ArkDSS Memorandum
Final

To: Bill Tyner and Kelley Thompson, Colorado Division of Water Resources

From: ParsonsWater Consulting

Subject: Task 2.1 – Water Commissioner Interviews
Notes from Water District 17 Meeting

Date: February 2019

Introduction

This memorandum provides notes from the September 12, 2017 meeting with Water District 17 Water Commissioner. Water District 17 encompasses portions of the Lower Arkansas River Basin between the town of Fowler and the upstream terminus of John Martin Reservoir. In addition to the mainstem Arkansas River, the district also includes tributary areas of Horse, Adobe, and Timpas Creeks and portions of the Purgatoire and Apishapa Rivers. Meetings were held with Water Commissioners in each Water District in the ArkDSS study area. The objectives of these meetings were to 1) develop an initial basin understanding; 2) determine diversion and reservoir structures that should be included in future detailed modeling efforts, and 3) determine which reservoirs and diversions warrant more detailed investigation and technical documentation. These objectives support Task 3 Consumptive Use Analysis and Task 4 Surface Water Modeling. Information in this memorandum is believed to be accurate; however, this information should not be relied upon in any legal proceeding.

Approach

Prior to the meeting, data discrepancies for District 17 were identified using the following procedure outlined in the ArkDSS Scope of Work:

1. Review the availability of diversion, reservoir storage, and streamflow data.
2. Review historical call data and identify how it may vary from current call reporting standards.
3. Identify net absolute water rights for structures in each Water District. Review the irrigated lands master parcel set and ditch service to identify ditches with water rights and/or diversions records but for which irrigated areas have not been identified.
4. Develop an initial list of key structures and structures with acreage and water rights, but no diversion records to understand areas without records and how to estimate their use.

Maps were also developed displaying reservoirs, diversion headgate locations, and irrigated acreage of the Water District to facilitate the discussions.

The interview with the Water Commissioners and the Division Engineer was intended to determine structures that should be considered key based on seniority, water administration, or basin operations. The following is a summary of the meeting agenda:

1. Review straight-line diagrams for accuracy
2. Develop a list of major projects, reservoirs, and ditches in the water district, including names of knowledgeable contact people
3. Gather information on dry-up points in the river, calling rights, augmentation plans, and administration specific to the water district
4. Gather general information on the preliminary list of irrigation diversions selected to include in future detailed modeling efforts (key structures), and solicit input on their final inclusion
5. Develop information on reservoirs, such as owner entities, ditches that get reservoir deliveries, assigned delivery losses, etc.
6. Correct irrigated acreage information

The final memo was also reviewed by Kevin Salter and Rachel Duran with the Kansas Department of Agriculture.

Meeting Attendance

The meeting was held at the Division of Water Resources Office in Pueblo. The following people attended the meeting:

- John Von Oort, DWR Division 2 River Operations Coordinator
- Lonnie Spady, DWR, Eastern Region Commissioner and Water District 17 Water Commissioner
- Jeannette Myers, DWR, District 17 Deputy Water Commissioner
- Kelley Thompson, DWR, Lead Modeler
- Rick Parsons, ParsonsWater Consulting
- Brenna Mefford, Wilson Water Group

Transbasin Diversions

- Water supplies diverted from the Fryingpan River (the “Fry-Ark water” or “Project Water”) that is conveyed to the upper Arkansas River basin is the primary transbasin import. Project Water is initial stored in Turquois Reservoir and Twin Lakes Reservoir then released and stored in Pueblo Reservoir and then subsequently released to various entities for both direct use and for storage. Project Water is sometimes stored in the off-channel reservoirs under the Colorado, Holbrook, and Fort Lyon canal systems.
- The transbasin water associated with the Twin Lakes Canal Company was historically delivered to the Colorado Canal system. A significant amount of the Colorado Canal system has been changed in water court, primarily by Colorado Springs and Aurora. These entities and the smaller municipal users with the changed ditch and reservoir

shares take much of their Arkansas River water from Pueblo Reservoir. Therefore, most of the Twin Lakes water is conveyed to Pueblo Reservoir rather than downstream to users under the Colorado Canal system.

Compacts and Agreements Affecting District 17 Administration

- The Colorado-Kansas interstate compact affects District 17 administration, especially during the winter storage season and spring runoff. John Martin Reservoir serves as a water bank to store water consistent with historical operations and provide flexibility of water use for the lower basin ditch companies. The gates on the John Martin Reservoir dam are closed during the winter storage season (November 1 – March 31) except to the extent that Colorado Water District 67 ditches or Kansas calls for a release of account water. Water is stored in the Conservation Pool (Section II Water, split 60:40 to Colorado and Kansas) and the Other Water Account (Section III Water, primarily for Fort Lyon, Amity, and Las Animas Consolidated canals). A storage charge is assessed on deliveries of water stored in Section III accounts (35%) and this storage charge portion is used to first replace to the Kansas Section II account any deficit from the prior deliveries to the stateline, then to fill the Kansas Transit Loss account to 1,700 acre-feet and is then distributed to Kansas and the other Water District 67 ditches pursuant to the 1980 Operating Agreement for John Martin Reservoir.
- The Winter Water Storage Program was decreed in 1989 following years of operation as a pilot program (all years from 1976 through 1983 except 1978 and under the provisions of a pending decree from 1984 through 1989) as a method to address competing rights in the Arkansas River basin. Winter operations were a mix of direct flow irrigation and diversion to storage, however in light of the 1970s construction and continued operation of Pueblo Reservoir the program was developed to maximize the beneficial use of the limited water supply. Water is stored in Pueblo Reservoir, John Martin Reservoir, and the reservoirs under the Colorado, Holbrook, and Fort Lyon canals (including through Fort Lyon Canal to Kickingbird Canal for storage in the Amity Great Plains Reservoirs) pursuant to a 1910 priority water right during the “Winter Water” storage season (November 15 – March 14). The waters in storage are apportioned to the various Winter Water participants in mid-March.

Stream Gages

The following gages on the Arkansas River are the primary gages used for river administration in District 17. All the gages are reliable and the streamflow records are considered good.

Arkansas River near Avondale, Co. (07109500, ARKAVOCO)

- Uppermost gage used to manage the District in an overall effort to distribute water to as many users as possible.

Arkansas River near Nepesta, Co. (07117000, ARKNEPCO)

- Located approximately ¾ mile above the Oxford Canal (1700541) headgate. The gage is located on the left bank, downstream side of the Pueblo County Road 613 Nepesta Road Bridge crossing the Arkansas River, 0.8 mi downstream of Kramer Creek, 9 mi downstream from Huerfano River, 1 mile NNW of the Nepesta Cemetery. Oxford Farmers Ditch gage is located approximately 0.25 miles upstream of Nepesta Bridge near right bank of Arkansas River. The gage was originally established May 1, 1901 and run intermittently until June 4, 1921 using either non-recording or water-stage recording gages at different datums at various sites up to 7 miles upstream. The gage was moved in June 1921 due to washout by flood. From June 5, 1921 to September 30, 2000 water-stage recorders, at various datums, at various sites within 2 miles upstream of the present site were used. On October 1, 2000 the gage was established at the present site and datum. The station was run by USGS until November 1988 at which time the Colorado State Engineer's Office took over operation and record responsibility. The lower gage is used in combination with the tributary gage on the Apishapa River near Fowler (07119500) to help with determining available flow for diversion at the Catlin Canal (1700552).

Arkansas River at Catlin Dam, near Fowler, Co. (07119700, ARKCATC)

- This is the primary gage used for measuring river flow below the Catlin Canal river headgate. Another gage was installed a few years ago below the 07119700 gage (Arkansas River below Catlin Dam Secondary, ARKCA2CO). The secondary gage is used to measure river flow when the Catlin Dam is diverting water running over the dam spillway has a negative impact on the 07119700 gage reading.

Arkansas River near Rocky Ford (ARKROCCO)

- Used in combination with the tributary gage on Timpas Creek near Swink (07121500, TIMSWICO) to help with determining available flow for diversion at the Fort Lyon Canal (1700553).

Arkansas River at La Junta, Co (07123000, ARKLAJCO)

- Pivotal to river administration, particularly during the spring runoff when the commissioner is determining how many junior storage rights are in priority.

Arkansas River at Las Animas, Co. (07124000, ARKLASCO)

- Used to estimate inflows to John Martin Reservoir. This gage is used in combination with tributary inflows recorded at the Purgatoire River near Las Animas gage (07128500, PURLASCO) to determine how much water can be diverted for use in District 17 to meet the need for water users in Water District 67.

Instream Flow Reaches

There is only one decreed instream flow reach in Water District 17.

- An instream flow (6703001) is decreed on the reach of Gageby Creek below the Fort Lyon Canal. Gageby Creek flows are measured at the GACBFLCO gage located below the Fort Lyon Canal

General Administration

The current Water Commissioner, Lonnie Spady, has managed Water District 17 for the last six years. The Water Commissioner is assisted by Jeanette Myers, the Deputy Water Commissioner.

- The headgates of the Colorado, Rocky Ford Highline, and Oxford Canals are located in Water District 14 but are currently administered in Water District 17 as the irrigated acres are located primarily in the downstream district. Some historical records for these canals are currently included under District 14 WDIDs in HydroBase, and there are some duplicate records under both districts. Diversion data for these canals in HydroBase may need to be consolidated under just the District 17 WDIDs.
- Most of the ditches on the Arkansas River are administered daily. The main stem ditches and augmentation stations off those ditches have diversion recorders connected to satellite telemetry. The recording devices are considered reliable. Water use on the tributaries above the main stem ditches is limited and therefore does not require as much administrative effort.
- Except for the Purgatoire River, the tributaries in District 17 above the main stem ditches are ephemeral. These creeks typically dry up for part of the year. The creeks become perennial as you approach the main stem ditches and the Arkansas River. Stock water use is the primary water use up gradient from the main stem ditches. Irrigation use by surface water is limited and many of the upper basin ditches rely on rain events and flood flows for supply. Wells are also used for supply in the upper reaches of the tributaries.
- The Water Commissioner has administered swing or bypass calls in Water District 17 but coding of those calls in HydroBase started in 2017.
- Irrigation in the District is comprised mostly of lands irrigated with surface water supplies, both with and without supplemental ground water. Lands supplied solely with ground water exist, but to a lesser extent. Depletions from ground water pumping are replaced by membership in or leases with Arkansas Groundwater Users Association (AGUA) or the Colorado Water Protection and Development Association (CWPDA). A few structures are also augmented by the Lower Arkansas Water Management Association.

- Most of the ditches receive supplemental supply from both Project water and Winter Water. The Rocky Ford Ditch and Otero Canal are the only two of the major District 17 ditches that do not receive Winter Water.
- The major ditches in the District typically run parallel to the Arkansas River. Although most of the irrigated land is within 15 miles of the river, the irrigation ditches in District 17 may extend up to 40 miles long (with the Fort Lyon Canal extending an additional ~80 miles into District 67).
- The north side of the District includes three major ditch systems with off-channel reservoirs – Colorado Canal, Holbrook Canal, and Fort Lyon Canal. Horse Creek and Adobe Creek are the largest of the northern tributary basins. The Fort Lyon Storage Canal also diverts and delivers water in the north side of the District (to Horse Creek and Adobe Creek Reservoirs).
- The south side of the District includes cascading ditches that are laid out one above another. There are several instances where lands located under a lower ditch (e.g., Catlin Canal) is irrigated with shares from an up gradient ditch (e.g., Rocky Ford Highline Ditch). These lands typically do not comingle shares from both ditch companies although a few parcels may be comingled with water from small seep ditches. On the lower portions of the Purgatoire River in District 17, most of the historically significant irrigated acreage has been dried up because of water court change cases for the Lower Arkansas Water Management Association (LAWMA), which augments well use in Water District 67 for the Highland Canal. The Ninemile Canal does still divert from the lower Purgatoire River and irrigate lands.

In addition to the changes of water rights for well augmentation use, a substantial amount of irrigated land in the District has been changed in water court to municipal use. The major municipal owners of the water rights include the cities of Pueblo, Colorado Springs, and Aurora. These users typically divert the changed direct flow and storage water at Pueblo Reservoir and points upstream and numerous exchange rights have been adjudicated. The choke point for the exchange is a minimum bypass of water through Pueblo Reservoir. The various municipalities operate a voluntary flow program to limit their exchanges to ensure 100 cfs is in the river below Pueblo Reservoir down to Avondale. Releases are made to meet the 100 cfs rate on weekends if reservoir inflows are too low. These releases are captured downstream in Lake Meredith or Holbrook Reservoir and exchanged back up to Pueblo Reservoir when flows increase. The release and exchange of the supplemental releases is the Recovery of Yield program.

Table 1 provides a normal year call sequence:

Table 1

Normal Year River Call Sequence

Winter	Compact storage in John Martin Reservoir administered with a 1949 priority starting Nov 1, typically through Apr 1. Winter Water storage in Pueblo Reservoir, Off-Channel Reservoirs and John Martin Reservoir administered with a 1910 priority between Nov 15 – Mar 14 15.
Begin Irrigation Season – April to early May	1st Call is Fort Lyon's Mar 1887 right or a more junior right bypassed to the Fort Lyon Canal. Amity Feb 1887 call typically placed late-Apr / early-May.
Spring Runoff	Colorado 1890 Call. Downstream junior storage rights may call in average and wet year (1896 Great Plains Lyon or 1906 Adobe Creek and Horse Creek.
July	More senior ditch rights – 1887 Fort Lyon down to 1875 Las Animas Consolidated and 1874 Rocky Ford during dry years.
End of Irrigation Season – September to October	Amity Feb 1887 Call and 1874 Rock Ford during dry years.

The La Junta gage is used during the spring runoff to determine which storage rights will be in priority to divert. A threshold flow equal to the amount of water called by District 67 water users plus the 933 cfs Fort Lyon Canal total irrigation rights is established. The junior 1896 Great Plains storage rights are fully in priority to divert if there is more than 1,150 cfs at the La Junta gage or at the Fort Lyon headgate (absent a concurrent delivery operation to John Martin Reservoir). At lower streamflow, the commissioner partitions the water to the more senior storage rights upstream in the District.

The Las Animas gage is used during the latter part of the irrigation season to estimate the depth of the call vis-à-vis the need for water below John Martin Reservoir. A flow of 600 cfs at the Las Animas gage is a "trigger" flow for downstream need. Flows above that rate are used to distribute water to the senior Fort Lyon canal and other upstream water rights.

The Las Animas gage is used at the end of the irrigation season to determine the distribution of water between water for the Conservation Pool (Section II water) and the Other Water Accounts (Section III water) in John Martin Reservoir to be stored during the subsequent winter storage season (November 1 – March 31).

Where to find more information:

- Additional information on historical calls is presented in the ArkDSS Task 2.9 Historical Calls memorandum.

Municipal Use

All the municipalities in the basin are supplied by wells and are primarily augmented by CWPDA. The City of La Junta recently adjudicated a change of water right and exchange related to Holbrook Canal shares for replacement of well depletions. Rocky Ford has an augmentation plan that includes changed Catlin shares and changed Rocky Ford Ditch shares. Towns within the Colorado Canal service area (Ordway, Crowley, Cheraw, and Sugar City) have their own augmentation plans with Twin Lakes water and Project Water for which replacement credits are provided by releasing water to the river.

Reservoir Specific Information

Most of the reservoirs with absolute storage rights greater than 1,000 acre-feet are under three canal systems, which include the following six reservoirs. Two reservoirs not associated with the following system have absolute storage rights greater than 1,000 acre-feet (Box Springs Reservoir No. 2 – 1703572 and Brown Reservoir – 1703562) but the physical capacity of these structures is much smaller than the storage rights.

- Lake Henry (1703525) and Lake Meredith (1703524) are operated in conjunction with direct flow rights, transbasin water, and Winter Water in the Colorado Canal system. Most of the canal system has been dried up pursuant to changes of the water rights to municipal uses.
- Dye Reservoir (1703510) and Holbrook Reservoir (1703511) are operated in conjunction with direct flow rights, transbasin water, and Winter Water in the Holbrook Canal system. Most of the canal system remains in irrigation use although the City of La Junta and CWPDA recently adjudicated changes of the water rights to municipal and augmentation uses.
- Adobe Creek Reservoir (1703546) and Horse Creek Reservoir (1703545) are operated in conjunction with direct flow rights, transbasin water, and Winter Water in the Fort Lyon Canal system. Most of the canal system remains in irrigation use although Colorado Beef has recently adjudicated a change of some Fort Lyon Canal water rights to augmentation use. Arkansas River Farms has also initiated a temporary change of water rights through the Lower Arkansas Water Management Association Rule 14 Plan, but no Water Court application has yet been filed. Thurston Reservoir is also used under the Fort Lyon Canal system.

Multiple colors of water and different owners of water typically exist in Pueblo Reservoir and the District 17 reservoirs. This includes Winter Water and Project Water in Pueblo Reservoir owned by irrigators in most of the major irrigation ditches; Winter Water, Project Water, Twin Lakes, and water stored by priority in Lake Henry and Lake Meredith; and similar colors of water, save the Twin Lakes water, in Holbrook, Dry, Adobe Creek, and Horse Creek reservoirs. Winter Water for Las Animas Consolidated is typically stored in John Martin Reservoir. After March 14, the total volume of Winter Water is apportioned to the various

ditches and then the physical water in storage is assigned to the various users. The ditches lower in the basin prefer their Winter Water stored below Pueblo Reservoir so that they suffer less transit loss when that water is released.

The Project Water is often used first since it is already paid for and only 20 percent of the previous year's Project water can be carried over. Winter Water in other ditch companies' reservoirs (e.g., Las Animas Consolidated Winter Water in Lake Meredith) is also released early since that water will be spilled if the storage rights come into priority to divert. A further complication occurs since municipalities with the changed ditch shares have Winter Water stored below Pueblo Reservoir but their use of that water starts in Pueblo Reservoir. Therefore, they may trade some lower basin supplies (e.g., municipal share of Winter Water in Lake Meredith) in exchange for the Winter Water stored in Pueblo Reservoir owned by a lower ditch company (e.g., Holbrook Canal).

These scenarios illustrate the general order of operations for the use of supplemental water supplies in District 17 for each ditch company and municipal user are dependent on several factors. Discussions with the individual ditch companies, municipal users, and well augmentation associations will be necessary to develop reasonable representation of the operations in the ArkDSS modeling effort.

Where to find more information:

- Additional information on the Fry-Ark Project and the Winter Water Storage Program is included in the ArkDSS Fryingpan-Arkansas Facilities and Related Operations memorandum.
- Additional information on the Twin Lakes System and Colorado Canal is included in the ArkDSS Colorado Canal Operations memorandum.
- Additional Information on the Holbrook Canal system is included in the ArkDSS Holbrook Canal Operations memorandum.
- Additional information on the Fort Lyon Canal system is included in the ArkDSS Fort Lyon Canal Operations memorandum.

Tributary Specific Information

Mainstem Arkansas River

Ditches discussed in this section are generally listed in upstream to downstream order. All the recording gages on the ditches are reliable and associated diversion data considered good. All the canals generally run parallel to the Arkansas River.

- Colorado Canal (1400540 and 1700540) – The Colorado Canal can sweep the river and has sufficient conveyance capacity to divert the company's junior 1890 direct flow right (756.28 cfs). The recording device is located near Boone, above the Haynes Creek confluence with the Arkansas River. The diversion dam is in District 14 and the irrigated lands and reservoirs are located and administered in District 17. Approximately 50,000 acres north of the Arkansas River were historically irrigated under the ditch system along with two off-channel reservoirs – Lake Henry (1703524) and Lake Meredith (1703525). Lake Henry historically served about 9,000 acres below the reservoir. Lake Meredith was developed from a natural depression on Bob Creek. The reservoir is located down gradient from the irrigated land and water is released to the river and exchanged up to the Colorado Canal headgate for irrigation use. Conveyance losses are estimated at approximately 30 percent; the main line canal loss is estimated as 19.1% in the H-I Model. Along with Project Water and Winter Water, the Colorado Canal gets supplemental supply from the Twin Lakes Canal Company.

  Over the last thirty years, Aurora and Colorado Springs along with some smaller municipalities have changed over 95% of the ditch and reservoir system. A small amount of dried up land is re-irrigated with wells that are covered by AGUA and/or CWPDA. The municipalities typically divert the changed water for municipal use at Pueblo Reservoir and upstream locations.

  The storage rights and supplemental supplies, including Winter Water, are at times stored under the ditch system. These supplies may be exchanged upstream to Pueblo Reservoir or traded to downstream ditches for those ditches' Project Water or Winter Water in Pueblo Reservoir. The Lake Meredith Outlet Canal can drop water into the Holbrook Canal and the Fort Lyon Storage Canal on its way down to the Arkansas River.

- Rocky Ford Highline Canal (1700542) – The Rocky Ford Highline Canal (the Highline) is the most up gradient of the District 17 canals on the south side of the Arkansas River. The conveyance capacity of the canal can divert the company's decreed rights (468.56 cfs) and the 32.5 cfs Las Animas Consolidated 1884 water right transferred to the Highline (note the transferred right is only used at the end of the irrigation season and the associated diversion is limited to 10,000 acre-feet per year). The recording device is located below the Huerfano River confluence with the Arkansas River and above the Oxford Farmers Ditch headgate. Conveyance losses are estimated at approximately 20 percent; canal loss is estimated as 29.3% in the H-I Model. Siphons on the canal run over Chicosa Creek and the Apishapa River and the canal terminates at Timpas Creek. A couple of augmentation stations were installed on the ditch and operated during a change of water right pursuant to a substitute water supply plan wherein approximately

one-third of the canal was dried up for municipal use by Aurora (2004 and 2005) and by Colorado Springs Utilities (2005).

- Oxford Farmers Ditch (1700541) – The Oxford Farmers Ditch (the Oxford Canal) has conveyance capacity capable of diverting the company's decreed rights (129.4 cfs). The river headgate is located above the Nepesta gage from where the canal runs along the south side of the Arkansas River. The recording device is located near the river headgate. Conveyance losses are estimated at approximately 10 percent; canal loss is estimated as 7.3% in the H-I Model. The canal has a siphon over and can waste water into Chicosa Creek. The canal terminates at the Apishapa River. The Oxford Farmers Ditch also operates a bank of wells near the headgate for supply throughout the ditch. Although these wells are not decreed as points of diversion for the canal, they have been a consistent supplemental supply for the canal.

- Otero Canal (1700557) – The Otero Canal has conveyance capacity of about 70 cfs, well under the company's decreed rights (457.92 cfs). The ditch rights are junior but the company has Project Water available for use. Return flows from up gradient ditches on the south side of the Arkansas River also contribute to flows in the ditch, however extensive effort in recent years has gone into ensuring inflows to the canal not taken at the headgate are passed back to the river. Irrigation under the ditch is limited due to non-use by many landowners. Canal loss is estimated as 18.4% in the H-I Model.

- Catlin Canal (1700552) – The Catlin Canal can sweep the river, but typically does not, and has sufficient conveyance capacity to divert the company's decreed water rights (345 cfs). The recording device is located ~1.5 miles down the canal, which runs along the south side of the Arkansas River. The river headgate is located above two stream gages - the first gage records errant flows when the Catlin Canal sweeps the river. A secondary gage is used to measure river flows during those times. Conveyance losses are estimated at approximately 10 percent. Canal loss is estimated as 10.4% in the H-I Model but was estimated as 16.5% in a recent water right case changing Catlin shares (12CW94). The canal terminates at Crooked Arroyo. There are lift pumps in the ditch at various locations to deliver water to Catlin lands above the ditch.

  Two augmentation stations on the Catlin Ditch can be used to deliver water to Timpas Creek (1700800) and Crooked Arroyo (1700801). These stations have been used in the past for delivery of share water to the river for augmentation purposes. The Lower Arkansas Valley Water Conservancy District is currently operating a Lease-Fallow Pilot Project for selected fields supplied by the Catlin Canal. The Pilot Project is intended to illustrate that fields under the ditch can be temporarily fallowed and resulting historical consumptive use credits can be used by others in the river system. Two recharge pits

under the canal are used to cover return flows obligated by the Lease Fallow Pilot Project (1707700) – Schweizer Recharge Area below the Rocky Ford Ditch headgate (1704800) and Hanagan Recharge Area between Swink and the Fort Lyon Canal headgate (1704801). A number of other recharge sites are being placed in operation during 2018.

- Holbrook Canal (1700554) – The Holbrook Canal can sweep the river, but typically does not except during the Winter Water storage period and has sufficient conveyance capacity to divert the company's direct flow rights (600 cfs). According to ditch company personnel, conveyance losses are approximately 25 percent; canal loss is estimated as 11.9% in the H-I Model. Approximately 15,000 acres north of the Arkansas River were historically irrigated under the ditch system along with two off-channel reservoirs – Dye Reservoir (1703510) and Holbrook Reservoir (1703511). Dye Reservoir is located above irrigated lands under the canal system. Holbrook Reservoir is located below the irrigated areas and water is released from storage for exchange up to the Holbrook Canal headgate for irrigation uses. The ditch terminates on Horse Creek below the Canady Ditch headgate (1700587). Dye Reservoir has been under a storage restriction for dam safety considerations for a number of years.

  Cheraw Lake is a natural depression located within the canal service area. The lake has no water rights, is not operated, and essentially serves as a return flow location. Approximately 20 percent of the irrigated land under the Holbrook Canal is tributary to the Arkansas River. The remaining lands are tributary to Cheraw Lake and ultimately to Horse Creek above Hwy 194 stream gage during average and wet years when water reaches a sufficient depth in Cheraw Lake and then overflows out of the pond toward the Horse Creek drainage. The H-I Model considers that about 17.53% and 8.28% of Holbrook deep percolation and tailwater return flows, respectively, accrue to Cheraw Lake and are essentially not tributary to the Arkansas River.

  The Holbrook Reservoir storage right priority (1892) is between the 155 cfs senior direct flow water right (1889) and 445 cfs junior right (1903). The Dye Reservoir 1903 storage right is junior to both direct flow rights. Based on the relative order of priorities, diversion records up to 155 cfs are for irrigation use; diversions above 155 cfs are for storage in Holbrook Reservoir until it fills and then for irrigation. In addition to storage water from the two reservoirs, the canal company has Winter Water in Holbrook Reservoir and/or Pueblo Reservoir or Lake Meredith, and Project Water in Pueblo Reservoir. On some occasions, the canal company will trade its water in Pueblo Reservoir for releases of Aurora's water in storage in Lake Meredith.

  There are multiple laterals out of Holbrook Reservoir that deliver water to irrigators and that deliver water to the river. Water delivered to the river for others (e.g., Winter

Water releases to the Fort Lyon Canal) is measured at the dam outlet. Water delivered for augmentation is released through a separate outlet canal and measured at an augmentation station (1700806) that is located just below where the outlet canal goes past the Fort Lyon Storage Canal.

- Rocky Ford Ditch (1700558) – The Rocky Ford Ditch headgate is located on the south side of the Arkansas River between the Holbrook Canal and Fort Lyon Storage Canal headgates. The ditch has a conveyance capacity of about 55 cfs, well under the company's decreed rights (152.02 cfs). The ditch was previously able to run its senior 111.76 cfs water right but use and maintenance of the ditch has reduced significantly since the 1980s and 1990s when Aurora dried up lands pursuant to two change cases (83CW18 and 99CW169) covering approximately 94% of the ditch. Canal loss is estimated as 6.6% in the H-I Model. Of the remaining irrigated lands, most are within the Arkansas Valley Research Center (AVRC) operated by Colorado State University. It should be noted that the only two large scale weighing lysimeters are operated within the AVRC and provide important data used to verify or dispute H-I Model assumptions.

  There are some parcels lower on the ditch (Continued Farmers Group) that re-irrigate parcels with ground water that is covered under their own augmentation plan (Case No. 07CW116, ID 1707014), supplemented with reusable supplies from the City of Aurora. There are two augmentation stations on the ditch – one not far from the river headgate that wastes to the river below the Fort Lyon Storage Canal (170668); and one at the tail of the ditch on Timpas Creek (170667).

- Fort Lyon Storage Canal (1700648) – The Fort Lyon Storage Canal headgate is located on the north side of the Arkansas River and carries water to storage in Horse Creek Reservoir (1703545) and Adobe Creek Reservoir (1703546). There is no irrigation under the Storage Canal, but the reservoirs supply water to the Fort Lyon Canal for irrigation. The canal has a conveyance capacity of about 2,200 cfs based on historical diversions, however the maximum amount diverted since 1997 was 1,132 cfs raising some question about the current maximum capacity of the canal. The measurement device is located below the Lake Meredith Reservoir outlet. Conveyance losses to Horse Creek Reservoir are approximately 25 percent and 35 percent to Adobe Creek Reservoir; canal loss is estimated as 19.8% in the H-I Model. Water carried to Adobe Creek Reservoir is siphoned over Adobe Creek below the Adobe Creek Feeder (1700674). The Feeder sweeps the creek and carries the water into Adobe Creek Reservoir. Adobe Creek Reservoir releases water down Adobe Creek into the Fort Lyon Canal. Releases are measured at the ADOBARCO gage. Any water that is stored out of priority via the Feeder is carried down the Fort Lyon Canal and released into Gageby Creek and then into John Martin Reservoir. An instream flow (6703001) is decreed on the reach of Gageby Creek

below the Fort Lyon Canal. Gageby Creek flows are measured at the GACBFLCO gage located below the Fort Lyon Canal.

- Fort Lyon Canal (1700552) – The Fort Lyon Canal has two diversion dams on the north side of the Arkansas River that are located above the Crooked Arroyo confluence with the river. The canal serves approximately 93,000 irrigated acres along its ~110-mile length, extending north of and beyond John Martin Reservoir toward the town of Lamar. There are lift pumps in the ditch at various locations to deliver water to Fort Lyon lands above the canal. The river headgate and canal are also used to carry water to the Great Plains Reservoirs via the Kickingbird Canal, located at a bifurcation on the Fort Lyon Canal approximately 45 miles below the headgate. The Great Plains Reservoirs are owned by the Amity Mutual Irrigation Company (6700607) and operated in coordination with the Fort Lyon Canal Company. Operations between the two companies has changed over the years but was formalized in an agreement in 2017.

  The canal has a conveyance capacity of about 1,500 cfs, insufficient to meet its decreed irrigation rights (933 cfs) and the 1,150 cfs decreed for Great Plains storage. The recording device is located about two miles below the diversion dam. Conveyance losses are estimated to be approximately 35 percent; canal loss for the Fort Lyon Canal is estimated as 36.7% in the H-I Model. The engineering supporting a change case for an alternate point of storage for the Great Plains Reservoirs storage rights identified a ditch loss of 25 percent down to the bifurcation.

  The canal company uses supplemental water from Horse Creek and Adobe Creek reservoirs. The canal is siphoned over Horse Creek but can pick up releases from Horse Creek Reservoir. The canal sweeps Adobe Creek, which may result in water diverted out of priority on Adobe Creek these flows are carried down the canal and turned out to Gageby Creek. This is the lowest point on the canal that is administered by the water commissioner except for the various augmentation stations referenced below.

  - Although use of supplemental supplies differs depending on several conditions, a general order of supplemental water use is as follows:
  - Winter Water from Lake Meredith and/or Adobe Creek Reservoir
  - Section III Water (“Other Water”) stored in John Martin Reservoir, by exchange
  - Storage water from Adobe Creek Reservoir and Horse Creek Reservoir
  - Project Water in Pueblo Reservoir

  A few augmentation stations have been installed and used under the ditch in the last few years. A station at Horse Creek (1700805) was previously operated with CWPDA. Arkansas River Farms (ARF), the owner of temporarily changed water rights used for augmentation, installed eight stations in 2017 year from which water is delivered to the

river. Four of the stations are above John Martin Reservoir and can deliver water for storage in the Offset Account in John Martin Reservoir, while four are below John Martin Dam. Several new stations will go into operation in 2018 to measure deliveries to recharge ponds under the Fort Lyon Canal operated by LAWMA/ARF.

- Las Animas Consolidated (1700556) – The Las Animas Consolidated Canal (Consolidated aka Jones Ditch) has conveyance capacity capable of diverting the company's decreed rights (129.8 cfs). The river headgate is located above the town of Las Animas from where the canal runs through and along the south side of town. The recording device is located near the river headgate. Conveyance losses are estimated at approximately 10 percent; canal loss is estimated as 8.1% in the H-I Model. The canal turns south and travels toward the Purgatoire River at a location near the end of the Highland Canal (1700615). The turn in the ditch is sometimes referred to as the Consolidated Extension. The Consolidated Extension (1700614) had a 1909 priority right decreed from the Arkansas River and the Purgatoire River via the Highland Canal. This 44 cfs water right has not been used for decades.

  The canal is siphoned under the Purgatoire River and terminates just above John Martin Reservoir. The Consolidated can also waste water into the Purgatoire River at the location of the siphon and several other wasteways.

Purgatoire River

- Nine Mile Canal (1700604) – Operated under futile call conditions when flows in the Purgatoire River are below 8 cfs. The recording device is close to the headgate with two wasteways down ditch; river flows passing Nine Mile Canal are recorded at the PURNINCO gage (except for minor waste back to the river).
- Highland Canal (1700615) – The senior water rights will typically require water to be bypassed at the Ninemile Canal headgate or call out Ninemile Canal entirely except as stated above when flows at the Ninemile Canal headgate fall to 8 cfs or less when a futile call condition is recognized and Ninemile Canal can sweep the river. Approximately 94 percent of the ditch has been changed to augmentation use for the LAWMA plan. Augmentation diversions are accounted at PURHILCO (1700900) along with the other LAWMA credits in the river. The remaining water rights total about 2.5 cfs. The use of that water under the canal is limited to May 1 – September 15 due to terms of an agreement between LAWMA and the remaining irrigators. This agreement is acknowledged in the LAWMA change case decrees and allows the remaining irrigators to divert at a slightly higher rate during the shortened diversion season.

Apishapa River

- Red Top Ditch (1700609) and Red Top Reservoir (1703564) – Operate under futile call conditions.
- Mustang Reservoir Canal (1700608) and Brown Reservoir (1703562) – Operate under futile call conditions.

Crooked Arroyo

- Crooked Arroyo Ditch (1700578) – aka Fairview was historically taken to the cemetery in La Junta. Recently parcels under the ditch are supplied by the Catlin Canal but are not coded as such; technically both Catlin Canal and Crooked Arroyo Ditch can both serve the parcels.
- A J Anderson Ditch (1700577) – Along with Catlin Canal, serves two circles north of Hwy 50 and either side of Crooked Arroyo. Water from Crooked Arroyo only is used on the pivot on the east side of Crooked Arroyo. Water from Crooked Arroyo comingled with Catlin water for the pivot on the west side of Crooked Arroyo.

West of Timpas Creek

- Clute Spring Ditch (1700627) – Junior water right with seepage as source. Currently active and irrigates most years. Could be considered a futile call. Approximately 10 acres irrigated in S1/2 SW1/4 SE1/4 S18 T23S R56W not shown on 2015 irrigated acreage coverage.
- Potter Ditch (1700620) – Decreed for diversion from the Arkansas River but takes water from Rocky Ford seepage ditch to irrigate a pie shape parcel adjacent to and south of the Arkansas River.

Down-gradient of Colorado Canal

- Baldwin Stubbs (1700551) – Diverts from the Arkansas River via a lift pump above the Catlin Canal diversion dam. Typical diversion of 5 cfs although water right is 22 cfs. Note that only in recent years has this ditch begun to divert again. Diversions did not occur from 1985 through 2013 and lands have predominately been irrigated by wells.
- Auckland Ditch and Reservoir System (1700657) – Structure is not abandoned and diverts water from tile drainage of return flows from Colorado Canal to serve areas in NE1/4 S9 and SW1/4 S10, both of T22S R58W.

Horse Creek

Upper Horse Creek above Box Springs Canal No. 1 (about 12 miles north of Lake Henry) is an ephemeral stream that is operated under futile call conditions. The surface rights and storage in the upper basin are typically flood rights that may only have supply a few days per year. Many of the reservoirs and ponds in this area are silted in and, if able to store water, are typically subject to high seepage rates. The 2015 acreage outlined in the upper Horse Creek basin overall

looks correct except for lands tied to structures that are abandoned, as noted in Table 1 at the end of the memorandum.

- Horse Creek Ranch – Includes the structures listed below, which is essentially everything above the Gammon Ditch (1700588). The ranch is owned and operated by a single owner who maintains daily diversion records.
- Cutler Ditch and Reservoir (1700623)
- Southside Ditch (1700598)
- Deadman Gulch Ditch No. 4 (1700580)
- Viaduct Ditch and Reservoir No. 2 (1700610)
- Two Springs Ditch (1700600)
- Gammon Ditch (1700588) – Operates consistently and supplies diversion records. The water rights for Big Horse Ditch and Res 6 (1700585) were transferred to the Gammon Ditch.
- TJ Miller West Ditch (1700595) and East Ditch (1700596) – East Ditch water right abandoned and West Ditch 5 cfs water right transferred to well on property for augmentation use (Mill Craus Ranch Well ID 1706336).
- Smith Ranch – Includes most of the structures on the upper reaches of Steels Fork, tributary to Horse Creek, including:
- Brett Gray Ditch No. 1 (1700632) – Serves two pivots
- Brett Gray Reservoir (1703604) and Douglas Reservoir (1703912) – Operated in tandem to serve irrigation under Brett Gray Ditch No. 1. Also used for fish and recreation and some augmentation for Smith Cattle Aug Plan (1707009). In combination, the reservoirs are limited to 290 acre-feet storage due to excessive siltation, as adjudicated in a previous decree.
- Brooks Ditch (1700633) and Reid Ditch Nos. 1, 2, and 3 (1700656, 690, and 691) – Operated in concert on Reid Ranch.
- Box Springs Canal No. 1 (1700586) and Box Springs Reservoir Nos. 2 – 5 (1703572-3575) – Operated together on same ranch using lift pumps and sprinklers to irrigate lands in the area.
- Box Springs Reservoir No. 1 (17003571) storage rights transferred to Box Springs Reservoir No. 2.
- 35 cfs of 60 cfs 1899 water right in the Box Springs Canal No. 1 was dedicated to the stream as a replacement water supply for the Horse Creek Water Users Association (HCWUA). HCWUA essentially covers all well use upstream of the Box Springs Canal No. 1. The specific well IDs included in the augmentation plan are summarized in Appendix F of the Case No. 97CW52 decree.
- Windmill Lake Ditch (1700647) – Runs water to a pond but is not used for irrigation.

- Horse Creek & Black Draw Ditch (1700592) – Used for irrigation but supply is limited. Ditch can be used to carry water to Horse Creek & Black Draw Reservoir (1703553) but storage is not currently allowed due to dam safety restrictions.
- Osborne Ditch (1700597) – Irrigation ditch that was integrated with Horse Creek Supply Ditch (1700673) that used to divert water into storage in the Horse Creek Reservoir – Horse Creek (1703570). Irrigation no longer occurs under the system but occasionally diversions are made to storage for stock water use.
- Canady Ditch (1700587) – Can irrigate but has not in the past few years.
- Herman Klinkerman (1700594) – Diverts from Horse Creek below the Hwy 194 gage to irrigate two big pivots and corners. Horse Creek supply is comingled with Fort Lyon Canal shares. Pivots have been in place since before 1996 and do not need to be covered by a Rule 10 plan.

Adobe Creek

- Beer Ditch (1700561) – Has historically irrigated pasture but diversion structure has not been well maintained.
- Best Ditch Headgate Nos. 1 (1700605) and 2 (1700649) – In the process of abandoning ditches and converting Trimble Lake over to stock pond – historically irrigated below Best Reservoir aka Trimble Lake (1703522). Most recently irrigating just from the Best Ditch No. 1.
- Adobe Valley Ditch (1700560) – Senior to the Adobe Reservoir storage right but basically takes water from Adobe Reservoir outlet for irrigation of a few parcels downstream of the ditch and above the Fort Lyon Canal. 8 – 10 cfs capacity to irrigation.
- Las Animas Fish Hatchery (1703925) – Has a water right and evaporative depletions covered under LAWMA plan.
- Cheyenne Ditch (1700563) – Diverts from Dawn Pond (1703508), a CPW pond with evaporation depletions covered by LAWMA. Cheyenne Ditch irrigates lands to the east of Adobe that is not supplied with Fort Lyon Canal share water.
- Foulk Ditch and Irrigation System (1700564) – Surface water right but administered as a well. Pumps from Adobe Creek just downstream of Dawn Pond.

Where to find more information:

- Additional information on Rocky Ford Ditch operations is included in the ArkDSS City of Aurora Operations memorandum.
- Additional information on the Amity Canal system is included in the ArkDSS Amity Canal Operations memorandum.
- Additional information on ground water augmentation is included in the ArkDSS Lower Arkansas Valley Water Conservancy District Operations memorandum and the Division 2 Groundwater Augmentation memorandum.

Diversion Coding

- IDs in the 900s are temporary “buckets” in the river that represent the sum of all the various augmentation sources for a specific plan. There are pumping records, aggregated lagged depletions under each aug plan (Q:D), replacement sources USE (A) for each aug plan, and actual replacements from the temporary buckets to meet the depletion reaches (Q:Q). Q is a Quantitative record that is not additive. The “additive” portion or “replace” portion is the USE (A) record. The (Q:Q) indicates the release from the “Bucket” and is done this way to prevent double accounting of the amount added to the river.
- IDs in the 20000s are the River Reach depletion reaches.
- For Recharge sites – Q:R is diversions into recharge pit and Q:V is the lagged accretions.
- Type V coding – Return flow factor for Project Water; i.e., Fry-Ark unused return flow.