ArkDSS Memorandum
Final

To: Bill Tyner, John van Oort, Kelley Thompson, Division of Water Resources

From: ParsonsWater Consulting

Subject: Task 2.1 – Fort Lyon Canal Company

Date: April 2019

INTRODUCTION

One of the Task 2 objectives is to:

> *Develop and document an understanding of the operations of key water use facilities in the basin in order to facilitate consumptive use modeling and to support selected data needs for the ArkDSS effort. This understanding will be developed through interviews with DWR personnel, major water users, including operators of large canal and reservoir systems and representatives of federal facilities.*

Key water use facilities include diversion structures, transmountain diversions, and reservoirs A number of components in the Fort Lyon Canal Company have been identified as key structures for the Arkansas Decision Support System (ArkDSS) consumptive use and surface water modeling efforts. The purpose of this Task 2 memorandum is to document physical, legal, and operational aspects of those key structures.

The information provided in this memorandum was developed from publicly accessible sources, discussions and meetings with Division 2 personnel, DWR Modeling Group, Canal Company Superintendent Jerred Hoffman, the Fort Lyon Canal Company Board, and the District 17 Water Commissioner, Lonnie Spady. Information in this memorandum is believed to be accurate. However, this information should not be relied upon in any legal proceeding.

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SYSTEM OVERVIEW

The Fort Lyon Canal, Fort Lyon Storage Canal, Adobe Creek Reservoir (aka Blue Lake), Horse Creek Reservoir (aka Timber Lake) and Thurston Reservoir are owned by the Fort Lyon Canal Company. These canals and reservoirs are operated together to provide irrigation supplies to lands in Otero, Bent and Prowers Counties. The Kicking Bird Canal and Great Plains Reservoirs are owned by the Amity Mutual Irrigation Company and are operated in conjunction with the Fort Lyon Canal Company.

The Fort Lyon Canal headgate is located on the Arkansas River between Swink and La Junta. The canal runs along the north side of the Arkansas River for approximately 110 miles from above to below John Martin Reservoir.

The Fort Lyon Storage Canal headgate is located on the Arkansas River approximately three miles east of Manzanola and 14 miles above the Fort Lyon Canal headgate. The storage canal runs along the north bank of the Arkansas River and turns north near Rocky Ford, Colorado. The Fort Lyon Storage Canal and Holbrook Canal run adjacent to one another for most of their length. The Fort Lyon Storage Canal is down-gradient of the Holbrook Canal until it is siphoned under the Holbrook Canal about 10 miles below the river headgate, after which it runs above the Holbrook Canal. Water is carried to the north side of Horse Creek Reservoir from where water can be released to the reservoir via an inlet canal, and ultimately carried to Adobe Creek Reservoir. These reservoirs are located up-gradient from the Fort Lyon Canal and can deliver water via gravity for irrigation under the canal system.

There are currently 93,989.4166 outstanding shares of stock issued in the company. Direct flow and storage water is delivered to shareholders on a rotational basis ("runs") to five divisions: La Junta and Horse Creek Divisions, both located upstream of John Martin Reservoir; Las Animas Division to the north of John Martin Reservoir; and Limestone and Lamar Divisions, located downstream of John Martin Reservoir.

Key facilities identified in the Fort Lyon Canal Company System are as follows. The Great Plains Reservoirs and John Martin Reservoir are also discussed in this memorandum as they relate to the Fort Lyon Canal /company system operations.

1. Fort Lyon Canal
2. Fort Lyon Storage Canal
3. Adobe Creek Reservoir
4. Horse Creek Reservoir
5. Great Plains Reservoirs
6. John Martin Reservoir

The contact information for the Fort Lyon Canal Company is:

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The general locations of the Fort Lyon Canal and associated infrastructure related to the Fort Lyon Canal Company system are shown on **Figure 1**.

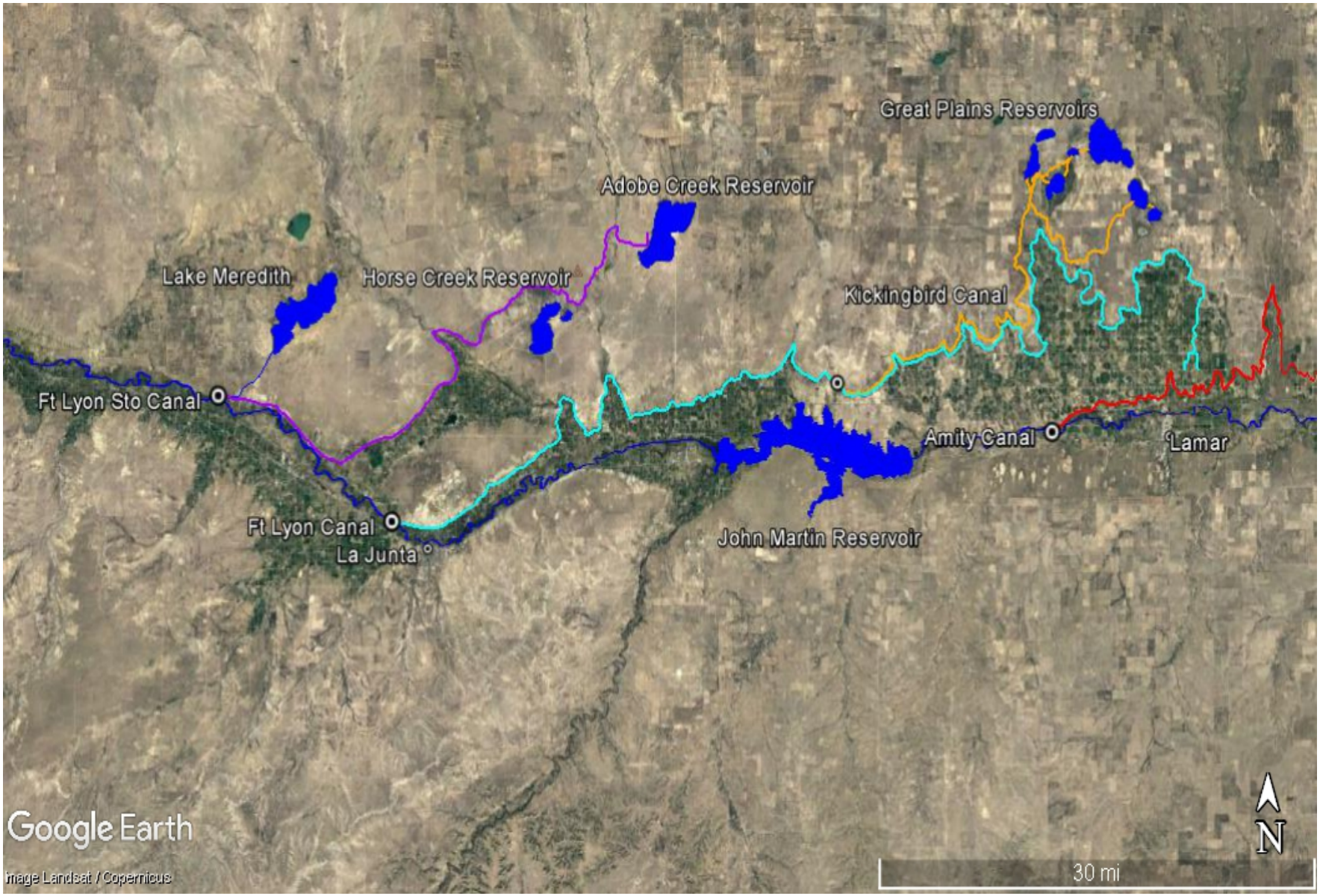

Figure 1: Fort Lyon Canal Company Water Resources System

PHYSICAL INFORMATION

The major structural elements in the Fort Lyon Canal Company's water resources system include the Fort Lyon Canal, the Fort Lyon Storage Canal, Adobe Creek Reservoir, and Horse Creek Reservoir. The system has been used consistently for irrigation since the water rights were originally appropriated. There has been limited use for augmentation of well depletions since the early 2000s. Augmentation use under the ditch is anticipated to increase due, in part, to a change of use of canal company shares by Colorado Beef and the initial use of shares dedicated to the LAWMA augmentation plan by Arkansas River Farms (ARF). To that end, ARF has constructed or has plans to construct about eight augmentation stations and about three recharge ponds under the ditch.

The history, operations, and current specifications of the elements of the FLCC's water resources infrastructure are summarized below. Information and analysis from the FLCC – Amity Mutual Irrigation Company negotiations (16CW3038), Colorado Beef change case (08CW83), past studies, and the ARF Rule 14 Plan is included herein. Also included, for reference, is data used in the Hydrological-Institutional (H-I) Model to represent portions of the Fort Lyon Canal system.

Additional information related to a number of the structural elements and operations of nearby water districts is listed in the *Where to find more information* section at the end of this memorandum.

1. Fort Lyon Canal (1700553) and Kicking Bird Canal (1700555)

The Fort Lyon Canal diverts from the Arkansas River upstream of Crooked Arroyo and the town of La Junta. The canal runs eastward along the north side of John Martin Reservoir and the Arkansas River for about 110 miles before it terminates north of the town of Lamar. The Kicking Bird Canal leaves the main canal near the midpoint of John Martin Reservoir and travels approximately 27 miles to the Great Plains Reservoirs system. Approximately two-thirds of the irrigated land is located below John Martin Reservoir in the Limestone and Lamar Divisions.

Length: The length of the Fort Lyon Canal is approximately 110 miles. The Kicking Bird Canal bifurcation is located approximately 42 miles down the Fort Lyon Canal from where it travels approximately 27 miles to the Great Plains Reservoir System.

Capacity: The capacity of the Fort Lyon Canal is approximately 1,040 cfs. Ditch diversions were typically recorded up to about 1,500 cfs prior to about 2000, with a maximum diversion of 1,919 cfs recorded on June 29, 1983. The Fort Lyon Company actively sluices sand out of the main canal but the system is overwhelmed by sand inflows during high flow periods that have reduced the carrying capacity of the canal. Much of the impact is felt during flood events when water is stored in Pueblo Reservoir and then released at a steady rate to meet a flow of about 6,000 cfs at Avondale. This may lengthen the impact of storm events, causing high river flows for up to a month, when similar events would last only a couple days prior to the construction and operations of Pueblo Reservoir for flood control.

The capacity and maintenance of the Fort Lyon Canal has been at the center of numerous

agreements and legal actions between FLCC and the Amity Mutual Irrigation Company (AMIC) related to the conveyance of water to AMIC's Great Plains Reservoirs. Historically, the Fort Lyon Canal direct flow rights have had precedence over the Great Plains storage rights. Subsequent to a recent court case filing, FLCC and AMIC agreed that during periods when the Great Plains storage rights are in priority to divert, AMIC is entitled to 400 cfs at the river headgate (300 cfs at the Kicking Bird bifurcation). The two companies are in the process of rehabilitating the ditch to its historical capacity and will share in the amount of additional conveyance capacity that is created.

Conveyance Efficiency: Fort Lyon Canal Company personnel indicate ditch losses average approximately 38 percent to the ditch lateral turnouts in the Fort Lyon Canal system. Based on information outlined in the storage right decrees for the Great Plains Reservoirs that were transferred to John Martin Reservoir (Case No. 80CW19) and subsequent cases, conveyance loss in the Fort Lyon Canal has been decreed to be 25 percent from the headgate to the bifurcation, with an additional 15 percent loss for the Kicking Bird Canal (37 percent total loss from the Fort Lyon Canal headgate). The H-I Model uses a mainline canal loss of 36.7 percent for the Fort Lyon Canal plus additional off-farm and on-farm lateral losses of 3.5 percent and 2.1 percent, respectively, as a proportion of headgate diversion (resulting in a 40.2 and 42.3 percent loss at the farm headgate and parcel, respectively).

Irrigated Acreage and Crop Types: GIS coverages from the State of Colorado's Decision Support System (CDSS) list approximately 85,000 to 90,000 irrigated acres under the Fort Lyon Canal over the past 10 years. Additional acreage under the canal system is fallowed. The two primary crops that are irrigated under the Fort Lyon Canal are alfalfa and corn. Additional GIS coverages are being developed as part of the ArkDSS project to provide snapshots of irrigated acreage covering the 1950 to 2017 period.

The Division 2 office maintains more detailed coverages of total acreage, field verification of dry-up acreage, well associations, and augmentation plan assignments. This information may be helpful in analysis of system operations and subsequent studies.

Ground Water Use: A portion of the land served by the Fort Lyon Canal is also supplied with tributary ground water. Preliminary estimates from the CDSS coverages indicate approximately 15,000 acres (~25 percent) of the FLCC lands are also supplied by tributary wells. These wells are augmented primarily by the Colorado Water Protective and Development Association (CWPDA) and the Lower Arkansas Water Management Association (LAWMA) and to a lesser degree by the Arkansas Groundwater Users' Association (AGUA).

Return Flow Locations: Return flows from the ditch system accrue to John Martin Reservoir and to the Arkansas above the confluence with Big Sandy Creek. **Table 1** lists a preliminary distribution of return flows based on the general layout of the canal and the irrigated lands in relation to locations of gages and major ditch headgates (active and inactive) in Water District 67.

Table 1: Fort Lyon Canal Return Flow Locations

Model Node	Structure ID	Canal Loss Return	Irrigated Lands Return
Arkansas River at La Junta gage	07123000	3%	---
Las Animas Consolidated	1700556	9%	5%
Horse Creek near Hwy 194 gage	HRC194CO	3%	---
Arkansas River at Las Animas gage	07124000	13%	9%
John Martin Reservoir	1703512	17%	14%
Fort Bent Canal	6700610	9%	7%
Amity Canal	6700607	8%	11%
Lamar Canal	6700614	21%	28%
Arkansas River at Lamar gage	07133000	3%	6%
X-Y Graham Canal	6700617	14%	20%
TOTAL		100%	100%

HydroBase Data:

Fort Lyon Canal – Diversion data are available in HydroBase for the Fort Lyon Canal from the early 1910s to present. Total diversions and diversions to irrigation (Use 1) are complete since 1911. Total diversions over the 1950 to 2015 period (see **Figure 2**) average 80,538 ac-ft/yr and range from 14,114 ac-ft (2012) to over 132,000 ac-ft (1966 and 2015).

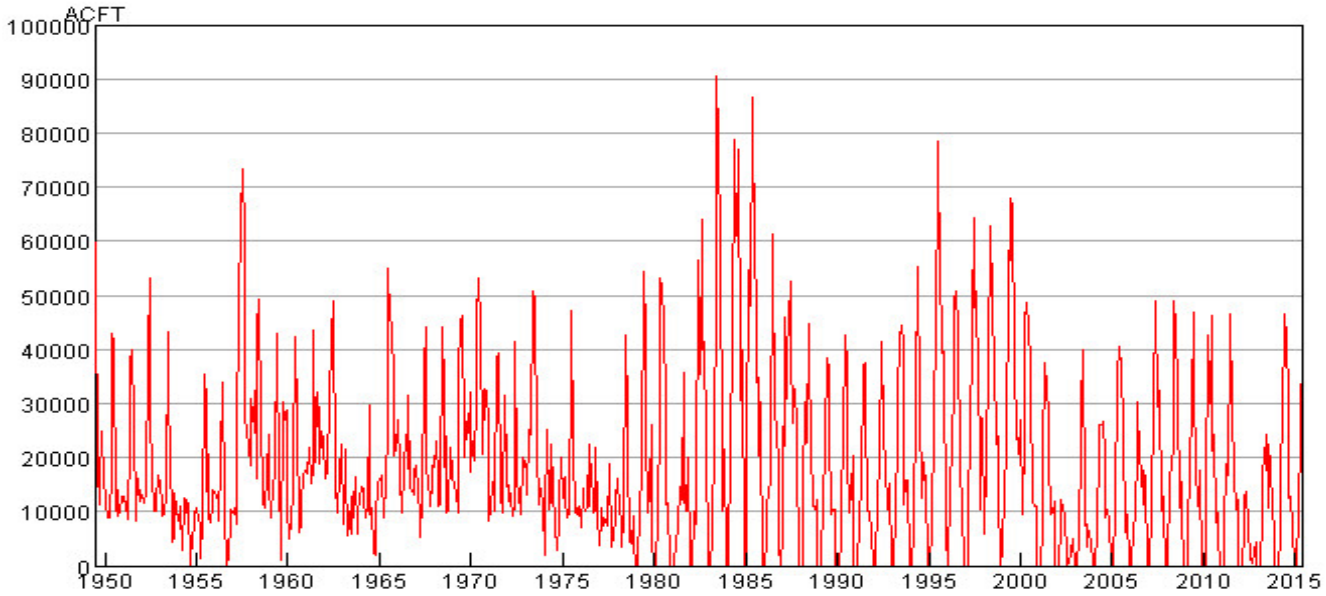

Figure 2: Fort Lyon Canal River Headgate Diversions

Other diversion coding through the headgate include:

- Diversions from storage (Source 2) from John Martin Reservoir (1990 to 1994, 1996 to1997, 2002, 2004 to 2006, 2008, 2010, and 2013 to2014)
- Winter Water deliveries from Pueblo Reservoir (1976, 1980 to1981, and 2003 to 2006)
- Deliveries from Lake Meredith (1990, 1993, 1996, 2003 to 2005, 2008 to 2009, and 2011 to 2015) and Holbrook Reservoir (2005 and 2013), also possibly Winter Water releases
- Fry-Ark Project deliveries for 1975, 1978 to 1982, 1984, 1988 to 1994, 1996, and 1998 to 2010.

Kicking Bird Canal – Diversion data are available in HydroBase for the Kicking Bird Canal for all but eight years during the 1970 to 2000 period (see **Figure 3**). Data prior to 1970 are only available for parts of each year. Records are also available for 2008 and 2015. Water commissioner notes indicate Kicking Bird Canal was not used or taken in another structure during the 2001 to 2007 and 2009 to 2014 periods, which corresponds with the zeroes in Figure 3. The different records available in HydroBase include Diversion Total, Diversion Classes, and Infrequent data and are presumed to be recorded at the bifurcation, after the estimated 25 percent ditch loss down the Fort Lyon Canal. Total diversions for the 1950 to 2015 period average 39,417 ac-ft/yr, with a maximum of almost 139,000 ac-ft in 1985.

A number of other sources of information for Kicking Bird diversion data have also been identified. The two following reports were developed primarily based on FLCC Annual Reports.

1. 1911 to 2016 monthly diversions (Helton & Williamsen, 2016, 16CW3038)
2. 1936 to 1974 monthly diversions (Zorich and Spronk, 1981)

The Helton & Williamsen data are complete over the 1950 to 2015 period. These data are generally consistent with the HydroBase data. The Zorich and Spronk data agree with the available HydroBase data for the 1950 to 1963 period; although the two sets of data diverge after 1963. The data developed for 16CW3038 should be used to replace the errant HydroBase values for July 1958 and October 1957 and should also be used to fill remaining missing HydroBase data.

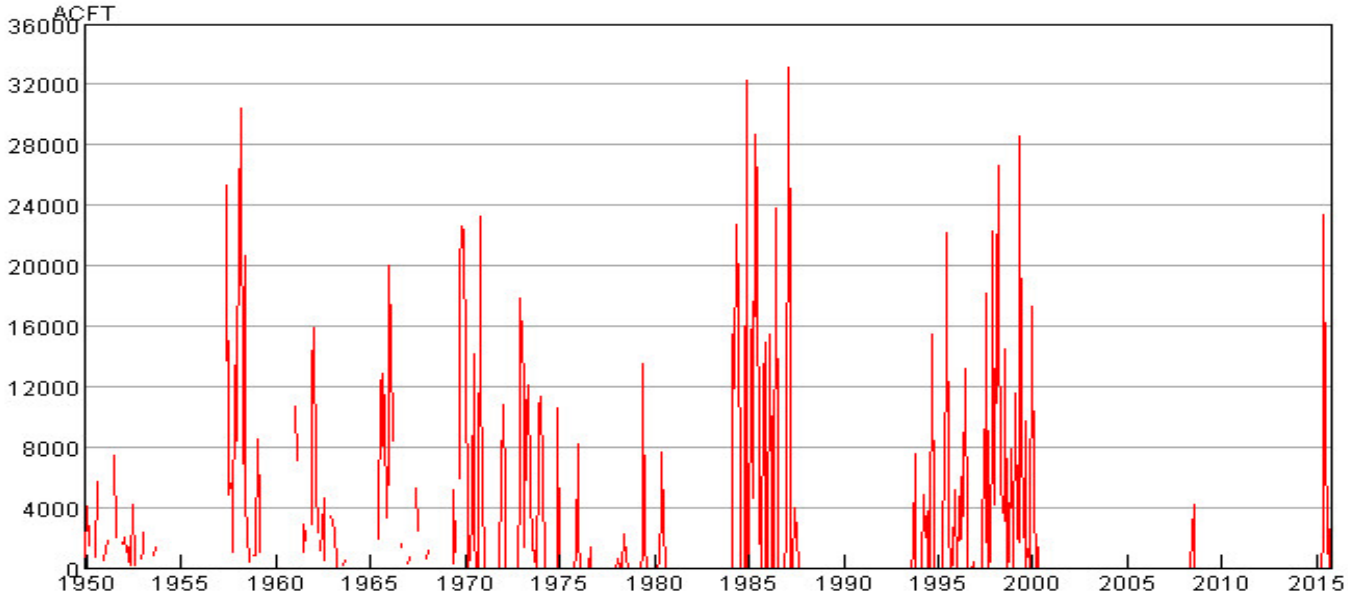

Figure 3: Kicking Bird Canal Diversions

2. Fort Lyon Storage Canal (1700648)

The Fort Lyon Storage Canal runs along the north side of the Arkansas River generally parallel to the river east of Rocky Ford. The Storage Canal turns north from the river and travels over Horse Creek to Horse Creek Reservoir before terminating in Adobe Creek Reservoir.

Length: The length of the Fort Lyon Storage Canal is approximately 46 miles to Adobe Creek Reservoir.

Capacity: The capacity of the Fort Lyon Storage Canal is approximately 700 cfs. Diversions up to about 1,400 cfs were recorded prior to about 2000, with a maximum diversion of 3,540 cfs on September 7, 1920.

Conveyance Efficiency: Estimates of seepage and evaporation losses from the Fort Lyon Storage Canal vary widely. Fort Lyon Canal Company personnel indicate ditch losses to Adobe Creek Reservoir range from 10 to 30 percent; depending on the diversion rate, whether the Holbrook Canal is diverting, and other factors. The H-I Model uses a ditch loss of 19.8 percent for the Fort Lyon Storage Canal.

Return Flow Locations: Return flows from the canal system accrue above several headgates on the Arkansas River above John Martin Reservoir and to Horse Creek. **Table 2** lists the aggregated distribution of return flows based on the general layout of the Storage Canal and irrigated lands in relation to locations of gages and major ditch headgates in Water District 17.

Table 2: Fort Lyon Storage Canal Return Flow Locations

Model Node	Structure ID	Canal Loss Return
Arkansas River near Rocky Ford	ARKROCCO	17%
Fort Lyon Canal	1700553	10%
Horse Creek near Hwy 194 gage	HRC194CO	52%
Las Animas Consolidated	1700556	21%
TOTAL		100%

HydroBase Data: Diversion data are available in HydroBase for the Fort Lyon Storage Canal from the early 1910s to present (see **Figure 4**). During the 1950 to 2015 period, diversion data are missing for 1956, 1964, 1966-1969, 1978, and 2003-2005. Records for 1966 to 1969 are recorded under Infrequent Data. Water commissioner notes indicate "Diversions Taken in Another Structure" during the 2003 through 2005 period, the location of which has not been identified. Total diversions over the 1950 to 2015 period average 49,106 ac-ft/yr, with a maximum of 145,500 ac-ft in 1986.

Monthly diversions to storage from other sources are available sporadically for water from Lake Meredith (1983, 1993 to 1994, 1996, 2007 and 2009 to2010 (including separate entries for Lake Meredith Winter Water in 2007 and 2010) and Pueblo Reservoir (Winter Water 1982-1983 and Fry Ark Water 1988-1992 and 1998). Note the Storage Canal diversion data and storage contents for Horse Creek Reservoir and Adobe Creek Reservoir are not always consistent and historical diversion total record prior to 1970 has limited diversions in the winter months.

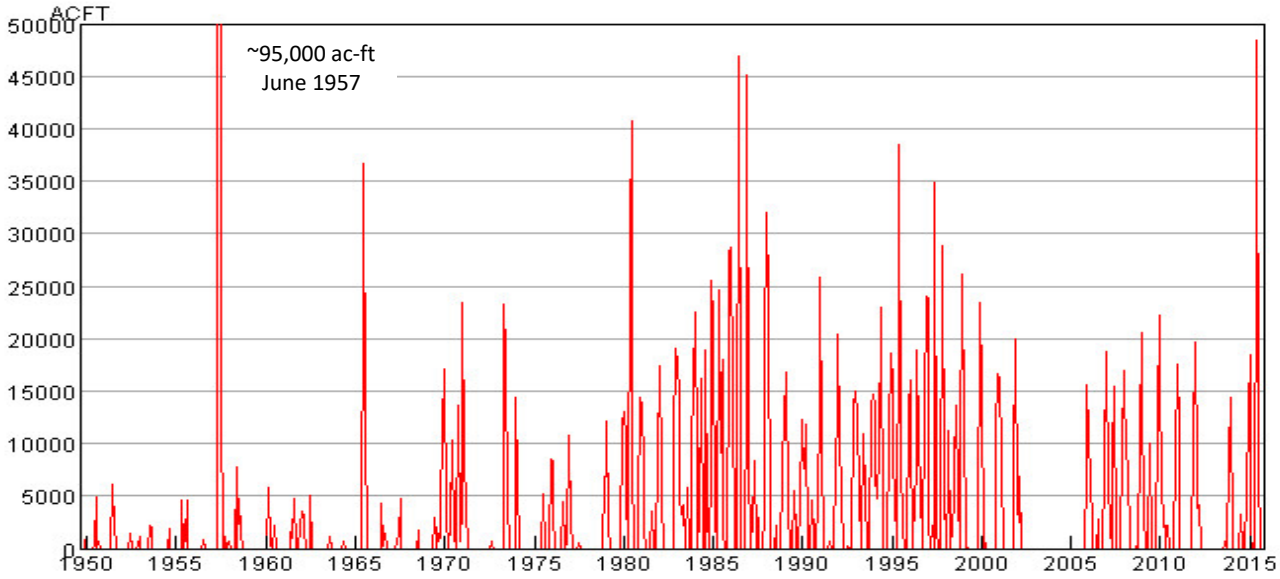

Figure 4: Fort Lyon Storage Canal River Headgate Diversions

3. Adobe Creek Reservoir (Structure ID 1703546)

Adobe Creek Reservoir is filled by the Fort Lyon Storage Canal. Water stored under the Adobe Creek Reservoir storage rights is available to Fort Lyon Canal Company shareholders. Inflows from Adobe Creek via the Adobe Creek Inlet Canal are minimal, outside of occasional high precipitation events. In addition to storing the reservoir storage water right, Adobe Creek Reservoir is one of the off-channel reservoirs in the Winter Water storage program.

Capacity:

- Total Storage: 81,592 ac-ft
- Active Storage: 77,527 ac-ft
- Dead Storage: 4,065
- Maximum Surface Area: 5,094 acres

Area/Capacity Data: The area/capacity data in **Table 3** were obtained from a 2005 survey. Since 2005, the storage contents data measured by the transducer in the reservoir are slightly higher than the records of storage contents in HydroBase; this may be due to run up from winds or various issues related to electronic operations with the transducer.

Table 3: Adobe Creek Reservoir Elevation – Area – Capacity

Gage Height (ft)	Surface Area (acres)	Cumulative Capacity (ac-ft)
4089.2	4.7	81
4090.9	16.2	277
4092.5	32.2	549
4094.1	51.9	886
4095.8	76.6	1,308
4097.4	113	1,920
4099.1	166	2,826
4100.7	236	4,031
4102.3	307	5,242
4104.0	407	6,942
4105.6	528	9,017
4107.2	678	11,578
4108.9	858	14,651
4110.5	1,074	18,325
4112.2	1,319	22,519
4113.8	1,593	27,187
4115.4	1,893	32,312
4117.1	2,225	37,981
4118.7	2,590	44,208
4120.3	2,983	50,926
4122.0	3,405	58,115
4123.6	3,846	65,657
4125.3	4,307	73,520
4126.9	4,782	81,630

Reservoir Storage Management: Storage levels in Adobe Creek Reservoir are measured using a staff gage. For the last 15 years or so, water elevation measurements have also been measured with a transducer.

Reservoir Seepage Information: Seepage from Adobe Creek Reservoir is not routinely monitored. Seepage from the reservoir accrues mostly to the Adobe Creek Reservoir Outlet Ditch.

The Adobe Creek Reservoir Outlet Canal is used to deliver water to Adobe Creek to be picked up by the Fort Lyon Canal for delivery to shareholders. Four outlet tubes are constructed from the reservoir. The total capacity of the outlets is approximately 700 cfs. Two of the outlets have been restricted for a few years and the outlet gates will be repaired in the next couple of years. The two non-restricted outlets are limited to 350 cfs; the capacity is not typically a limit to reservoir operations.

HydroBase Data: Historical storage contents data are mostly complete in HydroBase starting in water year 1988, with sporadic data available prior to that time (see red line in **Figure 4**). The Fort Lyon Canal Company provided a complete record of storage contents on a weekly basis for the January 1986 to present period (blue line). No diversions were made through the Fort Lyon Storage Canal during 2003 through 2005, which is consistent with the zero acre-foot storage contents provided for that period by the Canal Company. No Canal Company data prior to 1986 were made available. The Canal Company data are generally consistent with the HydroBase data, with differences likely due to different days that staff gage readings were taken, minor differences in capacity estimates based on staff gage elevations, etc. As noted above, the post-2004 Canal Company data are typically of higher magnitude than the HydroBase data.

Use of the Canal Company data as the primary source of model input data is appropriate for the ArkDSS Surface Water Model since these data are more complete after 1985. The change in storage contents for Adobe Creek Reservoir and Horse Creek Reservoir can be used with the Fort Lyon Canal diversion data to estimate total water supply for irrigation use. Some of the river headgate diversion data (total diversions and diversions to storage) and the storage contents and monthly release data for Adobe Creek Reservoir and Horse Creek Reservoir from the Fort Lyon Canal Company annual reports are not consistent. Therefore, some of the colors of water at the Fort Lyon Storage Canal river headgate may need to be revised to develop a “best fit” to make the various model input data consistent.

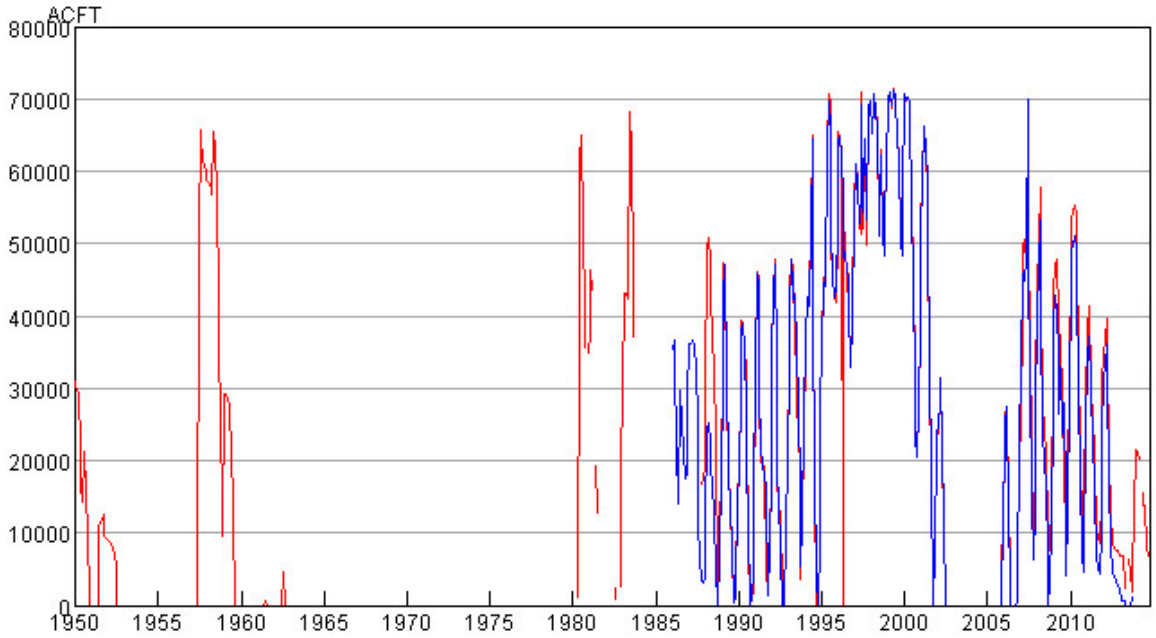

Figure 4: Adobe Creek Reservoir Storage Contents

4. Horse Creek Reservoir (Structure ID 1703545)

The Horse Creek Reservoir is filled by the Fort Lyon Storage Canal. Water stored under the Horse Creek Reservoir storage rights is available to Fort Lyon Canal Company shareholders. Inflows from Horse Creek via the Horse Creek Supply Ditch are minimal, outside of occasional high precipitation events. In addition to storing the reservoir storage water right, Horse Creek Reservoir is one of the off- channel reservoirs in the Winter Water storage program.

Capacity:

- Total Storage: 28,746 ac-ft, based on maximum storage contents in HydroBase
- Active Storage: 28,746 ac-ft
- Dead Storage: Minimal; gage height is at bottom of active pool

Area/Capacity Data: The area/capacity data in **Table 4** were obtained from a 2005 survey.

Table 4: Horse Creek Reservoir Elevation – Area – Capacity

Gage Height* (ft)	Surface Area (acres)	Cumulative Capacity (ac-ft)
0	23	12
1	83	71
2	128	187
3	158	344
4	182	532
5	207	745
6	238	989
7	296	1,285
8	389	1,664
9	508	2,160
10	641	2,793
11	770	3,570
12	871	4,382
13	945	5,214
14	1,065	6,316
15	1,234	7,574
16	1,403	9,017
17	1,595	10,674
18	1,814	12,556
19	2,064	14,694
20	2,318	17,109
21	2,521	19,773
22	2,720	22,654
23	2,907	25,748
24	3,089	29,041
25	3,280	32,537
26	3,526	36,270
27	3,776	40,296
28	3,985	44,571
29	4,185	49,070
30	4,360	53,773
31	4,518	58,657
32	4,658	63,704
33	4,774	68,891
34	4,884	74,199
35	4,995	79,630

* Based on gage height of 4888.0 (0 ac-ft capacity at 4087.6 feet)

Reservoir Storage Management: Storage levels in Horse Creek Reservoir are measured using a staff gage.

Reservoir Seepage Information: Seepage from Horse Creek Reservoir is not routinely monitored. Seepage from the reservoir accrues mostly to the Horse Creek Reservoir Outlet Ditch.

The Horse Creek Reservoir Outlet Canal is used to convey water to the Fort Lyon Canal for delivery to shareholders. The capacity of the outlet canal is unknown.

HydroBase Data: Historical storage contents data are mostly complete in HydroBase starting in water year 1988 through 2002, after which data are not available in HydroBase (see red line in **Figure 6**). The Fort Lyon Canal Company provided a complete record of storage contents on a weekly basis for the April 1985 to 2013 (blue line). Only a limited amount of water was been stored in Horse Creek Reservoir from the 2001 until 2015. No Canal Company data prior to 1986 were made available. The available Canal Company data are generally consistent with the HydroBase data, with differences likely due to different days that staff gage readings were taken, minor differences in capacity estimates based on staff gage elevations, etc.

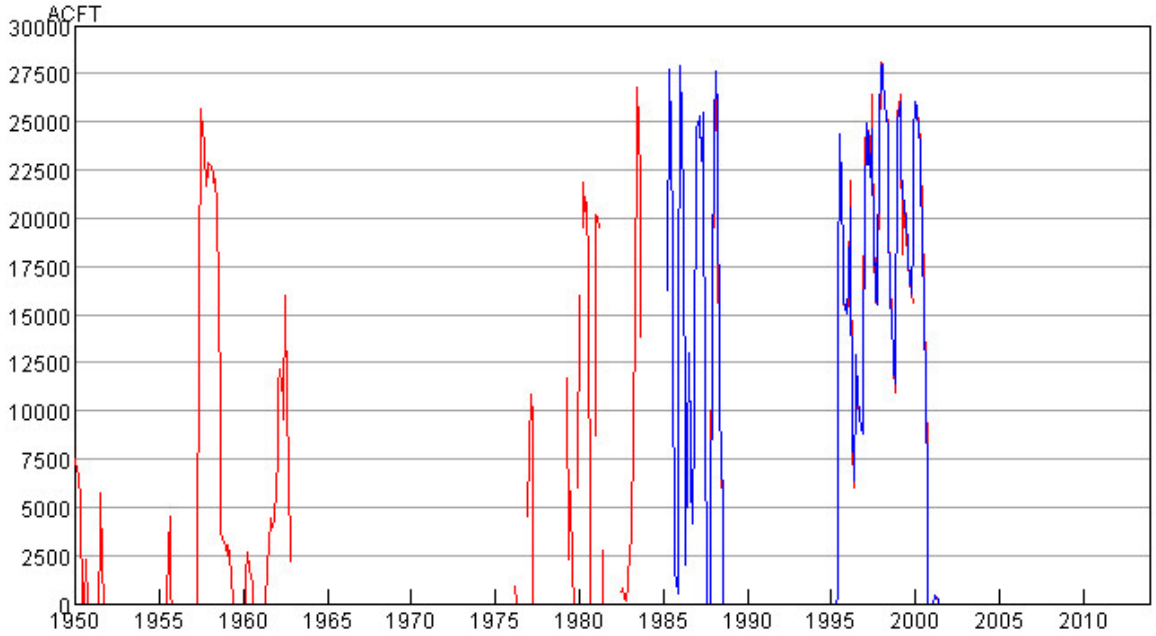

Figure 6: Horse Creek Reservoir Storage Contents

5. Great Plains Reservoirs (various Structure IDs)

The AMIC system also includes the Great Plains Reservoirs (Neesopah Reservoir; Nee Gronda Reservoir; Neenoshe Reservoir; and Neeskah, aka Queen, Reservoir). The reservoirs are filled by water diverted from the Arkansas River through the Fort Lyon Canal to the Kicking Bird Canal. Water is released from the Great Plains Reservoirs through the Comanche and Pawnee Canals and delivered to the Amity Canal at a point near where it crosses Big Sandy Creek.

In Civil Action 2158, the Fort Lyon Canal Company (FLCC) was granted preferential use of the first 5,483 ac-ft/yr of the Great Plains Reservoirs storage rights yield to compensate the company for use of its canals to convey water to the reservoirs. At the beginning of the storage season, FLCC will decide where it wants to take the "5483 Water". Note the 5483 Water is based on flows at the Fort Lyon Canal headgate, prior to ditch losses to the storage reservoirs and/or or transit losses to John Martin Reservoir. Since about 1944, Amity has provided Fort Lyon's 5483 water from Neeskah (Queen) Reservoir until entry of Fort Lyon's decree in 80CW51 (ca. 1987), after which John Martin Reservoir has typically been the preferred choice because transportation and evaporation losses are lower than would occur in FLCC's storage reservoirs.

Further information regarding the Great Plains Reservoirs and diversion data available for the reservoirs is included in the ArkDSS Amity Mutual Irrigation Company Operating Memorandum.

6. John Martin Reservoir (6703512)

John Martin Reservoir was constructed in 1948 and provides flood control, enhanced irrigation supply for both Colorado and Kansas irrigators, and facilitates delivery requirements pursuant to the Colorado-Kansas Compact. Details regarding John Martin Reservoir are described in the ArkDSS Water District 67 Meeting memorandum. The focus on John Martin Reservoir operations related to FLCC is discussed herein.

The gates on John Martin Reservoir are shut on November 1 and all inflows accrue to the Conservation Storage (Section II Winter Water) account (335,693 acre-feet) and Section III (Other Water) accounts used to store water for the lower Winter Water Program participants (75,000 acre-feet total, split 50,000 acre-feet to the Amity Canal; 20,000 acre-feet to the Fort Lyon Canal; and 5,000 acre-feet to the Las Animas Consolidated Canal). Winter storage in the Section III accounts is limited to the November 15 – March 15 Winter Water storage season. FLCC's portion of the Great Plains Reservoirs storage rights (5483 Water) can also be stored in John Martin Reservoir, as part of Amity Canal's alternate point of storage decreed in Case No. 80CW19, but is shown as storage in Fort Lyon's Section III account if applicable. Use of John Martin Reservoir is complicated for FLCC for two reasons. First, 35 percent of the water stored in the Article III account is transferred to the Transit Loss and Conservation Storage accounts pursuant to the John Martin Reservoir 1980 Operating Plan including any of the 5483 water stored in John Martin Reservoir. Second, water must be released and exchanged to the Fort Lyon Canal headgate, and these operations are limited to periods when river flows allow the physical exchange to occur on water Fort Lyon would otherwise have to pass to water rights below John Martin Reservoir.

WATER RIGHTS

The FLCC owns direct flow rights on the mainstem Arkansas River and tributaries that intersect the canal along its length. Storage rights owned by FLCC include Horse Creek, Adobe Creek, and Thurston Reservoirs.

Direct Flow Rights

The FLCC has a total decreed flow rate of 933 cfs for irrigation uses, as summarized in **Table 5**. Also listed in Table 5 are the exchange rates from John Martin Reservoir, the filling rates for the Fort

Lyon Storage Canal for the Horse Creek Reservoir and Adobe Creek Reservoir storage decrees, and the filling rate for the Kicking Bird Canal for the Great Plains Reservoirs storage decrees (see Table 6).

Table 5: Direct Flow Rights

Structure	Appropriation Date	Adjudication Date	Admin. No.	Decreed Amount (cfs)	Case No.	Notes
Fort Lyon Canal	4/15/1884	4/8/1905	12524.0	164.64	4/8/1905	Irrigation Use
	3/1/1887		13574.0	597.16		
	8/31/1893		15949.0	171.2		
			Total	933		
	8/12/1889*	4/8/1905	14469.0	355.2	4/8/1905	Storage in Thurston Reservoir
	8/1/1896	2/3/1927	20186.17015	1,150	2/3/1927	Storage in Great Plains Reservoirs
	4/24/1980	12/31/1990	47596.0	544	90CW47	JMR Exch (Absolute)
			51134.47596	606		JMR Exch (Conditional)
Fort Lyon Storage Canal	1/25/1906	11/8/1928	20478.0	840	11/8/1928	Storage in Horse Creek and Adobe Creek Reservoirs
	6/12/1908		21347.0	840		Storage in Horse Creek Reservoir
	23/29/1908		21547.0	840		Storage in Adobe Creek Reservoir
	3/1/1910		21974.0	1466		Storage in Horse Creek and Adobe Creek Reservoirs

Source: Colorado Water Rights Tabulation.
Note: * Water right originally for Prince Reservoir (1703825). A stipulation with Colorado Fuel and Iron (CF&I) made this water right junior to CF&I's storage right in the upper Arkansas River basin.

Storage Rights

The storage rights associated with Adobe Creek Reservoir, Horse Creek Reservoir and Thurston Reservoir are summarized in **Table 6**. Adobe Creek Reservoir has undergone one enlargement from its initial decreed capacity of 61,575 ac-ft; the enlargement increased the decreed storage capacity by 25,425 ac-ft to its current decreed capacity of 87,000 acre-feet.

Horse Creek Reservoir has undergone two enlargements from its initial decreed capacity of 11,400 ac-ft. The first enlargement increased the decreed storage capacity by 15,487 ac-ft. The second enlargement increased the decreed storage capacity by 1,113 ac-ft to its current decreed capacity of 28,000 acre-feet.

Table 6: Storage Rights

Storage Unit	Appropriation Date	Adjudication Date	Admin. No.	Decreed Amount (ac-ft)	Case No.	Notes
Adobe Creek Reservoir *	8/1/1896	2/3/1927	20186.17015	5,483	89CW76	Queen Res. Alt Point
	1/25/1906	11/8/1928	20478.0	61,575	11/8/1928	Absolute (Irrig)
	12/29/1908		21547.0	25,425		
		Totals	87,000 (Storage)		5,483 (Alternate Point)	
Horse Creek Reservoir *	8/1/1896	2/3/1927	20186.17015	5,483	89CW76	Queen Res. Alt Point
	8/15/1900	11/8/1928	20186.18489	11,400	11/8/1928	Absolute (Irrig)
	1/25/1906		20478.0	15,487		
	6/12/1908		21347.0	1,113		
		Totals	28,000 (Storage)		5,483 (Alternate Point)	
Thurston Reservoir *	8/12/1889	4/8/1905	14469.0	1,515.15	W-27	Absolute (Irrig)

Source: Colorado Water Rights Tabulation
Note: * Storage rights changed to include Commercial and Stock Water uses in Case No. 08CW83

In Civil Action 2148, the Fort Lyon Canal Company was granted preferential use of the first 5,483 ac-ft/yr of the Amity Mutual Irrigation Company's Great Plains Reservoirs storage rights yield to compensate the company for use of the Fort Lyon Canal to convey water to the reservoirs. The storage rights associated with the Great Plains Reservoirs are discussed in the ArkDSS Amity Mutual Irrigation Company Operating Memorandum

Administration

Administration of the water rights associated with the Fort Lyon Canal Company involves interaction with the Commissioners for Water District 17 and 67 and the Division 2 Engineer. The Superintendent of the canal company is more often in contact with these individuals during periods of storage and during periods when direct flow calls have been placed downstream on the Arkansas River.

In addition to providing water for direct irrigation, the Fort Lyon Canal is used to deliver water to the Kicking Bird Canal and into storage in the Great Plains Reservoirs (Neesopah Reservoir; Nee Gronda Reservoir; Neenoshe Reservoir; and Neeskah, aka Queen, Reservoir). The Great Plains Reservoir are owned by the Amity Mutual Irrigation Company and used to make supplemental deliveries to the Amity Canal near Big Sandy Creek. Operational agreements and various water court decrees have outlined the cooperative operations related to the canals and reservoirs.

OPERATIONAL INFORMATION

The general operating strategy for the Fort Lyon Canal Company System in a typical year is as follows:

Non-Irrigation Season

At the beginning of the storage season, FLCC will decide where it wants to take the "5483 Water" from the yield of the Great Plains Reservoirs storage rights. The decision is typically between FLCC's Horse Creek and Adobe Creek Reservoirs, Lake Meredith, or John Martin Reservoir. The preference is dependent on a number of factors and, according to the ditch superintendent, all of the storage locations are commonly used. Since 2015, FLCC has dedicated its 5483 Water to Amity Mutual

Irrigation Company to pay back a water debt that has accumulated over the past few years corresponding with the extent of Great Plains Reservoir storage right diversions through the Fort Lyon Canal.

Winter Water is stored in multiple locations, which may include Pueblo Reservoir, John Martin Reservoir, Lake Meredith, Dye Reservoir, Holbrook Reservoir, Adobe Creek Reservoir, and Horse Creek Reservoir. The amount of water available to the Winter Water program participants is dependent on river flows, as outlined in the 84CW179 decree that officially recognized the Winter Water Storage Program. FLCC is entitled to 38.16 percent of the first 100,000 ac-ft yield and a similar percentage of any water stored above 103,106 ac-ft. Total yields for the Winter Water Program have ranged as low as about 75,000 ac-ft in 2003 to almost 180,000 ac-ft in 2000. FLCC's portion of the 2000 yield was about 57,000 ac-ft.

The Company's Winter Water yield has been historically stored under the Fort Lyon Storage Canal, but since the early 2000s drought, the canal company has generally stored its pro rata share in Lake Meredith. The Lake Meredith option is attractive since transit losses down the Colorado Canal are not counted against the Winter Water stored under the Colorado Canal system. In addition, releases from Lake Meredith can be picked up in the Fort Lyon Storage Canal prior to Outlet Canal releases reaching the Arkansas River. Nonetheless, a general preferred order of Winter Water storage is as follows:

- Fort Lyon Storage Canal reservoirs (Adobe Creek, followed by Horse Creek)
- Lake Meredith
- Pueblo Reservoir
- John Martin Reservoir

Irrigation Season

The Fort Lyon Canal has relatively senior direct flow rights. The 1884 priority is generally in priority and the 1887 cfs direct flow right is typically in priority to divert some amount, depending on the amount of return flows and demands associated with the large senior 1887 rights at the Amity Canal and the Oxford Farmers Ditch.

There is approximately 1,500 cfs of direct flow rights in Water District 67 senior to the Fort Lyon Canal's 1893 direct flow right. The Fort Lyon Canal can divert river flows in exchange for releases from John Martin Reservoir when river flows past the Fort Lyon Canal headgate and downstream gains are insufficient to meet the District 67 senior rights. The Fort Lyon Canal Company generally takes delivery of its Winter Water in Lake Meredith early in the irrigation season since its water will be booked out if the Lake Henry or Lake Meredith storage rights come into priority during the spring runoff.

Other supplemental supplies are also available for the Fort Lyon Canal, including storage water from its own reservoirs, John Martin Reservoir, and Fryingpan-Arkansas water stored in Pueblo Reservoir.

Although the sequence of delivery each year varies based on hydrologic conditions, ditch operational issues and locations of storage of its Winter Water and other supplies, a general order

of operations for water supplies into the Fort Lyon Canal system is as follows:

- John Martin Reservoir
- Direct Flow Water
- Various colors of water in storage, first from Pueblo Reservoir, then Lake Meredith, then Horse Creek Reservoir, and Adobe Creek Reservoir
- Fry-Ark Project Water from Pueblo Reservoir

Where to find more information:

- Additional information on ditch and reservoir operations in and around the Fort Lyon Canal and its service area, including John Martin Reservoirs, is presented in the ArkDSS Water District 17 and 67 memoranda.
- Additional information on Pueblo Reservoir and the Winter Water Storage Program is presented in the ArkDSS Fryingpan-Arkansas Facilities and Related Operations memorandum.
- Additional information on Amity Canal Company operations is presented in the ArkDSS Amity Mutual Irrigation Company Operating Memorandum.

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Meeting with Water Division 2, Water District 17 Commissioner Lonnie Spady (lonnie.spady@state.co.us, 719.250.1655).

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