FOUNTAIN CREEK WATERSHED, FLOOD CONTROL AND GREENWAY DISTRICT

ANALYSIS OF WATER RIGHT AND ADMINISTRATIVE ISSUES ASSOCIATED WITH THE OPERATION OF A PROPOSED FLOOD REMEDIATION PROJECT IN THE FOUNTAIN CREEK WATERSHED

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INTRODUCTION

This report has been prepared for the Fountain Creek Watershed, Flood Control and Greenway District (FCWFC&GD). It describes and presents the results of an analysis of the water right and administrative issues associated with the operation of a flood remediation project in the Fountain Creek watershed, and it recommends provisions for use in operating the project to insure that downstream water users on the Arkansas River are not injured.

The FCWFC&GD is considering the construction and operation of a flood remediation project in the Fountain Creek drainage to reduce peak flood flows and sediment loads in Fountain Creek (hereinafter the "Fountain Creek Flood Remediation Project" or "Project"). As part of the effort, the U.S. Geological Survey, in cooperation with the FCWFC&GD, assessed 14 remediation scenarios to reduce peak flows and sediment transport. The results of this assessment are reported in Scientific Investigations Report 2014-5019 by Kohl and others (2013). One of these scenarios represents the current conditions in the Fountain Creek drainage and was used as a baseline scenario.

The FCWFC&GD has identified two of these scenarios for more detailed evaluation. One of these two scenario involves a dam and reservoir on Fountain Creek; the other involves up to ten side-detention facilities into which streamflow will be diverted when flooding of a prescribed magnitude occurs on Fountain Creek. These scenarios are discussed in more detail in the next section of this report. The basic concept proposed for the operation of the Project is that Fountain Creek flood waters will be stored temporarily in Project facilities so as to reduce the peak flows discharging into the Arkansas River from Fountain Creek to flow rates of not more than 10,000 cubic feet per second ("cfs"). The flood waters stored temporarily in the Project facilities will then be released back to Fountain Creek when the Fountain Creek flows have dropped to levels below the 10,000 cfs threshold for delivery to the Arkansas River and distribution under the Colorado priority system.

Water users on the Arkansas River have expressed concerns that the operation of the Project will reduce the flow rates and volumes of the flood flows reaching the Arkansas River will alter the timing of the flood flows, and thereby will have an effect on the “ownership” of the water. Specifically, the water users are concerned that the operation of the project will increase the losses that occur to the water temporarily detained in Project facilities, and thereby will reduce the water available to their junior water rights under the priority system. Thus, the primary objective of this analysis was to develop a methodology for determining the ditches and reservoirs that would have diverted the water had it not been stored temporarily in Project facilities and the volumes of water that they would have diverted.

Several individuals were helpful in completing the analysis described in this report. Larry Small of the FCWFC&GD and Abigail Ortega and Justin Zeisler of Colorado Springs Utilities were helpful in explaining the intents and purposes of the Project and in providing the initial data for the 1999 and 2011 Fountain Creek flood events and either copies of or citations for U.S. Geological Survey publications. Steve Witte and Bill Tyner of the Division 2 Office in Pueblo provided data and information pertaining to Arkansas River water rights and administration. Mr. Tyner also provided data and information concerning the Arkansas River Transit Loss Accounting Program (hereinafter “TLAP”) and the Fountain Creek Transit Loss Model and outputs from several TLAP runs. Doug Hollister, the Fountain Creek Water Commissioner, provided additional data and information about the Fountain Creek Transit Loss Model and copies of the model output for selected time periods. Finally, Jim Brannon, initially with the Denver Office of the Division of Water Resources and more recently as a consultant, provided a copy of TLAP and the output from several additional TLAP runs, including the run used to develop the methodology described later in this report.

The documents that were reviewed and relied on in the analysis are listed in the reference section of this report.

THE FOUNTAIN CREEK FLOOD REMEDIATION PROJECT

As stated above, the FWFC&GD has identified two scenarios for the Fountain Creek Flood Remediation Project for further evaluation. One scenario (Scenario 10 in Scientific Investigations Report 2014-5019) involves a reservoir on the main stem of Fountain Creek located approximately 9.6 miles upstream from its mouth. This reservoir would have a total capacity of 52,700 acre-feet, of which 27,000 acre-feet would be used for temporary flood storage and 25,700 acre-feet would be used for recreational and water supply purposes. The other scenario (Scenario

12 in Scientific Investigations Report 2014-5019) involves ten side-detention facilities that would be constructed along Fountain Creek in El Paso and Pueblo Counties (four in El Paso County and six in Pueblo County) that would be used to temporarily store Fountain Creek flood flows. The side-detention facilities would have a total capacity of 13,230 acre-feet.

Table 1 summarizes some of the key data for these facilities. The travel time along Fountain Creek from the Scenario 10 reservoir to the mouth of Fountain Creek will be about 5 hours. The travel times from the various Scenario 12 detention ponds to the mouth of Fountain Creek will range from about 2 to 17 hours. These travel times were estimated from information presented in Table 3 and on page 77 of Water-Resources Investigations Report 87-4119 (Kuhn, 1988) that indicates the travel time is approximately one day for the 50.1 stream miles between the Colorado Springs Wastewater Treatment Facility and the mouth of Fountain Creek.

The FCWFC&GD has concluded that reasonable reductions in peak flows and sediment transport can be achieved through the temporary storage of flood flows that might otherwise exceed 10,000 cfs at the U.S. Geological Survey gaging station at the mouth of Fountain Creek. More specifically, the Fountain Creek Flood Remediation Project will be operated to temporarily store Fountain Creek water as necessary so that the flow in Fountain Creek at the Pueblo gaging station does not exceed 10,000 cfs. Once the flow at this gaging station drops below 10,000 cfs, the water will be released from the Project facilities and delivered to the Arkansas River and the ditches and reservoirs that would have diverted the water had it not been stored in Project facilities. A methodology for determining the ditches and reservoirs that would have diverted this water and the volumes they would have diverted has been developed as part of this analysis and is described in a later section of this report.

FOUNTAIN CREEK HYDROLOGY

The U. S. Geological Survey has operated the gaging station on Fountain Creek at Pueblo intermittently since 1921. The specific time periods when consistent records are available for this gaging station are January 1922 through September 1925, October 1941 through September 1965, and February 1971 to the present.

Columns 2 and 3 of Table 2 show the annual streamflow in acre-feet and the average annual streamflow in cubic feet per second or “cfs” both for years in which the gaging station was operated during the entire year. Columns 4 and 5 show the peak annual flows in cfs and the dates on which the peak annual flows occurred. Except in 1923, the peak annual flows are "instantaneous" flows; in 1923, the peak annual flow is a daily value. From columns 2 and 3, the annual flows averaged 73,564 acre-feet or 101.5 cfs during the 71 years for which these records are available and ranged from 3,198 acre-feet (4.4 cfs) in 1953 to 318,276 acre-feet (439.3 cfs) in 1999.

Column 4 shows that the annual peak flows averaged 7,121 cfs over the 75 years for which the data are available, and ranged from 204 cfs on April 11, 1959 to 47,000 cfs on June 17, 1965. As shown in column 6, the annual peak flow exceeded 10,000 cfs in 18 of the 75 years. During these 18 years, the peak daily flows averaged 17,489 cfs or 7,489 cfs more than the 10,000 cfs threshold planned for the Fountain Creek Flood Remediation Project. The peak flows that exceeded 10,000 cfs occurred during the April-through-October period in all the years, but occurred most frequently during the months of June, July, and August. None of these annual peak flows occurred outside of the April-through-October period.

John Martin Reservoir began operating under the Arkansas River Compact in 1949. Eleven of the 18 years with peak flows exceeding 10,000 cfs occurred since 1949. The peak flows in 8 of these 18 years were associated with periods of conservation storage in John Martin Reservoir. The significance of these periods of conservation storage in John Martin Reservoir will be clear later in this report.

More detailed 15-minute flow data are available for this gaging station beginning in the 1990s, as well as for gaging stations on the Arkansas River and the diversions from the Arkansas River. For this reason, this analysis focused on the Fountain Creek flood events in 1999, 2011, and 2013.[1]

Figures 1 through 3 show hydrographs for the 1999, 2011, and 2013 Fountain Creek flood events. During April 29 through May 2, 1999, when the peak flow was 18,900 cfs, a total of 47,504 acre-feet flowed through the Fountain Creek gaging station at Pueblo, of which 42,213 acre-feet occurred at flow rates of 10,000 cfs or less and 5,291 acre-feet occurred at flow rates larger than 10,000 cfs. During September 14 through 17, 2011, when the peak flow was 13,800 cfs, a total of 13,650 acre-feet flowed through the gaging station at Pueblo, of which 13,285 acre-feet

[1] The flow in Fountain Creek at the Pueblo gaging station exceeded 10,000 cfs in May and June of 2015. These flood events were not considered in this analysis because they occurred too late in the analysis process. Also, inspection of the flow data associated with these flood events showed that they both were of short duration – less than 3 hours on May 19 and 4 hours on June 16. Both of these flood events occurred when conservation storage was accruing in John Martin Reservoir. Thus, the inclusion of these 2015 flood events in this analysis would not have changed the conclusions and recommendations.

occurred at flow rates of 10,000 cfs or less and 366 acre-feet occurred at flow rates larger than 10,000 cfs. During September 12 through 18, 2013, when the peak flow was 11,800 cfs, a total of 35,309 acre-feet flowed through the gaging station at Pueblo, of which 35,281 acre-feet occurred at flow rates of 10,000 cfs or less and 44 acre-feet occurred at flow rates larger than 10,000 cfs.

Water year 1999 was a year of unusually high runoff, especially on the Arkansas River. As stated above, in 1999, Fountain Creek had the largest runoff of any of the 75 years for which complete data are available. In addition, as indicated in the next section of this report, Conservation Storage in John Martin Reservoir spilled, and the Arkansas River went to a “free river” condition during the 1999 Fountain Creek flood event.

An examination of the data in column 6 of Table 2 shows that the peak flows in 2011 and 2013 are reasonably representative of the peak flows in the other years, particularly if 1921, 1935, 1965, and 1999 are excluded from consideration because of general flooding or unusually high runoff conditions. The exclusion of these years from further consideration is justified in this analysis because the operation of the Fountain Creek Flood Remediation Project would be unlikely to have an effect on the diversions by the junior ditches in years of general flooding or unusually high runoff.

The hydrographs in Figures 2 and 3 show that the flows in Fountain Creek exceeding 10,000 cfs were of short duration. The duration of the flows that exceeded 10,000 cfs in 2011 was approximately three and one-half hours. The duration of the flows that exceeded 10,000 cfs in 2013 was approximately 45 minutes. Additionally, as indicated above, the volumes of the water involved in the flows that exceeded 10,000 cfs were small – 368 acre-feet in 2011 and 44 acre-feet in 2013. A comparison of the peak and mean daily flows shown in columns 6 and 7 of Table 2 shows that a disparity exists between the two types of data, and this disparity is further confirmation that the duration of the flows that exceeds 10,000 cfs tends to be relatively short in time and that the volumes of the flow that exceed 10,000 cfs tend to be relatively small. This can be seen in the September 15, 2011 portion of the hydrograph in Figure 2. The peak flow was 13,800 cfs on that day, but the mean flow over the 24-hour period was 4,800 cfs.

Thus, the operation of the Fountain Creek Flood Remediation Project during typical Fountain Creek flood events, as presently conceived at least, will involve the storage of relatively small volumes of water. Additionally, the time periods during which the water will be retained in Project facilities will be relatively short. It has been concluded in this analysis that the Project operation is not likely to have significant effects on the junior ditches and reservoirs that divert and store from the Arkansas River during at least some of the years in which the Project is operated. A methodology has been developed, however, that can be applied to cover these and larger Fountain Creek flood events if the parties decide this should be done.

For the purposes of developing a methodology to account for temporary flood storage in the Fountain Creek Flood Remediation Project facilities, a composite flood event was constructed for 2013 (hereinafter the “2013 composite flood”) by overlaying an additional flood increment on the actual flows in the 2013 flood event. This additional flood increment, which amounted to 366 acre-feet, was equal in volume and timing to that portion of the 2011 flood event that exceeded the Project’s 10,000 cfs threshold. It was overlaid in such a way that the peak of the additional flood increment corresponded to the peak of the actual 2013 flow. This additional flood increment was the water that would have been temporarily stored in Project facilities had the Fountain Creek Flood Remediation Project been operating and the water that would have been later released when the antecedent flows in Fountain Creek dropped below the 10,000 cfs.

As explained later in this report, the TLAP was then used to route the water in this additional flood increment down the Arkansas River and to determine the ditches and reservoirs that would have diverted the water under the priority system and the volumes of water they would have diverted. This approach was necessary so that the water in this additional flood increment was being superimposed on actual, historical water use and administration, as reflected in the historical call and diversion records. Also, the magnitude of the peak flow in the 2013 flood event was reasonably close to the 10,000 cfs threshold adopted for the Project operation.

It was learned through discussions with Messrs. Witte and Tyner that relatively high flood discharges from Fountain Creek are sometimes accompanied with reductions in the native Arkansas River flows that are passed through Pueblo Reservoir. The reductions in the native Arkansas River flow passed through Pueblo Reservoir are made by the Division 2 staff pursuant to the Pueblo Reservoir Water Control Plan, which seeks to limit the Arkansas River flow at the Avondale gaging station to not more than 6,000 cfs, and which results in an amount of temporary flood storage in Pueblo Reservoir. The historical practice has been simply to release the temporary flood storage to the river for normal distribution under the priority system as the flows at the Avondale gaging station drop below 6,000 cfs. This practice has the same effect on downstream junior water and water storage rights as the temporary storage of flood water in the Fountain Creek Flood Remediation Project will have in the future. The methodology developed for the temporary storage in the Fountain Creek Flood Remediation Project could and probably should be applied to this temporary flood storage in Pueblo Reservoir.

ARKANSAS RIVER WATER AND WATER STORAGE RIGHTS

Table 3 summarizes data for the direct flow water rights that divert from the Arkansas River in Water Districts 14, 17, and 67. Water rights for 24 ditches are shown on this table allowing for diversions at a maximum combined rate in excess of 6,000 cfs, under priorities ranging from April 1, 1861 to April 15, 1909. All the ditches that divert under these water rights, except the Bessemer Canal, divert below Pueblo Reservoir. The water for the Bessemer Canal is actually diverted into the canal through Pueblo Dam. The water rights for at least three of the ditches on this listing (the Graham, the Sisson, and the Stubbs) are exercised through wells and no longer satisfied with diversions from the river.

Table 4 summarizes data for the water storage rights that are supplied from the Arkansas River.

In addition to the direct flow and storage water rights discussed above, Conservation Storage in John Martin Reservoir will at times be a consideration in the operation of the Fountain Creek Flood Remediation Project. When water is contained in Conservation Storage, water users in Water District 67 cannot call against the water users in Water Districts 14 and 17 so water users in Water Districts 14 and 17 can divert without regard to the water users in Water District 67. When Conservation Storage spills and unusable quantities of water occur at the state line, the water storage rights for Pueblo Reservoir may come into priority. If the storage rights at Pueblo are subsequently satisfied and more junior post-Compact rights are satisfied (e.g. Tri-State's storage right), it may be determined that "free water" is available in all three Water Districts below Pueblo Reservoir. The timing of the Conservation Storage accruals within a period of Conservation Storage may not be a concern so long as the total volume of Conservation Storage inflows is maintained. However, when John Martin is spilling from accounts prior to when Conservation Storage spills, the Arkansas River inflows into John Martin Reservoir affects the rate at which water spills from accounts occur and the effect of upstream detention must be taken into consideration.

In the unlikely situation that a Fountain Creek flood event occurs during the November 15-through-March 14 period, the call would be from the Pueblo Reservoir Winter Storage

Program. The timing of the Pueblo Reservoir Winter Storage Program inflows within the winter storage period will not be a concern so long as the total volume of inflow is maintained.

Not all the water rights listed in Tables 3 and 4 will potentially be affected by the operation of the Fountain Creek Flood Remediation Project. Only more junior water rights will potentially be affected because the senior water rights will be satisfied from the other inflows to the Arkansas River including those otherwise occurring from Fountain Creek. Table 5 shows the calls that were associated with the 1999, 2011, and 2013 Fountain Creek flood events and the structures for which the calls were made. It can be seen in this table that calls were recorded under the water rights diverted into several ditches as well as conservation storage in John Martin Reservoir. These water rights, as well as conservation storage in John Martin Reservoir, are the ones that most likely would have been affected by the operation of the Fountain Creek Flood Remediation Project in these years. Some of the calls shown for the ditches in Water District 67 were "secondary" calls[2] and would not have been affected by the operation of the Fountain Creek Flood Remediation Project. Based on this information as well as the author's past experience, it was concluded that the primary water rights that may be affected by the operation of the Fountain Creek Flood remediation Project are 4/15/1884 in the Fort Lyon Canal, 12/3/1884 in the Catlin and Las Animas Consolidated Canals, 2/21/1887 in the Amity Canal, 3/1/1887 in the Fort Lyon Canal, 9/25/1889 in the Holbrook Canal, 6/9/1890 in the Colorado Canal, 4/1/1893 in the Amity Canal, 8/31/1893 in the Fort Lyon Canal, 8/31/1896 in the Great Plains Reservoir System, and 1/25/1906 in the Fort Lyon Storage System. In the actual application of the recommended methodology, however, all water rights as well as conservation storage in John Martin Reservoir will be considered.

METHODOLOGY FOR ALLOCATING THE WATER TEMPORARILY STORED IN THE FOUNTAIN CREEK FLOOD REMEDIATION PROJECT

As discussed above, the Fountain Creek Flood Remediation Project will temporarily store flood flows that would otherwise result in flow rates in excess of 10,000 cfs at the Fountain Creek gaging station at Pueblo. Although the flood flows that are temporarily stored in Project facilities will be released as soon as practical after the flood peak has passed, the temporary storage of these flood flows will to some extent alter the timing of their travel down Fountain Creek and the

[2] In this analysis, the term "secondary call" refers to a call that occurs under a water right that diverts downstream from a more senior water right under which a "primary call" is being made. On September 14, 2011, for example, the call under the Fort Lyon's April 15, 1884 water right was the primary call, and the call under the Buffalo's January 29, 1885 water right was secondary. Any effect from out-of-priority storage in the Fountain Creek Project on that day would have occurred to the Fort Lyon Canal.

Arkansas River and may affect their availability to the junior water and water storage rights. The primary objective in this analysis, therefore, was to develop a methodology to identify the ditches and reservoirs that would have diverted this water had it not been temporarily stored in Project facilities and to determine the volumes of water that each of them would have diverted. The application of this methodology is referred to in the remainder of this report as "allocating" the water temporarily stored in Project facilities among the Arkansas River ditches and reservoirs.

It has been recognized for this analysis that the ditches and reservoirs that diverted from Fountain Creek will be satisfied during these flood events and, thusly, have not been considered in this analysis.

The flood flows that travel down Fountain Creek to the Arkansas River suffer transit losses from evaporation, channel storage, and bank storage. The channel storage and bank storage losses in Fountain Creek were not considered in this part of the analysis because they are temporary losses, not actual depletions to the flow in Fountain Creek.

Evaporation losses, however, do deplete the flow in Fountain Creek and were calculated for a representative flood flow situation in order to judge their significance in this analysis. The evaporation loss calculations were made using the following assumptions and criteria:

- The Fountain Creek flood event for which the evaporation calculation was made was assumed to occur over an 8-hour period in September. This assumption was based on the actual flows associated with the 2013 Fountain Creek flood event.
- The flow in Fountain Creek during this 8-hour period averaged 9,000 cfs and produced a total volume of flow of 5,900 acre-feet. Again, this assumption was based on the actual flows associated with the 2013 Fountain Creek flood event
- It was assumed that the operation of the Fountain Creek Flood Remediation Project would affect not more than a 30-mile segment of Fountain Creek wherein the stream width averaged 367 feet. This stream width was estimated through an extrapolation of the relationship between stream flow and stream width shown in Figure 7 of Water-Resources Investigations Report 87-4119.
- The free-water-surface evaporation rate in September was estimated to be 5.53 inches (0.184 inches per day) from information in Table 8 in Water-Resources Investigations Report 87-4119. This free-water-surface evaporation rate was the result of applying a 0.72 pan coefficient to 7.68 inches of pan evaporation.

The evaporation losses calculated using these assumptions and criteria amounted to only 6.83 acre-feet during the 8-hour period, or only about 0.12 percent of the total flow.

Additional calculations were made for the larger flows and longer duration of the 1999 Fountain Creek flood event, and, on a percentage basis, the result was of similar magnitude. Therefore, the evaporation losses that will occur to the Fountain Creek flows involved with the operation of the Fountain Creek Flood Remediation Project were considered to be negligible.

TLAP was evaluated as part of this analysis to confirm its suitability for use in allocating the water temporarily stored in the Fountain Creek Flood Remediation Project. This effort included several discussions with Messrs. Tyner and Brannon concerning TLAP and several demonstrations of its use. Mr. Brannon provided the output from several TLAP runs including one in which the antecedent flows in the Arkansas River were set relatively high so as to reduce the effects of bank and channel storage in the TLAP output. In addition, the author of this report ran TLAP under various assumed hydrologic conditions and reviewed the output from these runs. The conclusion from this effort was that TLAP is reasonable and appropriate for this use. Although TLAP is reasonable and appropriate for this use, it is recognized that some modifications to TLAP are desirable to simplify its applications for the purposes discussed in this analysis.

After the above-stated conclusion was drawn, the output from the TLAP run in which the antecedent flows in the Arkansas River were set relatively high was used to route the additional water in the 2013 composite flood down the Arkansas River. In essence, this TLAP run superimposed the additional water in the 2013 composite flood on the historical flows in the Arkansas River, accounted for the transit losses that would have occurred to this water in its travel down the Arkansas River, and showed the flow rates at which this additional water reached the various downstream points of diversion. As discussed previously in the Fountain Creek Hydrology section of this report, the additional water in the 2013 composite flood amounted to 368 acre-feet; it was represented in the TLAP run as a release from Pueblo Reservoir with the release timed so that the water reached the mouth of Fountain Creek at approximately the same time as the additional water in the 2013 composite flood would have. Specifically, the additional flood increment was approximated by a release from Pueblo Reservoir of 1,012.5 cfs over the 4-hour period of 8:00 a.m. through 12:00 p.m. on September 13, which amounted to a total release of 368 acre-feet.

Table 6 shows the flow rates of the additional water at the key diversion points between the mouth of Fountain Creek and John Martin Dam as indicated in this TLAP output. Because

TLAP operates on a 4-hour time step, these additional flows are shown in 4-hour increments. As shown in Table 6, the additional water reached the Colorado Canal headgate over a 3-day period beginning in the same 4-hour period as the reservoir release. Transit times were longer for downstream diversion points. The additional water reached John Martin Reservoir over a 7-day period beginning approximately 36 hours after the completion of the reservoir release. Transit losses in this TLAP run varied from 2.0 percent of the reservoir release at the Colorado Canal headgate to 6.0 percent of the reservoir release at John Martin Reservoir.

Table 7 shows the flow rates at the various headgates after an upward adjustment to exclude the effects of the transit losses. This upward adjustment was made because, in actual operation, the additional water allocated to the affected ditches and reservoirs will be subject to the transit losses in its delivery to the affected ditches and reservoirs after the temporary storage in Project Facilities. Without this upward adjustment, the water delivered to the affected ditches and reservoirs would suffer transit losses twice.

Table 8 shows the historical river calls and diversions for the period of September 13 through 22, 2013 that were used in identifying the ditches and reservoirs that would have been able to divert the additional water in the 2013 composite flood. The river calls shown in columns 3 and 4 were obtained from the Arkansas River daily reports. The 4-hour diversions into the key ditches and reservoirs shown in columns 5 through 12 were obtained from the Division of Water Resources' "Real Time Streamflow" website[3]. The rates of the 4-hour diversions shown in columns 5 through 12 were then considered in relation to the diversion rates for the water rights summarized in Table 3, and the priority dates of the junior water rights under which diversions were occurring were identified. Finally, the river call in each 4-hour period was identified as the priority date of the most junior water right under which water was being diverted. These river calls were highlighted in green in Columns 13 through 21. During the 4-hour period from midnight to 4:00 am on September 15, for example, the most junior water right under which diversions were occurring was the 3/2/1892 water storage right for Holbrook Reservoir. Therefore, the river call during that 4-hour period was identified to be 3/2/1892 for Holbrook Reservoir. From the data in this table, it was concluded that the Colorado Canal, the Holbrook Canal, the Fort Lyon Storage Canal, and the Amity Canal are the structures that would have diverted the additional water in the 2013 composite flood.

[3] The 15-minute diversion values obtained at this website were aggregated and averaged for the 4-hour periods.

Table 9 allocates the additional water in the 2013 composite flood among the four structures identified above. The diversions into the particular structures were limited to the time periods when their water rights were in priority. The amounts of the diversions were the amounts of water that were available at their headgates, but limited to the amounts of water that would have been needed to satisfy their water rights. Diversions at upstream headgates were recognized to reduce the additional water at downstream headgates. For example, the diversion of 52 acre-feet of the additional water in the 2013 composite flood into the Colorado Canal headgate reduced the additional water at the Holbrook Canal headgate from 368 acre-feet to 315 acre-feet. The overall conclusion from this allocation was that of the 368 acre-feet in the 2013 composite flood, 52 acre-feet would have been diverted into the Colorado Canal, 254 acre-feet would have been diverted into the Holbrook Canal, 3 acre-feet would have been diverted into the Fort Lyon Storage Canal, and 58 acre-feet would have been delivered into John Martin Reservoir for the Amity Canal.

PROVISIONS FOR ALLOCATING WATER TEMPORARILY STORED IN THE FOUNTAIN CREEK FLOOD REMEDIATION PROJECT

The provisions recommended herein for allocating the water temporarily stored in the Fountain Creek Flood Remediation Project among the affected ditches and reservoirs on the Arkansas River are set forth below.

1. FCWFC&GD should measure all water delivered into temporary flood storage either as inflow to a Scenario 10 on-channel reservoir or at the locations where water is diverted from Fountain Creek into the Scenario 12 detention ponds.

2. When the temporary flood storage is released, FCWFC&GD’s obligation to deliver such water to the Arkansas River will be the total volume of water that was either stored in the Scenario 10 on-channel reservoir or diverted from Fountain Creek for storage in the Scenario 12 detention ponds. Thus, FCWFC&GD will be responsible for replacing all the losses that occur to the water temporarily stored in Project facilities in the Fountain Creek drainage.

3. The water temporarily stored in Fountain Creek Flood Remediation Project facilities should be allocated to the ditches and reservoirs that otherwise would have diverted the water using the methodology described in the previous section of the report. Specifically, TLAP should be used to route the water down the Arkansas River. The specific ditches and reservoirs that would have diverted the water should be identified using the river calls and diversions that actually occurred during the period when Fountain Creek water was temporarily stored in Project facilities. The water allocated to particular calling water rights should be the amounts of water that otherwise would have been water available at their points of diversion during the particular times of their call. In allocating this water, the existence of any special circumstances that would limit the ditches' need or ability to divert should be recognized and taken into consideration.

4. Once flows in Fountain Creek have dropped below the Project threshold of 10,000 cfs and the water temporarily stored in Project facilities has been apportioned to the affected Arkansas River ditches and reservoirs, it should be released from Project facilities and delivered to those ditches and reservoirs. These deliveries should be treated as releases of water from Pueblo Reservoir and TLAP should be used to determine the timing of and amounts of transit losses on these deliveries. To the extent that the water is or a portion thereof is allocated to the Amity or other canal that diverts from the Arkansas River below John Martin Reservoir, it is suggested that the allocated water be delivered into John Martin Reservoir, accumulated over a relatively short period of time until a reasonable delivery volume has been accumulated, and then delivered to that structure. The use of Division 2's existing District 67 Ditch Operations Spreadsheet would appear to be useful for this purpose.

5. In situations when flood flows from Fountain Creek increase the flow in the Arkansas River Avondale gaging station and result in temporary flood storage of Arkansas River water in Pueblo Reservoir pursuant to the Pueblo Reservoir Water Control Plan, the releases from such temporary flood storage should be allocated and delivered to the downstream ditch and reservoirs using the methodology recommended herein for the Fountain Creek Flood Remediation Project. This provision should apply to all temporary flood storage in Pueblo Reservoir even if such flood storage is not associated with Fountain Creek flood flows.

CONCLUSIONS

1. The FCWFC&GD is considering the construction and operation of the Fountain Creek Flood Remediation Project to reduce peak flood flows and sediment loads in Fountain Creek. There are two scenarios for this project. One of these scenarios involves a dam and reservoir on Fountain Creek; the other involves up to ten side-detention facilities to be constructed along Fountain Creek in El Paso and Pueblo Counties. As presently planned, the Project would be used to temporarily store flood flows that would otherwise result in flows in the Fountain Creek gaging station at Pueblo in excess of a 10,000 cfs threshold.

2. From a consideration of the streamflow records available for Fountain Creek during water years 1921 through 2014, Fountain Creek has had fairly frequent flood events in which peak flows exceeded the 10,000 cfs threshold. Although streamflow records are not available for all the years in the period and are not complete in others, the available records indicate that peak flows in excess of 10,000 cfs occurred at the Fountain Creek gaging station at Pueblo in at least 18 years. The peak flows were as large as 47,000 cfs in 1965.

3. Although the owners of the ditches and reservoirs on the Arkansas River are appropriately concerned about the effects of the Fountain Creek Flood Remediation Project on their diversions under the priority system, a conclusion from this analysis is that the operation of the Fountain Creek Flood Remediation Project will not have significant effects on the diversions into the ditches and reservoirs on the Arkansas River in at least some of the years. This conclusion is based in part on the observations that (1) the flows in excess of 10,000 cfs in many, if not most, of these flood events, tend to be of short duration, (2) the volumes of water involved in them tend to be relatively small, and (3) the detention period for the water storage in the Project facilities will be short, normally a matter of only a few hours. It is likely that when general flooding or unusually high runoff conditions occur, such as what occurred in 1921, 1935, 1965, and 1999, Arkansas River flow conditions will be such that water will accrue in Conservation Storage in John Martin Reservoir. When water accrues in Conservation Storage, the operation of the Fountain Creek Flood Remediation Project will not be affecting Arkansas River ditches and reservoirs.

4. A methodology has been developed in this analysis and is described in this report that can be used to account for the temporary storage of Fountain Creek flood flows in Fountain Creek Flood Remediation Project facilities.

5. TLAP is a reasonable and appropriate tool for routing the water temporarily stored in the Fountain Creek Flood Remediation Project down the Arkansas River. Although TLAP is reasonable and appropriate for this use, it is recognized that some modifications to TLAP are desirable to simplify its applications for the purposes discussed in this analysis.

6. The methodology and provisions developed in this analysis for allocating the water temporarily stored in Fountain Creek Flood Remediation Project facilities to the ditches and reservoirs on the Arkansas River will work for other Fountain Creek flow rate storage thresholds. Higher flow rate thresholds will reduce the number of flood events in which flood waters are temporarily stored in Project facilities, will reduce the volumes of water involved in them, and will simplify the process of allocating the water to the Arkansas River ditches and reservoirs. Conversely, lower flood rate thresholds will increase the number of flood events in which flood waters are temporarily stored in Project facilities, will increase the volumes of water involved in them, will complicate the process, and likely will make the apportionments more controversial.

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TABLE 1
KEY DATA FOR
FACILITIES IN FOUNTAIN CREEK FLOOD REMEDIATION PROJECT

Facility type (1)	Miles above mouth of Fountain Creek (2)	Total volume, ac-ft (3)	Dam height or maximum depth, ft (4)	Surface area, ac (5)	Approx. Travel time to mouth, hours (6)
Scenario 10:					
Reservoir	11.2	52,700	84.5	n/a	5
Scenario 12:					
Detention pond	36.5	1,000	10	100	17
Detention pond	34.0	990	10	99	16
Detention pond	33.0	990	10	99	16
Detention pond	23.8	1,000	10	100	11
Detention pond	22.9	100	10	10	11
Detention pond	20.3	2,500	10	250	10
Detention pond	17.0	2,500	10	250	8
Detention pond	12.1	2,000	10	200	6
Detention pond	7.6	2,000	10	200	4
Detention pond	5.0	150	10	15	2
Scenario 12 total		13,230		1323	

Weighted average factors for Scenario 12 (by storage volume) =

	19.8				9.5

Notes: 1) Values in columns 2 through 5 were obtained from Table 9 in U.S. Geological Survey Scientific-Inverstigations Report 2014-5019.

2) Values in column 6 were calcualted as 0.48 hour per stream mile from the information presented in Water-Resources Investigations Report 87-4119, i.e. that the the travel time from the Colorado Springs Wastewater Treatment Facility downstream to its mouth (a distance of 50.1 miles) is approximately 1 day. See page 77 and Table 3 in Water-Resources Investigations Report 87-4119.

TABLE 2
ANNUAL AND PEAK ANNUAL STREAMFLOW
FOUNTAIN CREEK AT PUEBLO GAGING STATION

Water year (1)	Annual flow, ac-ft (2)	Annual flow, avg cfs (3)	Annual peak flow, cfs (4)	Date of annual peak (5)	Peak flow >= 10,000 cfs (6)	Largest mean daily flow associated with peak, cfs (7)
1921			34,000	Jun-21	34,000	n/a
1922			5,140	Aug-22		
1923	62,078	85.7	2,420	Jul-23		
1924	69,026	95.3	12,000	Oct-23	12,000	1,010
1925	16,755	23.1	2,500	Jul-25		
1935			35,000	May-35	35,000	n/a
1941	49,502	68.3	1,150	Apr-41		
1942	145,603	201.0	11,000	Aug-42	11,000	1,040
1943	30,559	42.2	324	May-43		
1944	54,523	75.3	12,900	Aug-44	12,900	500
1945	32,550	44.9	17,800	Jul-45	17,800	1,290
1946	22,885	31.6	16,500	Aug-46	16,500	1,060
1947	96,624	133.4	5,880	Jul-47		
1948	60,310	83.2	9,290	Jun-48		
1949	14,030	19.4	1,590	Jun-49		
1950	9,523	13.1	9,600	Jul-50		
1951	8,494	11.7	11,600	Jul-51	11,600	916
1952	5,005	6.9	5,170	Aug-52		
1953	3,198	4.4	3,730	Aug-53		
1954	3,836	5.3	5,800	Aug-54		
1955	19,685	27.2	11,500	Aug-55	11,500	2,360
1956	7,088	9.8	5,250	Aug-56		
1957	80,482	111.1	6,180	May-57		
1958	80,482	111.1	3,750	Aug-58		
1959	21,246	29.3	204	Apr-59		
1960	21,200	29.3	2,530	Jul-60		
1961	27,607	38.1	6,200	Aug-61		
1962	17,682	24.4	2,520	Jul-62		
1963	18,815	26.0	8,880	Aug-63		
1964	11,047	15.2	6,110	Aug-64		
1965	107,316	148.1	47,000	Jun-65	47,000	10,000
1971			2,030	May-71		
1972	35,547	49.1	3,220	Jul-72		
1973	96,192	132.8	2,970	Jul-73		
1974	31,648	43.7	2,560	Jun-74		
1975	25,718	35.5	5,360	Jul-75		
1976	25,646	35.4	5,870	Aug-76		
1977	36,484	50.4	5,120	Aug-77		
1978	24,038	33.2	1,860	Aug-78		
1979	42,010	58.0	946	May-79		
1980	124,389	171.7	15,200	Aug-80	15,200	2,020
1981	46,250	63.8	3,600	Jul-81		
1982	107,282	148.1	9,080	Aug-82		
1983	144,782	199.8	2,940	Aug-83		
1984	105,664	145.8	5,940	Jul-84		
1985	199,894	275.9	4,950	Jul-85		
1986	67,527	93.2	2,590	Jun-86		
1987	101,893	140.6	2,600	Jun-87		
1988	60,166	83.0	1,980	Aug-88		
1989	41,945	57.9	1,060	Jun-89		
1990	62,593	86.4	3,780	May-90		
1991	76,690	105.9	3,220	Jun-91		
1992	86,298	119.1	2,440	Aug-92		
1993	59,580	82.2	2,880	Jun-93		
1994	112,653	155.5	12,300	Jun-94	12,300	3,820
1995	235,162	324.6	11,300	May-95	11,300	3,870
1996	120,553	166.4	12,100	Jul-96	12,100	3,340
1997	194,772	268.8	10,100	Jun-97	10,100	5,820
1998	154,078	212.7	3,100	Jul-98		
1999	318,276	439.3	18,900	Apr-99	18,900	11,400
2000	131,280	181.2	2,080	Aug-00		
2001	102,531	141.5	1,950	Sep-01		
2002	67,861	93.7	2,400	Jul-02		
2003	72,588	100.2	3,580	Jun-03		
2004	108,303	149.5	4,880	Jul-04		
2005	75,854	104.7	2,900	Aug-05		
2006	93,191	128.6	9,310	Jul-06		
2007	136,635	188.6	3,720	Jul-07		
2008	78,492	108.3	4,540	Sep-08		
2009	87,542	120.8	2,530	Aug-09		
2010	97,116	134.1	1,560	Aug-10		
2011	69,482	95.9	13,800	Sep-11	13,800	4,800
2012	61,077	84.3	1,460	Jun-12		
2013	108,442	149.7	11,800	Sep-13	11,800	2,080
2014	97,783	135.0	4,040	Jul-14		
Average,	73,564	101.5	7,121		17,489	3,458
Minimum	3,198	4.4	204		10,100	500
Maximum	318,276	439.3	47,000		47,000	11,400
Average for years mean daily flow available =					15,363	

Source of data - U. S. Geological Survey records obtained from either the U. S. Geological Survey or CDSS websites.

TABLE 3

TABULATION OF WATER RIGHTS DIVERTING FROM THE ARKANSAS RIVER

WATER DISTRICTS 14, 17, AND 67

Ditch	Rate (cfs)	Appropriation Date	Cumulative Diversion Rate for Structure(cfs)	Reach[1]	Cumulative diversion rate for all structures(cfs)
Bessemer	2.00	4/1/1861	2.00	1	2.00
Bessemer	20.00	12/31/1861	22.00	1	22.00
Rocky Ford Highline	40.00	12/31/1861	40.00	3	62.00
Bessemer	3.74	5/31/1864	25.74	1	65.74
Bessemer	3.00	6/30/1866	28.74	1	68.74
Bessemer	2.50	1/8/1867	31.24	1	71.24
Bessemer	5.13	5/31/1867	36.37	1	76.37
Rocky Ford Highline	0.60	9/21/1867	40.60	3	76.97
Oxford Farmers	13.40	9/21/1867	13.40	3	90.37
Rocky Ford Highline	16.00	7/1/1869	56.60	3	106.37
Bessemer	1.47	11/30/1870	37.84	1	107.84
Bessemer	3.40	12/31/1870	41.24	1	111.24
Keesee	9.00	3/13/1871	9.00	6	120.24
Bessemer	2.00	9/18/1873	43.24	1	122.24
Rocky Ford	111.76	5/15/1874	111.76	4	234.00
Lamar	15.75	11/30/1875	15.75	6	249.75
Bessemer	3.00	12/31/1876	46.24	1	252.75
Bessemer	0.41	12/31/1879	46.65	1	253.16
Bessemer	14.00	5/4/1881	60.65	1	267.16
Bessemer	2.00	6/20/1881	62.65	1	269.16
Bessemer	8.00	3/31/1882	70.65	1	277.16
Keesee	4.50	12/31/1883	13.50	6	281.66
Rocky Ford Highline[2]	32.50	3/7/1884	89.10	3	314.16
Consolidated Extension[3]	5.50	3/7/1884	5.50	5	319.66
Fort Lyon	164.64	4/15/1884	164.64	4	484.30
Las Animas Consolidated	22.00	12/3/1884	27.50	5	506.30
Las Animas Consolidated[4]	22.30	4/10/1875	49.80	5	528.60
Catlin[4]	22.00	4/10/1875	22.00	4	550.60
Catlin	226.00	12/3/1884	248.00	4	776.60
Buffalo	67.50	1/29/1885	67.50	6	844.10
Rocky Ford Highline	30.00	6/30/1885	119.10	3	874.10
Rocky Ford Highline	2.00	3/11/1886	121.10	3	876.10
Fort Bent	27.77	4/1/1886	27.77	6	903.87
Lamar	72.09	11/4/1886	87.84	6	975.96
Amity	283.50	2/21/1887	283.50	6	1,259.46
Oxford Farmers	116.00	2/26/1887	129.40	3	1,375.46
Fort Lyon	597.16	3/1/1887	761.80	4	1,972.62
Collier	22.00	5/1/1887	22.00	3	1,994.62
Lamar	13.64	4/16/1887	101.48	6	2,008.26
Bessemer	322.00	5/1/1887	392.65	1	2,330.26
Excelsior	20.00	5/1/1887	20.00	2	2,350.26
Hyde	23.44	5/10/1887	23.44	6	2,373.70
Catlin	97.00	11/14/1887	345.00	4	2,470.70
Fort Bent	32.77	3/10/1889	60.54	6	2,503.47
Las Animas Consolidated	80.00	3/13/1888	129.80	5	2,583.47
X-Y	69.00	7/22/1889	69.00	6	2,652.47
Fort Bent	11.70	9/11/1889	72.24	6	2,664.17

TABLE 3

TABULATION OF WATER RIGHTS DIVERTING FROM THE ARKANSAS RIVER

WATER DISTRICTS 14, 17, AND 67

Ditch	Rate (cfs)	Appropriation Date	Cumulative Diversion Rate for Structure(cfs)	Reach[1]	Cumulative diversion rate for all structures(cfs)
Holbrook	155.00	9/25/1889	155.00	4	2,819.17
Rocky Ford Highline	378.00	1/6/1890	499.10	3	3,197.17
Excelsior	40.00	1/6/1890	60.00	2	3,237.17
Otero	123.00	3/3/1890	123.00	4	3,360.17
Rocky Ford	4.43	5/6/1890	116.19	4	3,364.60
Colorado	756.28	6/9/1890	756.28	3	4,120.88
Lamar	184.27	7/16/1890	285.75	6	4,305.15
Fort Bent	26.77	8/12/1890	99.01	6	4,331.92
Manvel	54.00	10/14/1890	54.00	6	4,385.92
Rocky Ford Highline	2.50	12/31/1890	501.60	3	4,388.42
Graham	61.00	8/24/1891	61.00	6	4,449.42
Sisson	18.00	12/1/1891	18.00	6	4,467.42
Fort Bent	50.00	1/1/1893	149.01	6	4,517.42
Amity	500.00	4/1/1893	783.50	6	5,017.42
Holbrook	445.00	8/30/1893	600.00	4	5,462.42
Fort Lyon	171.20	8/31/1893	933.00	4	5,633.62
Keesee	15.00	9/3/1893	28.50	6	5,648.62
Stubbs	7.20	12/1/1895	7.20	6	5,655.82
Fort Bent	80.00	12/31/1900	229.01	6	5,735.82
Otero	334.92	2/2/1903	457.92	4	6070.74
Consolidated Extension	44.80	4/15/1909	174.60	5	6115.54
Total	6115.54				

[1]River reaches: 1 - Above the mouth of Fountain Creek
2 - Mouth of FountainCreek to the Avondale gaging station
3 - Avondale gaging station to the Nepesta gaging station
4 - Nepesta gaging station to the La Junta gaging station
5 - La Junta gaging station to John Martin Dam
6 - John Martin Dam to the Stateline

[2]Transferred from the Las Animas Town Ditch and volumetrically limited. Must reduce by 10 cfs if Amity calls.

[3]Diverted into and delivered through the Las Animas Consolidated Canal

[3]The water rights for the Consolidated Extension Ditch are diverted into and delivered through the Las Animas Consolidated Canal.

[4]Administered as having a 12/3/1884 priority.

TABLE 4
TABULATION OF WATER STORAGE RIGHTS FILLED FROM THE ARKANSAS RIVER WATER DISTRICTS 14 AND 17

Reservoir	Storage volume (ac-ft)	Approp-riation Date	SEO Adm No.	Feeder Canal	Capacity of Feeder Canal cfs	Reach[1]
Lake Meredeth	6,355	12/31/1891	19465.15340	Colorado canal	756	3
Lake Meredeth	26,028	3/09/1898	19465.17600	Colorado canal	756	3
Lake Henry	6,355	12/31/1891	19465.15340	Colorado canal	756	3
Lake Henry	3,561	6/15/1909	21715.00000	Colorado canal	756	3
Lake Henry	2,000	9/10/1900	24435.18515	Colorado canal	756	3
Dye Reservoir	2,500	10/10/1903	20186.19640	Holbrook Canal	600	4
Dye Reservoir	3,486	9/3/1909	21795.00000	Holbrook Canal	600	4
Dye Reservoir	2,000	9/15/1909	21807.00000	Holbrook Canal	600	4
Holbrook Reservoir	4,247	3/02/1892	15402.00000	Holbrook Canal	600	4
Holbrook Reservoir	2,000	10/10/1903	20186.19640	Holbrook Canal	600	4
Holbrook Reservoir	1,196	9/9/1915	21807.00000	Holbrook Canal	600	4
Adobe Creek Reservoir	61,575	1/25/1906	20478.00000	Fort Lyon Storage Canal	1375	4
Adobe Creek Reservoir	25,425	12/29/1908	21547.00000	Fort Lyon Storage Canal	1375	4
HorseCreek Reservoir	11,400	8/15/1900	20186.18489	Fort Lyon Storage Canal	1375	4
HorseCreek Reservoir	15,487	1/25/1906	20478.00000	Fort Lyon Storage Canal	1375	4
HorseCreek Reservoir	1,113	6/12/1908	21347.00000	Fort Lyon Storage Canal	1375	4
Great Plains Reservoir System	265,552	8/1/1896	20186.17015	Kickingbird Canal[2]	1150[1] 880[2]	4

[1]River reaches: 1 - Above the mouth of Fountain Creek
2 - Mouth of FountainCreek to the Avondale gaging station
3 - Avondale gaging station to the Nepesta gaging station
4 - Nepesta gaging station to the La Junta gaging station
5 - La Junta gaging station to John Martin Dam
6 - John Martin Dam to the Stateline

* The water available under the water storage rights for the Great Plains Reservoir System is sometimes stored in an Article III Acount in John Marting Reservoir under the 1980 Operation Plan.

TABLE 5
SUMMARY OF CALLS ON THE ARKANSAS RIVER
DURING FOUNTAIN CREEK FLOOD EVENTS DURING 1999, 2011, AND 2013

Date	From Water Districts 14 and 17 Priority and Structure	From Water District 67 Priority and Structure
April 28, 1999	3/1/1887 Fort Lyon	- -
April 29, 1999	8/01/1896 Great Plains Reservoirs	- -
April 30, 1999	12/14/1948 John Martin Reservoir	- -
May 1, 1999	12/14/1948 John Martin Reservoir	- -
May 2, 1999	12/14/1948 John Martin Reservoir	- -
May 3, 1999	6/25/1962 Pueblo Reservoir/ Free River Free river through July 3	- -
September 14, 2011	4/15/1884 Fort Lyon	1/29/1885 Buffalo
September 15, 2011	12/3/1884 Catlin 5/1/1887 Bessemer/Excelsior	4/1/1886 Fort Bent
September 16, 2011	6/9/1890 Colorado Canal	2/21/1887 Amity
September 17, 2011	3/11/1886 Rocky Ford Highline	4/1/1893 Amity
September 18, 2011	3/11/1886 Rocky Ford Highline	4/1/1893 Amity
September 19, 2011	3/11/1886 Rocky Ford Highline	3/10/1889 Fort Bent
September 13, 2013	4/15/1884 Fort Lyon	1/29/1885 Buffalo
September 14, 2013	4/15/1884 Fort Lyon	1/29/1885 Buffalo
September 15, 2013	3/13/1888 Las Animas Consolidated 6/9/1890 Colorado Canal 3/2/1892 Holbrook	2/21/1887 Amity 7/22/1889 X-Y
September 16, 2013	6/9/1890 Colorado Canal 8/1/1896 Great Plains Reservoirs 1/25/1906 Fort Lyon Storage	7/22/1889 X-Y 4/1/183 Amity
September 17, 2013	3/13/1888 Las Animas Consolidated 6/9/1890 Colorado Canal 3/2/1892 Holbrook	7/22/1889 X-Y 4/1/183 Amity
September 18, 2013	6/9/1890 Colorado Canal 8/1/1896 Great Plains Reservoirs 1/25/1906 Fort Lyon Storage	7/22/1889 X-Y 4/1/183 Amity
September 19, 2013	3/13/1888 Las Animas Consolidated 6/9/1890 Colorado Canal 3/2/1892 Holbrook	7/22/1889 X-Y 4/1/183 Amity
September 20, 2013	3/13/1888 Las Animas Consolidated 6/9/1890 Colorado Canal 3/2/1892 Holbrook	7/22/1889 X-Y 4/1/183 Amity
September 21, 2013	3/11/1886 Rocky Ford Highline 3/13/1888 Las Animas Consolidated	7/22/1889 X-Y 4/1/183 Amity
September 22, 2013	3/11/1886 Rocky Ford Highline 3/13/1888 Las Animas Consolidated	7/22/1889 X-Y 4/1/183 Amity

Notes: River calls during 1999 were obtained from a tabulation by the Division 2 office. River calls during 2011 and 2013 were obtained from the Arkansas River Daily Reports on the Colorado Division of Water Resources Division 2 website.

TABLE 6
ADDITIONAL FLOW IN THE ARKANSAS RIVER AT KEY DIVERSION POINTS AS BY THE TLAP OUTPUT
FROM THE ADDITIONAL FLOOD INCREMENT IN THE 2013 COMPOSITE FLOOD
FLOW VALUES IN CFS

Date	Time	Release from Pueblo Reser-voir	Colo-rado Canal	Cum release dis-charge	Transit loss	Rocky Ford High-line	Cum release dis-charge	Transit loss	Catlin	Cum release dis-charge	Transit loss	Hol-brook	Cum release dis-charge	Transit loss	Fort Lyon Stor-age	Cum release dis-charge	Transit loss	Fort Lyon	Cum release dis-charge	Transit loss	Las Animas Consoli-dated	Cum release dis-charge	Transit loss	John Martin Reser-voir	Cum release dis-charge	Transit loss
9/13/2013	0000		0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0
9/13/2013	0400		0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0
9/13/2013	0800	1113	7.1	7.1	99.4	3.0	3.0	99.7	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0
9/13/2013	1200		52.4	59.5	94.7	25.8	28.8	97.4	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0
9/13/2013	1600		161.5	221.0	80.1	95.5	124.3	88.8	2.0	2.0	99.8	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0
9/13/2013	2000		272.0	493.0	55.7	200.7	325.0	70.8	12.4	14.4	98.7	3.3	3.3	99.7	2.5	2.5	99.8	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0
9/14/2013	0000		279.0	772.0	30.6	266.6	591.6	46.8	45.6	60.1	94.6	15.7	19.1	98.3	12.0	14.5	98.7	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0
9/14/2013	0400		184.6	956.6	14.0	236.6	828.2	25.6	109.8	169.8	84.7	49.0	68.1	93.9	39.0	53.5	95.2	1.0	1.0	99.9	0.0	0.0	100.0	0.0	0.0	100.0
9/14/2013	0800		82.5	1039.1	6.6	145.8	974.0	12.5	183.9	353.7	68.2	107.6	175.6	84.2	89.6	143.1	87.1	5.5	6.6	99.4	0.0	0.0	100.0	0.0	0.0	100.0
9/14/2013	1200		27.3	1066.4	4.1	65.0	1039.0	6.6	222.3	576.0	48.2	172.4	348.0	68.7	151.8	294.9	73.5	19.7	26.3	97.6	0.0	0.0	100.0	0.0	0.0	100.0
9/14/2013	1600		8.7	1075.1	3.4	23.1	1062.1	4.5	199.3	775.3	30.3	207.0	555.0	50.1	194.8	489.7	56.0	51.1	77.4	93.0	2.5	2.5	99.8	0.0	0.0	100.0
9/14/2013	2000		4.0	1079.1	3.0	8.3	1070.5	3.8	136.0	911.3	18.1	190.2	745.2	33.0	193.5	683.2	38.6	99.5	176.9	84.1	9.8	12.2	98.9	0.0	0.0	100.0
9/15/2013	0000		2.7	1081.8	2.8	4.2	1074.7	3.4	73.4	984.7	11.5	136.7	881.9	20.7	152.0	835.1	24.9	149.7	326.6	70.6	28.0	40.3	96.4	2.5	2.5	99.8
9/15/2013	0400		2.1	1083.9	2.6	2.9	1077.6	3.1	34.0	1018.7	8.4	79.5	961.4	13.6	97.0	932.1	16.2	178.0	504.6	54.6	61.5	101.8	90.9	8.6	11.2	99.0
9/15/2013	0800		1.7	1085.7	2.4	2.3	1079.9	2.9	15.6	1034.3	7.0	39.8	1001.2	10.0	52.6	984.8	11.5	170.6	675.2	39.3	105.5	207.3	81.4	23.0	34.1	96.9
9/15/2013	1200		1.5	1087.2	2.3	1.9	1081.8	2.8	8.5	1042.8	6.3	19.3	1020.5	8.3	26.3	1011.1	9.1	134.6	809.8	27.2	145.1	352.4	68.3	48.6	82.7	92.6
9/15/2013	1600		1.3	1088.5	2.2	1.6	1083.4	2.6	5.6	1048.4	5.8	10.5	1031.0	7.3	13.7	1024.8	7.9	89.8	899.7	19.1	162.8	515.2	53.7	83.6	166.3	85.1
9/15/2013	2000		1.2	1089.6	2.1	1.4	1084.9	2.5	4.3	1052.7	5.4	6.8	1037.8	6.7	8.3	1033.0	7.1	52.8	952.5	14.4	151.7	666.9	40.1	118.9	285.2	74.4
9/16/2013	0000		1.1	1090.7	2.0	1.3	1086.2	2.4	3.5	1056.2	5.1	5.1	1042.9	6.3	5.8	1038.9	6.6	29.2	981.7	11.8	119.9	786.8	29.3	141.9	427.1	61.6
9/16/2013	0400		0.0	1090.7	2.0	1.2	1087.3	2.3	2.9	1059.1	4.8	4.1	1047.0	5.9	4.5	1043.4	6.2	16.7	998.4	10.3	82.5	869.3	21.9	144.2	571.3	48.7
9/16/2013	0800					1.1	1088.4	2.2	2.5	1061.7	4.6	3.4	1050.4	5.6	3.7	1047.2	5.9	10.5	1008.9	9.3	51.5	920.8	17.2	126.4	697.7	37.3
9/16/2013	1200					1.0	1089.4	2.1	2.2	1063.9	4.4	2.9	1053.4	5.3	3.2	1050.3	5.6	7.5	1016.4	8.6	30.8	951.6	14.5	97.5	795.2	28.5
9/16/2013	1600					0.0	1089.4	2.1	2.0	1065.9	4.2	2.6	1056.0	5.1	2.8	1053.1	5.3	5.8	1022.3	8.1	18.9	970.6	12.8	67.7	862.9	22.4
9/16/2013	2000								1.8	1067.7	4.0	2.3	1058.3	4.9	2.5	1055.6	5.1	4.8	1027.0	7.7	12.6	983.2	11.6	44.0	906.9	18.5
9/17/2013	0000								1.7	1069.4	3.9	2.1	1060.3	4.7	2.2	1057.8	4.9	4.1	1031.1	7.3	9.2	992.3	10.8	27.9	934.8	16.0
9/17/2013	0400								1.5	1070.9	3.7	1.9	1062.2	4.5	2.0	1059.8	4.7	3.5	1034.7	7.0	7.2	999.5	10.2	18.2	953.0	14.3
9/17/2013	0800								1.4	1072.3	3.6	1.7	1063.9	4.4	1.8	1061.6	4.6	3.1	1037.8	6.7	5.9	1005.4	9.6	12.7	965.8	13.2
9/17/2013	1200								1.3	1073.7	3.5	1.6	1065.5	4.2	1.7	1063.3	4.4	2.8	1040.6	6.5	5.0	1010.4	9.2	9.6	975.3	12.3
9/17/2013	1600								1.2	1074.9	3.4	1.5	1067.0	4.1	1.6	1064.9	4.3	2.5	1043.1	6.2	4.3	1014.7	8.8	7.6	982.9	11.6
9/17/2013	2000								1.2	1076.1	3.3	1.4	1068.4	4.0	1.5	1066.4	4.1	2.3	1045.4	6.0	3.8	1018.6	8.4	6.3	989.3	11.1
9/18/2013	0000								1.1	1077.1	3.2	1.3	1069.7	3.8	1.4	1067.7	4.0	2.1	1047.6	5.8	3.4	1022.0	8.1	5.4	994.7	10.6
9/18/2013	0400								1.0	1078.1	3.1	1.2	1070.9	3.7	1.3	1069.0	3.9	2.0	1049.5	5.7	3.1	1025.0	7.9	4.7	999.4	10.2
9/18/2013	0800								0.0	1078.1	3.1	1.1	1072.1	3.6	1.2	1070.2	3.8	1.8	1051.4	5.5	2.8	1027.9	7.6	4.2	1003.6	9.8
9/18/2013	1200											1.1	1073.1	3.5	1.1	1071.3	3.7	1.7	1053.1	5.3	2.6	1030.4	7.4	3.7	1007.4	9.5
9/18/2013	1600											1.0	1074.2	3.4	1.1	1072.4	3.6	1.6	1054.6	5.2	2.4	1032.8	7.2	3.4	1010.8	9.1
9/18/2013	2000											0.0	1074.2	3.4	1.0	1073.4	3.5	1.5	1056.1	5.1	2.2	1035.0	7.0	3.1	1013.9	8.9
9/19/2013	0000														0.0	1073.4	3.5	1.4	1057.5	4.9	2.0	1037.1	6.8	2.9	1016.7	8.6
9/19/2013	0400																	1.3	1058.9	4.8	1.9	1039.0	6.6	2.6	1019.4	8.4
9/19/2013	0800																	1.2	1060.1	4.7	1.8	1040.8	6.4	2.4	1021.8	8.2
9/19/2013	1200																	1.2	1061.3	4.6	1.7	1042.5	6.3	2.3	1024.1	7.9
9/19/2013	1600																	1.1	1062.4	4.5	1.6	1044.0	6.2	2.1	1026.2	7.8
9/19/2013	2000																	1.1	1063.5	4.4	1.5	1045.5	6.0	2.0	1028.2	7.6
9/20/2013	0000																	1.0	1064.5	4.3	1.4	1047.0	5.9	1.9	1030.1	7.4
9/20/2013	0400																	0.0	1064.5	4.3	1.3	1048.3	5.8	1.8	1031.8	7.3
9/20/2013	0800																				1.3	1049.6	5.7	1.7	1033.5	7.1
9/20/2013	1200																				1.2	1050.8	5.5	1.6	1035.1	7.0
9/20/2013	1600																				1.1	1051.9	5.4	1.5	1036.6	6.8
9/20/2013	2000																				1.1	1053.0	5.3	1.4	1038.0	6.7
9/21/2013	0000																				1.0	1054.0	5.3	1.3	1039.4	6.6
9/21/2013	0400																				0.0	1054.0	5.3	1.3	1040.7	6.5
9/21/2013	0800																							1.2	1041.9	6.3
9/21/2013	1200																							1.2	1043.1	6.2
9/21/2013	1600																							1.1	1044.2	6.1
9/21/2013	2000																							1.1	1045.2	6.0
9/22/2013	0000																							1.0	1046.3	6.0
9/22/2013	0400																							0.0	1046.3	6.0
9/22/2013	0800																									
9/22/2013	1200																									
9/22/2013	1600																									
9/22/2013	2000																									

TABLE 7
ADDITIONAL FLOW IN THE ARKANSAS RIVER ABOVE KEY DIVERSION POINTS FROM THE ADDITIONAL FLOOD INCREMENT IN THE 2013 COMPOSITE FLOOD
FLOW VALUES IN CFS

Date	Time	Release from Pueblo Reser-voir	Colo-rado Canal	Rocky Ford High-line	Catlin	Hol-brook	Fort Lyon Storage	Fort Lyon	Las Animas Consoli-dated	John Martin Reser-voir
9/13/2013	0000									
9/13/2013	0400									
9/13/2013	0800	1113	7.2	3.0						
9/13/2013	1200		53.5	26.3						
9/13/2013	1600		164.7	97.6	2.1					
9/13/2013	2000		277.5	205.0	12.8	3.5	2.6			
9/14/2013	0000		284.5	272.2	47.1	16.3	12.5			
9/14/2013	0400		188.3	241.6	113.3	50.8	40.4	1.1		
9/14/2013	0800		84.2	148.9	189.7	111.4	92.9	5.8		
9/14/2013	1200		27.8	66.4	229.4	178.5	157.3	20.6		
9/14/2013	1600		8.9	23.6	205.6	214.4	201.9	53.4	2.6	
9/14/2013	2000		4.1	8.5	140.3	197.0	200.5	104.0	10.3	
9/15/2013	0000		2.8	4.3	75.8	141.6	157.5	156.4	29.6	2.7
9/15/2013	0400		2.2	3.0	35.0	82.3	100.5	186.0	64.9	9.2
9/15/2013	0800		1.8	2.3	16.1	41.2	54.5	178.3	111.4	24.4
9/15/2013	1200		1.5	1.9	8.7	20.0	27.3	140.7	153.1	51.7
9/15/2013	1600		1.3	1.7	5.8	10.9	14.2	93.9	171.8	88.9
9/15/2013	2000		1.2	1.5	4.4	7.1	8.6	55.2	160.2	126.4
9/16/2013	0000		1.1	1.3	3.6	5.3	6.0	30.6	126.6	150.9
9/16/2013	0400			1.2	3.0	4.2	4.7	17.4	87.1	153.3
9/16/2013	0800			1.1	2.6	3.5	3.9	11.0	54.3	134.4
9/16/2013	1200			1.0	2.3	3.0	3.3	7.8	32.5	103.7
9/16/2013	1600				2.1	2.7	2.9	6.1	20.0	72.0
9/16/2013	2000				1.9	2.4	2.5	5.0	13.3	46.7
9/17/2013	0000				1.7	2.1	2.3	4.3	9.7	29.7
9/17/2013	0400				1.6	2.0	2.1	3.7	7.6	19.4
9/17/2013	0800				1.5	1.8	1.9	3.3	6.2	13.5
9/17/2013	1200				1.4	1.7	1.8	2.9	5.3	10.2
9/17/2013	1600				1.3	1.5	1.6	2.7	4.6	8.1
9/17/2013	2000				1.2	1.4	1.5	2.4	4.0	6.7
9/18/2013	0000				1.1	1.3	1.4	2.2	3.6	5.8
9/18/2013	0400				1.0	1.3	1.3	2.1	3.2	5.0
9/18/2013	0800					1.2	1.2	1.9	3.0	4.5
9/18/2013	1200					1.1	1.2	1.8	2.7	4.0
9/18/2013	1600					1.1	1.1	1.7	2.5	3.6
9/18/2013	2000						1.0	1.6	2.3	3.3
9/19/2013	0000							1.5	2.2	3.0
9/19/2013	0400							1.4	2.0	2.8
9/19/2013	0800							1.3	1.9	2.6
9/19/2013	1200							1.2	1.8	2.4
9/19/2013	1600							1.2	1.7	2.3
9/19/2013	2000							1.1	1.6	2.1
9/20/2013	0000							1.1	1.5	2.0
9/20/2013	0400								1.4	1.9
9/20/2013	0800								1.3	1.8
9/20/2013	1200								1.3	1.7
9/20/2013	1600								1.2	1.6
9/20/2013	2000								1.1	1.5
9/21/2013	0000								1.1	1.4
9/21/2013	0400									1.4
9/21/2013	0800									1.3
9/21/2013	1200									1.2
9/21/2013	1600									1.2
9/21/2013	2000									1.1
9/22/2013	0000									1.1
9/22/2013	0400									
9/22/2013	0800									
9/22/2013	1200									
9/22/2013	1600									
9/22/2013	2000									
Sum			1112.5	1112.5	1112.5	1112.5	1112.5	1112.5	1112.5	1112.5

Note: **The values in this table were calculated from the corresponding values in Table 6 with an upward adjustment to remove the affects of the TLAP transit losses.**

TABLE 8
SUMMARY OF DAILY ARKANSAS RIVER CALLS, 4-HOUR DIVERSION RATES, AND WATER RIGHTS UNDER WHICH WATER WAS DIVERTED DURING SEPTEMBER 13 THROUGH 22, 2013

Date	Time	River call(s) above JMD	River call(s) WD 67	Colo Canal 4-hr avg div	RFHL Canal 4-hr avg div	Catlin 4 hr avg div	Holbrook 4-hr avg div	FL Stor Canal 4-hr avg	Fort Lyon 4 hr avg div	LACC 4 hr avg div	Amity 4-hr avg div	Junior water right in structure under which water was diverted during period								
												Colo Canal	RFHL Canal	Catlin Canal	Holbrook Canal	FL Stor Canal	Fort Lyon Canal	Great Plains Resvrs	LACC	Amity
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
9/13/2013	0:00			0.0	91.9	0.0	46.3	0.0	131.4	18.3	0.0		6/30/1885		9/25/1889		4/15/1884		12/3/1884	
9/13/2013	4:00			0.0	94.6	14.5	46.7	0.0	129.0	27.6	0.0		3/7/1884	12/3/1884	9/25/1889		4/15/1884		12/3/1884	
9/13/2013	8:00	4/15/1884	1/29/1885	183.6	172.0	181.3	47.3	0.0	127.3	33.6	0.0	6/09/1890	1/6/1890	12/3/1884	9/25/1889		4/15/1884		12/3/1884	
9/13/2013	12:00			760.3	432.6	265.1	48.1	0.0	123.5	44.2	0.0	6/09/1890	1/6/1890	11/14/1887	9/25/1889		4/15/1884		12/3/1884	
9/13/2013	16:00			755.6	465.6	249.3	48.7	0.0	118.9	43.2	0.0	6/09/1890	1/6/1890	11/14/1887	9/25/1889		4/15/1884		12/3/1884	
9/13/2013	20:00			742.0	465.8	248.6	46.9	0.0	127.2	37.1	0.0	6/09/1890	1/6/1890	11/14/1887	9/25/1889		4/15/1884		12/3/1884	
9/14/2013	0:00			731.8	465.9	246.6	46.7	0.0	165.3	29.1	0.0	6/09/1890	1/6/1890	11/14/1887	9/25/1889		3/1/1887		12/3/1884	
9/14/2013	4:00			696.4	463.4	271.5	43.1	0.0	252.3	25.2	285.8	6/09/1890	1/6/1890	11/14/1887	9/25/1889		3/1/1887		12/3/1884	2/21/1887
9/14/2013	8:00	4/15/1884	1/29/1885	704.0	462.9	300.7	121.4	0.0	187.1	23.8	218.8	6/09/1890	1/6/1890	11/14/1887	9/25/1889		3/1/1887		12/3/1884	2/21/1887
9/14/2013	12:00			643.0	464.1	293.6	158.9	0.0	304.3	22.9	106.9	6/09/1890	1/6/1890	11/14/1887	3/2/1892		3/1/1887		12/3/1884	2/21/1887
9/14/2013	16:00			663.0	459.8	307.3	157.8	0.0	636.7	29.4	19.0	6/09/1890	1/6/1890	11/14/1887	3/2/1892		3/1/1887		12/3/1884	2/21/1887
9/14/2013	20:00			725.6	461.6	303.3	409.1	0.0	760.9	70.0	0.6	6/09/1890	1/6/1890	11/14/1887	3/2/1892		3/1/1887		3/13/1888	2/21/1887
9/15/2013	0:00			755.3	463.9	298.3	578.5	0.0	760.2	72.8	0.1	6/09/1890	1/6/1890	11/14/1887	3/2/1892		3/1/1887		3/13/1888	2/21/1887
9/15/2013	4:00			723.8	462.8	315.4	577.3	0.0	760.0	89.6	0.0	6/09/1890	1/6/1890	11/14/1887	3/2/1892		3/1/1887		3/13/1888	
9/15/2013	8:00	3/13/1888, 6/8/1890, 3/2/1892	2/21/1887, 7/22/1889	714.5	461.4	311.6	578.4	0.0	760.3	130.1	0.0	6/09/1890	1/6/1890	11/14/1887	3/2/1892		3/1/1887		3/13/1888	
9/15/2013	12:00			722.2	460.3	312.4	577.2	0.0	760.1	132.5	0.0	6/09/1890	1/6/1890	11/14/1887	3/2/1892		3/1/1887		3/13/1888	
9/15/2013	16:00			761.6	436.1	313.8	578.8	0.0	757.8	132.3	0.0	6/09/1890	1/6/1890	11/14/1887	3/2/1892		3/1/1887		3/13/1888	
9/15/2013	20:00			732.0	330.6	313.5	578.1	0.0	758.1	132.0	0.0	6/09/1890	1/6/1890	11/14/1887	3/2/1892		3/1/1887		3/13/1888	
9/16/2013	0:00			67.1	368.8	313.4	577.3	0.0	759.3	131.6	0.0	6/09/1890	1/6/1890	11/14/1887	3/2/1892		3/1/1887		3/13/1888	
9/16/2013	4:00			4.6	330.9	315.2	577.4	0.0	759.3	130.3	0.0	6/09/1890	1/6/1890	11/14/1887	3/2/1892		3/1/1887		3/13/1888	
9/16/2013	8:00	6/8/1890, 8/1/1896, 1/25/1906	7/22/1889, 4/1/1893	205.3	217.5	309.0	578.5	26.3	761.4	125.5	23.9	6/09/1890	1/6/1890	11/14/1887	3/2/1892	1/25/06	3/1/1887	8/01/1896	3/13/1888	2/21/1887
9/16/2013	12:00			755.2	188.4	265.2	558.3	463.3	903.3	122.1	27.1	6/09/1890	1/6/1890	11/14/1887	3/2/1892	1/25/06	8/31/1893	8/01/1896	3/13/1888	2/21/1887
9/16/2013	16:00			755.3	194.8	277.3	572.7	546.1	932.2	116.4	348.9	6/09/1890	1/6/1890	11/14/1887	3/2/1892	1/25/06	8/31/1893	8/01/1896	3/13/1888	4/01/1893
9/16/2013	20:00			710.5	188.9	275.5	576.1	548.9	923.6	125.4	403.7	6/09/1890	1/6/1890	11/14/1887	3/2/1892	1/25/06	8/31/1893	8/01/1896	3/13/1888	4/01/1893
9/17/2013	0:00			647.8	187.2	269.1	575.7	502.2	934.4	125.2	404.8	6/09/1890	1/6/1890	11/14/1887	3/2/1892	1/25/06	8/31/1893	8/01/1896	3/13/1888	4/01/1893
9/17/2013	4:00			481.4	198.1	269.2	571.6	468.3	920.3	125.7	403.4	6/09/1890	1/6/1890	11/14/1887	3/2/1892	1/25/06	8/31/1893	8/01/1896	3/13/1888	4/01/1893
9/17/2013	8:00	3/13/1888, 6/9/1890, 3/2/1892	7/22/1889, 4/1/1893	0.0	351.7	288.9	580.2	470.2	917.9	126.7	400.3	6/09/1890	1/6/1890	11/14/1887	3/2/1892	1/25/06	8/31/1893	8/01/1896	3/13/1888	4/01/1893
9/17/2013	12:00			0.5	350.3	291.7	577.4	212.3	922.7	128.3	407.7	6/09/1890	1/6/1890	11/14/1887	3/2/1892	1/25/06	8/31/1893	8/01/1896	3/13/1888	4/01/1893
9/17/2013	16:00			0.0	318.4	293.5	578.1	11.1	929.3	129.1	407.0		1/6/1890	11/14/1887	3/2/1892	1/25/06	8/31/1893	8/01/1896	3/13/1888	4/01/1893
9/17/2013	20:00			0.0	131.5	294.4	573.4	0.0	925.6	131.3	407.8		1/6/1890	11/14/1887	3/2/1892	1/25/06	8/31/1893	8/01/1896	3/13/1888	4/01/1893
9/18/2013	0:00			0.0	101.9	293.6	554.3	0.0	923.6	133.5	406.3		3/7/1884	11/14/1887	3/2/1892	1/25/06	8/31/1893	8/01/1896	3/13/1888	4/01/1893
9/18/2013	4:00			0.0	94.6	295.3	523.2	0.0	928.3	134.2	403.0		3/7/1884	11/14/1887	3/2/1892	1/25/06	8/31/1893	8/01/1896	3/13/1888	4/01/1893
9/18/2013	8:00	6/9/1890, 8/1/1896, 1/25/1906	7/22/1889, 4/1/1893	0.0	96.0	295.8	215.9	0.0	793.1	129.4	405.7		3/7/1884	11/14/1887	3/2/1892	1/25/06	8/31/1893	8/01/1896	3/13/1888	4/01/1893
9/18/2013	12:00			0.0	94.6	295.0	161.3	0.0	760.1	128.5	411.0		3/7/1884	11/14/1887	3/2/1892		3/1/1887		3/13/1888	4/01/1893
9/18/2013	16:00			0.0	94.6	296.2	159.6	0.0	761.7	130.2	497.0		3/7/1884	11/14/1887	3/2/1892		3/1/1887		3/13/1888	4/01/1893
9/18/2013	20:00			0.0	83.8	297.6	157.3	0.0	763.3	129.2	502.8		3/7/1884	11/14/1887	3/2/1892		3/1/1887		3/13/1888	4/01/1893
9/19/2013	0:00			0.0	90.0	295.4	157.1	0.0	762.1	127.9	506.9		3/7/1884	11/14/1887	3/2/1892		3/1/1887		3/13/1888	4/01/1893
9/19/2013	4:00			0.0	90.8	294.3	156.8	0.0	762.9	126.4	506.5		3/7/1884	11/14/1887	3/2/1892		3/1/1887		3/13/1888	4/01/1893
9/19/2013	8:00	3/13/1888, 6/9/1890, 3/2/1892	7/22/1889, 4/1/1893	0.0	88.9	293.0	157.3	0.0	760.9	127.4	528.5		3/7/1884	11/14/1887	3/2/1892		3/1/1887		3/13/1888	4/01/1893
9/19/2013	12:00			0.0	93.3	292.2	157.3	0.0	762.0	126.8	544.8		3/7/1884	11/14/1887	3/2/1892		3/1/1887		3/13/1888	4/01/1893
9/19/2013	16:00			0.0	93.4	292.0	158.8	0.0	760.9	126.7	552.9		3/7/1884	11/14/1887	3/2/1892		3/1/1887		3/13/1888	4/01/1893
9/19/2013	20:00			0.0	93.2	296.5	157.5	0.0	761.8	126.3	555.0		3/7/1884	11/14/1887	3/2/1892		3/1/1887		3/13/1888	4/01/1893
9/20/2013	0:00			0.0	93.2	296.1	157.0	0.0	763.3	125.3	553.9		3/7/1884	11/14/1887	3/2/1892		3/1/1887		3/13/1888	4/01/1893
9/20/2013	4:00			0.0	92.7	295.0	104.3	0.0	763.0	124.5	553.0		3/7/1884	11/14/1887	9/25/1889		3/1/1887		3/13/1888	4/01/1893
9/20/2013	8:00	3/13/1888, 6/9/1890, 3/2/1892	7/22/1889, 4/1/1893	0.0	91.9	200.0	0.0	0.0	762.4	126.4	553.6		3/7/1884	12/3/1884			3/1/1887		3/13/1888	4/01/1893
9/20/2013	12:00			0.0	91.8	245.4	0.0	0.0	768.4	126.8	553.8		3/7/1884	12/3/1884			3/1/1887		3/13/1888	4/01/1893
9/20/2013	16:00			0.0	91.5	245.1	0.0	0.0	763.6	133.1	540.2		3/7/1884	12/3/1884			3/1/1887		3/13/1888	4/01/1893
9/20/2013	20:00			0.0	91.4	246.6	0.0	0.0	762.3	139.7	407.1		3/7/1884	12/3/1884			3/1/1887		3/13/1888	4/01/1893
9/21/2013	0:00			0.0	91.5	245.2	0.0	0.0	761.4	140.3	371.0		3/7/1884	12/3/1884			3/1/1887		3/13/1888	4/01/1893
9/21/2013	4:00			0.0	91.0	244.0	0.0	0.0	700.8	140.3	357.3		3/7/1884	12/3/1884			3/1/1887		3/13/1888	4/01/1893
9/21/2013	8:00	3/11/1886, 3/13/1888	7/22/1889, 4/1/1893	0.0	90.2	246.2	0.0	0.0	487.9	139.2	297.5		3/7/1884	12/3/1884			3/1/1887		3/13/1888	4/01/1893
9/21/2013	12:00			0.0	90.2	246.8	0.0	0.0	553.8	137.3	301.1		3/7/1884	12/3/1884			3/1/1887		3/13/1888	4/01/1893
9/21/2013	16:00			0.0	90.0	249.1	0.0	0.0	420.0	137.0	381.5		3/7/1884	12/3/1884			3/1/1887		3/13/1888	4/01/1893
9/21/2013	20:00			0.0	90.0	249.2	0.0	0.0	381.1	137.1	422.2		3/7/1884	12/3/1884			3/1/1887		3/13/1888	4/01/1893
9/22/2013	0:00			0.0	90.1	248.9	0.0	0.0	379.6	137.1	422.9		3/7/1884	12/3/1884			3/1/1887		3/13/1888	4/01/1893
9/22/2013	4:00			0.0	90.0	248.6	0.0	0.0	374.6	137.8	425.2		3/7/1884	12/3/1884			3/1/1887		3/13/1888	4/01/1893
9/22/2013	8:00	3/11/1886, 3/13/1888	7/22/1889, 4/1/1893	0.0	90.2	248.1	0.0	0.0	370.0	137.8	488.4		3/7/1884	12/3/1884			3/1/1887		3/13/1888	4/01/1893
9/22/2013	12:00			0.0	90.2	248.9	0.0	0.0	326.4	137.1	517.1		3/7/1884	12/3/1884			3/1/1887		3/13/1888	4/01/1893
9/22/2013	16:00			0.0	90.0	249.3	0.0	0.0	305.6	136.5	548.1		3/7/1884	12/3/1884			3/1/1887		3/13/1888	4/01/1893
9/22/2013	20:00			0.0	90.0	249.2	0.0	0.0	243.9	136.6	551.7		3/7/1884	12/3/1884			3/1/1887		3/13/1888	4/01/1893

Note: Green shading indicates most junior water right diverting during indicated period as indicated by the diversion records.

TABLE 9
APPORTIONMENT OF THE ADDITIONAL WATER IN THE 2013 COMPOSITE FLOOD
SEPTEMBER 13 THROUGH 22, 2013

Date (1)	Time (2)	River call and maximum diversion rate (3)	Additional water at the Colo.Canal (4)	Historical diversion in Colo. Canal (5)	Additional diversion into Colo. Canal (6)	Additional water at the Holbrook (7)	Historical diversion into Holbrook Canal (8)	Additional diversion into Holbrook Canal 9.0	Addl water at FL Storage Canal (10)	Historical diversion into FL Storage (11)	Additional diversion into FL Stor (12)	Additional water at JMR for Amity (13)	Historical diversion into Amity (14)	Additional water at JMR for amity (15)
9/13/2013	0:00	9/25/1889-Holbrook Canal-155 cfs		0.0			46.3			0.0			0.0	
9/13/2013	4:00	9/25/1889-Holbrook Canal-155 cfs		0.0			46.7			0.0			0.0	
9/13/2013	8:00	6/09/1890-Colorado Canal -756.28 cfs	7.2	183.6	7.2		47.3			0.0			0.0	
9/13/2013	12:00	6/09/1890-Colorado Canal -756.28 cfs	53.5	760.3	0.0		48.1			0.0			0.0	
9/13/2013	16:00	6/09/1890-Colorado Canal -756.28 cfs	164.7	755.6	0.7		48.7			0.0			0.0	
9/13/2013	20:00	6/09/1890-Colorado Canal -756.28 cfs	277.5	742.0	14.2	3.0	46.9	3.0	0.0	0.0			0.0	
9/14/2013	0:00	6/09/1890-Colorado Canal -756.28 cfs	284.5	731.8	24.5	14.0	46.7	14.0	0.0	0.0			0.0	
9/14/2013	4:00	6/09/1890-Colorado Canal -756.28 cfs	188.3	696.4	59.9	43.5	43.1	43.5	0.0	0.0			285.8	
9/14/2013	8:00	6/09/1890-Colorado Canal -756.28 cfs	84.2	704.0	52.3	95.5	121.4	95.5	0.0	0.0			218.8	
9/14/2013	12:00	3/2/1892-Holbrook Reservoir-600 cfs	27.8	643.0		153.1	158.9	153.1	0.0	0.0			106.9	
9/14/2013	16:00	3/2/1892-Holbrook Reservoir-600 cfs	8.9	663.0		183.8	157.8	183.8	0.0	0.0			19.0	
9/14/2013	20:00	3/2/1892-Holbrook Reservoir-600 cfs	4.1	725.6		168.9	409.1	168.9	0.0	0.0			0.6	
9/15/2013	0:00	3/2/1892-Holbrook Reservoir-600 cfs	2.8	755.3		121.4	578.5	21.5	72.3	0.0			0.1	
9/15/2013	4:00	3/2/1892-Holbrook Reservoir-600 cfs	2.2	723.8		70.6	577.3	22.7	46.1	0.0			0.0	
9/15/2013	8:00	3/2/1892-Holbrook Reservoir-600 cfs	1.8	714.5		35.4	578.4	21.6	25.0	0.0			0.0	
9/15/2013	12:00	3/2/1892-Holbrook Reservoir-600 cfs	1.5	722.2		17.1	577.2	17.1	12.5	0.0			0.0	
9/15/2013	16:00	3/2/1892-Holbrook Reservoir-600 cfs	1.3	761.6		9.3	578.8	9.3	6.5	0.0			0.0	
9/15/2013	20:00	3/2/1892-Holbrook Reservoir-600 cfs	1.2	732.0		6.1	578.1	6.1	3.9	0.0			0.0	
9/16/2013	0:00	3/2/1892-Holbrook Reservoir-600 cfs	1.1	67.1		4.5	577.3	4.5	2.8	0.0			0.0	
9/16/2013	4:00	3/2/1892-Holbrook Reservoir-600 cfs		4.6		3.6	577.4	3.6	2.2	0.0			0.0	
9/16/2013	8:00	1/25/1906-Fort Lyon Storage-1,375 cfs		205.3		3.0	578.5		1.8	26.3	1.8		23.9	
9/16/2013	12:00	1/25/1906-Fort Lyon Storage-1,375 cfs		755.2		2.6	558.3		1.5	463.3	1.5		27.1	
9/16/2013	16:00	1/25/1906-Fort Lyon Storage-1,375 cfs		755.3		2.3	572.7		1.3	546.1	1.3		348.9	
9/16/2013	20:00	1/25/1906-Fort Lyon Storage-1,375 cfs		710.5		2.0	576.1		1.2	548.9	1.2	30.8	403.7	30.8
9/17/2013	0:00	1/25/1906-Fort Lyon Storage-1,375 cfs		647.8		1.8	575.7		1.0	502.2	1.0	28.9	404.8	28.9
9/17/2013	4:00	1/25/1906-Fort Lyon Storage-1,375 cfs		481.4		1.7	571.6		1.0	468.3	1.0	18.9	403.4	18.9
9/17/2013	8:00	1/25/1906-Fort Lyon Storage-1,375 cfs		0.0		1.5	580.2		0.9	470.2	0.9	13.2	400.3	13.2
9/17/2013	12:00	1/25/1906-Fort Lyon Storage-1,375 cfs		0.5		1.4	577.4		0.8	212.3	0.8	9.9	407.7	9.9
9/17/2013	16:00	1/25/1906-Fort Lyon Storage-1,375 cfs		0.0		1.3	578.1		0.7	11.1	0.7	7.9	407.0	7.9
9/17/2013	20:00	1/25/1906-Fort Lyon Storage-1,375 cfs		0.0		1.2	573.4		0.7	0.0		6.6	407.8	6.6
9/18/2013	0:00	1/25/1906-Fort Lyon Storage-1,375 cfs		0.0		1.2	554.3		0.6	0.0		5.6	406.3	5.6
9/18/2013	4:00	1/25/1906-Fort Lyon Storage-1,375 cfs		0.0		1.1	523.2		0.6	0.0		4.9	403.0	4.9
9/18/2013	8:00	1/25/1906-Fort Lyon Storage-1,375 cfs		0.0		1.0	215.9		0.6	0.0		4.3	405.7	4.3
9/18/2013	12:00	4/01/1893-Amity-783.5 cfs		0.0		0.9	161.3		0.5	0.0		3.9	411.0	3.9
9/18/2013	16:00	4/01/1893-Amity-783.5 cfs		0.0		0.9	159.6		0.5	0.0		3.5	497.0	3.5
9/18/2013	20:00	4/01/1893-Amity-783.5 cfs		0.0			157.3		0.5	0.0		3.2	502.8	3.2
9/19/2013	0:00	4/01/1893-Amity-783.5 cfs		0.0			157.1			0.0		3.0	506.9	3.0
9/19/2013	4:00	4/01/1893-Amity-783.5 cfs		0.0			156.8			0.0		2.7	506.5	2.7
9/19/2013	8:00	4/01/1893-Amity-783.5 cfs		0.0			157.3			0.0		2.5	528.5	2.5
9/19/2013	12:00	4/01/1893-Amity-783.5 cfs		0.0			157.3			0.0		2.4	544.8	2.4
9/19/2013	16:00	4/01/1893-Amity-783.5 cfs		0.0			158.8			0.0		2.2	552.9	2.2
9/19/2013	20:00	4/01/1893-Amity-783.5 cfs		0.0			157.5			0.0		2.1	555.0	2.1
9/20/2013	0:00	4/01/1893-Amity-783.5 cfs		0.0			157.0			0.0		1.9	553.9	1.9
9/20/2013	4:00	4/01/1893-Amity-783.5 cfs		0.0			104.3			0.0		1.8	553.0	1.8
9/20/2013	8:00	4/01/1893-Amity-783.5 cfs		0.0			0.0			0.0		1.7	553.6	1.7
9/20/2013	12:00	4/01/1893-Amity-783.5 cfs		0.0			0.0			0.0		1.6	553.8	1.6
9/20/2013	16:00	4/01/1893-Amity-783.5 cfs		0.0			0.0			0.0		1.6	540.2	1.6
9/20/2013	20:00	4/01/1893-Amity-783.5 cfs		0.0			0.0			0.0		1.5	407.1	1.5
9/21/2013	0:00	4/01/1893-Amity-783.5 cfs		0.0			0.0			0.0		1.4	371.0	1.4
9/21/2013	4:00	4/01/1893-Amity-783.5 cfs		0.0			0.0			0.0		1.3	357.3	1.3
9/21/2013	8:00	4/01/1893-Amity-783.5 cfs		0.0			0.0			0.0		1.3	297.5	1.3
9/21/2013	12:00	4/01/1893-Amity-783.5 cfs		0.0			0.0			0.0		1.2	301.1	1.2
9/21/2013	16:00	4/01/1893-Amity-783.5 cfs		0.0			0.0			0.0		1.2	381.5	1.2
9/21/2013	20:00	4/01/1893-Amity-783.5 cfs		0.0			0.0			0.0		1.1	422.2	1.1
9/22/2013	0:00	4/01/1893-Amity-783.5 cfs		0.0			0.0			0.0		1.1	422.9	1.1
9/22/2013	4:00	4/01/1893-Amity-783.5 cfs		0.0			0.0			0.0			425.2	
9/22/2013	8:00	4/01/1893-Amity-783.5 cfs		0.0			0.0			0.0			488.4	
9/22/2013	12:00	4/01/1893-Amity-783.5 cfs		0.0			0.0			0.0			517.1	
9/22/2013	16:00	4/01/1893-Amity-783.5 cfs		0.0			0.0			0.0			548.1	
9/22/2013	20:00	4/01/1893-Amity-783.5 cfs		0.0			0.0			0.0			551.7	
		Sum - 4hr cfs	1112.5	n/a	158.8	953.7	n/a	768.1	185.6	n/a	10.2	175.4	n/a	175.4
		Ac-ft	368	n/a	52	315	n/a	254	61	n/a	3	58	n/a	58

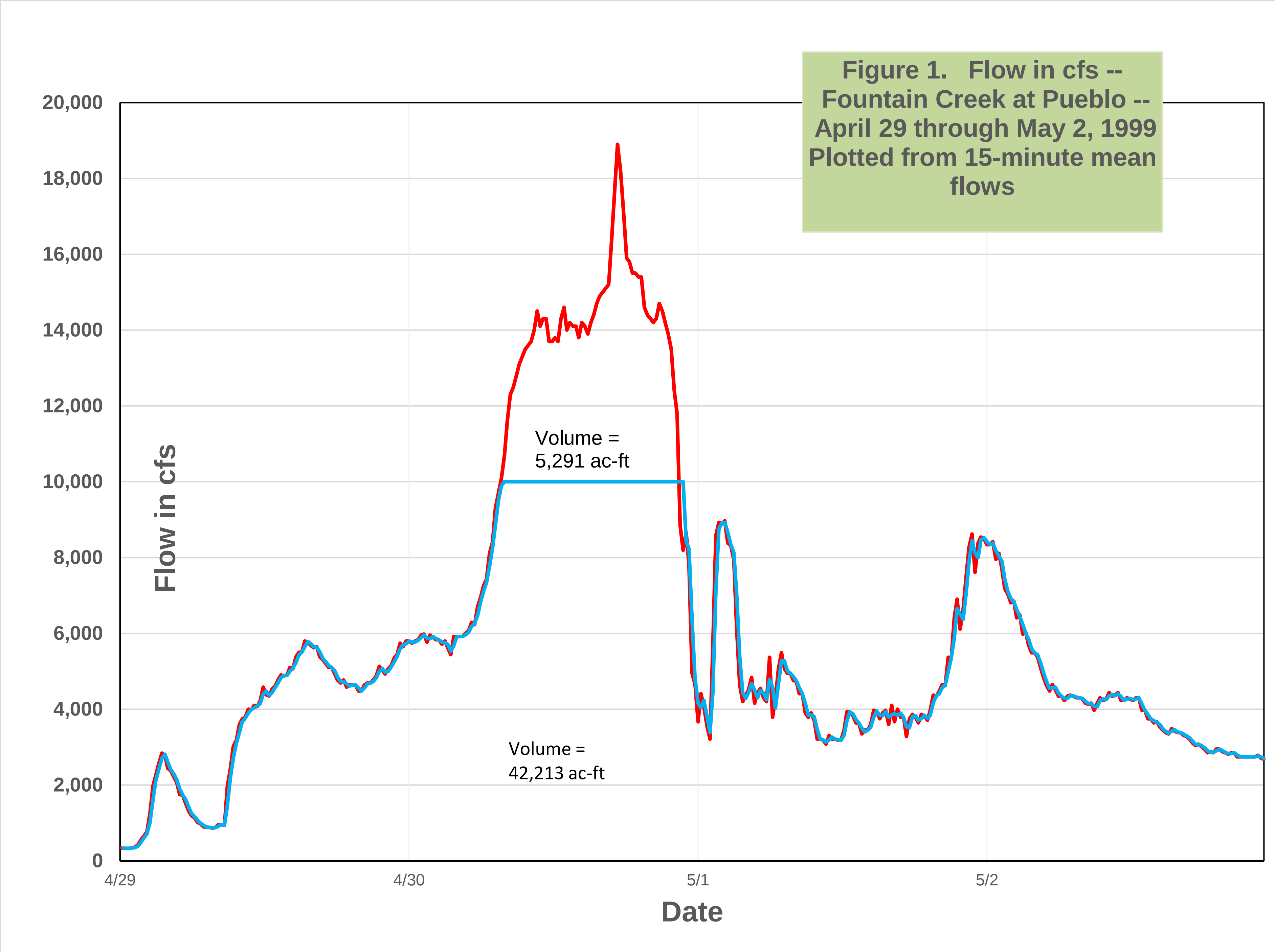
Figure 1. Flow in cfs -- Fountain Creek at Pueblo -- April 29 through May 2, 1999 Plotted from 15-minute mean flows
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Flow in cfs
Volume = 5,291 ac-ft
Volume = 42,213 ac-ft
4/29
4/30
5/1
5/2
Date

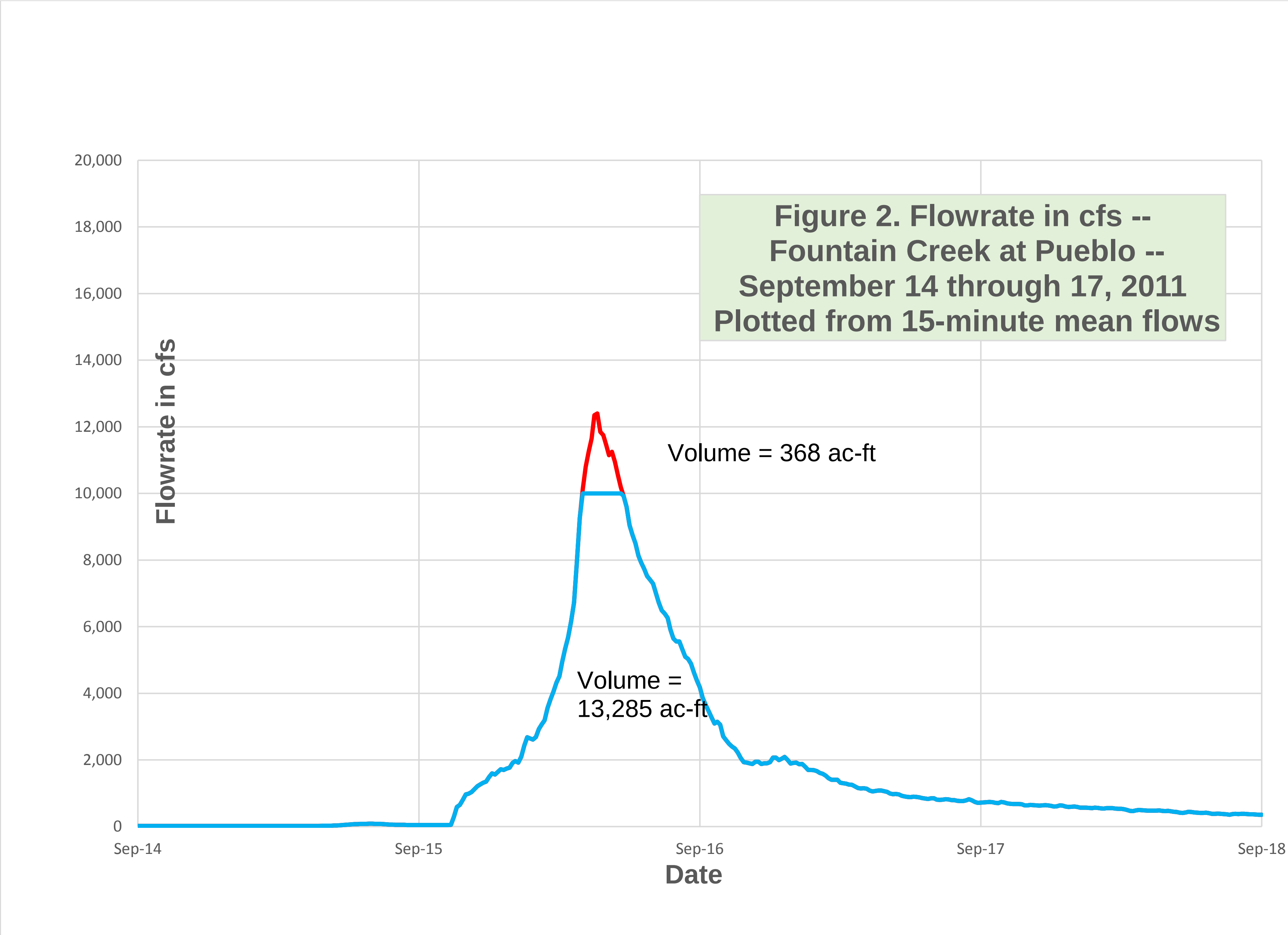
Figure 2. Flowrate in cfs --
Fountain Creek at Pueblo --
September 14 through 17, 2011
Plotted from 15-minute mean flows
Volume = 368 ac-ft
Volume =
13,285 ac-ft
Flowrate in cfs
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Date

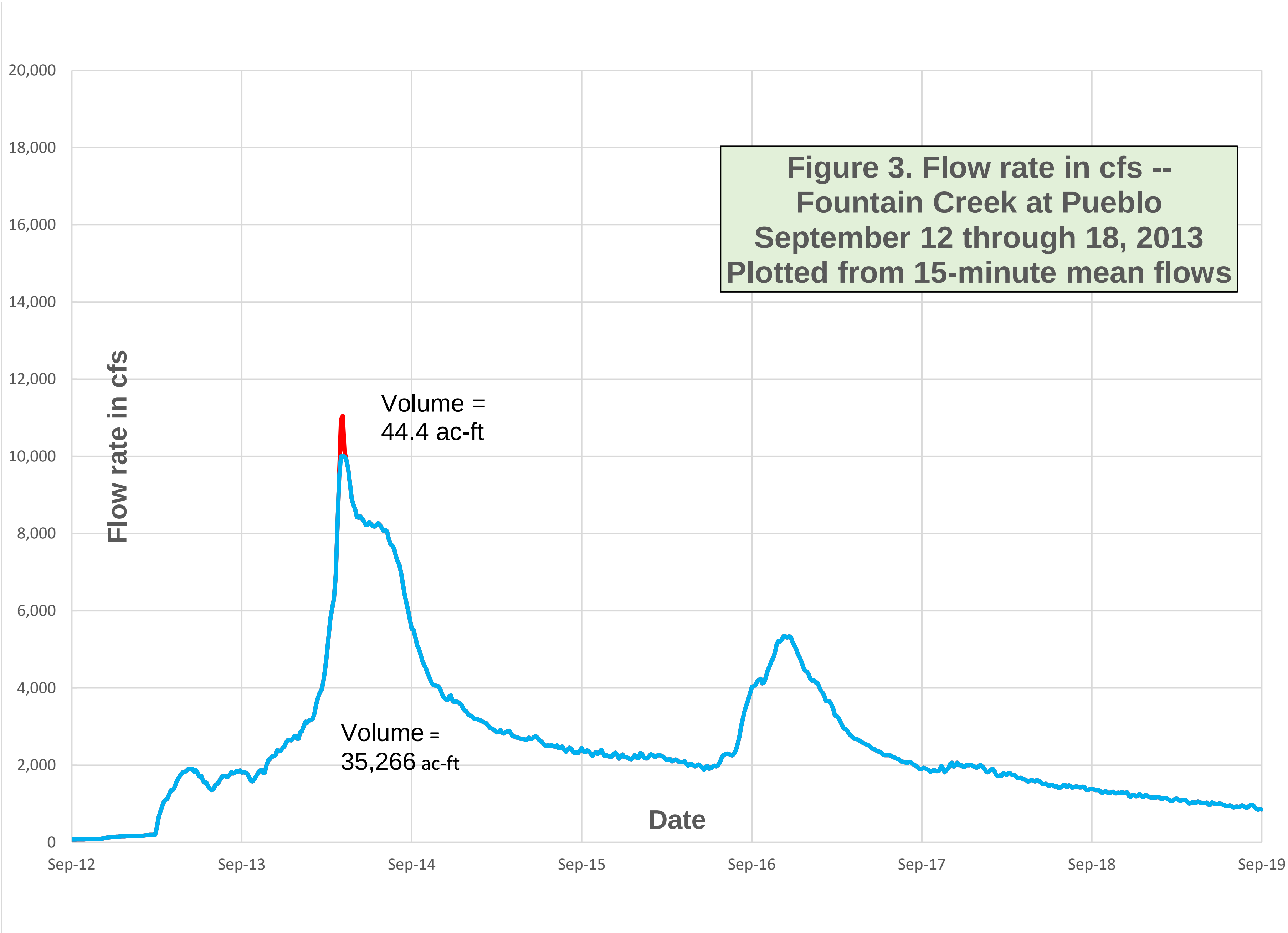
Figure 3. Flow rate in cfs --
Fountain Creek at Pueblo
September 12 through 18, 2013
Plotted from 15-minute mean flows
Flow rate in cfs
Date
Volume =
44.4 ac-ft
Volume =
35,266 ac-ft
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
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