

**APPENDIX F**

**OPERATION STUDY**

**APPENDIX F: SIMULATED OPERATION STUDY WITH M&I CONTRACT WATER**

**CALCULATION OF SOUTHERN UTE AND PRID STORAGE ALLOTMENT BASED ON THE MAXIMUM CONTENT EACH YEAR, IMPACTS TO SOUTHERN UTE STORAGE ON November 15 OF EACH YEAR, AND IMPACTS TO CONTENT OF RESERVOIR ON May 10 OF EACH YEAR (All Content and Releases Volumes are in acre-feet)**

CALCULATION OF SOUTHERN UTE AND PRID STORAGE ALLOTMENT BASED ON THE MAXIMUM CONTENT EACH YEAR, IMPACTS TO SOUTHERN UTE STORAGE ON November 15 OF EACH YEAR, AND IMPACTS TO CONTENT OF RESERVOIR ON May 10 OF EACH YEAR (All Content and Releases Volumes are in acre-feet)												
Mathematical Storage Allotment					Impacts to Storage				Shows Exchange Water is Restored Each Year			
A	B	C	D	E	F	G	H	I	J	K	L	M
Footnotes	Date of Maximum Reservoir Content	Historical Maximum Reservoir Content see footnote (1)	SoUte Portion of Reservoir Storage (1/6)	PRID Portion of Reservoir Storage (5/6)	Historical Reservoir Content on Nov-15	Historical Reservoir Content on Nov-15 Minus SoUte Allocation	Impact of Releasing M&I Contract Water on PRID Historical Nov15 Reservoir Content	M&I Contract Water Balance on Nov-15	Historical Reservoir Content on May10 Yr +1	Impact of Restoring M&I Contract Water on Historical May10 Reservoir Content	Difference in Historical May-10 Reservoir Content	Date M&I Contract Water was Restored If May-10 Fails
	7/2/1941	63,858	10,643	53,215	54,268	43,625	43,313	313	48,747	48,747	-	
	06/19/42	93,533	15,589	77,944	45,657	30,069	27,210	2,858	61,544	61,544	-	
	06/30/43	73,693	12,282	61,411	30,209	17,926	14,975	2,952	45,479	45,479	-	
(2)	07/06/44	86,012	14,335	71,677	2,753	(11,582)	(12,779)	1,196	36,555	36,555	-	
	06/25/45	84,582	14,097	70,485	40,790	26,693	23,780	2,913	65,566	65,566	-	
	06/20/46	89,140	14,857	74,283	51,564	36,707	33,707	3,000	82,451	82,451	-	
	07/10/47	112,227	18,704	93,522	85,773	67,069	64,468	2,601	28,588	28,588	-	
	07/11/48	108,773	18,129	90,644	53,489	35,360	32,937	2,424	31,757	31,757	-	
	07/03/49	110,528	18,421	92,106	43,189	24,768	22,374	2,394	81,041	81,041	-	
	06/14/50	97,931	16,322	81,609	20,491	4,169	1,169	3,000	35,620	35,620	-	
	06/22/51	62,590	10,432	52,159	17,346	6,914	3,914	3,000	29,525	29,525	-	
	07/10/52	112,935	18,822	94,112	51,278	32,456	30,097	2,359	70,127	70,127	-	
	06/19/53	102,044	17,007	85,037	26,897	9,889	6,889	3,000	61,544	61,544	-	
	06/07/54	89,043	14,840	74,202	52,715	37,875	34,875	3,000	70,127	70,127	-	
	06/25/55	110,423	18,404	92,019	38,473	20,069	17,069	3,000	69,687	69,687	-	
(3)	06/16/56	105,333	17,556	87,778	15,516	(2,040)	(5,040)	3,000	46,375	46,375	-	
	07/27/57	126,792	21,132	105,660	70,789	49,657	47,203	2,455	55,250	55,250	-	
	06/25/58	111,650	18,608	93,042	40,959	22,351	19,354	2,996	53,684	53,684	-	
	06/15/59	67,290	11,215	56,075	28,455	17,240	14,240	3,000	50,426	50,426	-	
	06/23/60	109,903	18,317	91,586	37,347	19,030	16,111	2,919	71,366	71,366	-	
	06/13/61	119,113	19,852	99,261	67,160	47,307	44,384	2,923	68,484	68,484	-	
	07/04/62	111,520	18,587	92,933	46,465	27,879	24,907	2,971	81,886	81,886	-	
	06/01/63	97,831	16,305	81,526	28,152	11,847	8,847	3,000	38,441	38,441	-	
	06/16/64	73,063	12,177	60,886	27,359	15,181	12,181	3,000	53,237	53,237	-	
	07/12/65	117,175	19,529	97,646	67,160	47,630	44,830	2,800	104,642	104,642	-	
	06/15/66	121,850	20,308	101,542	42,342	22,033	19,289	2,744	52,870	52,870	-	
	06/25/67	77,308	12,885	64,423	27,423	14,538	11,538	3,000	51,069	51,069	-	
	06/25/68	119,941	19,990	99,951	62,003	42,013	39,405	2,608	95,288	95,288	-	
	07/20/69	120,719	20,120	100,599	73,220	53,100	50,309	2,791	86,587	86,587	-	
	06/22/70	121,068	20,178	100,890	74,144	53,966	53,079	887	93,312	93,312	-	
	06/26/71	108,268	18,045	90,224	51,526	33,481	30,951	2,530	80,037	80,037	-	
	06/14/72	95,536	15,923	79,613	61,878	45,955	43,022	2,933	59,477	59,477	-	
	07/06/73	122,255	20,376	101,879	67,268	46,892	46,424	468	83,798	83,798	-	
	05/31/74	92,550	15,425	77,125	19,302	3,877	1,813	2,064	24,063	24,063	-	
	07/16/75	120,075	20,013	100,063	48,765	28,753	26,432	2,321	80,480	80,480	-	

**CALCULATION OF SOUTHERN UTE AND PRID STORAGE ALLOTMENT BASED ON THE MAXIMUM CONTENT EACH YEAR, IMPACTS TO SOUTHERN UTE STORAGE ON November 15 OF EACH YEAR, AND IMPACTS TO CONTENT OF RESERVOIR ON May 10 OF EACH YEAR (All Content and Releases Volumes are in acre-feet)**

		Mathematical Storage Allotment			Impacts to Storage				Shows Exchange Water is Restored Each Year			
A	B	C	D	E	F	G	H	I	J	K	L	M
Footnotes	Date of Maximum Reservoir Content	Historical Maximum Reservoir Content see footnote (1)	SoUte Portion of Reservoir Storage (1/6)	PRID Portion of Reservoir Storage (5/6)	Historical Reservoir Content on Nov-15	Historical Reservoir Content on Nov-15 Minus SoUte Allocation	Impact of Releasing M&I Contract Water on PRID Historical Nov15 Reservoir Content	M&I Contract Water Balance on Nov-15	Historical Reservoir Content on May10 Yr +1	Impact of Restoring M&I Contract Water on Historical May10 Reservoir Content	Difference in Historical May-10 Reservoir Content	Date M&I Contract Water was Restored If May-10 Fails
	06/22/76	121,823	20,304	101,519	48,433	28,129	25,874	2,256	50,125	50,125	-	
(4)	05/03/77	50,558	8,426	42,132	13,289	4,863	1,863	3,000	50,898	48,553	2,345	14-Jun-78
	06/26/78	116,911	19,485	97,426	27,904	8,418	5,828	2,590	44,010	44,010	-	
	07/11/79	118,395	19,732	98,662	38,165	18,433	17,817	616	40,186	40,186	-	
	07/02/80	120,961	20,160	100,801	56,922	36,762	34,627	2,135	86,803	86,803	-	
	06/14/81	101,512	16,919	84,593	54,503	37,584	35,306	2,278	85,773	85,773	-	
	07/02/82	122,363	20,394	101,970	86,204	65,810	63,923	1,887	64,752	64,752	-	
	07/08/83	123,312	20,552	102,760	61,544	40,992	39,732	1,260	80,924	80,924	-	
	06/30/84	118,474	19,746	98,729	55,646	35,900	34,062	1,838	84,582	84,582	-	
	06/16/85	123,827	20,638	103,190	55,745	35,107	33,174	1,933	79,874	79,874	-	
	06/28/86	123,041	20,507	102,534	56,802	36,295	34,686	1,609	70,171	70,171	-	
	06/17/87	122,120	20,353	101,767	57,304	36,950	34,564	2,386	79,061	79,061	-	
	06/29/88	107,158	17,860	89,298	76,165	58,305	55,402	2,903	99,751	99,751	-	
(4)	06/06/89	113,673	18,946	94,728	43,668	24,723	21,772	2,950	70,971	69,780	1,191	11-Jun-90
	06/19/90	125,147	20,858	104,289	76,923	56,065	53,190	2,875	84,698	84,698	-	
	06/23/91	122,030	20,338	101,691	62,327	41,988	38,988	3,000	97,643	97,643	-	
	06/26/92	122,678	20,446	102,232	57,600	37,154	34,154	3,000	51,130	51,130	-	
	06/23/93	124,605	20,768	103,838	76,351	55,584	53,384	2,199	101,395	101,395	-	
	06/19/94	125,637	20,940	104,698	64,719	43,779	41,022	2,757	42,409	42,409	-	
	07/11/95	122,895	20,482	102,412	72,623	52,140	50,285	1,856	94,016	94,016	-	
	05/22/96	104,879	17,480	87,399	39,836	22,356	20,018	2,338	59,846	59,846	-	
	06/28/97	124,479	20,747	103,733	72,883	52,137	50,901	1,235	88,463	88,463	-	
	06/23/98	119,247	19,875	99,373	69,885	50,011	47,386	2,625	99,037	99,037	-	
	06/09/99	124,561	20,760	103,801	66,426	45,666	43,571	2,095	109,175	109,175	-	
	06/03/00	122,933	20,489	102,444	36,351	15,862	13,484	2,378	54,699	54,699	-	
	06/26/01	123,611	20,602	103,009	51,641	31,039	28,653	2,386	61,148	61,148	-	
	04/29/02	64,007	10,668	53,339	26,642	15,974	13,101	2,873	59,272	59,272	-	
	06/06/03	82,098	13,683	68,415	41,078	27,395	24,586	2,809	97,280	97,280	-	
	06/15/04	124,805	20,801	104,004	82,451	61,650	58,937	2,713	35,374	35,374	-	
	07/07/05	124,479	20,747	103,733	83,491	62,745	59,899	2,846	110,267	110,267	-	
	05/25/06	124,886	20,814	104,072								
<b>65-Year Average</b>		107,366	17,894	89,471	50,548	32,654	30,207	2,447	67,429	67,374	54	
<b>Annual Maximum</b>		126,792	21,132	105,660	86,204	67,069	64,468	3,000	110,267	110,267	2,345	
<b>Annual Minimum</b>		50,558	8,426	42,132	-	(11,582)	(12,779)	313	24,063	24,063	-	

**Footnotes**

(1) Storage allotments shown do not include loss adjustments (i.e., reservoir evaporation, transit losses, etc.) that are applied throughout the year to both the PRID and Southern Ute portion. This loss adjustment is variable depending on weather and hydrological conditions.

(Footnotes continued on next page)

## Footnotes (cont'd)

(2)

In 1944, the reservoir was evacuated to a Nov 1st content of 1,645 af to clean the trash racks. It wasn't necessary to fill the reservoir because not all the canals were available to service the full project area. Therefore, May-July releases were large (118,000 af) limiting maximum storage to 86,000 af. This operation is unique and therefore excluded as an indicator of inadequate water supply. The inflow was more than sufficient to fill the reservoir.

(3)

Project Histories show that the Tribe used 3,301 af of their storage water in 1956. Their share of reservoir evaporation was 368 af and their share of the EW development is 600 af. Their remaining storage pool on Oct 31st should have been 17,556 - 3,301 - 368 - 600 = 13,287 af, leaving 1,768 af of storage resulting in a 1,232 af shortfall to PRID. Based on current level of management that conserves reservoir storage, 1956 could have stored an additional 14,241 af by June 16, 1956, the date of maximum reservoir content. This would have increased the Tribe's pool from 17,556 to 19,929, an increase of 2,273 af and PRIDs pool from 87,778 af to 99,645 af an increase of 11,867 af. This additional storage would have provided more irrigation supplies and met the M&I Contract Water needs.

(4)

Excess Water is available between May 11th and date of Maximum Content to replace M&I Contract Water used the previous year.

## Operation Study Column Description

Column A – **Footnotes:** Contains additional explanation of years where initial analysis revealed possible issues with water supply

Column B – **Date of Max Content:** Date reservoir achieved its maximum content for each year of the record (1941-2006)

Column C – **Historical Maximum Content:** Maximum content of reservoir for each year of record.

Column D – **SoUte Portion of Reservoir Storage:** Southern Ute Indian Tribe's allocation of reservoir storage based on 1/6<sup>th</sup> of the maximum content for each year of record.

Column E – **PRID Portion of Reservoir Storage:** Pine River Irrigation District's allocation of reservoir storage based on 5/6<sup>th</sup> of the maximum content for each year of record.

Column F – **Historical Reservoir Content on November 15<sup>th</sup>:** Reservoir content on November 1<sup>st</sup> for each year of record. November 15<sup>th</sup> is considered the end of irrigation season in this analysis.

Column G – **Historical Reservoir Content on Nov 15<sup>th</sup> Minus SoUte Allocation:** Demonstrates that M&I Contract water was not derived from Tribe's storage allocation by breaking out Tribe's allocation from historical reservoir content. For all years except for 1956, "Column G" = "Column F" – "Column D" (This is conservative because it shows that the Tribe's full allotment would still be available at the end of the year (i.e., assumes Tribe's did not use any water from their allotment during the year)). For 1956, the Tribe's actual delivery from storage was accounted for (as explained in the Footnotes).

## Operation Study Column Description (cont'd)

Column H – **Impact of Releasing M&I Contract Water on PRID Historical Nov 15<sup>th</sup> Reservoir Content:** Demonstrates that M&I Contract water would have been available during the year without impacting PRID's historical supply.

Column I – **M&I Contract Water Balance on Nov 15<sup>th</sup>:** Shows how much of the M&I Contract water needs to be "restored" between November 15<sup>th</sup> and May 10<sup>th</sup> of the next year. Numbers less than 3,000 acre-feet indicate some exchange water has already been restored during the year.

Column J – **Historical Reservoir Content on May 10<sup>th</sup>, Year + 1:** Reservoir content on May 10<sup>th</sup> for each year of record. May 11<sup>th</sup> is considered the start of irrigation season.

Column K – **Impact of Restoring M&I Contract Water on Historical May 10<sup>th</sup> Reservoir Content:** Demonstrates that, with the exception of two years, restoring M&I Contract water (released the year before) would not have had an impact on the historical reservoir content by the start of the following year's irrigation season.

Column L – **Difference in Historical May 10<sup>th</sup> Reservoir Content:** Shows that in all years except for two, the reservoir content would have been restored to its historic level by the start of irrigation season. The two years that it wouldn't have been (1977 and 1989), the reservoir content would have been restored by mid-June.

Column M – **Date M&I Contract Water was Restored, if not by May 10<sup>th</sup>:** Shows the dates the reservoir content was restored in the two years indicated in Column L.