



Monthly Report – Cycle 35

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Background and Objectives

Water availability and water supply in the Rio Grande basin depend on numerous factors related to climate conditions, storage in reservoirs and aquifers, stochastic characteristics of rainfall, water allocation policies, and other climatic variables.

As a result, it is essential to determine the current conditions and estimate the most probable future conditions of water availability to define strategies to meet water demands in the basin in order to mitigate the risk of not complying with the commitments of the international agreement (See Appendix A, Article 4 of the 1944 Water Treaty).

The main objective this study is to present the current conditions of the allocation of water to the United States (US) for the fulfilling the agreements established in the 1944 Treaty, including probable future scenarios if no management actions are taken and also if some management actions are taken in order to fulfill international commitments.

This document presents three scenarios for allocating water to the US:

- Current Situation - The allocation of water to the US on the date of this monthly report.
- Probable Future:
 - Without any management action: This scenario depends exclusively on weather conditions with predictions based on the current conditions of the basin and the historical behavior of the streamflow from 1953 to 2019.
 - With management action(s): This scenario considers transfers from some Mexican rivers, reservoirs, and international dams.

In both scenarios, the probable allocation of water to the US in a medium-term (October 25, 2020 as the probable date of the end of the Cycle 35) is estimated. Finally, given the possible occurrence of an extraordinary phenomenon during hurricane seasons, statistical analyses of hurricanes and their influence on the Río Grande/Bravo basin are presented along with their as well as their impact on meeting demand [\[in progress\]](#).



Water allocation scenarios in the Rio Bravo designated to the United States

First scenario - Current situation: Allocation of water to the US up to the date of this report

Figure 1 shows the current conditions of the accumulated volume of the Rio Grande/Bravo water in thousands of acre-feet (TAF) designated to the US from one-third of the total volume of the six Mexican tributary rivers (Conchos, San Diego, San Rodrigo, Escondido, Salado, and Arroyo Las Vacas) until **July 31, 2020**, as stipulated in the 1944 Treaty.

As of the date of this report, **1,239 TAF has been delivered** of **1,669 TAF that is committed to this date**, which represents a **deficit of 430 TAF**.

Comparing the cumulative volume delivered up to the date of this report with the commitment established for the possible end of the cycle on October 25, 2020 (1,750 TAF), the current deliveries have a difference below the amount of **511 TAF**.

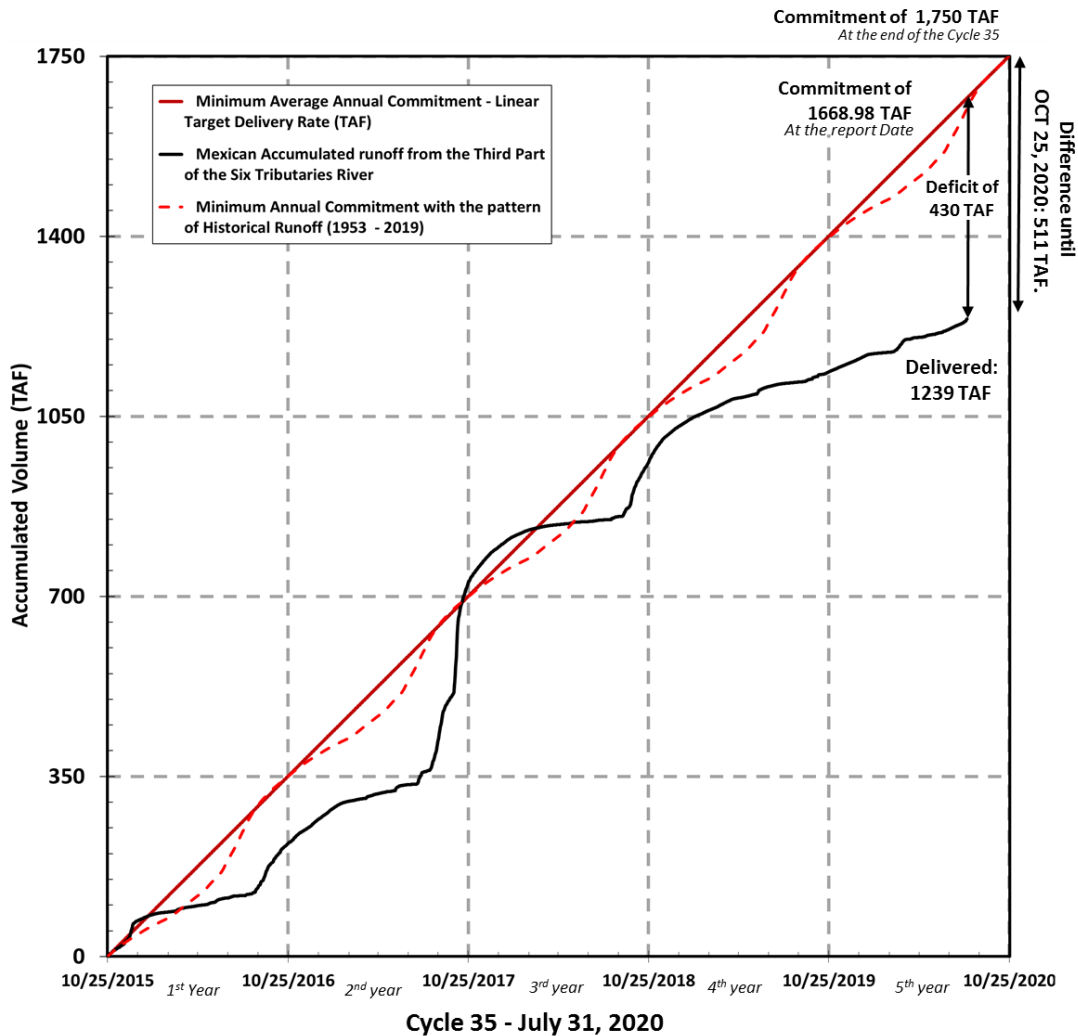


Figure 1. Accumulated volume assigned to the United States for Cycle 35 (from Oct. 25, 2015 to July 31, 2020) from the six Mexican tributary rivers in accordance with the Treaty of 1944.



Second scenario – Probable future: Without any management action

a) Medium term - Until October 25, 2020 (probable end of the cycle 35)

The procedure used to estimate runoff at the possible end date of cycle 35 (October 25, 2020) without any management action is as follows:

- The accumulated runoff for the previous year was calculated from October 26, 2018 to October 25, 2019, with a total volume of 497 TAF.
- The values of all the previous years from 1953 to 2019 were obtained to determine the years with equal to or less than 503 TAF (similar to 497 TAF) leading to 11 years with similar cumulative runoff: 1956, 1983, 1984, 1994, 1995, 1996, 1997, 1998, 2000, 2001, 2002 and 2012.
- Using the immediate next years of the series from the previous step (for example, for the year 1956 we use the upcoming year, 1957), we were able to determine the probable volume accumulated for the following year (from October 26, 2019, to October 25, 2020).

Figure 3 shows the result of the described analysis. The table in the figure shows the different probabilities (P (x)) associated with the volume delivered, showing that the higher the volume, the lower the probability that the water (or the required amount) will be delivered.

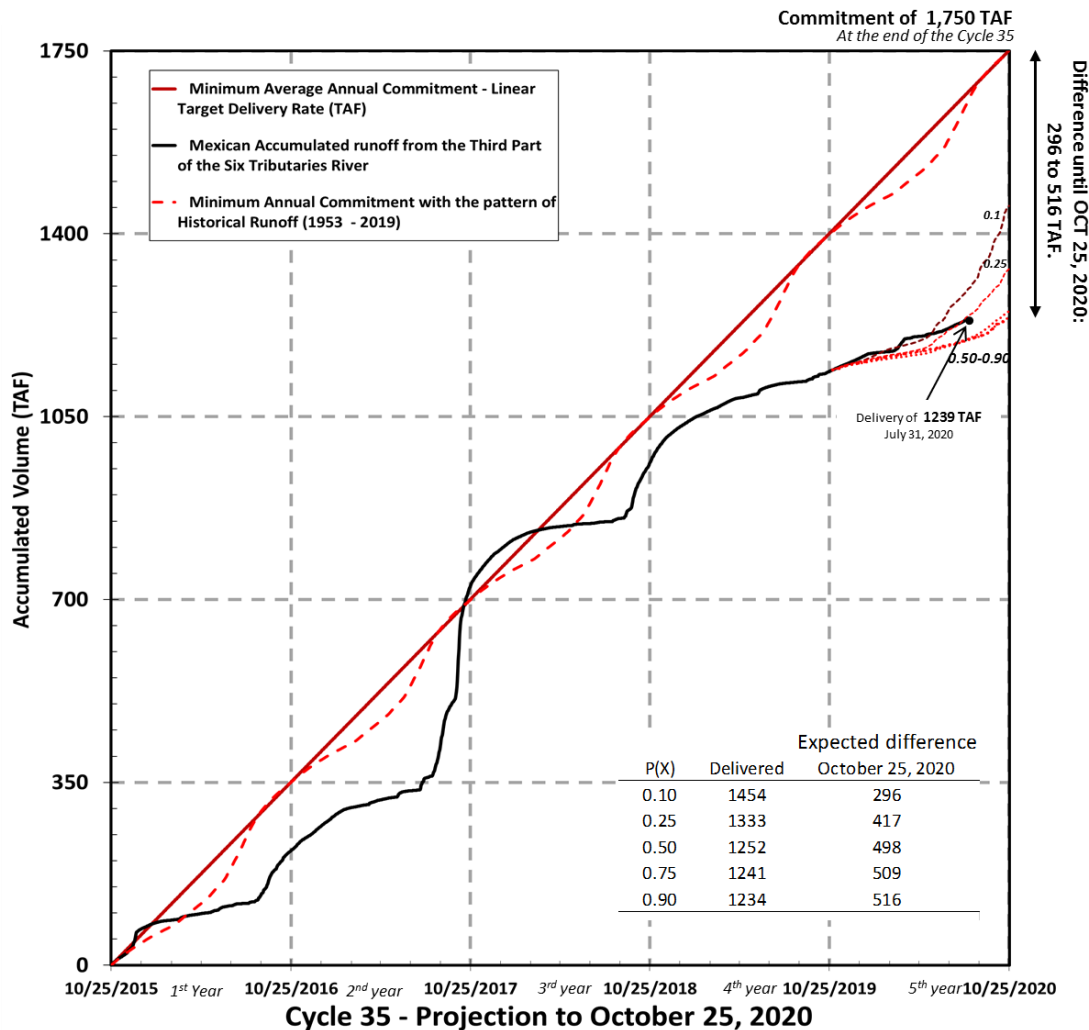


Figure 2. Estimated accumulated volume likely until October 25, 2020, to predict possible difference with treaty commitments at the end of cycle 35.



Third Scenario – Probable Future: Considering management action(s)

a) Water resources model: End of the cycle 35 with and without management action(s)

This section presents the water transfer and sharing from the six Mexican tributaries and reservoirs (stipulated in the Treaty) as shown in the schematic. Here, we present different strategies that vary from operating the system as business as usual (no water transfers to meet treaty commitments) to different levels of water transfers from reservoirs. The strategies are evaluated based on their hydrologic feasibility and do not represent any recommended action, here we only explore different scenarios.

This water resources model is based on a mass balance principle (Figure 3) that consider the initial storage for each reservoir on June 25th 2020 (beginning of the wet season) and evaluate different scenarios considering the following variables: (1) annual water demands for the districts, (2) hydrologic conditions (wet, semi-wet, moderate, dry and extremely dry), and (3) no water transfers or a certain amount of water transfers from reservoirs to the treaty.

There are three main results estimated in this analysis:

- Treaty deliveries from the six Mexican tributaries and the subsequent water deficit or surplus in meeting the treaty obligations (see Table 1); and
- End of cycle storage for each reservoir considering no water transfers or a given water transfer (Table 2). Results with blank spaces represent scenarios where the reservoir is empty.

This model, even with its simplicity, creates an excellent opportunity to explore different scenarios. Appendix B shows the discharges of water from October 25, 2019 up to date of this report. The discharges from the Rio Conchos could have been modified in a way to benefit the sediment transportation by changing the magnitude and timing of the release.

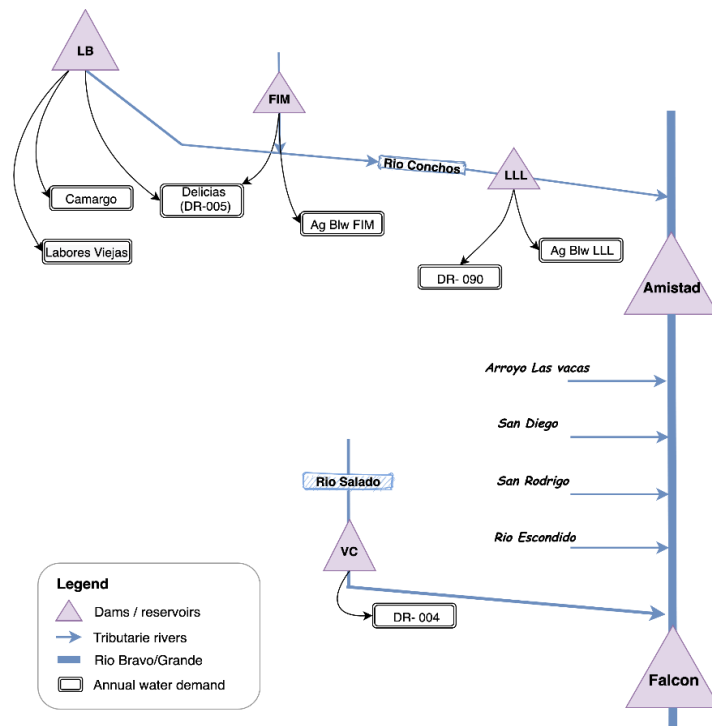


Figure 3. Water resources model schematic



	Maximum Deficit					Minimum Deficit				
	1	2	3	4	5	1	2	3	4	5
0	-127	-366	-450	-556	-601	-127	-366	-450	-556	-601
100	-98	-309	-421	-527	-572	-105	-344	-428	-534	-579
200	-9.9	-249	-333	-439	-484	-83	-322	-406	-512	-557
300	137	-102	-186	-293	-337	-61	-300	-384	-490	-535
500	606	367	283	177	132	-17	-256	-340	-446	-491
700	1310	1071	987	881	836	27.7	-211	-295	-402	-446
900	2249	2010	1926	1819	1276	72	-167	-251	-357	-402
1000	2806	2567	2483	2377	2332	94.1	-145	-229	-335	-380

Table 1. Water surplus or deficit to meet treaty obligations

		Initial Storage																			
		Venustiano Carranza					La Boquilla					Francisco I. Madero					Luis L. Leon				
		255.441					1290.741					242.696					144.017				
		*Hydrologic Condition																			
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Treaty Transfers (MCM)	0	894	529	385	286	237.6	2407	1991	1411	1251	1089	894	529	385	286	238	263	114	153	195	191
	100	794	429	285	186	137.6	2307	1891	1311	1151	989	794	429	285	186	138	163	14	53	95	91
	200	694	329	185	86	37.6	2207	1791	1211	1051	889	694	329	185	86	38	63				
	300	594	229	84.6			2107	1691	1111	950.9	789	594	229	85							
	500	394	28.99				1907	1491	910.9	750.9	589	394	29								
	700	194					1707	1291	710.9	550.9	389	194									
	900						1507	1091	510.9	350.9	189										
1000						1407	991.4	410.9	250.9	88.9											

• 1 - Wet, 2 - Semi-wet, 3 - Moderate, 4 - Dry, 5 - Extreme Dry
 • Results in this table are the Storage at the end of Cycle 35, October 24th, 2020.

Table 2. End of cycle storage for each reservoir considering (a) no water transfer or a given amount of water transfers, and (b) hydrologic condition (1 – wet, 2 – semi-wet, 3 – moderate, 4 – Dry, 5 – very dry)

Figure 4. Different scenarios based on the possible conditions and transfers from the reservoirs



Appendix A - Water distribution between Mexico and the United States in the Rio Grande

Article 4 of the 1944 Water Treaty (Treaty) establishes the distribution of Rio Bravo water between Mexico and the United States (EU) as follows:

For Mexico (MX):

- 100% from San Juan and Álamo rivers
- **Two-thirds of the six Mexican rivers: Conchos, San Diego, San Rodrigo, Escondido, Salado, and Arroyo Las Vacas**
- Half of any other runoff including ungraded rivers (not specified in the treaty)

For the United States (US):

- 100% Pecos, Devils rivers and Alamito, Terlingua, San Felipe, and Pinto streams.
- **One-third of the six Mexican rivers. This third must not be less than 350 Thousand Acre-Feet on an annual average, during cycles of 5 consecutive years.**
- Half of any other runoff and ungraded rivers

Treaty Cycles:

The cycles last **five years**. However, the cycles will be considered completed (**it may last less than five years**) if the useful capacity assigned to the US of both international dams (Amistad and Falcón) is filled with water assigned to the US.

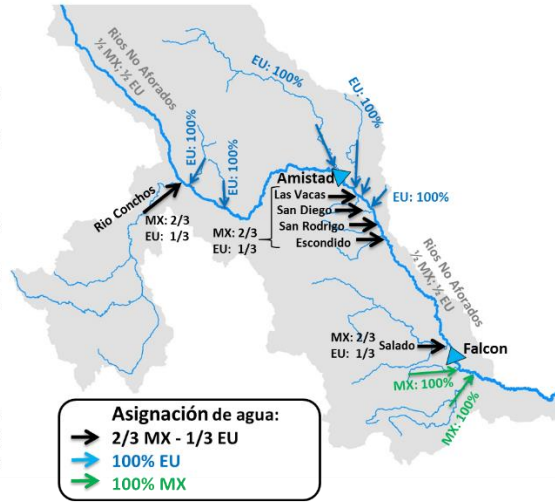


Figure A.1 – Global description of water distribution within the US and Mexico according to the 1944 Treaty.

The accumulated volume of the one-third of water assigned to the US from the six Mexican rivers is accounted for in cycles of the treaty. The treaty cycles last five years. However, the cycle will be considered concluded (it may last less than five years) if the useful capacity of water assigned to the US of both of the international dams (Amistad and Falcón) is filled with water assigned to the US from México. When this occurs, all debts will be considered entirely paid, beginning from this moment a new cycle.

Appendix B - Water releases from October 25, 2019.

