

# Welcome!

Thank you for joining us for the **Republican River Basin Annual Meeting**.

Please sign in:

- **In-person attendees:** the sign-in sheet is located on the table near the entrance.
- **Virtual attendees:** Please make sure your name is set as your screen name.

# Republican River Basin-Wide Plan Fifth Annual Meeting

November 15, 2023

Tri-Basin Natural Resources District Offices, Holdrege, NE



# Nebraska Open Meetings Act

## ➤ Location of:

- Open Meetings Act
- Sign-in-Sheets

## ➤ Where meeting was noticed:

- Benkelman Post
- Grant Tribune
- Harlan County Journal
- Holdrege Citizen
- Imperial Republican
- McCook Gazette
- [urnrd.org](http://urnrd.org)
- [dnr.nebraska.gov](http://dnr.nebraska.gov)
- [lnrd.org](http://lnrd.org)
- [mrnr.org](http://mrnr.org)

# Meeting Agenda

Link to Annual Report:  
[rrbwp.nebraska.gov](http://rrbwp.nebraska.gov)

## Fifth Annual Meeting Republican River Basin-Wide Plan

Wednesday, November 15, [2023](#)  
1:00 pm Central Time (12:00 pm Mountain Time)

Tri-Basin Natural Resources District Office  
1723 Burlington Street  
Holdrege, NE  
Virtual participation option via Zoom

### Agenda

1. Welcome and [introductions](#)
  - a. Nebraska Open Meetings Act [requirements](#)
  - b. Review agenda and meeting objectives
  - c. Introductions
2. Plan implementation progress
  - a. Annual Report: Plan Implementation Progress 2022
    - i. Water supplies and uses in the [basin](#)
    - ii. Progress toward goals and objectives of the plan
      1. Management activities
      2. Measurable Hydrologic Objectives (MHOs)
  - b. 5-Year Technical Analysis
  - c. Feasibility and potential impacts of planned projects
  - d. Water market feasibility study
  - e. Drought planning exercise [report](#)
3. Collaboration
  - a. Existing and potential new water conservation programs
  - b. Information sharing about water user management practice [improvements](#)
    - i. Future opportunities to encourage and support water users to share information about management practice [improvements](#)
4. Conflicts Resulting from Implementation of the [Plan](#), if any
  - a. None submitted for [consideration](#)
5. Public comment

# Introductions

# Water Supplies and Uses in the Basin

## ➤Location in Report –

Water Supplies and Uses in the Basin.....	3
Upper Republican Natural Resources District .....	6
Middle Republican Natural Resources District.....	9
Lower Republican Natural Resources District.....	12
Tri-Basin Natural Resources District .....	15
Nebraska Department of Natural Resources .....	18
Augmentation Pumping.....	28

# Water Supplies and Uses – What's Included?

## NRDs

- Allocations
- Annual Groundwater Use for Irrigation
- Conservation and Irrigation Buyout Programs and # of acres involved
- Groundwater Levels and Observation Well Locations
- Curtailment of Groundwater Pumping for Compact Compliance

## Augmentation Pumping

- N-CORPE
- Rock Creek
- Turkey Creek

## NeDNR

- Precipitation
- Streamflow
- Irrigated Acres
- Allocation and Computed Beneficial Consumptive Use (CBCU)
- Reservoir Storage and Evaporation
- Surface Water Municipal and Industrial CBCU
- Qualitative Evaluation of Net Effect of Management Actions for Compact Compliance

# Qualitative Evaluation of Effects of Management Actions for Compact Compliance on Water Users (p. 27)

- In 2022, no management actions taken for 2022 Compact compliance
- Effects of 2022 actions to help with future compliance:

Action	Effect
Enroll or re-enroll landowners in temporary or permanent irrigation decertification programs	Reduce consumptive use of water
Allocations on groundwater use	Reduce consumptive use of water
Water Conservation Incentive Program (TBNRD voluntary allocation program)	Reduce consumptive use of water
Support FCID and NBID to automate canal gates/headgates	Reduce unintended operational spills, increase reliability of surface water supplies, allow more water to be stored in Swanson and Harlan County Lake Reservoirs



# Progress toward Goals and Objectives

## ➤ Location in Report –

Management Activities.....	30
Progress Snapshot.....	32
Progress Summaries.....	39
Assessment of Measurable Hydrologic Objectives (MHOs) .....	62
MHO A Evaluation .....	62
MHO A Assessment Criteria .....	62
MHO A Evaluation Results for 2022 .....	63
Tri-Basin NRD Hydrologically Balanced Assessment Results for 2022 .....	64
MHO B Evaluation.....	66
MHO B Assessment Criteria.....	66
MHO B Evaluation Results.....	66
MHO C Evaluation.....	67
MHO C Assessment Criteria.....	67
MHO C Evaluation Results.....	67
MHO D Evaluation .....	68
MHO D Assessment Criteria .....	68
MHO D Evaluation Results for 2022 .....	68
MHO E Evaluation.....	68
MHO E Assessment Criteria .....	68
MHO E Evaluation Results for 2022.....	69

# Progress Towards Plan Goals and Objective NRD Updates

- URNRD
- MRNRD
- LRNRD
- TBNRD

# Progress Toward Plan Goals and Objectives

## NeDNR Update

- 5-Year Technical Analysis
  - MHOs A-E
  - Lag-time effect
- Water Market Feasibility Study
- Drought Planning Exercise

# 5 Measurable Hydrologic Objectives (MHOs)

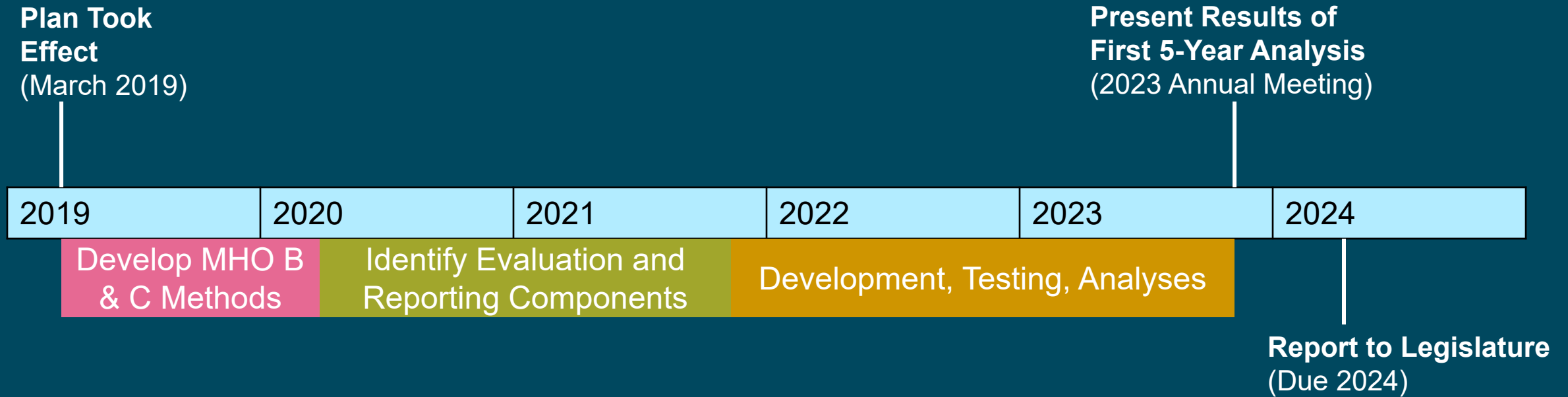
Measurable Hydrologic Objective (MHO)	Evaluation Frequency
<b>MHO A: Maintain each NRD's net groundwater depletions to streamflow within its portion of Nebraska's allowable groundwater depletions to streamflow</b>	<b>Annually</b>
MHO B: Limit groundwater depletions to streamflow to a relatively constant level over the long-term both across the basin as a whole and within each NRD	Every 5 years, beginning in 2023
MHO C: Ensure there is always enough groundwater for all groundwater uses within the timeframe of this plan, either by stabilizing groundwater levels or managing declining groundwater levels	Every 5 years, beginning in 2023
<b>MHO D: Continue existing and initiate new actions that reduce the need for special regulations in the Rapid Response Area for Compact compliance</b>	<b>Annually</b>
<b>MHO E: Continue existing and initiate new actions that reduce the need for administration of surface water use for Compact compliance</b>	<b>Annually</b>

# 5-Year Technical Analysis

# 5-Year Technical Analysis

Requirement from Statute
Available supplies, current uses, and changes in long-term water availability
Effects of conservation practices and natural causes including, but not limited to, drought
Effects of the plan in sustaining a balance between water uses and supplies

# 5-Year Technical Analysis – Timeline



# First Five-Year Technical Analysis for the Republican River Basin-Wide Plan



# Purpose and Overview

- **Completed required evaluation of progress toward achieving plan goals/objectives**
- **Evaluated effects of conservation practices, natural causes, plan implementation**
- **Completed required five-year analyses (MHOs B/C, Action Item 2.5.2)**
- **Determined if the plan needs to be updated to meet its goals/objectives**

# Measurable Hydrologic Objectives (MHOs)

- Objective indicators of hydrological status
- Used as a benchmark of progress
- Each MHO has evaluation requirements
- Actions triggered by not meeting an MHO
- Five MHOs under the plan (A-E)

# MHO A

- **“Maintain each NRD’s net groundwater depletions to streamflow within its portion of Nebraska’s allowable groundwater depletions to streamflow”**
- **Allowable net depletions are defined in IMPs**
- **Net depletions must remain under this limit during an averaging period**








# MHO A Results (URNRD, MRNRD, LRNRD)

Key to Possible Test Results		Year	URNRD	MRNRD	LRNRD
<div><div><div></div></div><div>MHO is being achieved. NRD’s actual depletions were within its allowable depletions. No further discussion is needed.</div></div> <div><div><div></div></div><div>MHO is not being achieved. NRD’s actual depletions exceeded its allowable depletions. Discussion of next steps is required.</div></div>	2019	<div><div></div></div>	<div><div></div></div>	<div><div></div></div>	
	2020	<div><div></div></div>	<div><div></div></div>	<div><div></div></div>	
	2021	<div><div></div></div>	<div><div></div></div>	<div><div></div></div>	
	2022	<div><div></div></div>	<div><div></div></div>	<div><div></div></div>	

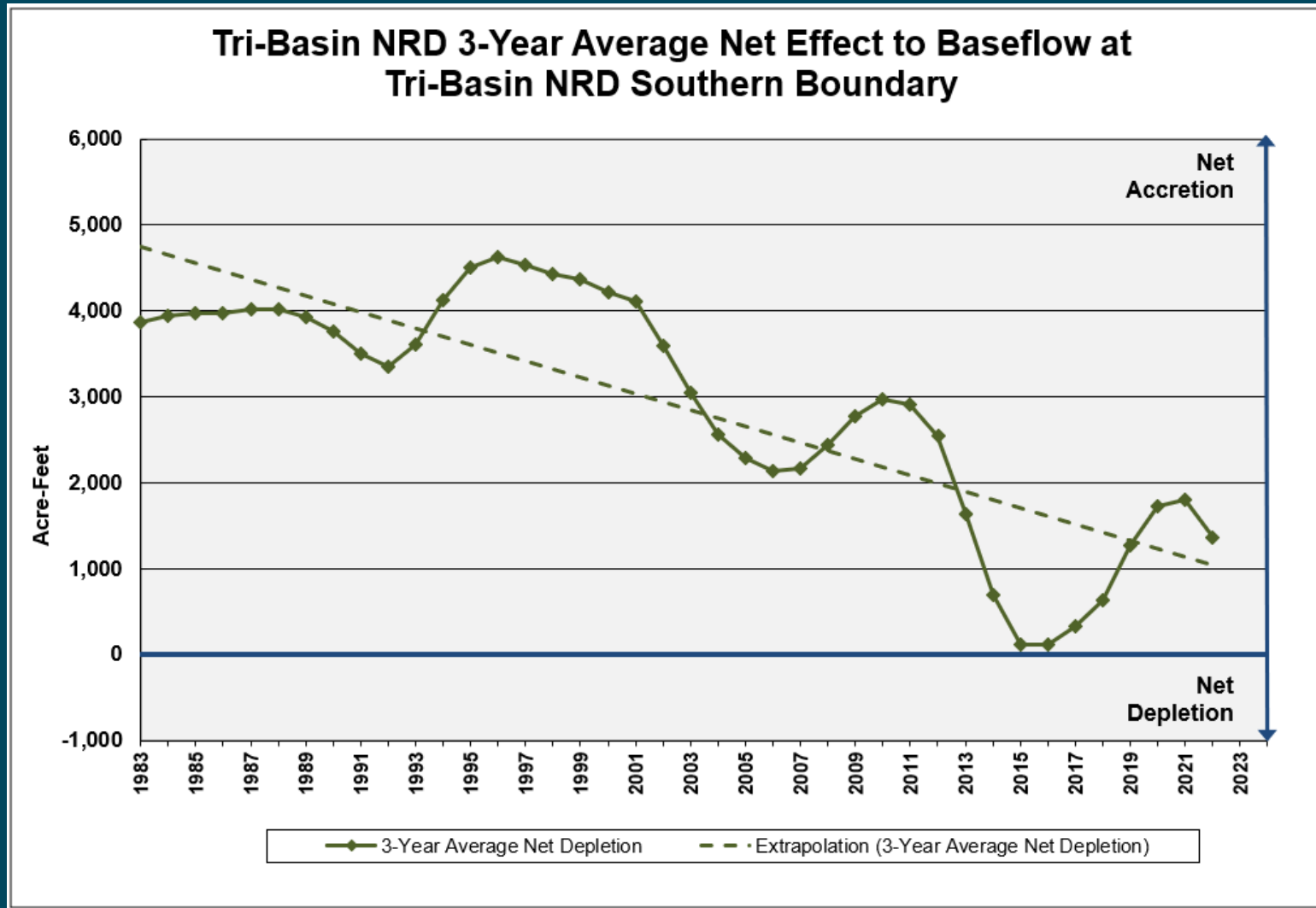
# MHO A Results (URNRD, MRNRD, LRNRD)

	Difference between allowable depletions and actual groundwater net depletions (acre-feet)		
Year	LRNRD	MRNRD	URNRD
2018	540	-1,919	2,922
2019	40,262	46,951	65,758
2020	14,844	28,487	26,335
2021	2,229	12,180	12,577
2022	-6,947	2,063	-7,059
5-year average (2018–2022)	10,185	17,552	20,106
5-year average positive?	Yes	Yes	Yes

# MHO A Results (TBNRD)

Key to Possible Test Results		Year	TBNRD
 In compliance with IMP. On a three-year rolling average basis, depletions from groundwater pumping did not exceed accretions from the mound.  Caution. On a three-year rolling average basis, depletions from groundwater pumping exceeded accretions from the mound.  Insufficient management actions were taken in evaluation year to offset net depletions from previous year's assessment.		2019	
		2020	
		2021	
		2022	

# MHO A Results (TBNRD)









# MHO B

- **“Limit groundwater depletions to streamflow to a relatively constant level over the long-term both across the basin as a whole and within each NRD”**
- **Depletion values analyzed using the Mann-Kendall Trend Test**
- **TBNRD depletions are evaluated including a groundwater “Mound Credit”**

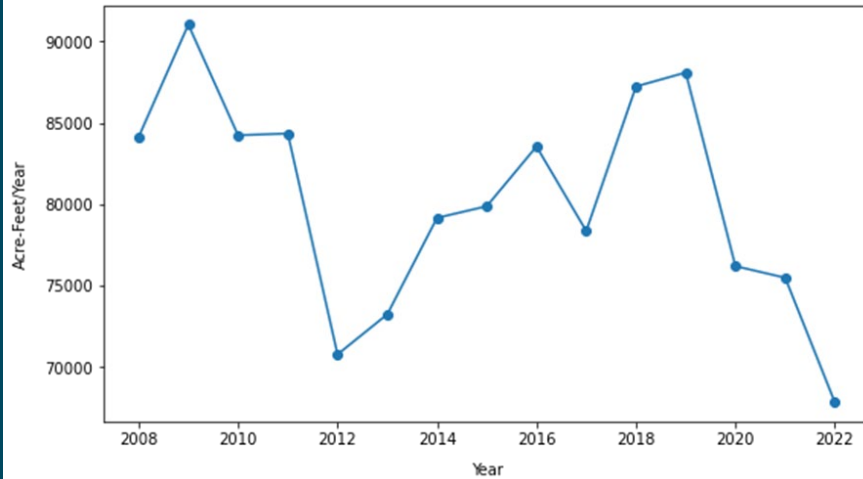


# MHO B Results

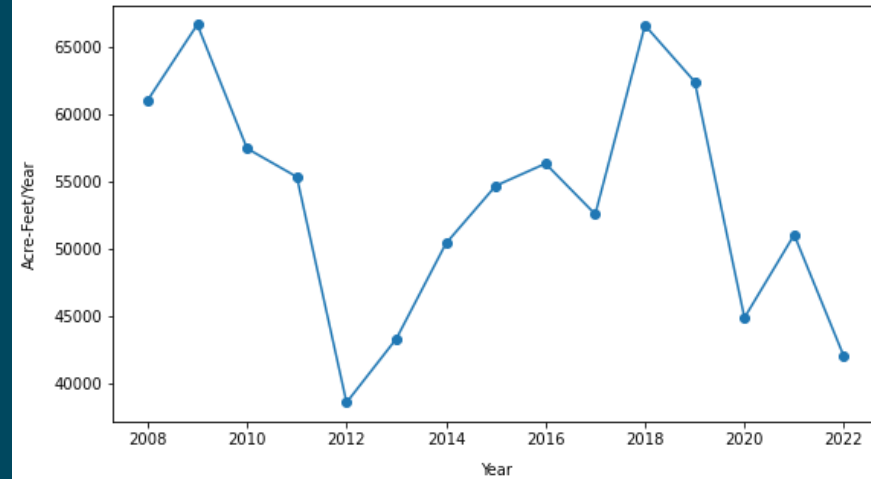
MHO B Test Results				
<div> MHO is being achieved. No trend or statistically significant decrease in depletions was observed for unmodified and all three categories of decorrelated depletions.</div> <div> Caution. A statistically significant increase in unmodified or at least one of the three categories of decorrelated depletions was observed. Further investigation is needed.</div>				
URNRD	MRNRD	LRNRD	TBNRD	
				

# MHO B Results

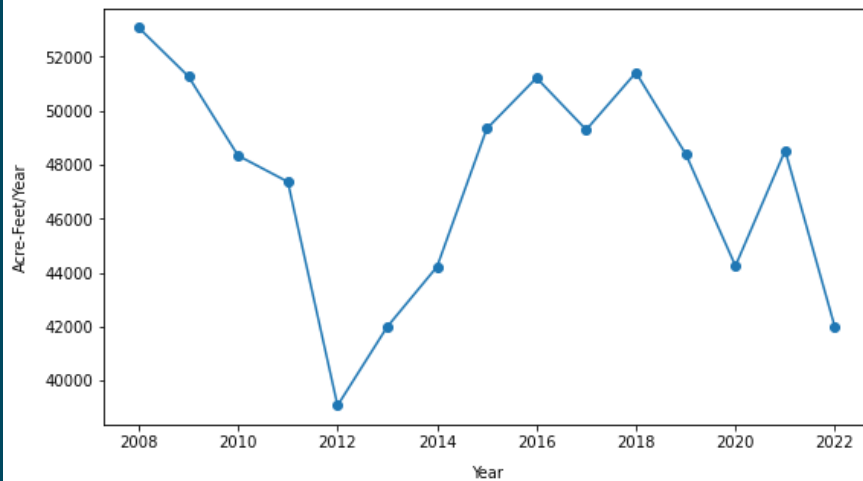
URNRD depletions AF/year (2008 – 2022)



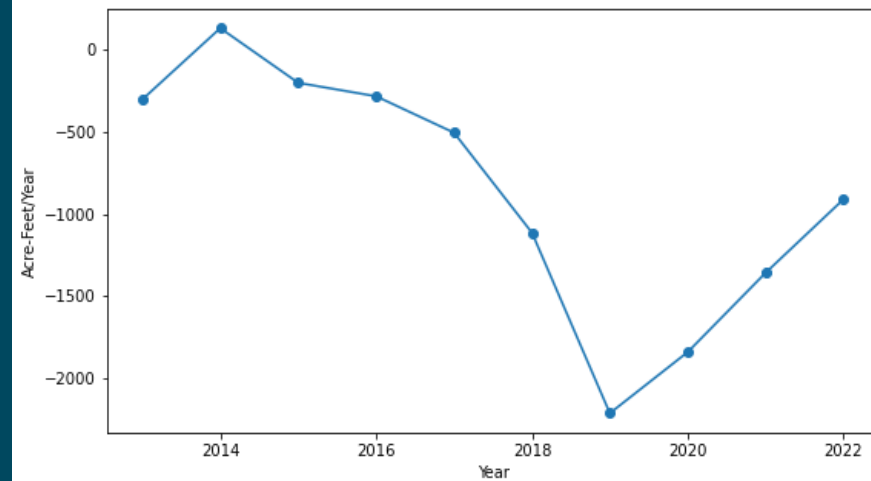
MRNRD depletions AF/year (2008 – 2022)



LRNRD depletions AF/year (2008 – 2022)



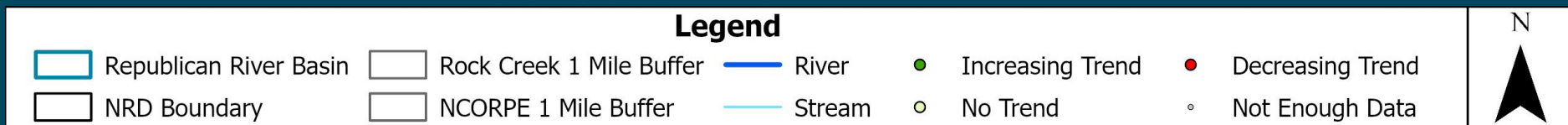
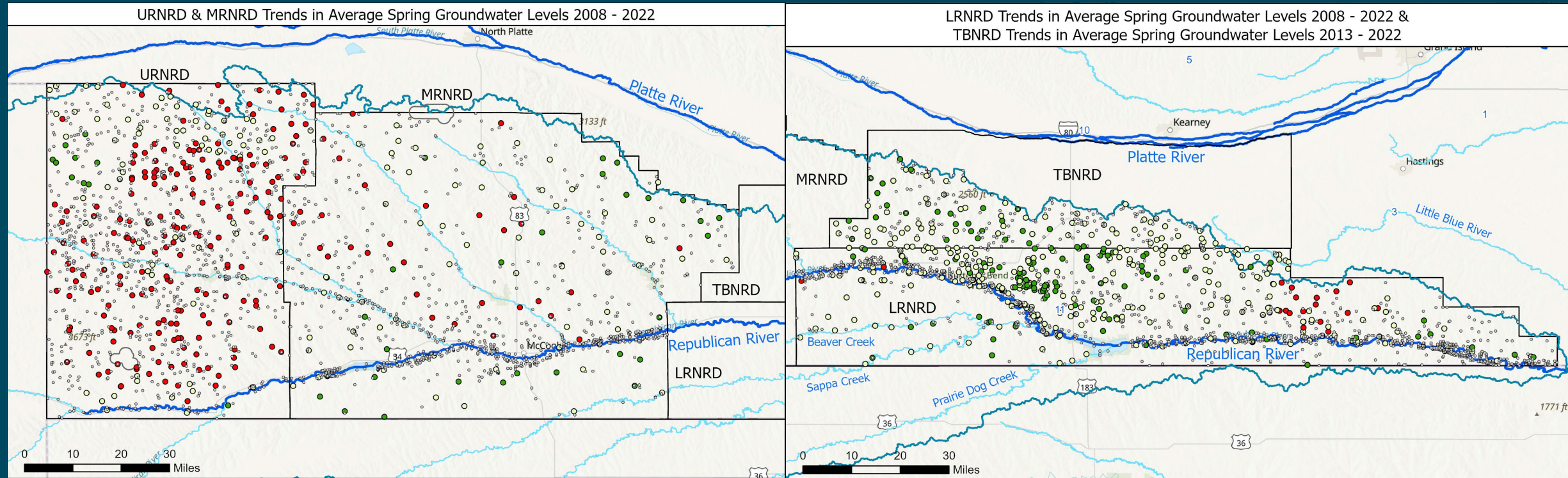
TBNRD depletions AF/year (2013 – 2022)



# MHO C

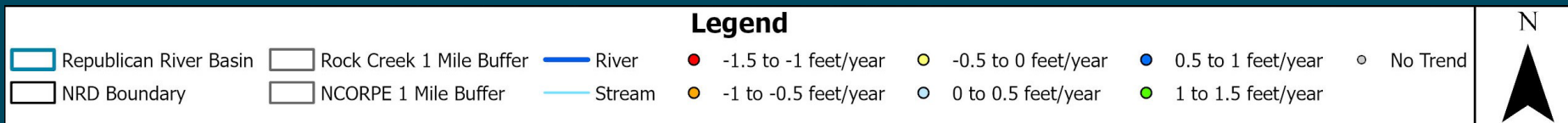
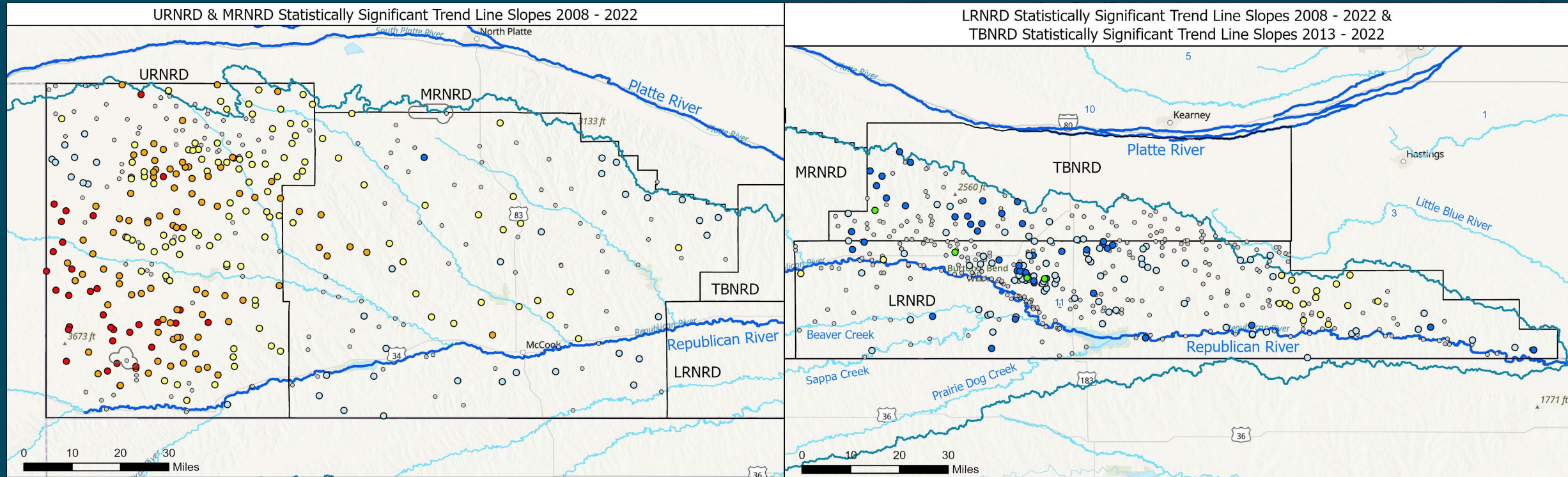
- **“Ensure there is always enough groundwater for all groundwater uses within the timeframe of this plan, either by stabilizing groundwater levels or managing declining groundwater levels”**
- **Spring groundwater levels assessed using Mann-Kendall Trend Test**
- **Areas near N-CORPE and Rock Creek excluded from analysis**

# MHO C Results

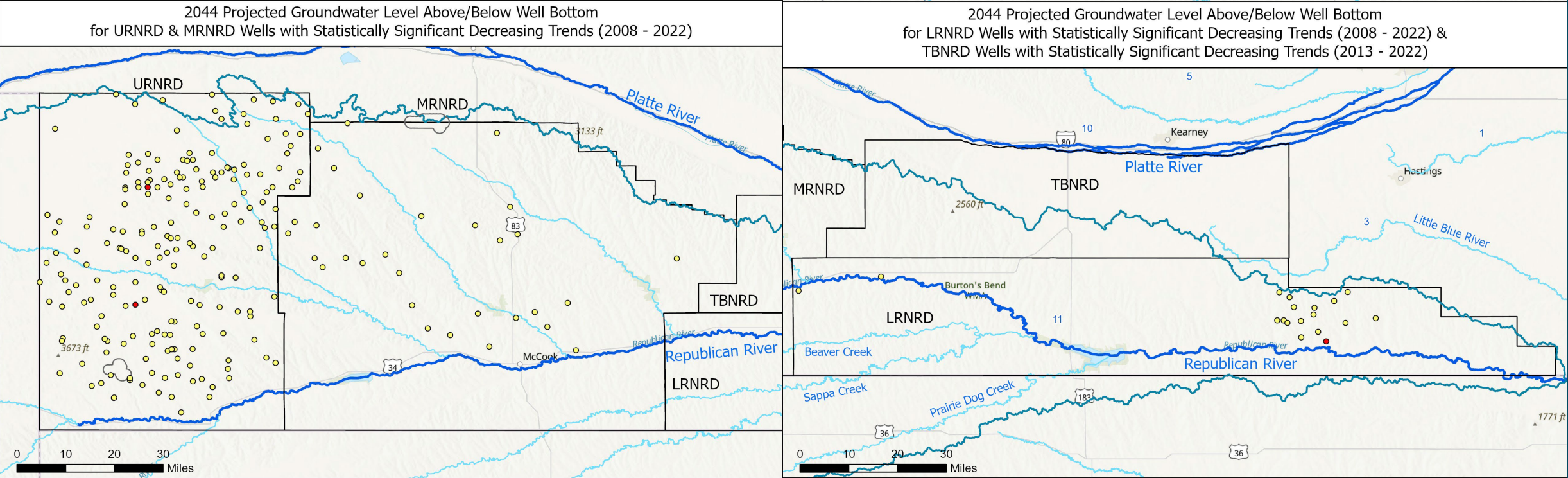




# MHO C Results



# MHO C Results

















# MHO D

- **“Continue existing and initiate new actions that reduce the need for special regulations in the Rapid Response Area for Compact compliance”**
- **Rapid Response Area curtailment of pumping**
- **TBNRD does not have a Rapid Response Area**



# MHO D Results







Key to Possible Test Results		Year	URNRD	MRNRD	LRNRD
	MHO is being achieved. NRD did not curtail groundwater pumping within the Rapid Response Area to ensure Compact compliance. No further discussion needed.	2019			
		2020			
	MHO is not being achieved. NRD curtailed groundwater pumping within the Rapid Response Area to ensure Compact compliance. Discussion of next steps is required.	2021			
		2022			



# MHO E

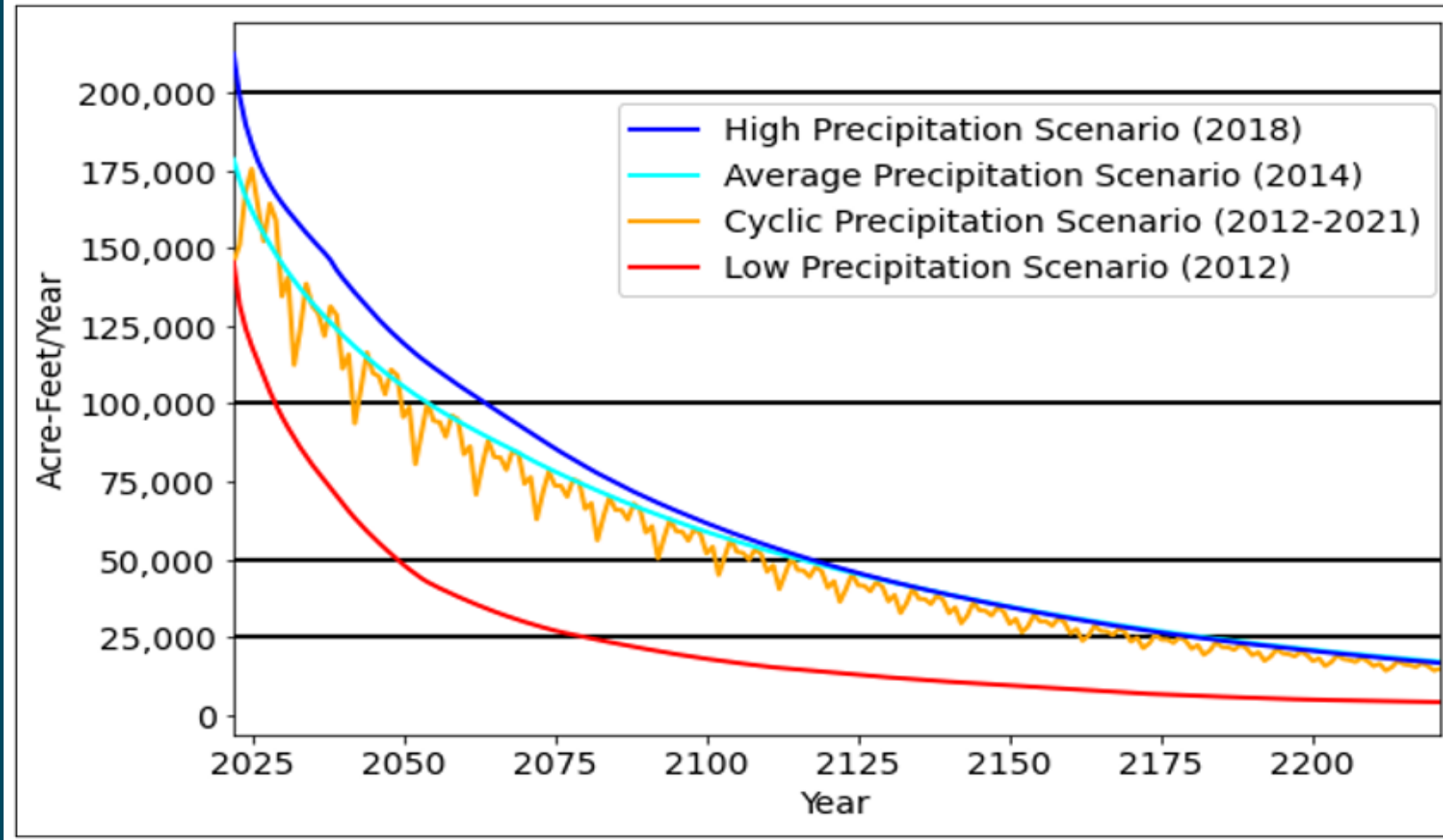
- **“Continue existing and initiate new actions that reduce the need for administration of surface water use for Compact compliance”**
- **Any administration automatically triggered under terms of FSS is not included**

# MHO E Results

Key to Possible Test Results		Year	Result
	MHO is being achieved. NeDNR did not administer surface water to ensure Compact compliance, except as required under the FSS. No further discussion needed.	2019	
		2020	
	MHO is not being achieved. NeDNR administered surface water to ensure Compact compliance. Discussion of next steps is required.	2021	
		2022	

# Analysis of Streamflow Depletion Lag Time

Graph showing simulated lagged groundwater depletions to streamflow (acre-feet) per year (2022-2221) for the four simulation scenarios.



# Available Water Supplies

- **Water supply limited by Nebraska's Allocation under the Compact**
- **Allocation is a sum of subbasin water supplies**
- **Subbasin water supplies are computed by adding consumptive use to measured streamflow**

# Available Water Supplies

Year	Allocation (Col 1)	Computed Beneficial Consumptive Use (Col 2)	Imported Water Supply Credit and NERWS (Col 3)	Difference between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit and NERWS Credit Col 1 – (Col 2- Col 3)
<b>2018</b>	241,680	266,080	25,943	1,543
<b>2019</b>	389,300	262,870	26,541	152,971
<b>2020</b>	303,070	252,400	18,995	69,665
<b>2021</b>	258,180	252,650	21,456	26,986
<b>2022</b>	221,860	249,960	16,157	-11,943
<b>Average 2018-2022</b>	282,820	256,790	21,820	47,840

# Current Water Uses

- **Groundwater pumping for irrigation and municipal use**
- **Surface water irrigation**
- **Reservoir evaporation**

# Current Water Uses

Year	Surface Water CBCU (SW CBCU) – Irrigation & Canal Losses	SW CBCU – Non-Federal Reservoir Evaporation	SW CBCU – Federal Reservoir Evaporation	SW CBCU – Total	Total Groundwater CBCU
2018	29,948	1,181	12,603	43,733	222,338
2019	29,727	1,003	15,789	46,519	216,337
2020	39,299	2,695	31,371	73,365	179,049
2021	39,825	1,940	19,606	61,370	191,285
2022	46,522	3,518	35,700	85,740	164,197

# Changes in Long-Term Water Availability

- **No definitive/measurable trends in overall long-term water availability in Basin were identified**
- **Conservation and efficiency projects will continue to improve long-term availability of water**
- **Appears to be downward trend in Tri-Basin mound accretions**



# Effects of Conservation Practices

- Literature on conservation practices and their general impacts on streamflow was reviewed is first step for five-year technical analysis and to fulfill Action Item 2.5.1
- Includes general overview of each practice, conservation benefits, impacts on surface water and groundwater supply, and associated trade-offs
- There are trade-offs between short-term and long-term streamflow impacts for many practices such as conservation tillage

# Conservation Programs Implemented During Analysis Period

- **Voluntary irrigation reduction programs**
- **Improved efficiency with remote sensing**
- **Canal control and efficiency improvements**
- **Conjunctive management projects such as N-CORPE**
- **Aquifer mapping and modeling**

# Voluntary Irrigation Reduction – CREP, WCIP, Voluntary Decertification

Year	URNRD Acres Enrolled in CREP	MRNRD Acres Enrolled in CREP	LRNRD Acres Enrolled in CREP	TBNRD Acres Enrolled in CREP	Total Estimated Water Savings (acre-feet)
2019	10,499	12,310	6,644	2,329	16,787
2020	10,589	16,559	8,382	2,201	36,742
2021	8,970	14,842	6,724	1,910	28,720
2022	8,630	14,555	6,975	1,742	39,336

Year	TBNRD Total Acres Enrolled WCIP	Estimated Water Savings (acre-feet/year)
2019	1,450	121
2020	1,445	121
2021	1,579	132
2022	2,114	176
Total		550

NRD	Voluntarily Decertified Acres 2019-2022	Estimated Water Savings (acre-feet)
URNRD	2,639	40,572
MRNRD	408.3	5,646

# Improved Efficiency - Remote Sensing

NRD	Projects 2019-2022	Estimated Water Savings
URNRD	Remote Monitoring and Soil Moisture Probe Programs	29,133 AF/year <sup>1</sup>
MRNRD	Phase 1 and 2 Remote Meter and Irrigation Conservation Project	10,396 AF/year <sup>2</sup>

1. Combined estimated values from URNRD's Water Sustainability Fund (WSF) grant applications.
2. Combined estimated values from MRNRD's USBR WaterSMART grant applications.



Photo of digital meter and radio module from URNRD WSF application.

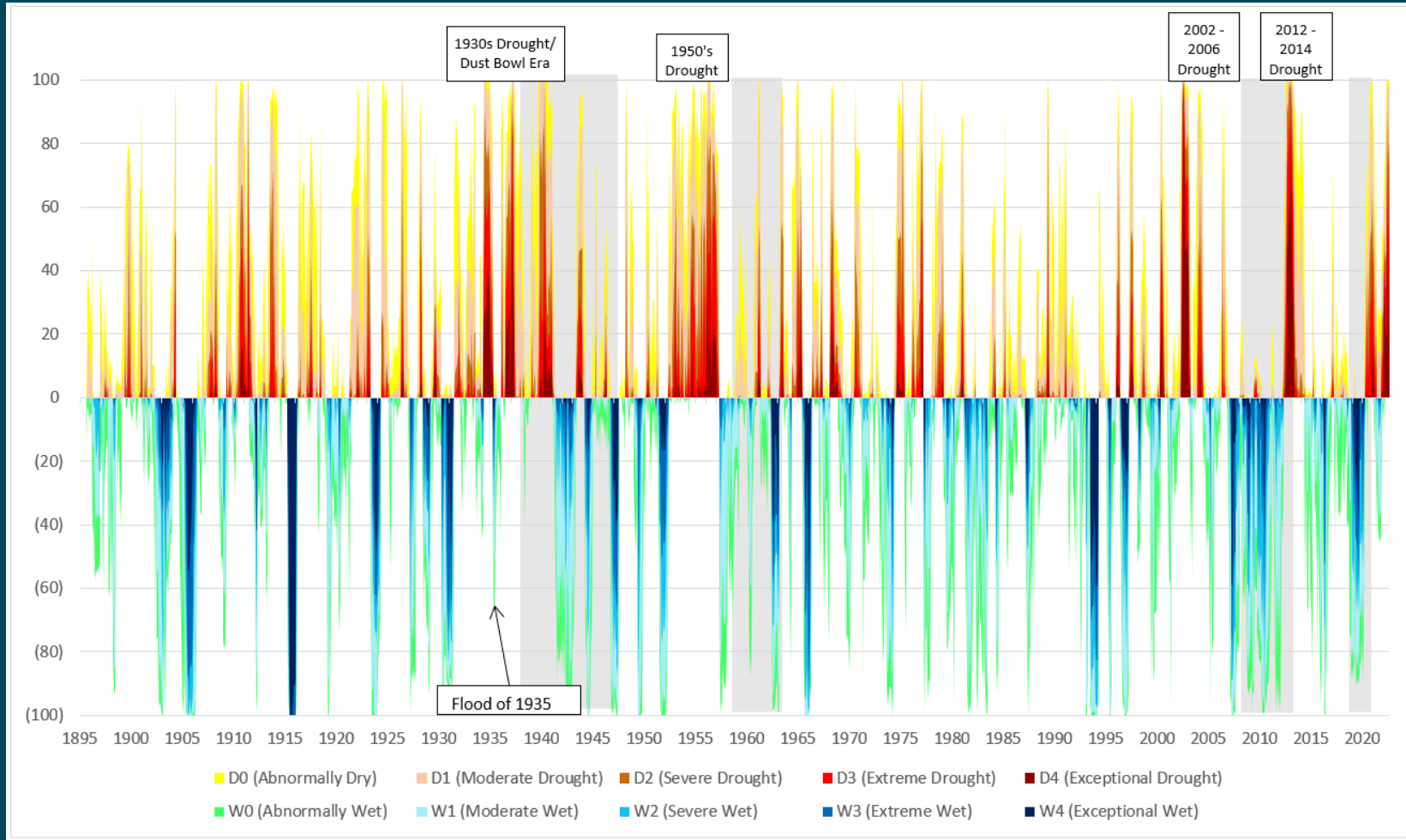
# Canal Control and Efficiency Improvements

Irrigation District/NRD	Projects with Matching State Funds 2019 – 2022	Estimated Water Savings
<b>FCID</b>	Canal Efficiency Improvements, Phase 2 Rubicon Gates	3,673 AF/year <sup>1</sup>
<b>NBID</b>	Superior and Courtland Canal Automation, Superior Canal Delivery Efficiency Improvement	4,406 AF/year <sup>2</sup>

1. Combined estimated values from FCID's Canal Efficiency Improvement's USBR WaterSMART grant application and Phase 2 Rubicon Gates WSF application.

2. Combined estimated values from NBID's Superior and Courtland Canal Automation and Superior Canal Delivery Efficiency Improvement USBR WaterSMART grant applications.

# Effects of Natural Causes



- Basin affected by cycles of drought and flood
- Average expected to be drier in the future
- There was great variation in precipitation during the analysis period

# Effects of the Plan on Water Balance

- **Plan implementation has been successful in maintaining Compact compliance**
- **Nebraska is maximizing beneficial use of available water to the greatest practical extent**
- **Water savings from various basin programs will create a more stable supply of water over time**

# Progress Made Under the Plan

- **Nebraska maintained Compact compliance throughout the analysis period**
- **No management actions or offsets were needed to maintain Compact compliance**
- **All projects in the basin were evaluated for hydrologic and economic feasibility and practicality**



# Feasibility & Potential Impacts of Planned Projects

- Platte Republican Diversion Application – TBNRD
- NBID Superior Canal Project – LRNRD
- NRCS Watershed Grants & Flag Creek Project – LRNRD

# Feasibility Analysis of Water Markets in the Republican River Basin

# Background

- **Objective 2.6 “Evaluate the feasibility and potential outcomes of establishing water markets in the Basin”**
- **Action Item 2.6.1: Cooperate in determining the feasibility of water markets in the Basin**
- **Action Item 2.6.2: Following the water markets feasibility analysis (Action Item 2.6.1), test conclusions through implementation of a water market program in a pilot area, if feasible.**

# What is a Water Market?

- **Trading platform for SW or GW rights**
- **Trades can be short-term, medium-term, or permanent**
- **Can be complicated to design, especially at scale**

# Conditions for Water Market Feasibility



Harlan County Dam Spillway

# Severity of Water Risk

- **Drought cycles create water risk**
- **Risk to supply creates demand for water rights**
- **Curtailment is common in fully appropriated systems**
- **Compact compliance obligations can pose a water risk**

# Legal Readiness

- **Water markets cannot exist unless allowed by laws and statutes**
- **NRDs have their own rules and regulations to follow**
- **There are limitations on the creation or transfer of SW rights in the Basin**

# Administrative Readiness

- Regime for monitoring and enforcing water use rights
- A water market would require resources devoted to reviewing and approving transfers
- There is good administration in the Republican River Basin



# Heterogeneity of Water Values

- **Difference in water values between users drives demand**
- **Similar crop types are less likely to incentivize trade**
- **Annual vs perennial crops**
- **Lack of spare water (hardened demand) makes trading less desirable**

# Infrastructure Readiness

- Comprehensive and efficient distribution is needed
- New construction is slow and costly
- GW users need to have the wells in place to trade allocations

# Stakeholder Survey



# Survey Results

- **55% were not willing to support a potential water market**
- **35% were willing to support a potential water market**
- **10% were unsure**

# Survey Results

- **50% believed a water market would increase water consumption**
- **50% believed a water market would have no effect on water consumption**
- **0% believed a water market would decrease water consumption**

# Respondent Comments

- **Pointed out constraints such as water right's attachment to land parcels**
- **Said potential market should be transparent to public**
- **Valued preventing injury to other water users**
- **Emphasized voluntary participation**

# Survey Conclusion

- **Majority of respondents were unwilling to support a water market**
- **No respondents believed a water market would reduce consumption**
- **Respondents expressed a variety of concerns over feasibility and legality**

# Examples of Real-World Water Markets



Murray River, Australia



# Central Platte NRD Groundwater Exchange Program, Nebraska

- **Piloted in 2016**
- **Consultant was hired to create virtual trade clearinghouse based on NRD rules for transfers**
- **Discontinued due to lack of interest**

# Diamond Valley Groundwater Market, Nevada

- **Exists in closed basin, small aquifer**
- **Severe depletions have created crisis over GW pumping**
- **Market created as alternative to curtailment**
- **Encountered but overcame lengthy legal challenge**

# Murray-Darling Basin, Australia

- Large integrated water market in southeast Australia
- Water rights are highly severed from land rights
- Scarcity created incentive to use any available right, increasing consumption
- Has been likened to a “stock market” for water

# Conclusion

- **Piloting a water market does not appear feasible**
- **Small, informal markets already exist**
- **Basin is lacking some key factors for feasibility**
- **Stakeholders did not express adequate interest**

# Drought Planning Exercise Report

# Basin-Wide Plan Action Item 2.8.1

## Republican River Basin-Wide Plan

Jointly developed by the Upper Republican, Middle Republican, Lower-Republican, and Tri-Basin Natural Resources Districts and the Nebraska Department of Natural Resources

2019



### Action Item 2.8.1 Organize and participate in a basin-wide drought planning exercise

NeDNR and the NRDs will organize and participate in a drought planning exercise for the Basin. A drought planning exercise is a workshop or other activity that brings together parties with expertise in various aspects of droughts to plan and prepare for managing drought. Some areas of focus for this exercise will be:

- Increasing understanding of the needs for and logistics of storing water for use during a drought,
- Evaluating existing and potential new management actions to determine the long-term availability trends that provide carry-over storage to meet crop-water needs during drought, and
- Developing metrics that could be used to evaluate whether conservation of water for future use during a drought is successful.

For the purposes of this action item, "storage" includes both surface water storage and aquifer storage. This exercise will support the evaluation of whether Plan revisions related to conserving water for a drought are needed (Action Item 2.8.2).

# 2022 Findings, Outcomes and Recommendations

## ➤ Findings:

- Existing policy (Compact, Basin-Wide Plan, Integrated Management Plans, etc.) appears to be adequate for managing water quantity
- Drought happens. We should plan for it instead of treating it like a disaster.
- Communication is important.
  - Who needs to be talking with whom?
  - How is information disseminated to the public?

## ➤ Outcomes:

- Many outcomes are yet to be realized.
- The drought planning exercise started a conversation about Statewide drought plan.

# Recommendations

- Develop a drought plan consisting of:
  - A phone tree to improve communication and coordination
  - A dashboard to provide access to real-time drought conditions, including Republican Basin-specific information for Compact Call Years, water-short years, etc.
  - A wish list of projects and initiatives to proactively or reactively prevent or minimize damage caused by drought



# Existing and Potential New Water Conservation Programs

# Republican River NRD acres that are purchased or leased and can no longer be irrigated, 2022 \*

NRD	CREP *	NRD/WRCF	Other Buyout Programs
Upper Republican NRD	8,630.23	2,824	0
Middle Republican NRD	14,554.92	0	0
Lower Republican NRD	6,975.43	0	4,999.12
Tri-Basin NRD	1,742.15	0	12.6

CREP \* = Cooperative Reserve Enhancement Program (as of 9/30/2022)

NRD/WRCF = Permanent irrigation buyout program jointly funded by the NRD and Water Resources Cash Fund (NeDNR)

# Tri-Basin Water Conservation Incentive Program (WCIP)

Discussion: Future Opportunities to encourage & support water users to share information about management practices.

# Conflicts Resulting from Plan Implementation

- Appendix E: Procedures for Addressing Conflicts Resulting from Implementation of the Republican River Basin-Wide Plan
- No conflicts submitted for consideration.

# Public Comment