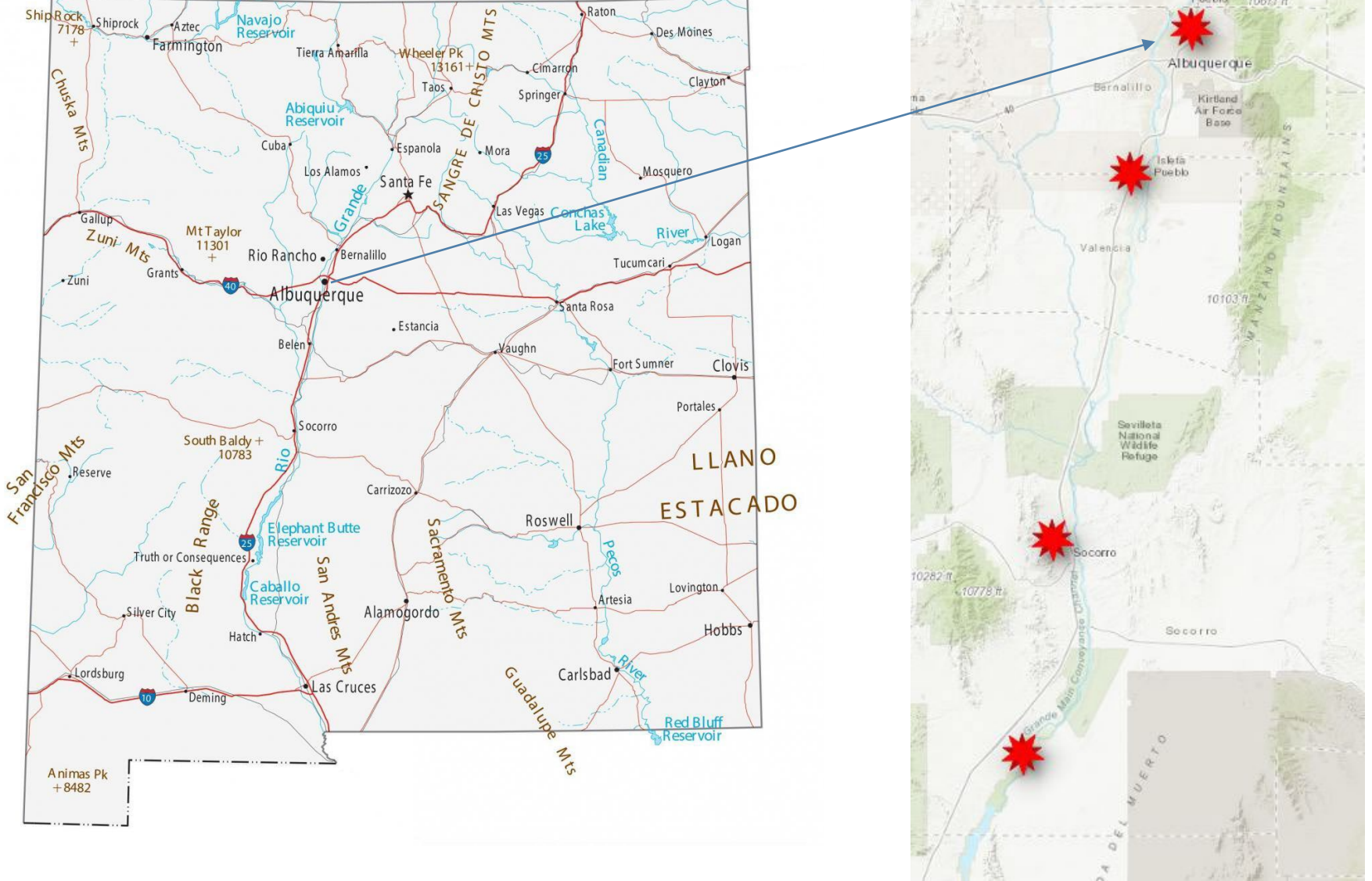
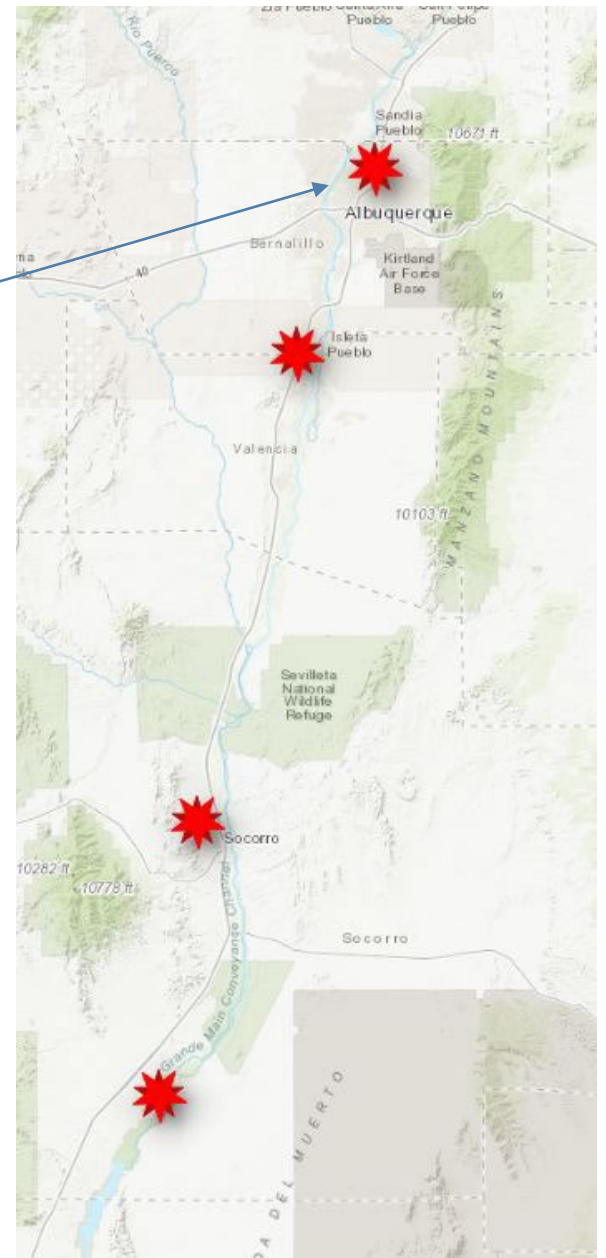
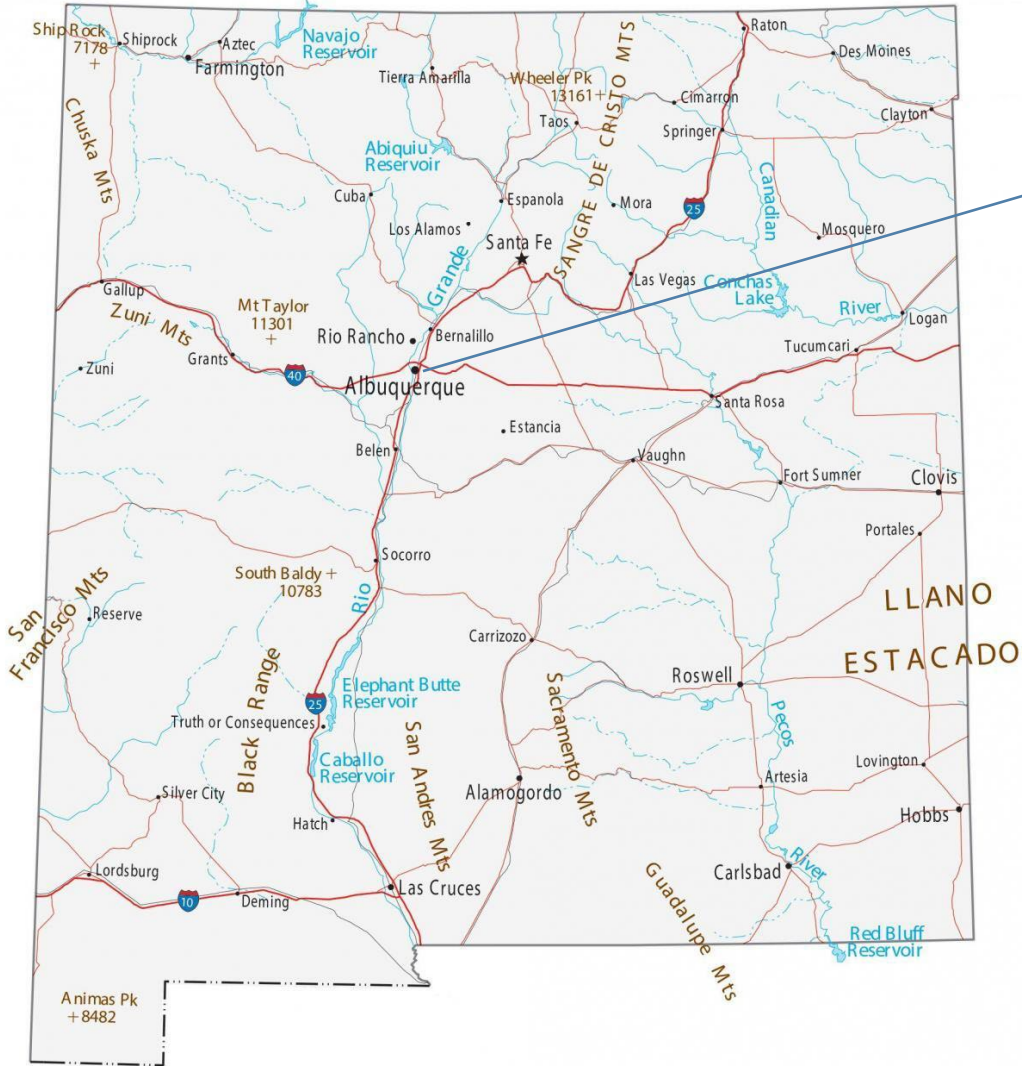


# Two Decades of Restoration on the Middle Rio Grande

Ondrea Hummel, CERP, Ecology Discipline Lead, Senior Ecologist

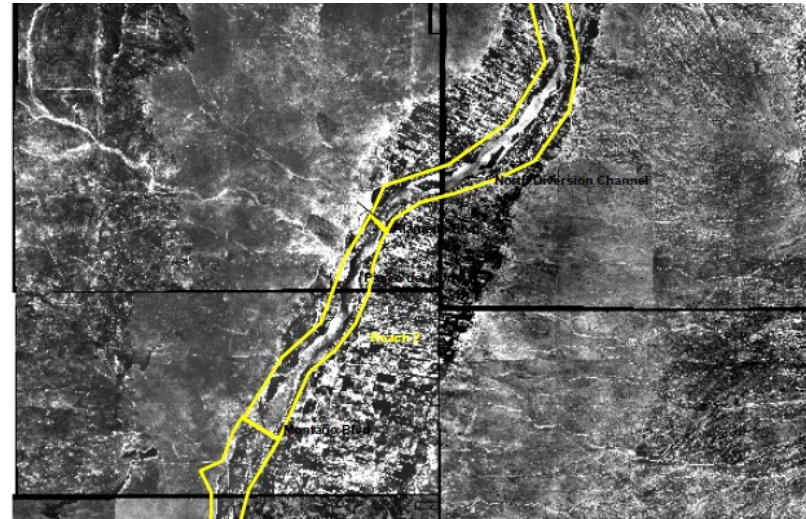




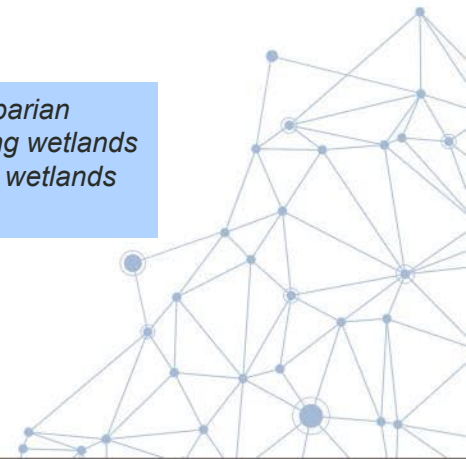


# Anthropogenic Changes

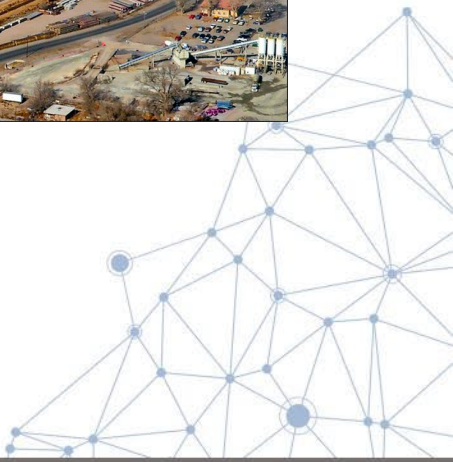
- Dams, levees, water delivery infrastructure
- **Resulting in changes to:**
  - Hydrology – quantity, timing, duration; compact delivery
  - Geomorphology
- **Along with**
  - Introduction of non-native vegetation
  - Increase in population
- **Resulting in:**
- **Lack of flooding and floodplain connection**
  - Reduced quantity of average annual flows
  - Infrastructure limitations
  - Reduced floodplain connection when there is enough water



*Among the greatest needs of the riparian ecosystem are the preservation of existing wetlands and expansion or creation of additional wetlands (Crawford et al., 1993).*



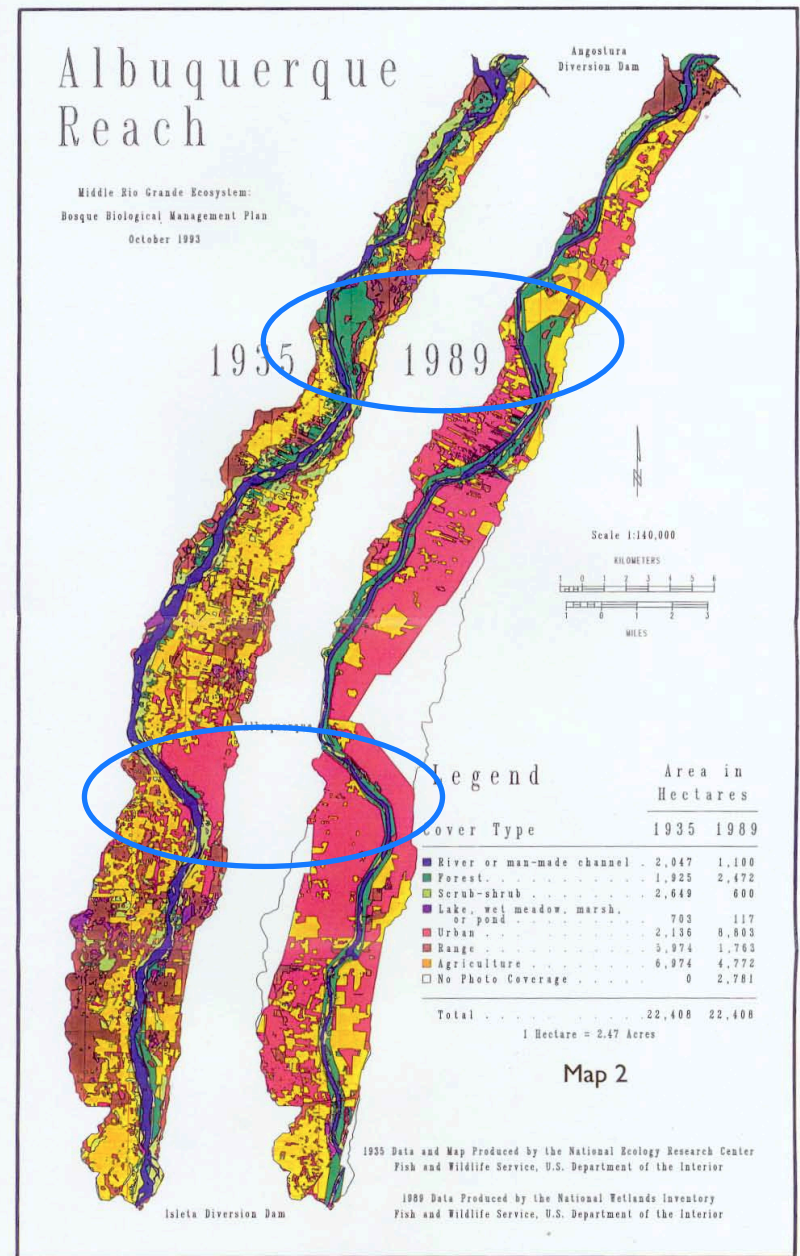






# Historic conditions and changes to the river and floodplain

- **1935 -1989 channel changes**
  - Loss of ~1500 acres of river channel
  - Urban population doubled
  - Forest (bosque) decreased
  - Due to:
    - Albuquerque Levees mid 1950's
    - Jetty Jacks – 1960's
    - Cochiti Reservoir – 1972
  - *Current channel 'locked in'*
  - *Less availability of water to put into the system*



# Peak Flows

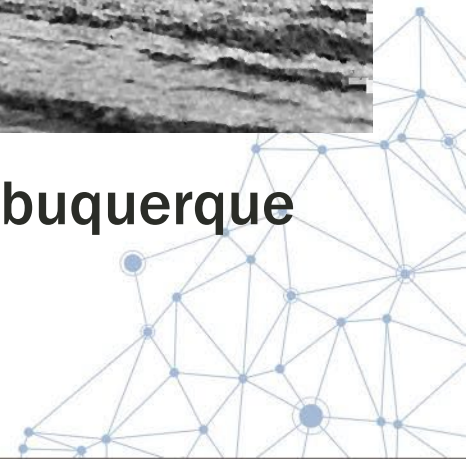
Date	Flow (cfs)
4-24-1942	25,000
6-23-1949	10,800
5-30-1958	12,700
8-10-1967	13,300
9-15-1972	4,380
8-14-1980	7,600
8-11-1986	5,150
6-7-1993	7,210
8-20-2000	2,040
5-25-2008	5,400
9-13-2013	4,350
6-18-2019	5,720

USGS Rio Grande at Albuquerque



**1942 – Downtown Albuquerque**

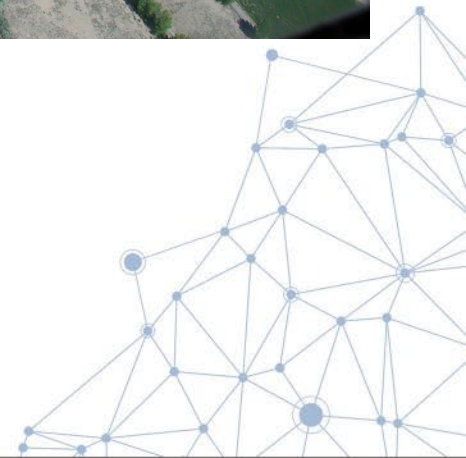
**Cochiti Dam closed in 1972**



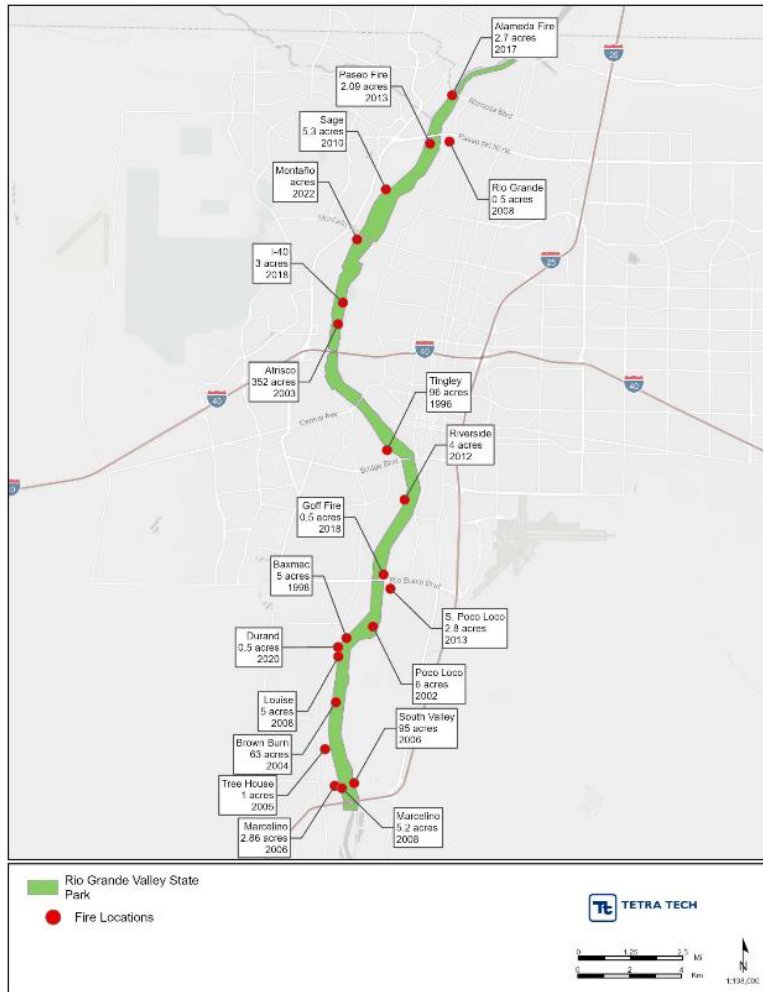


# Changes and constraints resulting in

- **Reduced Average Annual Water Flows**
  - Water Quantity, Drought
  - Climate Variability
- **Disconnected floodplain**
- **Non-Native Invasive Species**
- ***FIRE***
- *instead of flooding*

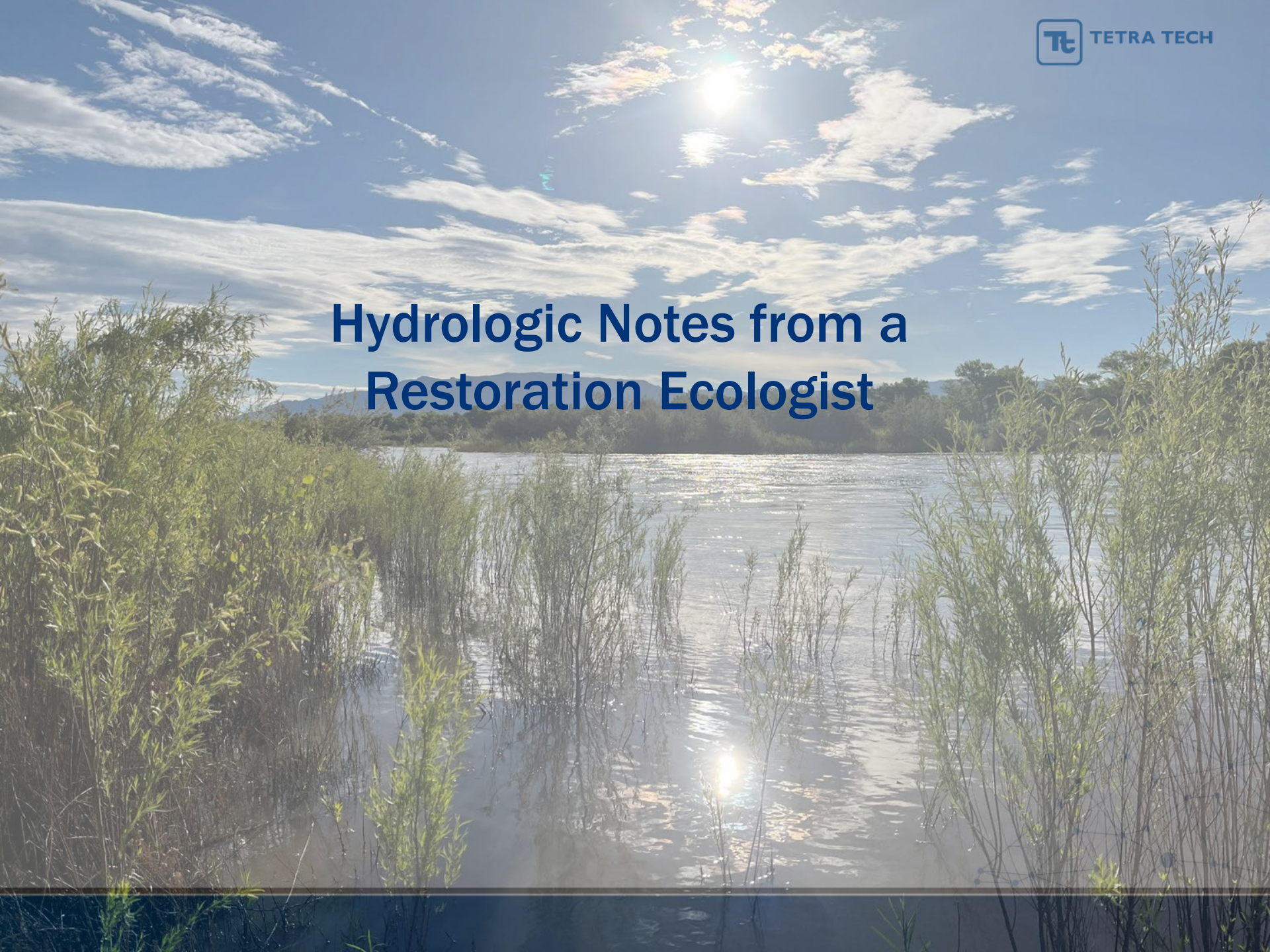


# Fires in the ABQ Reach in the past 20 years



Fire Name	Year of Occurrence	Acres Burned
Tingley	1996	98
Baxmac	1998	5
Poco Loco	2002	6
Montaño	2003	113
Atrisco	2003	352
Lavega	2003	0.1
Brown Burn	2004	63
Tree House	2005	1
Squirrel	2005	0.1
Barcelona	2006	0.2
South Valley	2006	95
Marcelino	2006	2.9
Rio Grande	2008	0.5
Louise	2008	5
Marcelino	2008	5.2
Sage	2010	5.3
Riverside	2012	4
Poco Loco	2013	2.9
Paseo Fire	2013	2.09
mm 4.5 Fire	2016	0.25
Alameda Fire	2017	2.7
Goff Fire	2018	0.5
I-40	2018	3
Durand	2020	0.5
Shelly	2020	0.1
Rio Bosque	2021	0.25
Stadium	2021	0
Valley High	2021	0.1
Montaño	2022	30
<b>Total</b>		<b>798.69</b>



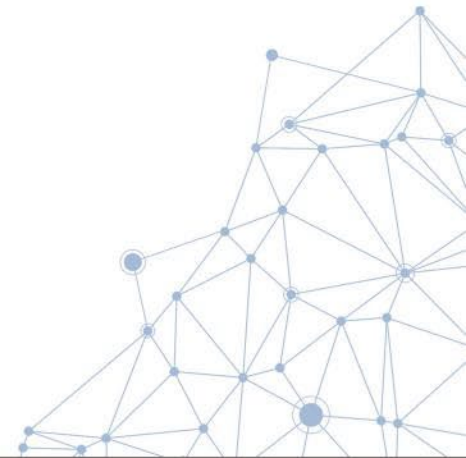


# Hydrologic Notes from a Restoration Ecologist

# Peak flows

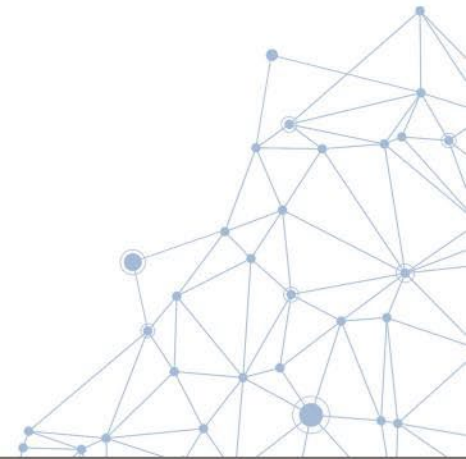
Description	Avg Peak Discharge/Flow	Note
Post-Cochiti Avg Annual Hydrograph	<b>3,770 cfs</b>	<b>~2000-2010</b>
Release capability (Cochiti)	6,000-7,000 cfs (was 10,000)	RR bridge, levee safety Belen Reach
Post-Cochiti Avg Annual Hydrograph	<b>2,000-2,500 cfs</b>	<b>~2010-2015+</b>
Last highest peak flow	<b>6,780 cfs</b>	<b>2005</b>
Max Release/Peak Flow	5080 cfs at Central	<b>2023</b>

USGS Rio Grande at Albuquerque





# RESTORATION – REHABILITATION – ENHANCEMENT - PRESERVATION



# Integrated Project Planning

- **Project Goals (Opportunities) based on Problems**
- **Planning and Design with integrated team**
  - **Ecosystem approach**
    - Hydrologists – flow, duration, inundation
    - Ecologist – vegetation, habitat
    - Geomorphologist – channel changes
    - Geotechnical, Civil and other engineering

## CONSIDERATIONS:

- **What is the site potential?**
- **Phasing**
  - For example, non-native vegetation removal targets
  - What species will be left (provide food and/or habitat)
  - What % will remain

**GOALS → DESIGN-IMPLEMENT → SUCCESS CRITERIA → MONITORING → ADAPTIVE MANAGEMENT**





# ‘Restoration’ (Rehabilitation) Techniques/ Goals (Opportunities)

- **Fuel reduction/exotic thinning**
  - Balance of vegetation where flooding does not occur anymore
- **Jetty Jack removal**
- **Revegetation - mosaic**
- **‘Bringing the Bosque Back to the River’**
  - High flow channels, backwater channels
  - Bank terracing – to allow overbanking at design flows
  - Willow swales – bring closer to shallow GW
  - Wetland restoration/recreation
  - Main goal – ‘floodplain connection’

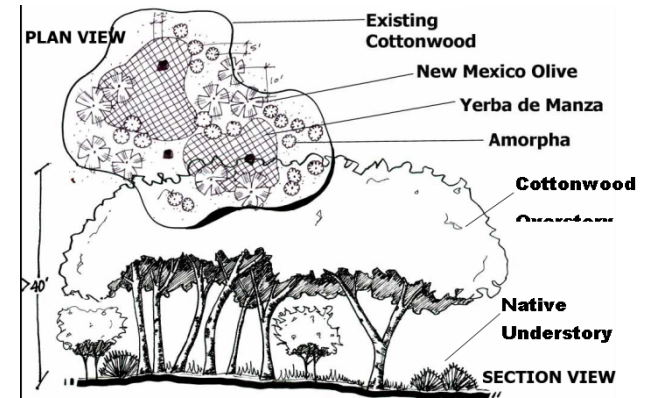
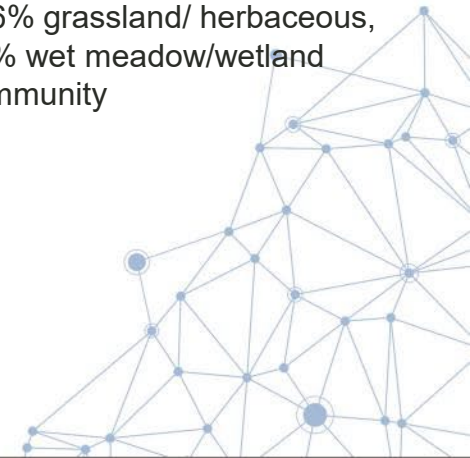


Figure 9. Schematic of a bosque forest



~ 50 % tree community (with  
25% tree/grass;  
25% tree/shrub),  
~30% shrub community,  
~16% grassland/ herbaceous,  
~4% wet meadow/wetland  
community



# Albuquerque Overbank Project - 1998

*First floodplain connection project,  
and with monitoring component*



*Let the river do the work!*

*Bring the bosque to the river*



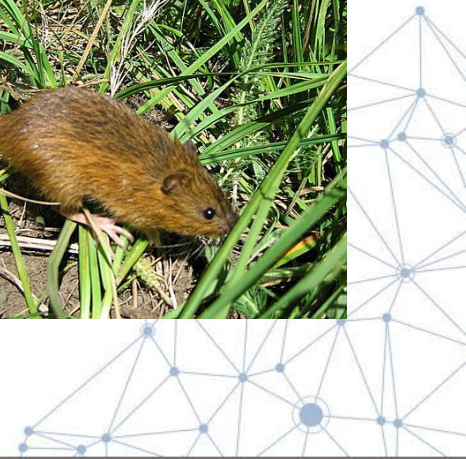
Peak flows: 1998 – 4,060 cfs; 1999 – 4,920  
COA Open Space Division, Reclamation, NHPM  
Long-term monitoring reporting; Muldavin et al.





# Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)

- Established in 2002
- Collaborative forum to support scientific analysis and implementation of adaptive management to benefit listed species within the Program Area
  - 30+ agencies, tribes, non-profits
- Rio Grande silvery minnow
- Southwestern willow flycatcher
- Yellow-billed cuckoo
- New Mexico meadow jumping mouse



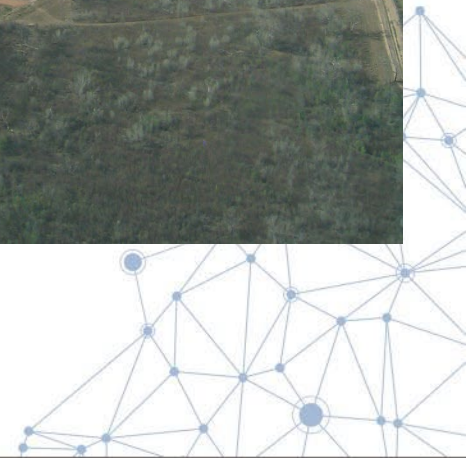


# Los Lunas Habitat Restoration Project – 2002-2003

- April 2000 fire
- MRGESCP – *Reclamation/USACE* leads
- Floodplain connection project
  - Terraces
  - High flow and backwater channels
  - Swales
- Annual monitoring of vegetation, birds, groundwater



2002	2002-09-10	1,770
2003	2003-03-21	1,880
2004	2004-04-03	3,590
2005	2005-06-03	6,780





Construction completed 10/2007



# Albuquerque Bio-Park Environmental Restoration Project



**US Army Corps of Engineers**  
Albuquerque District

**Bohannon & Huston**  
by images plus a division of Bohannon Huston, Inc.







# Rio Grande Nature Center Habitat Restoration Project - 2008

Finished construction before high flow

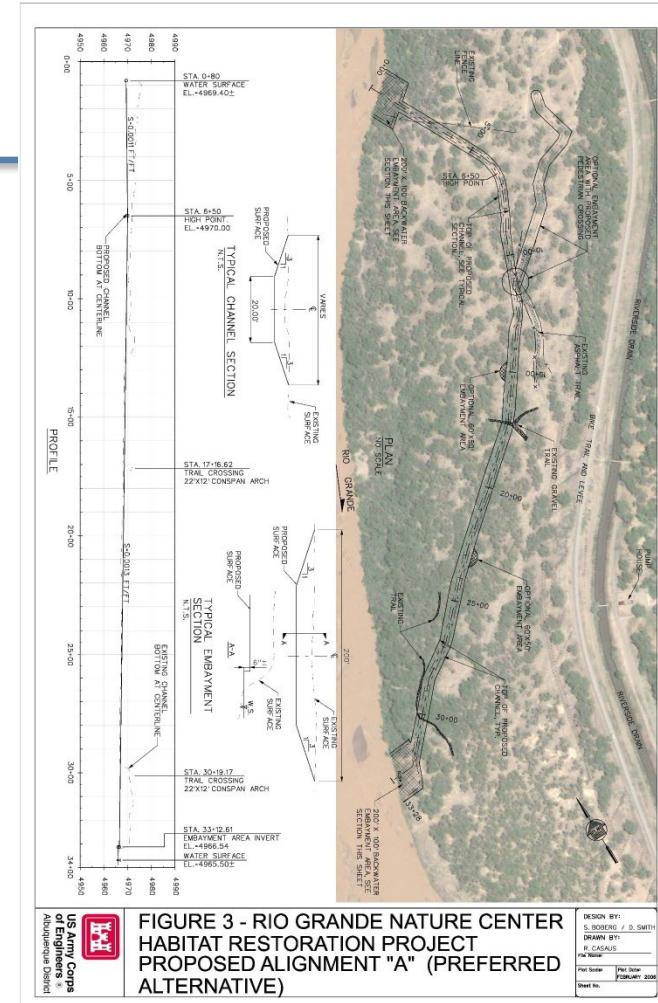


Peak flow:

2008 – 5,400

2009 – 4,940

2010 – 5,140





## Peak flows:

2011 – 2,710

2012 – 2,510

2013 – 4,350

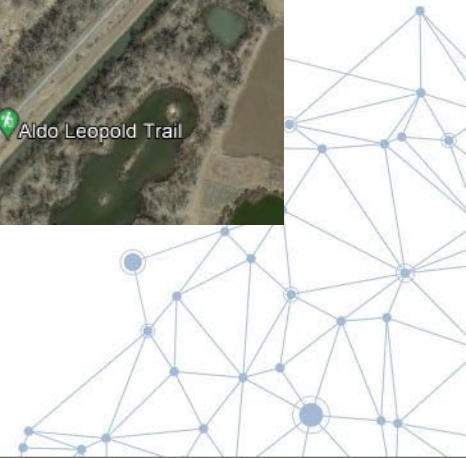
2014 - 3,770



Inlet - 2011



Inlet - 2014





# Lessons Learned, 1998-2008+

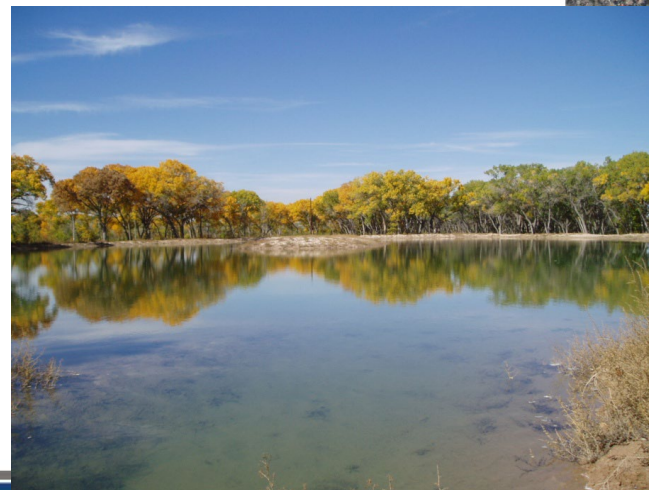
- **High flow channels**
  - Peaks, durations
- **Variable habitat**
- **Floodplain connection  
‘gain’ – sediment  
removal**
- **Maintenance of native  
vegetation**
- **Invasive species  
management**

Water Year	Date	Streamflow (cfs)
1997	1997-06-08	6,270
1998	1998-05-09	4,060
1999	1999-05-28	4,920
2000	2000-08-20	2,040
2001	2001-05-22	4,970
2002	2002-09-10	1,770
2003	2003-03-21	1,880
2004	2004-04-03	3,590
2005	2005-06-03	6,780
2006	2006-07-09	4,030
2007	2007-05-21	3,810
2008	2008-05-25	5,400
2009	2009-04-14	4,940
2010	2010-05-22	5,140
2011	2010-12-17	2,710
2012	2012-08-17	2,510
2013	2013-09-13	4,350
2014	2014-08-02	3,770



# Ecosystem Revitalization @ RT66 - 2010

- Fuel reduction, exotic thinning
- Jetty jack removal
- Start of Floodplain connection components:
  - High flow channel
  - Willow swale construction
  - (still not as much terracing/bank lowering)
- Native Revegetation
- *USACE, MRGCD* sponsor



Revitalization @ Route 66 Project

0 0.25 0.5 0.75 1 Miles  
 Source: Imagery: Geo-Port Area: 2008 MRGCD  
 All Data: 2008 Statewide DOGDC





## Finished construction before 2010 high flow



Peak flows:

**2010 – 5,140**

2011 – 2,710

2012 – 2,510



# Lessons Learned, taken into Middle Rio Grande Restoration Project; 2011-2017

Taking forward design:

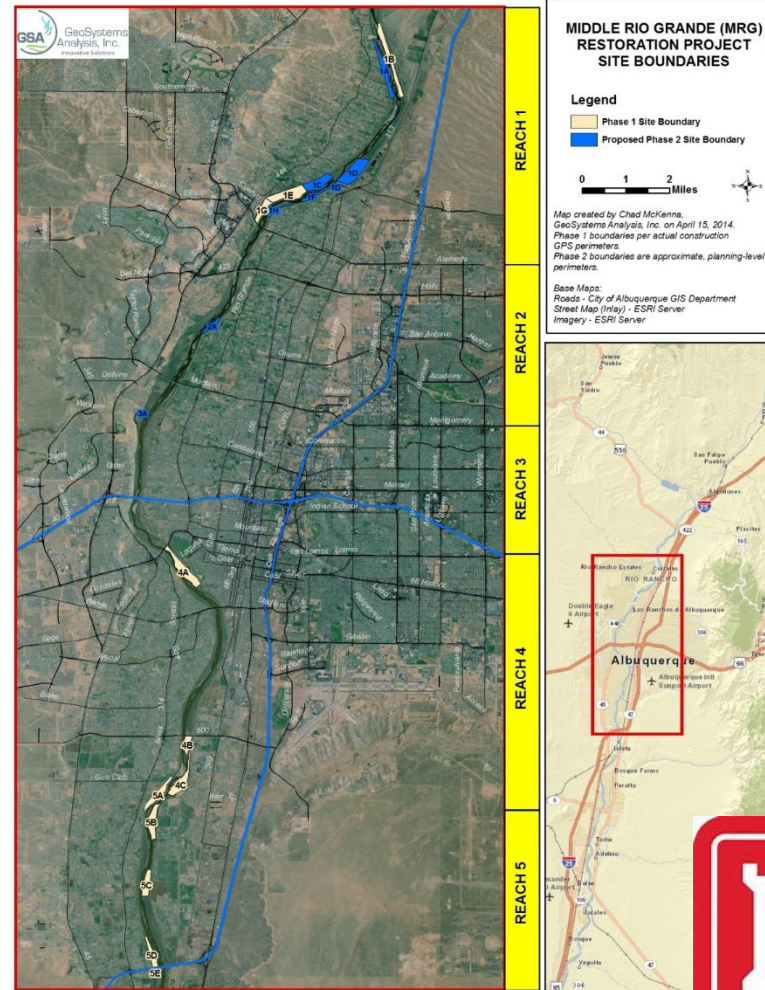
- a) Coordination of previous work and design features
- b) Floodplain connection overall 'gain'; options for managing soil removed
- c) Start of designing for lower flows
- d) Native vegetation options



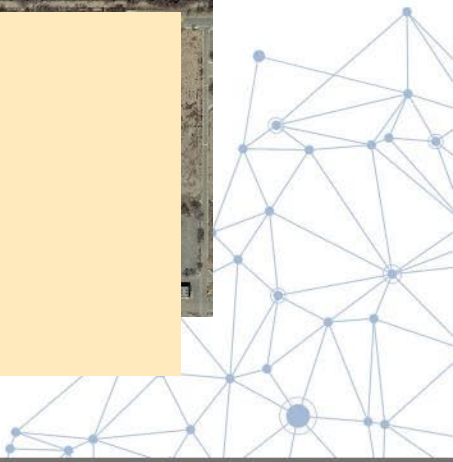


# Middle Rio Grande Restoration Project

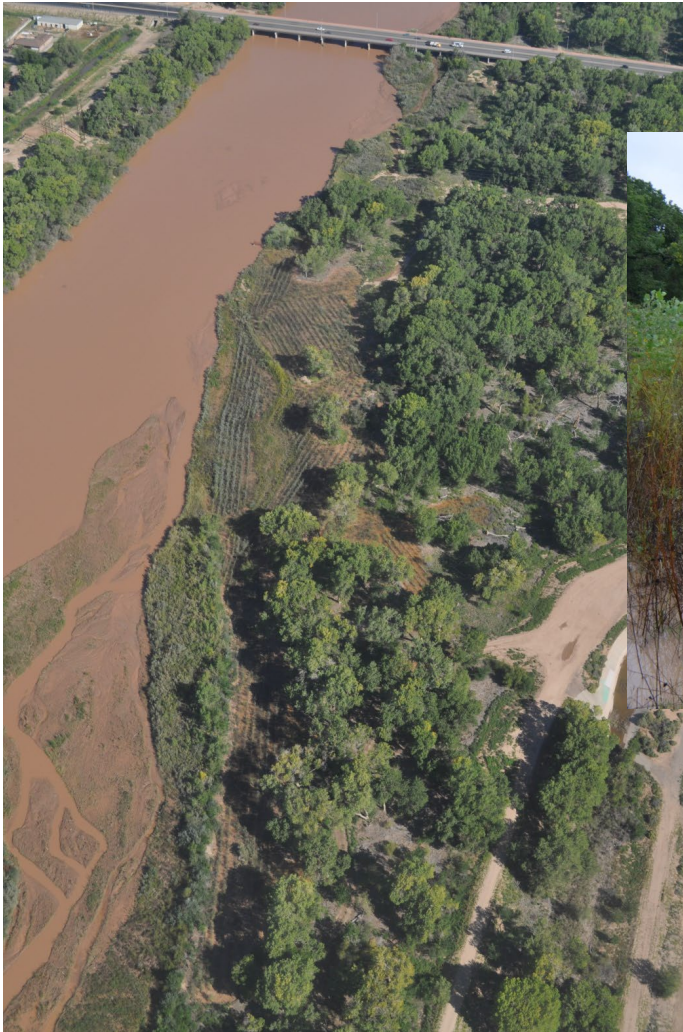
- 916 acres of restoration – floodplain connection focus; coordination with previous efforts
- Phase 1 (~600 acres) **2011-2014**
  - most completed by 2012 (4,350 cfs)
- Phase 2 (~300 acres) **2014-2017**
- Project sponsors:
  - Middle Rio Grande Conservancy District (MRGCD), Pueblo of Sandia, City of Albuquerque
- Other project stakeholders:
  - Village of Corrales
  - U.S. Bureau of Reclamation
  - City of Albuquerque Open Space Division
  - Pueblo of Sandia
- 5 years of follow up monitoring



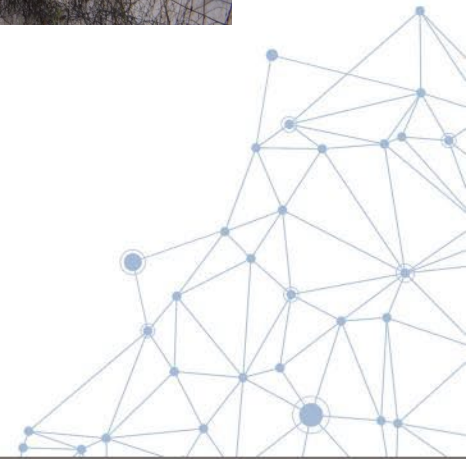
# 4B – Rio Bravo SE





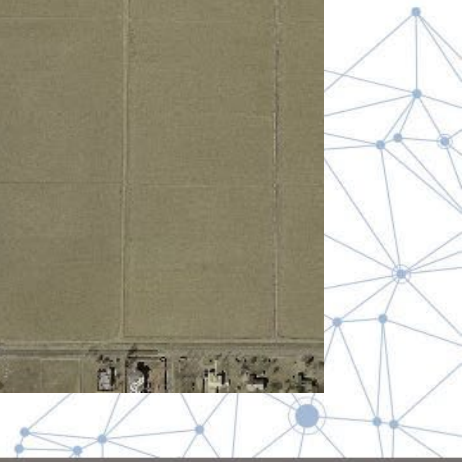
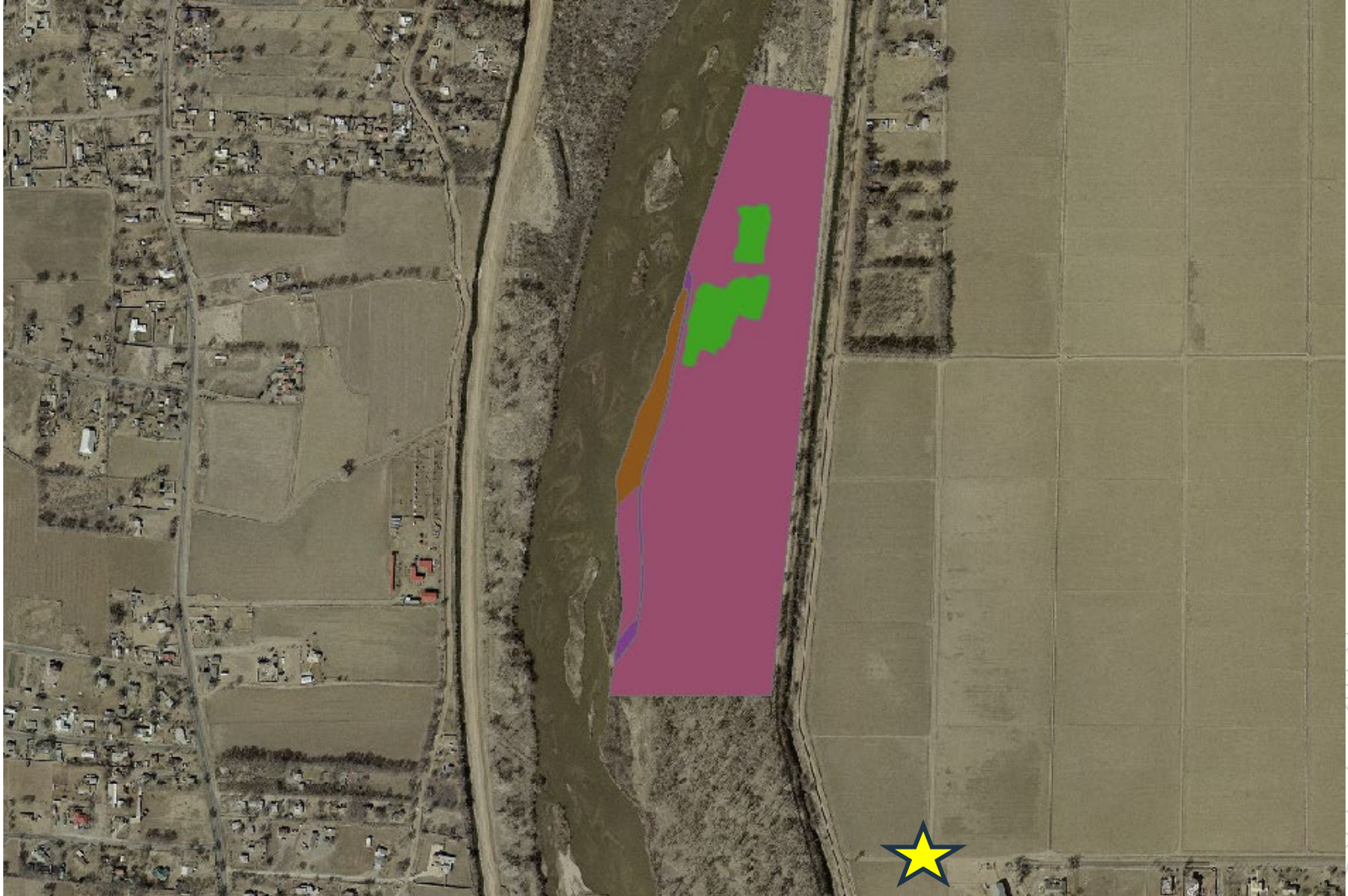


Peak flow:  
2011 – 2,710,  
2012 – 2,510,  
**2013 – 4,250**





# 5C – adjacent to Valle de Oro







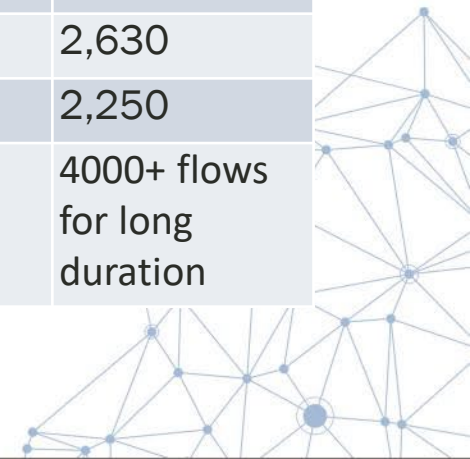
Peak flow:  
2011 – 2,710,  
2012 – 2,510,  
**2013 – 4,250**



# Phase 2 Design

- **Design: 2013-2014**
  - Design flows ~2,500 cfs
- **Implementation: 2014-2017**
- **Sites:**
  - Corrales
  - Pueblo of Sandia
  - San Antonio Oxbow

Water Year	Date	Streamflow (cfs)
2010	2010-05-22	5,140
2011	2010-12-17	2,710
2012	2012-08-17	2,510
2013	2013-09-13	4,350
2014	2014-08-02	3,770
2015	2015-05-27	3,070
2016	2016-06-07	3,950
2017	2017-05-10	5,660
2019	2019-06-18	5,720
2020	2019-22-21	2,630
2021	2021-05-31	2,250
2023		4000+ flows for long duration





# Corrales 1A



April 2016 (June 2016 3,950 cfs)  
cfs

April 2017 - (May 10, 2016 - 5,660)

Excavation quantity - field design change





# MRG Restoration Monitoring

- Avian surveys
- BEMP – Bosque Ecosystem Monitoring Program
- High flow monitoring
- Feature changes – agg/deg; vegetation
- Threatened & Endangered Species:
  - WIFL, RGSM, YBCU
- Vegetation
  - Survival, transects, Hink and Ohmart mapping



**MRG: 5-10 yrs**  
**RT66: 3-5 yrs**  
**MRGESCP**





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# Q&A Discussion



TETRA TECH