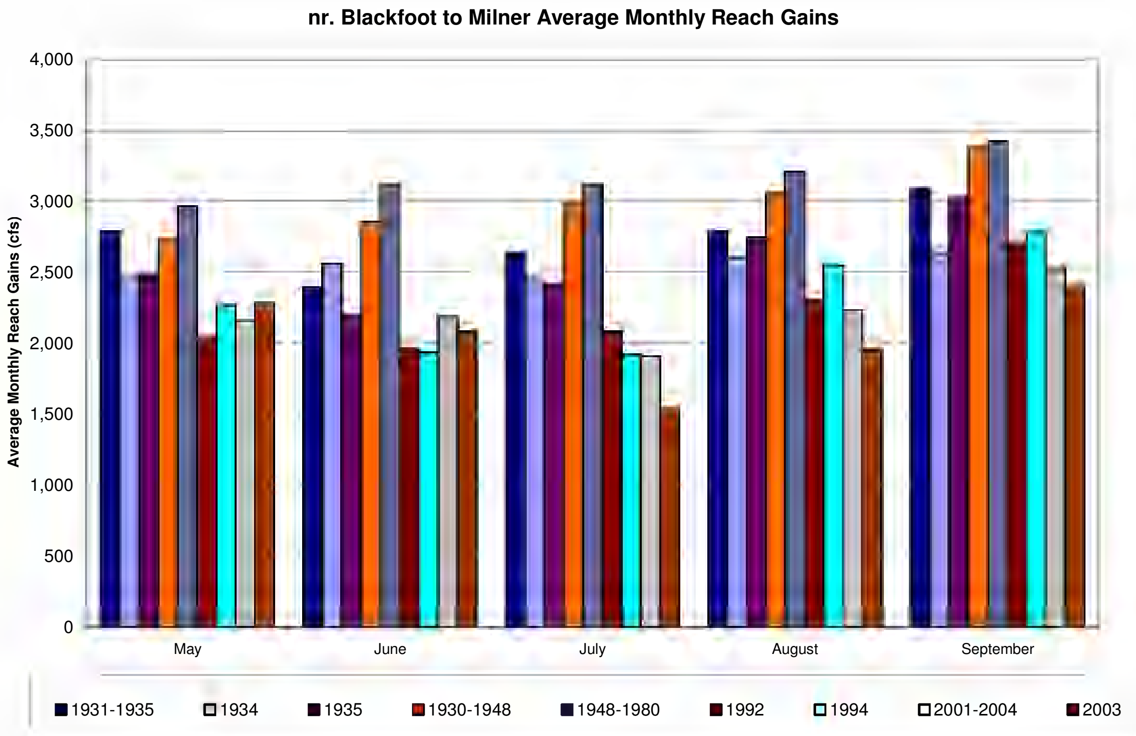


Exhibit 8212 **Comparison of monthly-average Snake River reach gains showing the decline between historic and recent periods including the 1930s drought and the more-recent drought in 1992, 1994 and in the 2000s.**

	Groundwater Reach Gains (acre ft/month)						
	Average of Monthly Values for the Year (Jan-Dec)	Average of Monthly Values for the Year (May-Sep)	May	June	July	August	September
Comparison of 1950-1960 Average Groundwater Reach Gains to 1990-2004 Minimum Groundwater Reach Gains							
Average 1950-1960	185,035	191,694	171,841	183,087	201,292	198,660	203,590
Min 1990-2004	135,013	124,494	122,116	100,053	94,789	120,457	142,878
Difference	50,023	67,200	49,725	83,034	106,503	78,203	60,712

Exhibit 8213 (from Table 7-4) **Reach gain declines in the nr Blackfoot to Milner reach**

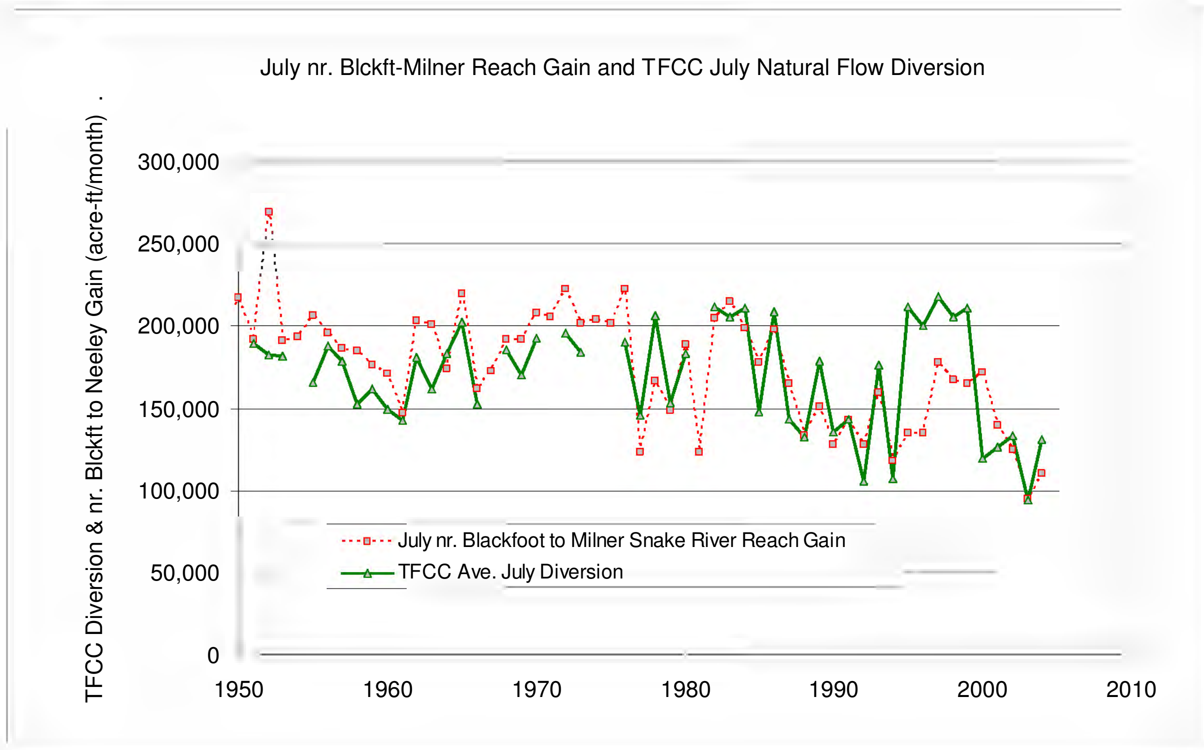


Exhibit 8214 (Figure 7-32) Relationship between declining TFCC monthly natural flow diversions and the declining reach gains in the near Blackfoot to Milner reach during the middle of the irrigation season.

BENDECKE OPINION 2

Ground water pumping has not reduced reach gains in the near Blackfoot to Neeley reach (*Expert Report, pg. 7, 4th paragraph; pg. 8, last paragraph*).

REBUTTAL

Dr. Brendecke states that ground water pumping has not reduced reach gains in the Blackfoot to Neeley reach. On page 7, 4th paragraph of his Expert Report he states, "*If ground water development on the ESRP were impacting this reach gain, it would be reasonable to expect the reach gain to show a declining trend since ground water development began. The reach gains shown in* ***Exhibit 4112*** *show no statistically significant trend over the ninety-three year period of record and no statistically significant trend between 1950, when substantial ground water development began, and the onset of the current drought in 2000. . . As shown on* ***Exhibit 4113****, there is no relationship between the annual reach gain and the accumulated rate of permitted ground water irrigation.*"

The Blackfoot to Milner reach gains during the irrigation season have declined significantly. Dr. Brendecke's opinion above is incorrect because it is based on the annual reach gain data in the Blackfoot to Neeley reach (**Exhibit 4112**) that shows no decline and ignores the monthly reach gain data for July (**Exhibit 4146**) that does show decline.

Exhibit 8215 in this report shows that there is a significant correlation between monthly reach gains in the Blackfoot to Milner reach (the reach that provides most of the SWC's natural flow supply) and permitted ground water irrigation.

Dr. Brendecke then goes on to use a double-mass analysis to incorrectly show that ground water pumping is not affecting reach gains in the Blackfoot to Neeley reach. "*Exhibit 4116 is a double- mass plot of the combined flow of the Snake River at the near Blackfoot gage and the flow of the Portneuf River versus the flow at the near Minidoka gage. If increasing ground water pumping over the 1950-1990 period were depleting the gains in this reach, the plotted line should veer increasingly to the right over that time period. However, there is no apparent change in slope of the double- mass plot over the 1950-1990 period of ground water development, which suggests that ground pumping has not reduced reach gains in the near Blackfoot to Neeley reach* (Expert Report, pg. 8, last paragraph).

Dr. Brendecke's double-mass curve (**Exhibit 4116**) compares the combined flow of the Snake River at the near Blackfoot gage and the flow of the Portneuf River versus the flow at the near Minidoka gage. Dr. Brendecke uses this figure to show that since the flow in the river over time has not declined, ground water pumping can not be affecting the natural flow in the river. The use of a double-mass curve for this analysis is incorrect. The main problem with Brendecke's **Exhibit 4116** is that it incorrectly attempts to identify the change in reach gains by only looking at the cumulative change in annual river flow. Since the annual flow in the river is very large (including winter and spring runoff), and is influenced by many factors like upstream diversions, storage, it is not possible to identify reach gain changes. This is illustrated by examining the estimated reach gain impacts in the Blackfoot to Milner reach predicted by the ESPA ground water model (about 20 MAF since 1950). By looking at the y axis on Brendecke's **Exhibit 4116** we can see that the total flow in the river since 1950 has been about 450 MAF. It is not possible to discern the effects of 18 MAF of ground water pumping on 450 MAF of river flow simply by plotting the cumulative annual river flow at Minidoka. This is why WD 01 and IDWR independently calculate reach gains based on the difference of upstream and downstream gages during a specific day or month factoring in the effects of evaporation, storage, diversions and returns as part of the administration of surface water rights in WD 01. A similar procedure was used by IWRRI and the USGS to calculate reach gains as part of previous studies for the ESPA and the ESPAM ground water model[1].

As noted above, a double-mass analysis is not the correct technique to evaluate whether ground water pumping has affected Snake River reach gains. However, if a double-mass technique were to be used, it would be more appropriate to plot the calculated reach gains occurring between Blackfoot and Milner to the unregulated river flow. This analysis was completed for both May-September and July-August reach gains as compared to the unregulated flow into the American Falls reach, as shown on **Exhibit 8216**. The graphs

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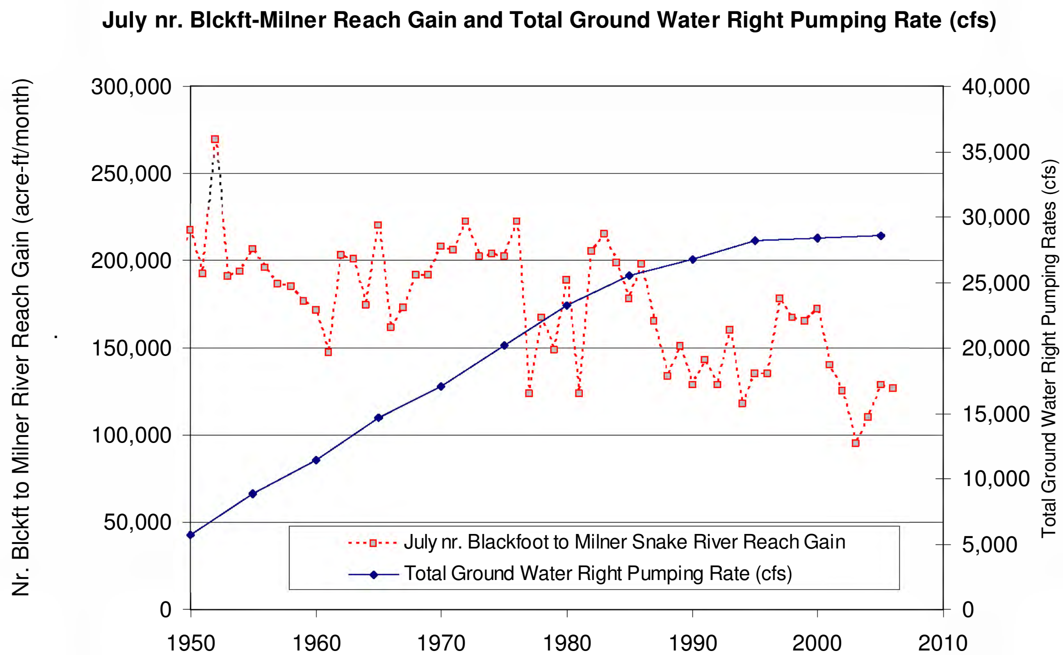
[1] Kjelstrom, L.C., 1995. Streamflow Gains and Losses in the Snake River and Ground-Water Budgets for the Snake River Plain, Idaho and Eastern Oregon. U.S. Geological Survey Professional Paper 1408-C, Boise, ID.

Cosgrove, D, et al., 2006. Final Report Enhanced Snake Plain Aquifer Model, IWRRI Technical Report 06-002. IWRRI, Idaho Falls, Idaho., Prepared for IDWR, Boise, ID.

indicate a decline in Snake River reach gains that becomes more pronounced over the last several decades and is independent of Snake River flow.

Dr. Brendecke's conclusion that ground water pumping is not impacting reach gains is incorrect. There is a large amount of information presented in Chapter 7 of the SWC Expert Report that ground water pumping is causing reach gain declines. A brief summary is presented below.

- There is about 1.6 million irrigated acres served by ground water pumping on the ESPA (of which 890,000 acres are served only by ground water and 700,000 acres served by both surface and ground water). A large majority of these ground water irrigated acres are within areas that would cause a reduction in the amount of Snake River reach gains in the hydraulicly-connected reaches above Minidoka Dam.
- Ground water levels have decreased by 5 to 60 feet across the ESPA. The ground water level decline is most evident in areas where ground water pumping is the greatest.
- The allocation of ground water rights on the ESPA closely correlates with the decline in ground water levels, the calculated decline in reach gains and the decrease in natural flow diversions by TFCC and NSCC in the mid-season when they are using all of the reach gains in the Blackfoot to Milner reach.
- Reservoir storage accrual has progressively decreased each successive drought year since ground water pumping began and since Palisades Reservoir began operations in the late 1950s. Ground water pumping is decreasing the amount of flow in the river that is available to fill the reservoirs.
- The ESPAM ground water model budget quantified consumptive use by ground water pumping for irrigation at about 1.5 to 3.0 MAF/yr from 1980 to 2004, with an average of 2.2 MAF/yr. This is about the same as the consumptive use by all surface water users on the Eastern Snake Plain and much more than the consumptive use by the SWC. Ground water pumping for irrigation only depletes the water from the aquifer and provides no incidental recharge to the ESPA.
- The Curtailment Scenario run using the ground water model indicated that ground water pumping is causing a reduction in reach gains of about 960 to 1,100 cfs in the Blackfoot to Minidoka reach and 1,800 to 2,050 cfs in all of the river reaches above Minidoka Dam.



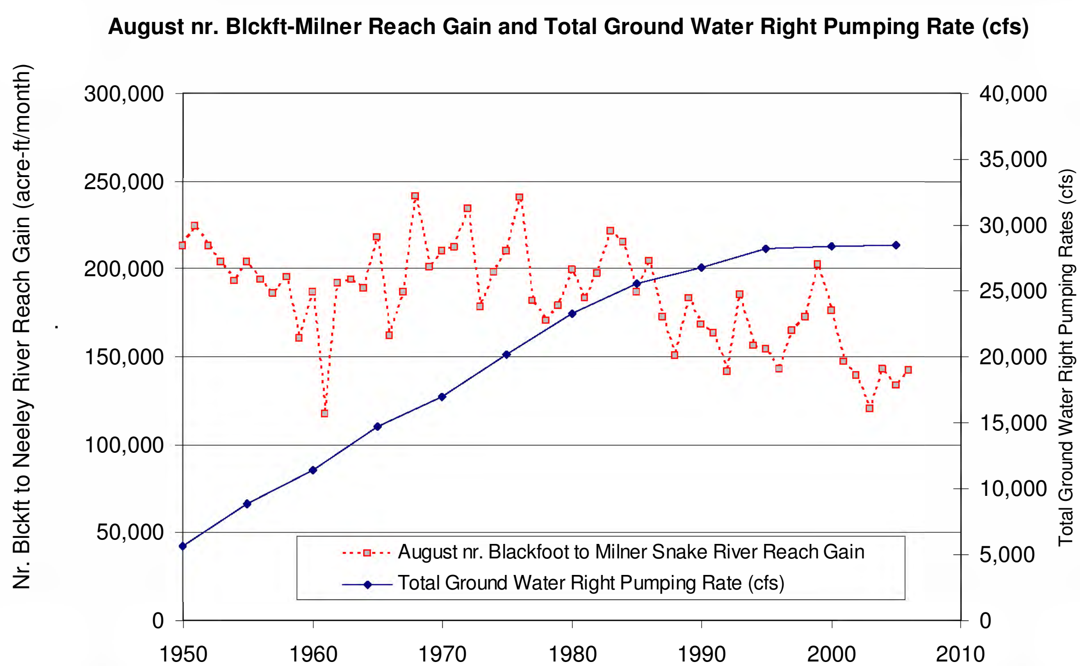
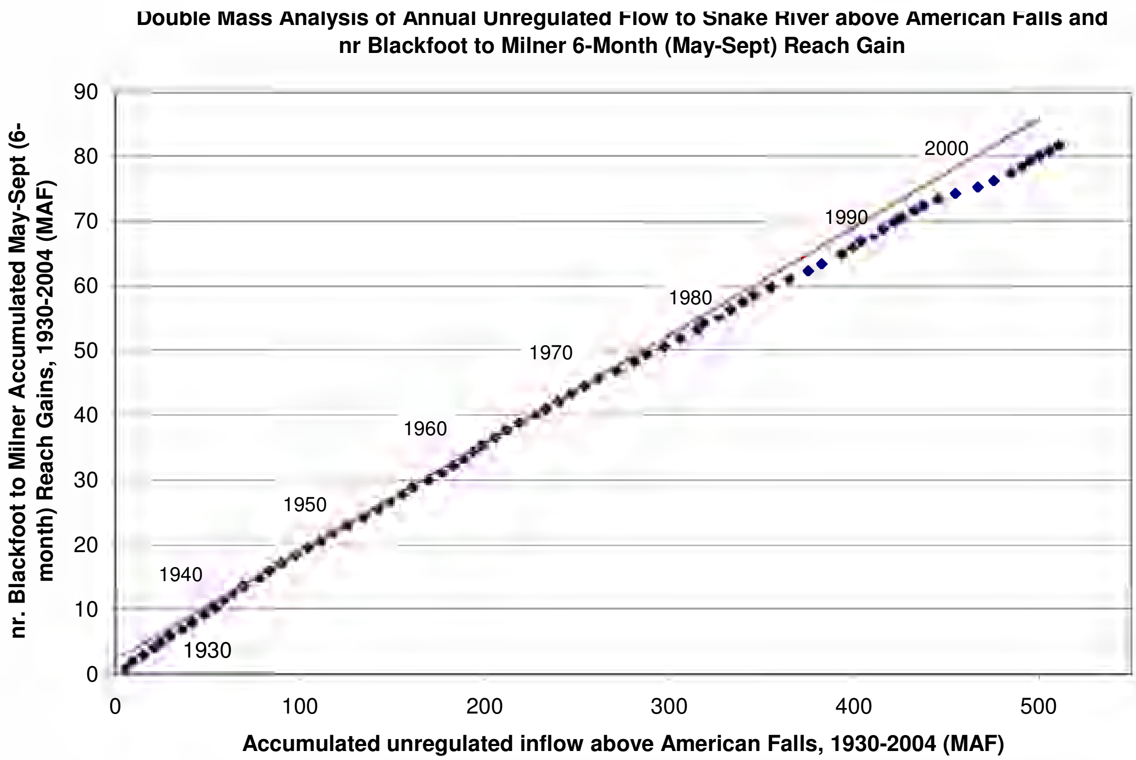


Exhibit 8215 **Correlation of Blackfoot to Milner reach gains and permitted ground water irrigation on the ESPA.**



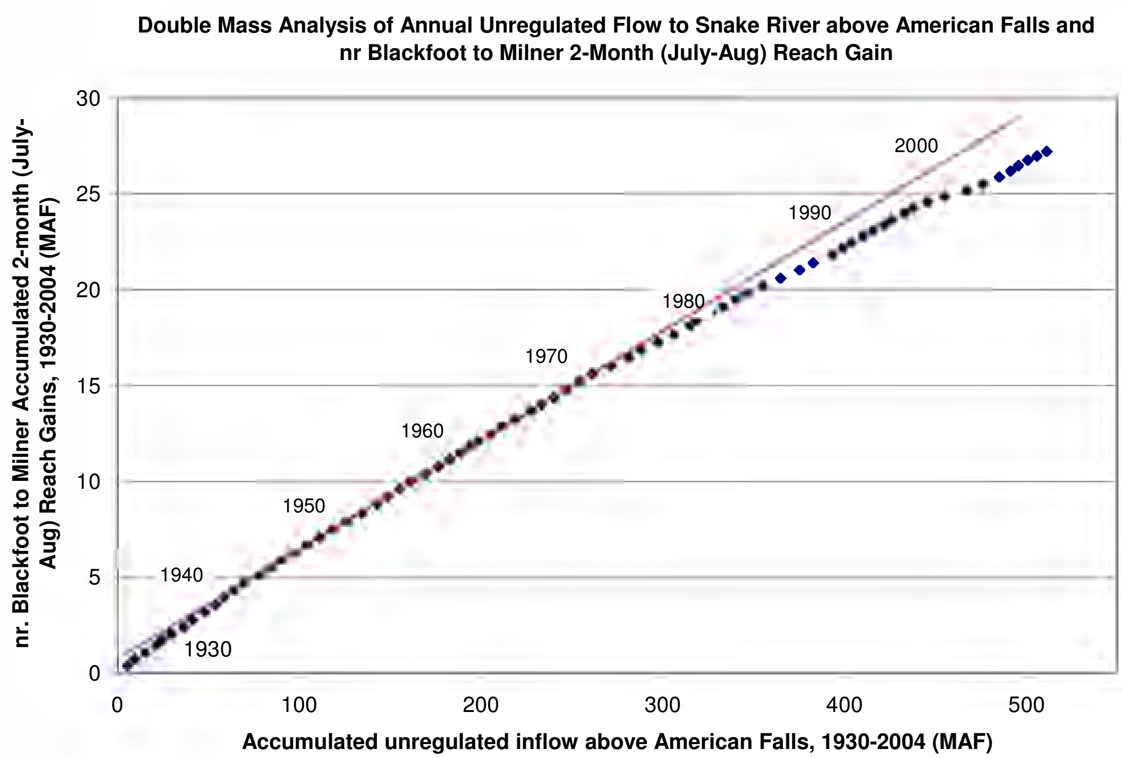


Exhibit 8216 Double-mass curve analysis for Blackfoot to Milner for May to Sept reach gains (upper graph) and July-Aug reach gains (lower graph) compared to unregulated Snake River flow into the America Falls reach.

BRENDECKE OPINION 3

The amount of natural flow available to the SWC during recent dry period in the 2000s is as much or more than was available during other comparable historic drought periods, like the 1930s drought, and more than the natural flow at the time the water rights were established (*Direct Testimony, pgs. 14 to 22; Expert Report, pgs. 7 and 9*).

REBUTTAL

Dr. Brendecke is incorrect in concluding that the amount of natural flow available to the SWC during the 2000s is more than in the 1930s. The following information, along with the information presented in Chapter 8 of the SWC Expert Report, shows that this conclusion is incorrect.

1. Reach Gain Data: **Exhibit 8211** shows the reach gains in the Blackfoot to Milner reach from the 1930s onward to 2006. **Exhibit 8212** is a chart summarizing the Blackfoot to Milner reach gains during drought periods. These Exhibits show that the amount of reach gains during the 1992, 1994 drought and the 2000s drought are much lower than the reach gains during the 1930s drought.

2. Natural Flow Diversions under TFCC and NSCC 1900-Priority Water Right: Since TFCC and NSCC share the 1900 natural flow water right, they have the first priority to natural flow and are the only natural flow water rights that are on during a time of drought in the middle of the irrigation season. The natural flow diversions for TFCC and NSCC under the 1900 water right are compared below.

    a. TFCC Natural Flow Diversion Records: The higher reach gains in the early 1900s (including during the 1930s drought) made it possible for TFCC to usually divert from between about 2,200 cfs to over 2,500 cfs in natural flow even during the worst drought on record during the 1931 to 1935 period. During the 1992 and 2000s drought TFCC diversions were often below 1,500 cfs. This is shown on **Exhibit 8217** for one of the years of drought and on the figures in the SWC Expert Report in Appendix AT on pages AT-30 to AT-35. A comparison of natural flow between specific drought years and other prior-comparable years is shown on **Exhibit 8218** for TFCC. **Exhibit 8218** shows that there are less natural flow diversions now as compared to previous similar years (average difference of about 83,000 AF/yr less natural flow diversions now and a maximum difference of about 170,000 AF/yr less natural flow diversions). This information demonstrates that TFCC natural flow supply during the recent drought is less than other prior comparable drought periods before the onset of ground water pumping.

    b. NSCC Natural Flow Diversion Records: The higher reach gains in the 1930s made it possible for NSCC to usually divert from 300 to 350 cfs during the middle of the irrigation season under their 1900-priority water right shared with TFCC. The reach gains have declined so significantly that NSCC now often only diverts about 160 to 200 cfs in the middle of the irrigation season under their 1900 right. This is shown on **Exhibit 8219** for 2003 and for other years in the figures on Appendix AT on pages AT-23 to AT-29. A comparison was made between the natural flow diverted in the 2000s drought and other prior comparable years (including the 1930s drought) as is shown on **Exhibit 8220**. During the driest years on record (including the 2000s drought period), NSCC diverted an average of about 91,000 AF/yr less (maximum of 212,000 AF/yr less) during the 2000s drought than during other comparable drought years. This information demonstrates that NSCC natural flow supply is less during the 2000s drought than other comparable drought periods before the onset of ground water pumping.

3. Natural Flow Diversion Records for Entire SWC: A comparison of natural flow diversions for the entire SWC during dry years is presented in **Exhibit 8221**. This comparison shows that on average there has been 256,000 AF less natural flow diversions during the recent drought years as compared to the previous drought years prior to the on-set of ground water pumping.

4. Problems with Dr. Brendecke's Analysis: On pages 18-19, Direct Testimony, Dr. Brendecke asserts that the SWC natural flow diversions were greater in the 2000s drought than in the 1930s drought, citing the information on **Exhibits 4154, 4155** and **4156** which are a comparison of the monthly natural flow diversions. There are problems with Dr. Brendecke's exhibits that invalidate his conclusions, as explained below.

    a. The natural flow diversion data on **Exhibits 4154, 4155, 4156** for the 2000s periods do not match the diversion records from WD 01. Most of the diversion data that is in these Exhibits for the 2000s are higher than the WD 01 diversion records. Dr. Brendecke does not explain the discrepancy in the records that he used compared to the records kept by WD 01

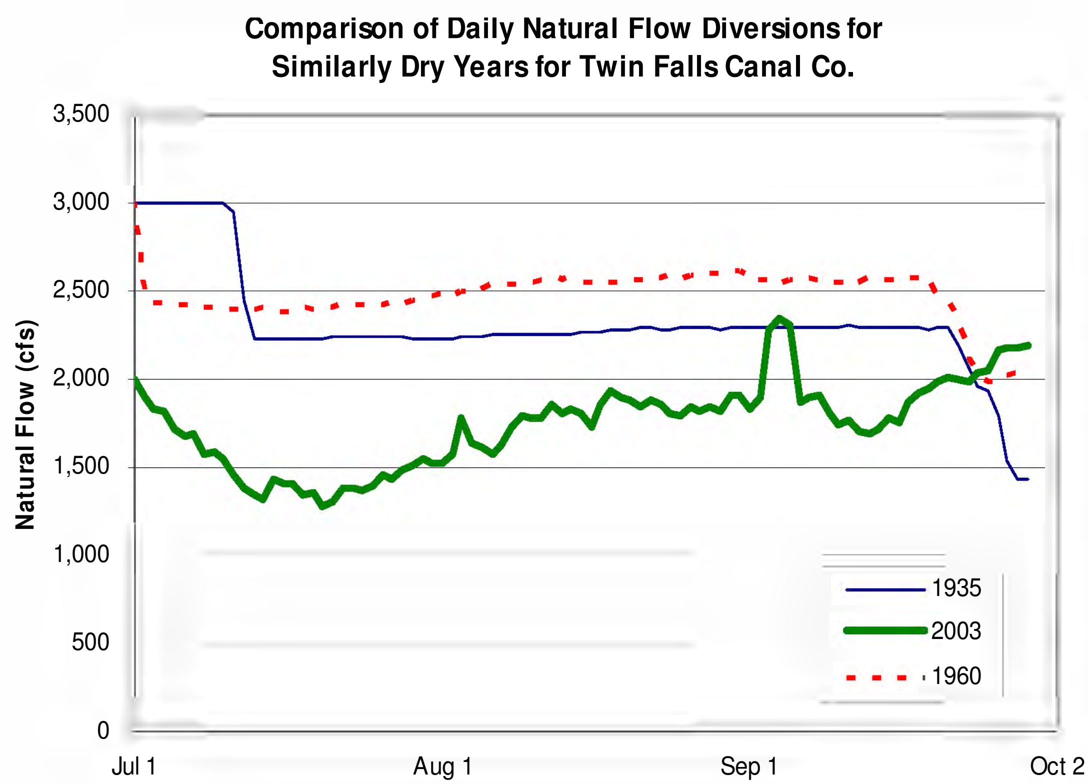
    b. Dr. Brendecke's conclusions that SWC natural flow diversions were greater in the 2000s drought than in the 1930s drought is not correct. Using the correct data from WD 01 records, shown on **Exhibits 8222 to 8224**, in almost all cases for TFCC, NSCC and the entire SWC there is less natural flow diversions during the 2000s drought as compared to the 1930s drought. This is not the case for the month of September when the natural flow diversions are at times more or less, depending on the years used for comparison. **Exhibits 8222 to 8224** presents a summary of the annual and monthly natural flow for the same periods described on Dr. Brendecke's exhibits, as well as other 4-year and 5-year combinations from the 1930s and 2000s droughts. The source of our data is from the WD 01 official record in the Watermasters Report for each year and from the Accounting Model output for the years after 2001 when Watermasters Reports are not available.

5. Comparison of Current Reach Gains to Early 1900s: Dr. Brendecke makes the conclusion that the Blackfoot to Neely reach gains in the early 1900s at the time the SWC natural flow rights were established were less than the natural flow supply available today. This is an incorrect conclusion. In the USGS Professional Paper 1408-C, Kjelstrom (1995), states on page C-18 that, "*The volume of discharge from the springs (springs in the American Falls reach) was first estimated in 1902 and 1905 by measuring streamflow in the Snake River upstream and downstream of the springs. The differences between upstream and downstream measurements were 2,000 and 1,960 cfs.*

A more reliable estimation of discharge from the springs was made in August 1908 when for 11 consecutive days stream flow in the Snake River near Neeley and Blackfoot was measured. The average difference in streamflow was adjusted for estimated surface water inflow and evapotranspiration losses in wetlands near the mouth of the Portneuf River. Ground water discharge to the reach in August 1908 was estimated to be about 2,000 cfs." On page 197 of USGS Water Supply Paper 774 by Stearns (1938) a table is presented showing the monthly near Blackfoot (Clough) to Neeley reach gains from 1912 to 1927. This table is reproduced as **Exhibit 8225** and it shows that the monthly reach gains vary from about 2,000 to 2,700 cfs with only one month when the reach gains are below 2,000 cfs.

The reach gains in the Blackfoot to Neeley reach are now much lower. The information presented on Figure 7-30 of the SWC Expert Report shows that the near Blackfoot to Neeley reach gains have dropped to about 1,600 cfs on a monthly average for July. The daily individual flow measurements for the Blackfoot to Neeley reach have been measured as low as about 1,100 to 1,200 cfs during July of 2002 using a very precise gaging procedure (Hortness and Vidmar, 2003)[2]. The reach gains for the near Blackfoot to Milner reach now falls below 1,500 cfs. This information shows that the reach gains now are less than in the early 1900s when the SWC natural flow rights were established.

[2] Hortness, J and P. Vidmar, 2003. Seepage Study on the Henry's Fork and Snake River, Idaho. USGS and Idaho Power Co., August 2003.



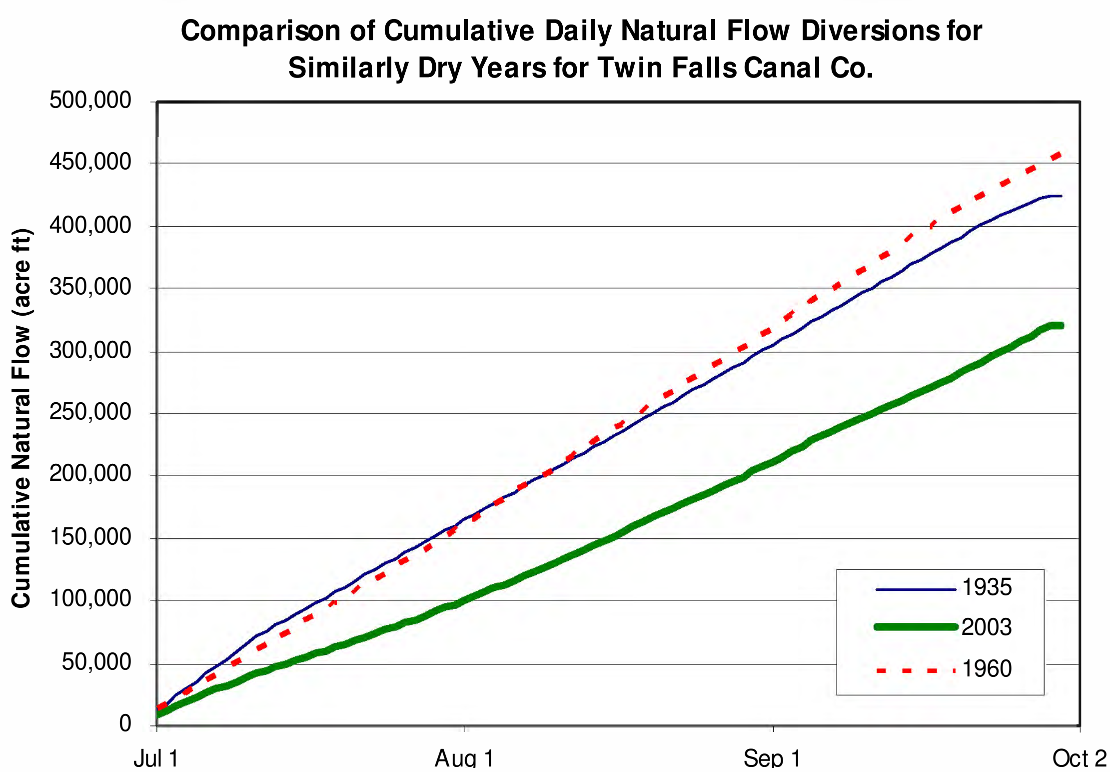


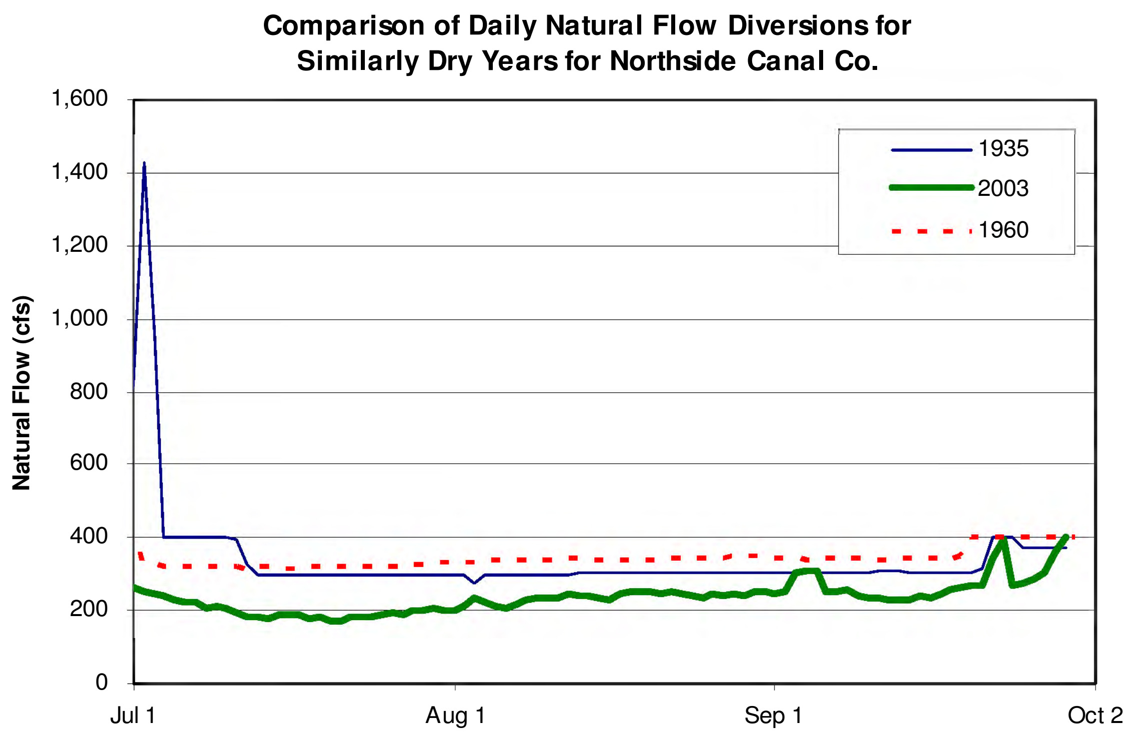
Exhibit 8217 (Figure 8 - 1) Comparison of TFCC Daily and Cumulative Daily Natural Flow Diversions – 2003

Exhibit 8218 (Table 8 - 1) Comparison of TFCC Natural Flow Diversions - Dry Years

Table of Twin Falls Canal Co. Natural Flow Diversions for Similarly Dry Years
Comparing post-1990 years with pre-1960 years

Rank*	Water Year	Natural Flow Diversions (April-Sep) (acre-ft)	Post-1990 Natural Flow Diversions Compared with pre-1960 Natural Flow: Compared with next Driest pre-1960 Year (acre-ft)	Compared with next Wettest pre-1960 Year (acre-ft)	Average of next Wettest and Driest Comparisons (acre-ft)
1	1934	785,000			
3	1931	827,000			
4	1992	712,000	-115,000	-117,000	-116,000
5	2001	752,000	-75,000	-77,000	-76,000
7	1940	829,000			
8	1994	774,000	-55,000	-81,000	-68,000
10	1941	855,000			
11	1937	854,000			
12	2002	791,000	-63,000	-14,000	-38,500
13	1935	805,000			
14	2003	712,000	-93,000	-172,000	-132,500
15	1960	884,000			
16	2004	802,000	-82,000	-56,000	-69,000
18	1955	858,000			
19	1930	925,000			
Averages		**811,000**	**-80,500**	**-86,167**	**-83,333**

* Ranking is based on estimated annual unregulated surface inflow to the Snake River above American Falls. Only 1960 and earlier and post-1990 dry years are shown and compared.



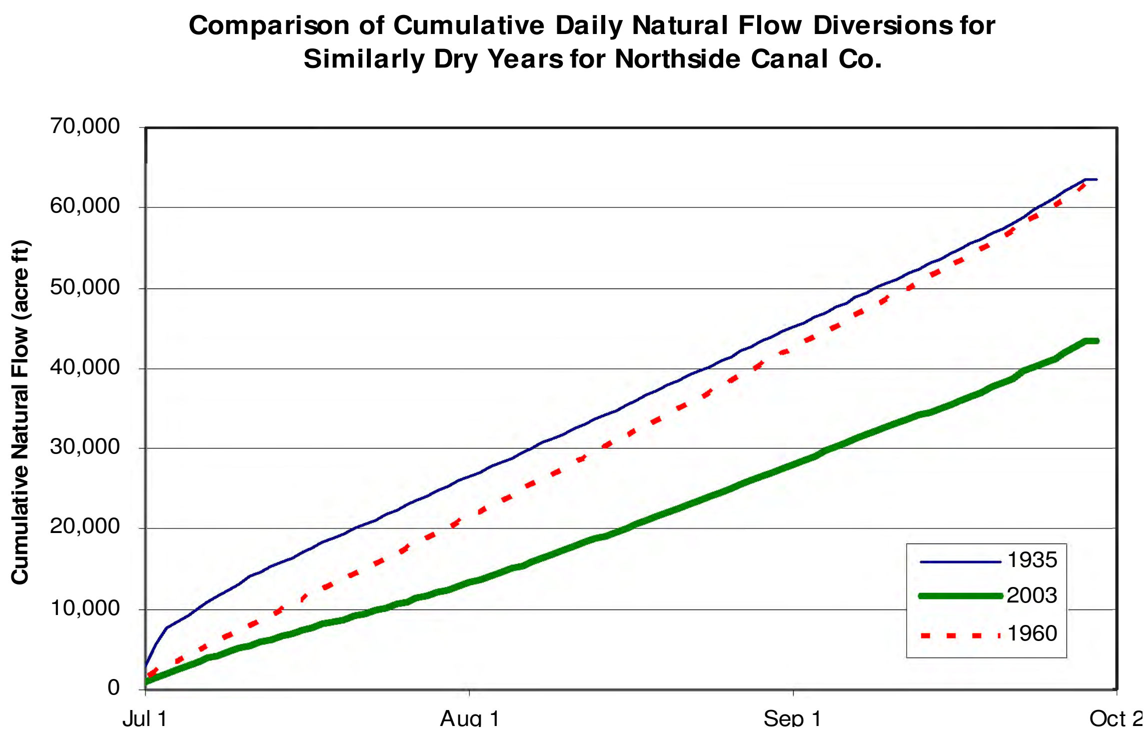


Exhibit 8219 (Figure 8 - 2) Comparison of NSCC Daily and Cumulative Daily Natural Flow Diversions - 2003

Exhibit 8220 (Table 8 - 2) Comparison of NSCC Natural Flow Diversions – Dry Years

Table of North Side Canal Co. Natural Flow Diversions for Similar Dry Years Comparing post-1990 years with pre-1960 years					
			Post-1990 Natural Flow Diversions Compared with pre-1960 Natural Flow		
Rank*	Water Year	Natural Flow Diversions (April-Sep) (acre-ft)	Compared with next Driest pre-1960 Year (acre-ft)	Compared with next Wettest pre-1960 Year (acre-ft)	Average of next Wettest and Driest Comparisons (acre-ft)
1	1934	121,000			
3	1931	182,000			
4	1992	185,000	3,000	-216,000	-106,500
5	2001	220,000	38,000	-181,000	-71,500
7	1940	401,000			
8	1994	341,000	-60,000	-84,000	-72,000
10	1941	425,000			
11	1937	442,000			
12	2002	332,000	-110,000	-78,000	-94,000
13	1935	410,000			
14	2003	334,000	-76,000	-34,000	-55,000
15	1960	368,000			
16	2004	290,000	-78,000	-212,000	-145,000
18	1955	502,000			
19	1930	446,000			
Averages		**333,267**	**-47,167**	**-134,167**	**-90,667**

* Ranking is based on estimated annual unregulated surface inflow to the Snake River above American Falls. Only 1960 and earlier and post-1990 dry years are shown and compared.

Exhibit 8221 (Table 8 - 3) Comparison of total SWC natural flow diversions – dry years

Table of Total SWC Natural Flow Diversions for Similarly Dry Years Comparing post-1990 years with pre-1960 years					
			Post-1990 Natural Flow Diversions Compared with pre-1960 Natural Flow		
Rank*	Water Year	Total SWC Natural Flow Diversions (April-Sep) (acre-ft)	Compared with next Driest pre-1960 Year (acre-ft)	Compared with next Wettest pre-1960 Year (acre-ft)	Average of next Wettest and Driest Comparisons (acre-ft)
1	1934	922,000			
3	1931	1,136,000			
4	1992	1,060,000	-76,000	-495,000	-285,500
5	2001	1,121,000	-15,000	-434,000	-224,500
7	1940	1,555,000			
8	1994	1,381,000	-174,000	-224,000	-199,000
10	1941	1,605,000			
11	1937	1,655,000			
12	2002	1,368,000	-287,000	-161,000	-224,000
13	1935	1,529,000			
14	2003	1,287,000	-242,000	-264,000	-253,000
15	1960	1,551,000			
16	2004	1,319,000	-232,000	-466,000	-349,000
18	1955	1,785,000			
19	1930	1,721,000			
Averages		**1,399,667**	**-171,000**	**-340,667**	**-255,833**

* Ranking is based on estimated annual unregulated surface inflow to the Snake River above American Falls. Only 1960 and earlier and post-1990 dry years are shown and compared.

Exhibit 8222 Comparison of TFCC natural flow diversions in the 1930s and 2000s drought.

	Annual Natural (AF/yr)	July Natural (AF/month)	Aug. Natural (AF/month)	Sept. Natural (AF/month)
1930	1,083,237	166,177	166,744	124,996
1931	1,093,440	156,240	153,241	109,448
1932	1,114,500	179,046	151,277	145,204
1933	1,204,600	160,574	151,557	135,618
1934	1,049,246	133,071	132,770	123,697
1935	1,040,352	155,944	139,414	128,676
total 1930-1935	6,585,375	951,053	895,004	767,639
total 1931-1935	5,502,138	784,875	728,259	642,643
total 1931-1934	4,461,786	628,931	588,845	513,967
total 1930-1934	5,545,023	795,108	755,589	638,963
2000	982,549	119,433	154,199	149,222
2001	811,004	126,355	141,025	136,683
2002	855,211	133,458	136,383	137,740
2003	791,375	94,038	109,079	116,650
2004	883,353	131,534	120,875	131,786
2005	740,451	122,668	121,069	111,749
total 2000-2005	5,063,943	727,486	782,630	783,830
total 2001-2005	4,081,394	608,053	628,431	634,608
total 2001-2004	3,340,943	485,385	507,362	522,859
total 2000-2004	4,323,492	604,818	661,561	672,081

Exhibit 8223 Comparison of NSCC natural flow diversions in the 1930s and 2000s drought.

	Annual Natural (AF/yr)	July Natural (AF/month)	Aug. Natural (AF/month)	Sept. Natural (AF/month)
1930	653,093	28,173	51,568	22,844
1931	418,502	20,880	20,487	27,392
1932	793,032	95,597	20,180	21,537
1933	748,774	38,553	20,214	21,308
1934	298,212	17,730	17,706	19,700
1935	571,190	25,319	18,549	19,444
total 1930-1935	3,482,803	226,253	148,705	132,224
total 1931-1935	2,829,710	198,079	97,137	109,380
total 1931-1934	2,258,520	172,760	78,587	89,937
total 1930-1934	2,911,613	200,934	130,155	112,780
2000	504,579	15,919	20,565	24,075
2001	233,916	16,860	18,811	22,459
2002	356,937	18,210	18,202	25,460
2003	343,551	12,536	14,555	16,350
2004	309,698	25,505	16,120	15,814
2005	383,331	28,715	16,171	17,435
total 2000-2005	2,132,012	117,745	104,424	121,593
total 2001-2005	1,627,433	101,825	83,859	97,517
total 2001-2004	1,244,102	73,111	67,688	80,083
total 2000-2004	1,748,681	89,030	88,253	104,158

Exhibit 8224 Comparison of SWC natural flow diversions in the 1930s and 2000s drought.

	Annual Natural (AF)	July Natural (AF)	Aug. Natural (AF)	Sept. Natural (AF)
1930	2,086,881	207,281	253,660	178,344
1931	1,667,745	177,120	173,728	159,332
1932	2,407,812	352,191	171,457	175,079
1933	2,370,149	227,248	171,771	167,953
1934	1,370,649	150,801	150,476	147,455
1935	1,929,389	208,092	157,964	156,867
total 1930-1935	11,832,625	1,322,733	1,079,056	985,030
total 1931-1935	9,745,744	1,115,453	825,396	806,686
total 1931-1934	7,816,355	907,361	667,432	649,819
total 1930-1934	9,903,236	1,114,641	921,092	828,163
2000	2,053,333	153,360	186,286	200,795
2001	1,209,256	143,215	159,836	169,131
2002	1,472,475	161,187	154,586	174,282
2003	1,376,375	106,574	123,634	133,083
2004	1,440,351	181,212	136,994	150,506
2005	1,448,397	171,489	137,240	138,585
total 2000-2005	9,000,187	917,036	898,576	966,381
total 2001-2005	6,946,854	763,676	712,290	765,586
total 2001-2004	5,498,457	592,187	575,050	627,001
total 2000-2004	7,551,790	745,547	761,336	827,796

Exhibit 8225 Table reproduced from USGS Water Supply Paper 774 (pg. 197) showing reach gains in the near Blackfoot (Clough) and Neeley reach.

Average daily gain, in second-feet, in Snake River between Clough ranch and Neeley gaging stations

Year ending Sept. 30—	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Yearly average
1912	2,440	2,670	2,740	2,740	2,930	2,730	2,630	2,170	2,770	2,770	2,570	2,930	2,670
1913	3,230	2,980	2,240	2,600	2,810	2,510	2,250	2,460	3,050	2,400	2,550	2,540	2,640
1914	2,750	2,640	2,500	2,750	3,050	2,920	2,520	2,570	2,150	2,080	2,050	2,050	2,500
1915	2,240	2,230	2,270	2,190	2,240	2,180	2,100	2,150	1,980	2,170	2,080	2,100	2,170
1916	[1] 2,080	[1] 2,190	2,300	2,080	2,410	2,560	2,200	2,450	2,140	2,330	2,280	2,350	2,290
1917	2,480	2,430	2,200	2,140	2,310	2,480	2,680	2,740	[1] 2,400	[1] 2,440	2,550	2,720	2,460
1918	2,540	2,520	2,550	2,410	2,110	2,540	2,490	2,470	2,150	2,680	2,570	2,380	2,470
1919	2,550	2,530	2,350	2,330	2,600	2,850	2,500	2,370	2,380	2,300	2,390	2,310	2,460
1920	2,330	2,460	2,340	2,390	2,500	2,600	2,640	2,490	2,690	2,340	2,370	2,450	2,470
1921	2,410	2,630	2,670	2,700	2,660	2,700	2,390	2,210	2,730	2,400	2,480	2,500	2,540
1922	2,440	2,450	2,420	2,540	2,530	2,870	2,760	2,510	2,640	2,460	2,650	2,500	2,570
1923	2,470	2,440	2,350	2,600	2,420	2,710	2,660	2,640	2,750	2,730	2,700	2,600	2,590
1924	2,720	2,790	2,590	2,460	2,610	2,730	2,580	2,360	2,210	2,220	2,360	2,380	2,500
1925	2,260	2,430	2,370	2,560	2,750	2,480	2,800	2,180	2,290	2,400	2,600	2,680	2,480
1926	2,510	2,640	2,590	2,540	2,690	2,670	2,580	2,370	2,460	2,400	2,450	2,510	2,540
1927	2,030	2,570	2,330	2,480	2,880	2,380	2,490	2,320	2,100	1,750	2,340	2,510	2,400
Average 1912-25[2]	2,500	2,540	2,420	2,470	2,570	2,620	2,520	2,400	2,430	2,380	2,440	2,470	2,480

[1] Based on partly estimated records.
[2] For years prior to American Falls Reservoir construction.

BRENDECKE OPINION 4

The planning reports for the SWC projects (such as the Palisades Reservoir Project Planning Report, the American Falls Reservoir Rehabilitation Planning Report and the Gooding Project Planning Report) show that the shortages that occurred during the 2000s were expected by the SWC entities. (*Expert Report, pgs. 12 to 13; Direct Testimony, pgs. 24 to 26*).

REBUTTAL

Dr. Brendecke asserts that Reclamation planning reports for the Upper Snake River Project include supply shortages, and that therefore, SWC should expect shortages. Dr. Brendecke states that "*The entities… would have suffered shortages of 803,000 af in 1934 and 157,000 af in 1935.*" "*These historical studies* (the Palisades Project Planning report and other early planning reports) *make it clear that the present system of reservoirs relied upon by the SWC entities was never designed nor expected to fill or prevent water shortages in very dry years. It is … reasonable to conclude that shortages in an extremely dry period, such as occurred in 2000-2004, were expected by the SWC entities regardless of the potential impact of future ground water development.*" (Expert Report of Charles M. Brendecke, Ph.D., P.E., pp. 12-13).

Dr. Brendecke is incorrect in his conclusion that the shortages during the 2000s are similar to the shortages that were planned for the SWC projects. He is correct in asserting that there were several years of shortages in the reservoir operations study presented in the Palisades Reservoir Project Planning report. However, the current shortages are far worse (both in terms of severity and frequency) than estimated in the Reclamation Planning Reports, even though the SWC has significantly reduced their irrigation demand by installing on-farm efficiency improvements. Pumping on ground water irrigated acreage has increased the consumptive use demands on the river and reservoir supply far beyond what was originally planned for the project.

Shortage Analysis from Previous Reclamation Planning Reports

Our review of the project planning reports and our analysis of the recent shortages experienced by the SWC (documented in the SWC Expert Report, Chapter 10) show that the SWC has experienced a greater volume of water supply shortage and more frequent shortages than were included in Reclamation planning for this water supply. Reclamation estimated two years of shortage during 1934 and 1935 in their 24-year study period for the Palisades Reservoir Project Planning Report and their 33-year study period for the American Falls Project (Reclamation, 1946, pg. 13-14; Reclamation, 1969, pg. 27). For both the American Falls and the Palisades Reservoir planning reports they extrapolate back to 1896 (a total of 47 and 59 years) without predicting any additional shortage. This study period contains many droughts, and a severe multi-year drought during the early 1930s that was comparable or worse than the drought during the 2000s. The study area was for 571,000 acres with 67,000 acres of new land so the irrigated project areas is roughly comparable to today's acreage within the SWC projects (about 581,000 acres).

The 1946 Palisades Project Planning Report predicts a 1934 shortage of 837,000 acre-feet on a diversion requirement of 3.92 million acre-feet (20 percent) and a 1935 shortage of 221,000 acre-feet on a diversion requirement of 3.64 million acre-feet (4 percent). These demands and shortages are for the area between Clough and Milner, including the development of 67,000 acres of new land. The 1969 Operations Study for the American Falls Project predicts an 11 percent shortage to the SWC members in 1934 and an 8 percent shortage in 1935. This corresponds to approximately 96 percent supply reliability for all shortages and 98 percent reliability for shortages greater than 10 percent. Reliability in water supply planning is the percentage of time that the supply is able to meet the water demand.

The shortage results presented in the Reclamation Planning Reports are typical of Reclamation project irrigation water supply planning criteria, which often allows partial supply shortages during the very driest years of the study period. Shortages that occur too frequently, or at too great a magnitude are not considered acceptable, and Reclamation would be unlikely to plan and construct a project with such an insecure supply.

Comparison of Recent Shortages to Planned Shortages

During the 47-year study period in the Palisade Planning Report, the total cumulative shortage was 1.58 MAF. An analysis was completed to evaluate the ability of the current natural flow and reservoir storage supply to meet the demands of the SWC projects using current irrigation diversion requirements since 1990. To determine how frequently the total SWC members' supplies have experienced shortage in recent years, we calculated the current SWC water demands and to compared these demands with the observed supply (i.e., the amount of water historically diverted or stored). Irrigation diversion requirements were developed for each SWC member using recent information on crop type, irrigated acreage, irrigation efficiency, conveyance losses, and consumptive use data.

The analysis shows that the SWC has experienced much more frequent shortage in recent years, including seven years of shortage greater than 10 percent in the last 17 years. The study results showing years of shortage match up with years when the SWC have experienced shortages and curtailed their deliveries to individual farms during the same seven of the past 17 years. The results of this analysis indicates that current supplies have dropped from a <u>96 percent reliability</u> as shown in the Palisades Reservoir Project Planning Report in 1946 to less than a <u>60 percent reliability</u> today. The amount of shortage is also greater. The total cumulative SWC shortages during the much shorter 1990-2006 period are 2.3 MAF, or more than two times the Reclamation-estimated shortages of about 1.1 MAF during a period that is only one-third as long. The decline in reliability and the increased shortages have happened despite the fact that the SWC has decreased their irrigation diversion requirements from the 1950s to present day considerably by installing efficiency improvements such as on-farm sprinkler technologies and management efficiencies. The average total irrigation diversion requirement demand in the Palisades Reservoir Project Planning Report is 3.705 MAF, whereas the average SWC estimated demand is 3.275 MAF. Assuming that conveyance losses have remained constant, this computes to an improvement in on-farm efficiency by over 400,000 AF or almost 20 percent. Despite the improved efficiency, which should have resulted in an increase in reliability (and in-fact would have reduced the historic shortages anticipated by Reclamation to zero and increased the Project reliability to 100%), the water supply reliability for the SWC has dropped by almost 40 percent to a 60 percent reliability. If our analysis was adjusted upward to account for equivalent acres used in the Palisades report, the shortages observed today as compared to the shortages in the Palisades report would have been even greater.

Summary

These frequent and unplanned for shortages are excessive, and much greater than planned by Reclamation for the following reasons:

1. In the Palisades Reservoir Project Planning Report, Reclamation planned for two year of shortage in 47 years. Seven of the past 17 years have had shortages of greater than 10 percent. SWC water conservation efforts have reduced demand by over 400,000 AF. In spite of these reduced demands, shortages have occurred more frequently and at a greater severity than the planned shortages.

2. The growth of ground water pumping and ground water irrigated acreage has greatly increased the consumptive use of water in the basin. In 1945 there was about 1.6 million irrigated acres and in 1992 there was about 2.5 million irrigated acres with about 1.6 million of those acres being either entirely served by ground water pumping or a mixture of surface and ground water pumping. The water that is consumptively used for ground water irrigation eventually is captured out of the natural flow of the river and reduces the ability of the river flow and reservoir storage system to meet that all of the consumptive use irrigation demands. This is a significant cause of the increased frequency and magnitude of the SWC shortages.

3. Dr. Brendecke's assertion that the SWC should have expected the shortages occurring over recent years is incorrect. The recent shortages are more frequent and at a greater severity than the shortages in the planning reports. Dr. Brendecke misses the point that ground water pumping is depleting the natural flow and causing more frequent and larger shortages. Some minor shortages were expected and planned for on rare occasions. However, the extent and frequency of observed shortages have far exceeded reasonable planning levels. The Reclamation planners never anticipated a doubling of the irrigated acres and the large increase in consumptive use cause by increasing the irrigated acreage on the Eastern Snake Plain by 1.6 million acres using ground water as a source of supply. The Reclamation planners did not anticipate the resultant effects of ground water pumping in depleting the Snake River natural flow. Dr. Brendecke's conclusion is that that because the planning documents for the SWC irrigation projects predicted some supply shortages in 2 extremely dry years over a 47 year period, an increase in shortages during recent years caused by ground water pumping is acceptable and does not cause impacts to the SWC. Dr. Brendecke's opinion is not supported by the facts, and it is clear that the recent shortages on the SWC projects are much greater in magnitude and severity than the shortages estimated in the planning documents. Even though a planning study may contemplate "shortages" due to natural conditions, this does not justify "shortages" caused by interfering junior priority water rights as Dr. Brendecke's opinion suggests. Dr. Brendecke provides no compelling evidence to show that recent shortages were not made worse by ground water pumping. It is our opinion

that the information presented above shows that ground water pumping has caused the SWC supply to be much less secure than planned.

BRENDECKE OPINION 5

If curtailment did increase natural flow this would be an "enhancement" of the SWC supply compared to the supply available at the time the rights were established. (*Direct Testimony, pg. 14, lines 12 to 15*). The SWC is not entitled to be provided "reasonable carryover" because the SWC had zero carryover in the planned operations of the projects as identified in the Palisades Reservoir Project Planning Report and other reports. (*Expert Report, pgs. 12 to 13; Direct Testimony, pgs. 30 and 31*).

REBUTTAL

Dr. Brendecke states on page 14 of his Direct Testimony that the "*natural flow supply is still*
greater than it was at the time of the appropriation. With this in mind, the present delivery call could be viewed as a demand for enhancement of the originally available supply, or at least for protection of an enhancement that arose after the original appropriation." In our rebuttal to Brendecke Opinion 3, we demonstrated that the natural flow of the SWC today is much less than other comparable drought periods and much less than the natural flow at the time the natural flow water rights were established from the 1900s through the 1930s. At the time the SWC natural flow rights were established the reach gains in the American Falls were about 2,000 cfs during the early 1900s and rose to about 2,200 to 2,700 cfs from the early 1900s to the 1930s (as shown on **Exhibit 8222**). In comparison, the reach gains in the Blackfoot to Milner reach are now regularly are below 1,500 cfs and at times have been measured as low as 1,100 to 1,200 cfs. Ground water pumping is a significant cause of that decline. The curtailment of ground water pumping would not be an "enhancement". Instead, it would remove the impact by a junior-priority ground water user on a senior-priority water right that results in shortages to the senior's water supply.

Dr. Brendecke states on page 25, line 6 to 12 of his Direct Testimony that, "This (the Palisades Reservoir Project Planning Report) operations study shows that the Bureau anticipated that all three reservoirs in the system (Jackson Lake, Palisades and American Falls) would be emptied and would fail to refill during a repeat of the 1930s drought conditions. So from this and other information in the 1946 planning report, I conclude that the Bureau and its clients, the SWC entities, could never have anticipated that the present reservoir system would eliminate water shortages in severe drought years and could never have expected to have any carryover storage left in such years." As shown in the previous rebuttal (to Opinion 4), Reclamation's Palisades Planning Report actually concluded that there would be carryover storage during the 1930s drought, in every year except 1934 and 1935 (when there were supply shortages), as shown on **Exhibit 8226**. Based on the Reclamation study, if their supply had not been depleted by groundwater pumping, the SWC should expect to have comparable amounts of carryover storage in all except approximately two years out of 50, corresponding to a 96 percent reliability. Factoring in the increased on-farm efficiency of about 400,000 AF from installation of sprinklers and other water saving devices, the SWC would have enjoyed adequate storage and carryover to avoid shortages in all years in the Reclamation Palisades planning study, corresponding to a 100 percent reliability. As described in the reservoir operations analysis in Chapter 10, the SWC now has shortages for 7 of 17 years (even when using all storage to meet irrigation demands), corresponding to a 60 percent reliability.

Based on these facts, Dr. Brendecke is contending that because there were a very few years in the past where the SWC had shortages (shortages that would have been removed by the efficiency improvements constructed by the SWC), this excuses the impacts and resulting many years of shortages caused by ground water pumping. Dr. Brendecke is arguing that because of the planning documents show that there were planned shortages and no carryover in a few years, the SWC should not be provided with carryover storage in any years under a delivery call, despite the fact that ground water pumping is causing the shortages to be worse than originally planned. This logic does not present a compelling argument for excusing the obligations of junior-priority ground water users to make up for their impacts to the SWC supply. The CMRs under Rule 42 clearly state that a senior-priority surface water user with a storage supply that is suffering from impacts caused by a junior-priority ground water user is to be provided "reasonable carryover" under "prior comparable" conditions. The Palisades planning document shows that under "prior comparable" conditions before the effects of ground water pumping, the SWC would have had carryover storage provided during 2 of 47 years. Accounting for increases in on-farm efficiency, there would have been no shortages and carryover storage would have been available every year.

Preservation of the SWC storage supply is very important to the long-term viability of the SWC irrigation projects. The graph presented in **Exhibit 822** from the results described in the Palisades Reservoir Project Planning Report shows that the storage and carryover in 1929 provided storage water to lessen the shortages that did occur during the 1930s drought. The SWC storage supply depends upon carryover storage to provide reliable supplies during multiple year droughts. In any given year there is no accurate way to predict whether the system is entering a dry period, so prudent water resources management principles dictates storing and holding water over for later dry years. For example, the water managers for the Upper Snake River Basin did not know what year a drought would begin, and certainly did not know in 1929 that storage was needed to be held in carryover for the 1930s drought. But the SWC managers do know that having carryover storage kept in reserve reduces the risk of future shortage and provides the option to have that storage available when it is needed for irrigation in a future dry year. The SWC carryover storage reduces the risk, frequency, and severity of water supply shortages, making their supply more reliable.

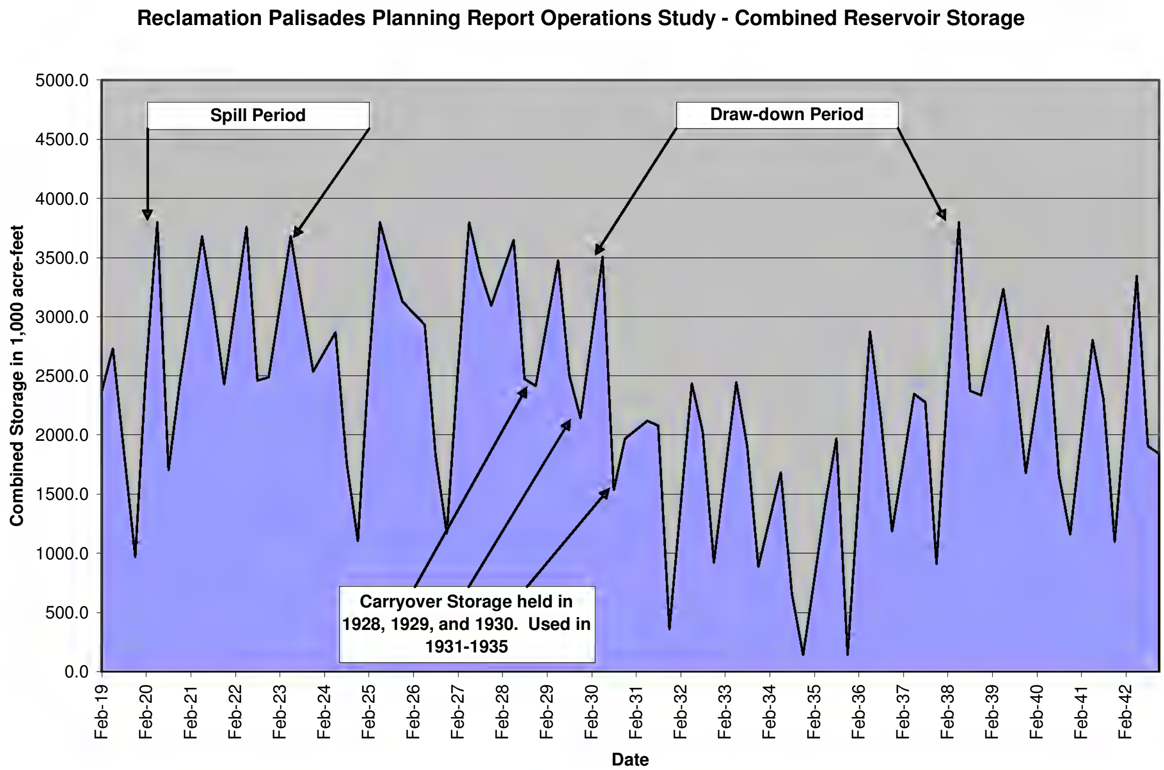


Exhibit 8226 Reclamation Palisades Reservoir Project Planning Report Operation Study Results

BRENDECKE OPINION 6

The Eastern Snake Plain Aquifer Model (the ground water model) may have failed to accurately represent some of the features of the aquifer that influence the simulation of distribution of the pumping impacts on reaches, such as anisotropy in the aquifer (*Direct Testimony, pgs. 28 to 30*).

REBUTTAL

There is no reasonable basis to conclude that the Eastern Snake Plain Aquifer Model (ESPAM) ground water model does not adequately simulate the flow of ground water in the aquifer or the effects of ground water pumping on flow in the river. The model was constructed and calibrated by a qualified team lead by IWRRI. The Eastern Hydrologic Modeling Committee, which includes Dr. Brendecke, provided input on the model development. The model development meets the standards set forth in the ASTM standards, standard texts and USGS guidelines for ground water modeling[3]. The adequacy of the model calibration and the ability of the model to simulate ground water flow in the aquifer and to the river is shown in the good fit of simulated ground water levels and river reach gains on **Exhibits 8227 and 8228**. It is our opinion that, although the model calibration could always be improved, the model adequately simulates the flow of ground water in the aquifer and the effects of ground water pumping on river flow and the model meets the accepted standards for this type of analysis.

Dr. Brendecke incorrectly suggests that the failure to include aquifer anisotropy in the ESPAM ground water model limit's the model's adequacy in his Direct Testimony on pg. 28 to 30. Anisotropy is a term used when an aquifer has directionally-dependent hydraulic properties that would cause ground water to preferentially flow in one direction over another direction. It is generally caused by structural deformation or other geologic changes after the aquifer is formed that causes ground water to flow preferentially in one direction versus another direction. Based on our experience in the basalt aquifers in the Umatilla Basin in Oregon, in the Moscow-Pullman Basin in Idaho and Washington and in the Columbia Basin in Washington and based on our understanding of the way basalt aquifers are formed and the way ground water flows in basalt aquifers, it is our opinion that anisotropy is not a major factor in the simulation of ground water flow in the basalt aquifer of the ESPA. Basalt aquifers are extruded in successive individual events resulting in the formation of flow units that may be from tens to over a hundred feet thick in places. The basalt flows from the point of extrusion to low areas along existing drainage pathways at the time of extrusion. As the basalt travels from the point of extrusion, the leading and side edges of the flow begin to cool and harden. This causes the flow to move in a different direction or into different drainages. A dam may form and the basalt may spill over across a

[3] Reilly, T.E. and A.W. Harbaugh, 2004. Guidelines for Evaluating Ground-Water Flow Models USGS, Scientific Investigations Report 2004-5038.

ASTM Standards describing the standard of practice for the development, calibration and reporting of ground water models are presented in Standards D5718, 5477, 5490, 5690, 5610 and 5611.

Anderson, M. and W. Woosner, 1991. Applied Ground Water Modeling, Simulation of Flow and Advective Transport. Academic Press, New York.

plain or into another drainage. Lava tunnels may form. As the basalt cools it forms vesicular zones and fractures near the top of the basalt flow unit with highly transmissive flow pathways that ground water can easily travel through. The top portion of the flow unit continues to crack and weather, further opening up fractures and flow pathways. Successive basalt flow units form multiple layers each with a high-permeability zone near the top of the unit. The high-permeability zones convey most ground water in a basalt aquifer. On the Eastern Snake Plain, the basalt flow units are fairly thin compared with other basalt aquifers (like the Columbia River Basalt Group in Washington and Oregon), and so there are many high permeability zones stacked on top of one another.

It is our experience that anisotropy is rarely a significant factor in the simulation of ground water flow in basalt aquifers because the deposition of the basalts does not cause a discernible preferentially flow pathway that can be described using anisotropy over a large region. To be sure, there are preferential flow pathways or structural features that may cause flow variations, but it is generally not practical or accepted to account for these features using anisotropy. For example, the U.S. Geological Survey (USGS) did not incorporate anisotropy into the model development process for the previous RASA model created for the Eastern Snake Plain[4]. It is highly unlikely that anisotropy in the ESPA could even be detected or measured during a conventional aquifer pumping test and so including it in a ground water model could only be done by trial and error basis during model calibration without field data.

Ground water flow models in basalt aquifers generally account for spatially varying hydraulic properties by varying the aquifer properties in model cells or groups of model cells. For example, the ground water models developed by the USGS for the basalt aquifers in the Deschuttes Basin and Umatilla Basin in Oregon and the Columbia Basin in Washington use this method[5]. The ESPA model development process included an innovative feature whereby the aquifer properties in individual cells were varied to represent changes in transmissivity and storage to obtain a good match to observed data during model calibration. The variable aquifer properties used in the model are shown on **Exhibit 8229**. If there are spatial differences in aquifer properties across the ESPA that would influence ground water flow pathways, then the process used to develop the ESPAM model by varying aquifer properties on a cell-by-cell basis during calibration has already addressed this issue.

In conclusion, Dr. Brendecke's assertion that the ESPAM ground water model is not well developed and does not include some features needed to adequately simulate flow in the ESPA, such as anisotropy, is not correct and is not justified.

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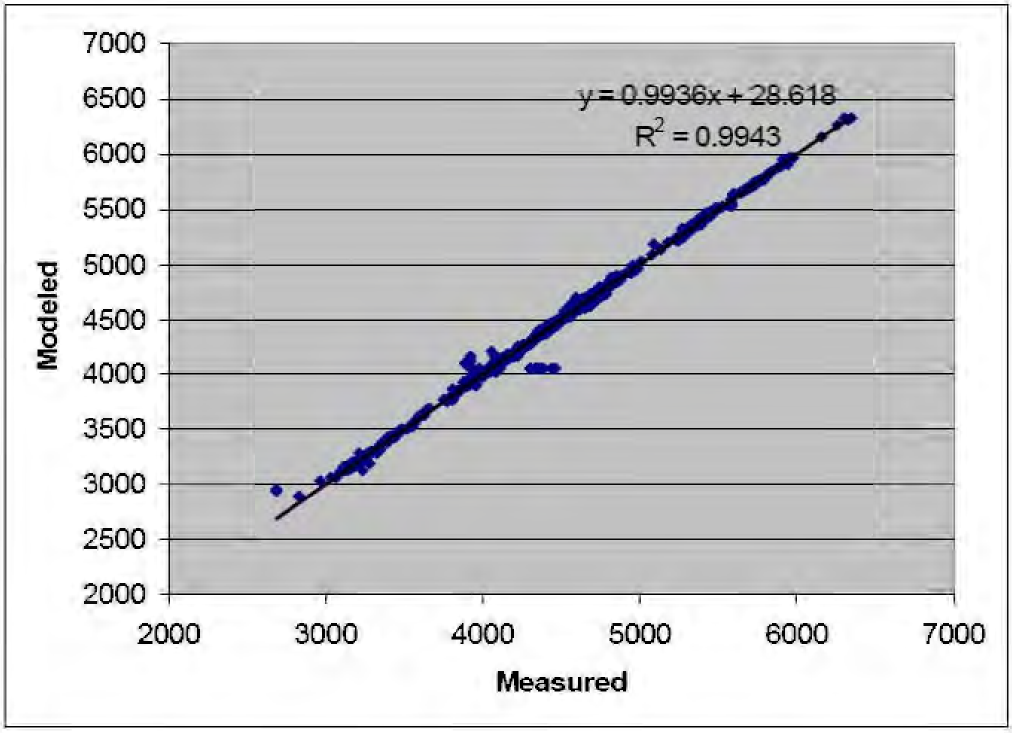
4 Garabedian, S.P., 1992. Hydrology and Digital Simulation of the Regional Aquifer System, Eastern Snake River Plain, Idaho. U.S. Geological Survey Professional Paper 1408-F.

5 Hansen, A. J., Vaccaro, J. J., and H.H. Bauer, H. H., 1994, Ground-water flow simulation of the Columbia Plateau regional aquifer system, Washington, Oregon, and Idaho: USGS Water-Resources Investigations Report 91-4187.

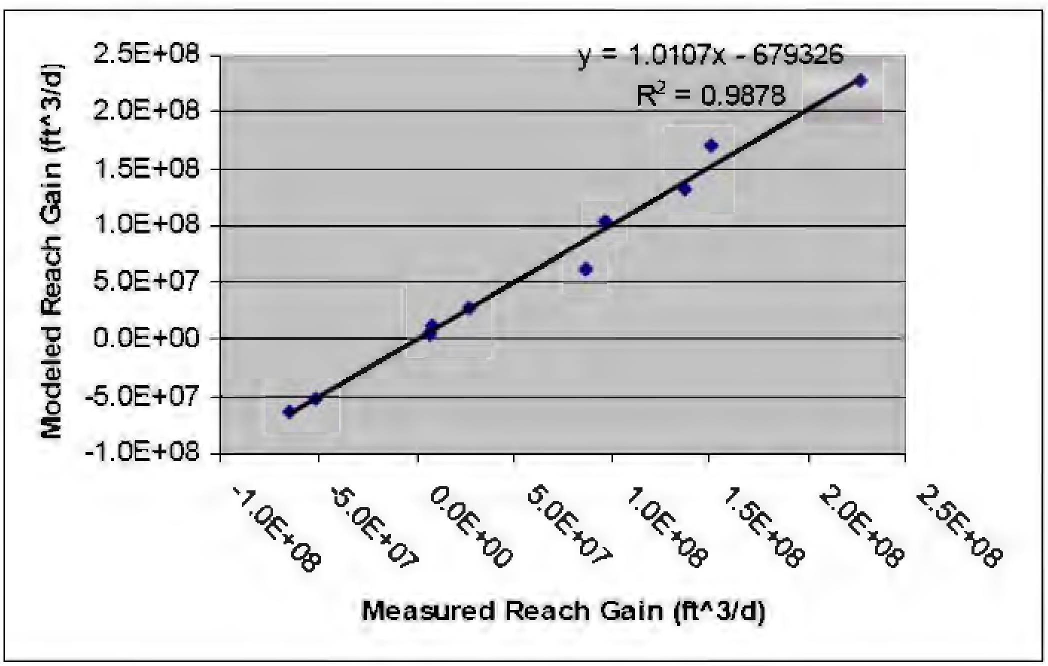
Davies-Smith, A., Bolke, E.L., and C.A. Collins, 1988, Geohydrology and digital simulations of the ground-water flow system in the Umatilla Plateau and Horse Heaven Hills area, Oregon, and Washington: USGS Water-Resources Investigations Report 87-4268.

Gannett, M.W. and K.E. Lite, 2004, Simulation of Regional Ground Water Flow in the Upper Deschutes Basin, Oregon. USGS Water Resouces Investigations Report 03-4195.



Source: ESPAM model report, Cosgrove et al, 2006, Figure 58

Exhibit 8226 Modeled and observed ground water levels from ESPAM model calibration.



Source: ESPAM model report, Cosgrove et al, 2006, Figure 60.

Exhibit 8227 Modeled and observed reach gains from ESPAM model calibration.

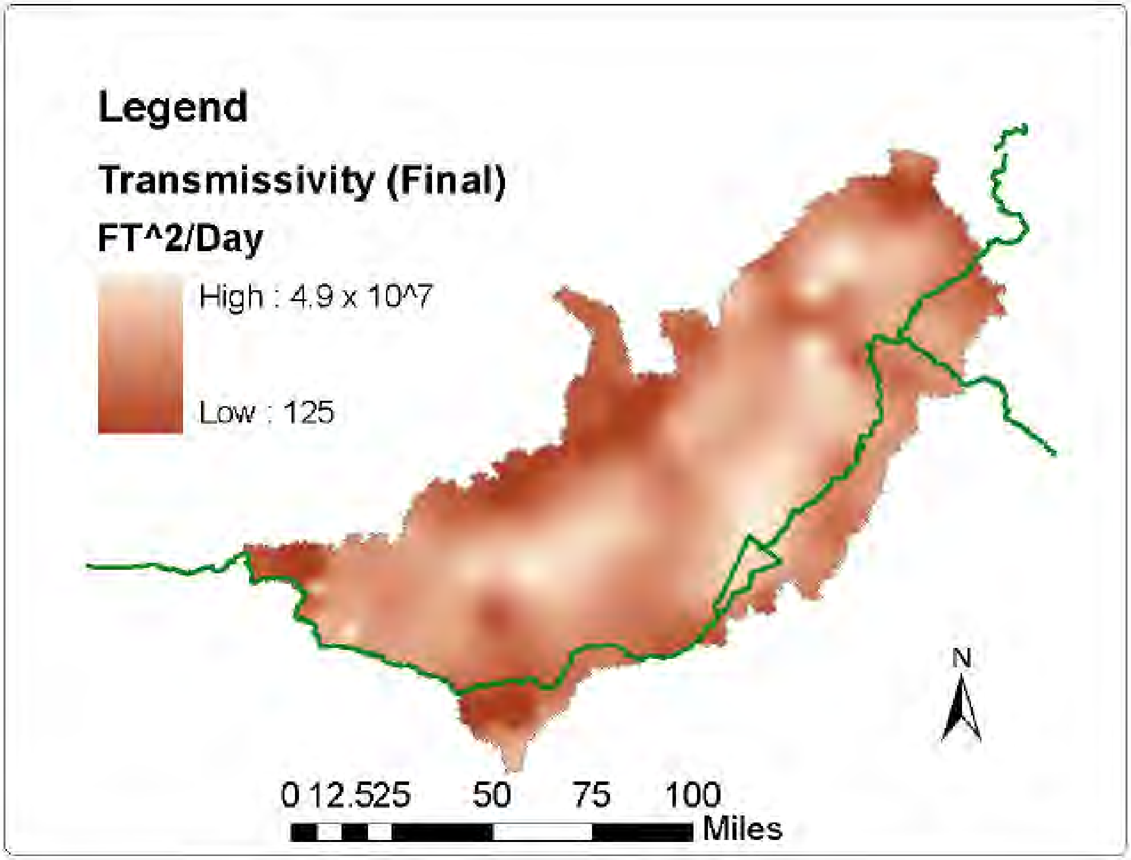


Exhibit 8228 Transmissivity distribution in ESPAM model showing cell-by-cell variations in transmissivity to account for varying hydraulic properties in the aquifer.

BRENDECKE OPINION 7

The "Curtailment Scenario" run using the ESPAM model over-predicts the amount of the increase in reach gains that would occur in the Blackfoot to Milner reach if ground water was curtailed because the historical records of reach gains don't show a decline similar to the decline predicted by the "Curtailment Scenario" (*Direct Testimony, pgs. 27 to 28*).

REBUTTAL

Dr. Brendecke presents an opinion in his Direct Testimony, pgs. 27 to 28, that the "Curtailment Scenario" results that simulate that ground water pumping will cause about 1,200 cfs of reach gain declines in the Blackfoot to Minidoka reach. Dr. Brendecke states, "*This scenario calculated that reach gains in the Blackfoot to Neeley reach would increased by 1,034 cfs at steady state and that the reach gains between Neeley and Minidoka, the next reach below Neeley, would be increased by 158 cfs. In other words, the ultimate impact of ground water pumping on the Blackfoot to Minidoka reach was calculated to be 1,192 cfs. Because the historical record of reach gains don't appear to show a decline of this magnitude, I did an analysis of what the reach gains would have looked like if the model calculations were correct. Essentially I added the model-simulated impacts of pumping back into the historical record of reach gains to see what those reach gains would have been in the early part of the 20th century.* ***Exhibit 4165*** *shows the results of this analysis.*"

Dr. Brendecke's conclusions about the Curtailment Scenario results are incorrect for the following reasons.

1. Dr. Brendecke's analysis of reach gains as presented in **Exhibit 4112** and **Exhibits 4145 to 4147** is only for the Blackfoot to Neeley reach and not for the same Blackfoot to Minidoka reach evaluated by the model. So the reach gain data and analysis used to support the conclusion that reach gains "*don't appear to show a decline of this magnitude*" is not comparable and does not support his opinion. Dr. Brendecke acknowledges that the monthly reach gain data shown on **Exhibit 4146** shows July reach gains have declined significantly in the Blackfoot to Neeley reach. This finding also contradicts his conclusion that there is no reach gain decline.
2. An analysis of the declines over the entire Blackfoot to Milner reach (which includes the Blackfoot to Minidoka reach simulated in the "Curtailment Scenario") is shown on **Exhibits 8211 and 8213**. **Exhibit 8213** shows that the average declines for the entire year are about 800 cfs. The declines during the irrigation season (May to September) average about 1,100 cfs. The declines during individual months during the irrigation season are as much as 1,800 cfs. About 10 percent of the Curtailment Scenario declines have yet to be realized in the Blackfoot to Minidoka reach, so the model result accounting for the unrealized decline is about 1,050 cfs. This shows that the model simulated results and the actual observed reach gain declines are comparable.
3. Dr. Brendecke's "backcasting" approach shown on **Exhibit 4165** superimposes the simulated decline in reach gains over the observed pre-1965 reach gains. Dr. Brendecke states that because the backcasted reach gains are not the same as historic reach gains; the Curtailment Scenario-predicted reach gains are over-predicted. The problem with

this approach is that it assumes that the reach gains during the 1900s to 1950s had reached equilibrium with respect to increased incidental recharge from surface water irrigation. Dr. Brendecke has already acknowledged that reach gains were increasing during that period in response to increasing incidental recharge, as shown on his **Exhibits 4145 to 4147**. Dr. Brendecke's conclusions regarding Exhibit 4165 and his "backcasting" method are not valid because reach gains during the period prior to ground water pumping are not at equilibrium with respect to increasing incidental recharge.

It is our opinion that the Curtailment Scenario results are sufficiently adequate for the purposes of determining the effects of ground water pumping on reach gains and that they compare well with the available data on declining ground water levels and river reach gains. Although the ESPAM ground water model, like any numerical model, could be improved it is our professional opinion based on experience developing and calibrating many other similar ground water flow models that the ESPAM model is adequate for the purposes of administration of hydraulicly-connected ground water and surface water in the ESPA and Snake River.

BRENDECKE OPINION 8

Curtailment of ground water pumping would not be effective because only a small percentage of the curtailed ground water would accrue to the Blackfoot to Milner reach (*Expert Report, pg. 21 to 22*). Further, this curtailment of ground water users and the time it takes for any resulting reach gains in usable quantity by the Surface Water Coalition would deem the delivery call futile (*No. 124, pg. 36-36 of Exhibit 4000*).

REBUTTAL

Dr. Brendecke opines that curtailment will not be an effective remedy because of the length of time needed for the curtailed ground water to improve the flow in the river. Dr. Brendecke states in his Expert Report on page 21 that, "*The reach gain effects of curtailment would be distributed both spatially and temporally. Scenario results indicate that reach gains would increase in all connected river reaches and springs, though the effect would vary greatly from place to place. Reach gains would increase slowly over time, approaching steady state conditions only after decades of curtailment. Exhibit 4140 summarizes curtailment results for an 1870 curtailment using Version 1.1 of the ESPAM. It can be determined from this table that at steady-state, after decades of curtailment of all ground water pumping on the ESRP, only 38% of the increased reach gain from this curtailment would appear in the near Blackfoot to Neeley reach. More than half of this steady-state reach gain would accrue above Blackfoot or below Milner Dam. In the first irrigation season, only 5% of the foregone ground water consumption would accrue to the near Blackfoot to Neeley reach. In the first year of curtailment, only 11% would accrue to the reach.*"

Dr. Brendecke is incorrect in this conclusion for the following reasons:

1. The Curtailment Scenario showed that ground water pumping is currently decreasing the flow in the Snake River by about 960 to 1,100 cfs in the Blackfoot to Minidoka reach the reach where the SWC diverts their senior surface water rights, and by about 1,800 to 2,050 cfs in all of the river reaches above Minidoka Dam[6]. Curtailment would result in an improvement of Blackfoot to Neeley reach gains over 1, 5 and 20 years at a rate of about 30%, 50% and 80% (rounded to the nearest 10%) of the amount of depletion caused by ground water pumping. Stated another way, the model predicts that approximately 50% of the water pumped out and consumed across the entire ESPA under junior priority ground water rights would show up in the various river reaches within 5 years. This information is based on the Curtailment Scenario results. Dr. Brendecke's statement that only 11% would accrue to the reach is not correct based on the results reported on Figure 10 and Figure 21 in the Curtailment Scenario Report[7].
2. Evaluation of whether curtailment is an effective remedy can not be judged on a single-year basis. The effects of ground water pumping have taken 50 years to build up to the current state of depletion. The Upper Snake Basin and Eastern Snake Plain irrigation

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[6] The method to estimate of current depletions on river reach gains using Curtailment Scenario data is presented in Chapter 11 of the SWC Expert Report.

[7] Contor et al., 2006. Hydrologic Effects of Curtailment of Ground Water Pumping using the ESPA Model, IWRRI, Idaho Falls, ID.

demands vary significantly on a year by year basis. The natural flow supply varies between wet and dry years. The storage system and storage fill and drawdown is operated on a multiple-year basis. There is no reasonable basis to judge the effectiveness of curtailment on a single years improvement of reach gains. Administration of hydraulicly-connected ground water needs to be based on the potential benefits that would occur over the long-term operation of the system considering the impacts occurring during dry and average years on the SWC supply.

3. The SWC would benefit from increased reach gains that would occur under curtailment in all of the reaches above Milner. The reach gains that would accrue above Blackfoot would benefit the SWC by providing more natural flow water to other surface water users with priority dates earlier than the SWC and causing more water to be available to fill the SWC later-priority natural flow and reservoir fill rights.

4. No basis is presented to support the opinion that curtailment of ground water users would be futile in restoring the natural flow supply and reservoir fill of the SWC in this delivery call. Certainly if ground water pumping was curtailed, then the impacts from that pumping on the SWC water supply would no longer occur. Furthermore, a significant amount of impact would be removed within 1 to 5 years after curtailment (approximately 50% within 5 years). This demonstrates that curtailment would improve the water supplies available to fill the SWC senior surface water rights.

BRENDECKE OPINION 9

If reach gains did increase as a result of curtailment of ground water pumping, the reach gains would not be useable by the SWC, as demonstrated by the 888 cfs Scenario run on the IDWR Planning Model (*Direct Testimony, pgs. 14 to 22; Expert Report pgs. 22 to 23*).

REBUTTAL

Dr. Brendecke incorrectly uses the 888 cfs Scenario results from the IDWR Planning Model to conclude that most of the increased reach gains from curtailment of ground water pumping would not be diverted by the SWC and would not accrue to the SWC storage account. Brendecke states, "*95% of the reach gain from curtailment would pass Milner Dam unused because it could not be diverted or stored*" (pg. 22).

The conclusions by Dr. Brendecke are not correct, for two main reasons.

1. The 888 cfs Scenario is not properly designed to evaluate the potential benefit to the SWC from increased reach gains by ground water curtailment. This is because:
   - The irrigation demands in the model do not allow increased diversions if additional reach gains are present, except during 4 years that are designated as irrigation shortfall years in the entire 64 year record simulated. In all other years, the demand is fixed based on historical diversions. In other words- the model results do not show a significant benefit realized from increased reach gains because the demands set in the model do not allow additional water to be diverted if it were present and the demands do not reflect the actual irrigation diversion requirements- instead they reflect historical diversions. By fixing the demands to historical diversions in most years, the model shows no benefit from increased reach gains in those years.
   - The 888 cfs Scenario stops at 1992 and does not include most of the period during the 1990s and 2000s when the SWC suffered shortages. The SWC Expert Report shows in Chapter 10 that shortages occurred during 7 of the last 17 years from 1990 to 2006. If the model was run through these shortage periods it would show significant increased benefit from increased reach gains.
   - The Planning Model is not the right tool to evaluate whether additional storage would accrue to the SWC reservoir storage accounts if additional reach gains were present. The Accounting Model used by WD 01 to determine natural flow and storage diversions is the correct tool to perform this analysis, since it includes all of the rules and priorities and the actual historical diversions and storage records needed to evaluate reservoir storage and it is run on a daily time step whereas the Planning Model is run on a monthly time step. Chapter 11 of the SWC Expert Report presents the results of an analysis of the benefits to reservoir storage by curtailment during 2004. The results of the analysis shows that over 1 million acre-feet of storage would accrue to the SWC reservoir storage accounts following curtailment of ground water pumping, and this additional storage would have offset the shortages that occurred during 2004.

2. Even though the 888 cfs Scenario is not setup to evaluate whether increased reach gains would benefit the SWC by providing more water for diversion and storage, Dr. Brendecke has mis-interpreted the results of the 888 cfs Scenario in his Direct Testimony and in his Expert Report. The 888 cfs Scenario clearly does show benefits during the 4 years with specified shortages, as shown on **Exhibit 8229** below. Shortages are dramatically reduced by 91 percent from the increased reach gains from curtailment of ground water pumping during these years. If the model would have included the correct SWC demands it would have shown increased surface water diversions. To test this hypothesis, a run was performed with irrigation demands adjusted up by only 10 percent. The test run showed that all 10 percent of increased reach gains were diverted.

More details on the problems with Dr. Brendecke's use of the 888 cfs Scenario results and the findings from the test run discussed above are presented in **Appendix A**.

Exhibit 8229 Increased water supply available with curtailment of ground water pumping based on results of 888 cfs Scenario for years with simulated irrigation shortfalls.

Date	Study 106 Irrigation Shortfall (With Groundwater Pumping) (1000 AF)	Study 108 Irrigation Shortfall (Without Ground Water Pumping) (1000 AF)	Reduction in Shortfall Without Ground Water Pumping (1000 AF)
September 1931	10.9	0	10.9
November 1931	23.3	0	23.3
July 1934	164.3	0	164.3
August 1934	221.3	0	221.3
September 1934	75.6	14.2	61.4
October 1934	24.5	0	24.5
November 1934	12.2	0	12.2
March 1935	2.8	0	2.8
August 1935	128.3	0	128.3
September 1935	111.9	0	111.9
October 1935	28.2	0	28.2
July 1992	284.1	0	284.1
August 1992	238.5	74.1	164.4
September 1992	95.4	35.2	60.2
TOTAL	**1,421**	**124**	**1,298**

BRENDECKE OPINION 10

The minimum full supply established by the Director in the May 2, 2005 Order is not appropriate and too large for the following reasons. The minimum full supply set in the Order did not appropriately consider the headgate delivery criteria set forth in TFCC operational policies and other documents (*Direct Testimony, pg 30; Expert Report, pg. 17, 25 to 26*). The minimum full supply is too large compared to the amount of supply available during other drought periods (*Expert Report, pg. 26 to 27*). The minimum full supply did not consider actual irrigation requirements (*Expert Report, pg. 27 of Report*). These errors have unduly increased the material injury determined by the Director (*Direct Testimony, pg. 33*).

REBUTTAL

Dr. Brendecke opines that the "minimum full supply" established in the May 2, 2005 Order is not appropriate because:

1. The minimum full supply set in the Order did not appropriately consider the headgate delivery criteria set forth in operational policies.
2. The minimum full supply is too large compared to the amount of supply available during other drought periods.
3. The minimum full supply did not consider actual irrigation requirements.

Each of these arguments is discussed below.

1. The minimum full supply set in the Order did not appropriately consider the headgate delivery criteria set forth in operational policies and other documents.

Dr. Brendecke incorrectly asserts in his Expert Report that a full head gate delivery and the irrigation diversion requirements for TFCC should be based upon the minimum annual volume diverted for a recent year with 5/8 miner's inch per share ("per share" is omitted hereafter) delivery to the head gates. He asserts that the diversion of 1,009,100 AF for the 2002 season when 5/8 miner's inch was delivered should be the full delivery amount needed by TFCC and not the 1,075,000 AF diverted during 1995 when 3/4 miner's inch was diverted. Dr. Brendecke bases this assertion on statements in: 1) TFCC's 1998 operation policy, 2) the TFCC Water Management Plan dated 1999 and, 3) statements in Jay Barlogi's deposition.

a. Headgate delivery criteria are not appropriate standards for delivery of a water right under a delivery call.

The Director of IDWR and watermasters are to delivery water pursuant to water rights according to the procedure described in the CMRs. The procedure for confirming that water should be delivered is described in Rule 40 and Rule 42 of the CMRs. Rule 40 of the CMRs directs the watermaster to "regulate the diversion and use of water in accordance with the priorities of rights of the various surface or ground water users whose rights are included within the district." The rules do not state that other sources of information, such as water management plans or other operational policies limit the delivery of water under a call. In the case of TFCC, as we identify in the next section, these documents were prepared, in part, to provide methods of operation during times of shortage. They do not limit TFCC's rights to delivery of water under a delivery call. Dr. Brendecke's characterization and use of the information in the documents to limit the delivery of water to TFCC under their senior-priority water right is not correct.

As a technical matter, the use of headgate delivery criteria in the Order and by Dr. Brendecke is inappropriate. If a delivery call requires evaluation of the need for water under a water right (and we understand this to be part of the legal questions to be resolved for this delivery call), headgate deliveries are not an appropriate or accurate estimate of the need for water in a surface water irrigation district because they do not measure the amount of water needed to overcome conveyance and operational losses. In addition, headgate deliveries vary between years and within the season depending on the irrigation demand which is a function of the temperature, wind speed, precipitation and other factors. Therefore, as a technical matter, headgate delivery criteria should not be used as a measurement of the SWC irrigation diversion requirements.

b. The headgate delivery documents and sources cited by Brendecke don't support the conclusion that TFCC should be limited to a headgate delivery of 5/8 of a miner's inch.

TFCC Water Management Plan

The TFCC 1999 Water Management Plan explains why a delivery rate of 3/4 miner's inch per acre is the customary rate for TFCC when supplies allow. The 1900 priority date water right for 3,000 cfs was initially intended to supply a 240,000 acre project. The water supply was planned at 1 cfs for each 80 acres or 5/8 miner's inch per acre. Before the proposed project could be fully completed, the early settlers determined that the planned water supply was not sufficient for a project as large as originally approved and took administrative and judicial actions to limit the size of the project to 203,569 shares at one share per acre (*State and Rice v. Twin Falls Land and Water Company*, 37 Idaho 73m 217 p.252 (1922) and *Twin Falls Land and Water Company v. Twin Falls Canal Company* 77F.2d 431, 1935). Subsequent acquisitions of treasury stock reduced the number of shares to 202,689. The 3,000 cfs water right provided, at the point of diversion at Milner, a flow rate of 1 cfs for each 67.6 acres (equivalent to 0.0148 cfs/acre or approximately 3/4 miner's inch per acre. Operation of the project showed that delivery to the farm head gate required additional water to compensate for delivery and operational losses. The 1999 management plan notes that since initial construction of the project, TFCC acquired additional natural flow water rights (780 cfs of relatively junior priority rights) and obtained storage rights (248,368 AF of space in American Falls and Jackson Reservoirs) to allow the diversion rate at Milner Dam to be increased to meet the conveyance loss and operational loss. The 1999 Water Management Plan states (top of Page 5):

> *In years in which TFCC receives its full 3,000 cfs of natural flow well into the summer because reservoirs are full and the spring runoff is still available, TFCC has traditionally delivered at least 3/4 miner's inch per acre/share,*

and sometimes up to an inch in critical periods (202,689 acres x ¾ m-in per acre/share = 3,040 cfs).

The Water Management Plan also notes that after about 1918 TFCC constructed drains, tunnels and other facilities to allow seepage and return flows to be captured and redistributed. The Plan states (Page 5, third paragraph) that:

With this result and better management of the system, TFCC has more often been able to deliver 3/4 inch per acre/share, succeeding in most average and above average water years.

The Water Management Plan at page 6, Table 3, lists that during the years 1992 to 1996 average monthly diversion from Snake River at Milner during July and August were 208,012 AF and 202,212 AF, respectively. These volumes convert to average flow rates of 3,383 cfs and 3,289 cfs, respectively, which are rates commensurate with supplying 3/4 miner's inch per acre at the farm head gate when adjusted for canal and operational losses and recovered seepage and waste flows. Accordingly, as referenced in this plan, TFCC has and continues to deliver 3/4 miner's inch per share pursuant to its water rights unless during times of shortage (caused by an insufficient supply) 3/4 miner's inch can not be delivered. TFCC 1999 Water Management Plan does not support Dr. Brendecke's opinion that TFCC should be limited to a headgate delivery of 5/8 miner's inch.

TFCC Operational Policy

TFCC developed an operational policy in 1981 (**Exhibit 8229**) that was revised in 1997. The 1997 Operational Policy states on page 3 that, "*TFCC water right is 5/8 miner's inch per share. This includes an obligation to deliver 1/80th of a cubic foot of water per second for each share of stock when the water supply is available. The TFCC delivers a proportionate share of the water supply for each share of stock.*" This statement reflects TFCC's management's position that TFCC is obligated to deliver at least 5/8 miner's inch per share. The statement does not limit TFCC's ability to deliver greater than 5/8 miner's inch when the water supply is available pursuant to TFCC's water rights. The statement does not limit TFCC's obligation to seek a full delivery of its water rights for its shareholders. TFCC has historically and continues to deliver water to its shareholders pursuant to its water rights, both natural flow and storage rights. The water rights provide for TFCC to deliver 3/4 miner's inch per share. The 1981 Operation Policy (although shortened in 1997) contains a more complete description of the history of the development of the TFCC tract and the fact that TFCC delivers more than 5/8 miner's inch per share when shortages do not limit their ability to deliver water:

The Twin Falls Canal Company, as successor to the Twin Falls Land & Company, is obligated to delivery 1/80th of the cube foot of water per second for each share of stock when the water is available (5/8ths of an inch per share). In other words, in accordance with the 1903 contract between the State of Idaho and the Twin Falls Land & Water Company, the Twin Falls Canal Company must deliver to its shareholders 50 inches (1 c/f/s) for each 80 acres with a headgate within ½ mile of the land. The Company's water rights permit deliveries above 5/8ths of an inch when water is available.

Although the updated 1997 operation policy shortened this section considerably, it did not change TFCC's ability to deliver water pursuant to its water rights, which provide for 3/4 miner's inch per share delivery.

In the 1997 policy, there is a summary table on page 3 (shown below) that clearly states TFCC natural flow and storage rights.

Information on Page 3 of TFCC Operational Policy dated 1997

PERTINENT INFORMATION

- **TFCC 24 HOUR EMERGENCY NUMBER IS 733-6731**
- The following are approximate amounts:

Area Irrigated	202,691 acres
Major Canals	110 miles
Laterals	1,000 miles
Number of waterusers	4,000
Number of service gates	3,000
Water Rights	3,000 cfs natural flow, priority date October 11, 1900
	600 cfs natural flow, priority date December 22, 1915
	180 cfs natural flow, priority date April 1, 1939
Storage Rights	151,185 acre feet in American Falls Reservoir
	97,183 acre feet in Jackson Reservoir
Irrigation Season	March 1 - October 31
Diversion	Per demand up to 3,800 cfs

12/10/97

Also, the TFCC share certificates show that, to the extent water availability and facility capacity exceed 5/8 miner's inch per acre, the share certificates recognize delivery of a greater amount.

> *Each of said shares or water rights shall represent a carrying capacity in said canal sufficient to deliver water at the rate of one eightieth of one second foot per acre and each share or water right sold or contracted as herein provided shall also represent a proportionate interest in said canal, together with all rights and franchises based upon the number of shares finally sold in the said canals.*

Taken in context with the information described above, it is clear that TFCC's operational policy is to seek a full delivery under their water right, but that at times of shortage it may need to restrict deliveries to 5/8 of a miner's inch at the headgate in order to distribute the limited supply that is available during a shortage. This does not mean that 5/8 of a miner's inch is a full delivery under the TFCC water rights nor does it mean that shortages are acceptable and do not cause impacts to TFCC.

Jay Barlogi's Deposition

Dr. Brendecke references the deposition of Jay Barlogi (a TFCC staff member) as support for limiting TFCC's need for water in this delivery call. The discussion of this issue in the Barlogi Deposition is within the context of canal operations during May and June, prior to peak irrigation demand. Mr. Barlogi clarifies at Pages 118 –119 of his deposition that he is referring to the ease and comfort of canal operations rather than the adequacy of the supply. Mr. Barlogi's deposition testimony does not support Dr. Brendecke's opinion that TFCC should be limited to a headgate delivery of 5/8 miner's inch.

2. The "minimum full supply" is too large compared to the amount of supply available during other drought periods.

Dr. Brendecke alleges that the "minimum full supply" is too large compared to the amount of supply available during other drought periods. He cites the supply volumes and shortage rates from the Palisades Reservoir Project Planning Reports and other planning studies. He states in his Expert Report (pg. 27) that, "*the natural flow supplies of the SWC entities are as good or better now than they were before ground water pumping began.*"

We have shown that the shortages experienced by the SWC recently (7 out of 17 years with shortage and a 60 percent supply reliability) are much greater than the planning report shortages (2 out of 47 years of shortages with a 98 percent reliability) in our rebuttal to Opinion 4. We have also shown in our rebuttal to Opinion 3 that the natural flow supplies of the SWC entities are less now than before ground water pumping began. We have shown that Dr. Brendecke's opinions are not supported by the facts.

Dr. Brendecke is alleging that the "minimum full supply" is too large compared to historical diversions. This is also not correct, as shown on **Exhibit 8230**. Before ground water pumping began to deplete the SWC supply by reducing reach gains (reach gains began to be affected from about 1950 to 1960), the SWC diversions were always more than the minimum full supply from 1930 to 1960 except during one year in 1935. After 1960, when ground water pumping was depleting the SWC water supply, the "minimum full supply" was not met during 10 years including 1961, 1977, 1992, 1994 and 2001 to 2006. This shows that before ground water pumping began depleting the supply, the supply was almost always more than the "minimum full supply", except for one year during extreme drought.

The term "minimum full supply" is not found in Rule 42 of the CMRs. Instead, Rule 42 lays out a procedure to confirm that water delivered under a senior's right will be used for irrigation supply to meet the irrigation diversion requirements for actual irrigation conditions (like acreage, method of delivery, etc.) based on prior comparable hydrologic conditions. The "minimum full supply" in the Order does not meet the irrigation diversion requirements of the SWC based on an examination of the actual irrigation conditions on the SWC projects, as explained below.

3. The minimum full supply did not consider actual irrigation requirements.

Dr. Brendecke opines that the minimum full supply should be based on actual irrigation requirements. We agree. A comparison of the irrigation diversion requirements calculated in the SWC Expert Report to the minimum full supply is presented on **Exhibit**

8231. This graph shows that the minimum full supply is insufficient for almost all years since 1990 and does not provide the water needed to meet the SWC irrigation diversion requirements.

Exhibit 8229 1981 TFCC Operational Policy

TWIN FALLS CANAL COMPANY

OPERATION POLICY

ADOPTED BY BOARD OF DIRECTORS

MAY 15, 1981

OPERATION

TWIN FALLS CANAL COMPANY

HISTORY AND LEGAL RIGHTS AND RULES

I. HISTORY OF DEVELOPMENT OF THE TRACT.

In 1894 the United States Congress passed the bill which carried a rider proposed by Congressman Carey of Wyoming. That bill allowed states to request the segregation of lands from the public domain if the state had a meaningful proposal for the development of an irrigation project. As early as 1895 the Idaho Legislature adopted the laws under which the State of Idaho could participate. The Twin Falls Land & Water Company, which was financed primarily with money from Pennsylvania, was the Company that proposed and constructed TFCC's system. The original natural flow right of the Twin Falls Canal Company (hereinafter "TFCC") in the amount of 3,000 c/f/s holds a priority date of October 11th of 1900. In addition to the original 1900 right, the Company holds a December 22, 1915 right for 600 c/f/s and an April 1, 1939 right for 180 c/f/s. The Company owns 97,183 acre feet of the top storage in Jackson Reservoir and the lands served by the Company own 151,185 acre feet of space in the American Falls Reservoir through the American Falls Reservoir District. An average of approximately 1.2 million acre feet is annually diverted into TFCC's system. The maximum annual diversion of the last 20 years in one year has been 1.345 million acre feet and the maximum flow diversion is somewhere around 4,000 c/f/s. This water is delivered to 202,000+ acres.

Many have said that the Twin Falls Canal Company system is the most successfuly developed Carey Act project in America. In addition to dependable river supplies, portions of Rock Creek, Deep Creek and Cedar are also diverted into the system. The coulee system allows recapture of waste and other subterranean seepage flows that have been developed so that efficiency can be increased.

Under a 1903 agreement with the State, the Twin Falls Land & Water Company was authorized to sell water stock to the persons who would settle within the irrigated tract. The settlers obtained a patent by complying with the Homestead Act requirements. The settlers also executed contracts to purchase water rights from the Land & Water Company and upon payment therefore, obtained stock representing their proportionate share of water rights of the Company. The Twin Falls Canal Company, as successor to the Twin Falls Land & Water Company, is obligated to deliver 1/80th of the cubic foot of water per second for each share of stock when the water is available (5/8ths of an inch per share). In other words, in accordance with the 1903 contract between the State of Idaho and the Twin Falls Land & Water Company, the Twin Falls Canal Company must deliver to its shareholders 50 inches (1 c/f/s) for each 80 acres with a headgate within 1/2 mile of the land. The Company's water rights permit deliveries above 5/8ths of an inch when water is available.

II. LEGAL STATUS AND SPECIFIC POLICIES.

A. Legal Status. Pursuant to the Articles of Incorporation and the By-Laws of the Company, the Twin Falls Canal Company is a nonprofit irrigation corporation incorporated under the laws of the State of Idaho.

B. Tax Status. The Twin Falls Canal Company is exempt from both federal and state income tax so long as less than 15% of the Company's income is derived from other than the assessment of its shareholders. The rights of way, and irrigation facilities are exempt from ad valorem taxes so long as they are not used in profit making ventures. The Company is exempt from certain other taxes and license fees from both the federal and state levels. e.g., Vehicle license plates, some gasoline tax, workman's compensation requirements, and other labor laws by reason of the exemption of their employees within the definition of "agricultural labor".

C. Stockholders' Meeting and Election of Directors. The By-Laws provide the annual stockholders' meeting be held in the City of Twin Falls on the second Tuesday in January of each year. Appropriate notices are given to the stockholders. Voting can be in person or by proxy and five directors are elected. Cumulative voting (five votes per share) for directors is required by the Idaho Constitution so long as the Articles of Incorporation provide that five directors are to be elected annually.

D. Election of Officers. The Board of Directors elects a President, Vice President and a Secretary-Treasurer. They also employ such people as are necessary to generally supervise, control, and oversee all of the business affairs of the corporation. The Board makes provision for the collection of the necessary assessments so as to be able to pay the expenditures and disbursements of the Company.

III. STOCKHOLDERS' RIGHTS.

A. Water Rights and Assessments. The Twin Falls Canal Company holds the legal title to the Company's water rights. Each stockholder is the beneficial owner of his

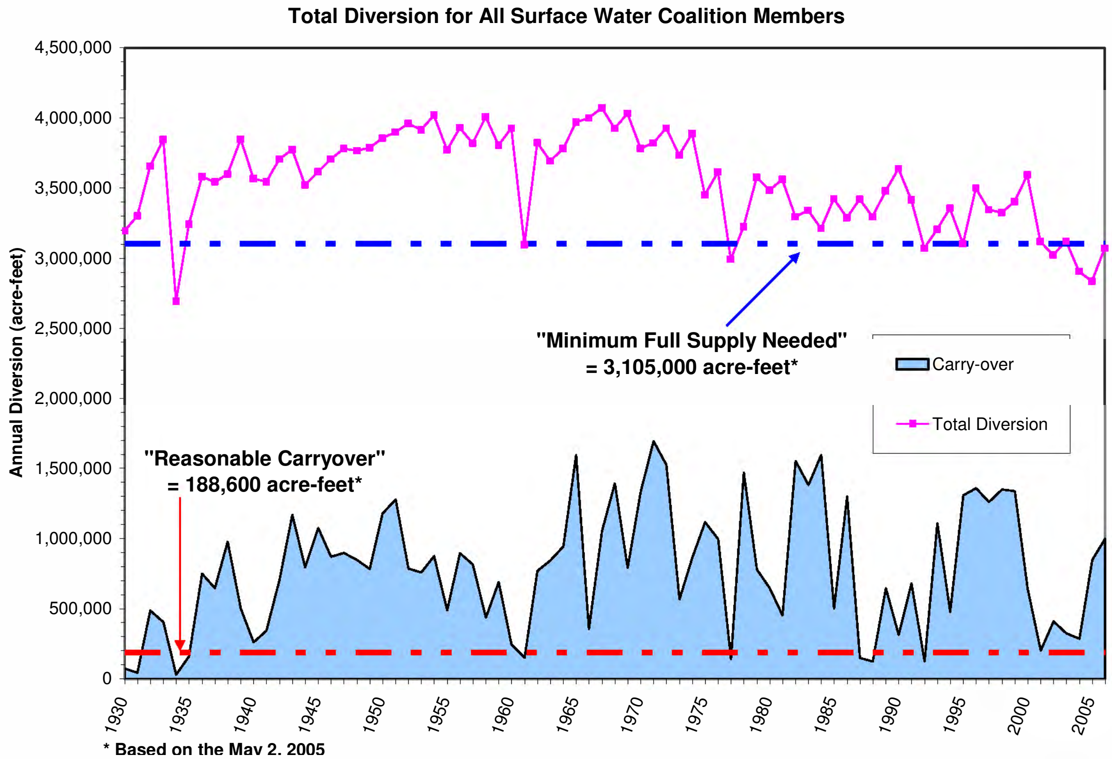

Exhibit 8230 Comparison of the minimum full supply in the IDWR Order with the SWC diversions. (Figure 8-4, SWC Expert Report)

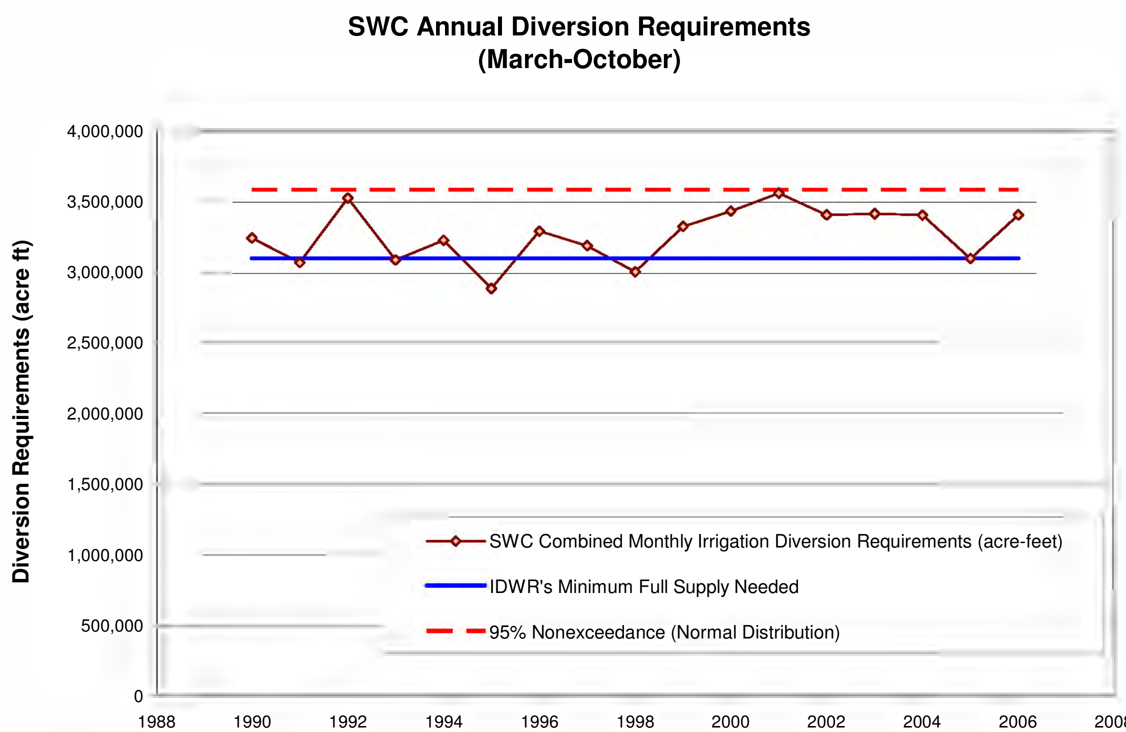

Exhibit 8231 Comparison of the minimum full supply in the IDWR Order with the SWC irrigation diversion requirements.
(Pg 9-8, SWC Expert Report)

APPENDIX A
REBUTTAL OF BRENDECKE'S USE OF IDWR PLANNING MODEL
888 CFS SCENARIO

INTRODUCTION

The IDWR Planning Model simulates reservoir operations, river flow and diversions in the Snake River basin. The 888 cfs Scenario (also called Study 108) was run on the IDWR Planning Model and reportedly simulates changes in reservoir operations, river flow, and deliveries from an 888 cfs increase in reach gains between Shelley and Minidoka resulting from ground water curtailment. The results of the 888 cfs Scenario are compared to a base run (Study 106) assuming no curtailment of groundwater pumping.

Brendecke incorrectly uses the 888 cfs Scenario results from the IDWR Planning Model to conclude that most of the increased reach gains from curtailment of ground water pumping would not be diverted by the SWC and would not accrue to the SWC storage account. Brendecke states, "*95% of the reach gain from curtailment would pass Milner Dam unused because it could not be diverted or stored*" (pg 22).

The conclusions by Dr. Brendecke are not correct, for two main reasons.

1. The 888 cfs Scenario is not properly designed to evaluate the potential benefit to the SWC from increased reach gains by ground water curtailment. This is because:
   - The irrigation demands in the model do not allow increased diversions if additional reach gains are present, except during 4 years that are designated as irrigation shortfall years in the entire 64 year record simulated. In all other years, the demand is fixed based on historical diversions. In other words- the model results do not show a significant benefit realized from increased reach gains because the demands set in the model do not allow additional water to be diverted if it were present and the demands do not reflect the actual irrigation diversion requirements- instead they reflect historical diversions. By fixing the demands to historical diversions in most years, the model shows no benefit from increased reach gains in those years.
   - The 888 cfs Scenario stops at 1992 and does not include most of the period during the 1990s and 2000s when the SWC suffered shortages. The SWC Expert Report shows in Chapter 10 that shortages occurring during 7 of the last 17 years from 1990 to 2006. If the model was run through these shortage periods- it would have shown significant increased benefit from increased reach gains.
   - The Planning Model is not the right tool to evaluate whether additional storage would accrue to the SWC reservoir storage accounts if additional reach gains were present. The Accounting Model is the correct tool to perform this analysis, since it includes all of the rules and priorities and the actual historical diversions and storage records needed to evaluate reservoir storage and it is run on a daily time step whereas the Planning Model is run on a monthly time step. Chapter 11 of the SWC Expert Report presents the results of an analysis of the benefits to reservoir storage by curtailment during 2004. The results of the analysis shows that over 1 million acre-feet of storage would accrue to the SWC reservoir storage accounts under curtailment

of ground water pumping, and this additional storage would have offset the shortages that occurring during that year.

2. Even though the 888 cfs Scenario is not setup to evaluate whether increased reach gains would benefit the SWC by providing more water for diversion and storage, Dr. Brendecke has mis-interpreted the results of the 888 cfs Scenario in his Direct Testimony and in his Expert Report. The 888 cfs Scenario clearly does show benefits during the 4 years with specified shortages, as shown on Table 2 below. Shortages are dramatically reduced by 91 percent from the increased reach gains from curtailment of ground water pumping during these years. Again- if the model would have included the correct SWC demands it would have shown increased surface water diversions. To test this hypothesis, a run was performed with irrigation demands adjusted up by only 10 percent. The test run showed that all 10 percent of increased reach gains were diverted.

DESCRIPTION OF IDWR PLANNING MODEL

The IDWR Planning Model consists of a computer program and database that were originally developed in the early 1970's. The Planning Model has been periodically updated by IDWR and versions were released in 1992 and 2002[8]. The IDWR Planning Model was developed to simulate Upper Snake River reservoir operations. The program accounts for reservoir storage changes, evaporation, diversions, return flow and river reach gains using a monthly time step. The river is divided into reaches, with reach endpoints usually located at USGS gaging sites. The model includes historical river flow, reservoir storage, diversions and reach gains. The model runs over the historical period of record from 1928 to 1992.

Water demands in the model include irrigation diversions, minimum instream flow requirements, municipal/industrial diversions and flood control. The model attempts to meet these demands based on the available water and according to the model's prioritized operating rules. If the demands cannot be satisfied by the available natural flow in the river, releases are made from water stored in upstream reservoirs. Within the Planning Model there is a specific reservoir release algorithm that defines how reservoir storage water is released to the river.

EXPLANATION OF THE METHODS AND RESULTS OF THE 888 CFS SCENARIO

General Description of 888 cfs Scenario

The 888 cfs Scenario (also called Study 108) reportedly simulates changes in reservoir operations, river flow, and deliveries from a 888 cfs (approximately 642,000 acre-feet/year) increase in reach gains between Shelley and Minidoka resulting from curtailment of junior groundwater pumping rights granted after January 1,1961 (Goyal, 2006). The increased reach gains represented in the scenario are presented on Table 1. No formal documentation

[8] The current version of the IDWR Planning Model is considered to be the 2002 version.

of this analysis has been prepared by IDWR; however, spreadsheets have been made available with the scenario results. IDWR compared the results of Study 108 (with additional reach gains) with the results of Study 106 (base run without additional reach gains). Study 108 differs from the Study 106 only by the additional reach gain inputs (included as constant inflows in the SnkMod.Ind file). No other input values were changed in comparison to the base run.

Results of 888 cfs Scenario

Irrigation Diversions and Shortfalls

The 888 cfs Scenario shows that for every year specified in the model with an annual shortfall deficit (when supply could not meet irrigation diversions), the SWC supply was improved when increased reach gains were present in the river, as shown in Table 2 and Figure 1. Cumulatively, these findings represent a 91% improvement in water supply for the "irrigation shortfall" years specified in the model. This finding contradicts Brendecke's assertion that increased reach gains due to curtailment would not be used by SWC members. Although the Planning Model underestimates irrigation shortages for most years (discussed later), it does show that the shortages are largely eliminated by the extra reach gains produced by curtailment of groundwater pumping.

Reservoir Carryover Storage

Figure 2 shows that the 888 cfs Scenario provides an increase in the minimum amount of reservoir carryover storage. In the water shortage periods specified in the model, this increase is between 200,000 acre-feet and 500,000 acre-feet. This increase in storage is due to the availability and diversion to storage of increased reach gains, and the reduction in storage releases. The increased minimum and carry-over storage provides the storage contract holder with greater flexibility in operations and a higher level of security to face the potential drought conditions that may occur in subsequent water years.

Limitations of 888 cfs Scenario

All hydrologic models are limited by the assumptions included in the model design and the analysis. The strength and applicability of the results of a model scenario are based on the quality of the input data and the assumptions included in the scenario. The information presented below shows that the 888 cfs Scenario run on the IDWR Planning Model is not appropriate to make conclusions about the usability of increased reach gains by surface water irrigators. The following limitations were discovered during our research of the 888 cfs Scenario.

- **The 888 cfs Scenario only allows increased surface water diversions during "irrigation shortfall" years.**

  The surface water irrigation diversions in the IDWR Planning Model are based on a modified record of the historical diversions. There is almost no change in diversions between the two scenarios (Figure 3). The model does not include operational rules that would simulate increases in surface water diversions that would occur if additional reach gains were available. If additional reach gains are available, the model will only simulate increased diversions during pre-specified "irrigation shortfall" years (1931, 1934, 1935 and 1992). This does not mean that these are the only years when there was an insufficient supply to meet irrigation demand- rather- these are only the years included in the model when simulated diversions were set above the available flow (causing an irrigation shortfall). No shortfalls were simulated in the base run for critically dry years such as 1940, 1941, 1955, 1960, 1961, and 1977. This means that the modeled irrigation demands for the 888 cfs Scenario are set too low. The model can not simulate the benefit of increased reach gains to the SWC for other years- even during extreme drought years when there obviously was insufficient water to meet all demands- like 1977. In reality, if there was more natural flow in the river, SWC members would divert more natural flow, use less reservoir storage and have a more reliable water supply. Additionally, the model run stops at 1992 and does include most of the shortages occurring during the 1990s and 2000s. The SWC Expert Report showed that there were shortages during 7 of the 17 years during this period. With this understanding- it is obvious that the assumptions included in the 888 cfs Scenario are not adequate to evaluate the benefit of increased reach gains for surface water irrigators.

- **The historic diversions included in the 888 cfs Scenario represent a depleted supply and are not reflective of full irrigation demand.**

  The historically-based diversions reflect water use decisions that were made because the supply was short. If there had been more water available, diversions would have increased. The 888 cfs Scenario fails to increase the demands that would occur if return flow increased between Blackfoot and Milner. Thus, it does not simulate the fact that irrigators would typically choose to divert more water in dry years if increased reach gains were available. A test-run of the additional potential diversions associated with the curtailment-generated reach gains is summarized in a later section.

- **The early historic record in the model does not reflect the current effects of depletions to reach gains from ground water pumping.**

  The IDWR Planning model runs using the historic data from 1928 to 1992. This is a common method used in hydrologic modeling to evaluate the water supply during historic drought events. However, the historic natural river flow has not been adjusted to represent the reach gains depletions caused by the current ground water pumping rates. This is a major flaw that causes an overestimation of the water supply available during extreme drought events for the current depleted conditions. Under the current depleted reach gains condition resulting from decades of groundwater pumping, significant water supply impacts would be expected in low water years, similar to the shortages that have occurred in the early 1990s and more recently. .

- **The 888 cfs Scenario incorrectly allocates increased ground water curtailment reach gains and does not include the benefit of curtailment of ground water rights prior to 1961.**

  The 888 cfs Scenario does not account for the increase in steady state reach gains that would occur if groundwater pumping rights prior to 1961 were also curtailed. The steady state increase in reach gains due to curtailment of groundwater rights junior to 1961 as indicated by the ESPAM v.1.0 analysis are incompletely represented in Study 108. Additionally, the 888 cfs Scenario uses the reach gain data from version 1.0 of the ESPAM ground water model instead of the more current version 1.1.

- **The 888 cfs Scenario uses an outdated version of the IDWR Planning Model.**

The 888 cfs Scenario is based on the 1992 version of the Planning Model. The 1992 version has been updated by the 2002 version.

RESULTS USING A MODIFIED 888 CFS SCENARIO

A modified 888 cfs Scenario was run to answer this question. "What would be the result of the analysis if the 888 cfs Scenario allowed higher irrigation diversions when more reach gains are present for diversion as a result of ground water curtailment?" We previously explained that the 888 cfs Scenario is flawed because irrigation diversions are fixed to historical diversions- even if there is additional reach gains available for diversion (except for four "irrigation shortfall years). A test was completed using a modified version of the 888 cfs Scenario to evaluate whether additional surface water would be diverted if irrigation demands were increased to reflect the availability of increased reach gains.

The test involved keeping all of the aspects of the 888 cfs Scenario the same, except that: 1) irrigation demands were increased uniformly every year by 10 percent in the near Blackfoot to Milner reach. A 10 percent increase in demand was run as a test case to see if the additional reach gains would be diverted.

Results of this analysis are presented in Figures 4 and 5, and Table 3. These results show the additional reach gains from curtailment of ground water pumping would be diverted by the surface water irrigators (in accordance with their natural flow water rights). Table 3 shows that the increased reach gains are diverted when the SWC members' demands are higher than those estimated in Study 106. In fact, almost all of the assumed 10 percent increase in demands is satisfied in the revised Study 108. The end of year reservoir storage results in Figure 5 show that the additional reach gains associated with curtailment are used to satisfy the increased demands and end up having little or no impact on reservoir storage. In other words, in times of shortage, the irrigators would be able to divert the additional 888 cfs of reach gain with little change in reservoir carry-over storage. Thus, Brendecke's contention that "*95% of the reach gain from curtailment would pass Milner Dam unused because it could not be diverted or stored*" is incorrect and a major over-simplification. A more complete simulation of the upper Snake River system would show that the significant water supply impacts caused by groundwater pumping would be reduced or eliminated by the increased reach gains associated with curtailment of pumping.

REFERENCES

Goyal, Sudhir (IDWR). January 17, 2006.Personal Communication.

IDWR (2004). 1992 Planning Model Files for Study 106 and Study 108 and supporting documentation.

Table 1 Distribution of additional 888 cfs of reach gains in the 888 cfs Scenario

Model Reach #	Reach Descrip.	Additional Reach Gain (x 1000 acre-feet)												
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
49	Blackfoot to Nr. Blackfoot	12.0	11.6	12.0	12.0	10.8	12.0	11.6	12.0	11.6	12.0	12.0	11.6	181
57	Nr. Blackfoot to American Falls Reservoir	38.4	37.2	38.4	38.4	34.7	38.4	37.2	38.4	37.2	38.4	38.4	37.2	452
59	Neeley to Lake Walcott	4.2	4.0	4.2	4.2	3.8	4.2	4.0	4.2	4.0	4.2	4.2	4.0	49
TOTAL		54.6	52.8	54.6	54.6	49.3	54.6	52.8	54.6	52.8	52.8	52.8	52.8	643

Table 2 Increased water supply available based on results of 888 cfs Scenario for years with simulated irrigation shortfalls

Date	Study 106 Irrigation Shortfall (1000 AF)	Study 108 Irrigation Shortfall (1000 AF)	Reduction in Shortfall (1000 AF)
September 1931	10.9	0	10.9
November 1931	23.3	0	23.3
July 1934	164.3	0	164.3
August 1934	221.3	0	221.3
September 1934	75.6	14.2	61.4
October 1934	24.5	0	24.5
November 1934	12.2	0	12.2
March 1935	2.8	0	2.8
August 1935	128.3	0	128.3
September 1935	111.9	0	111.9
October 1935	28.2	0	28.2
July 1992	284.1	0	284.1
August 1992	238.5	74.1	164.4
September 1992	95.4	35.2	60.2
TOTAL	**1421.3**	**123.5**	**1297.8**

Table 3 Comparison of demands and diversions (Near Blackfoot to Milner) for Study 106, Study 108, and Study 108 with 10 percent increase in demand

Parameter	**Study 106**	**Study 108**	**Study 108 plus 10% Increase in Demand**
Average Annual Demand (1000 acre-ft)	3,460	3,460	3,806
Average Annual Diversion (1000 acre-ft)	3,438	3,458	3,793
Average Irrigation Shortage (1000 acre-ft)	21.9	1.8	13.0
Additional Diversion (1000 acre-ft)	--	20.1	355
Additional Diversion (percentage)	--	0.6 %	10 %

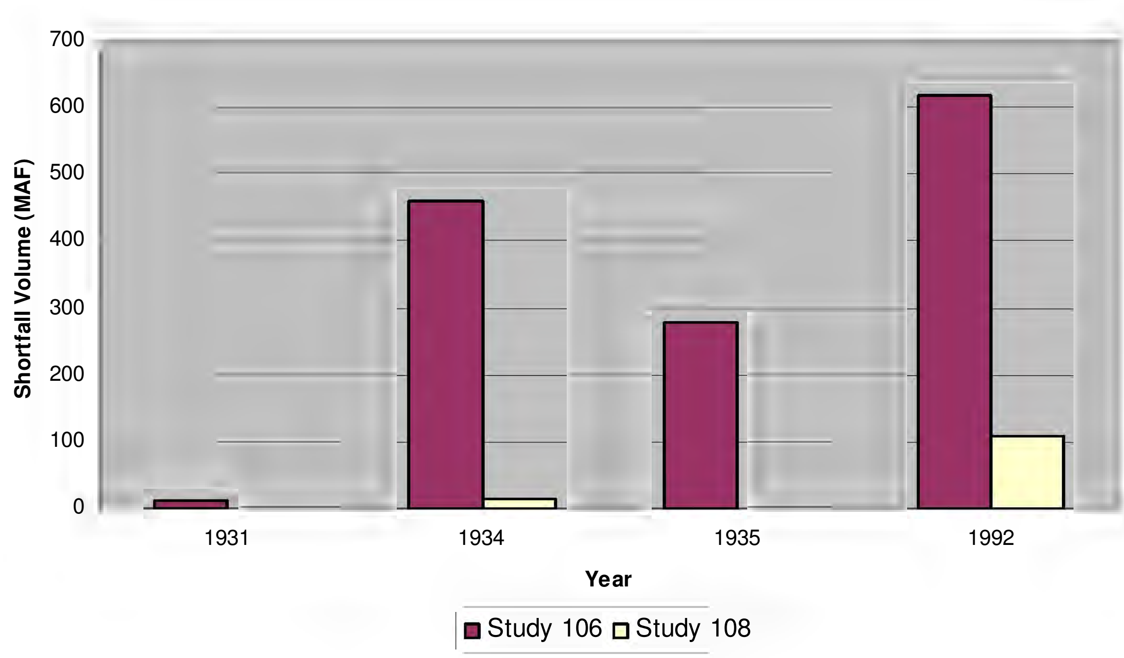

Figure 1 Increased water supply available based on results of 888 cfs Scenario for years with simulated irrigation shortfalls.

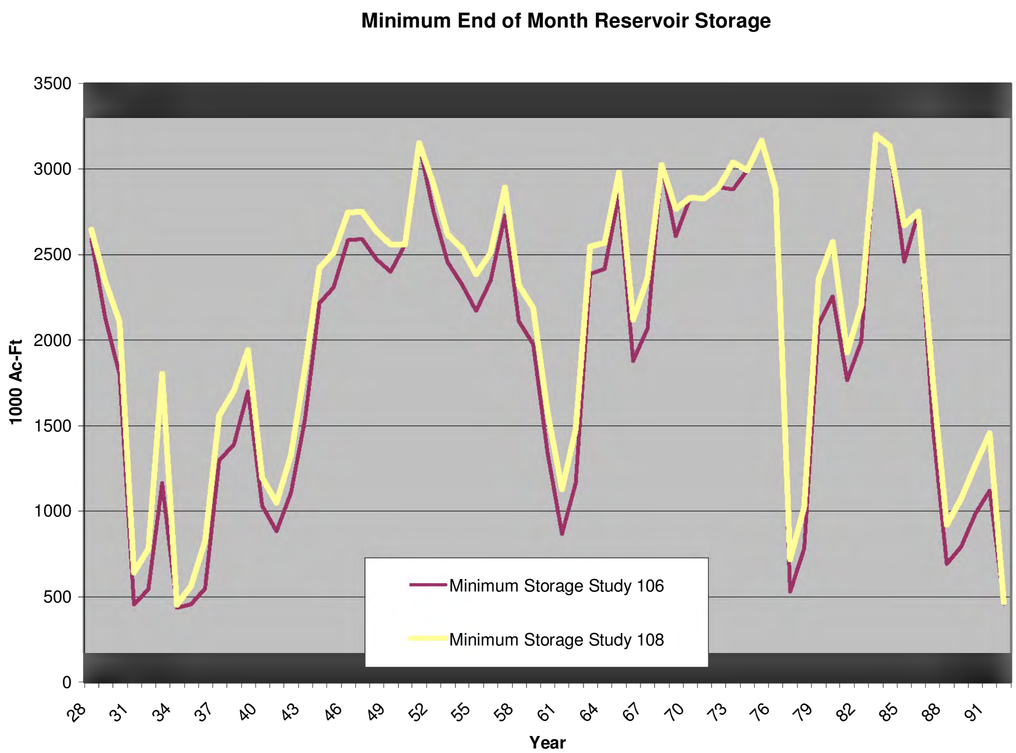

Figure 2 Minimum end of month reservoir storage from 888 cfs Scenario

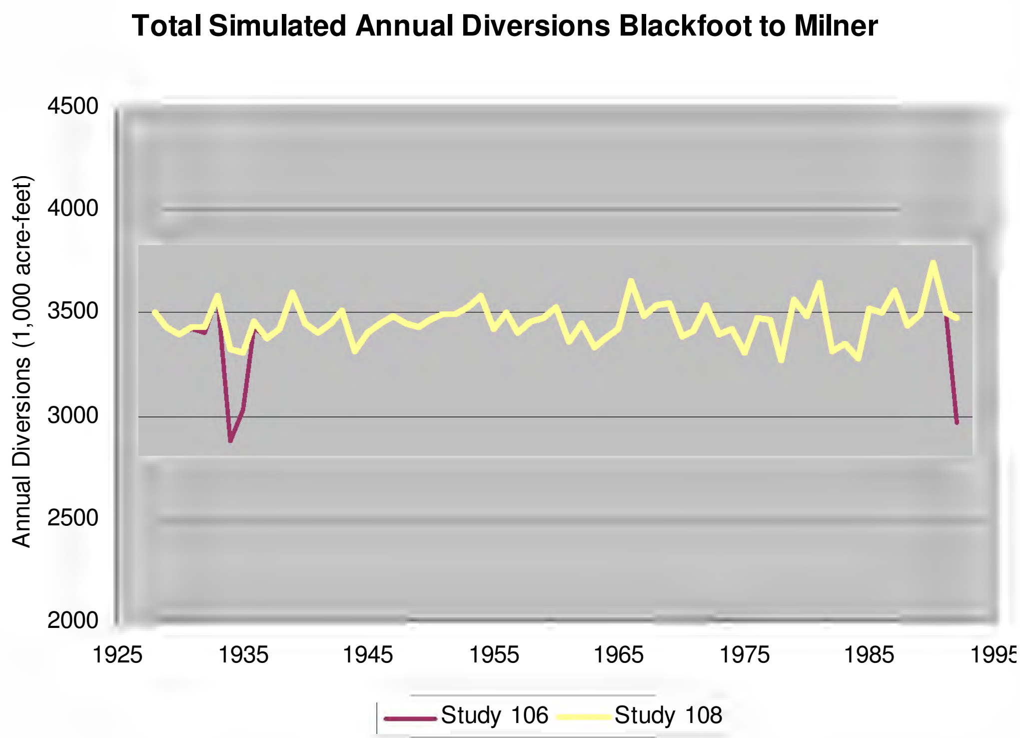

Figure 3 Annual irrigation diversions in the 888 cfs Scenario from Blackfoot to Milner

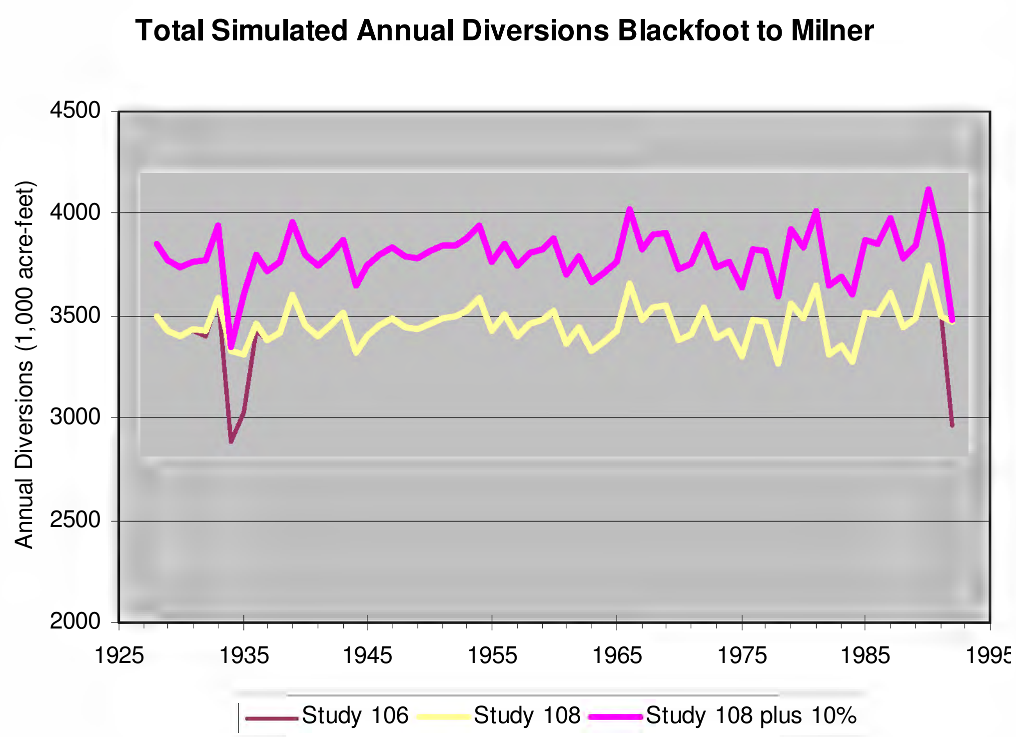

Figure 4 Annual surface water use in the 888 cfs Scenario from Blackfoot to Milner when irrigation diversions are increased by 10 percent. Note the increase in surface water diversions under this change in model assumptions.

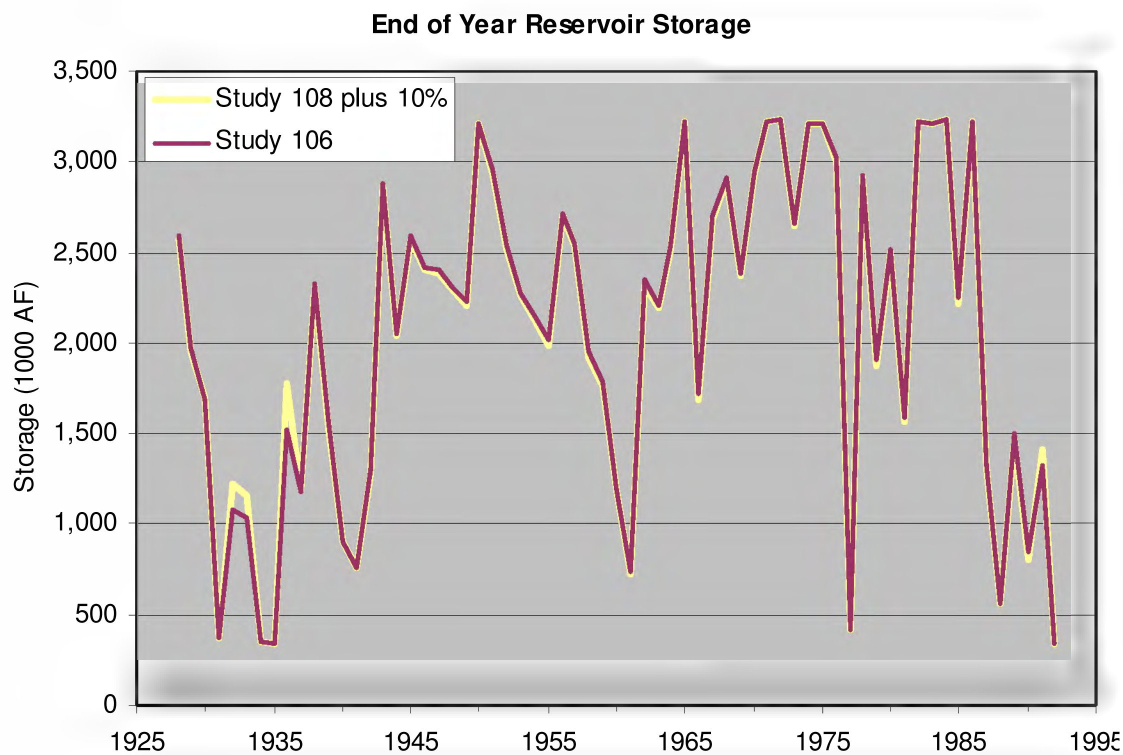

Figure 5 End of year reservoir storage 888 cfs Scenario from Blackfoot to Milner when irrigation diversions are increased by 10 percent.