

SPNRD 2023 Robust Review

March 13, 2024



Presentation Overview

- Integrated Water Management Overview
- Robust Review Analysis
 - Introduction
 - Updates to Model
 - SPNRD Model Inputs
 - SPNRD Results
- Path Forward



Integrated Water Management Overview

IWM – Overview

Statutes

- *Nebraska Revised Statute* § 46-713(3): A river basin, subbasin, or reach shall be deemed fully appropriated if
- Current uses of hydrologically connected surface water and ground water... will cause insufficient streamflow / surface water supply for:
 - (a) existing surface water appropriations,
 - (b) dependent wells, or
 - (c) noncompliance with an interstate compact, decree, agreement, or applicable state or federal laws



IWM – Overview

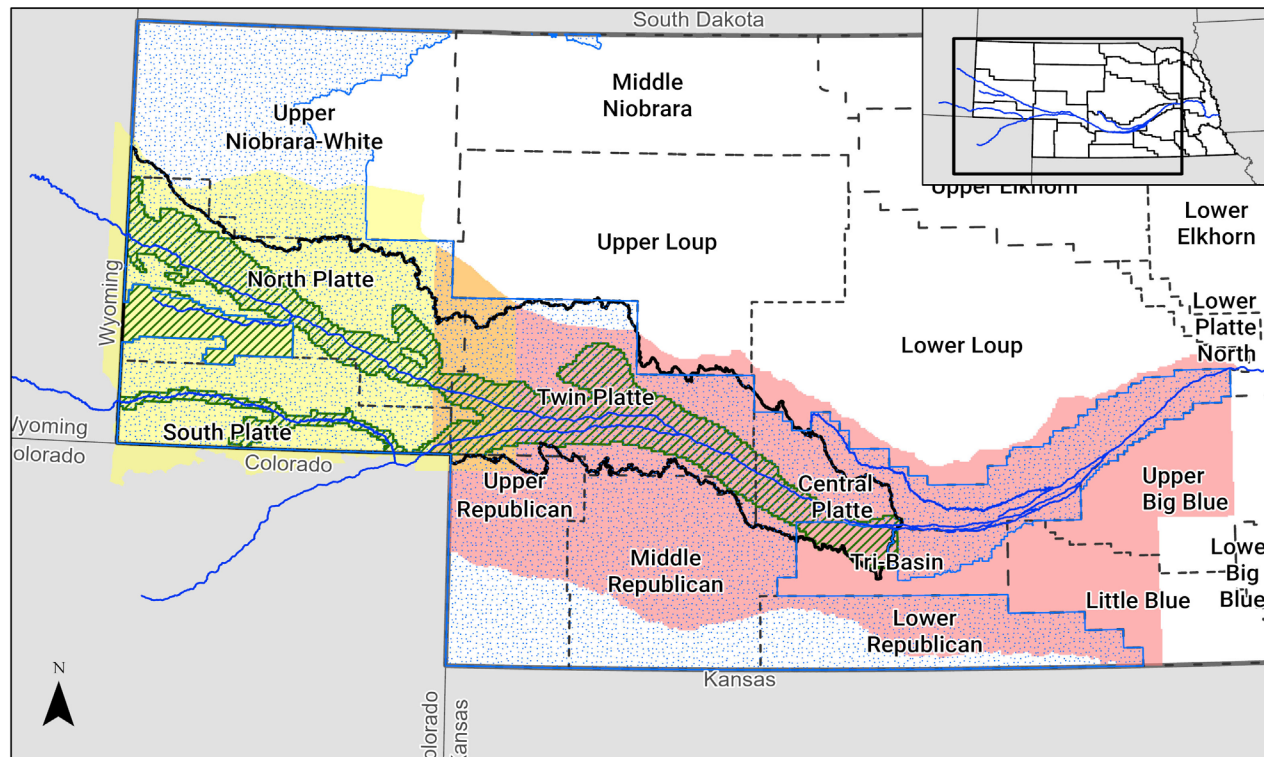
Statutes

- *Nebraska Revised Statute § 46-713(4)(a)*: A river basin, subbasin, or reach shall be deemed overappropriated if
- Subject to an interstate cooperative agreement
 - and, the NeDNR has declared a moratorium on new surface water appropriations
 - and has requested each NRD
 - To close the issuance of additional water well permits
 - Or to temporarily suspend the drilling of new water wells



IWM - Overview

Fully and Overappropriated Areas within Model Area

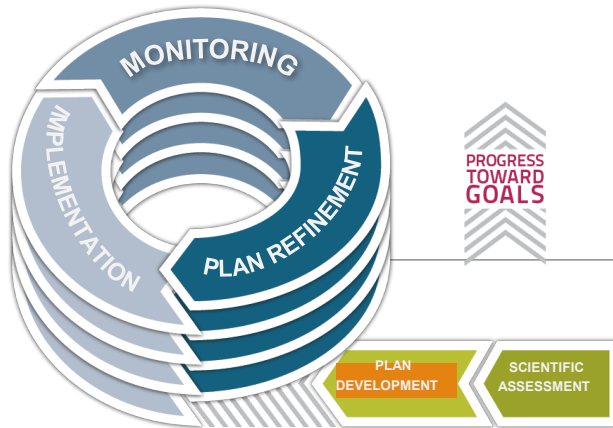


Upper Platte River
Model Areas

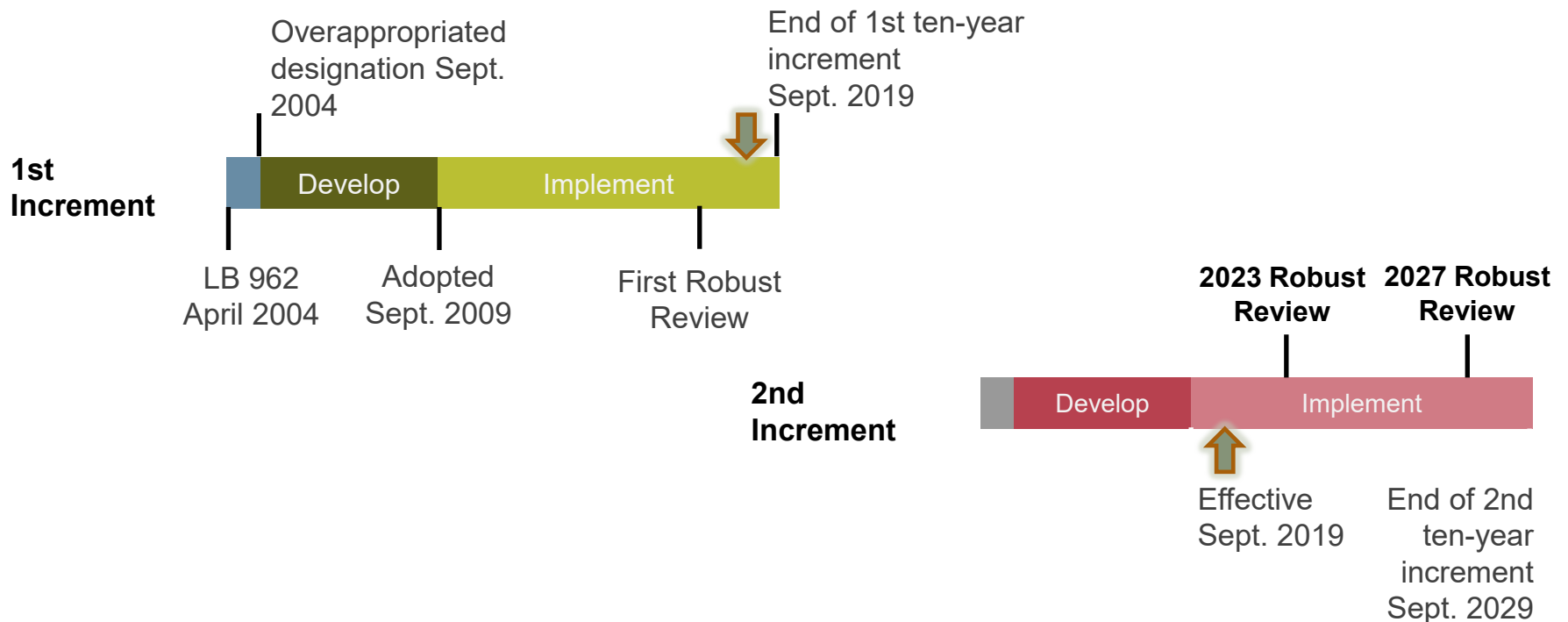
IWM – Overview

Statutes

- *Nebraska Revised Statute § 46-715(5):*
 - ✓ IMPs
 - ✓ Basin-wide Plan
 - ✓ Use Consultation & Collaboration Process w/Stakeholders
 - ✓ Identify overall difference between Over and Fully appropriated
 - ✓ Incremental (10 year) Approach to Fully Appropriated Impacts (stream depletion) of water use initiated after 7/1/1997 to existing users
 - ✓ Technical Analysis to evaluate progress (Robust Review)
 - ✓ Repeat Increments until Fully Appropriated
 - ✓ Afterwards, maintain Fully Appropriated condition

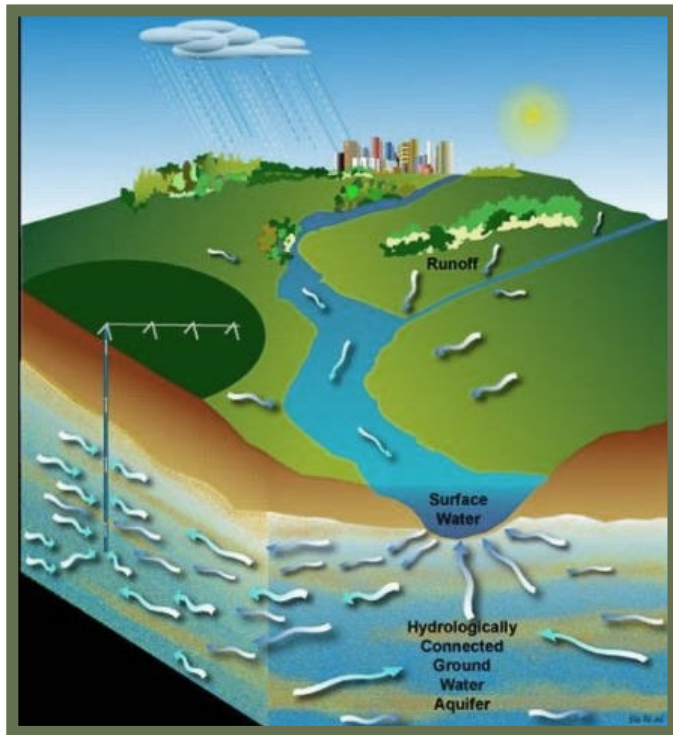


IWM – Overview Timeline & Process



IWM – Overview

Surface & Ground Water Authorities



Surface Water

- Regulated by NeDNR
- Prior appropriations
- First in time is first in right

Integrated
water
management

Groundwater

- Regulated by NRDs
- Correlative rights
- Share and share alike

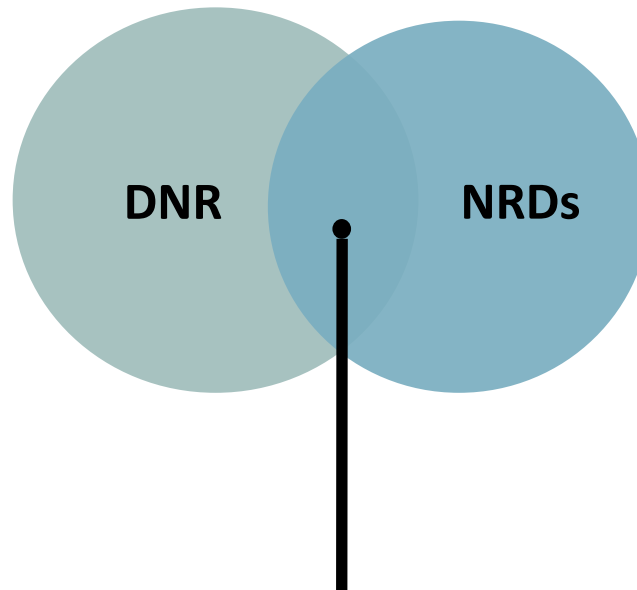
- 46-715(1)(a): ...jointly develop an IMP....
- 46-719: IWRB, resolving disputes between NRDs and NeDNR

IWM – Overview

Roles and Responsibilities

DNR'S INDIVIDUAL ROLES:

- Implement and enforce surface water controls
- Provide reports on new water use and permitting activities to the NRD
- Implement surface water monitoring and data collection activities



NRD'S INDIVIDUAL ROLES:

- Implement and enforce groundwater controls
- Provide reports on new water use and permitting activities to DNR
- Implement groundwater monitoring or data collection activities

JOINT DNR/NRD ROLES:

- Coordinate on joint implementation aspects of the plan
- Review annual reports and data that is collected
- Conduct Robust Review and other IMP required analyses
- Keep stakeholders informed on progress towards fulfilling plan goals

IWM – Overview

Goals and Objectives

- Clear Goals & Objectives of BWPs & IMPs § 46-715(2)(a)
 - Protect existing uses from negative impacts of new uses
 - Ensure both the short-term and long-term balance of water supplies and uses to maintain
 - Economic viability
 - Social and environmental health
 - Safety
 - Overall welfare of the basin
- Meet interstate agreement compliance obligation



IWM – Overview

Interstate Compliance



Platte River Recovery Implementation Program (PRRIP) & Nebraska New Depletion Plan (NNDP)

- The Extended First Increment ends December 2032
- Associated Habitat Reach: Platte River from Lexington to Chapman, NE
- PRRIP Water Action Plan projects can be used to meet post-1997 offset requirements towards fully appropriated
- Prevent streamflow depletions that would cause non-compliance
- The Basin-wide Plan and IMPs have goals, objectives and action items to ensure compliance with the Program
- Requires annual reporting of new or expanded uses
- ✓ Requires basin-wide inventory/analysis of depletions and accretions from post-1997 new and expanded development every 5 years (Robust Review)

IWM – Overview

Relationship between Basin and NRD Plans

BWP

All basin NRDs and NeDNR

Overappropriated Area

Goals & objectives:

- Focus on regional, cross-boundary issues and opportunities
- Consistency and collaboration among basin NRDs
- A broad framework used for basing IMPs

IMP

1 NRD and NeDNR

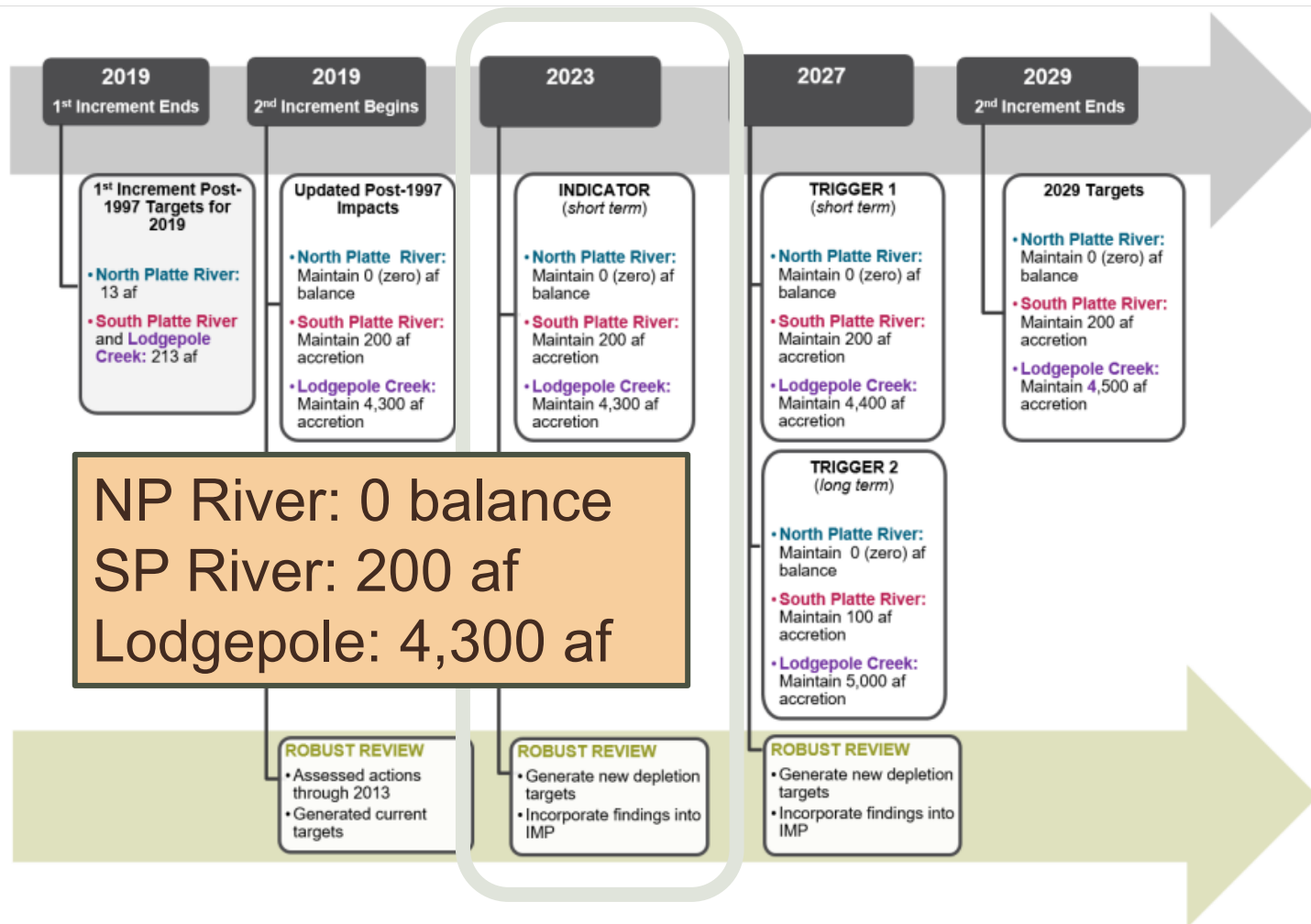
Overappropriated and Fully Appropriated Areas

Goals, objectives, & controls:

- Specific to the one NRD
- Tailored to local issues
- Specific targets and actions

IWM – Overview

SPNRD IMP Requirements - Indicator



2023 Robust Review Analysis: Introduction

Robust Review

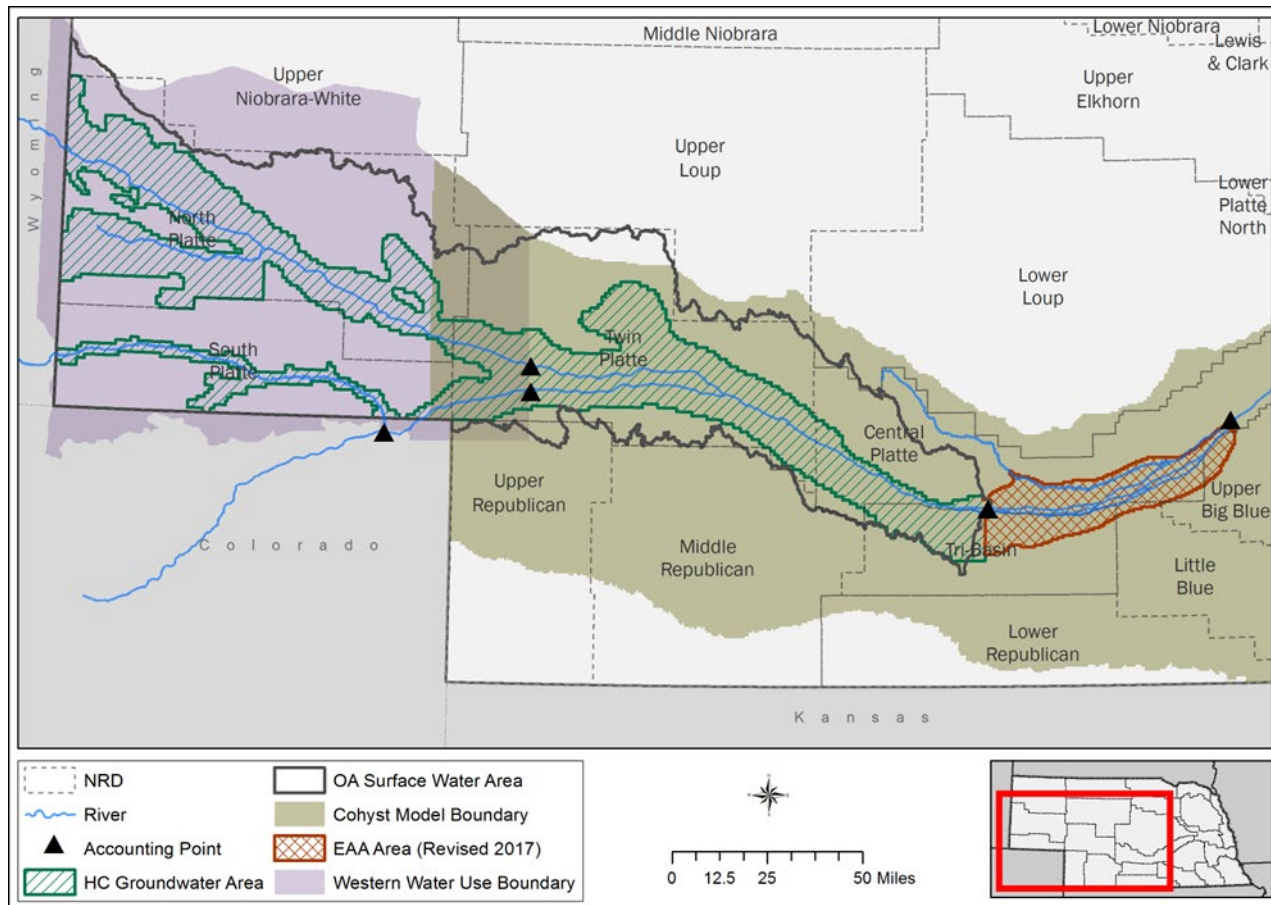
Introduction

Goals of Robust Review

- Assess progress on second increment goals and objectives (2023 Indicators)
- Assess compliance with PRRIP and NNDP
- Provide information for decision makers

Robust Review Introduction

Analysis Set-Up: Map (Model Area)



Robust Review

Introduction

Simulation Set-Up

- Model simulation period: 1953-2020, extended to 2070
- SPNRD Scenario repeat:
 - 2017-2019
 - Includes the most recent full allocation cycle before 2020
 - Captures a wetter than average climate period
- Results are summarized for:
 - South Platte River, Lodgepole Creek, and the North Platte River

2023 Robust Review Analysis: Updates to Model

Robust Review Analysis

Updates to Model

Western Water Use Management Modeling (WWUMM) Overview

CropSim

ESC Model

GW Model

Climate
Data

Run
CropSim

Output

Input
Data

CropSim files
Landuse
Canals
Diversions
Wells
Model Grid
Soils
Pumping

Model
Run

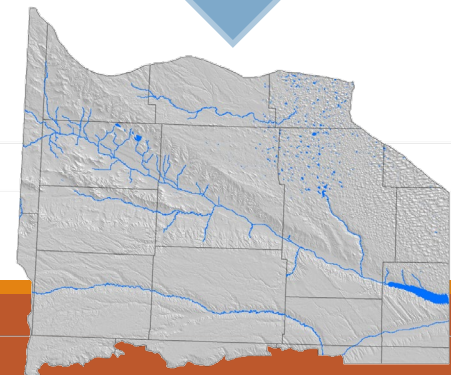
Model is parcel based for irrigation, climate, crops
WSPP from previous runs was recreated
Many Options available, historical, Steady State, Post97 options

Output

Output to local computer in SQLite Database
Creates QC files that are summaries of parcel NIR, pumping, recharge and well pumping
Creates wel, rch files for Modflow

ESC Well
and
Recharge
Files

Run Model



Robust Review Analysis

Updates to Model

Major Differences from 2019 Robust Review

- Update input data 2014 through 2020
 - Climate data
 - Land use
 - Crops
 - Meter data
- Update Cropsim/Watershed Model to ESC
 - Parcel based calculations
 - Modified crop growth specifications
- Update Groundwater Model to Modflow 6
 - New solver & pumping function / fixed dry cells
 - Brule Fractures
 - Base of Aquifer

Robust Review Analysis

Updates to Model

Impacts to Overall Water Budget (WWUMM)

- ESC Appears to have a net effect of reduced recharge
 - Replaced a weather station
 - Impacted by change from grass pasture to native vegetation
- More modeled groundwater pumping is occurring
 - Impacted by aquifer adjustments (base/fractures)
 - Dry cells resolved

Robust Review Analysis

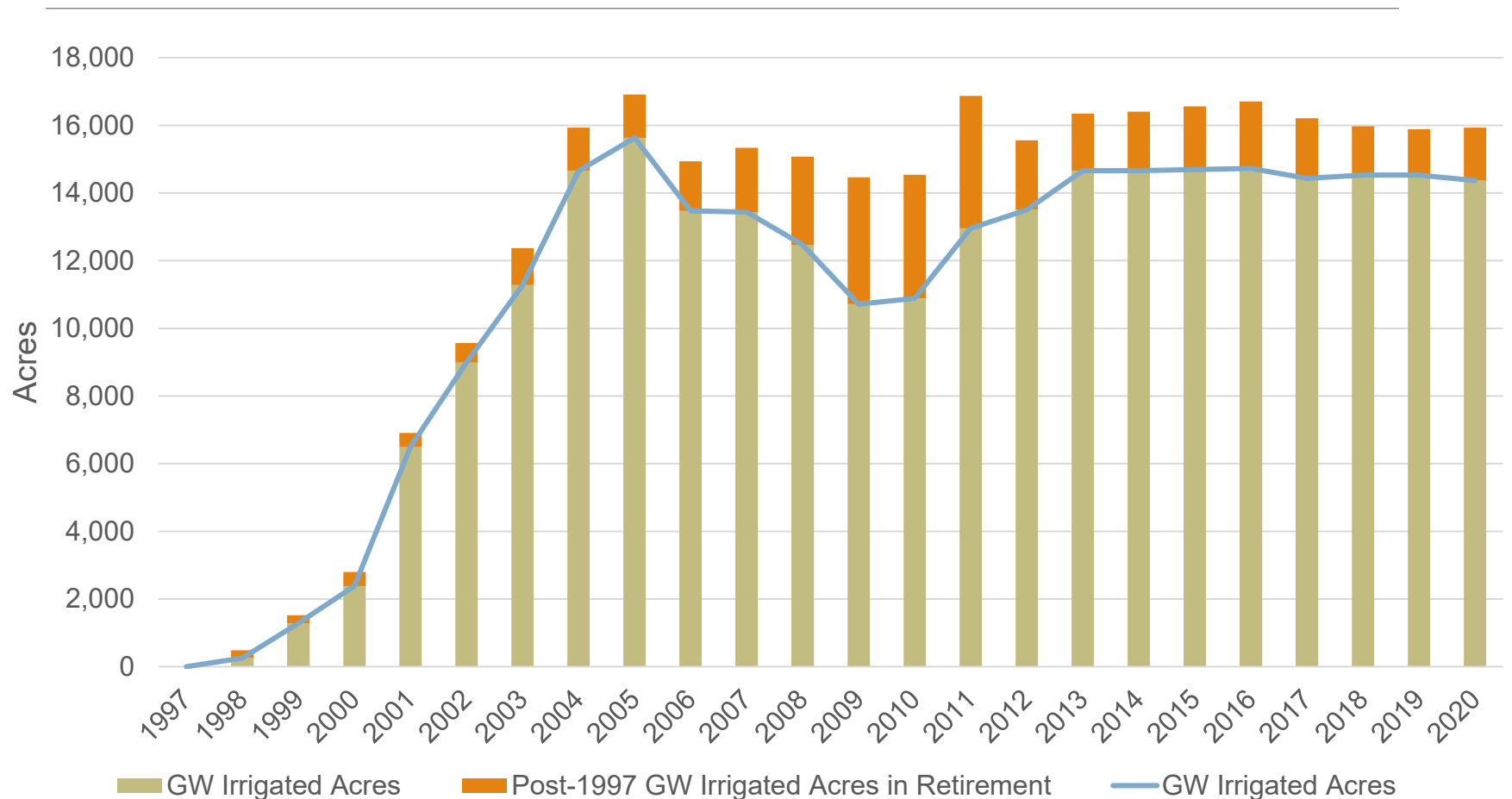
Performance of Updates to Model

- Significant changes to aquifer properties & model update
- Model performs comparatively well to the prior model
 - Underestimates groundwater levels in the vicinity of the South Platte River
 - Overestimated heads and underestimated baseflows in the last 10-15 years of the calibration period along the North Platte River in the western half of the model domain
- Recalibration is suggested before next robust review

2023 Robust Review: Management Actions & Model Inputs

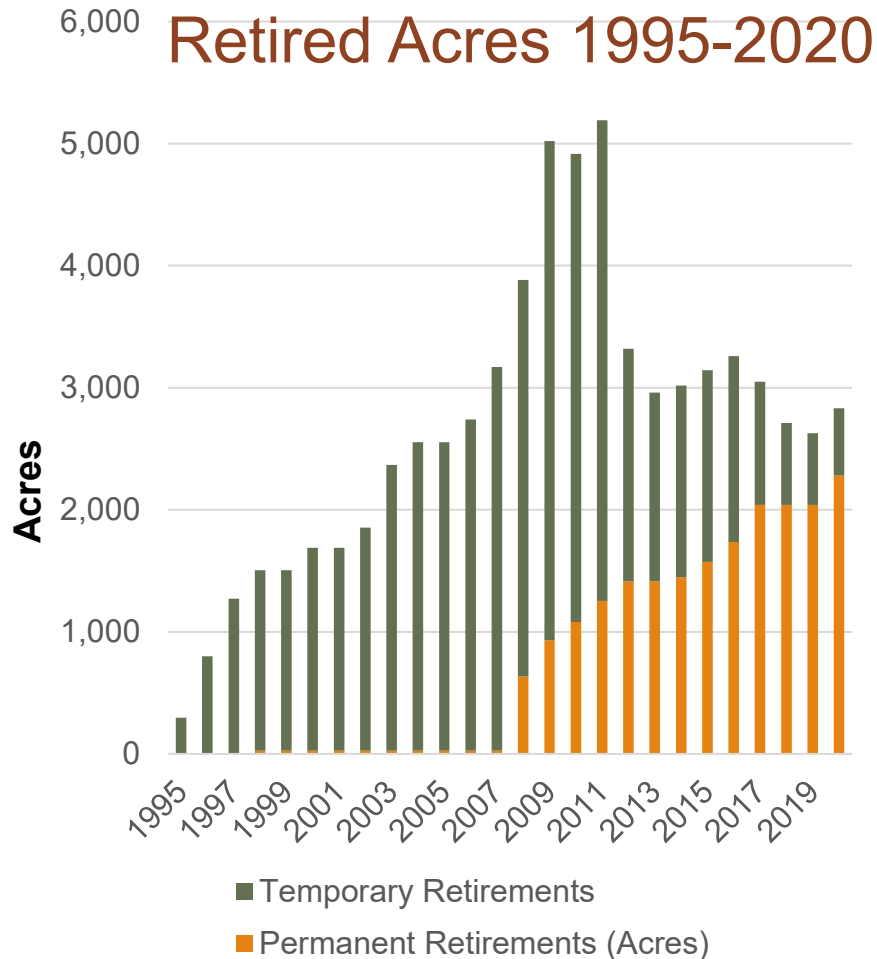
Management Action & Model Input:

Net Change in Groundwater-Only Irrigated Acres 1997 to 2020



Management Action & Model Input:

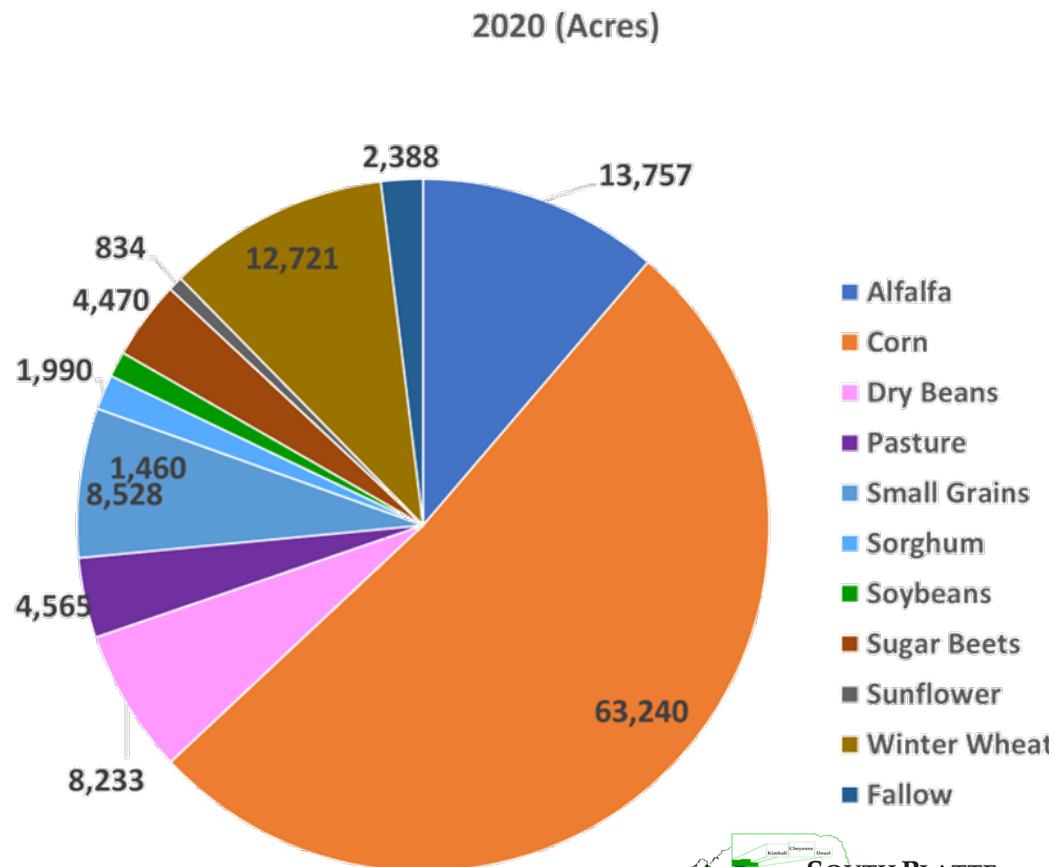
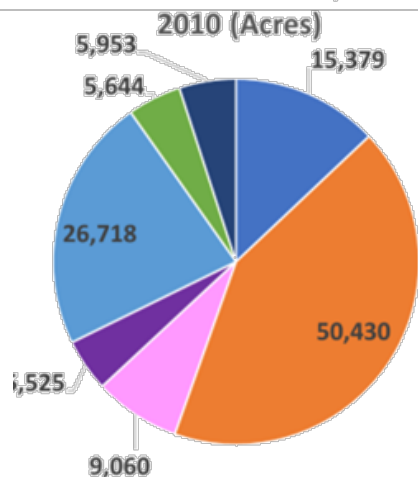
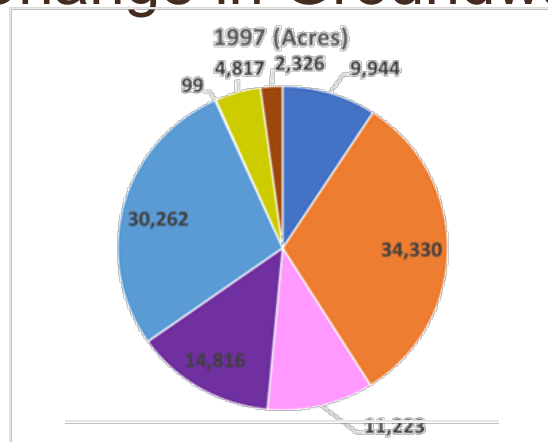
Decertified groundwater only irrigated acres



- Temporary retirements began in 1995
- Permanent retirements began in 1998
- Modeled as net pumping
 - $\text{Allocation} \times \text{efficiency} \times \text{acres}$
- Average NRD-wide change in CU
 - ~10 Inches/Acre/Year

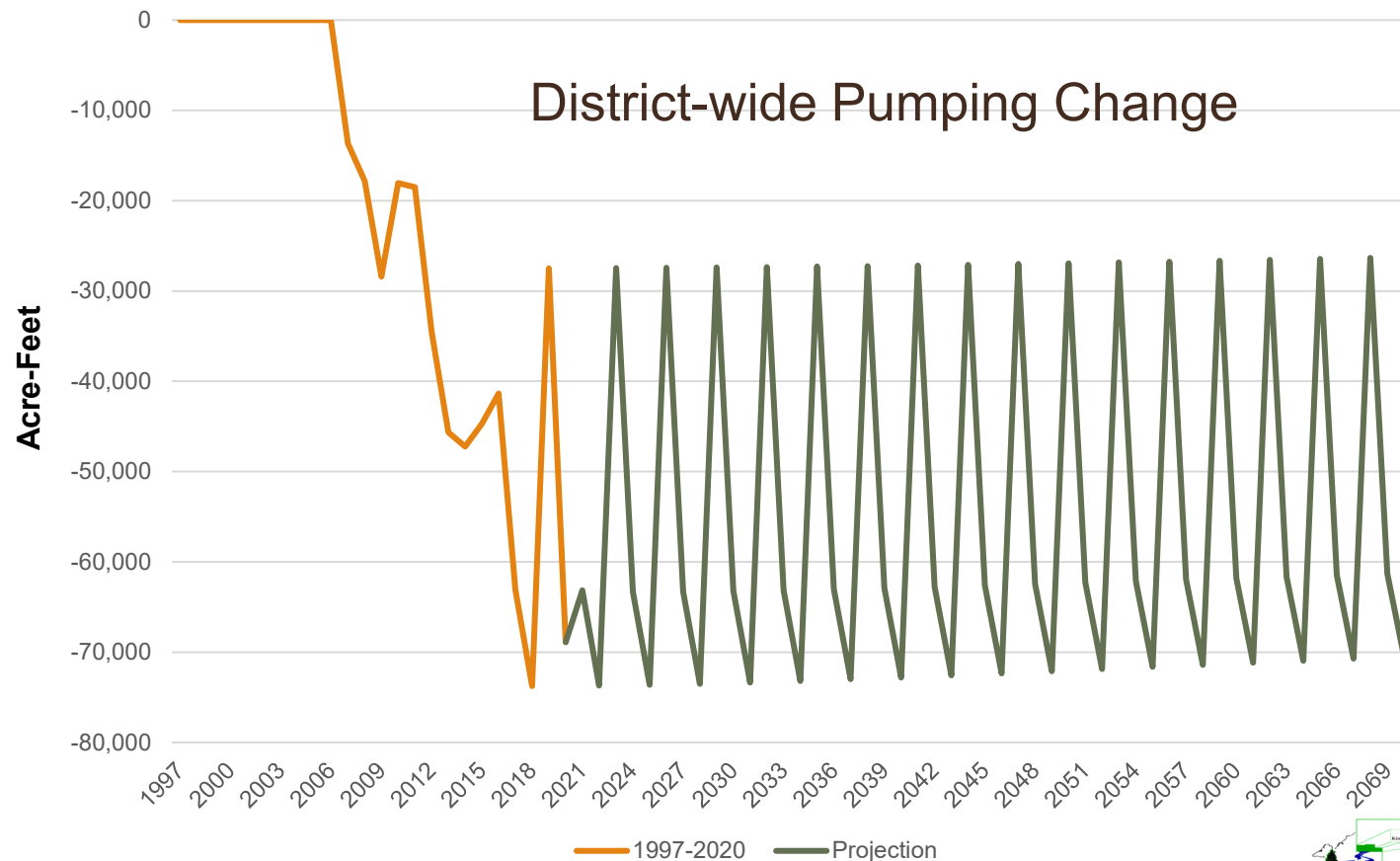
Management Action & Model Input:

Change in Groundwater-Only Irrigated Crop Types



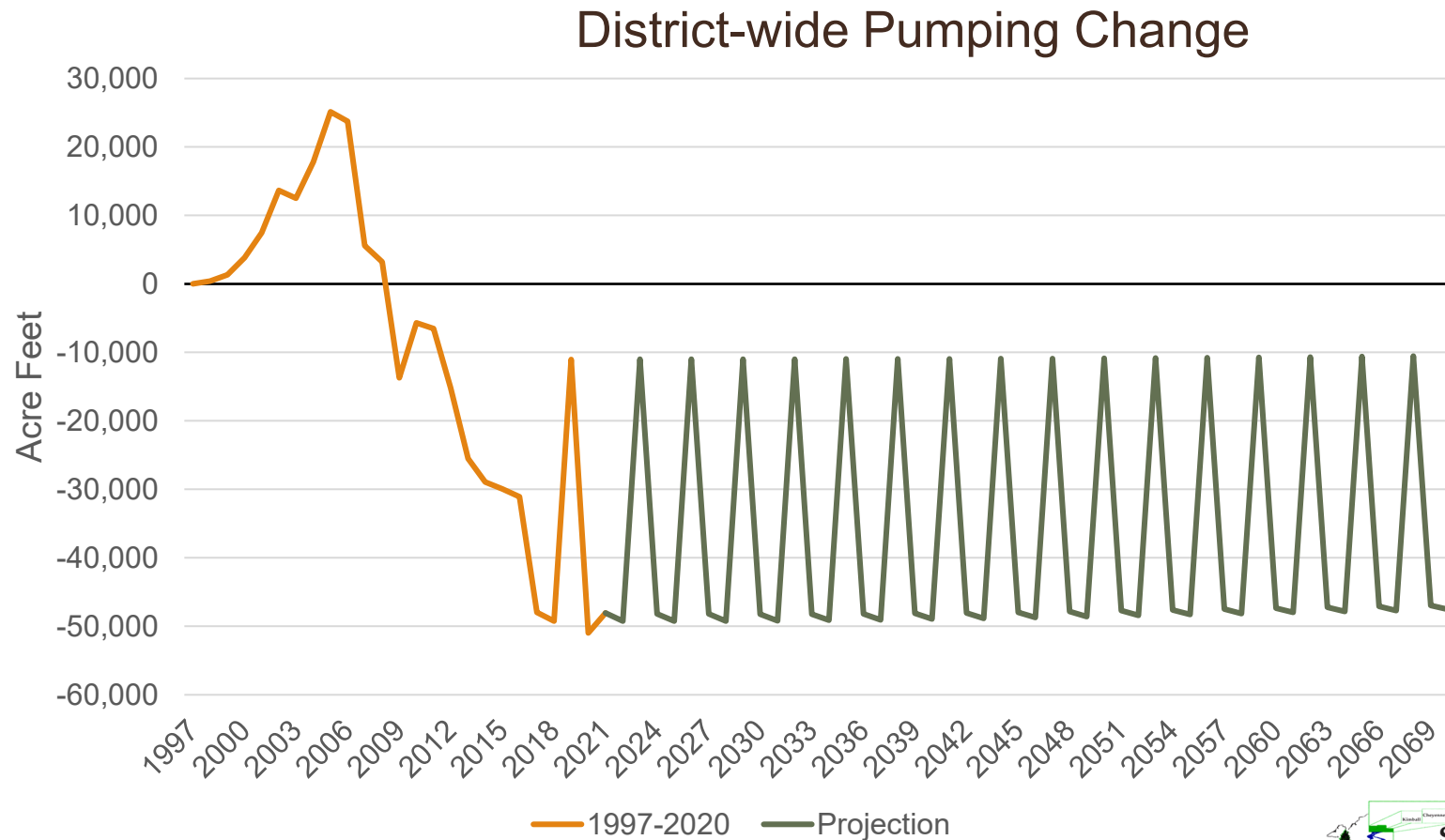
Management Action & Model Input: Allocations

Change in Groundwater-Only Irrigation Pumping: Allocations

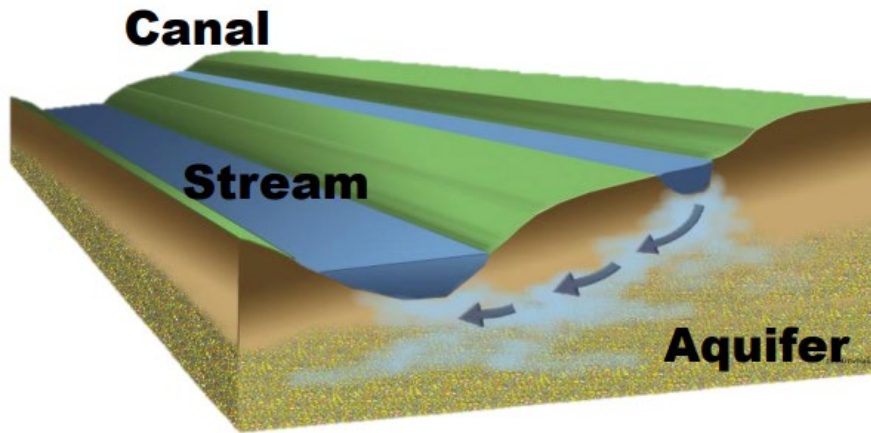


Management Action & Model Input:

Change in Post-1997 Groundwater-Only Irrigation Pumping: Total

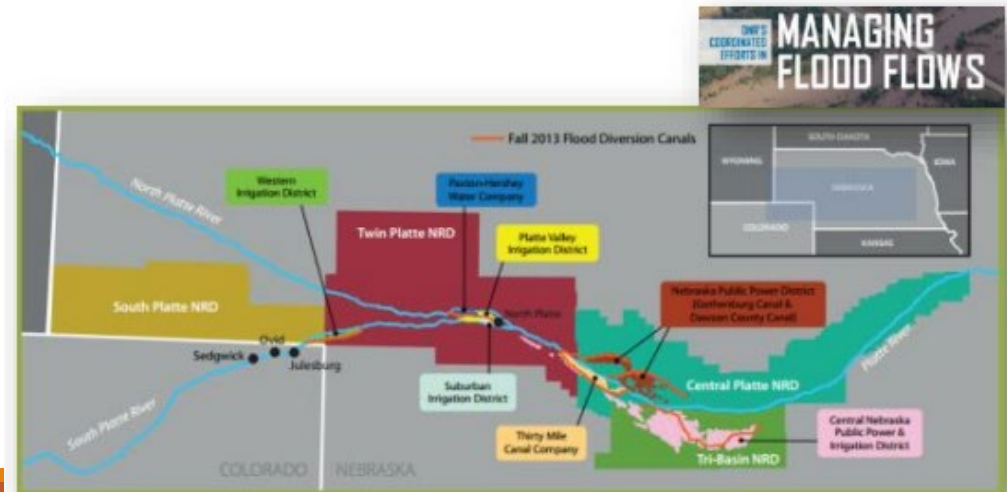


Management Action: Conjunctive Water Management (CWM)



Conjunctive Water Management is an *adaptive process* that utilizes the *connection* between surface water and groundwater to *maximize water use*, while *minimizing impacts* to streamflow and groundwater levels in an effort to increase the overall water supply of a region and improve the reliability of that supply.

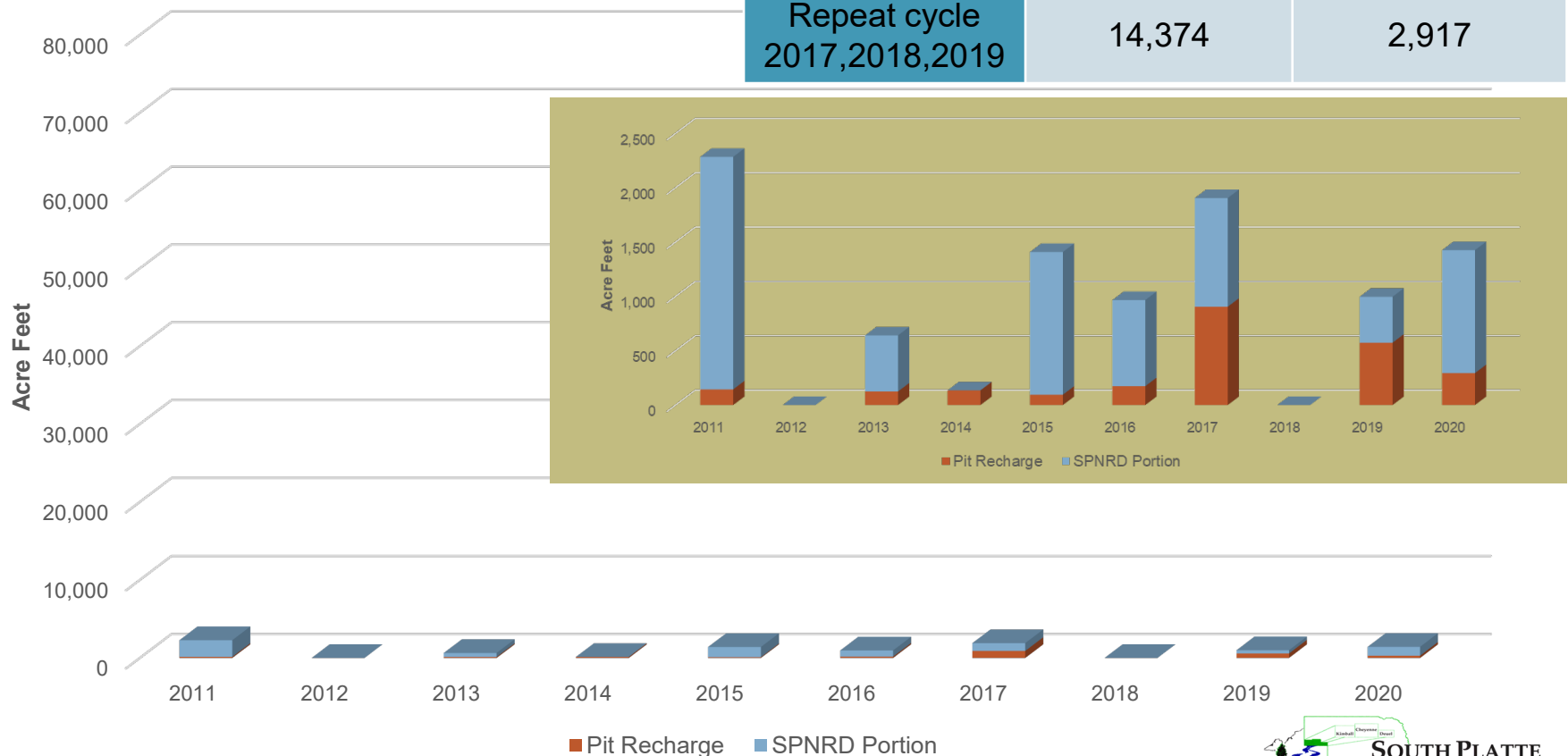
- Excess flow capture
- Augmentation
- Water leasing
- Water transfers
- Canal refurbishment



Management Action: CWM / Excess Flows

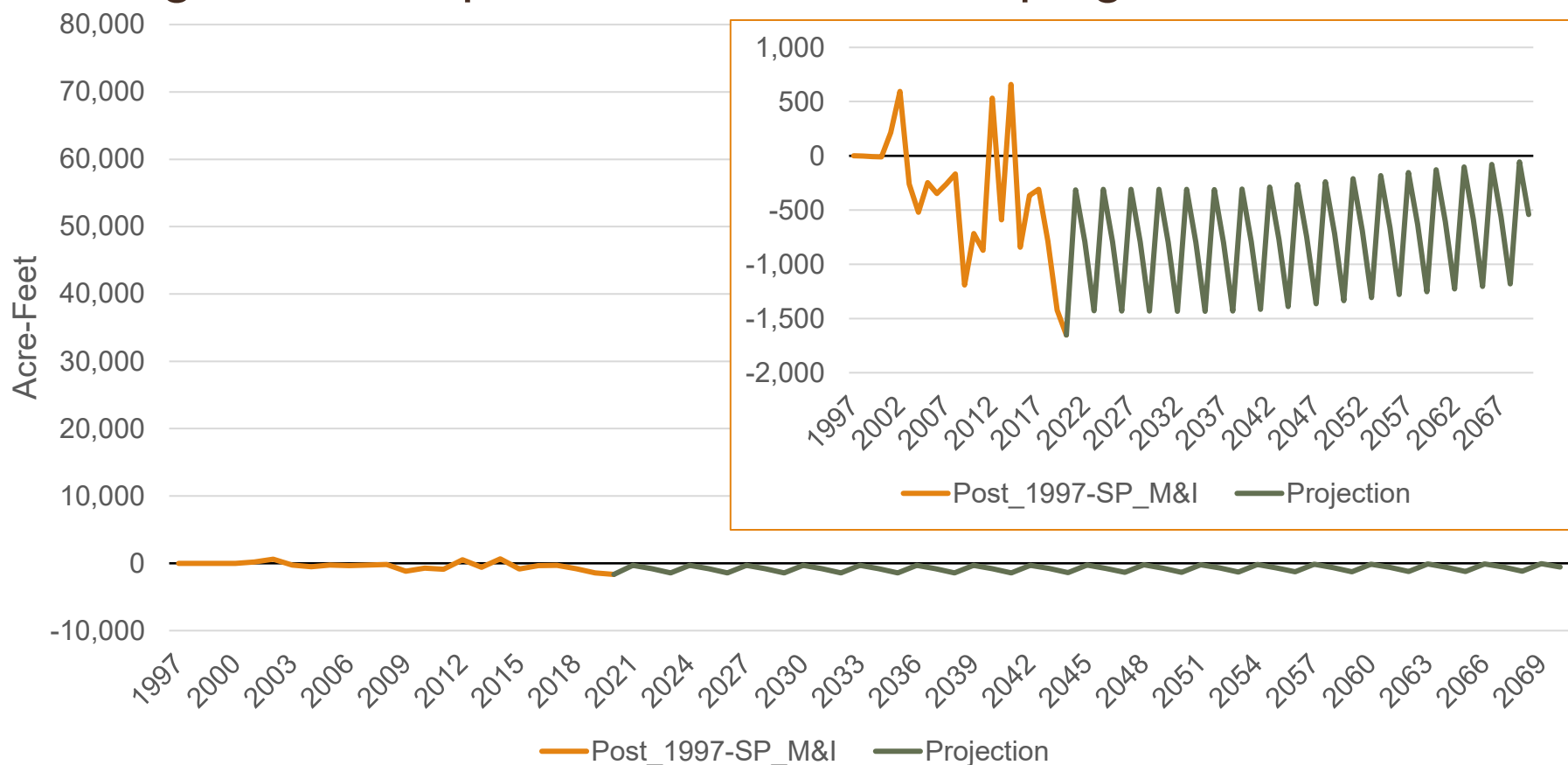
Excess Flow Recharge

SPNRD	Acre-Feet of Excess Flow	
	Diversion	Recharge
2011-2020	47,955	9,781
Repeat cycle 2017,2018,2019	14,374	2,917



Management Action & Model Input:

Change in Municipal and Industrial Pumping from 1997



2023 Robust Review: Analysis – SPNRD Results

Robust Review Analyses

- Post-1997 Analysis
 - Historic Run (Same as last RR)
 - 1997 Development Run (Same as last RR)
 - Excess Flow Analysis (Same as last RR)
 - Included additional scenario with projected excess flows (New)
 - Allocation Effects Analysis (New to RR)
 - Ground Water Irrigation Retirements Analysis (New)
 - M&I Analysis (New)
- Total Depletions Analysis (Same as last RR)
- Livestock Analysis (Same as last RR)

WWUMM

Model-Wide Streamflow Impacts for Post-1997 Management Actions

- Post-97 Development
- M&I
- Excess Flow
- Allocation on all GW Development
- GW Irrigation Retirements

Accretions

Depletions

1997

2021

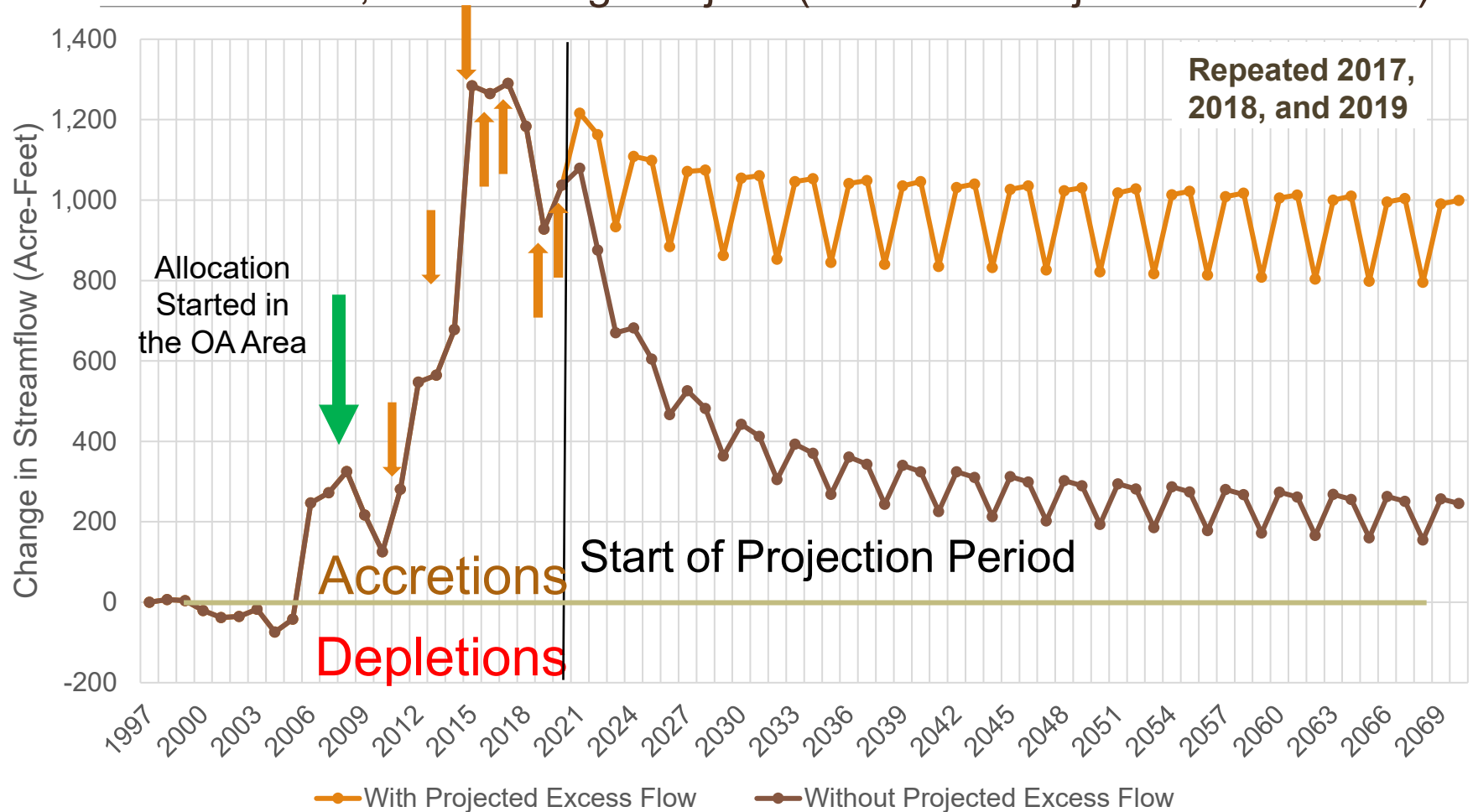
2030 - 2070

(start projection period)

South Platte River

SPNRD Results:

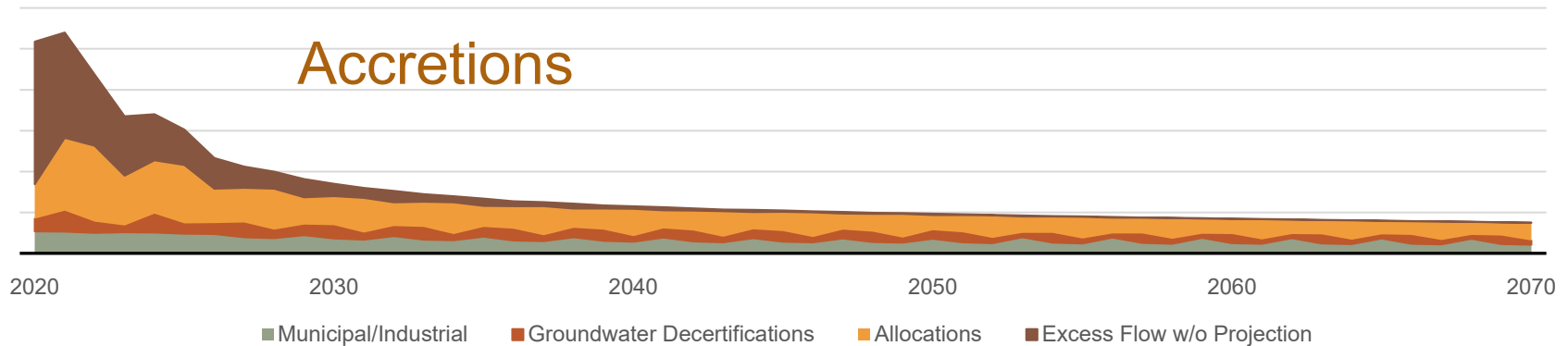
Robust Review Analysis Results: Post-1997 Analysis, includes M&I, Allocations, Decertifications, and Recharge Projects (with & w/o Projected Excess Flow)



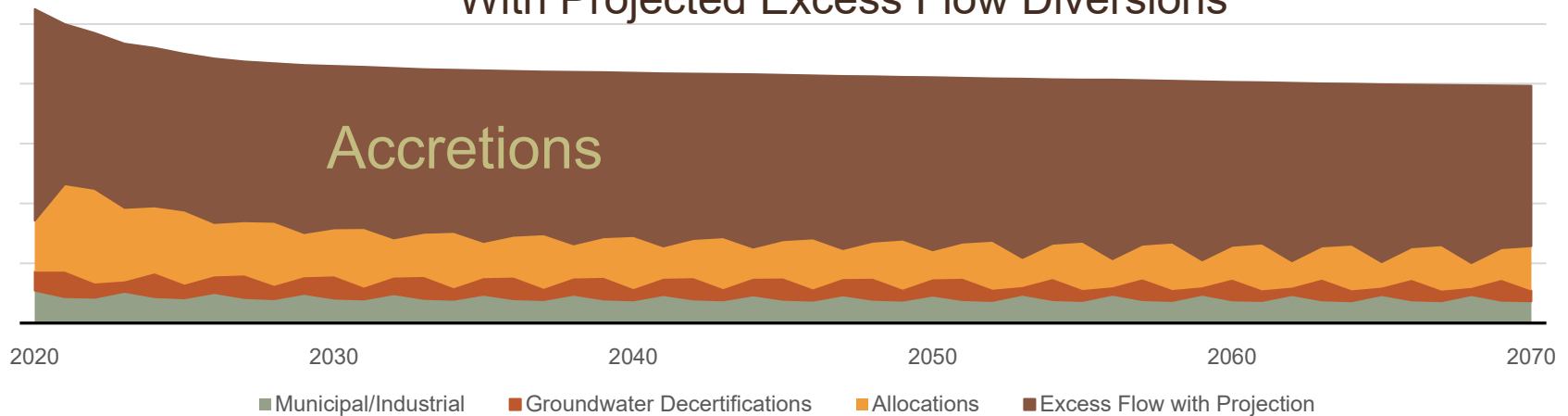
SPNRD Results

Future Projection Generalized Components

Without Projected Excess Flow Diversions



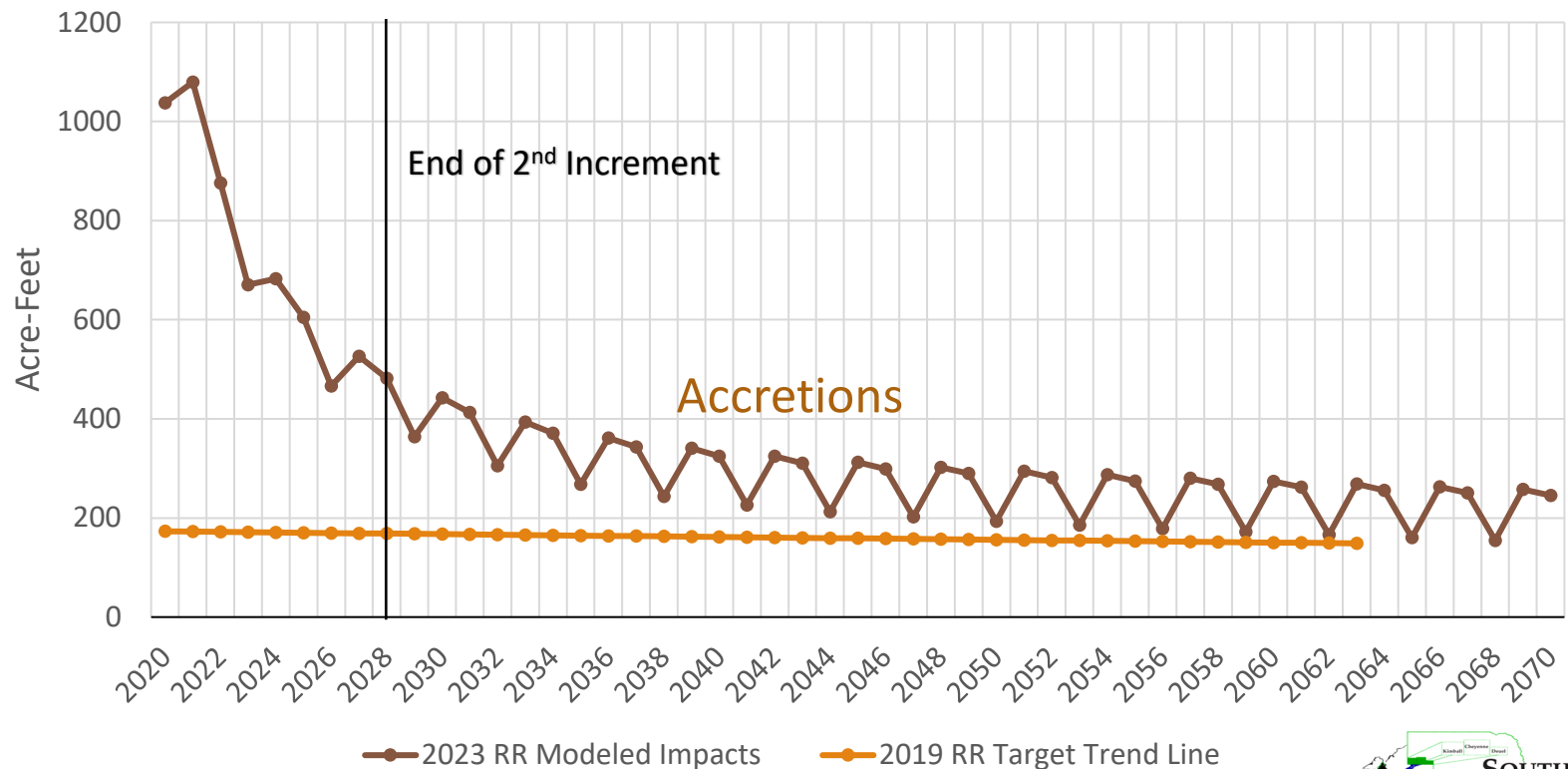
With Projected Excess Flow Diversions



SPNRD Results

Target Comparison: South Platte River

SPNRD Baseflow Impacts to South Platte River



SPNRD Results

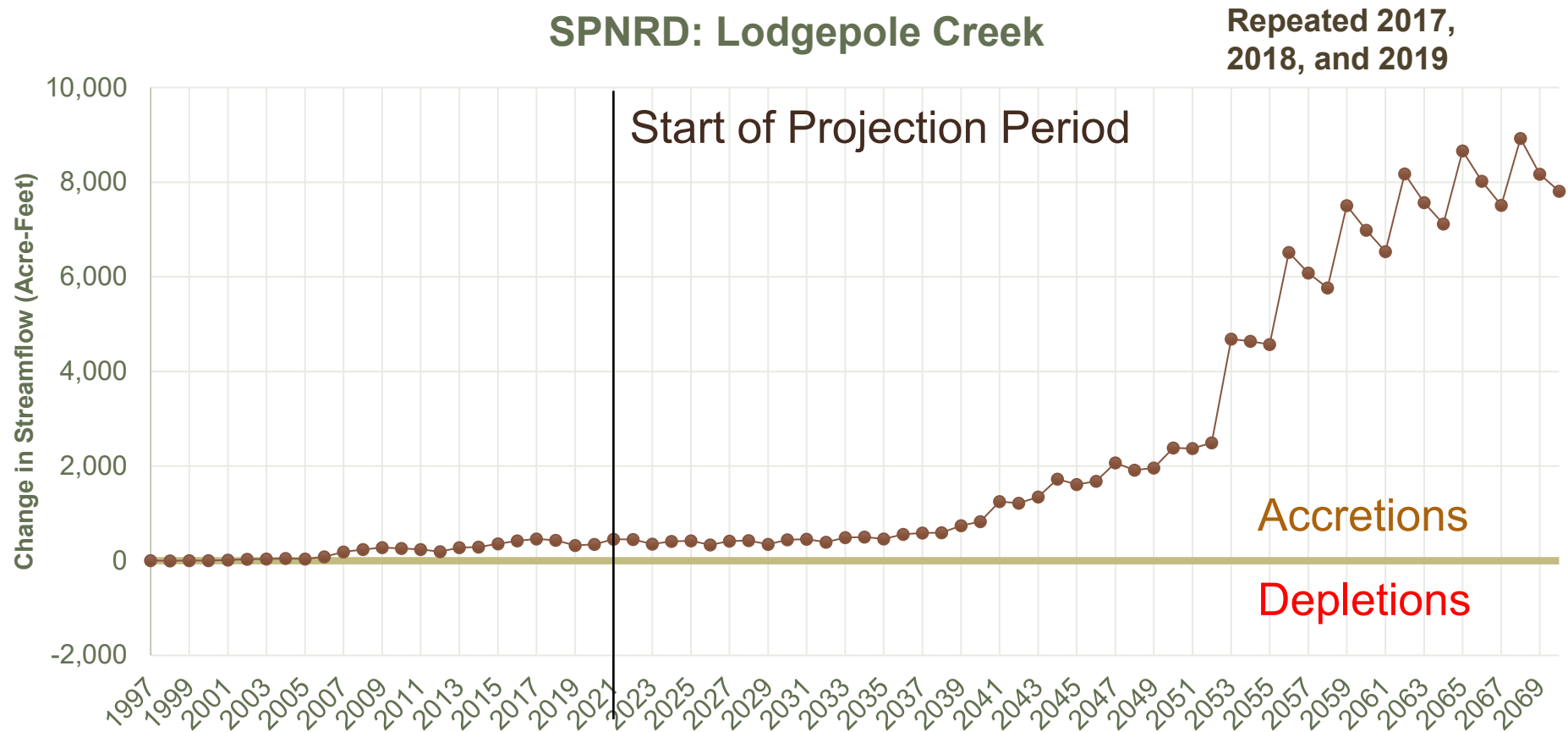
Indicator* Review: South Platte River

Year	Current IMP Targets	2023 Robust Review Results
2019	200	1000
2020	200	1000
2021	200	900
2022	200	900
<u>2023*</u>	<u>200</u>	<u>800</u>
2024	200	700
2025	200	700
2026	200	600
2027	200	500
2028	200	500
2029	200	400

Lodgepole Creek

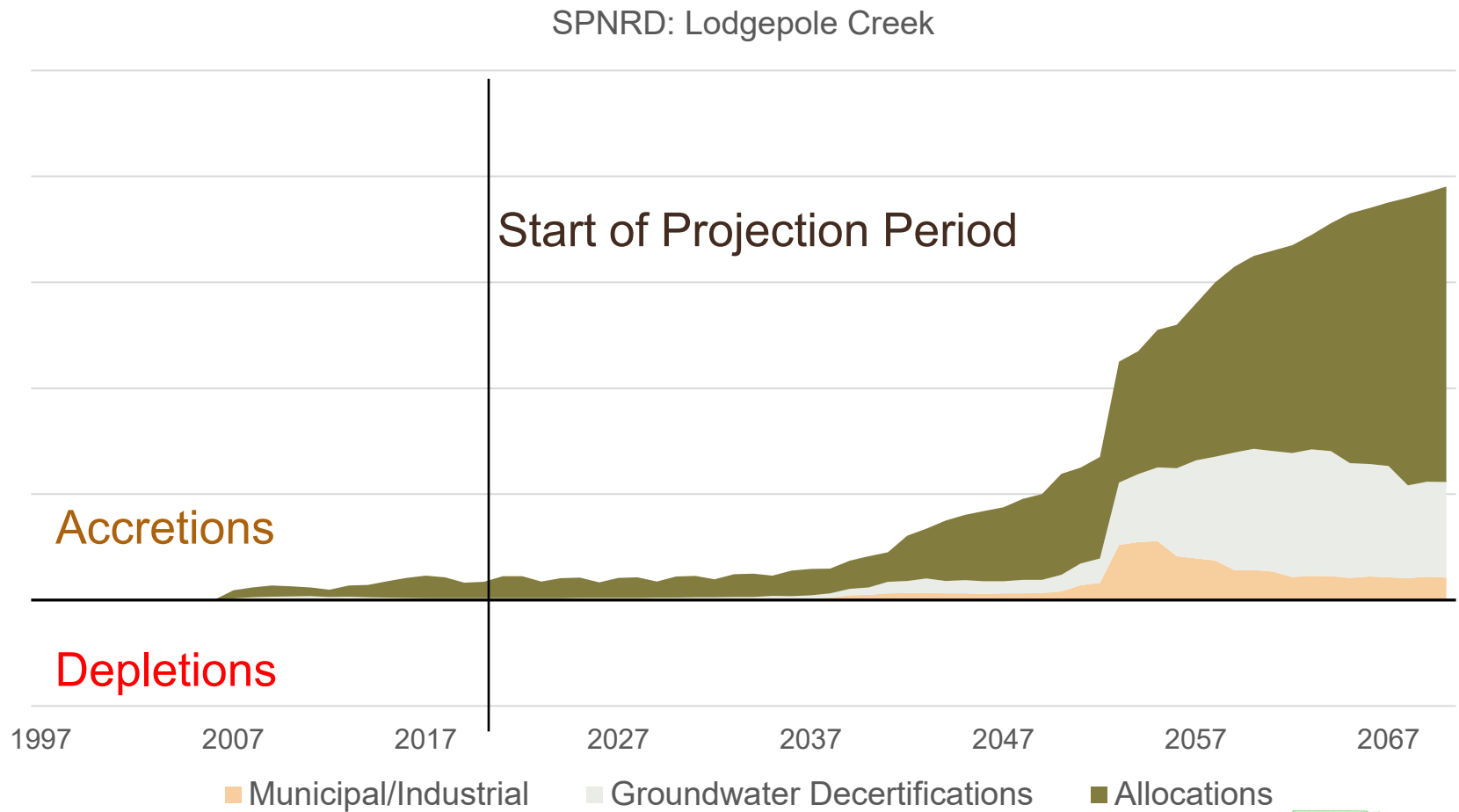
SPNRD Results

Robust Review Analysis Results: Post-1997 Combined



SPNRD Results

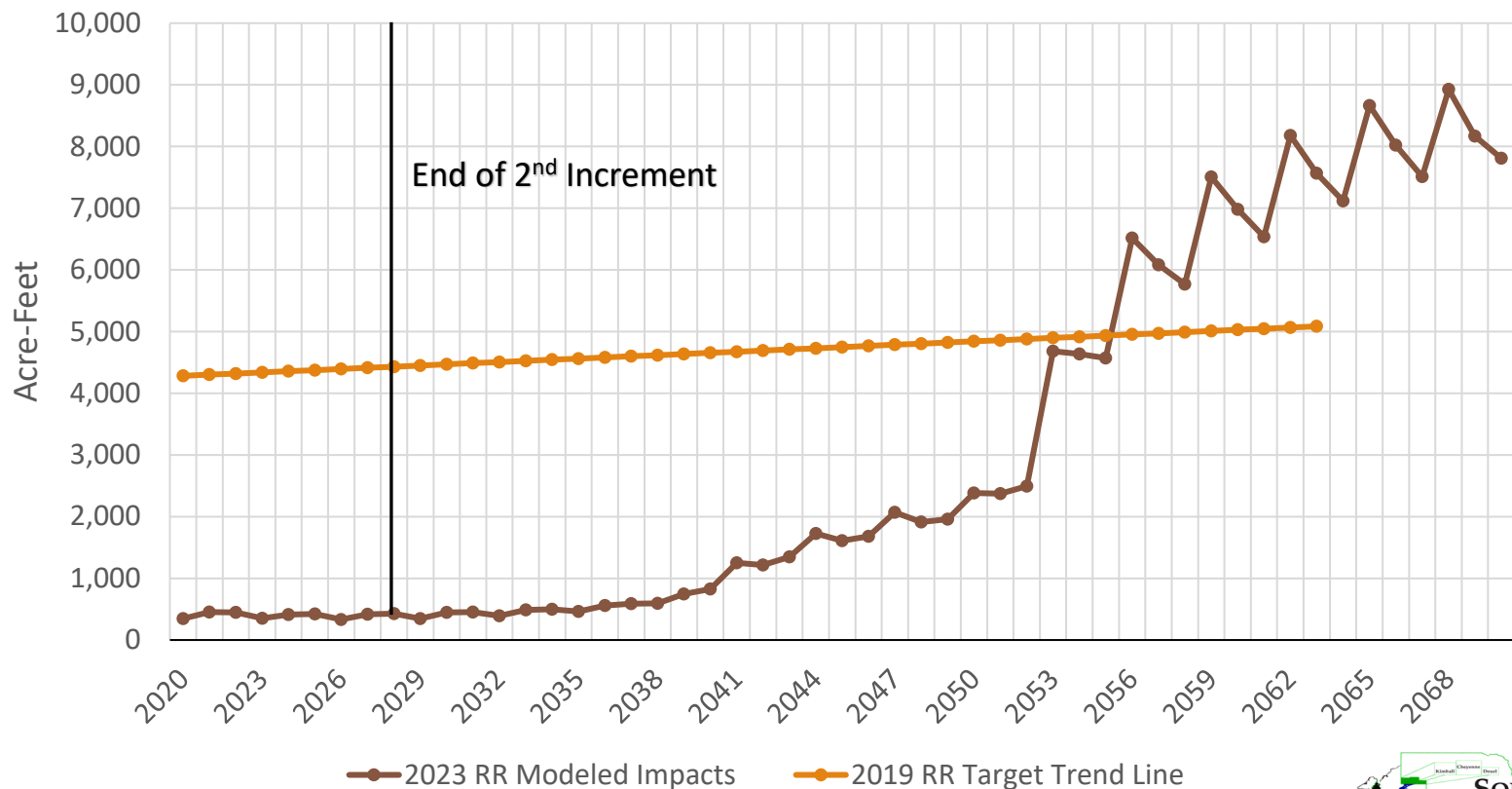
Robust Review Analysis Generalized Post-1997 Components



SPNRD Results

Target Comparison Lodgepole Creek

SPNRD Baseflow Impacts to Lodgepole Creek



SPNRD Results

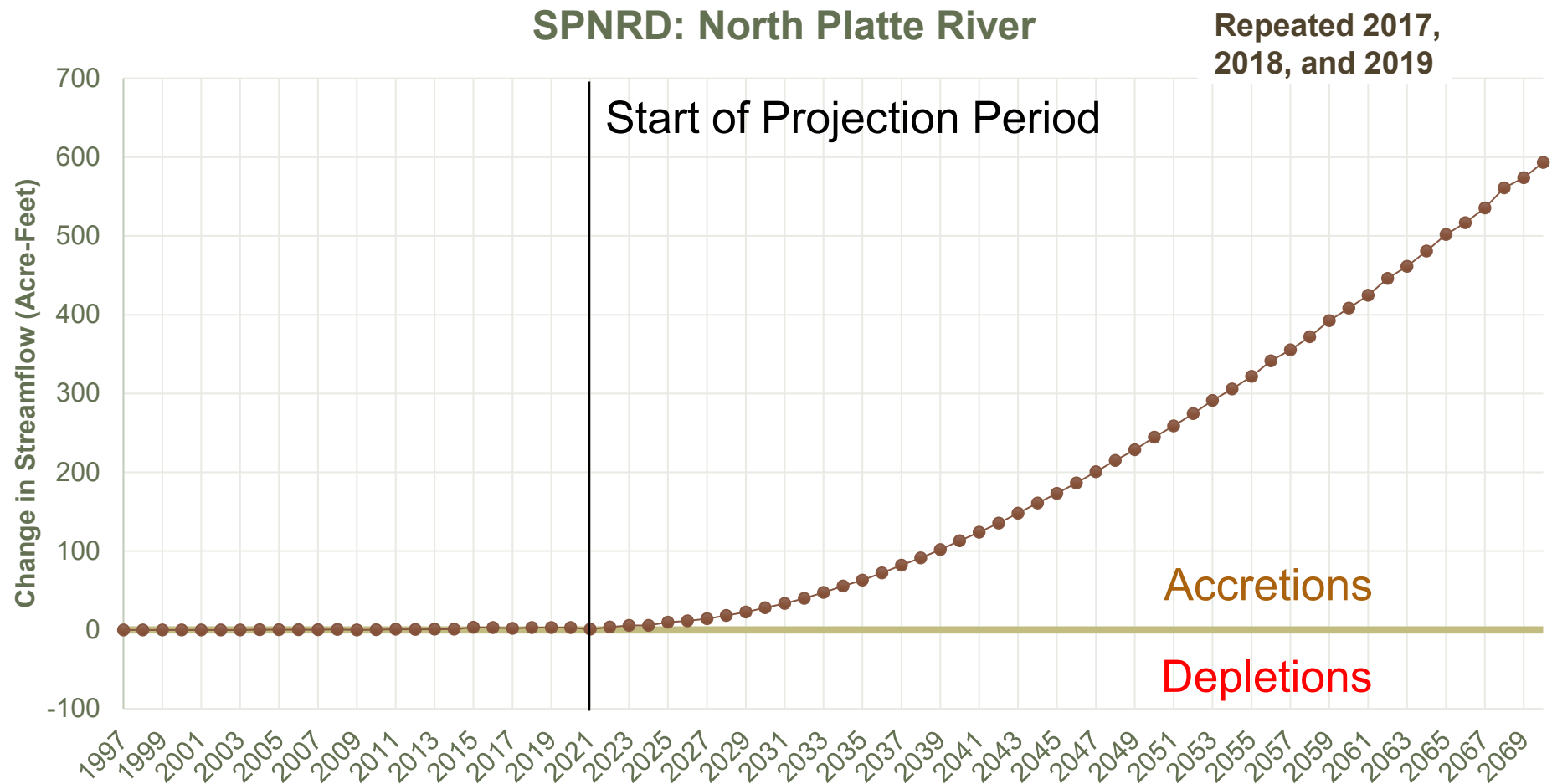
Indicator Review*: Lodgepole Creek

Year	Current IMP Targets	2023 Robust Review Results
2019	4,300	400
2020	4,300	400
2021	4,300	400
2022	4,300	400
<u>2023*</u>	<u>4,300</u>	<u>400</u>
2024	4,400	400
2025	4,400	400
2026	4,400	400
2027	4,400	400
2028	4,400	400
2029	4,500	400

North Platte River

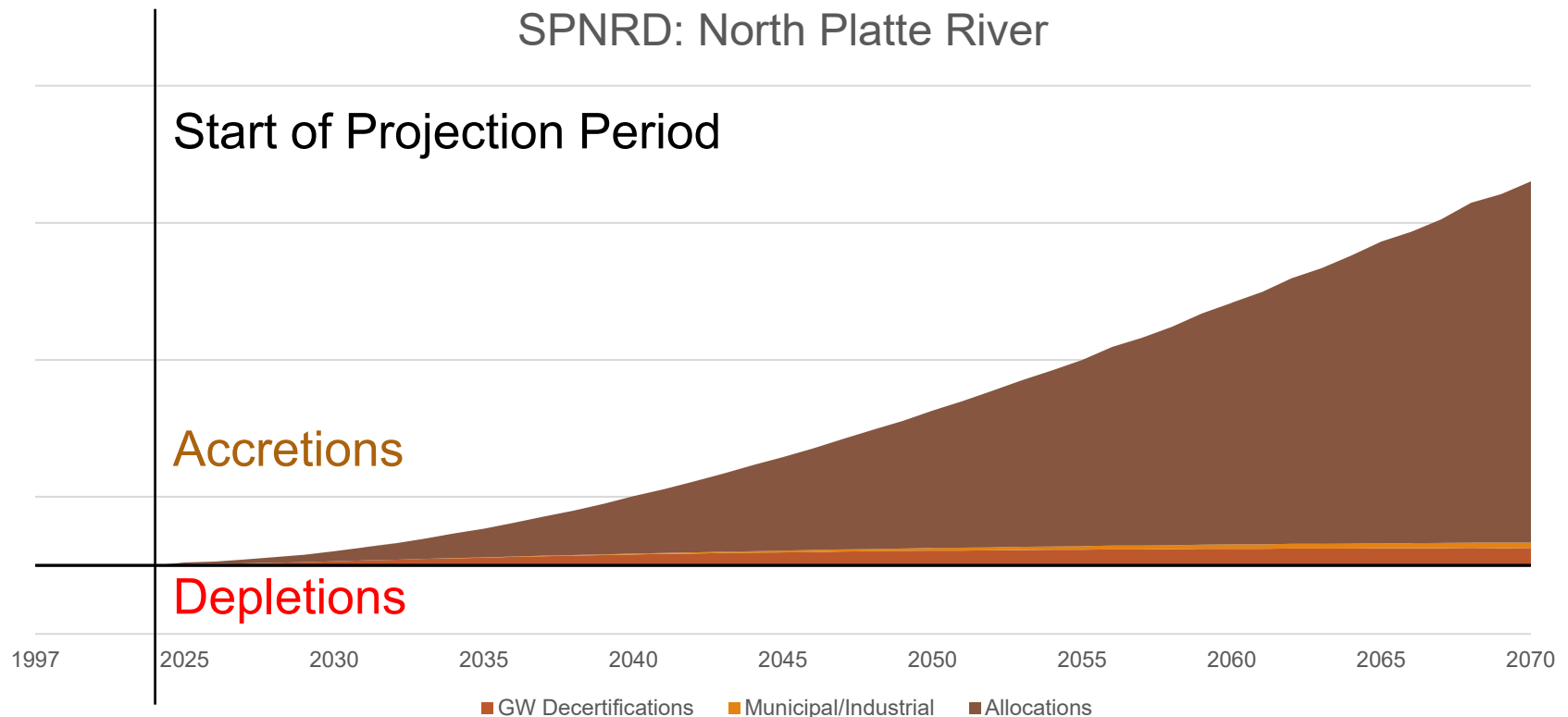
SPNRD Results

Robust Review Analysis Results: Post 1997 Combined



SPNRD Results:

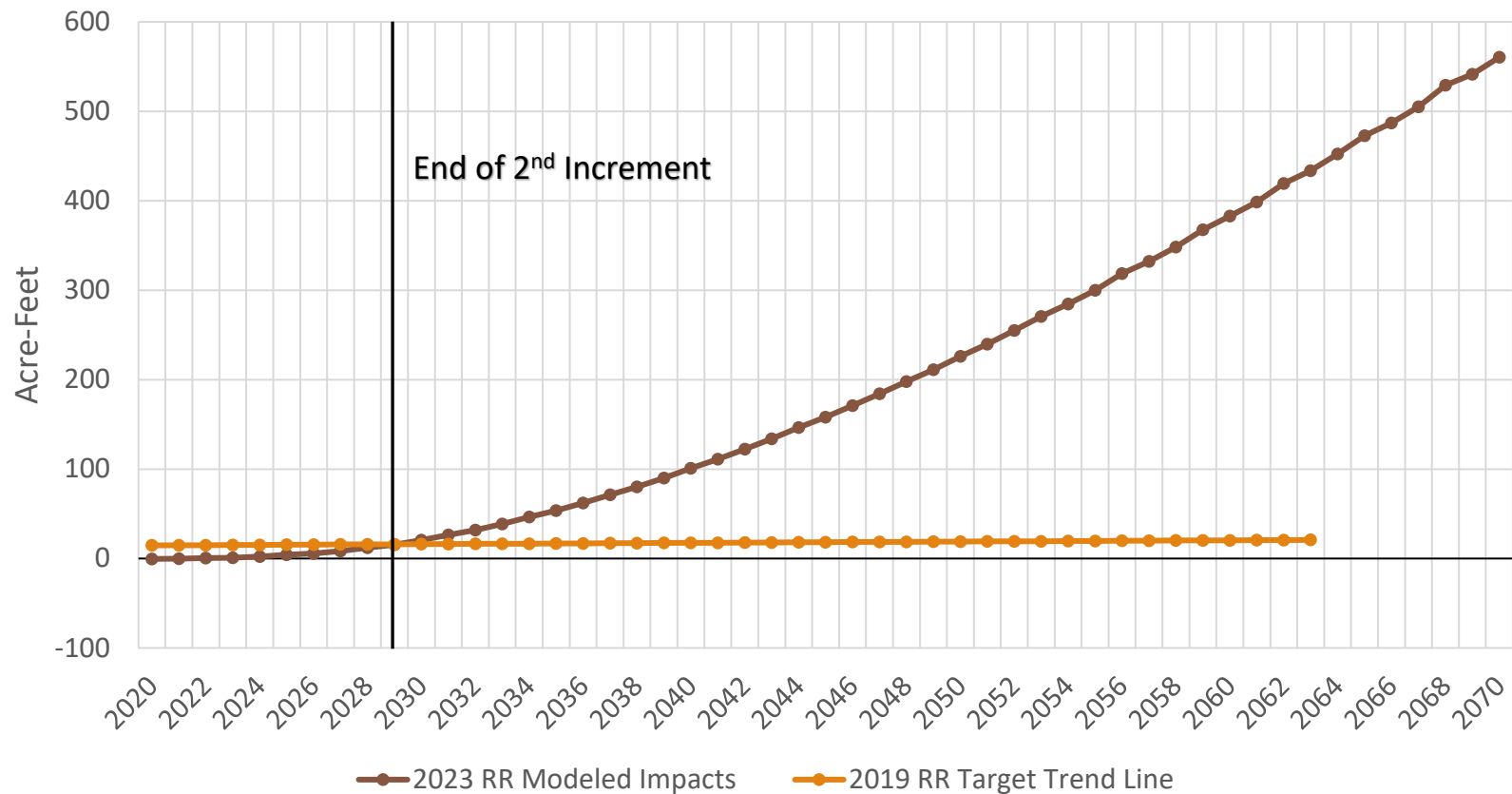
Robust Review Analysis Generalized Post-1997 Components



SPNRD Results

Target Comparison North Platte River

SPNRD Baseflow Impacts to North Platte River



SPNRD Results

Indicator* Review: North Platte River

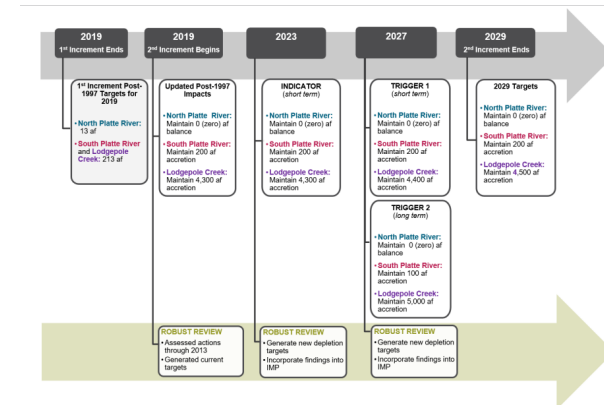
Year	Current IMP Targets	2023 Robust Review Results
2019	0	0
2020	0	0
2021	0	0
2022	0	0
<u>2023*</u>	<u>0</u>	<u>0</u>
2024	0	0
2025	0	0
2026	0	0
2027	0	0
2028	0	0
2029	0	0

IMP Target Summary

No Changes to the IMP are Necessary

“additional regulatory actions will not be required as long as either:

- 1) The 2023 Robust Review shows that management actions offset post-1997 depletions
- 2) The SPNRD maintains their management actions.”

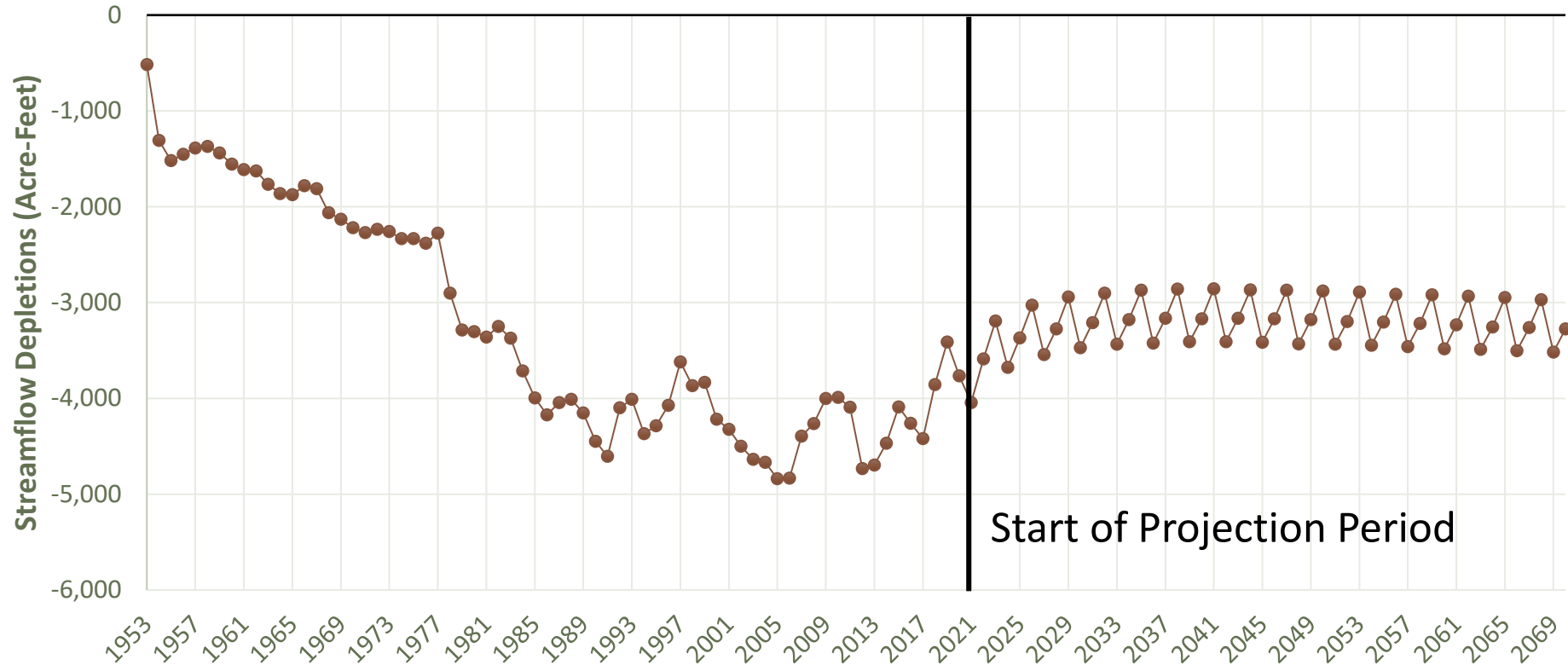


Total Depletions Results

SPNRD Results – Total Depletions

Impacts from all Groundwater Pumping

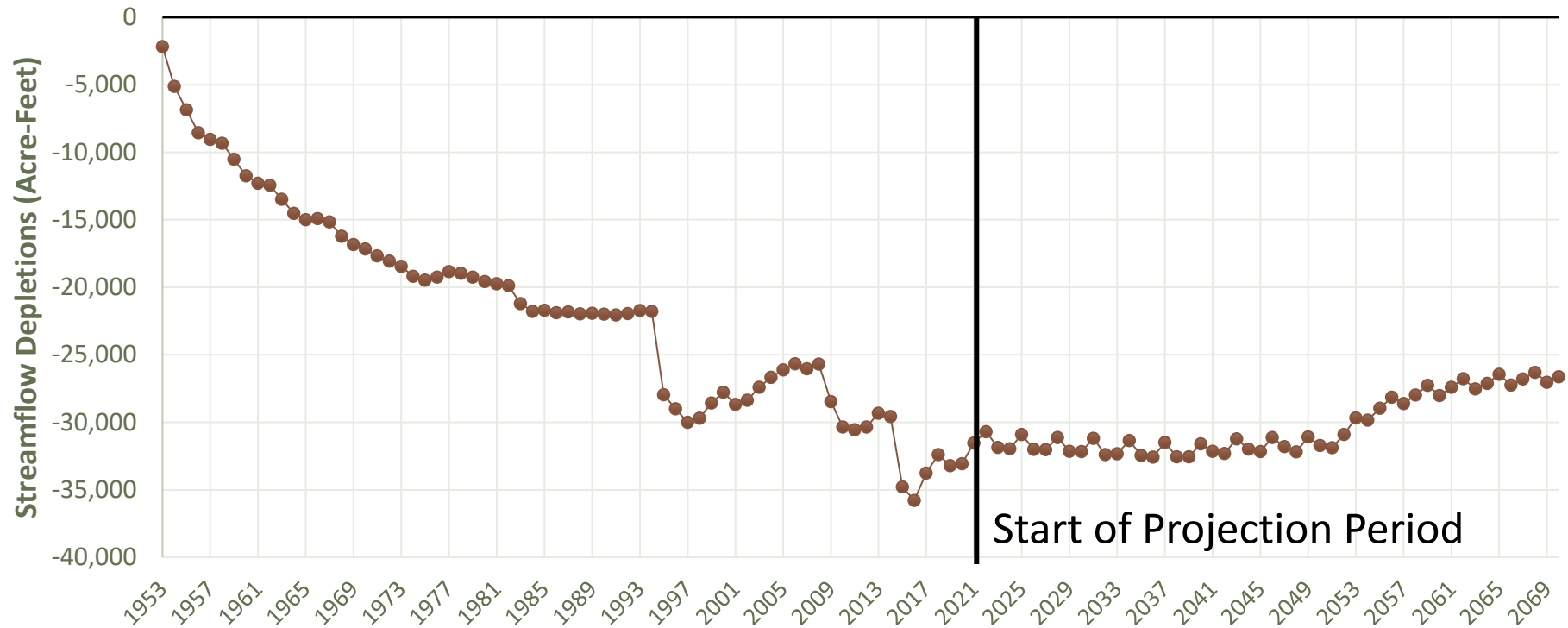
SPNRD: South Platte River



SPNRD Results – Total Depletions

Impacts from all Groundwater Pumping

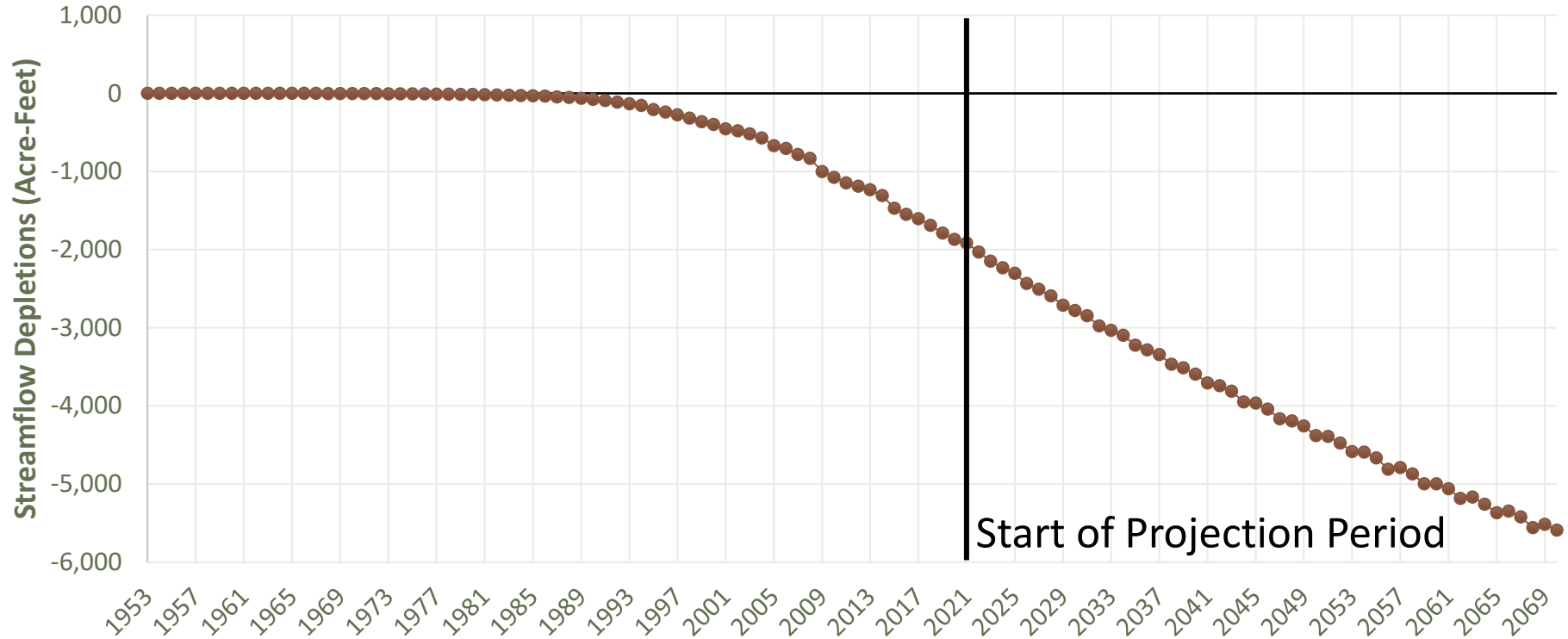
SPNRD: Lodgepole Creek



SPNRD Results – Total Depletions

Impacts from all Groundwater Pumping

SPNRD: North Platte River



Path Forward

Path Forward / Next Steps

- Finish Documentation of Models and Analyses
- Present Results during May PRRIP meeting
- Present Results during August 1st BWP Stakeholder meeting
- Prepare for 2027 Robust Review in this Increment
 - Model Updates
 - Recalibration
 - Data
- Develop Basin-Wide and NRD drought plans
 - UPRDCP to be in place by end of 2024
- Changes to Municipal and Industrial offset requirements in 2026



NEBRASKA

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DEPT. OF NATURAL RESOURCES

THANK YOU

Jennifer Schellpeper, Water Planning, NeDNR