2022 Rio Grande Annual Operating Plan
April 1 Runoff Forecast
Presented by Bureau of Reclamation
April 14, 2022
Agencies & Major Users

• Reclamation: Bureau of Reclamation
• USACE/Corps: US Army Corp of Engineers
• IBWC: US Section International Boundary and Water Commission
• Santa Fe: City and/or County of Santa Fe
• Albuquerque/Water Authority: Albuquerque Bernalillo County Water Utility Authority (ABCWUA)
• MRGCD: Middle Rio Grande Conservancy District
• EBID: Elephant Butte Irrigation District
• EP1/El Paso: El Paso County Water Improvement District
Operating Rules

• Treaty/1906 Convention: between the U.S. and Mexico, signed 1906

• Rio Grande Compact: agreement between Colorado, New Mexico, and Texas apportioning Rio Grande water between the three states

• Project Authorizations: each Project (Dam) has its own set of federal laws that apply to its storage and release of water

• Article VII restrictions: restricts storage of Rio Grande water in post 1929 reservoirs (El Vado) when usable storage in Elephant Butte and Caballo is less than 400,000 ac-ft, with some exceptions

• Operating Agreement: between EBID, EP1, Reclamation, signed in 2008
Types of Water

- Native/natural Rio Grande water: water that comes directly from the Rio Grande Basin
- San Juan-Chama water: water imported from San Juan Basin of Colorado River into Rio Grande Basin through San Juan-Chama Project
- Supplemental water: water leased by Reclamation to augment flows in support of Rio Grande Silvery Minnow
- P&P water: water for the Prior & Paramount lands of the six Middle Rio Grande Pueblos
Hydrology Terms

- cfs: cubic feet per second (flowrate)
- ac-ft: acre-feet (volume), amount of water needed to cover one acre to depth of one foot
- Hydrograph: graph of flowrate over time
- Runoff Forecast: predicted volumes for March through July provided by Natural Resources Conservation Service (NRCS)
- SNOTEL: Snow Telemetry (SNOTEL) network composed of automated data collection sites located in remote, high-elevation mountain watersheds used to monitor snowpack, precipitation, temperature, and other climatic conditions
Map of Reclamation's Albuquerque Area Office Projects
What Drives the Process?

- Volume forecast from NRCS
- Based on snowpack, soil moisture, climate forecast
- Choose similar year based on similar volume
- Actual hydrograph vs. average hydrograph
- Can shift timing of hydrograph to best match forecasted conditions (warm spring vs. cool spring)
- Inflows/outflows based on nature and policies
- Article VII restrictions
- Flood control and channel capacity
- Timing of water deliveries
- Demand plans from water users and historical data
Using NRCS/NWS Forecasting In the Model(s)…

DEFAULT: CLOSEST HISTORIC YEAR DAILY TIMESTEP HYDROGRAPH SHAPE, SHIFTED TO MATCH VOLUME
Similar Year Hydrographs Example

Rio Chama at La Puente

Year: Volume (ac-ft)
- 2003: 143,907
- 2004: 145,170
- 2016: 168,329
<table>
<thead>
<tr>
<th>Dam</th>
<th>Agency Owner/Operator</th>
<th>Water Supply</th>
<th>Other Authorized Purposes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reclamation</td>
<td>USACE</td>
<td>Rio Grande</td>
</tr>
<tr>
<td>Heron</td>
<td>Reclamation</td>
<td>USACE</td>
<td>Rio Grande</td>
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<tr>
<td>El Vado</td>
<td>Reclamation</td>
<td>USACE</td>
<td>Rio Grande</td>
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<tr>
<td>Abiquiu</td>
<td>Reclamation</td>
<td>USACE</td>
<td>Rio Grande</td>
</tr>
<tr>
<td>Cochiti</td>
<td>Reclamation</td>
<td>USACE</td>
<td>Rio Grande</td>
</tr>
<tr>
<td>Elephant Butte</td>
<td>Reclamation</td>
<td>USACE</td>
<td>Rio Grande</td>
</tr>
<tr>
<td>Caballo</td>
<td>Reclamation</td>
<td>USACE</td>
<td>Rio Grande</td>
</tr>
</tbody>
</table>
2021: The Year in Review
2021 Heron Inflow
2021 Heron Outflow
2021 Heron Storage
2021 El Vado Inflow
2021 El Vado Reservoir Outflow
2021 El Vado Storage
2021 Abiquiu Inflow
2021 Abiquiu Outflow
2021 Abiquiu Storage

[Graph showing storage levels from 4/1/2021 to 12/1/2021, with Modeled Storage and Actual Storage lines.]

- Modeled Storage
- Actual Storage
2021 Cochiti Inflow
2021 Cochiti Storage
2021 Elephant Butte Inflow

Graph showing modeled and actual inflow for 2021.
2021 Elephant Butte Outflow
2021 Elephant Butte Storage
2021 Caballo Inflow
2021 Caballo Outflow

![Graph showing modeled and actual outflow for 2021 Caballo. The graph is titled "2021 Caballo Outflow" and shows the flow in cfs from April 1, 2021, to December 31, 2021. The x-axis represents the dates, and the y-axis represents the flow in cfs. The graph includes two lines: one for modeled outflow and another for actual outflow. The most significant peak occurs in August 2021.](image-url)
2021 Caballo Storage
Current Snow Conditions
SNOTEL Locations
Rio Chama Snow Data
Low Elevation

Chamita SNOTEL 2021-22
Elev. 8400'

Snow Water Equivalent & Precip (in)

- 21-22 SWE Data
- Avg. SWE
- 21-22 Precip.
- Avg. Precip.
Rio Chama Snow Data
High Elevation

Cumbres SNOTEL Site 2021-22
Elev. 10,400'

- 21-22 SWE Data
- Avg. SWE
- 21-22 Precip.
- Avg. Precip.
Rio Chama Snow Comparison
Rio Chama Basin Total Snow Water Equivalent
Current Year vs Average and Similar Years

Mar-Jul Runoff Volumes (ac-ft)
La Puente gage
2021 - 117,727
2020 - 81,506
2015 - 184,199
2004 - 145,170
2003 - 143,907
Rio Grande Snow Data
Low Elevation

Upper Rio Grande SNOTEL 2021-22
Elev. 9,400'

Snow Water Equivalent & Precip (in.)

- '21-22 SWE data
- Avg. SWE
- '21-22 Precip. data
- Avg. Precip.
Rio Grande Snow Data
High Elevation
Elk Cabin SNOTEL 2021-22
Elev. 8,210'

Snow Water Equivalent & Precip. (in)

- 21-22 SWE data
- Avg. SWE
- 21-22 Precip.
- Avg. Precip.
Sangre de Cristo Snow Data
High Elevation

Trinchera SNOTEL 2021-22
Elev. 10,859'

Snow Water Equivalent & Precip. (in)

- 21-22 SWE data
- Avg. SWE
- 21-22 Precip.
- Avg. Precip.
Western U.S. River Basin Streamflow Forecast
Monsoon Season Temperature Outlook
Monsoon Season Precipitation Outlook

Seasonal Precipitation Outlook
Valid: Jul-Aug-Sep 2022
Issued: March 17, 2022
2022 Projected Water Operations
Model Assumptions

• April 1st 50% exceedance forecast
• El Vado Storage restrictions for construction
  • P&P water managed from Abiquiu
  • Rafting flows managed from Heron
• Article VII restrictions all year- no native storage for MRGCD
• Irrigation
  • MRGCD staggered start for river diversions in March, reduced demand
  • Caballo Reservoir irrigation release begin early June
• ~4,200 ac-ft supplemental water, expect additional ~12,000 depending on SJCP shortage allocation
# Changes to Forecast Information

- NRCS updated 30-yr (1981-2010) average to 30-yr (1991-2020) median

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Upper Rio Grande</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Rio Grande nr Del Norte</td>
<td>Apr-Sept</td>
<td>480</td>
<td>515</td>
<td>93%</td>
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<tr>
<td>Conejos R nr Magote</td>
<td>Apr-Sept</td>
<td>168</td>
<td>194</td>
<td>87%</td>
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<tr>
<td>Rio Grande nr Lobatos</td>
<td>Apr-July</td>
<td>119</td>
<td>200</td>
<td>60%</td>
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<tr>
<td><strong>San Juan Chama and Middle Rio Grande</strong></td>
<td></td>
<td></td>
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<tr>
<td>Jemez R bl Jemez Canyon Dam</td>
<td>Mar-July</td>
<td>22</td>
<td>34</td>
<td>65%</td>
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<tr>
<td>El Vado Reservoir Inflow</td>
<td>Mar-July</td>
<td>186</td>
<td>225</td>
<td>83%</td>
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<tr>
<td>Rio Grande at Otowi Bridge</td>
<td>Mar-July</td>
<td>565</td>
<td>720</td>
<td>78%</td>
</tr>
<tr>
<td>Rio Grande at San Marcial</td>
<td>Mar-July</td>
<td>345</td>
<td>510</td>
<td>68%</td>
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</tbody>
</table>
### 2022 vs 2021 April Streamflow Forecasts

<table>
<thead>
<tr>
<th>Location</th>
<th>2022</th>
<th>%*</th>
<th>↑or↓ 22vs21</th>
<th>2021</th>
<th>%*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rio Grande @ Del Norte</td>
<td>375,000</td>
<td>78%</td>
<td>↑</td>
<td>365,000</td>
<td>76%</td>
</tr>
<tr>
<td>Rio Blanco @ diversion</td>
<td>40,000</td>
<td>83%</td>
<td>-</td>
<td>40,000</td>
<td>83%</td>
</tr>
<tr>
<td>Navajo River @ diversion</td>
<td>48,000</td>
<td>86%</td>
<td>↑</td>
<td>45,000</td>
<td>81%</td>
</tr>
<tr>
<td>El Vado Inflow</td>
<td>150,000</td>
<td>81%</td>
<td>↑</td>
<td>116,000</td>
<td>63%</td>
</tr>
<tr>
<td>Nambe Falls Inflow</td>
<td>3,400</td>
<td>61%</td>
<td>↑</td>
<td>2,800</td>
<td>50%</td>
</tr>
<tr>
<td>Rio Grande @ Otowi</td>
<td>375,000</td>
<td>66%</td>
<td>↓</td>
<td>415,000</td>
<td>73%</td>
</tr>
<tr>
<td>Jemez River @ Jemez</td>
<td>15,600</td>
<td>54%</td>
<td>↑</td>
<td>11,200</td>
<td>39%</td>
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<tr>
<td>Rio Grande @ San Marcial</td>
<td>151,000</td>
<td>44%</td>
<td>↓</td>
<td>205,000</td>
<td>60%</td>
</tr>
</tbody>
</table>

*Percentage based on the 1991-2020 Median*
Historic March-July Flow Volumes at Otowi

March-July Volumes at Otowi with 2022 - NRCS forecast volumes

- April Forecast - (Mar-Jul vol)
  - 50% probability: 375,000 ac-ft
  - 90% probability: 240,000 ac-ft
  - 10% probability: 545,000 ac-ft
- 30-year median: 565,000 ac-ft
  (last year the 30-year avg = 720,000 ac-ft)
El Vado Dam
El Vado Restrictions during Construction

- During embankment construction, reservoir restricted to 6,785 ft +/- 1.5 ft (1,420 ac-ft to 2,476 ac-ft) from May 15, 2022, to winter 2023
- Intended to reduce risk of downstream sediment discharge and inundation of construction area
2022 Rio Chama Operations during Construction

- El Vado not available for storage during embankment construction
- Release water by May 15 to meet reservoir restriction
- USACE Abiquiu deviation
  - 2022 P&P water to be moved from El Vado to Abiquiu before May 15
  - Retain additional P&P water, as available and needed, up to 20,000 ac-ft
- Rafting releases managed from Heron and bypassed through El Vado
Projected 2022 El Vado Operations
Abiquiu Dam
Projected 2022 Abiquiu Operations
Estimated 2022 Hydrograph at Embudo
Cochiti Dam
Projected 2022 Cochiti Operations
Estimated 2022 Hydrograph at Central
Estimated 2022 Hydrograph at San Acacia

2022 Flow at San Acacia Gage
Projected 2022 Rio Grande Project Operations

- 40% of a normal release from Caballo
- 25-35% of a full irrigation delivery
  - Reduced delivery efficiencies due to consecutive years of less than 50% of normal release
- Most recent similar year for irrigation supply
  - For EP1 and Mexico: 2014
  - For EBID: 2011 if May/June is dry or 2021 if May/June is wetter
Elephant Butte Dam
Projected 2022 Elephant Butte Operations

2022 Elephant Butte Operations

Inflow
Outflow
Storage

Flow (cfs)
Storage (ac-ft)

Flow (cfs)
Storage (ac-ft)
Projected 2022 Elephant Butte Levels

2022 Elephant Butte Elevation

Elevation (ft)

4/1/2022 5/1/2022 6/1/2022 7/1/2022 8/1/2022 9/1/2022 10/1/2022 11/1/2022 12/1/2022
Caballo Dam
Projected 2022 Caballo Operations

2022 Caballo Operations

Flow (cfs)

Storage (ac-ft)

Inflow
Outflow
Storage
Projected 2022 Usable Water

2022 Rio Grande Project Usable Storage

Article VII Storage Restrictions
if less than 400,000 ac-ft
Questions / Comments

Slide deck will be posted at: