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To: Peter Ampe – Hill & Robbins, P.C – Counsel for the Republican River Water Conservation District

From: James E. Slattery
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Date: August 31, 2016

Subject: September 2016 Projected Delivery for the Colorado Compact Compliance Pipeline

The “Resolution by the Republican River Compact Administration Approving a Temporary Augmentation Plan and Related Accounting Procedures for the Colorado Compact Compliance Pipeline” was approved October 22, 2014 and remains in effect for calendar year 2016. The delivery schedule for the Compact Compliance Pipeline (CCP) is described in that resolution and supporting attachments. Colorado is now delivering water in compliance with the schedule set forth in the resolution.

The projected CCP delivery requirement to meet Colorado’s obligation under the Compact in 2016 is approximately 10,000 ac-ft. The current delivery capacity of the CCP pipeline project is in the range of 31 to 32 cfs. The following table summarizes the estimated delivery schedule:

Time Period	Amount of CCP Delivery (ac-ft)
January – March	5,030
October-December	4,970
Total	10,000

The Republican River Water Conservation District should start the winter deliveries on October 10 and continue to make deliveries through December 31. The deliveries should then continue from January 1, 2017 until at least the end of February. The turnoff date in the spring of 2017 will be finalized in the January 10, 2017 projections. Unless there are unforeseen operational problems, the deliveries should be continuous through this period to avoid icing problems in the North Fork. The estimated delivery for 2016 is a target delivery that can be exceeded by several 100 ac-ft if necessary to maintain a constant flow during the delivery period.

The attached Table 1 and Table 2 summarize the calculations used to derive the delivery amount. As shown in Column 38 of Table 1, Colorado is projected to be in compact compliance by a total of approximately 200 ac-ft for the three-year period of 2014-2016. Colorado started making CCP deliveries in 2014.

Data Utilized to Determine Delivery Amount

The footnotes of the attached Table 2 summarize the source of the Colorado surface water data utilized in the projection.

The RRCA Groundwater Model was run to obtain an estimate of the Groundwater CBCU. For all States' groundwater pumping, the 2015 data was repeated for 2016. Precipitation for the groundwater model run was estimated as the long term average monthly data at each station when historical data was not available. Reservoir stages and potential evapotranspiration values were estimated to be the same as the 2015 values.

The model was run using the "Dry Bonny" approach, which restores the South Fork Model cells to the condition before Bonny Reservoir was built to reflect the current state of no impoundment of water behind Bonny Dam. The projections were made assuming water short year administration on Harlan County Reservoir, which results in Colorado's Beaver Creek allocation being zero. The 5-run model approach was utilized in these projections.

Table 1 (page 1 of 3)
Operation of the Colorado Compact Compliance Pipeline
(units of ac-ft)

Jan - Dec Calendar Year	North Fork Basin Accounting									Arikaree Basin Accounting					
	Consumptive Use									Consumptive Use					
	North Fork Gaged Flow	CCP Deliveries	Net North Fork Gaged Flows for Virgin Flow Calculations	0.40 x Haigler Canal Divs Measured at Stateline	CO SW and Small Res Evap	CO GW Con Use	KS GW Con Use	NE GW and SW Con Use	Virgin Flow	Gaged Flow	CO SW	CO GW	KS GW and Non- Fed Res Evap	NE GW	Virgin Flow
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
2000	19,430	0	19,430	2,338	3,595	13,173	15	4,663	43,215	3,629	0	1,918	169	196	5,912
2001	19,748	0	19,748	1,971	3,320	13,537	18	4,221	42,815	552	0	1,324	231	317	2,424
2002	15,903	0	15,903	1,946	4,497	13,560	14	4,271	40,190	231	0	398	155	242	1,026
2003	17,700	0	17,700	1,986	2,615	14,023	17	4,381	40,722	1,060	0	242	100	507	1,909
2004	19,759	0	19,759	1,493	3,022	14,373	16	3,685	42,348	341	0	353	157	431	1,282
2005	21,060	0	21,060	1,898	3,171	14,359	17	4,290	44,795	1,151	0	811	163	250	2,375
2006	17,608	0	17,608	1,767	3,140	14,301	12	4,017	40,844	404	0	1,116	130	125	1,775
2007	20,566	0	20,566	1,809	3,015	14,762	0	4,135	44,287	1,331	0	1,143	117	112	2,703
2008	21,636	0	21,636	1,998	671	14,959	0	4,468	43,732	1,568	0	1,419	106	127	3,220
2009	24,408	0	24,408	1,677	267	15,741	0	3,468	45,561	779	0	3,672	162	153	4,767
2010	20,418	0	20,418	2,016	325	15,479	0	3,999	42,238	2,358	0	1,446	109	73	3,986
2011	19,722	0	19,722	1,930	354	15,689	0	3,899	41,594	1,074	0	1,830	170	93	3,167
2012	14,376	0	14,376	2,452	583	15,309	0	4,698	37,418	494	0	1,558	116	78	2,246
2013	18,433	0	18,433	1,536	377	15,649	0	3,362	39,357	66	0	458	214	126	864
2014	26,707	7,448	19,259	1,245	285	16,283	0	2,964	40,037	0	0	1,137	236	128	1,501
2015	27,913	10,760	17,153	1,451	511	16,424	0	3,299	38,838	142	0	2,823	189	107	3,261
2016	28,321	10,000	18,321	1,589	511	17,268	0	3,540	41,229	356	0	3,091	203	122	3,772
2017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 1 (page 2 of 3)
Operation of the Colorado Compact Compliance Pipeline
(units of ac-ft)

South Fork Basin Accounting								CO Compact Allocation				
Consumptive Use								22.37%	78.53%	44.41%		All Basins
Jan - Dec Calendar Year	Gaged Flow at Benkelman	CO SW + CO Small Res Evap	CO GW + Bonny Res Seepage	CO Bonny Res Evap	KS GW, Non-Fed Res Evap, SW CU	NE GW	Virgin Flow	North Fork	Arikaree	South Fork	Colorado Allocation of Beaver Creek (zero for any Water Short Year)	Total of All Basins
(1)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)
2000	4,857	3,031	10,450	5,945	6,623	982	31,889	9,668	4,643	14,160	1,940	30,411
2001	3,100	1,522	10,904	4,673	7,753	529	28,481	9,578	1,904	12,647	1,500	25,629
2002	1,578	1,295	11,044	4,673	5,195	1,149	24,934	8,991	806	11,072	770	21,639
2003	905	598	12,115	3,375	5,380	1,347	23,720	9,110	1,499	10,533	0	21,142
2004	0	770	12,874	3,158	6,084	1,202	24,088	9,474	1,007	10,696	0	21,177
2005	0	275	14,952	3,430	7,522	1,372	27,550	10,021	1,865	12,234	0	24,120
2006	0	518	11,757	3,031	4,723	1,040	21,069	9,137	1,394	9,356	0	19,887
2007	674	266	12,511	2,715	5,670	1,055	22,891	9,908	2,123	10,165	0	22,195
2008	1,424	52	12,895	1,980	5,933	1,030	23,314	9,783	2,529	10,353	2,840	25,505
2009	8,487	100	15,921	1,117	7,856	1,302	34,782	10,193	3,743	15,445	3,160	32,541
2010	12,756	919	11,938	1,921	3,006	625	31,164	9,449	3,130	13,839	2,890	29,308
2011	9,916	177	13,092	1,965	6,153	941	32,245	9,305	2,487	14,319	2,580	28,690
2012	6,441	107	5,794	67	2,550	810	15,769	8,371	1,764	7,002	1,860	18,997
2013	0	45	2,108	0	2,002	471	4,626	8,805	679	2,054	0	11,538
2014	0	148	5,574	0	3,852	515	10,089	8,957	1,179	4,480	0	14,616
2015	4,820	421	10,821	0	6,905	604	23,571	8,689	2,561	10,467	0	21,716
2016	4,820	421	11,092	0	7,185	1,075	24,593	9,223	2,962	10,920	0	23,106
2017	0	0	0	0	0	0	0	0	0	0	0	0
2018	0	0	0	0	0	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0	0	0	0	0

Table 1 (page 3 of 3)
Operation of the Colorado Compact Compliance Pipeline
(units of ac-ft)

	CO Consumptive Use							Colorado Compact Compliance Accounting			
	Instate			GW Con Use in Nebraska							
Jan - Dec Calendar Year	North Fork	Arikaree	South Fork	Buffalo and Rock Creek	French- man Creek	Rep River Mainstem	Total Colorado Con Use	Annual Amount Colorado Exceeded Compact Entitlement BEFORE CCP Delivery	Annual Amount Colorado Exceeded Compact Entitlement after Accounting for CCP Deliveries	5-year Running Average of the Amount Colorado Exceeded Compact Entitlement after Accounting for CCP Delivery	
(1)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)
2000	16,768	1,918	19,426	276	599	-4,242	34,745	4,334	0	4,334	
2001	16,857	1,324	17,099	293	569	-2,779	33,363	7,734	0	7,734	
2002	18,057	398	17,012	294	620	-5,482	30,899	9,260	0	9,260	
2003	16,638	242	16,088	324	37	132	33,460	12,318	0	12,318	
2004	17,395	353	16,802	348	39	-1,269	33,669	12,491	0	12,491	9,228
2005	17,530	811	18,656	367	42	-1,954	35,452	11,332	0	11,332	10,627
2006	17,441	1,116	15,306	383	43	-3,009	31,280	11,393	0	11,393	11,359
2007	17,777	1,143	15,492	406	55	-2,033	32,839	10,644	0	10,644	11,636
2008	15,630	1,419	14,927	429	345	-2,185	30,565	5,060	0	5,060	10,184
2009	16,008	3,672	17,138	450	2,839	-1,650	38,456	5,915	0	5,915	8,869
2010	15,804	1,446	14,777	472	3,030	-2,699	32,831	3,522	0	3,522	7,307
2011	16,043	1,830	15,234	492	2,554	-2,306	33,847	5,157	0	5,157	6,060
2012	15,892	1,558	5,968	513	1,485	-6,712	18,704	-293	0	-293	3,872
2013	16,026	458	2,153	531	1,125	-1,929	18,364	6,826	0	6,826	4,226
2014	16,568	1,137	5,722	553	951	-863	24,069	9,453	7,448	2,005	3,443
2015	16,935	2,823	11,242	582	1,688	-2,277	30,992	9,276	10,760	-1,484	2,442
2016	17,779	3,091	11,513	608	1,855	-2,439	32,406	9,300	10,000	-700	1,271
2017	0	0	0	0	0	0	0	0	0	0	1,330
2018	0	0	0	0	0	0	0	0	0	0	-36
2019	0	0	0	0	0	0	0	0	0	0	-437
2020	0	0	0	0	0	0	0	0	0	0	-140
2021	0	0	0	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0	0	0	0

Table 2
Surface Water Data Used in Accounting
(units of acre-feet)

Calendar Year	Streamflow Gages					Colorado Surface Water Diversions			Reservoir Evaporation					Beaver Creek	
	North Fork at CO-KS Stateline Gage	Measured Compact Compliance Pipeline Delivery	Haigler Canal Stateline Flume	Arikaree at Haigler, NE Gage	South Fork at Benkelman Gage	Total North Fork Divs including CO Pioneer	Colorado Arikaree Divs	Colorado South Fork Divs	Colorado Non-Fed Res Evap in North Fork	Colorado Non-Fed Res Evap in South Fork	Kansas Non-Fed Res Evap in Arikaree	Kansas Non-Fed Res Evap and Small SW Div Con Use in South Fork	Bonny Res Evap	Colorado Compact Entitlement in non-water short years	Water Short Year (Yes/No) CO receives no Beaver Creek Allocation in Water Short Year
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
2000	19,430	0	5,846	3,629	4,857	5,915	0	5,052	46	0	41	303	5,945	1,940	No
2001	19,748	0	4,927	552	3,100	5,457	0	2,536	46	0	41	303	4,673	1,500	No
2002	15,903	0	4,865	231	1,578	7,418	0	2,158	46	0	41	303	4,673	770	No
2003	17,700	0	4,965	1,060	905	4,358	0	996	0	0	0	29	3,375	260	Yes
2004	19,759	0	3,732	341	0	4,961	0	1,283	46	0	41	303	3,158	360	Yes
2005	21,060	0	4,745	1,151	0	5,213	0	458	43	0	41	295	3,430	910	Yes
2006	17,608	0	4,418	404	0	5,150	0	864	50	0	46	325	3,031	1,420	Yes
2007	20,566	0	4,522	1,331	674	4,961	0	443	38	0	18	143	2,715	2,320	Yes
2008	21,636	0	4,995	1,568	1,424	1,055	0	87	38	0	14	121	1,980	2,840	No
2009	24,408	0	4,193	779	8,487	398	0	166	28	0	7	65	1,117	3,160	No
2010	20,418	0	5,041	2,358	12,756	474	0	1,336	41	117	11	98	1,921	2,890	No
2011	19,722	0	4,826	1,074	9,916	530	0	39	36	154	14	119	1,965	2,580	No
2012	14,376	0	6,129	494	6,441	886	0	0	51	107	24	213	67	1,860	No
2013	18,433	0	3,839	66	0	553	0	0	45	45	17	147	0	1,130	Yes
2014	26,707	7,448	3,113	0	0	412	0	184	38	38	11	100	0	1,250	Yes
2015	27,913	10,760	3,627	142	4,820	788	0	616	38	51	11	100	0	2,080	Yes
2016	28,321	10,000	3,973	356	4,820	788	0	616	38	51	11	100	0	2,080	Yes

green shaded values estimated as described below

USGS gaged records and RRCA Accounting records used when available.

Description of estimated data.

- (1) January-December Calendar Year
- (2) Used available provisional data Jan-Aug and estimated values Sept-Dec.
- (3) 2016 estimated.
- (4) Used available provisional data Jan-Aug and estimated values Sept-Dec.
- (5) Used available provisional data Jan-Aug and estimated values Sept-Dec.
- (6) Used available provisional data Jan-Aug and estimated values Sept-Dec.
- (7) Estimated to be same as 2015
- (8) Estimated to be same as 2015
- (9) Estimated to be same as 2015
- (10) Used available provisional data Jan-Aug and estimated values Sept-Dec.
- (11) Used available provisional data Jan-Aug and estimated values Sept-Dec.
- (12) Used available provisional data Jan-Aug and estimated values Sept-Dec.
- (13) Used available provisional data Jan-Aug and estimated values Sept-Dec.
- (14) Used available provisional data Jan-Aug and estimated values Sept-Dec.
- (15) Used available provisional data Jan-Aug and estimated values Sept-Dec.
- (16) From BOR annual letters concerning water short years.