Conejos Water Conservancy District
P. O. Box 550
Manassa, CO 81141
Cwcd1971@hotmail.com
Phone 719-843-5261 fax 5452

Craig Godbout
Program Manager
Colorado Water Conservation Board
Water Supply Planning Section
1580 Logan Street, Suite 200
Denver CO 80203
(303) 866-3441, ext 3210 (office)
(303) 547-8061 (cell)
craig.godbout@state.co.us

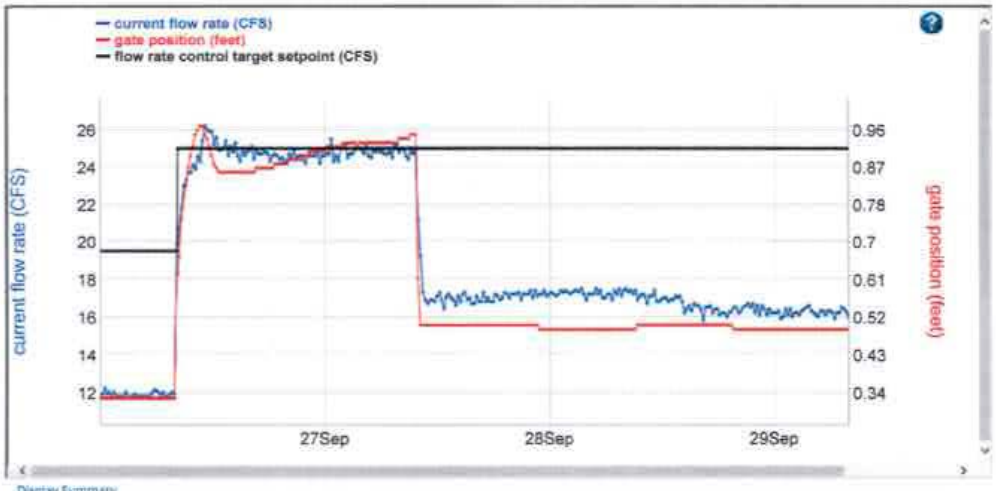
Craig,
This document will constitute the final reporting of the project titled; *Quantifying Mogote/Romero Flows & Effects on the Conejos System*.

The Problem: When water is high, 667 cfs, or about 25% of the Conejos River flow, is diverted into the Romero Ditch. As these flows enter the RMNE system, they run through about 80 miles of earthen canals and ditches along the Mogote foothills. Although losses throughout this combined and complex ditch system are substantial, RMNE has had no way to quantify or to know the timing of the return flows or to equitably distribute and manage water for its water users

Through the combined technologies of measuring weirs, automation, and telemetry, RMNE can now extend the success experienced in similar projects in south-central Colorado. With the pressures of drought, a critically diminished aquifer, and the Rio Grande Basin's priority to improve the efficiency of surface and ground water management, RMNE needed to find out where its water was. This Project installed measuring weirs and telemetry in order to quantify its flows and losses and to more accurately identify return flows.

AUTOMATION

At the Romero's head gate, which is one of the bigger gates off of the river channel, the diurnal effect has significant impact as it was adjusted multiple times each day by the ditch rider to meet DWR regulations. Since there are multiple priorities that come to the Romero and to each of the other large gates off the Conejos, collaboration with the District and with DWR's commissioners was essential so that RMNE could be able to verify at a glance that the flows are correct. With the installation of the automated gate RMNE is accomplishing this.



The above figure is a direct snapshot of the monitoring that happens with the automation of the Romero Headgate. The Blue line represents the Current flow by cfs. The red line represents gate position as it adjusts to meet the target flow.

The Romero has experienced an improvement in consistency of flows. In the past the variability was +/- 11cfs. That was an overall variability of up to 22cfs in a 24 hour period! As the figure above shows; the change in any 24 hour period is now a +/_ of 1cfs, that is less than 2 cfs variability in the same 24 hour period.

The difference of the flows is now staying in the Conejos River to either fill other user's rights or can be passed on to pay Compact deliveries if needed. The Conejos River System as a whole is experiencing more and more efficiencies for all its irrigators. This type of improvement is necessary to adapt to differing climatic conditions and ever increasing pressures on water uses.

MEASUREMENT & MONITORING

The other part of this project was to install 16 Parshall flumes with live measurement and telemetry. The system was designed to allow the water manager live access to the most critical areas in the system and provide the CWCD with critical data that will be necessary for future water management decisions.. With this system, the Romero's water manager can make a more accurate delivery of water to *every* shareholder. Now that there is an absolute measurement of the volumes, adjustments are made far sooner which avoids wasted time, wasted water, and disgruntled shareholders.

The second benefit is the data that is recorded for long term understanding of how the surface water moves in the entire Conejos area. With the added pressure on surface vs ground water, needed improvements of applications, and respecting compact obligations, correct, accurate, and recorded information is essential.

Collectively and cooperatively, all irrigators in this part of the San Luis Valley are beginning to work more closely together to save time, reduce transportation costs, and assist in the efficient management of return flows. The effect is to optimize beneficial water use and to support Colorado in meeting its obligations to the Rio Grande Compact.

Installation of the largest Flume required 2 trackhoes and a lot of coordination

In order for a Flume this size to work properly it is necessary to be *perfectly* level. The ground compaction, elevation, and backfill must be within +/- 1/16" over a 15 ft width and a 35 ft length!

The “mogote” flume was inserted and removed numerous times to ensure that the installation was perfect.

During the installation, precise coordination for the two trackhoe’s operation was absolutely necessary so as to not warp the flume.

The installation of the 16 flumes took a little longer than was originally anticipated on account of the unforeseen high water volumes experienced this irrigation season. The locations for each of the installations had to be dry and able to be compacted. This was difficult to achieve since the ditch manager was also obligated to deliver water in these same ditches! Robins’ Construction did an amazing job in working around these conditions.

As the different flumes experience varying flows at different times of the normal irrigation rotations, we can now see at a glance potential problem areas before they occur. The Telemetry system will call or text an alert to the water manager or other designated individual when conditions exceed pre-determined values. With the RMNE system managing around 80 miles of system there was just not enough time to do anything but constantly be driving and watching. With this new system, the amount of time now available for maintenance and repairs has increased dramatically. Because of better maintenance of structures, culverts, and bridges the operating costs have also decreased.

The following page shows the page which an individual can see when they log in to the RMNE site. The flumes are named on the left according to the closest land owner or well known geologic feature. This way everyone knows the location. Then on the fifth (5^{th}) column from the left the current flow at that site is listed in “cfs”. This is the number used to determine if the correct amount of water is in the correct location in the system for meeting water user’s needs.

Crawford 2.5-ft Parshall Flum Solar12V12W,12V20Ah,CTM1(IA),P,CMU0000226	normal	9/29/2015 9:02:57 AM	Crawford 2.5-ft Parshall Flume stage 0.15 feet	Crawford 2.5-ft Parshall Flume flow rate 0.52 CFS	Crawford 2.5-ft Parshall Flume RSSI -92 dBm	Crawford 2.5-ft Parshall Flume battery voltage 4.219 volts	
D.Mortesnson 6-ft Parshall Solar12V12W,12V20Ah,CTM1(IA),P,CMU0000226	normal	9/29/2015 9:02:57 AM	D.Mortesnson 6-ft Parshall gage height 0.81 feet	D.Mortesnson 6-ft Parshall flow rate 17.15 CFS	D.Mortesnson 6-ft Parshall RSSI -93 dBm	D.Mortesnson 6-ft Parshall battery voltage 4.132 volts	
Five Head Gates 10-ft Parshall Flume Solar12V12W,12V20Ah,CTM1(IA),P,CMU0000227	normal	9/29/2015 9:01:28 AM	Five Head Gates 10-ft Parshall Flume gage height 0.54 feet	Five Head Gates 10-ft Parshall Flume flow rate 14.78 CFS	Five Head Gates 10-ft Parshall Flume RSSI 0 dBm	Five Head Gates 10-ft Parshall Flume battery voltage 0 volts	
Five Head Gates Gateway Unit Solar12V12W,12V20Ah,CTM1(IA),P,CMU0000227	alarm	9/29/2015 9:01:34 AM			RSSI -53 dBm	solar-charged battery voltage 12.882 volts	5 2 c e g . F
Fred Cordova 6-ft Parshall Flum Solar12V12W,12V20Ah,CTM1(IA),P,CMU0000226	normal	9/29/2015 9:02:57 AM	Fred Cordova 6-ft Parshall Flum stage 0.32 feet	Fred Cordova 6-ft Parshall Flum flow rate 3.9 CFS	Fred Cordova 6-ft Parshall Flum RSSI -88 dBm	Fred Cordova 6-ft Parshall Flum battery voltage 4.13 volts	
Gilleland 12-ft Parshall Flume Solar12V12W,12V20Ah,CTM1(IA),P,CMU0000227	normal	9/29/2015 9:01:34 AM	Gilleland 12-ft Parshall Flume stage 0.604 feet	Gilleland 12-ft Parshall Flume flow rate 21.17 CFS	Gilleland 12-ft Parshall Flume RSSI -62 dBm	Gilleland 12-ft Parshall Flume battery voltage 4.139 volts	
H.Martinez 7-ft Parshall Flume Solar12V12W,12V20Ah,CTM1(IA),P,CMU0000227	normal	9/29/2015 9:01:34 AM	H.Martinez 7-ft Parshall Flume stage 0 feet	H.Martinez 7-ft Parshall Flume flow rate 0 CFS	H.Martinez 7-ft Parshall Flume RSSI -80 dBm	H.Martinez 7-ft Parshall Flume battery voltage 4.071 volts	
Hawkings 7-ft Parshall Flume Solar12V12W,12V20Ah,CTM1(IA),P,CMU0000226	normal	9/29/2015 9:02:52 AM	Hawkings 7-ft Parshall Flume gage height 0 feet	Hawkings 7-ft Parshall Flume flow rate 0 CFS			
Hawkings Gateway Unit Solar12V12W,12V20Ah,CTM1(IA),P,CMU0000226	warning	9/29/2015 9:02:57 AM			RSSI -53 dBm	solar-charged battery voltage 12.863 volts	5 2 c e g . F
Overflow 10-ft Parshall Flume Solar12V12W,12V20Ah,CTM1(IA),P,CMU0000227	normal	9/29/2015 9:01:34 AM	Overflow 10-ft Parshall Flume stage 0 feet	Overflow 10-ft Parshall Flume flow rate 0 CFS	Overflow 10-ft Parshall Flume RSSI -87 dBm	Overflow 10-ft Parshall Flume battery voltage 4.091 volts	
R. Romero 4-ft Parshall Flume Solar12V12W,12V20Ah,CTM1(IA),P,CMU0000226	nocomm	9/28/2015 10:56:06 PM	R. Romero 4-ft Parshall Flume gage height 0.058 feet	R. Romero 4-ft Parshall Flume flow rate 0.18 CFS	R. Romero 4-ft Parshall Flume RSSI -97 dBm	R. Romero 4-ft Parshall Flume battery voltage 4.137 volts	
Rubago 7-ft Parshall Flume Solar12V12W,12V20Ah,CTM1(IA),P,CMU0000227	normal	9/29/2015 9:01:34 AM	Rubago 7-ft Parshall Flume gage height 0 feet	Rubago 7-ft Parshall Flume flow rate 0 CFS	Rubago 7-ft Parshall Flume RSSI -92 dBm	Rubago 7-ft Parshall Flume battery voltage 4.101 volts	
Rudy Villapando 7-ft Parshall Flume Solar12V12W,12V20Ah,CTM1(IA),P,CMU0000227	normal	9/29/2015 9:01:34 AM	Rudy Villapando 7-ft Parshall Flume gage height 1.04 feet	Rudy Villapando 7-ft Parshall Flume flow rate 29.81 CFS	Rudy Villapando 7-ft Parshall Flume RSSI -85 dBm	Rudy Villapando 7-ft Parshall Flume battery voltage 4.117 volts	
Sky View Node 83 Flume Solar12V12W,12V20Ah,CTM1(IA),P,CMU0000226	normal	9/29/2015 9:02:57 AM	Sky View 12-ft Parshall Flume gage height	Sky View 12-ft Parshall Flume flow rate	Skyview 12-ft Parshall Flume RSSI	Skyview 12-ft Parshall Flume battery voltage	

Although the RMNE system does not always directly participate in meeting Colorado's obligations to the Rio Grande Compact, this project provides the infrastructure and technology (weirs and telemetry) to greatly improve water management efficiencies for up to 25% of the flows on the Conejos. This directly and positively assists the District's and the Division's administration of compact-entitled waters and promotes maximum beneficial use of state waters.

Because of the area the RMNE covers, this project is an essential component in the determination of surface water impacts. Without the ability to measure there is not the ability to manage. The data collected and logged is not only available to the RMNE staff and board, but also to the Conejos Water Conservancy District. The District can then use the information for better determination of return flow timing, locations, and amounts. This information will be absolutely essential for determining Annual Replacement Plan particulars and all other requirements that will be associated with the coming Sub-Districts.

The willingness of the Colorado Water Conservation Board to participate and be the leading cooperator for funding projects like this is immeasurable. With this ability to proceed in better management of water resources Colorado's water future is made more secure.

Thank you, to all of the CWCB staff and Board of Directors for this opportunity.

Sincerely,

Nathan Coombs, Manager CWCD
&
Grace Bagwell, Secretary RMNE