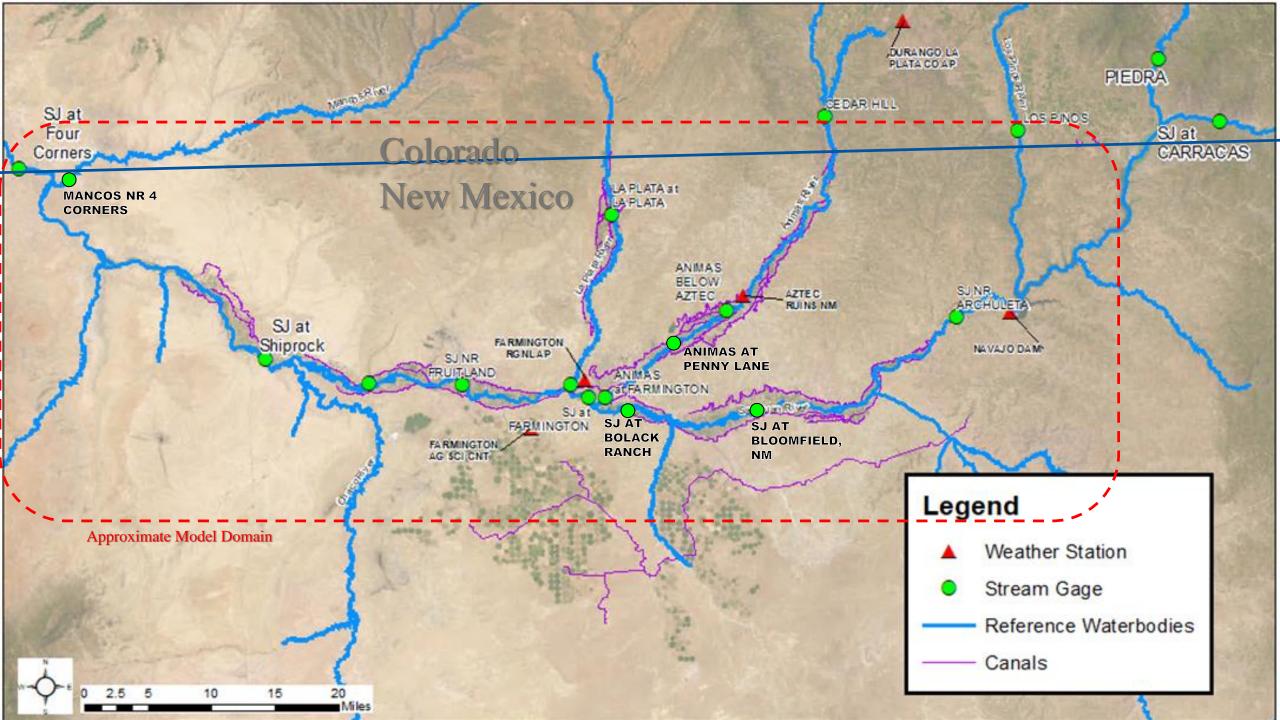


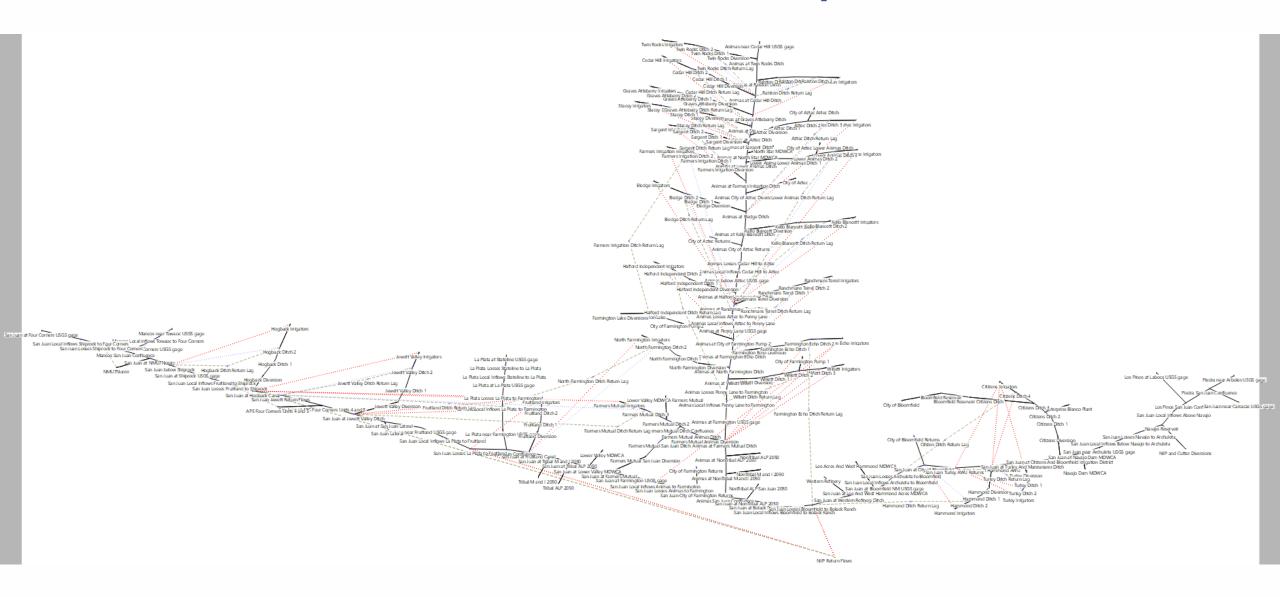


A Daily-Timestep Planning and Administration Model of the San Juan River, New Mexico

Nick Mander, Hydros Consulting, Inc.



RiverWare Workspace



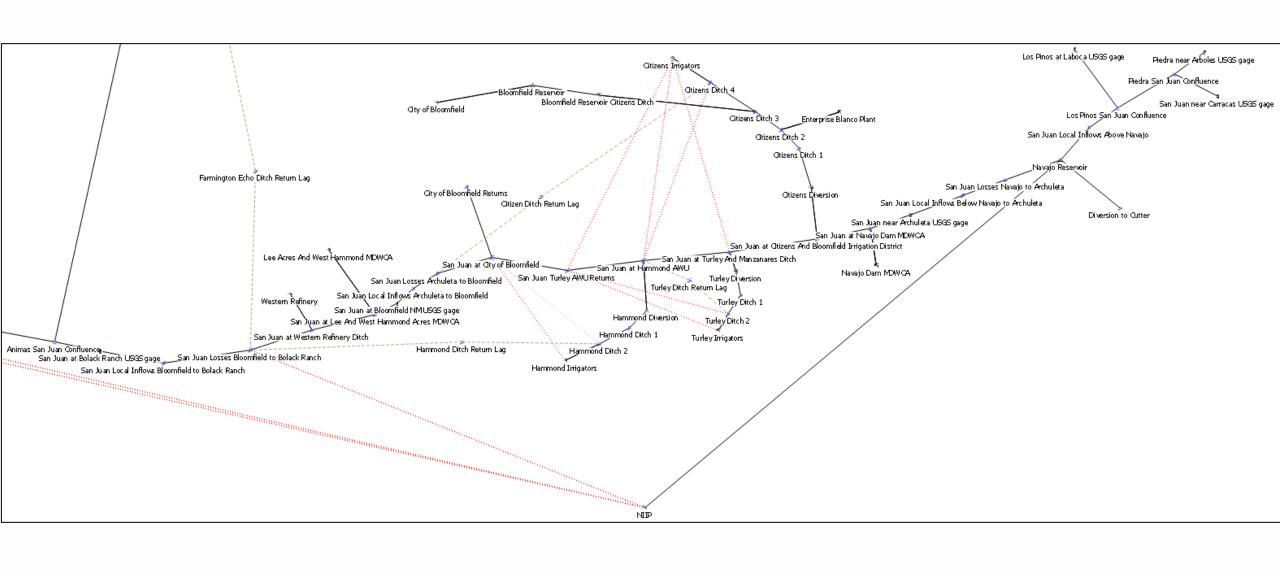
```
Twin Rocks Irrigators
                                           Twin Rocks Ditch 2
Twin Rocks Ditch 1
Animas near Cedar Hill USGS gage
Twin Rocks Diversion
Twin Rocks Ditch
                       Gedar Hill Irrigators
                                                                  Twin Rocks Ditch Return Lag
                                     Gedar Hill Ditch 2
                                                                                       Animas at Ralston Divers Ralston Ditch 1 Ralston Ditch 2 Ralston Irrigators
                                                         Gedar Hill Ditch 1-
              Graves Atteberry Trigators

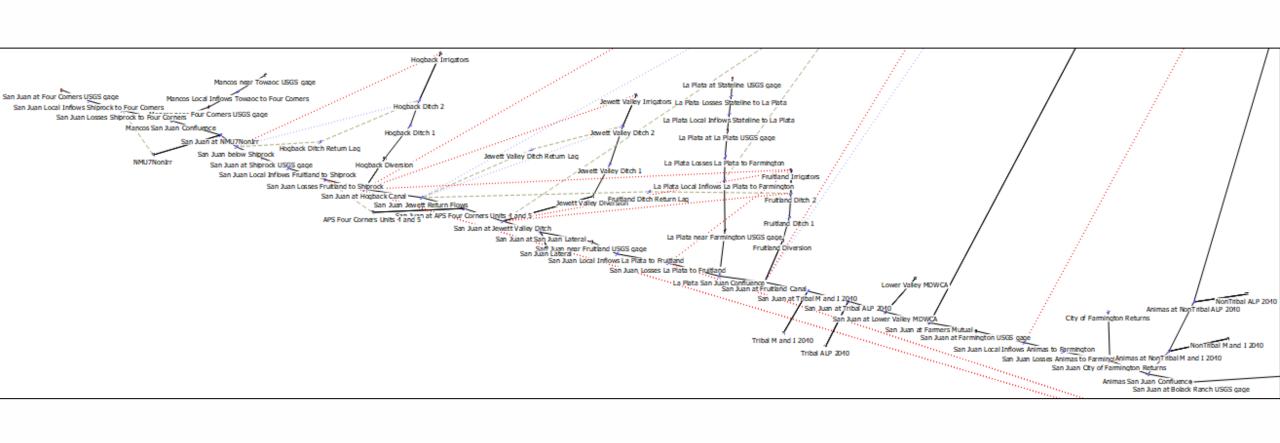
Graves Atteberry Dtch 2

Graves Atteberry Dtch 2

Animas

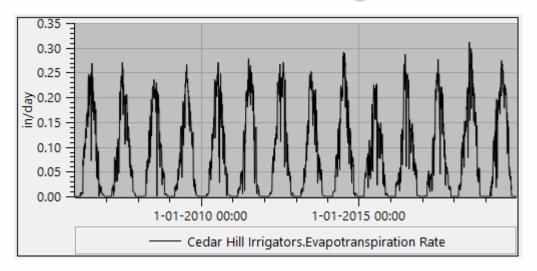
Animas
                                                                                                            Ralston Ditch Return Lag
                                                                                      Animas at Gedar Hill Ditch
                                                       'Graves Atteberry Diversion
                             Stacey Ditch 2 Graves Atteberry Ditch Return Lag
                                                                                                                              City of Aztec Aztec Ditch
                                           Stacey Ditch 1
                                                          Stacey Diversion —
                                                                                  Animas at Graves Atteberry Ditch
                                                                                                                               Aztec Ditch 2 Aztec Ditch 3 Aztec Irrigators
                               Sargent Irrigators
Sargent Ditch 2
                                                  Stacey Ditch Return Lag
                                                                                     Animas at Stacey Partec Diversion
                                                        Sargent Ditch 1
                                                                                                                               Aztec Ditch Return Lag
                                                                                    Animas at Aztec Ditch
                                                                                  Animas at Sargent Ditch
                                                     Sargent Ditch Return Lag
                                                                                                                              Oty of Aztec Lower Animas Ditch
                         Farmers Irrigation Irrigators
                                                                                                  North Star MDWCA
                                        Farmers Irrigation Ditch 2
Farmers Irrigation Ditch 1
                                                                                                                               Lower Animas Ditch 3
                                                                               Animas at North Star MDWCA
                                                                                                Lower Animas Dive Lower Animas Ditch 1
                                                                  Animas at Lower Animas Ditch
                       Eledge Irrigators
                                                                                                                       Oty of Aztes
                                                                             Animas at Farmer's Irrigation Ditch
                                           Eledge Ditch 2
                                                                                                                    Lower Animas Ditch Return Lag
                                                              Bedge Diversion Animas City of Aztec Diversion
                                                                                 Animas at Bedge Ditch
                                                                                                                    Kello Blancett Ditch 1 Kello Blancett Ditch 2
                                          Eledge Ditch Return Lag
                                                           Oty of Aztec Returns nimas at Kello Blancett Diversion
                                                                                                                     Kello Blancett Ditch Return Lag
Farmers Irrigation Ditch Return Lag
                                                                              Animas Oty of Aztec Returns
                  Halford Independent Irrigators
                                                                            Animas Losses Çedar Hill to Aztec
                                Halford Independent Ditch 2
                                                                        Animas Local Inflows Cedar Hill to Aztec
                                                                                                                                           Ranchmans Terrel Irrigators
                                            Halford Independent Ditch 1
                                                                          Animas below Aztec USGS gage
                                                                                                                          Ranchmans Terrel Ditch 2
                                                       Halford Independent Diversion
                                                                                                            Ranchmans Terrel Ditch 1
                                                                       Animas at Halford Independent Direkt
                                                                       Animas at Ranchmans Terrel Crackmans Terrel Ditch Return Lag
                                   Halford Independent Ditch Return Lag
                      Farmington Lake
                                                                      Animas Losses Aztec to Penny Lane
                                                                   Animas Local Inflows Aztec to Penny Lane
 Farmington Lake Diversions
                                    Oty of Farmington Pump 2
                                                                       Animas at Penny Lane USGS gage
                                                                                                                                                       Farmington Echo Irrigators
             North Farmington Irrigators
                                                                      Animas at Oty of Farmington Pump 2
                                                                                                                               Farmington Echo Ditch 2
                          North Farmington Ditch 2
                                                                                                              Farmington Echo Ditch 1
                                                                       Farmington Echo Diversion
Animas at Farmington Echo Ditch
   North Farmington Ditch Return Lag North Farmington Ditch 1
                                                                                                                         Otyof Farmington Pump 1
                                                                                                                            Willett Ditch 2 Willett Ditch 3
                                                  North Farmington Diversion
                                                                    Animas at North Farmington Ditch
       Farmers Mutual Irrigators
                         gators - 4
--- Lovyer Valley MDW CA Farmers Mutual
                                                                                                            Willett Ditch 1
                                                                          Animas at Willett Ditch Willett Diversion
                    Farmers Mutual Ditch 3
                                                                Animas Losses Penny Lane to Farmington
                                 Farmers Mutual Ditch 2
                                     Farmers Mutual Ditch Confluence
                                                                                                 Willett Ditch Return Lag
                                               Farmers Mutual Animas Ditch
 Farmers Mutual Ditch Return Lag
                                                       Farmers Mutual Animas Diversion
                            Farmers Mutual San Juan Ditch
                                                                     Animas at Farmers Mutual Ditch
                                                                                             NonTribal ALP 2040
              Farmers Mutual San Juan Diversion
                                                                     Animas at Non Tribal ALP 2040
                                                                                              NonTribal M and I 2040
                                                                   Animas at NonTribal Mand I 2040
                                                                      Animas San Juan Confluence
                                                                                                     San Juan at Bolack Ranch USGS gage -
```

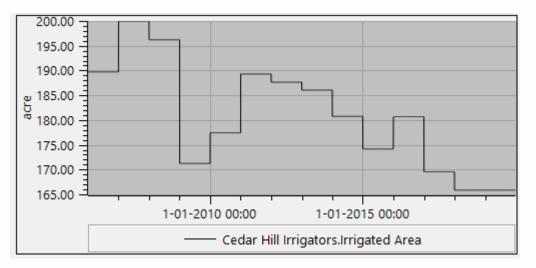


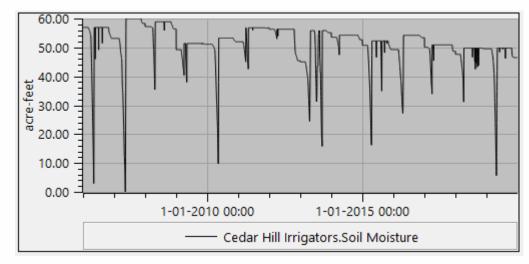


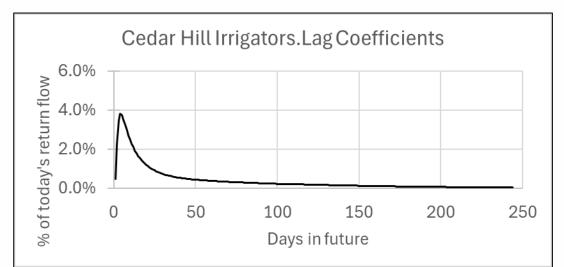
Irrigation Demands and Return Flow

• RiverWare's "Irrigation Requests with Soil Moisture" methods





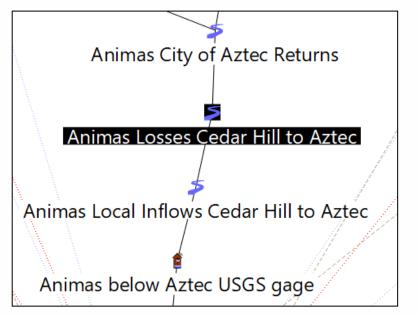


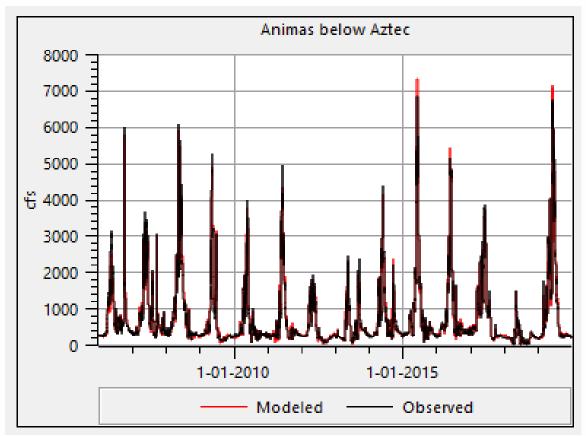


River Losses

Loss rates based on literature, and automatic Parameter Estimation software (PEST)

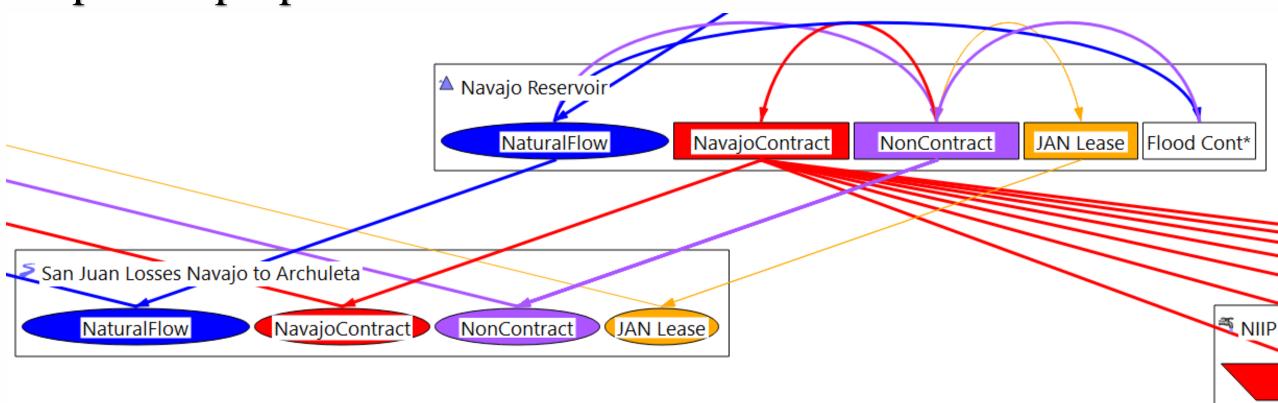






Accounting

Different colors of water: Natural flow, or water that was stored under a storage water right, and released for a specific purpose at a later date



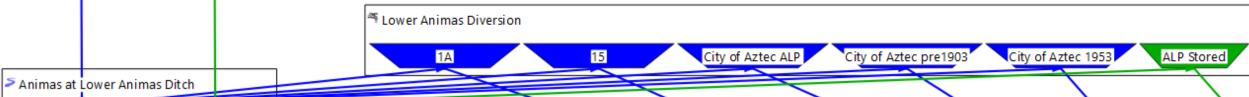
Water Rights

Ob	oject	Acc	ount Name	Туре	Water Type	Water Owner	Priority Date
25	Lower Animas Diversion	D	15	Diversion	NaturalFlow	NONE	Jan. 1, 1908 12:00
25	Farmers Mutual Animas Diversion	D	16	Diversion	NaturalFlow	NONE	Apr. 7, 1920 00:00
35	Farmers Irrigation Diversion	D	Farmington pre1956	Diversion	NaturalFlow	NONE	Jan. 1, 1925 00:00
35	City of Farmington Pump 2	D	Farmington pre1956	Diversion	NaturalFlow	NONE	Jan. 1, 1925 00:01
35	Willett Diversion	D	Farmington pre1956	Diversion	NaturalFlow	NONE	Jan. 1, 1925 00:02
35	Lee Acres And West Hammond MDWCA	D	Lee Acres and West Hammond pre1956	Diversion	NaturalFlow	NONE	Dec. 31, 1946 12:00
-25	Citizens Diversion	D	Enterprise Blanco Plant	Diversion	NaturalFlow	NONE	Aug. 24, 1951 00:00
35	Aztec Diversion	D	City of Aztec 1953	Diversion	NaturalFlow	NONE	Dec. 21, 1953 00:00
===	Lower Animas Diversion	D	City of Aztec 1953	Diversion	NaturalFlow	NONE	Dec. 21, 1953 00:01
===	City of Aztec	D	City of Aztec 1953	Diversion	NaturalFlow	NONE	Dec. 21, 1953 00:02
===	Hammond Diversion	D	27A	Diversion	NaturalFlow	NONE	Jan. 1, 1955 00:00
===	APS Four Corners Units 4 and 5	D	APS Four Corners Units 4 and 5	Diversion	NaturalFlow	NONE	Feb. 28, 1955 00:02
35	Farmers Mutual Animas Diversion	D	Lower Valley pre1956	Diversion	NaturalFlow	NONE	Apr. 30, 1956 12:00
35	Lower Valley MDWCA	D	Lower Valley pre1956	Diversion	NaturalFlow	NONE	Apr. 30, 1956 12:01
35	Western Refinery	D	Western Refinery	Diversion	NaturalFlow	NONE	Apr. 30, 1956 22:00
- 35	Navajo Dam MDWCA	D	Navajo Dam MDWCA	Diversion	NaturalFlow	NONE	Apr. 30, 1956 23:00
҈	Navajo Reservoir	S	NonContract	Storage	NaturalFlow	NONE	Apr. 30, 1956 23:59
35	Farmers Irrigation Diversion	D	Farmington ALP	Diversion	NaturalFlow	NONE	May. 1, 1956 00:00
25	North Stor MDMCA	D	North Stor ALD	Diversion	NaturalFlau	NONE	May 1 1055 00:05

NaturalFlow

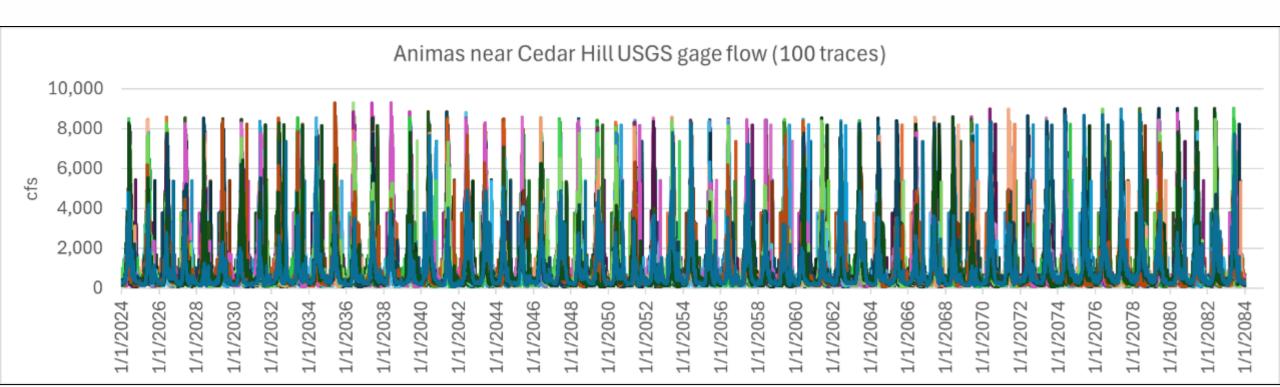
ALP Stored

₹ Wate	er Rights.	Flow Rates
File Ec	dit Rov	v Column
	⊞ Flo	w Rates
====	Value:	16.05
		cfs
6: 11		10.00
7: 12		16.08
8: 14		5.26
9: 15		16.05
10: 16		104.53
11. 20		100.00



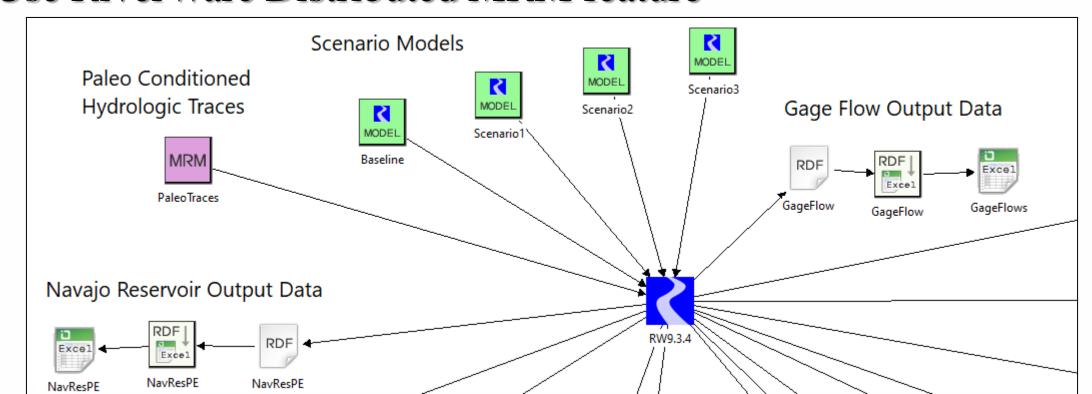
Planning Models: Hydrology

- 100 traces of Paleo-conditioned flows (tree-ring data)
 - 60 years into the future
 - Modified from Reclamation's CRSS paleo ensembles

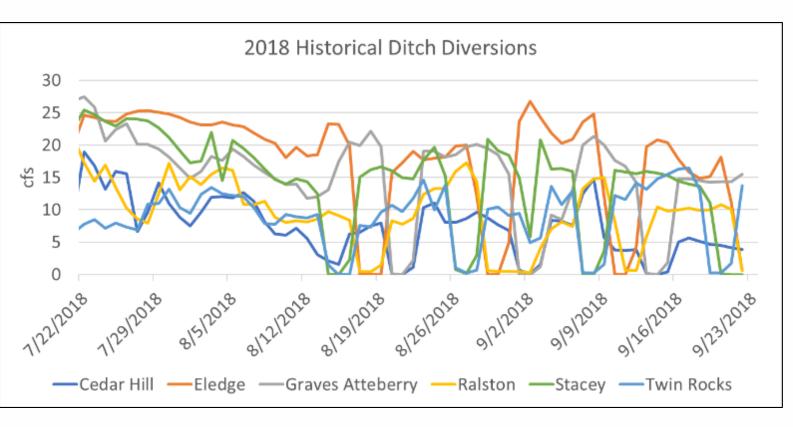


Planning Models

- Ran Scenarios using RiverSMART, including:
 - Tribes developing their water rights
 - Voluntary ditch rotations on the Animas River
- Use RiverWare Distributed MRM feature

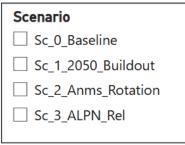


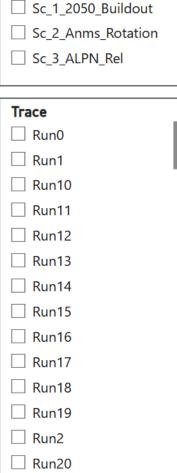
Animas Ditch Rotations

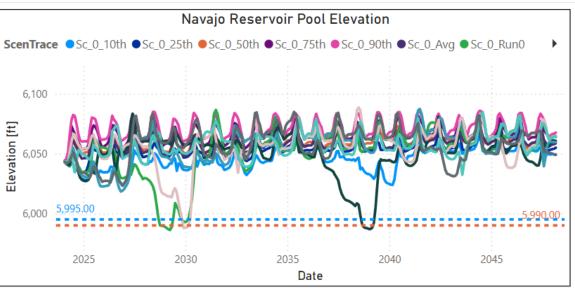


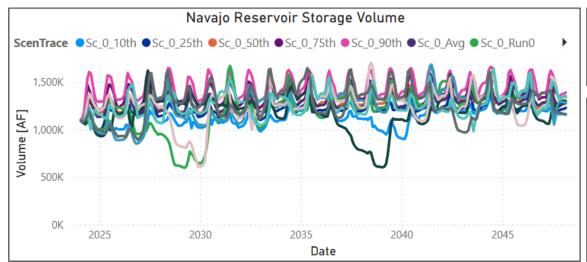
Rotation	Total Annual Crop Shortage when		
Schedule Name	Ditches Shutoff		
Schedule0-ABCD	283		
Schedule1-ABCD	225		
Schedule1-DABC	193		
Schedule1-CDAB	168		
Schedule1-BCDA	164		
Schedule2-CDAB	138		
Schedule2-BCDA	158		
Schedule2-ABCD	166		
Schedule2-DABC	180		
Schedule3-CABD	178		
Schedule3-DCAB	206		
Schedule3-BDCA	152		
Schedule3-ABDC	168		
Schedule4-CABD	223		
Schedule4-DCAB	159		
Schedule4-BDCA	279		
Schedule4-ABDC	202		
Schedule5-BDAC	169		
Schedule5-CBDA	160		
Schedule5-ACBD	153		
Schedule5-DACB	195		

Power BI Model Dashboard









Count of Days at/below **Elevation:**

Scenario	Below 5990	Below 5995
☐ Sc_0_Baseline		
Run0	224	372
Run1	198	243
Run10	0	0
Run11	104	147
Run12	0	0
Run13	0	0
Run14	0	0



Notes:

- Traces are ordered driest (Run0) to wettest (Run99).
- The top plot shows traces of Navajo Reservoir Pool Elevations (monthly average)
- The bottom plot shows Navajo Reservoir Storage Volume (monthly average)
- The data table shows the count of days equal to or below the specified threshold (5990 or 5995) based on daily results. Note that the "Count of Days.." table reflects the entire simulation and does NOT update with the time slicer.

Power BI Model Dashboard (continued)



View Selection

View Selected Gage

Locations are approximate.
Use map to select a Diversion, Irrigator, or Stream Flow Gage.
While an object on the map is selected,
click the appropriate "View Data" button to view the selected data.



