MEMORANDUM

TO: 10825 STEERING COMMITTEE
FILES

FROM: GRAND RIVER CONSULTING

DATE: January 1, 2008

SUBJECT: HYDROLOGY MEMO
ALTERNATIVES THAT INVOLVE RUEDI RESERVOIR

Ruedi Reservoir can supply all of the 10825 Water to the 15-Mile Reach, or can be used as partial source of the Recovery Program water when paired with other storage facilities. A matrix of 10825 Water Supply Alternatives is provided in Exhibit 1. Five of these alternatives utilize Ruedi Reservoir either as a stand-alone alternative, or paired with other elements:

- Stand Alone Ruedi Reservoir - Alternative A
- Ruedi Reservoir paired with Sulphur Gulch Reservoir - Alternative C1
- Ruedi Reservoir paired with Buzzard Creek Reservoir - Alternative C2
- Ruedi Reservoir paired with Williams Fork Reservoir - Alternative C3
- Ruedi Reservoir paired with Wolford Mountain Reservoir - Alternative C5

This memorandum summarizes the operation of Ruedi Reservoir in conjunction with the 10825 Alternatives Assessment. Specific study years have been analyzed to represent a dry year (1977), a below average year (1988), an above average year (1982) and a wet year (1983). Three important hydrologic parameters are addressed:

1. Changes to Fryingpan River Stream Flow. Stream flow of the Fryingpan River below Ruedi Reservoir will increase during the summer months as all or a portion of the 10825 Water is released from the reservoir. Further, winter stream flow of the Fryingpan River may decrease as less water may be evacuated from the reservoir in anticipation of the following year's runoff. The potential changes in stream flow are illustrated in the attachments to this memo and described in the text below. It is our understanding that when flow on the Fryingpan River exceeds 300 cfs, recreation and aquatic habitat resources may be impacted. Accordingly, the number of days in which the discharge of the Fryingpan River exceeds 300, 400 and 450 cubic feet per second are summarized.

2. Changes to Roaring Fork River Stream Flow. The Roaring Fork River at a site below the confluence with the Fryingpan River is assessed.

3. Changes to Reservoir Storage. Potential changes in Ruedi Reservoir storage content have been simulated. Reductions in summertime storage through the important Labor Day recreation season are addressed.

Please note that this memo does not address the aquatic and environmental impacts that may be associated with each of these alternatives. These resource issues are being addressed by other specialists.

SIMULATION MODEL

A daily simulation model of Ruedi Reservoir and the Fryingpan–Arkansas Collection System was utilized for this assessment. The daily model has been used to simulate operation of the reservoir from 1975 through 2005. The model considers many variables including:

- Undepleted reservoir inflow
- Upstream Fry-Ark Project diversions
- Estimates of daily water right calls (Cameo)
- Evaporation
- Inflow bypasses when out-of-priority
- Bypasses for instream flow maintenance (110 cfs and 39 cfs)
- Timing and amount of contract water releases
- Discretionary releases for reservoir drawdown or stream flow enhancement

The following important assumptions have been utilized in this assessment:

Contract Releases. A maximum annual contract demand of 19,023 acre feet has been assumed. This demand is consistent with the currently contracted volume of water from the reservoir. Much of this contract demand is for future growth and development in the basin, and only a relatively small fraction of this contract water has been historically.

The contract water is only released from the reservoir during periods of a Cameo water right call. In the critically dry period of the summer of 2002 through the winter of 2003, a total of 19,023 acre feet of water is released from the reservoir in this model. In all other simulation years, a lesser volume of contract water is released in response to an anticipated Cameo Call of a shorter duration. No contract water is released in many above average and wet years, as a Cameo Call often does not occur in these years.

This simulation does not consider future contract demands in excess of the 19,023 acre feet that is currently committed.

Fryingpan – Arkansas Replacement Releases. The trans-basin Fryingpan-Arkansas Project collection system can divert water only if applicable instream flow conditions on the

Fryingpan River downstream of the collection system are satisfied. Commonly, natural stream flow drops below these required instream flows in the late summer, before the project is curtailed by a water right call from Cameo. However, if the trans-basin project is estimated to be out-of-priority while water is still physically available for diversion at the collection system, replacement releases are made from Ruedi Reservoir.

Fryingpan River Stream Flow below Ruedi Reservoir. Water is bypassed from the reservoir to maintain a summer stream flow of 110 cubic feet per second (cfs) and a winter flow of 39 cfs, or natural inflow, whichever is less. Please note that historical stream flow conditions in the Fryingpan River have typically exceeded these minimum amounts, particularly in above average and wet years when water availability has greatly exceeded historical water demands. The historical stream discharge is shown on the attached hydrographs in a red line. With the increased contract demands simulated in this assessment, the amount of releases in excess of the 100 cfs/39 cfs stream flow requirement is reduced. This reduction in winter flow is the result of having less water in the reservoir that needs to be evacuated over winter in order to make room for the spring snowmelt inflows to the reservoir.

Permanent 5 & 5 Water (Recovery Program). This permanent and existing Recovery Program obligation is for 5,000 acre feet of water in all years, and 10,000 acre feet in 80% of the years. In the six driest study years of the simulation (1977, 1981, 1990, 1992, 2002 and 2004) only 5,000 acre feet of water is released in this simulation.

2012 Recovery Program Water. This contract for 10,825 acre feet of water for the Recovery Program expires in 2012. This water was not included in the simulation as it will not be released from the reservoir after 2012.

ALTERNATIVES

Simulation results for the alternatives involving Ruedi Reservoir are outlined below and illustrated in the attachments.

NO-ACTION ALTERNATIVE

In the No-Action Alternative, no 10825 Water is released from Ruedi Reservoir. Please note that the simulation results for the No Action Alternative differ substantially from current conditions at or downstream of Ruedi Reservoir for the following reasons:

- Contract releases from the reservoir are substantially increased over current releases
- The annual release of 10,825 acre feet pursuant to the “2012 Agreement” no longer occurs

While the No-Action Alternative is significantly different from current conditions, we believe that a comparison with the No-Action Alternative is the most appropriate way to distinguish any changes that may specifically result from the delivery of 10825 Water from Ruedi Reservoir. The attached hydrographs illustrate future releases of water for contract purposes, for 5 & 5 Recovery Program water, and for 10825 Water. Only the changes associated with the releases of 10825 Water are associated with this assessment.

STAND ALONE RUEDI RESERVOIR - ALTERNATIVE A

In this alternative, all of the 10825 Water is supplied by Ruedi Reservoir in each and every year. Releases from Ruedi Reservoir would occur in the summer months pursuant to the Recovery Program Release Schedule. This schedule varies from year to year and is described under a separate memorandum: *Recovery Program Release Schedule (Updated 12-22-07)* which is posted at www.grandriver.us/10825 under the heading "Notes and Memos".

Potential changes in stream flow and reservoir storage are illustrated in on pages 13 through 16 for this alternative. Simulation results for each of the four study years presented in this attachment are also discussed below.

Fryingpan River Stream Flow (Exhibit 2)

- Dry Years: In a dry year such as 1977, the number of days when the July 1st through October 31st stream flow exceeds 300 cfs increases from 1 day without the 10825 Water to about 6 days if all 10,825 acre feet are released from the reservoir. In this dry year, only 5,000 acre feet of the existing "5 & 5" Recovery Program water is released rather than the full 10,000 acre feet that is used in other years.

- Below Average and Above Average Years: The number of days in which flow exceeds 300 cfs is increased by the greatest amount in the below average through above average years. This occurs because the natural flow in the Fryingpan River is greater, a full 10,000 acre feet of "5 & 5" Recovery Program water is released, and some contract releases also occur. In below average years such as 1988, the number of days that flow is in excess of 300 cfs increases by over four weeks; from 9 days without the project to 42 days when Ruedi Reservoir supplies the full 10825 Water (Exhibit 2). Further, in above average years, stream flow is simulated to exceed 400 cfs for almost four weeks, which is two weeks longer than without the 10825 water.

- Wet Years: In the wet year of 1983, the number of days that flow exceeds 300 cfs increases from 3 weeks without the project to over five weeks with 10825 Water releases. This change isn't greater because no contract releases from Ruedi Reservoir occur in wet years. Peak summer flows are simulated to exceed 450 cfs for about two weeks in wet years, with OR without the 10825 water.

- Winter Flows: In this alternative, winter stream flow is not substantially altered in a dry year like 1977. Following the summer of dry years, the reservoir is already drawn down below storage targets and excess winter releases to evacuate storage space do not occur, either with or without the release of 10825 Water. In all other study years, winter flow is reduced by about 30 cfs. This reduction occurs because less reservoir draw-down is required to meet springtime storage targets. In below average years such as 1988, winter flow drops from about 70 cfs to about 40 cfs. In the above average year of 1982, winter flow decreases from approximately 140 cfs to 110 cfs.

Roaring Fork River Stream Flow

Summer stream flow of the Roaring Fork River below Basalt is marginally increased with the release of ALL of the 10825 Water from Ruedi Reservoir. Also, winter stream flow is reduced by about 30 cfs in the below average, above average and wet study years (1988, 1982 and 1983). In the 1983 wet year, winter flow decreases from about 150 cfs to 120 cfs in this alternative.

Reservoir Storage (Exhibit 3)

Storage in Ruedi Reservoir is reduced by as much as 10,825 acre feet each summer. In the dry year of 1977, simulated reservoir storage at the end of August is about 70,400 acre feet without the release of the 10825 Water and about 61,375 acre feet with the release of the 10825 Water. This Labor Day weekend date is an important recreation target for the reservoir. At the end of October in the 1977 dry year, the reservoir content has declined to about 53,000 acre feet if all of the 10825 Water is released from the reservoir as in Alternative A.

As outlined in Exhibit 3, relative changes in storage contents are similar for the other study years, although the content of the reservoir does not get as low. Please note that 10825 Water releases are not simulated to begin until September in wet years such as 1983 therefore reservoir contents are not impacted through Labor Day.

RUEDI RESERVOIR PAIRED WITH SMALLER SULPHUR GULCH RESERVOIR – ALTERNATIVE C1

Another alternative pairs Ruedi Reservoir with an 8,000 acre foot Sulphur Gulch Reservoir. This alternative (C1) provides half of the 10825 Water obligation or 5,412 acre feet of water from Ruedi Reservoir in each and every year. This water is released at a relatively constant rate during the summer (base-load) in order to minimize fluctuations in the flow of the Fryingpan River. Sulphur Gulch Reservoir provides the remaining 5,412 acre feet each year. Releases from Sulphur Gulch Reservoir (peaking releases) are varied more than Ruedi Reservoir releases in order to coincide with fluctuating Recovery Program demands in the 15 Mile Reach.

The simulated changes in stream flow and reservoir storage associated with this alternative are illustrated on pages 17 through 20.

Fryingpan River Stream Flow (Exhibit 2)

- Dry Years: In the 1977 dry year, releasing half of the 10825 water from Ruedi Reservoir augments flow in the Fryingpan by about 50 cfs per day. Discharge of the Fryingpan River is simulated to exceed 300 cfs for only one day, either with or without the 10825 Water. This alternative would not increase the number of days that stream flow exceeds 300 cfs.

- Below Average and Above Average Years: In moderate years (1988 and 1982), the flow of the Fryingpan River exceeds 300 cfs for an additional two to four weeks over the No-Action Alternative. The number of days in which flow exceeds 400 cfs is not affected by this alternative.

- Wet Years: In the 1983 wet year, this alternative will not increase the number of days between July 1st and September 31st that stream flow exceeds 300 cfs. The Fryingpan River discharge will exceed 300 cfs for 23 days during this period with or without the release of 10825 Water (the same as the No-Action alternative). The 300 cfs flow target is exceeded in July as snowmelt runoff is receding.

- Winter Flows: Winter stream flow decreases about 15 to 20 cfs in all years except very dry years. In the below average year of 1988, winter flow drops from about 70 cfs to about 55 cfs. In the above average year of 1982, winter flow decreases from approximately 140 cfs to 125 cfs. In the 1983 wet year, winter flow decreases from about 150 cfs to 135 cfs.

Roaring Fork River Stream Flow

Summer stream flow of the Roaring Fork River below Basalt is marginally increased with the release of 10825 Water (pages 17 through 20). Also, winter stream flow is reduced by about 15 to 20 cfs in below average, above average and wet years such as 1988, 1982, and 1983.

Reservoir Storage (Exhibit 3)

With half of the 10825 Water released from Ruedi Reservoir, end of August storage in Ruedi Reservoir is reduced by 3,000 to 4,000 acre feet in most years. In the wet year of 1983, reservoir storage is not affected through Labor Day, as 10825 Water releases do not begin until after this time.

RUEDI RESERVOIR PAIRED WITH BUZZARD CREEK RESERVOIR – ALTERNATIVE C2

This alternative is identical to the above alternative (C1) except that 5,412 acre feet is supplied from Buzzard Creek Reservoir instead of Sulphur Gulch Reservoir. The impacts of this alternative to Ruedi Reservoir, and to the stream flow of the Fryingpan River and the Roaring Fork River, are identical.

RUEDI RESERVOIR PAIRED WITH WILLIAMS FORK RESERVOIR – ALTERNATIVE C3

This paired alternative would provide different amounts of water from Ruedi and Williams Fork Reservoirs from year to year, depending upon whether it was a drier than average or wetter than average year.

In this scenario, Ruedi Reservoir provides 8,125 acre feet of the 10825 Water in above average and wet years (when Williams Fork Reservoir fills) while Williams Fork Reservoir provides the remaining 2,700 acre feet of 10825 Water. In below average and dry years Ruedi Reservoir would supply 13,525 acre feet of water; all of the 10,825 acre feet of water, plus an additional 2,700 acre feet of water from a Reserve Account. The Reserve Account is established to prevent a loss of yield to Denver Water that may associated with prior year releases from Williams Fork Reservoir.

Total releases from Ruedi Reservoir for this alternative are summarized in Table 1. Also, the operation of Williams Fork Reservoir and the concept of the 'reserve account' in this alternative is addressed in a separate memorandum entitled *Williams Fork Reservoir Paired With Ruedi or Sulphur Gulch (12-20-07)* which is posted at www.grandriver.us/10825 under the heading 'Notes and Memos'.

Table 1
Recovery Program Water Sources for Alternative C3 (acre feet)

	10825 Water			Ruedi Reservoir		
Study Year	Williams Fork Reservoir	Ruedi Reservoir	Total	10825 Water	Reserve Account Releases	Total Releases
Dry (1977)	0	10,825	10,825	10,825	2,700	13,525
Below Average (1988)	0	10,825	10,825	10,825	2,700	13,525
Above Average (1982)	2,700	8,125	10,825	8,125	0	8,125
Wet (1983)	2,700	8,125	10,825	8,125	0	8,125

The simulated changes in stream flow and reservoir storage associated with this alternative are illustrated on pages 21 through 24. In below average years, pairing Ruedi Reservoir and Williams Fork Reservoir modifies stream flow and reservoir storage the most of any alternative involving Ruedi Reservoir, as dry year reservoir releases are the greatest.

Fryingpan River Stream Flow (Exhibit 2)

- Dry Years: In the 1977 dry year, the number of days Fryingpan River stream flow exceeds 300 cfs increases from 1 day without 10825 Water to about three weeks with this alternative.

- Below Average and Above Average Years: In the below average year of 1988 with this paired alternative, the time Fryingpan River stream flows exceed 300 cfs increases from one week without 10825 Water to about seven weeks. In the above average year of 1982, flows over 300 cfs increase from four weeks without 10825 Water to six weeks with this alternative. We estimate that the greatest change in the number of days with stream flow over 300 cfs will

occur in moderate water years (1988 and 1982). This alternative also substantially increases the number of days in which flow exceeds 400 and 450 cfs.

- Wet Years: In the 1983 wet year, Fryingpan River stream flows would exceed 300 cfs for about three weeks without 10825 Water and for about five weeks with this alternative.

- Winter Flow: Winter stream flow decreases about 25 to 30 cfs in all years except dry years such as 1977. No change in winter flow is expected during very dry years, when releases will approach the 39 cfs minimum instream flow requirement with or without the release of 10825 Water.

Roaring Fork River Stream Flow

Summer stream flow of the Roaring Fork River below Basalt is marginally increased with the release of 10825 Water (pages 21 through 24) with this paired alternative. Also, winter stream flow is reduced by about 25 to 30 cfs in the below average, above average and wet years of 1988, 1982, and 1983.

Reservoir Storage (Exhibit 3)

With this alternative, end of August storage in Ruedi Reservoir is reduced by about 12,000 acre feet in dry years. Labor Day storage in 1977 is simulated to be about 67,000 acre feet. In moderate years, the end of August storage decreases by about 10,000 acre feet. In the wet study year (1983), reservoir storage is not affected through Labor Day, as 10825 Water releases do not begin until after this time.

RUEDI RESERVOIR PAIRED WITH WOLFORD MOUNTAIN RESERVOIR – ALTERNATIVE C5

In this paired alternative, 5,412 acre feet of water is provided from Ruedi Reservoir, and the remaining 5,412 acre feet of water is provided from an enlarged Wolford Mountain Reservoir and Colorado River pumping station in each and every year.

Unlike alternatives C1 and C2, the Ruedi Reservoir water is not base-loaded throughout the Recovery Program demand period. Instead, Ruedi Reservoir releases occur early in the demand period and Wolford Mountain Reservoir releases occur later in the demand period. This schedule supports secondary objectives by providing releases to the upper Colorado River later in the year, when stream flow may be most critical in this area.

The simulated changes in stream flow and reservoir storage associated with this alternative are illustrated on pages 25 through 28. While this alterative releases the same amount of Recovery Program water as Alternatives C1 and C2 (5,412 acre feet), the changes to Fryingpan River stream flow may be more significant. This is because the Recovery Program releases are concentrated earlier in the summer, and are not base-loaded as they are in Alternatives C1 and C2.

Fryingpan River Stream Flow (Exhibit 2)

- Dry Years: In the 1977 dry year, stream flow in the Fryingpan River would exceed 300 cfs for about 1 day without 10825 Water and would exceed 300 cfs for about one week with half of the 10825 Water released in a short period earlier in the summer months. This alternative would also cause stream flow to exceed 450 cfs for about six days in the 1977 year.

- Below Average and Above Average Years: In below average years the flow of the Fryingpan River exceeds 300 cfs for 9 days without 10825 Water, and increases to four weeks with this alternative. In above average years, flows above 300 cfs increase from four weeks without 10825 Water to six weeks with this alternative. We estimate that the greatest change in the number of days over 300 cfs will occur in moderate water years such as 1988 and 1982. Using Ruedi paired with Wolford also substantially increases the number of days in which flow exceeds 400 cfs.

- Wet Years: In the 1983 wet year, stream flow in the Fryingpan would exceed 300 cfs for about three weeks without 10825 Water and for about five weeks with this alternative.

- Winter Flows: Winter stream flow decreases about 15 to 20 cfs in all years except very dry years. In below average years such as 1988, winter flow drops from about 70 cfs to about 55 cfs. In the above average year of 1982, winter flow decreases from approximately 140 cfs to 125 cfs. In the wet year of 1983, winter flow decreases from about 150 cfs to 135 cfs.

Roaring Fork River Stream Flow

Summer stream flow of the Roaring Fork River below Basalt is marginally increased with the release of 10825 Water (pages 23 through 28). Also, winter stream flow is reduced by about 15 to 20 cfs in below average, above average and wet years.

Reservoir Storage (Exhibit 3)

With this alternative, end of August storage in Ruedi Reservoir is reduced by 3,000 to 4,000 acre feet in dry, below average, and above average years. In the 1983 wet year, reservoir storage is not affected through Labor Day, as 10825 Water releases do not begin until after this time.

SUMMARY AND CONCLUSIONS: RUEDI RESERVOIR ALTERNATIVES

- Each of the alternatives will increase the number of days between July 1st and October 31st when stream flow of the Fryingpan River exceeds 300 cfs. The largest increase in the number of days above 300 cfs is associated with the pairing of Ruedi Reservoir with Williams Fork Reservoir (Alternative C3). In the below average year of 1988, stream flow is simulated to exceed 300 cfs for an additional six weeks with this alternative. In this alternative, 13,525 acre feet of water is released in below average years, in order to compensate Denver Water for the 2,700 acre feet prior year releases from Williams Fork Reservoir.

- Ruedi Reservoir paired with Sulphur Gulch (Alternative C1) and Ruedi Reservoir paired with Buzzard Creek (Alternative C2) both provide relatively constant releases of 5,412 acre feet from Ruedi Reservoir in all years. These alternatives have the least affect on stream flow of both the Fryingpan River and the Roaring Fork River.

- Ruedi Reservoir alone (Alternative A), or Ruedi paired with Williams Fork Reservoir (Alternative C3) or Wolford Mountain Reservoir (Alternative C5) also increases the number of days that Fryingpan River stream flow exceeds 400 cfs. Ruedi Reservoir paired with Sulphur Gulch Reservoir or Buzzard Creek Reservoir (Alternatives C1 and C2) does not increase the number of days that discharge of the Fryingpan River exceeds 400 cfs.

- Winter stream flow of the Fryingpan River is typically decreased by 15 cfs to 30 cfs, depending upon the alternative. An exception to this is during a critically dry year such as 1977. In a 1977 type year, the minimum release of 39 cfs from Ruedi Reservoir is likely to occur, both with and without the supply of 10825 Water.

- On a percentage basis, none of the alternatives substantially alter stream flow of the Roaring Fork River below Basalt. Never-the-less, aquatic habitat changes in the Roaring Fork River may be important and will be addressed by other specialists.

- Storage in Ruedi Reservoir at the end of August (Labor Day) will be decreased with the supply of 10825 Water in all years, except the wet year of 1983. Labor Day storage decreases will likely range from less than 4,000 acre feet when Ruedi Reservoir is paired with Sulphur Gulch or Buzzard Creek (Alternatives C1 and C2), to about 14,000 acre feet when Ruedi Reservoir is paired with Williams Fork Reservoir (Alternative C3).

Exhibit 1

ALLOCATION OF WATER SUPPLY

Primary 10825 WATER SUPPLY ALTERNATIVES

Project Element	NO ACTION ALTERNATIVE	STAND ALONE ALTERNATIVES		SYNCHRONIZED ALTERNATIVES					
		Alternative A: Ruedi Reservoir	Alternative B: Sulphur Gulch Reservoir	Alternative C1: Ruedi / Sulphur Gulch Reservoirs	Alternative C2: Ruedi / Buzzard Creek Reservoirs	Alternative C3: Ruedi / Williams Fork Reservoirs	Alternative C4: Sulphur Gulch / Williams Fork Reservoirs	Alternative C5: Wolford Mtn / Ruedi Reservoirs	Alternative C6: Buzzard Ck / Wolford Mtn Reservoirs
Ruedi Reservoir		10,825 AF		5,412 AF (baseload release)	5,412 AF (baseload release)	8,125 AF most years 13,525 AF dry years		5,412 AF	
Sulphur Gulch Reservoir (16,000 AF)			10,825 AF				8,125 AF most years 13,525 AF dry years		
Sulphur Gulch Reservoir (8,000 AF)				5,412 AF (peaking release)					
Buzzard Creek Reservoir (16,800 AF)					5,412 AF (peaking release)				5,412 AF dry years 10,825 AF all other years
Williams Fork Reservoir						2,700 AF if reservoir fills 0 AF dry years	2,700 AF if reservoir fills 0 AF dry years		
Wolford Mtn Reservoir Pumpback & Enlargement								5,412 AF	5,412 AF dry years only
Grandby Reservoir									
Orchard Mesa Water Management / Green Mtn HUP Surplus									
Wolcott Reservoir (1)									
Webster Hill Reservoir (1)									
Roan Creek Reservoir(1)									
Yank Creek Reservoir(1)									
Grand Valley Lake (1)									
15 Mile Reach Pumpback (1)									
Shoshone Subordination (1)									

(1) Screened from further consideration at this time

Exhibit 2

Fryingpan River below Rocky Fork; July 1 through October 31

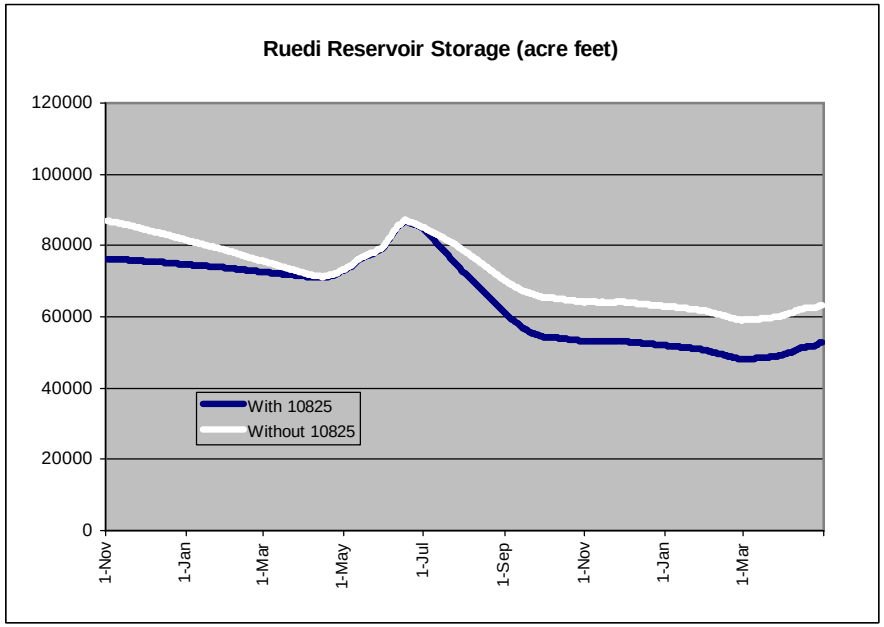
	No Action	Alternative A: 10,825 AF from Ruedi	Alt. C1 & C2: 5,412 AF from Ruedi (baseload)	Alt. C3: 8,125 AF most years; 13,525 AF dry years	Alt. C5: 5,412 AF from Ruedi (early season)
Other 10825 Supplies	N/A	N/A	Sulphur Gulch (C1), Buzzard Ck (C2)	Williams Fork Reservoir	Wolford Mtn Reservoir
300 cfs: Number of Days Flow Exceeded					
Dry (1977)	1	6	1	20	6
Below Average (1988)	9	42	35	48	28
Above Average (1982)	29	43	43	43	43
Wet (1983)	23	37	23	37	37
400 cfs: Number of Days Flow Exceeded					
Dry (1977)	0	1	0	1	1
Below Average (1988)	0	14	1	14	14
Above Average (1982)	2	23	2	23	16
Wet (1983)	15	27	15	27	15
450 cfs: Number of Days Flow Exceeded					
Dry (1977)	0	1	0	1	1
Below Average (1988)	0	1	0	1	1
Above Average (1982)	0	21	0	21	0
Wet (1983)	14	14	14	14	14

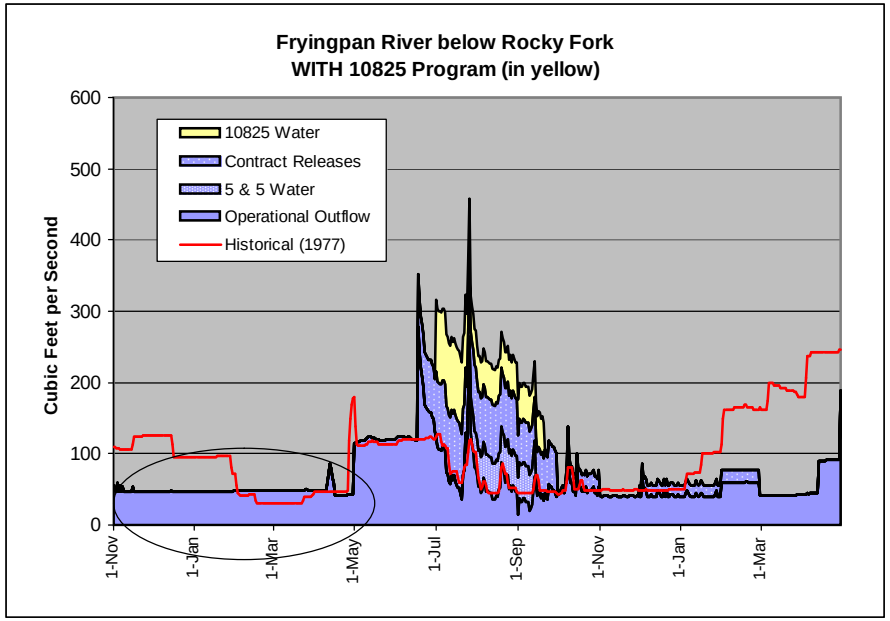
Exhibit 3

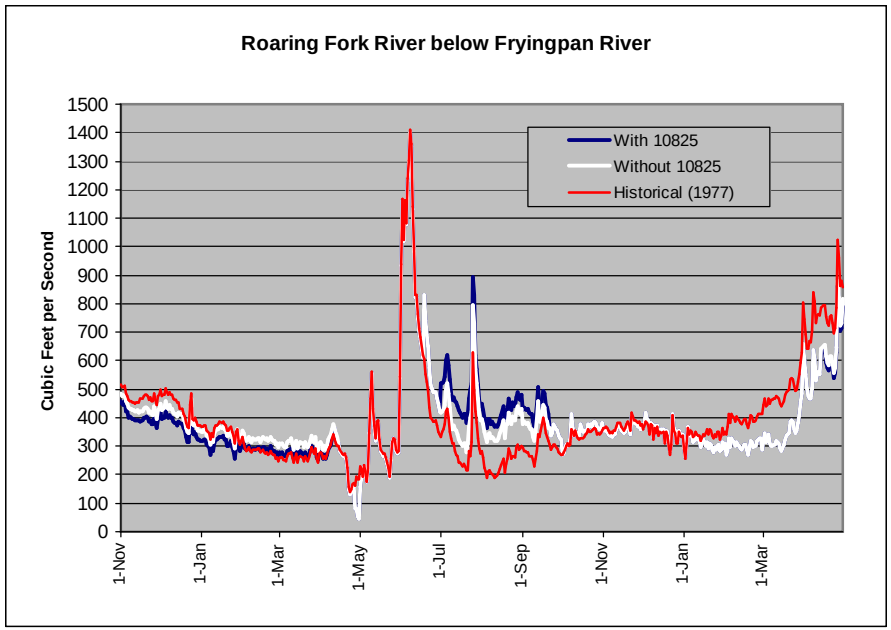
Simulated End of August Storage Contents
Ruedi Reservoir (acre feet)

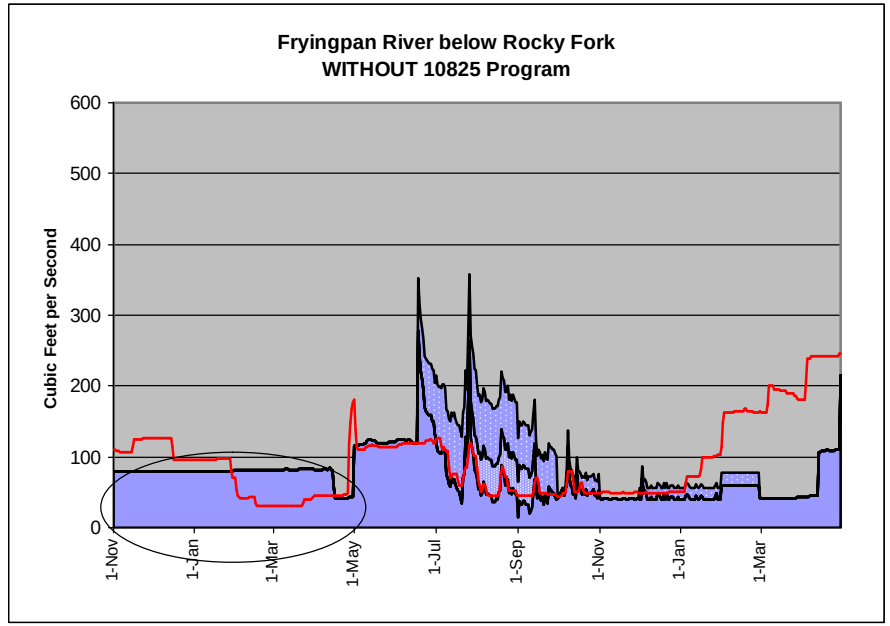
	No Action	Alternative A: 10,825 AF from Ruedi	Alt. C1 & C2: 5,412 AF from Ruedi (baseload)	Alt. C3: 8,125 AF most years; 13,525 AF dry years	Alt. C5: 5,412 AF from Ruedi (early season)
Other 10825 Supplies	N/A	N/A	Sulphur Gulch (C1), Buzzard Ck (C2)	Williams Fork Reservoir	Wolford Mtn Reservoir
Dry (1977)	70,402	61,374	66,914	58,761	64,924
Below Average (1988)	86,087	77,275	82,589	76,575	80,633
Above Average (1982)	94,691	85,976	91,363	86,576	89,283
Wet (1983)	102,373	102,373	102,373	102,373	102,373

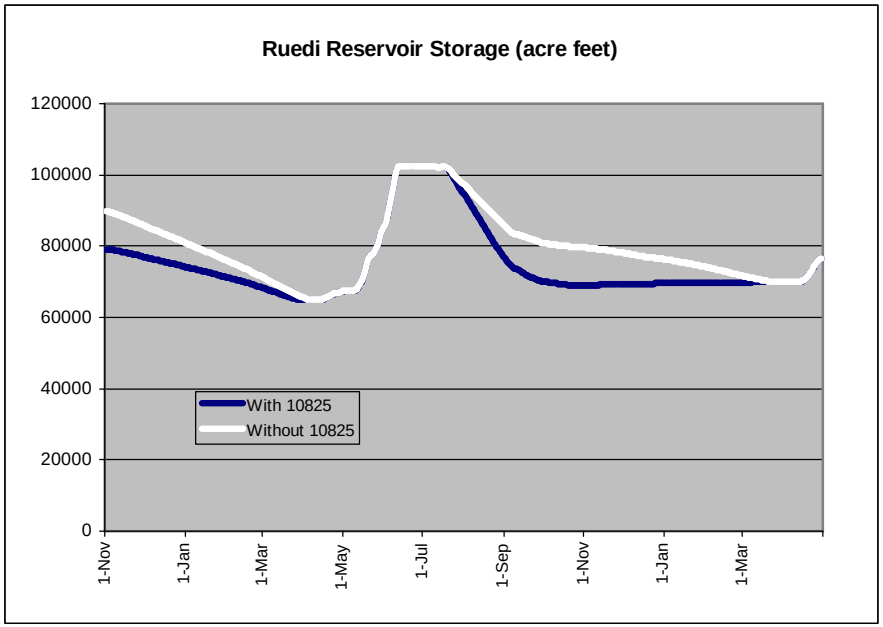
ALTERNATIVE A **10,825 AF from Ruedi Reservoir** **1977 (DRY YEAR)**

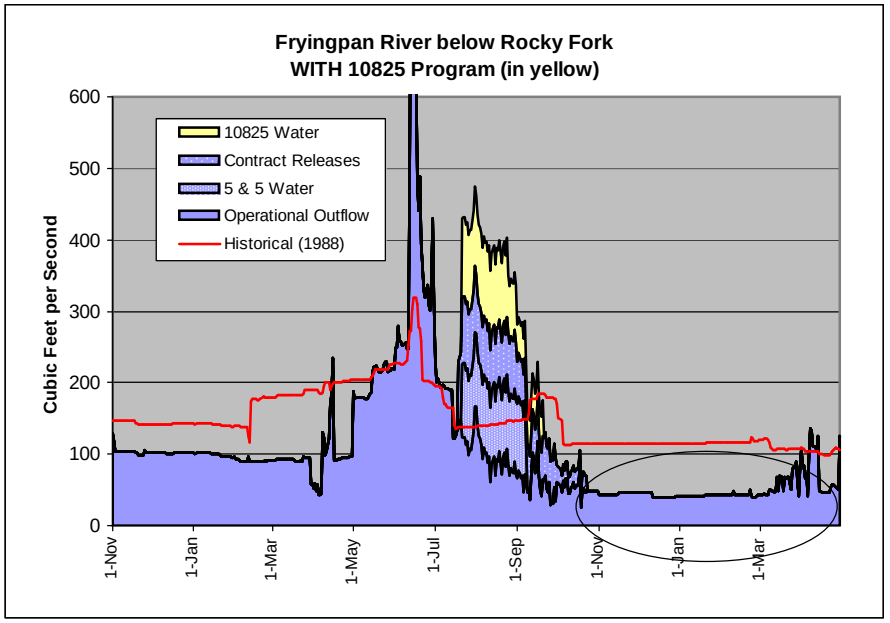


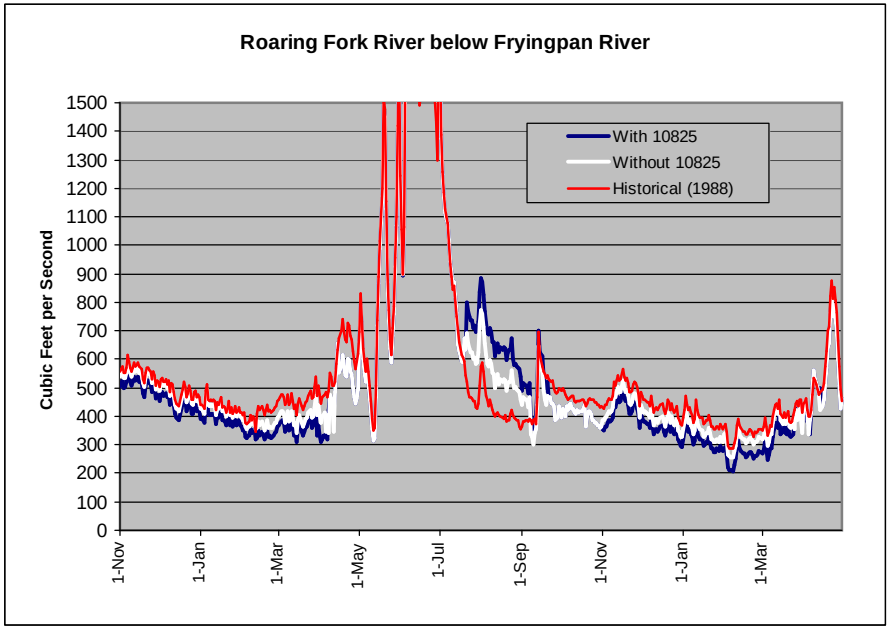


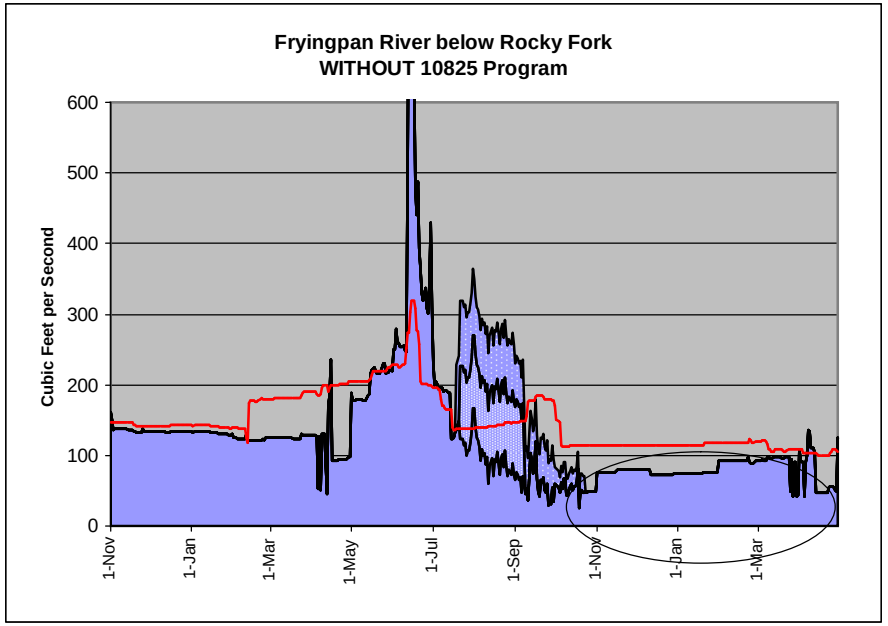


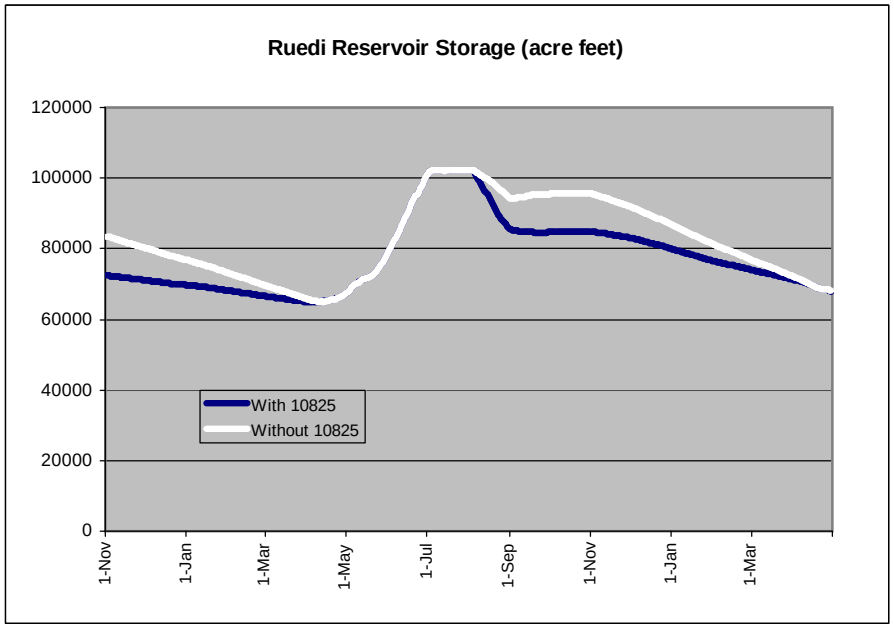


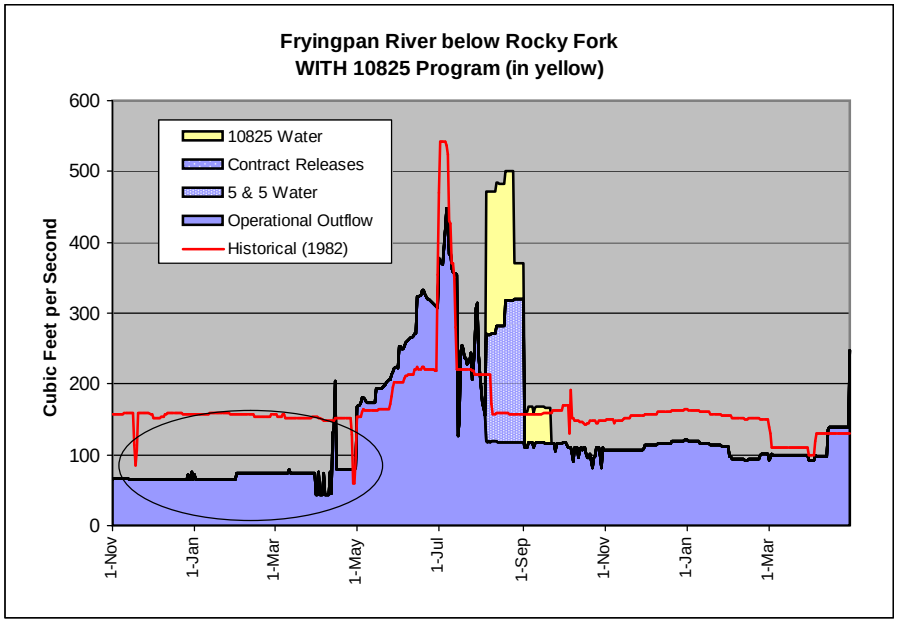

Ruedi Reservoir Storage (acre feet)
120000
100000
80000
60000
40000
20000
0
With 10825
Without 10825
1-Nov
1-Jan
1-Mar
1-May
1-Jul
1-Sep
1-Nov
1-Jan
1-Mar

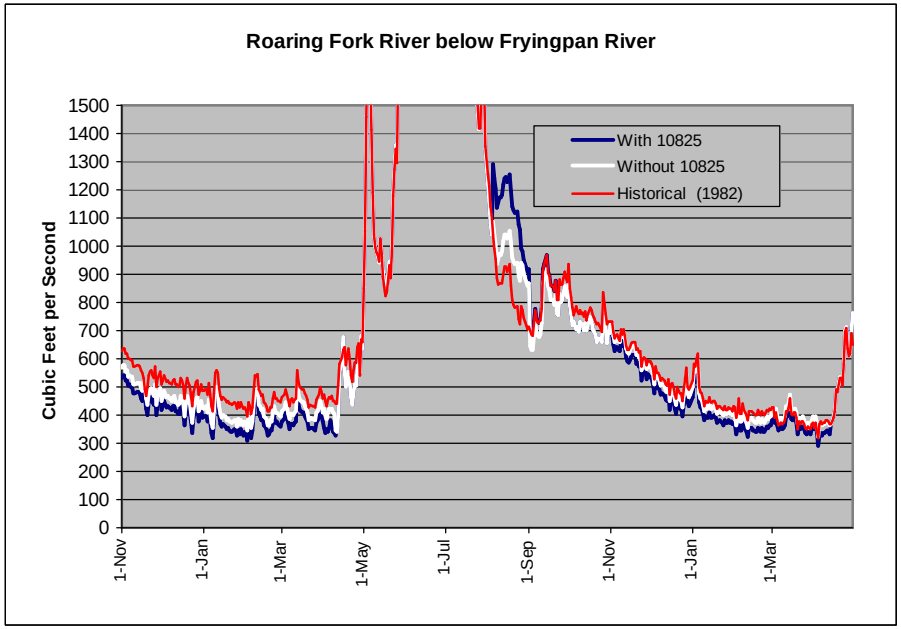

Fryingpan River below Rocky Fork
WITH 10825 Program (in yellow)
Cubic Feet per Second
600
500
400
300
200
100
0
10825 Water
Contract Releases
5 & 5 Water
Operational Outflow
Historical (1988)
1-Nov
1-Jan
1-Mar
1-May
1-Jul
1-Sep
1-Nov
1-Jan
1-Mar

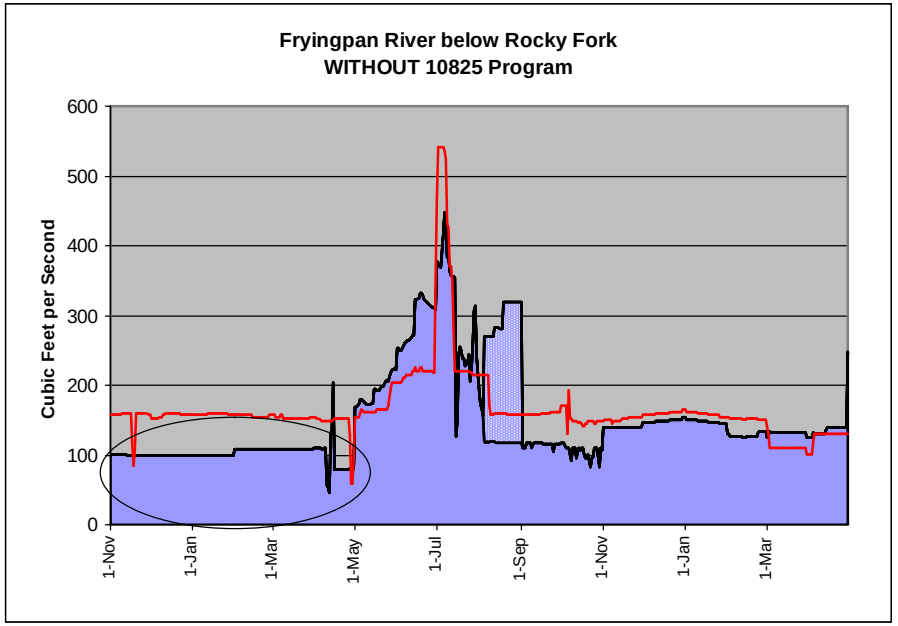

Roaring Fork River below Fryingpan River
Cubic Feet per Second
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
With 10825
Without 10825
Historical (1988)
1-Nov
1-Jan
1-Mar
1-May
1-Jul
1-Sep
1-Nov
1-Jan
1-Mar

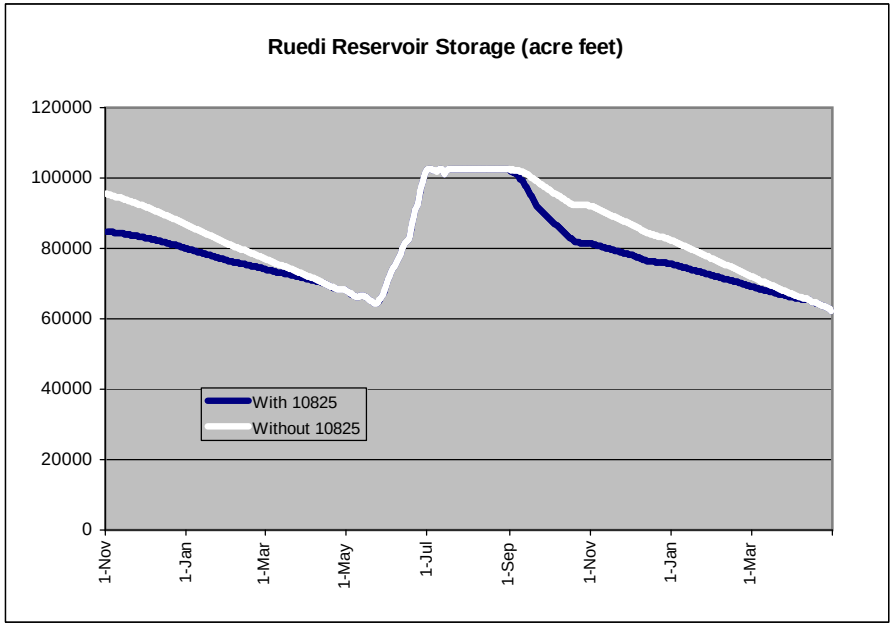

Fryingpan River below Rocky Fork
WITHOUT 10825 Program
Cubic Feet per Second
600
500
400
300
200
100
0
1-Nov
1-Jan
1-Mar
1-May
1-Jul
1-Sep
1-Nov
1-Jan
1-Mar

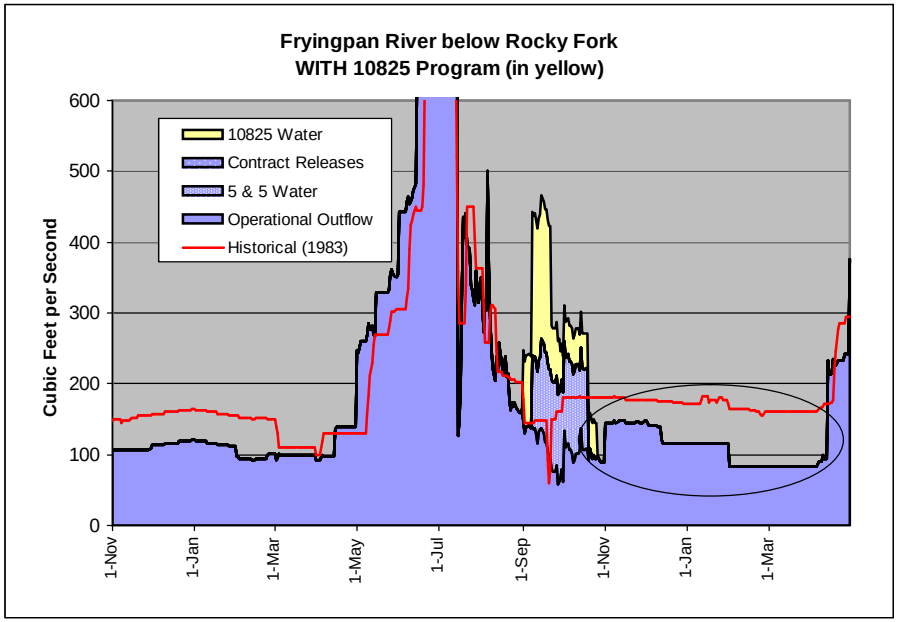

Ruedi Reservoir Storage (acre feet)
120000
100000
80000
60000
40000
20000
0
With 10825
Without 10825
1-Nov
1-Jan
1-Mar
1-May
1-Jul
1-Sep
1-Nov
1-Jan
1-Mar

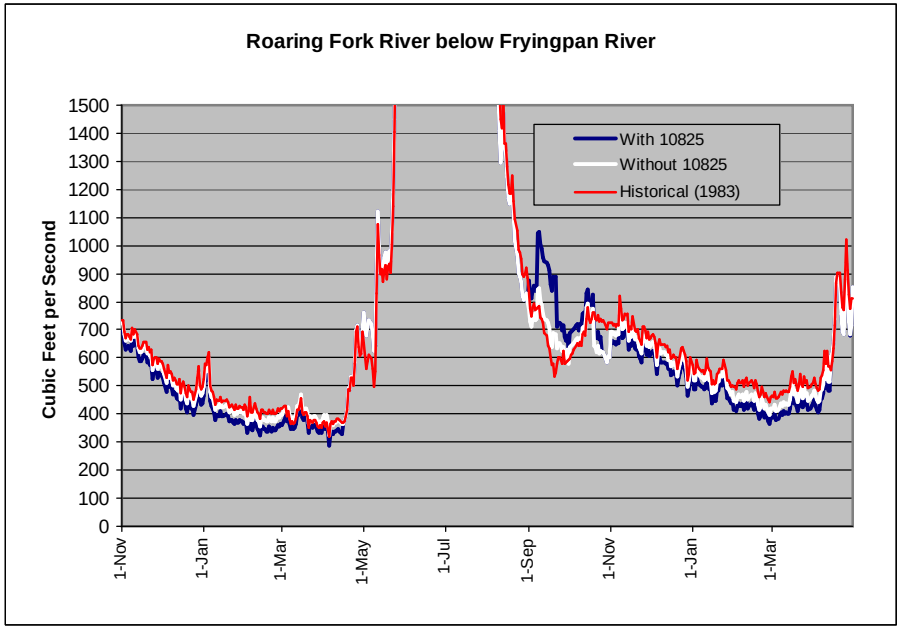

Fryingpan River below Rocky Fork
WITH 10825 Program (in yellow)
Cubic Feet per Second
600
500
400
300
200
100
0
10825 Water
Contract Releases
5 & 5 Water
Operational Outflow
Historical (1982)
1-Nov
1-Jan
1-Mar
1-May
1-Jul
1-Sep
1-Nov
1-Jan
1-Mar

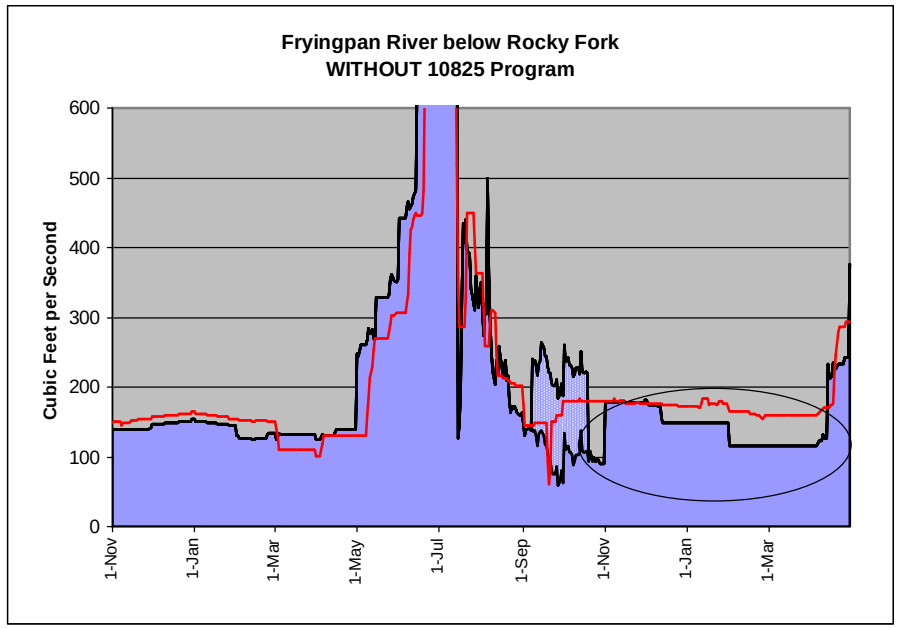

Roaring Fork River below Fryingpan River
Cubic Feet per Second
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
With 10825
Without 10825
Historical (1982)
1-Nov
1-Jan
1-Mar
1-May
1-Jul
1-Sep
1-Nov
1-Jan
1-Mar


Fryingpan River below Rocky Fork
WITHOUT 10825 Program
Cubic Feet per Second
600
500
400
300
200
100
0
1-Nov
1-Jan
1-Mar
1-May
1-Jul
1-Sep
1-Nov
1-Jan
1-Mar

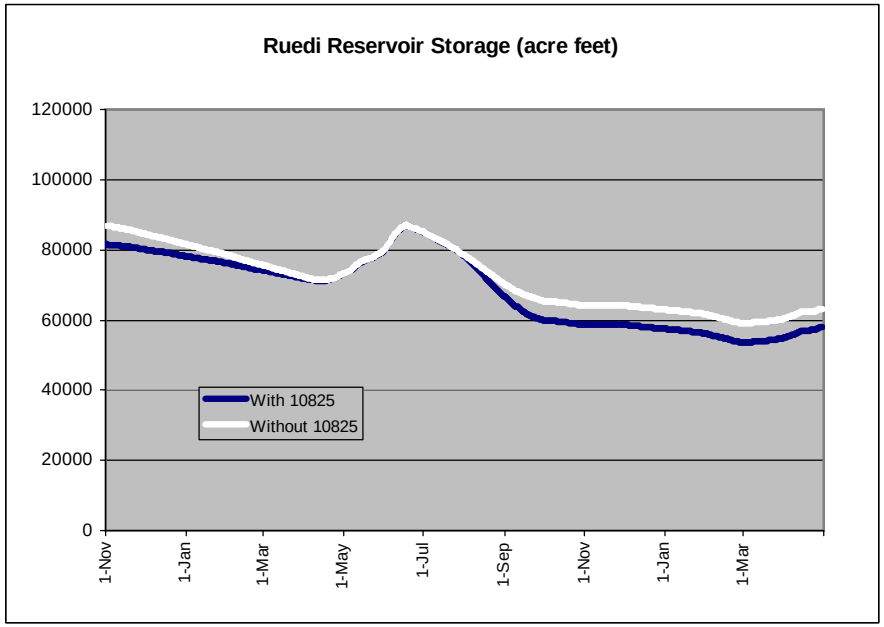

Ruedi Reservoir Storage (acre feet)
120000
100000
80000
60000
40000
20000
0
With 10825
Without 10825
1-Nov
1-Jan
1-Mar
1-May
1-Jul
1-Sep
1-Nov
1-Jan
1-Mar

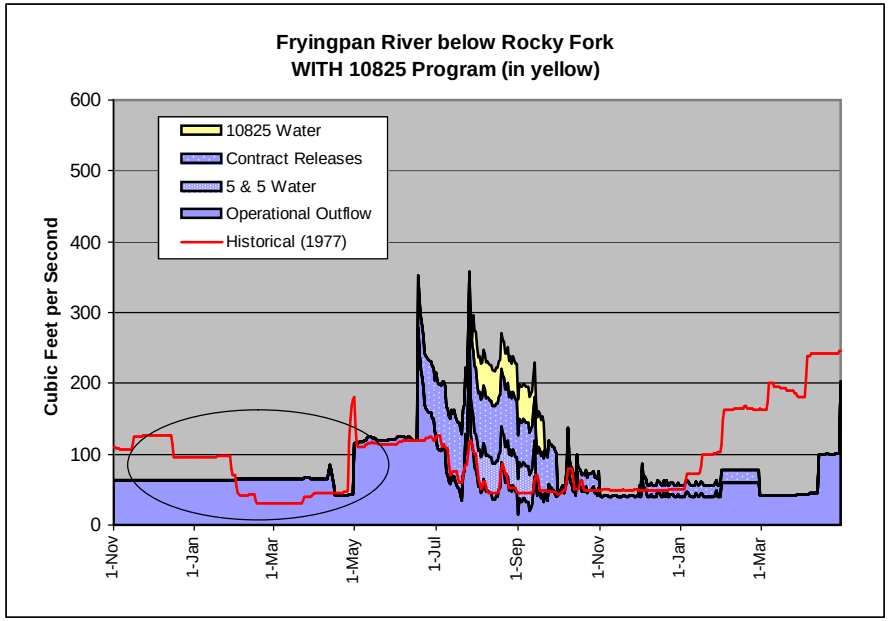

Fryingpan River below Rocky Fork
WITH 10825 Program (in yellow)
Cubic Feet per Second
600
500
400
300
200
100
0
10825 Water
Contract Releases
5 & 5 Water
Operational Outflow
Historical (1983)
1-Nov
1-Jan
1-Mar
1-May
1-Jul
1-Sep
1-Nov
1-Jan
1-Mar

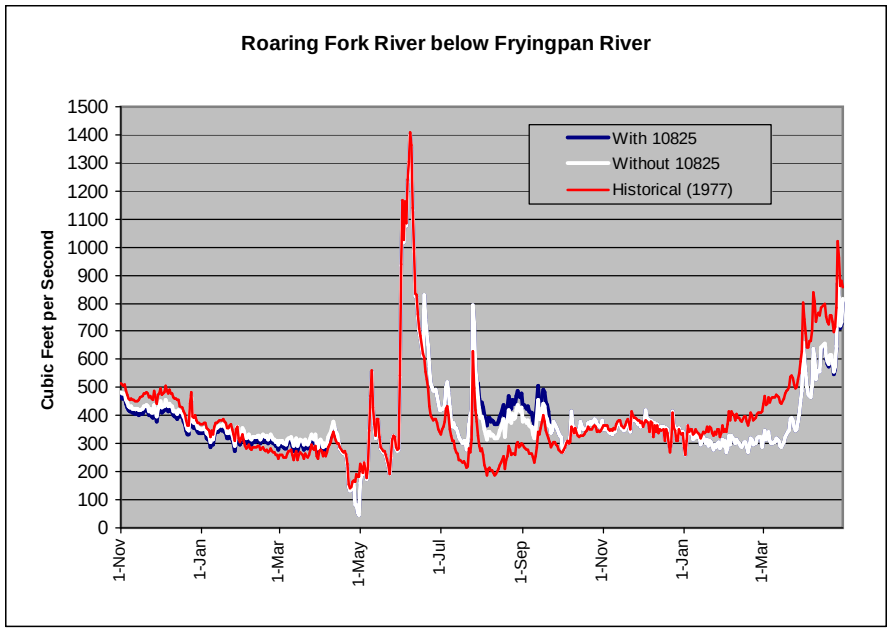

Roaring Fork River below Fryingpan River
Cubic Feet per Second
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
With 10825
Without 10825
Historical (1983)
1-Nov
1-Jan
1-Mar
1-May
1-Jul
1-Sep
1-Nov
1-Jan
1-Mar

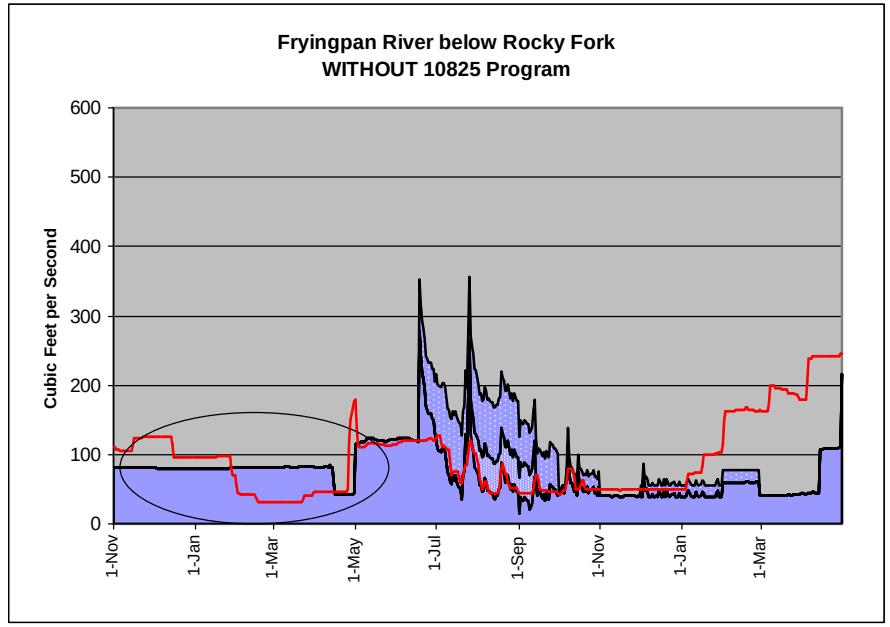

Fryingpan River below Rocky Fork
WITHOUT 10825 Program
Cubic Feet per Second
600
500
400
300
200
100
0
1-Nov
1-Jan
1-Mar
1-May
1-Jul
1-Sep
1-Nov
1-Jan
1-Mar

ALTERNATIVES C1 & C2 **5,412 AF from Ruedi Reservoir (baseload) with Sulphur Gulch or Buzzard Creek** **1977 (DRY YEAR)**

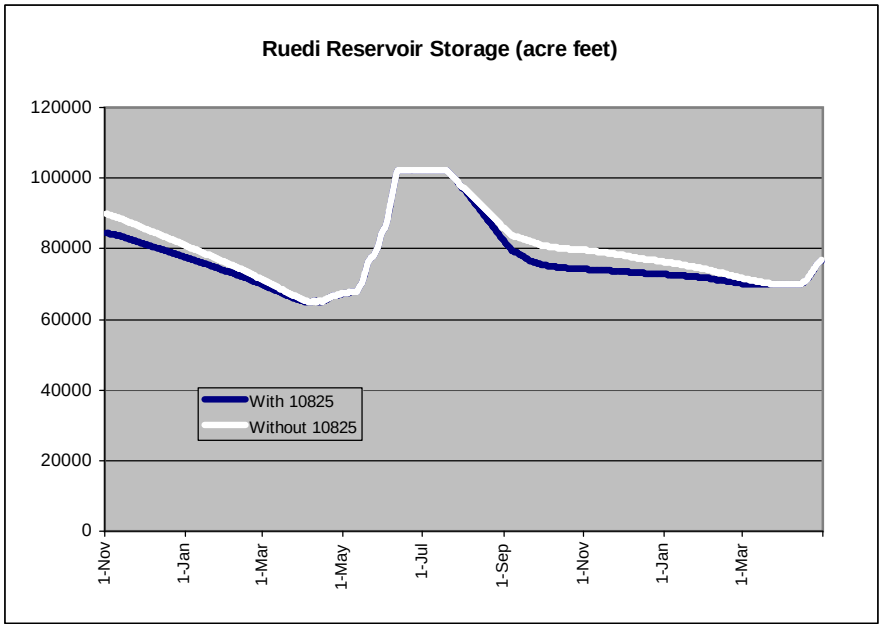


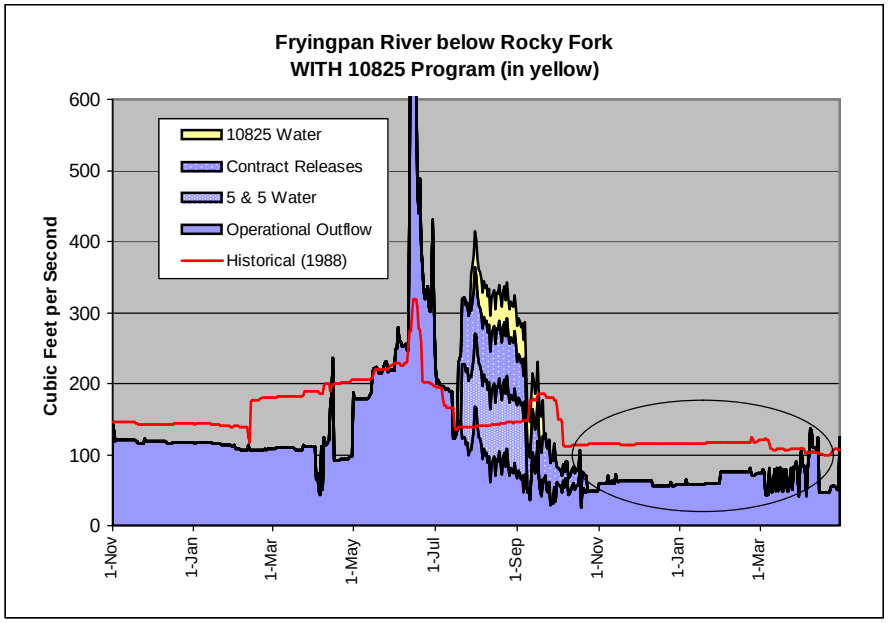


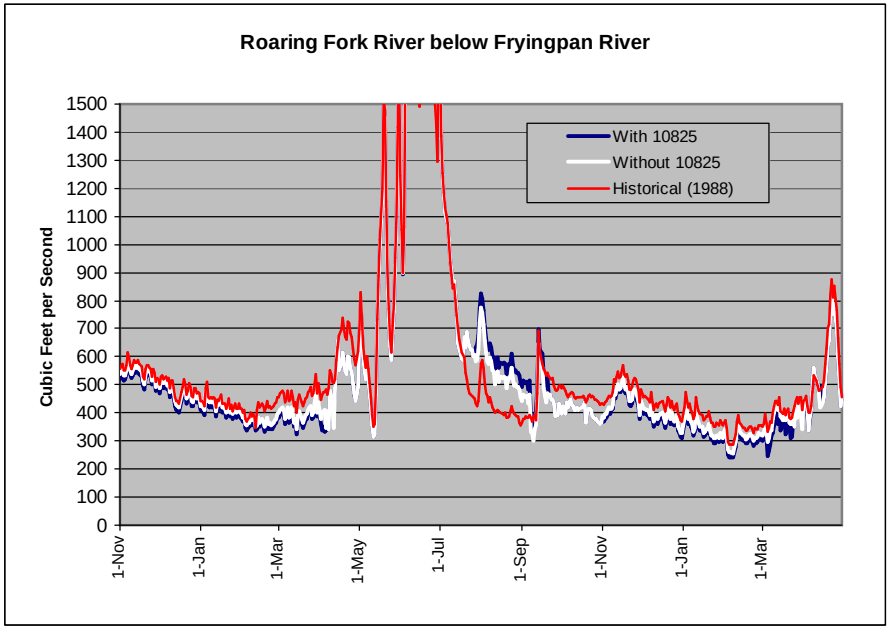


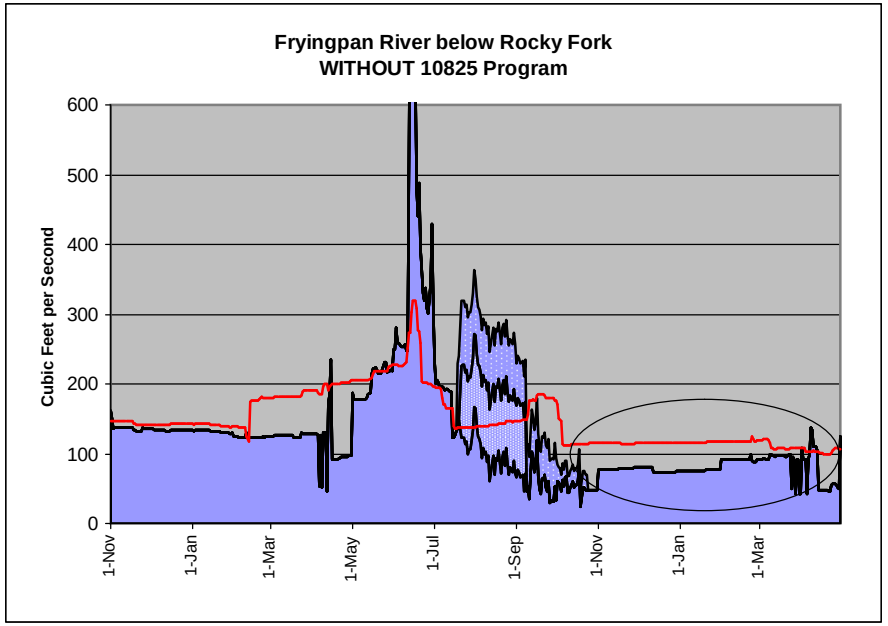


ALTERNATIVES C1 & C2 **5,412 AF from Ruedi Reservoir (baseload) with Sulphur Gulch or Buzzard Creek** **1988 (BELOW AVERAGE)**

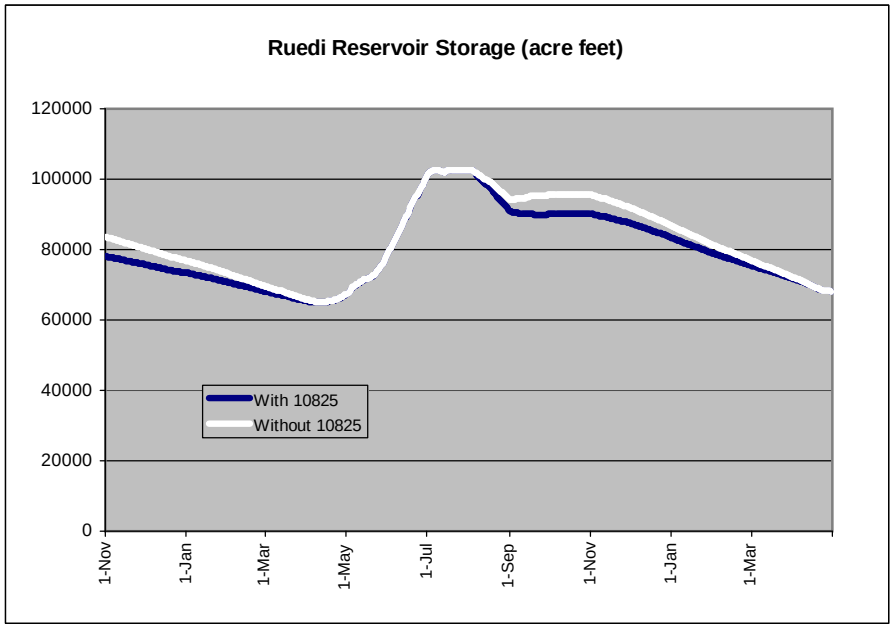


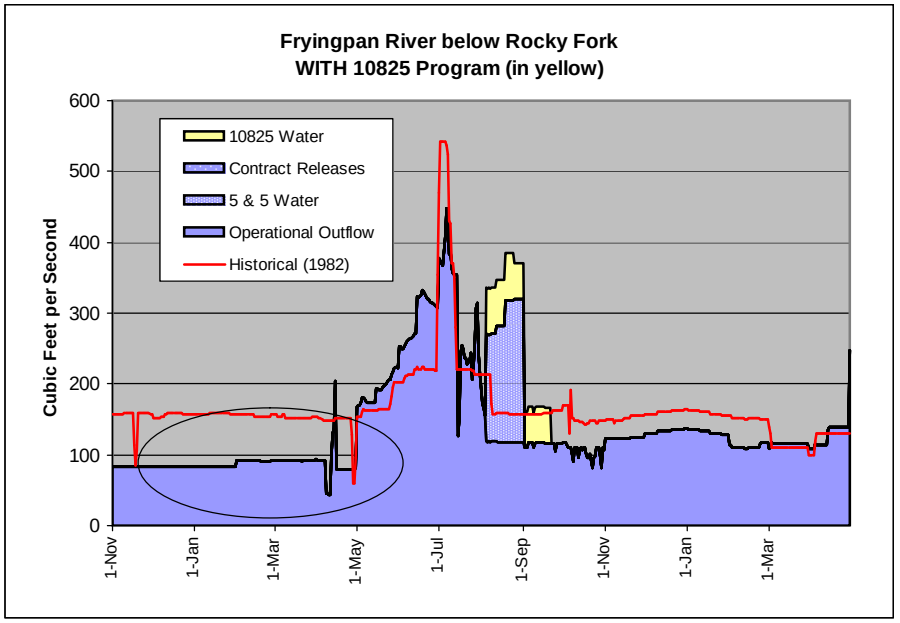


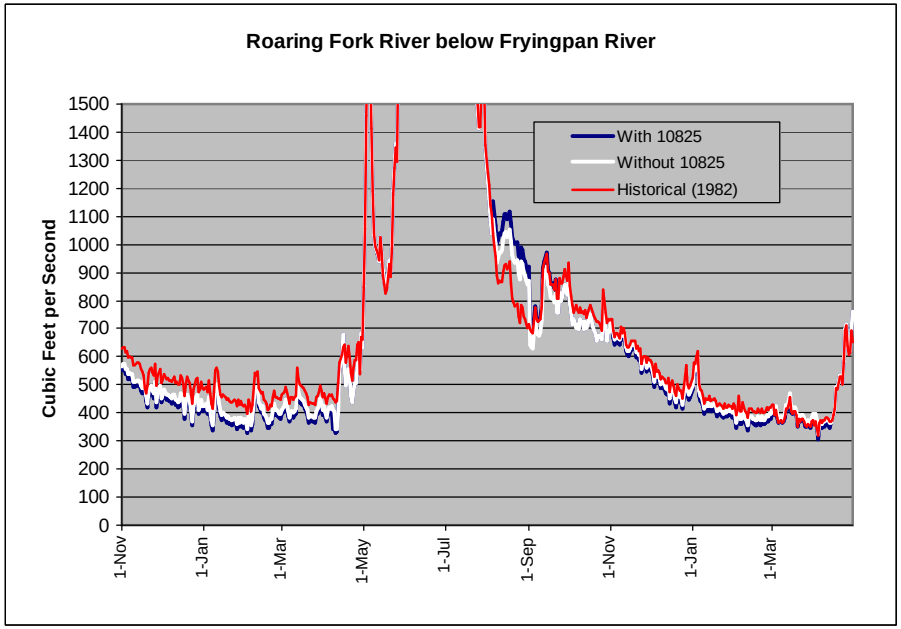


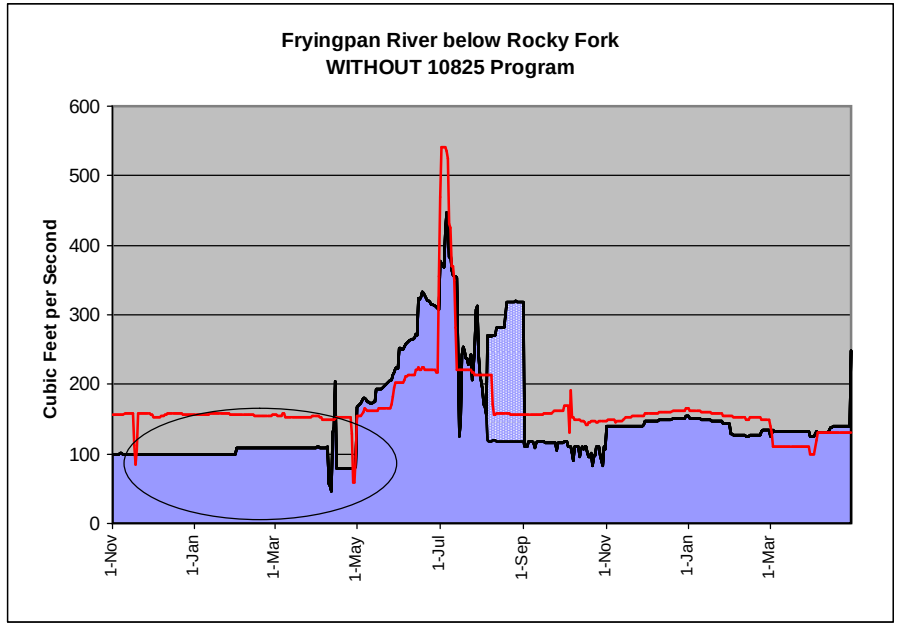


ALTERNATIVES C1 & C2 **5,412 AF from Ruedi Reservoir (baseload) with Sulphur Gulch or Buzzard Creek** **1982 (ABOVE AVERAGE)**

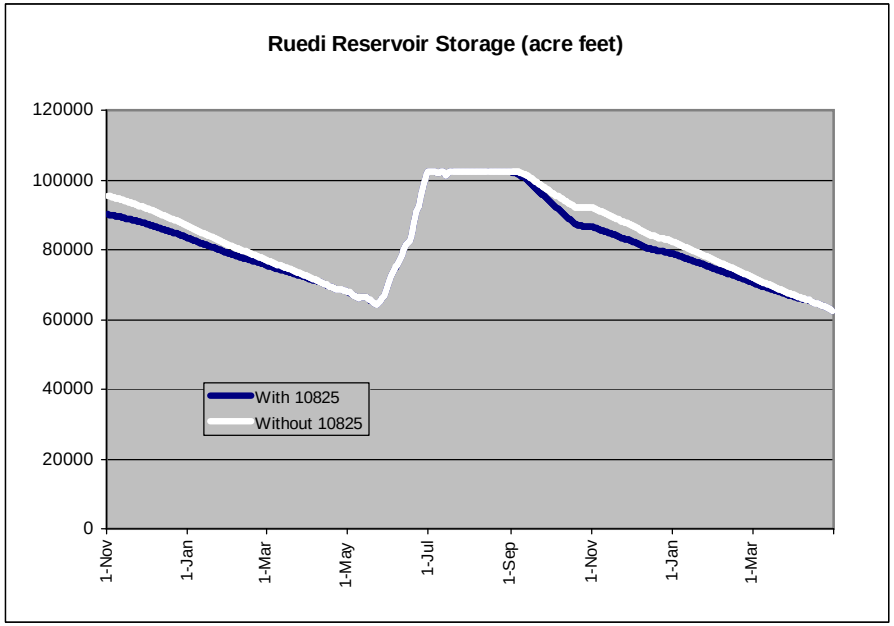


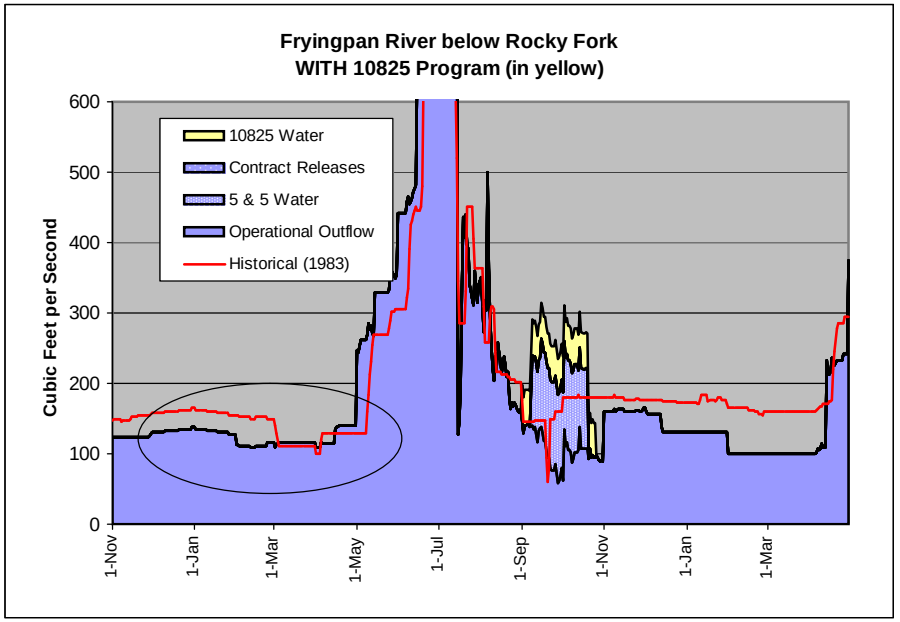


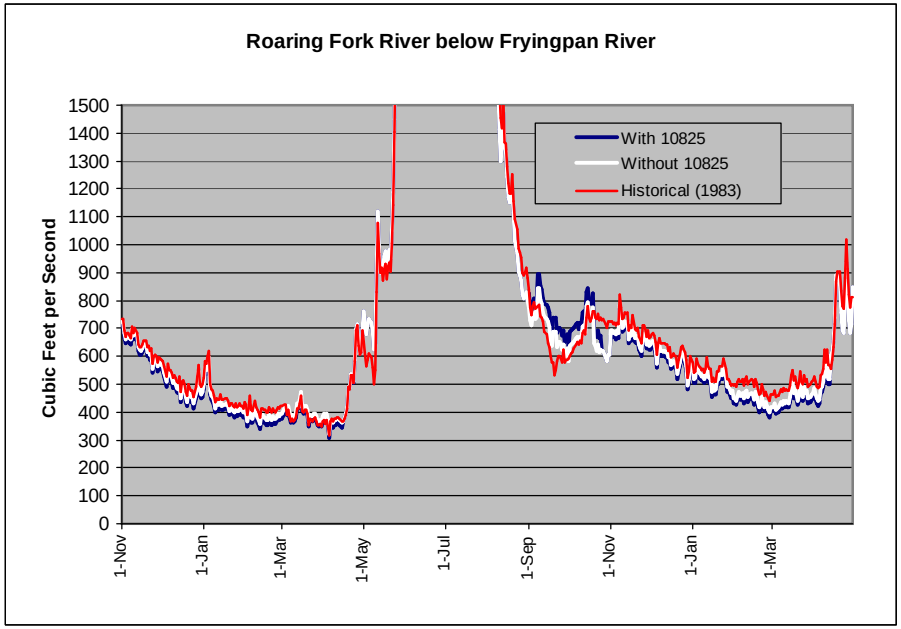


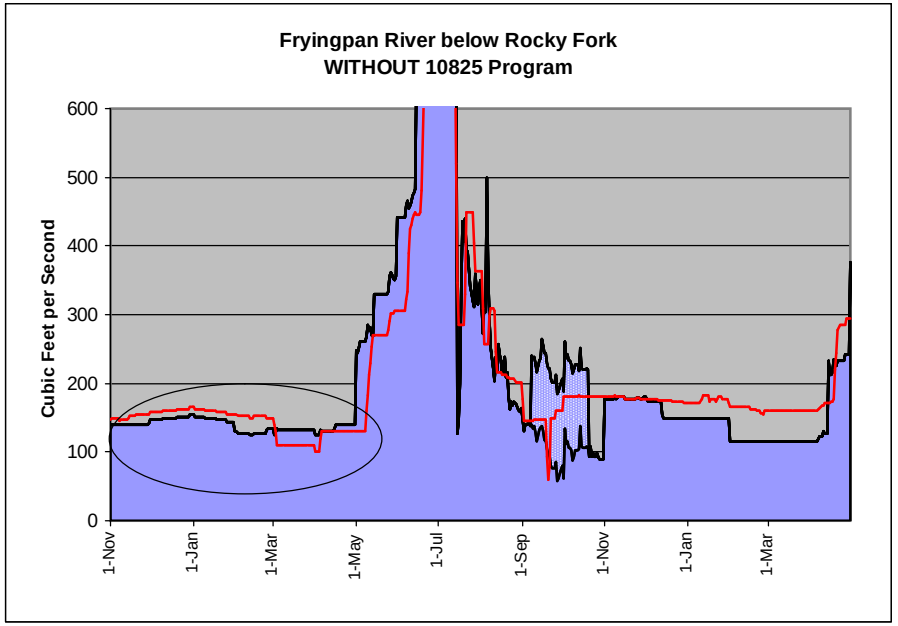


ALTERNATIVES C1 & C2 **5,412 AF from Ruedi Reservoir (baseload) with Sulphur Gulch or Buzzard Creek** **1983 (WET YEAR)**

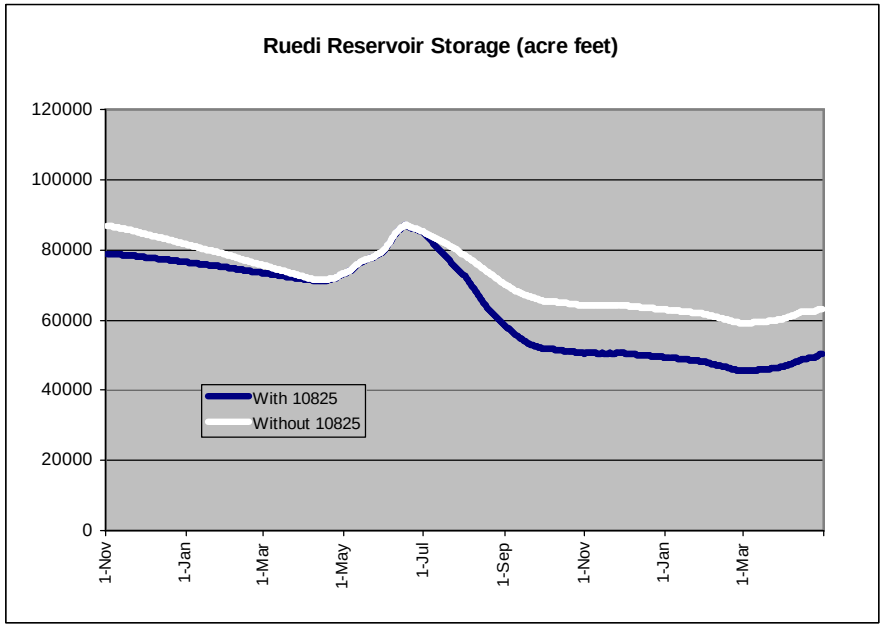


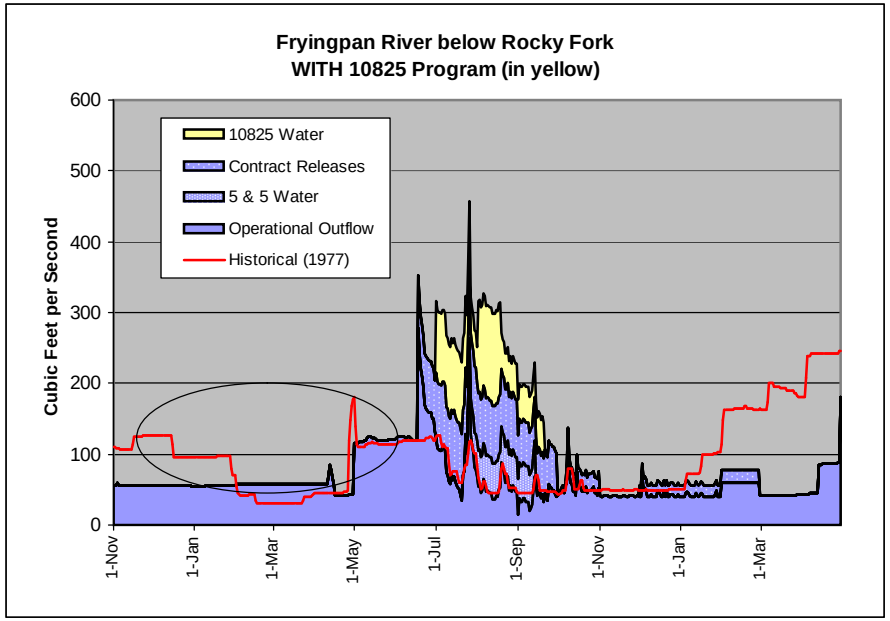


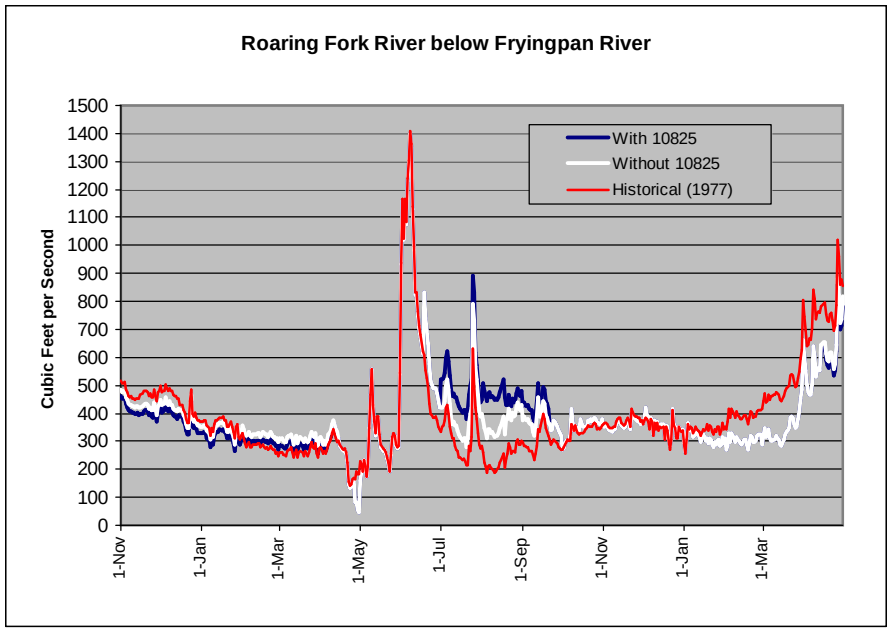


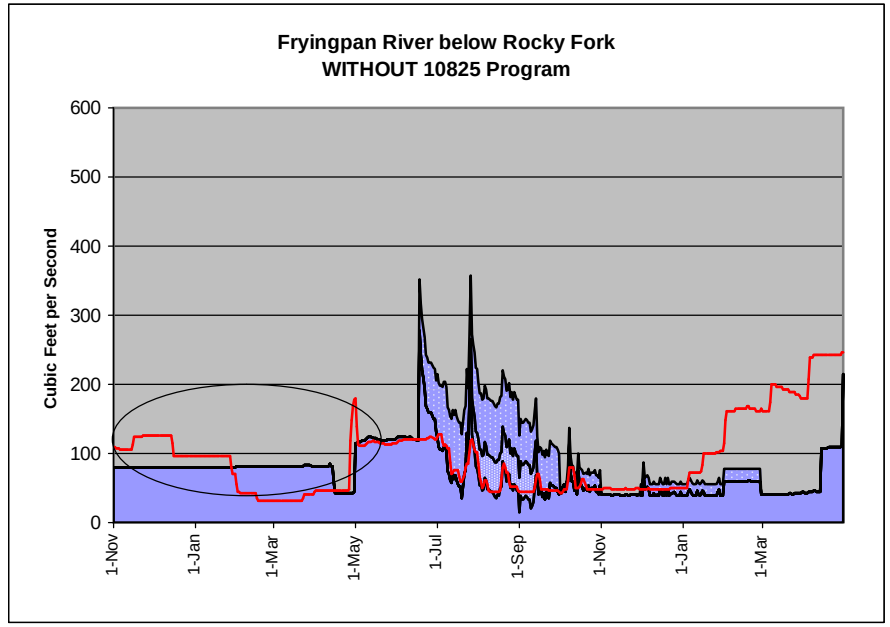


ALTERNATIVE C3 **8,125 AF in most years; 13,525 AF in dry years with 2,700 AF from Williams Fork Reservoir** **1977 (DRY YEAR)**

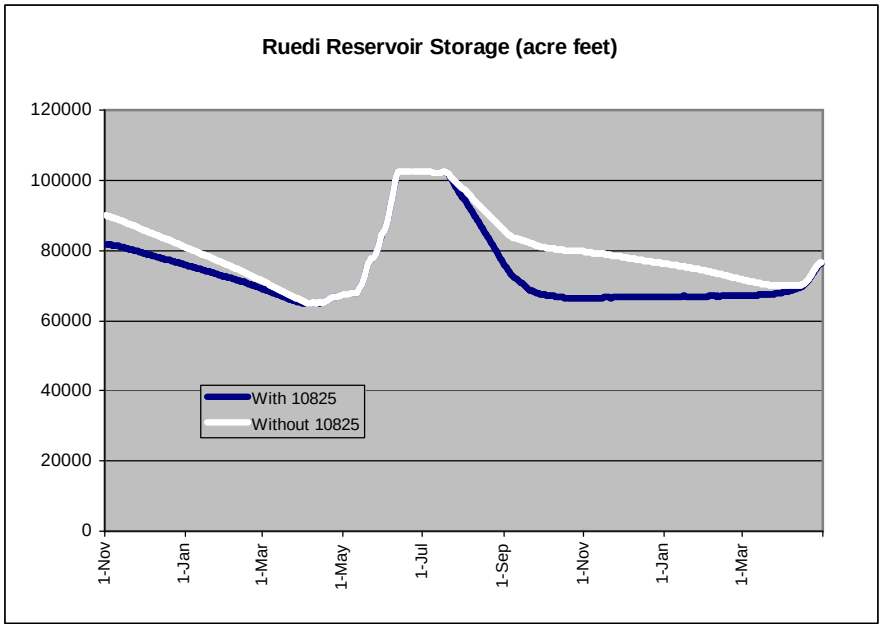


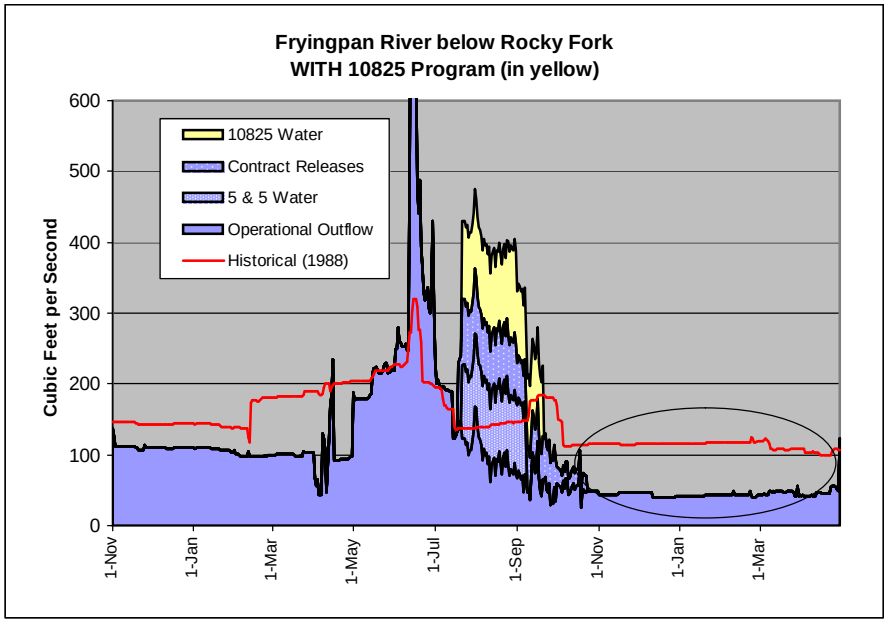


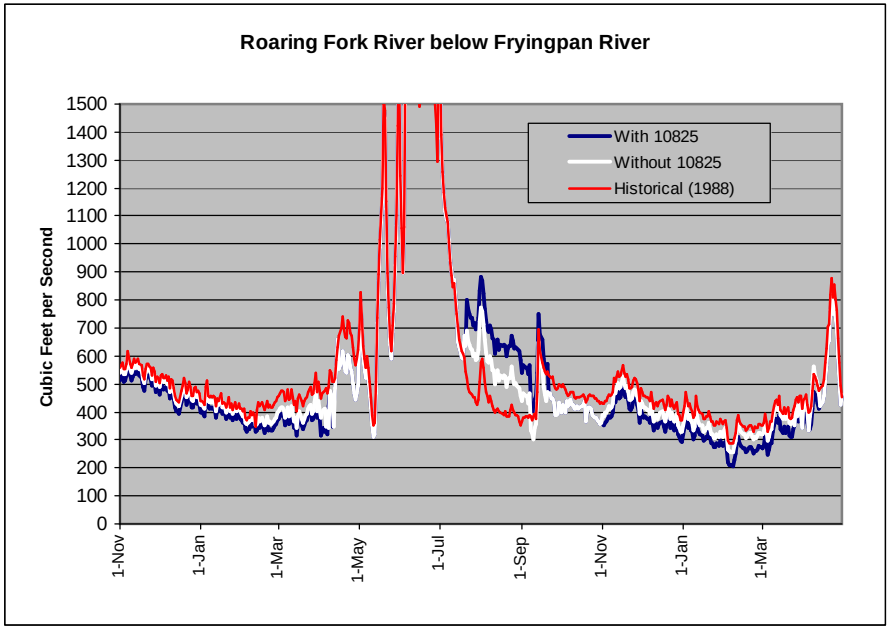


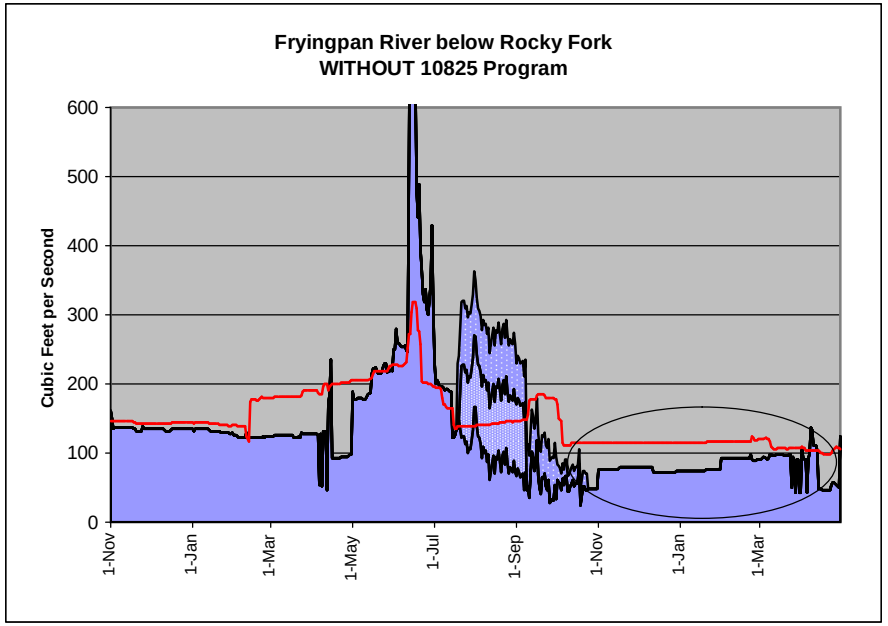


ALTERNATIVE C3 **8,125 AF in most years; 13,525 AF in dry years with 2,700 AF from Williams Fork Reservoir** **1988 (BELOW AVERAGE)**

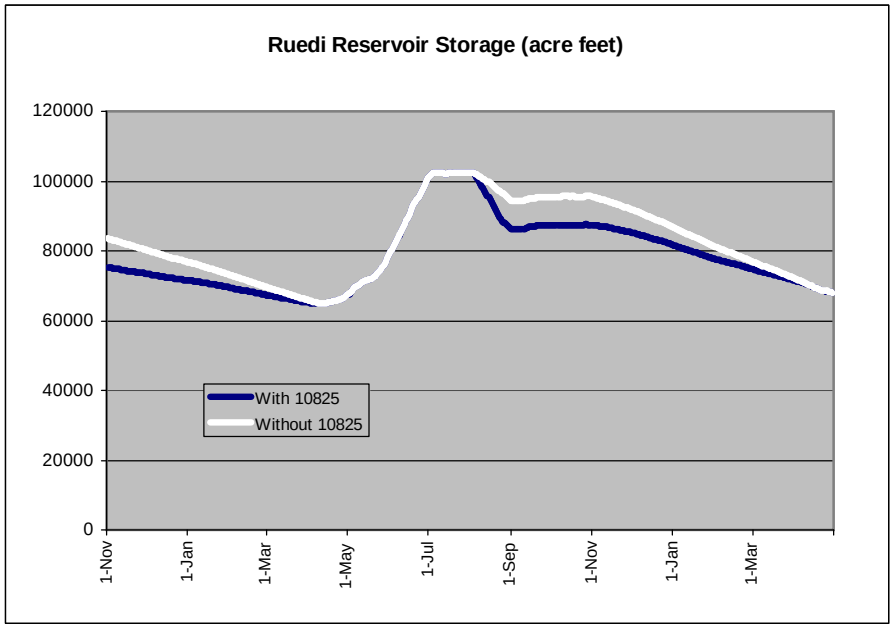


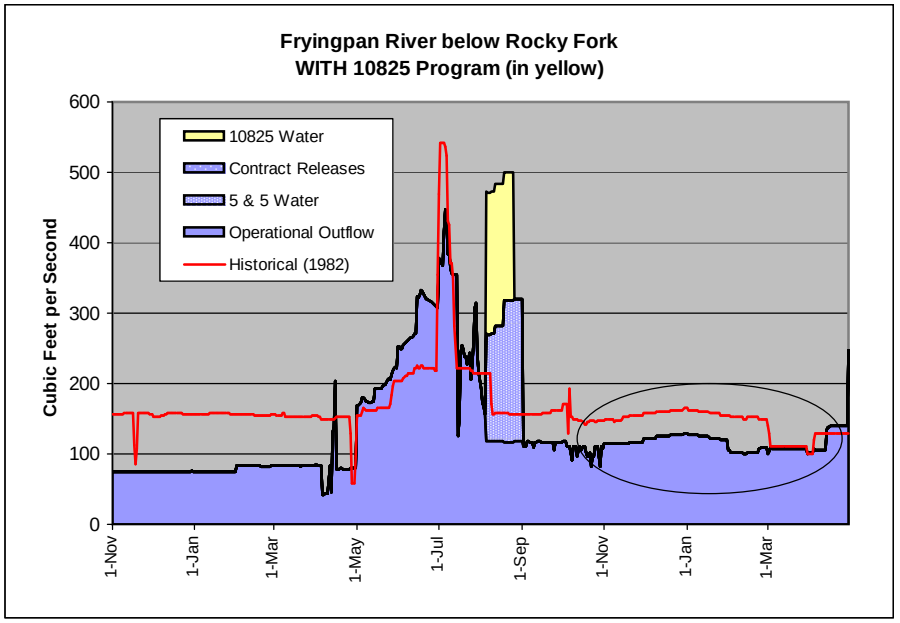


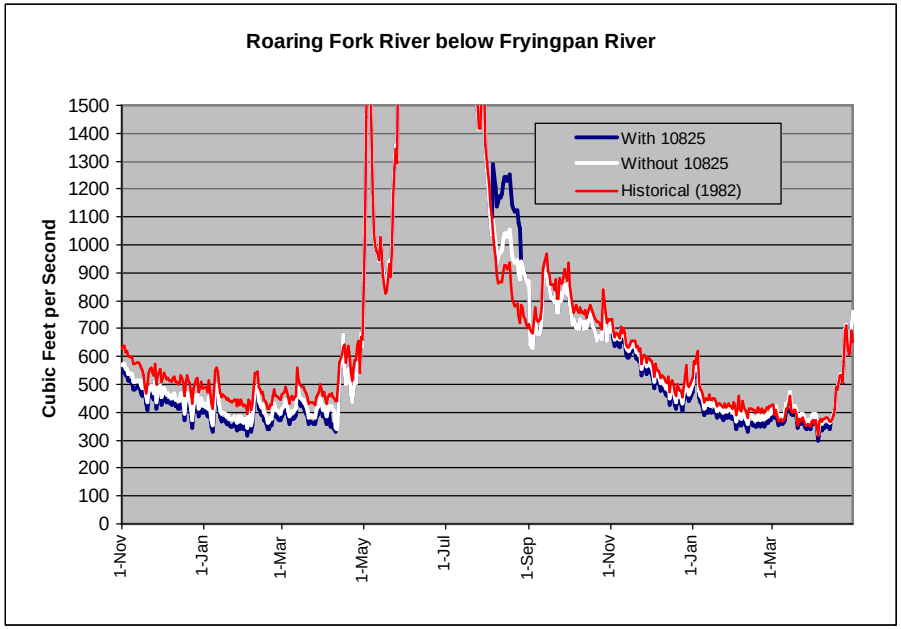


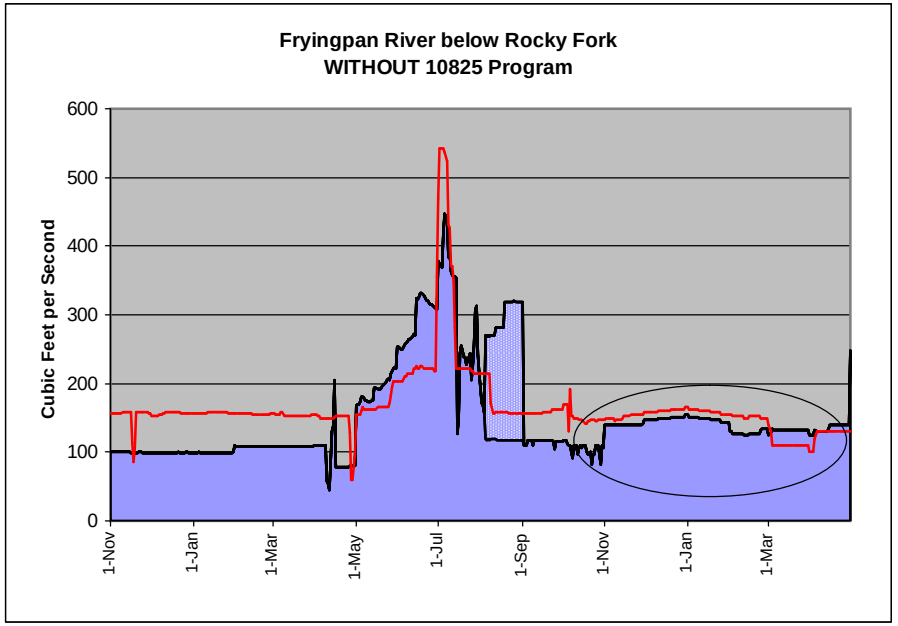


ALTERNATIVE C3 **8,125 AF in most years; 13,525 AF in dry years with 2,700 AF from Williams Fork Reservoir** **1982 (ABOVE AVERAGE)**

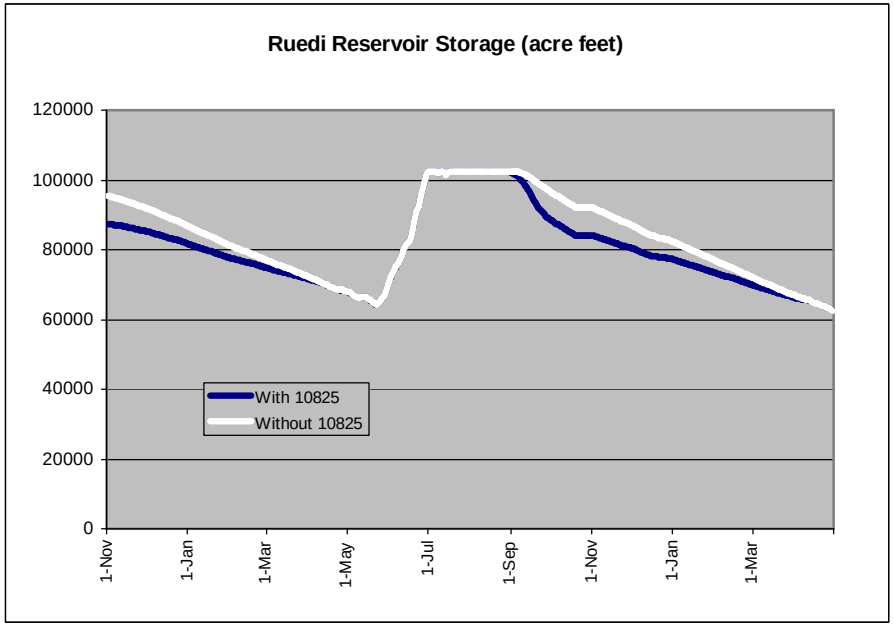


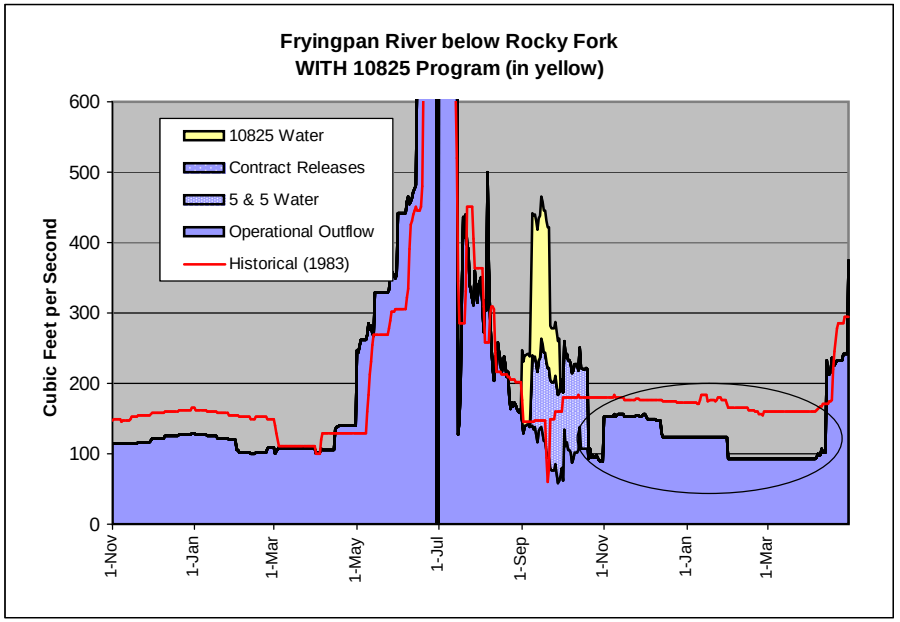


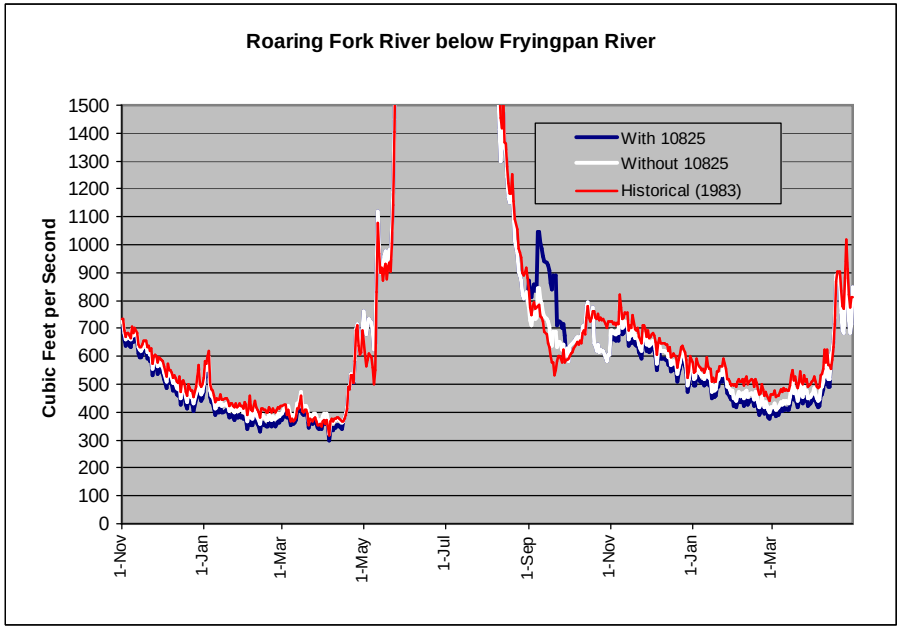


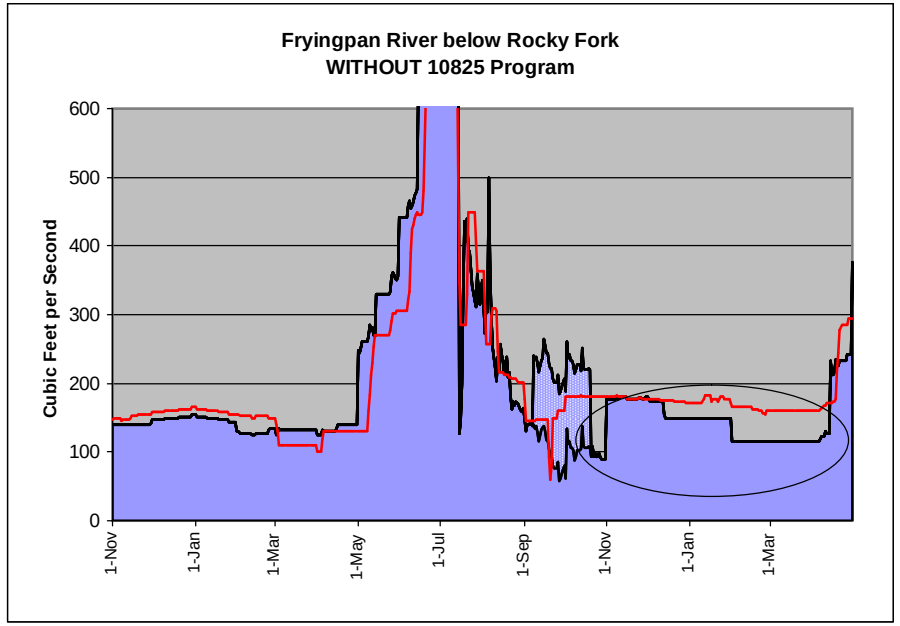


ALTERNATIVE C3 **8,125 AF in most years; 13,525 AF in dry years with 2,700 AF from Williams Fork Reservoir** **1983 (WET YEAR)**

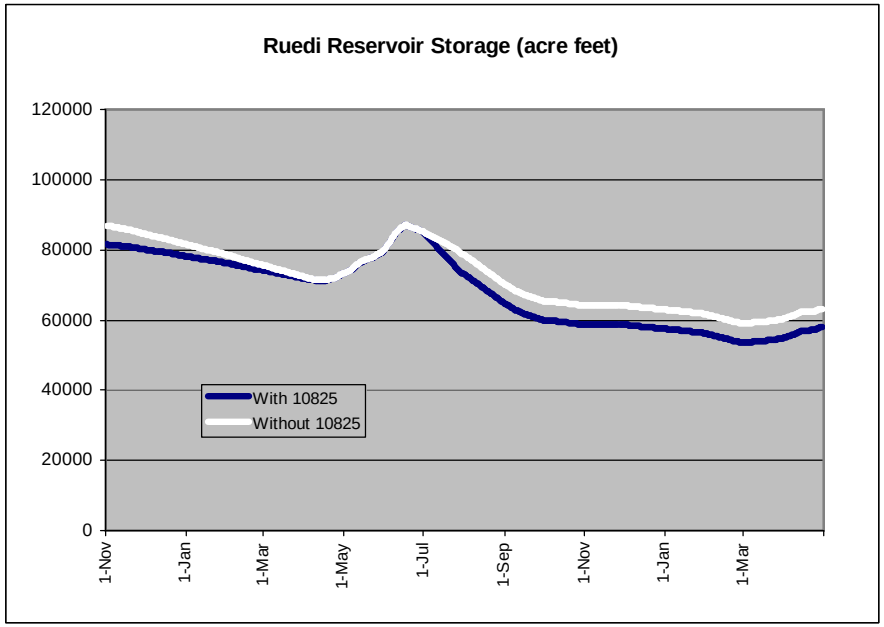


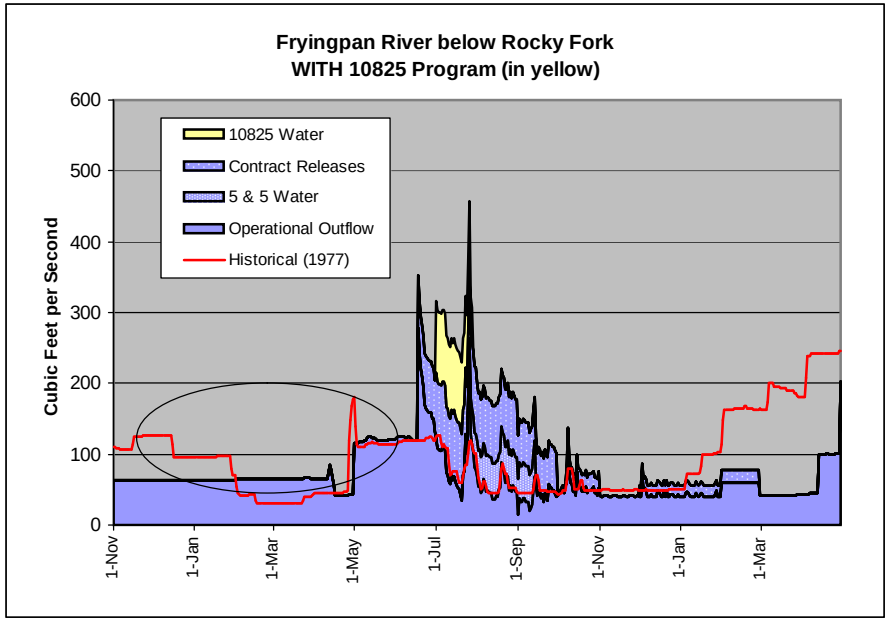


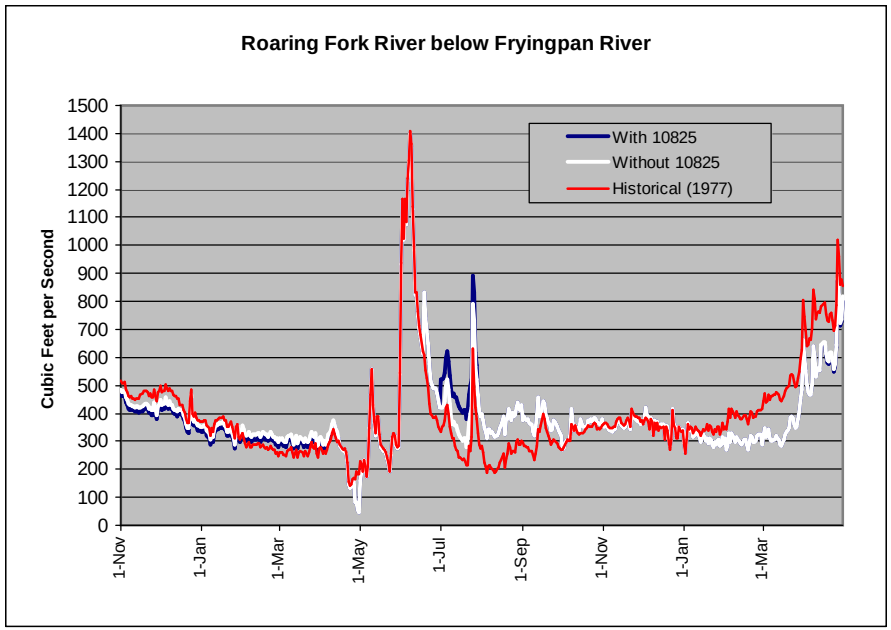


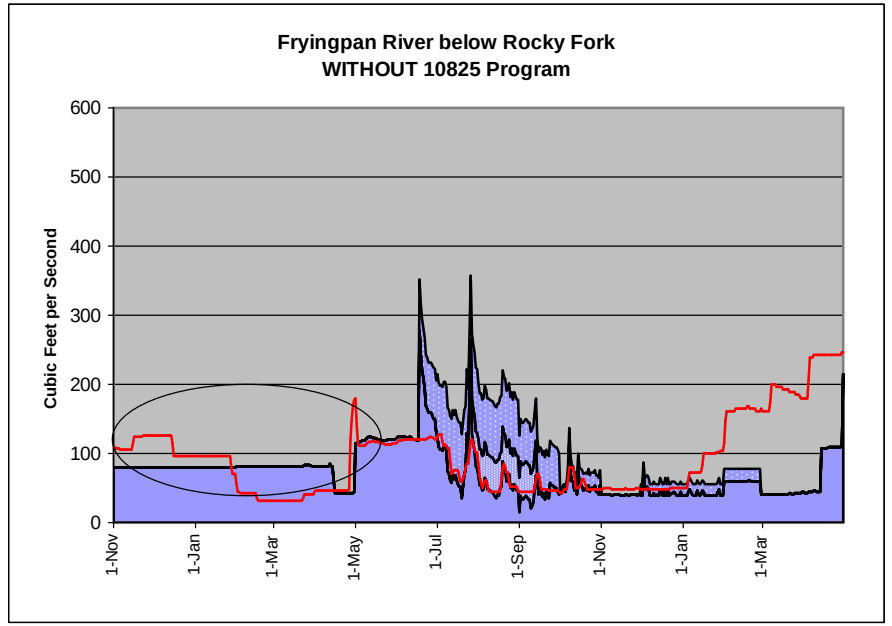


ALTERNATIVE C5 **5,412 AF in All Years (early season release) with 5,412 AF from Wolford Mtn Reservoir** **1977 (DRY YEAR)**

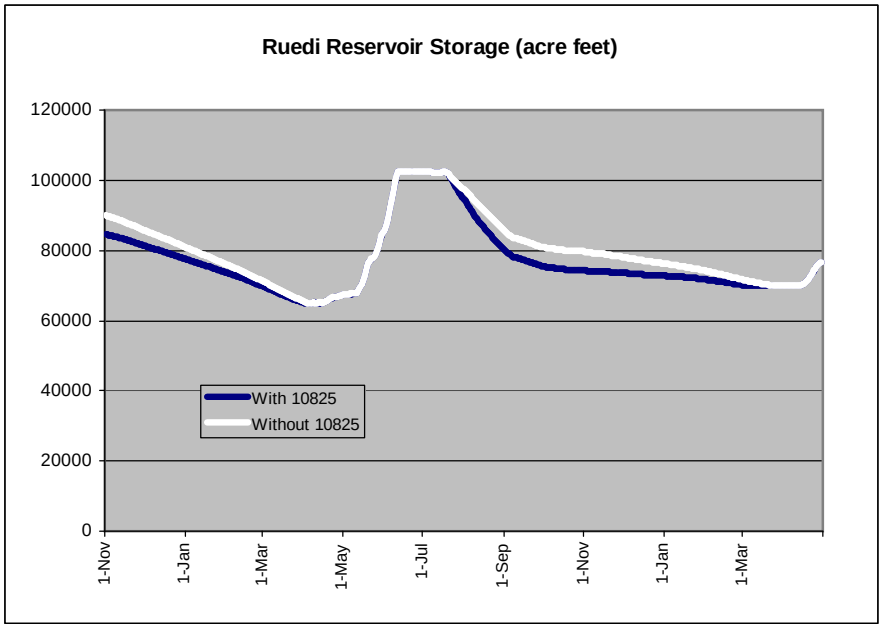


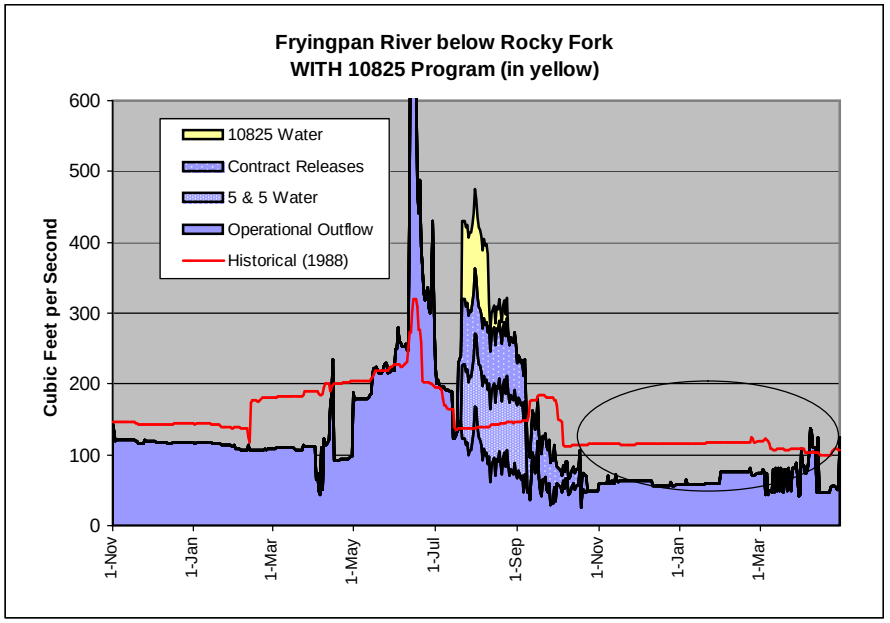


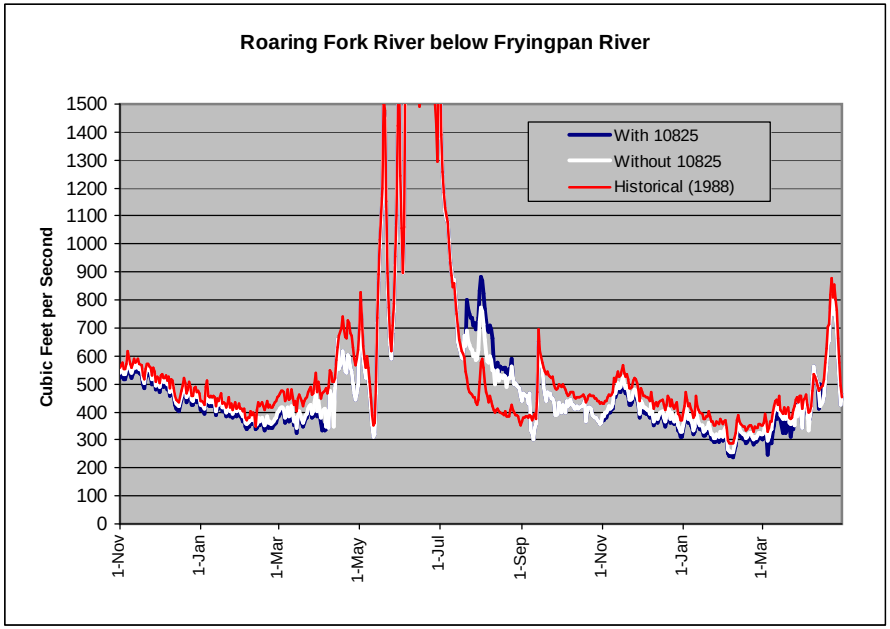


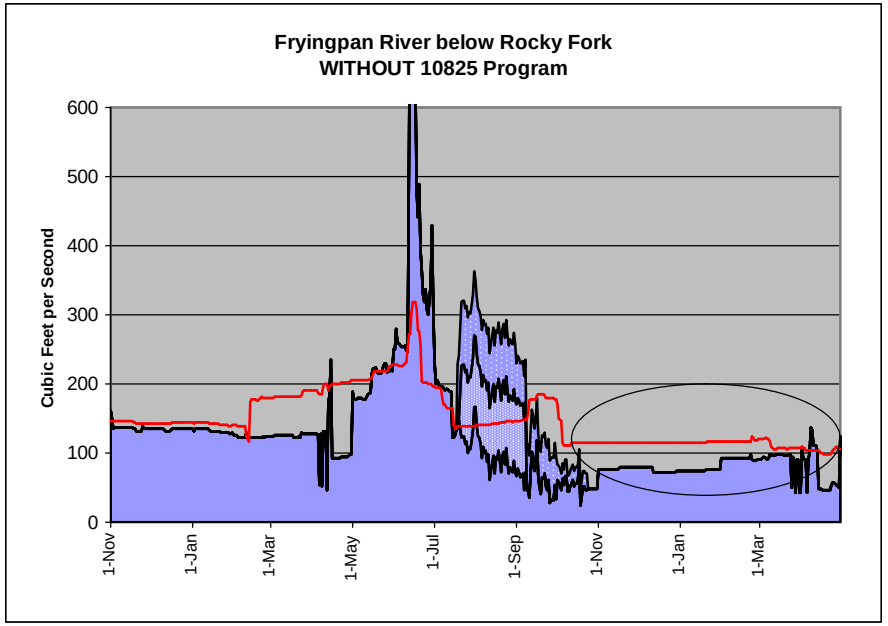


ALTERNATIVE C5 **5,412 AF in All Years (early season release) with 5,412 AF from Wolford Mtn Reservoir** **1988 (BELOW AVERAGE)**

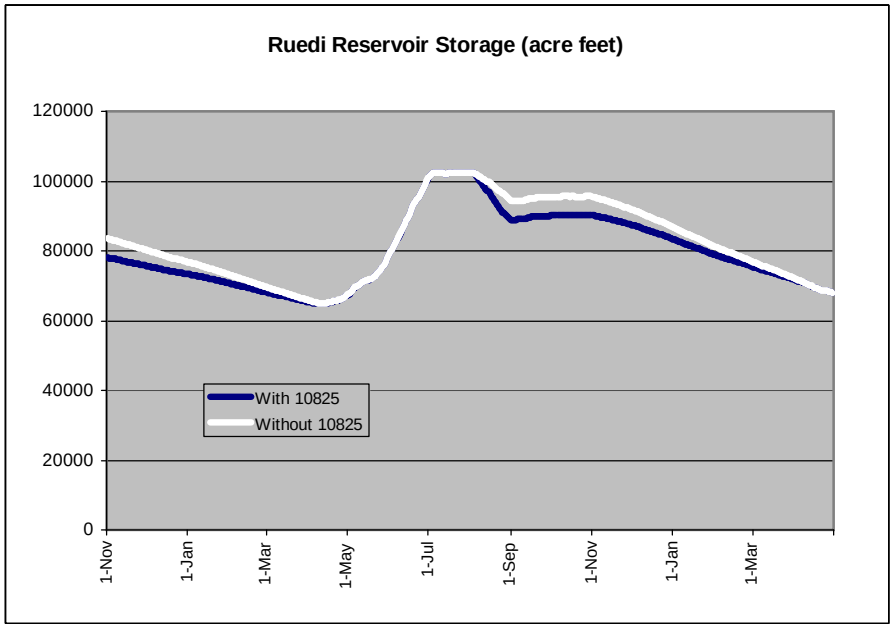


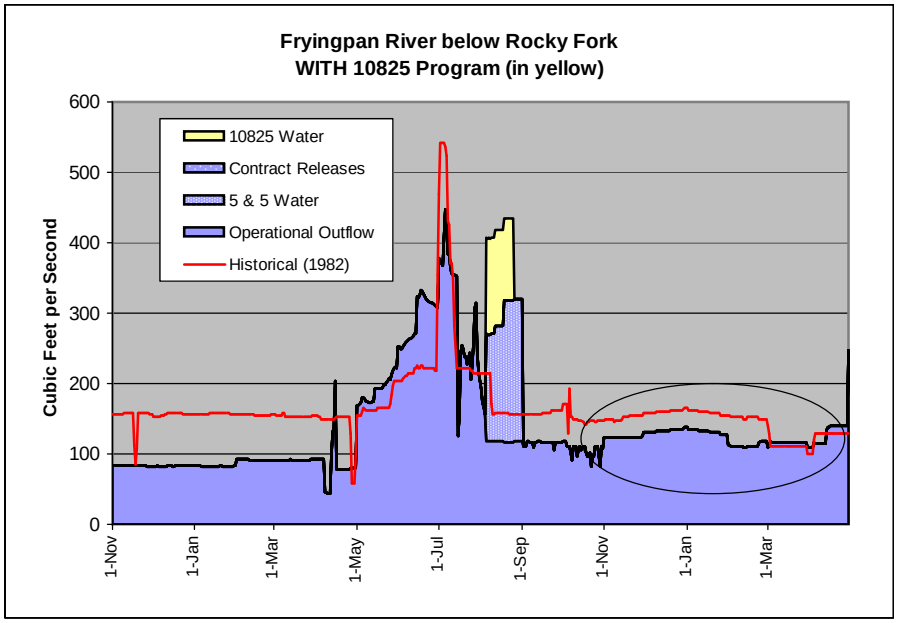


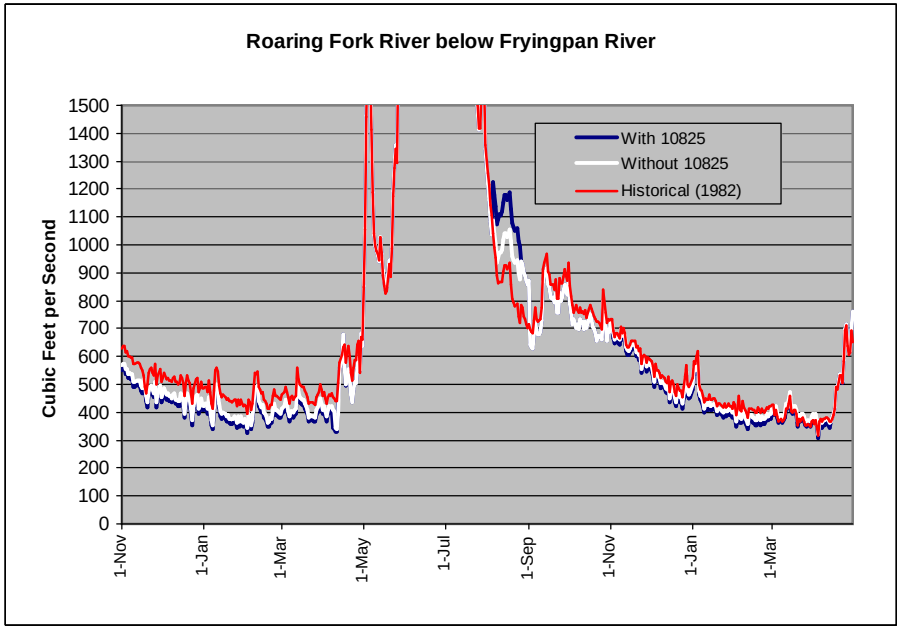


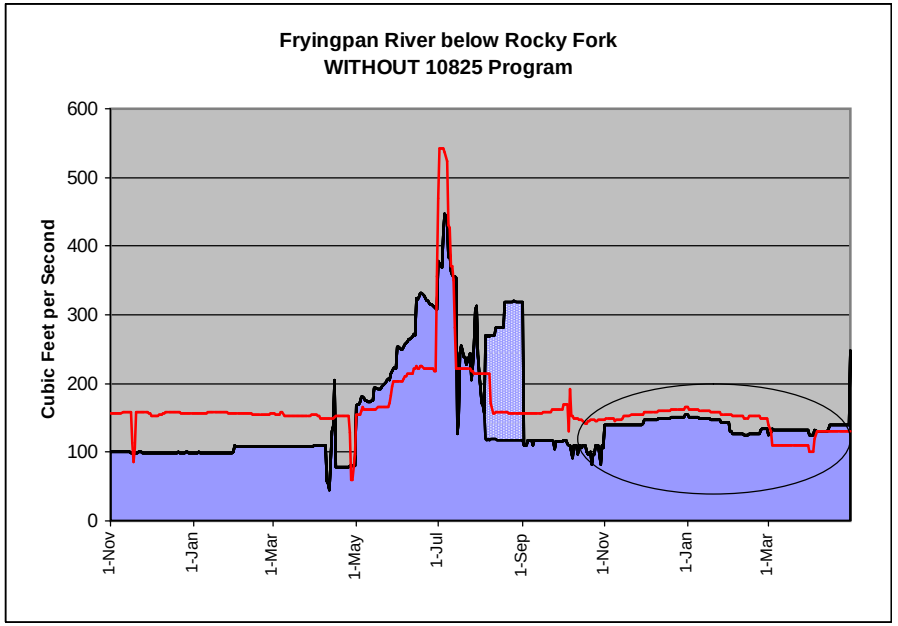


ALTERNATIVE C5 **5,412 AF in All Years (early season release) with 5,412 AF from Wolford Mtn Reservoir** **1982 (ABOVE AVERAGE)**









ALTERNATIVE C5 **5,412 AF in All Years (early season release) with 5,412 AF from Wolford Mtn Reservoir** **1983 (WET YEAR)**