INTERNATIONAL BOUNDARY AND WATER COMMISSION

COMISIÓN INTERNACIONAL DE LÍMITES Y AGUAS

# IMPROVING BINATIONAL WATER MANAGEMENT POLICY THROUGH SCIENCE

Presented by

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- North American Southwest
  - Water is vital but disappearing resource

- Increasing population and irrigation demands
  - Along international border of the Rio Grande between the U.S. and Mexico
  - Puts strain on already sparse resource

- Water management officials along U.S. / Mexican border
  - Using binational water management policies over 100 years old

- To more efficiently manage water use in this region
  - New approaches using science & technology are needed
  - To better allocate Rio Grande water to meet needs of both countries

- International Boundary & Water Commission
  - U.S. Section
  - Mexican Section
- Provides binational solutions to issues related to treaties
  - Boundary demarcation
  - Ownership of water
  - Sanitation
  - Water quality
  - Flood control

# INTERNATIONAL BOUNDARY

## COMISIÓN INTERNACIONA

- Water along border is shared in accordance with
  - *U.S. – Mexico 1944 Water Treaty for the Utilization of Water of the Colorado and Tijuana Rivers and of the Rio Grande (Treaty series 994, 1946)*


TREATY SERIES 994

UTILIZATION OF WATERS

OF THE COLORADO AND TIJUANA RIVERS

AND OF THE RIO GRANDE

+

TREATY

BETWEEN THE UNITED STATES OF AMERICA

AND MEXICO

Signed at Washington February 3. 1944.

AND

PROTOCOL

Signed at Washington November 14,1944.

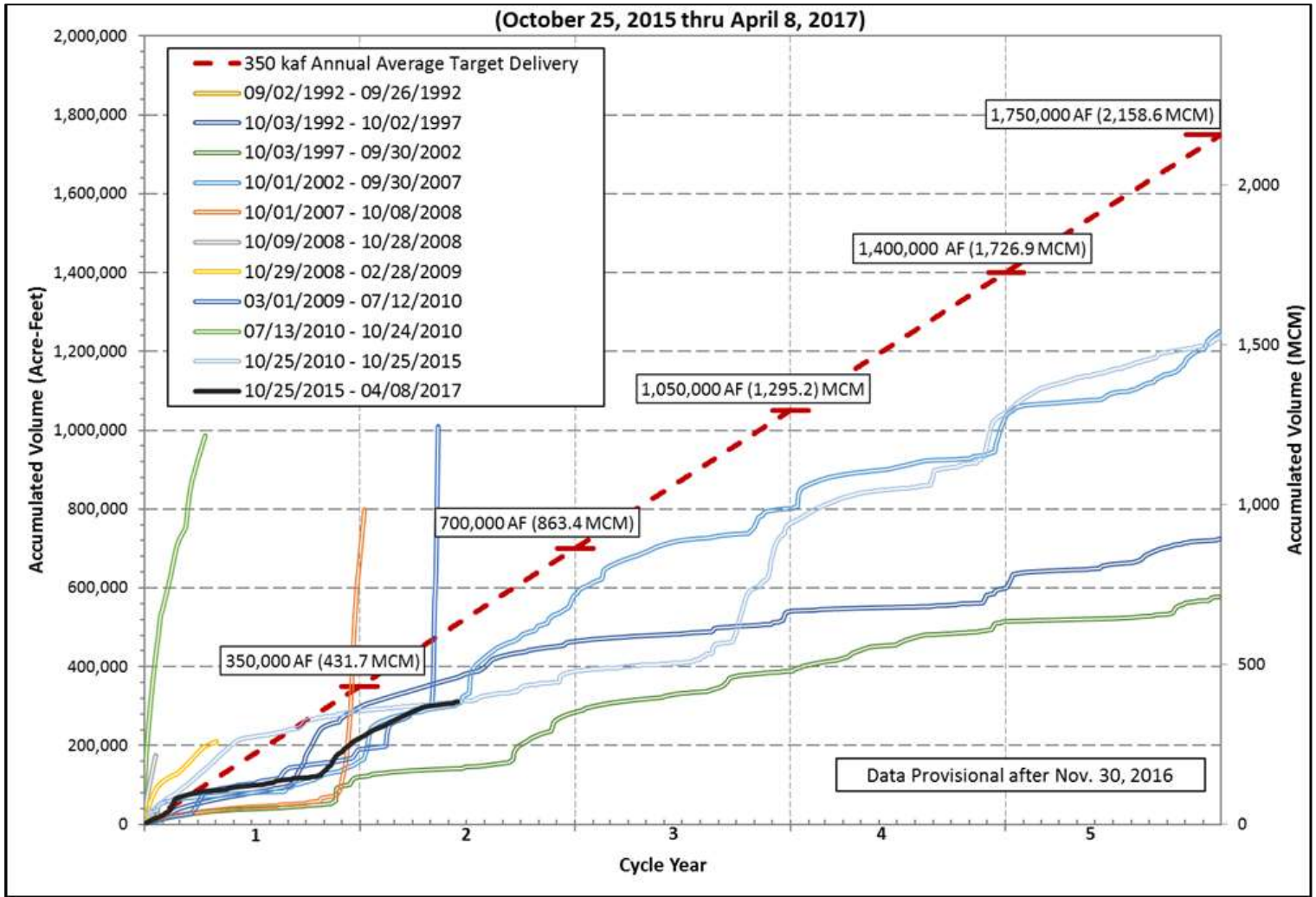
Ratification advised by the Senate of the United States of America April 18, 1945, subject to certain understandings.
Ratified by The President of the United States of America November 1, 1945, subject to said understandings.
Ratified by Mexico October 16, 1945.
Ratifications exchanged at Washington November 8, 1945.
Proclaimed by the President of the United States of America November 27 , 1945, subject to said understandings.
Effective November 8. 1945.

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1946

# ➢Treaty Summary: Article 4



- Since 1992
  - Four five-year cycles have ended in deficit



- By not meeting the obligation, various measures have been taken to satisfy the deficit
- Recognizing these measures and present hydrologic conditions
  - More proactive options and measures are being analyzed
    - To meet treaty obligations
    - To ensure U.S. receives all water allotted to it in timely and predictable manner

- U.S. Section of IBWC developed a RiverWare model based on treaty requirements
  - Explore new and innovative delivery options
  - That maintain spirit of the treaty
  - While ensuring compliance and availability of water to upstream users

# Model Components

- Named Tributaries
- Dams on Tribs
  - Francisco I Madero
  - La Boquilla
  - Luis L Leon
  - Centenario
  - San Miguel
  - La Fragua
  - Venustiano Carranza
  - Las Blancas
  - El Cuchillo
  - Marte R Gomez
- International Reservoirs
- Tributaries below Falcon

# Model Methodology

- Monthly RiverWare model
- Evaluate alternate sources of water to meet delivery requirements
- Consider effects on Mexican reservoir system and International reservoirs
- Mexico and U.S. must agree on deliveries other than 1/3 of Named-Tributaries

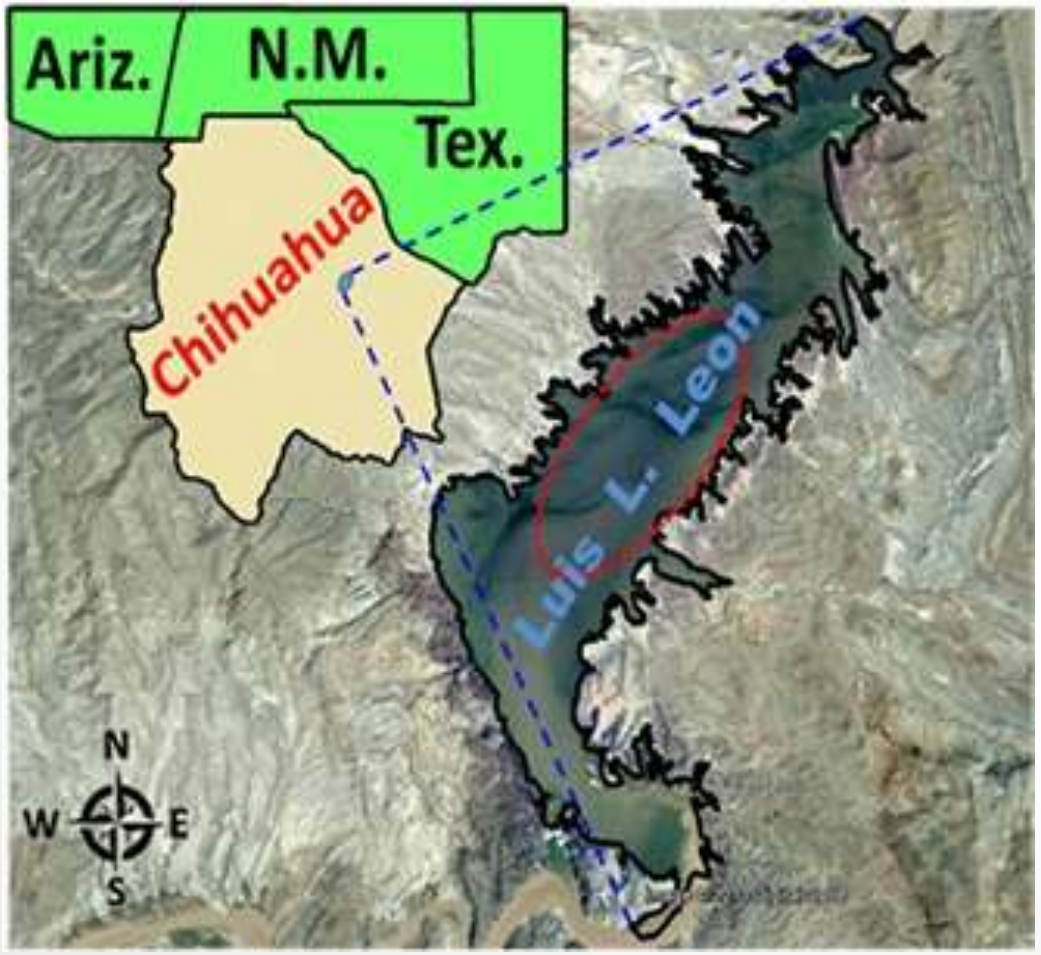
# Case Study

- A variety of scenarios were simulated with the RiverWare model
  - On historic five-year cycles that ended in deficit
  - To consider the effects of adjustments on
    - Delivery volume
    - Storage in Mexican and International reservoirs

- One of the case studies is presented as an example
  - Two five-year cycles
    - 2010-2015
    - 2015-2020
    - Study done near the end of the 2010-2015 cycle which was ending in deficit
  - Shows the adjustment settings
  - And the results

# Delivery Adjustment Types

- Additional water from Mexican reservoirs
  - Deliver a specified volume to U.S. when
    - below target delivery and
    - conservation level is above a specified percent



# Delivery Adjustment Types

- Increase U.S. share of Six Named-Tributaries
  - Mexico normally delivers 1/3 of flow
  - Deliver a greater share to the U.S.

# Delivery Adjustment Types

- Water from Rio Alamo and Rio San Juan
  - Typically Mexico receives 100% of this water
  - Provide some % of this flow when reservoirs are above their conservation level

# Delivery Adjustment Types

- Increase U.S. share of Unmeasured Tributary Flow
  - Normally split 50/50
  - Mexico could give some of it's share to U.S.

# Delivery Adjustment Types

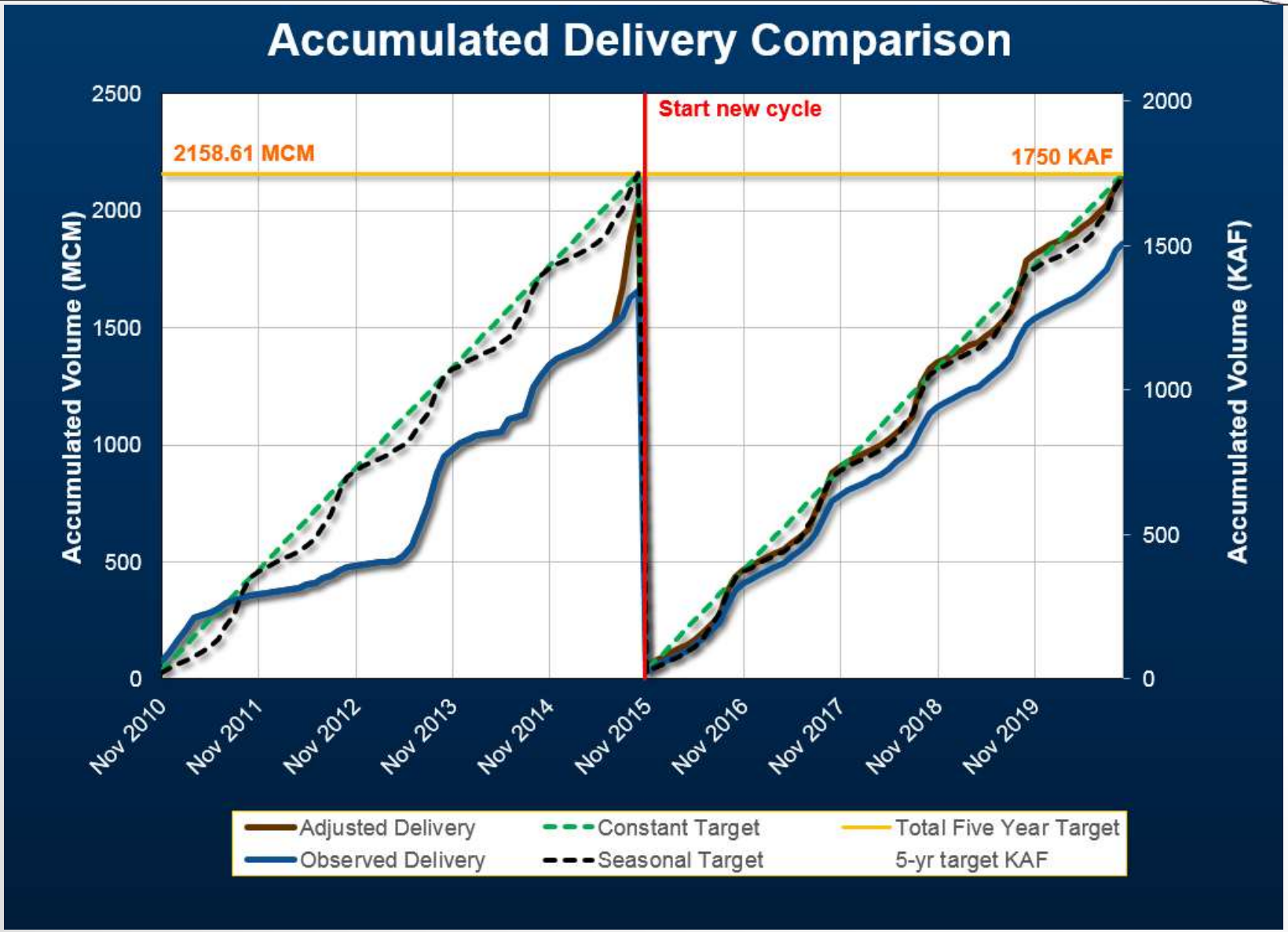
- Transfer of Storage in International Reservoirs
  - Specify amount of water in each reservoir to transfer to meet deficit
  - Usually at end of a cycle in deficit

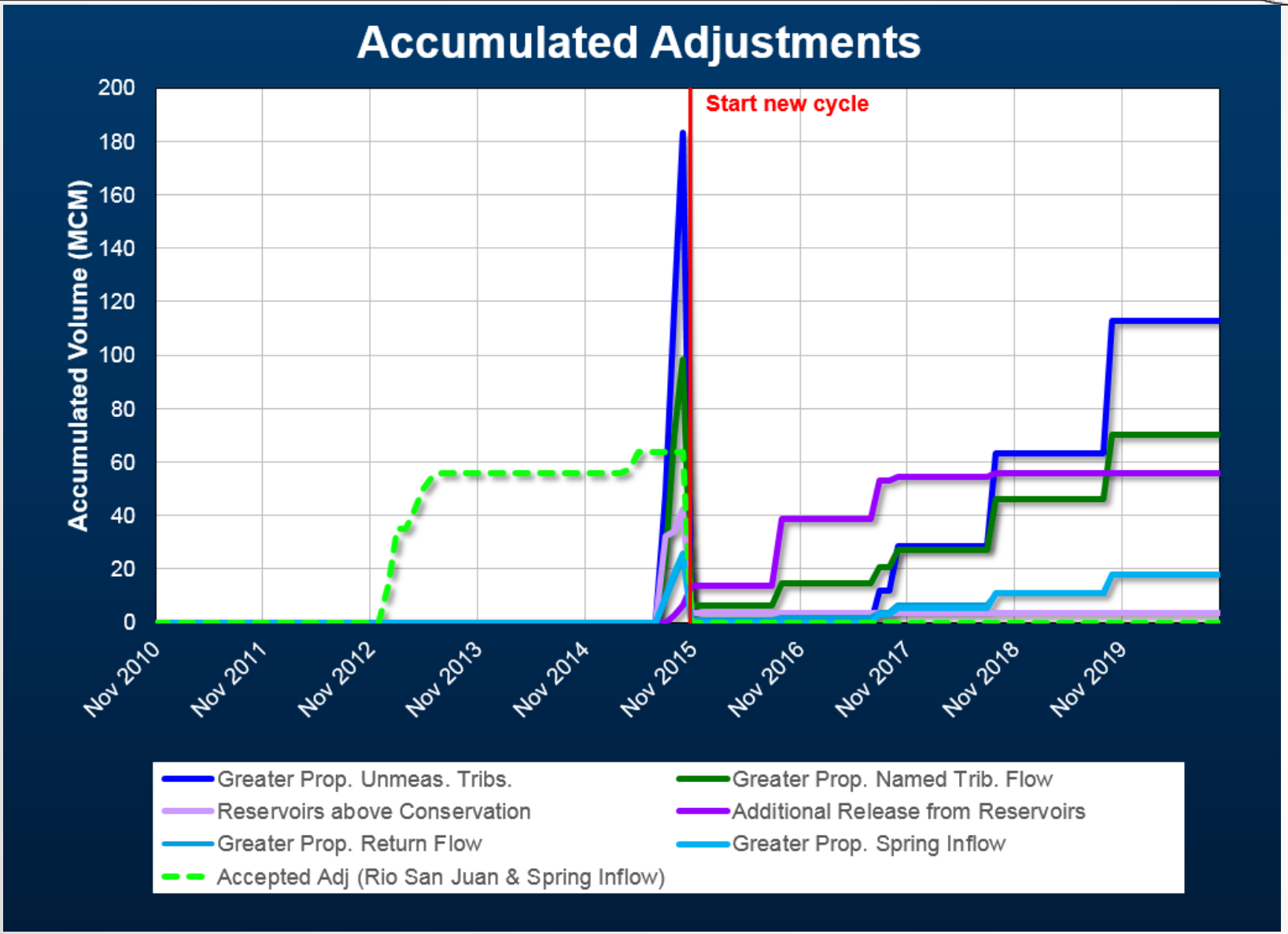
Article 9 of the treaty and Minute 234 permit use of other sources:

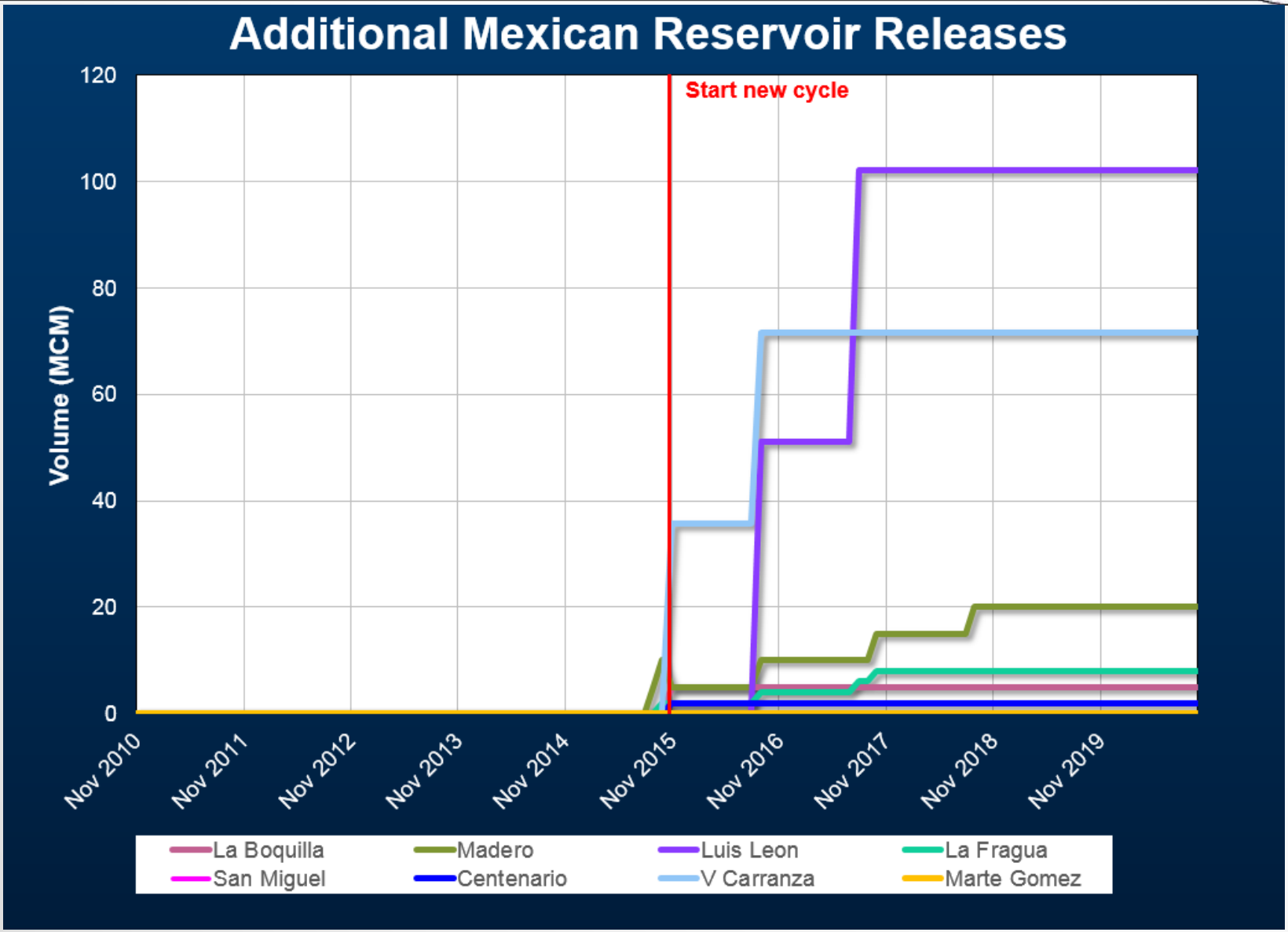
- Additional reservoir releases
- Rio San Juan
- Greater than 1/3 at named tribs.
- Reservoir transfer

# Case Study

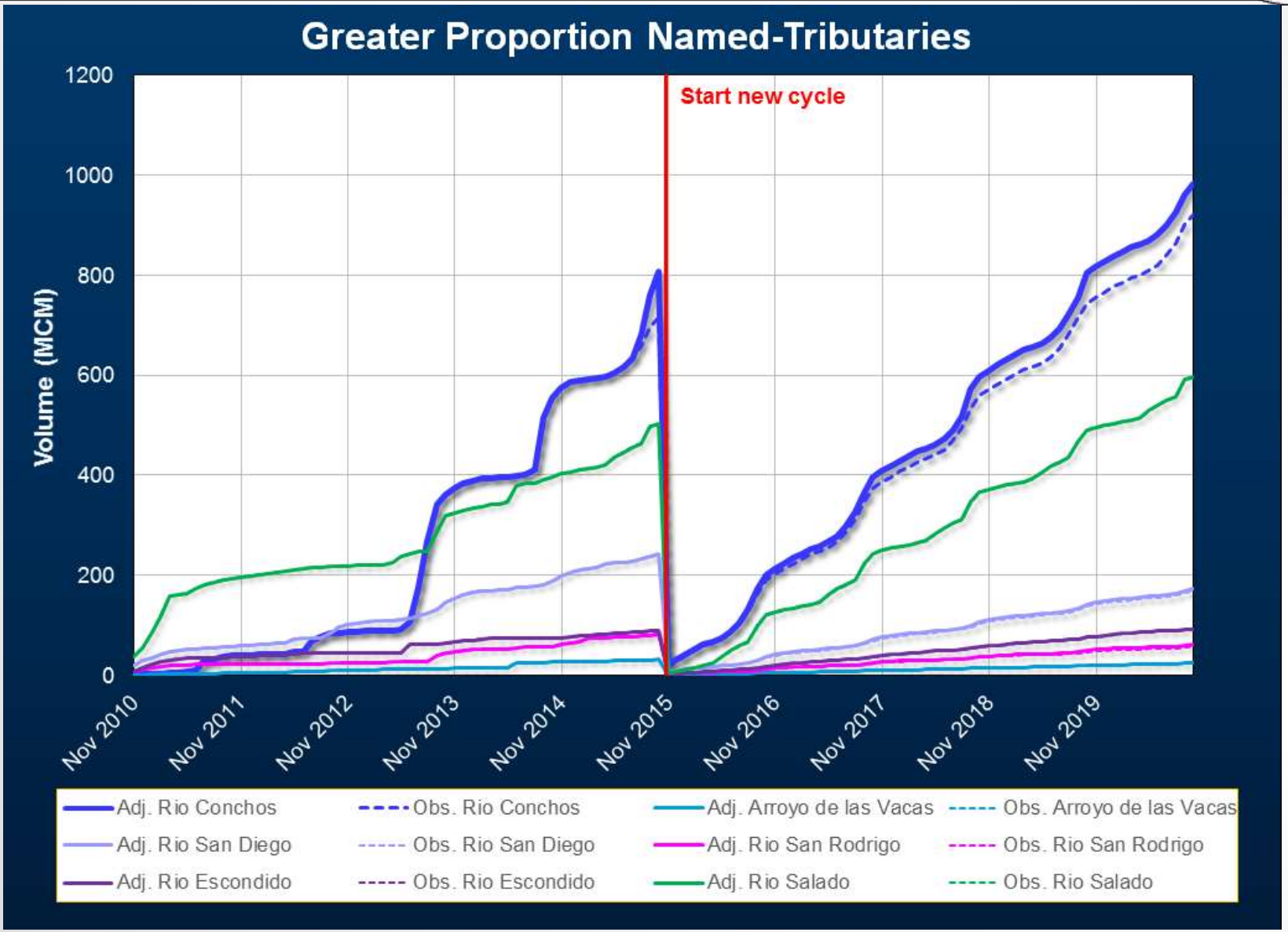
- Review results

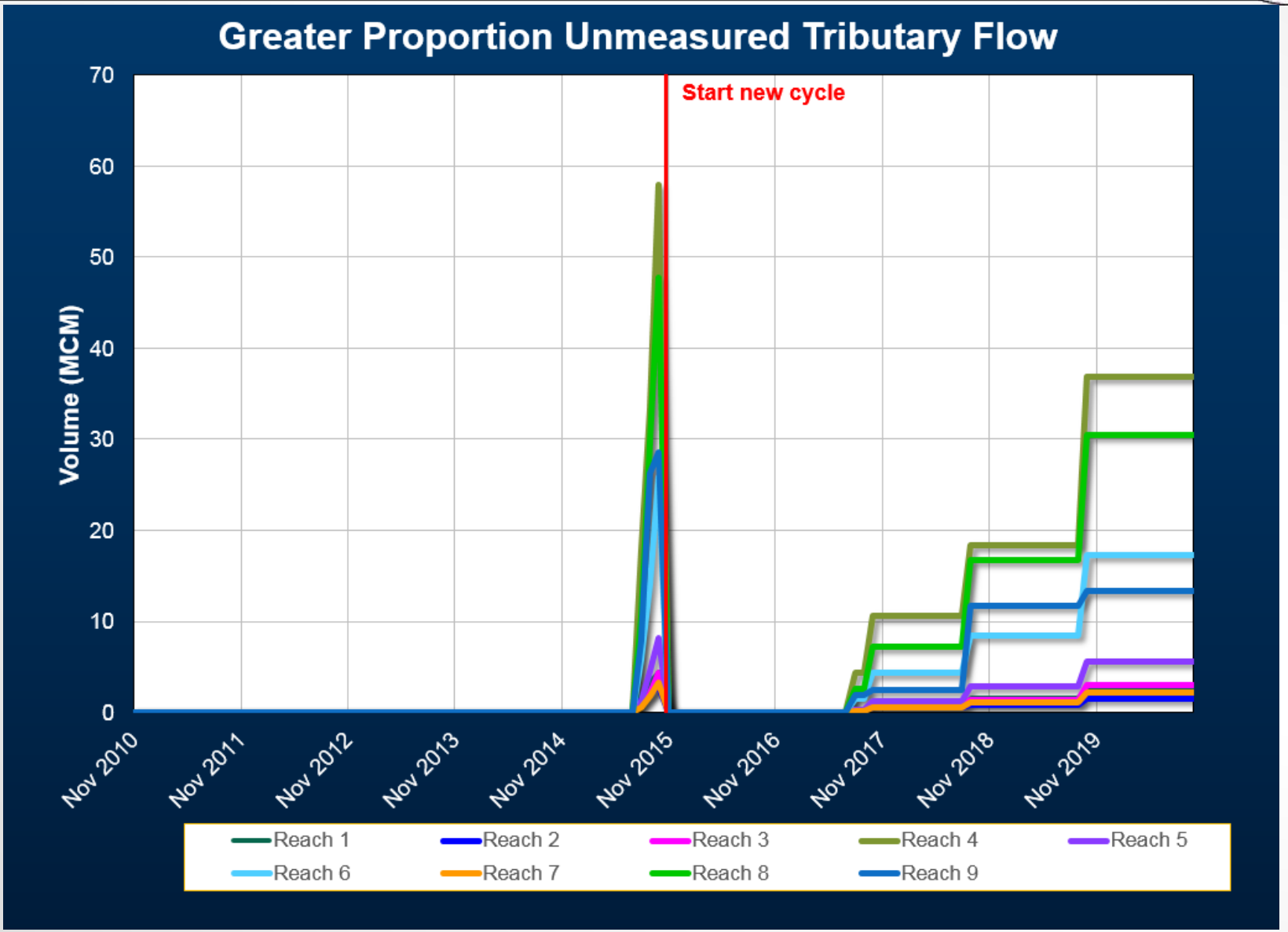

Accumulated Delivery Comparison
Start new cycle
2158.61 MCM
1750 KAF
Accumulated Volume (MCM)
Accumulated Volume (KAF)
2500
2000
1500
1000
500
0
2000
1500
1000
500
0
Nov 2010
Nov 2011
Nov 2012
Nov 2013
Nov 2014
Nov 2015
Nov 2016
Nov 2017
Nov 2018
Nov 2019
Adjusted Delivery
Observed Delivery
Constant Target
Seasonal Target
Total Five Year Target
5-yr target KAF


Accumulated Adjustments
Accumulated Volume (MCM)
200
180
160
140
120
100
80
60
40
20
0
Start new cycle
Nov 2010
Nov 2011
Nov 2012
Nov 2013
Nov 2014
Nov 2015
Nov 2016
Nov 2017
Nov 2018
Nov 2019
Greater Prop. Unmeas. Tribs.
Greater Prop. Named Trib. Flow
Reservoirs above Conservation
Additional Release from Reservoirs
Greater Prop. Return Flow
Greater Prop. Spring Inflow
Accepted Adj (Rio San Juan & Spring Inflow)


Additional Mexican Reservoir Releases
Start new cycle
Volume (MCM)
120
100
80
60
40
20
0
Nov 2010
Nov 2011
Nov 2012
Nov 2013
Nov 2014
Nov 2015
Nov 2016
Nov 2017
Nov 2018
Nov 2019
La Boquilla
Madero
Luis Leon
La Fragua
San Miguel
Centenario
V Carranza
Marte Gomez


Luis L. Leon Reservoir
Start new cycle
292.5 MCM
Volume (MCM)
500
450
400
350
300
250
200
150
100
50
0
Nov 2010
Nov 2011
Nov 2012
Nov 2013
Nov 2014
Nov 2015
Nov 2016
Nov 2017
Nov 2018
Nov 2019
Observed Storage
Above Conservation Adj
Conservation Level
Adjusted Storage
Additional Releases Adj


Greater Proportion Named-Tributaries
Start new cycle
Volume (MCM)
1200
1000
800
600
400
200
0
Nov 2010
Nov 2011
Nov 2012
Nov 2013
Nov 2014
Nov 2015
Nov 2016
Nov 2017
Nov 2018
Nov 2019
Adj. Rio Conchos
Obs. Rio Conchos
Adj. Arroyo de las Vacas
Obs. Arroyo de las Vacas
Adj. Rio San Diego
Obs. Rio San Diego
Adj. Rio San Rodrigo
Obs. Rio San Rodrigo
Adj. Rio Escondido
Obs. Rio Escondido
Adj. Rio Salado
Obs. Rio Salado


Greater Proportion Unmeasured Tributary Flow
Start new cycle
Volume (MCM)
70
60
50
40
30
20
10
0
Nov 2010
Nov 2011
Nov 2012
Nov 2013
Nov 2014
Nov 2015
Nov 2016
Nov 2017
Nov 2018
Nov 2019
Reach 1
Reach 2
Reach 3
Reach 4
Reach 5
Reach 6
Reach 7
Reach 8
Reach 9

# CONCLUSIONS

- The RiverWare model can
  - Act as an invaluable tool for evaluating alternate scenarios of water delivery in a complex system
  - Based on science and technology
  - While providing potential consequences resulting from the various adjustments
- Working together, the U.S. and Mexico can jointly agree to adjustments that are acceptable to both countries

# QUESTIONS?