NPNRD 2023 Robust Review

March 14, 2024

ADAPTIVE RESOURCES INC
WATER • GEOLOGY • MAPPING

NEBRASKA
DEPT. OF NATURAL RESOURCES

North Platte
NATURAL RESOURCES DISTRICT

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

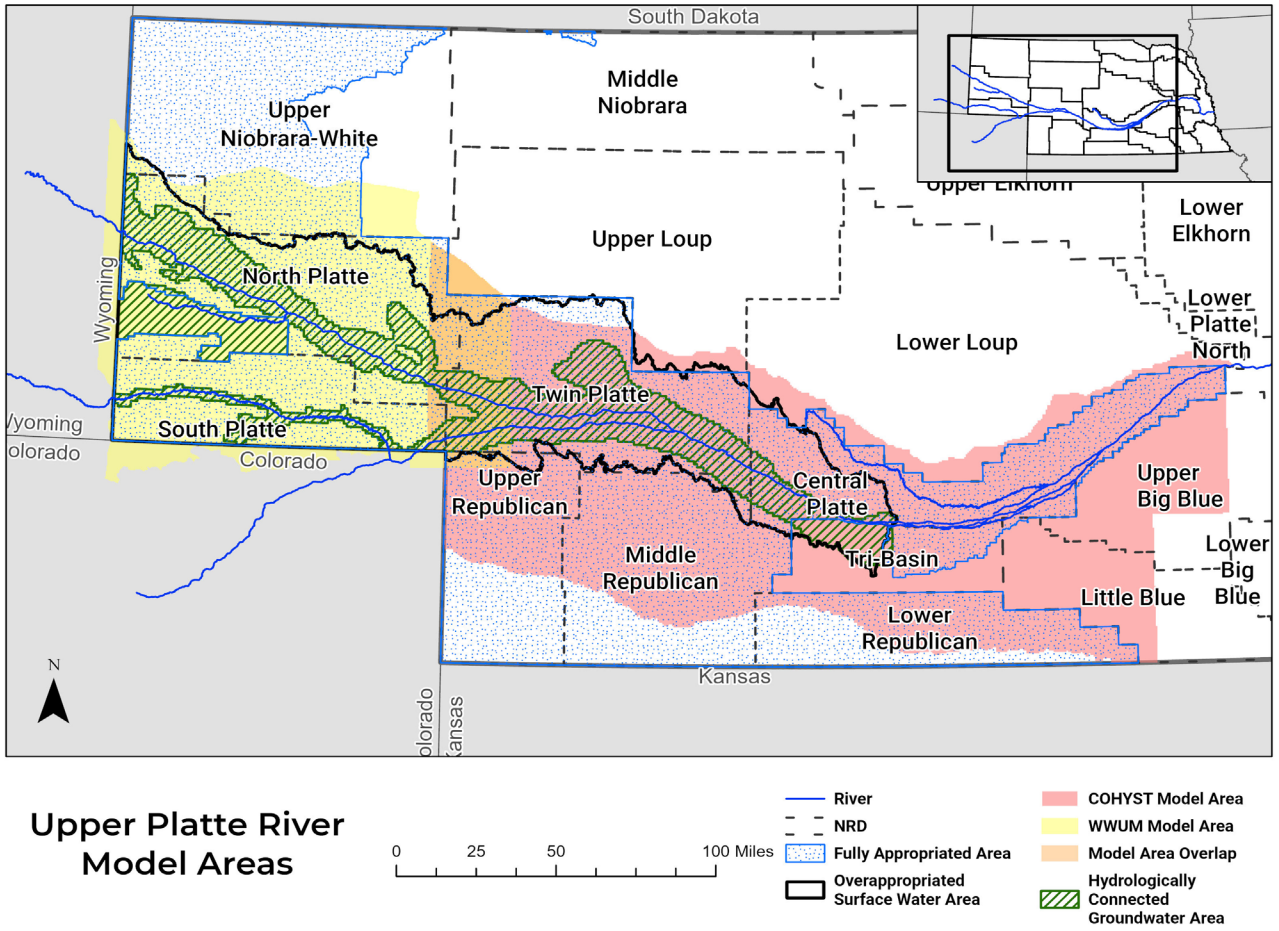
IWM – Overview
Statutes

- *Nebraska Revised Statute* § 46-713(4)(a): A river basin, subbasin, or reach shall be deemed overappropriated if on July 16, 2004:
  - 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

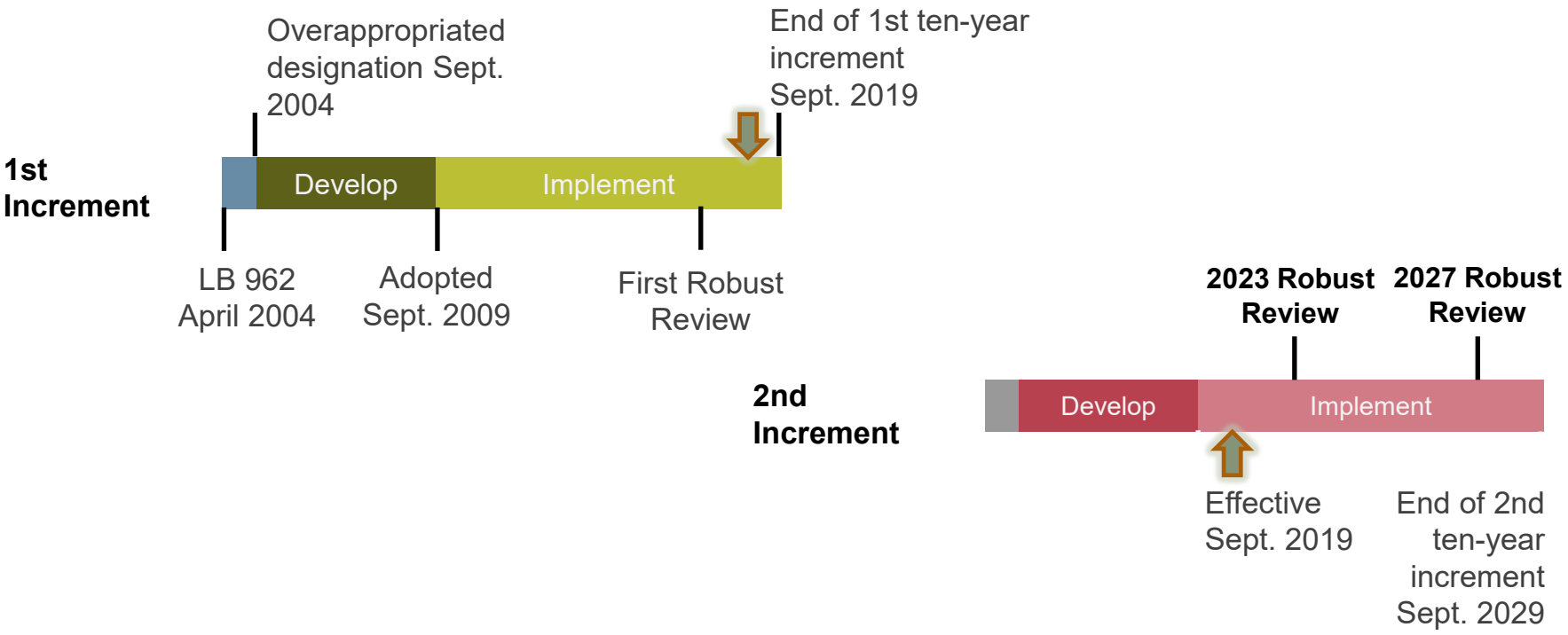
Fully and Overappropriated Areas within Model Area



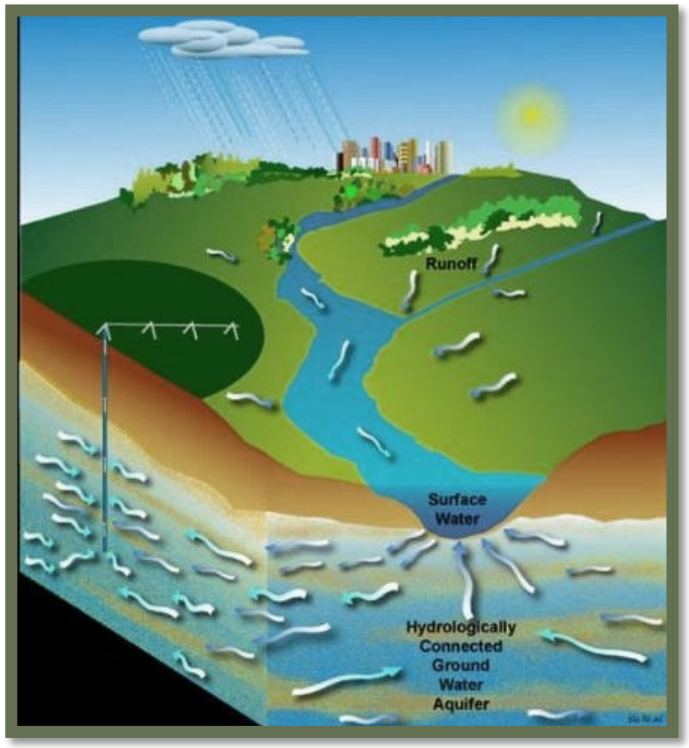
IWM – Overview Statutes

- *Nebraska Revised Statute* § 46-715(5):
  - ✓IMPs
  - ✓Basin-wide Plan
  - ✓Use Consultation & Collaboration Process
  - ✓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

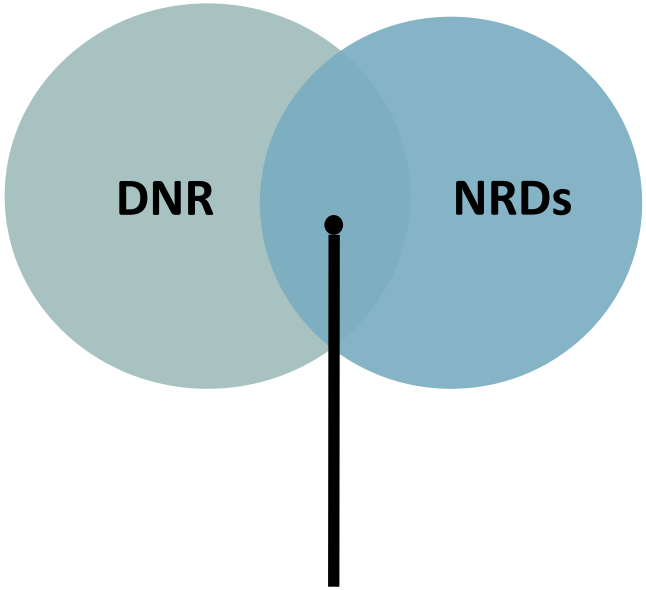
Groundwater
- Regulated by NRDs
- Correlative rights
- Share and share alike

- 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
- Requires annual reporting of new or expanded uses

✓ The Basin-wide Plan and IMPs have goals, objectives and action items to ensure compliance with the Program

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

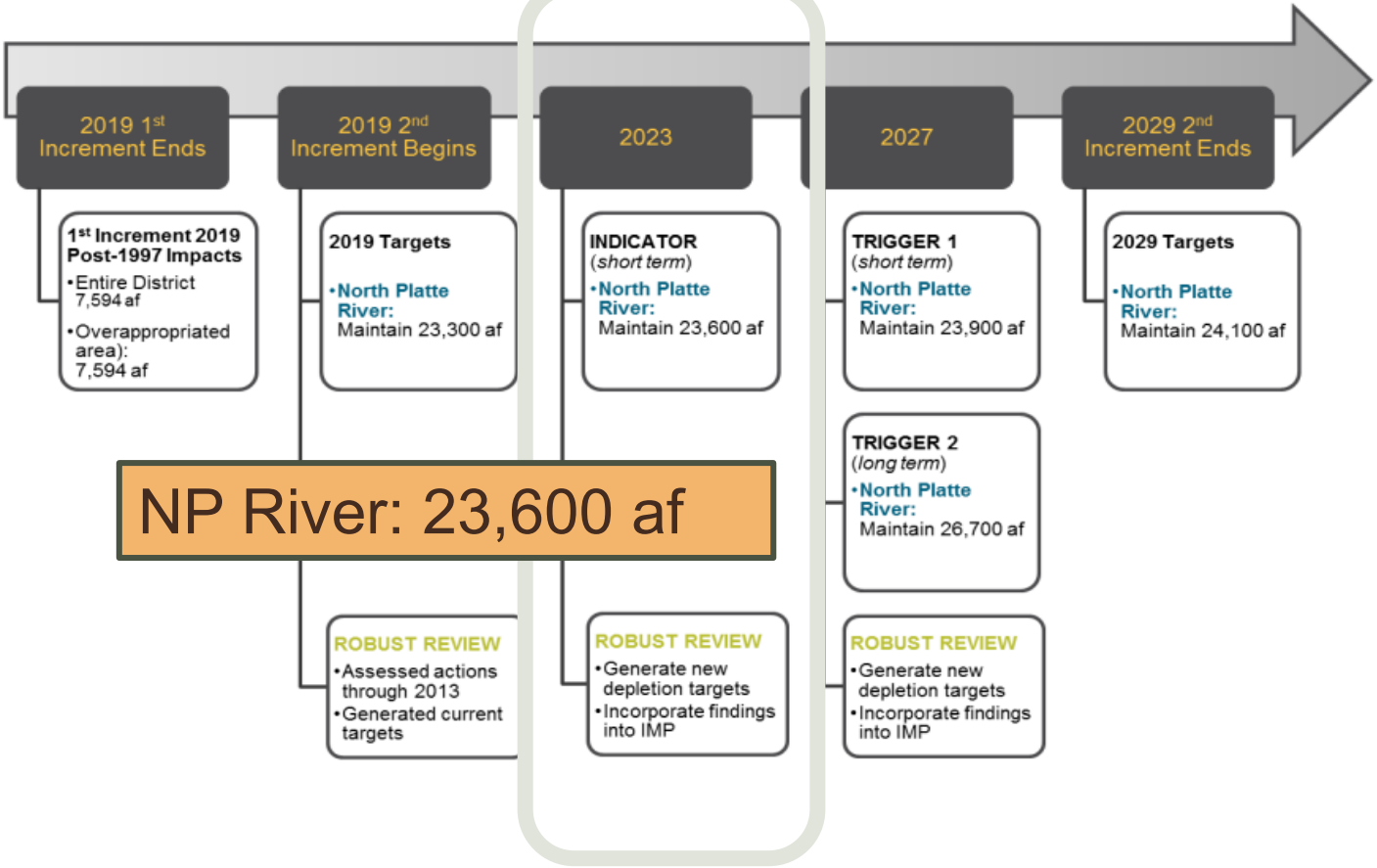
1 NRD and NeDNR

Overappropriated and Fully Appropriated Areas

Goals, objectives, & controls:

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

IWM – Overview
NPNRD IMP Requirements -Triggers



2023 Robust Review Analysis: Introduction

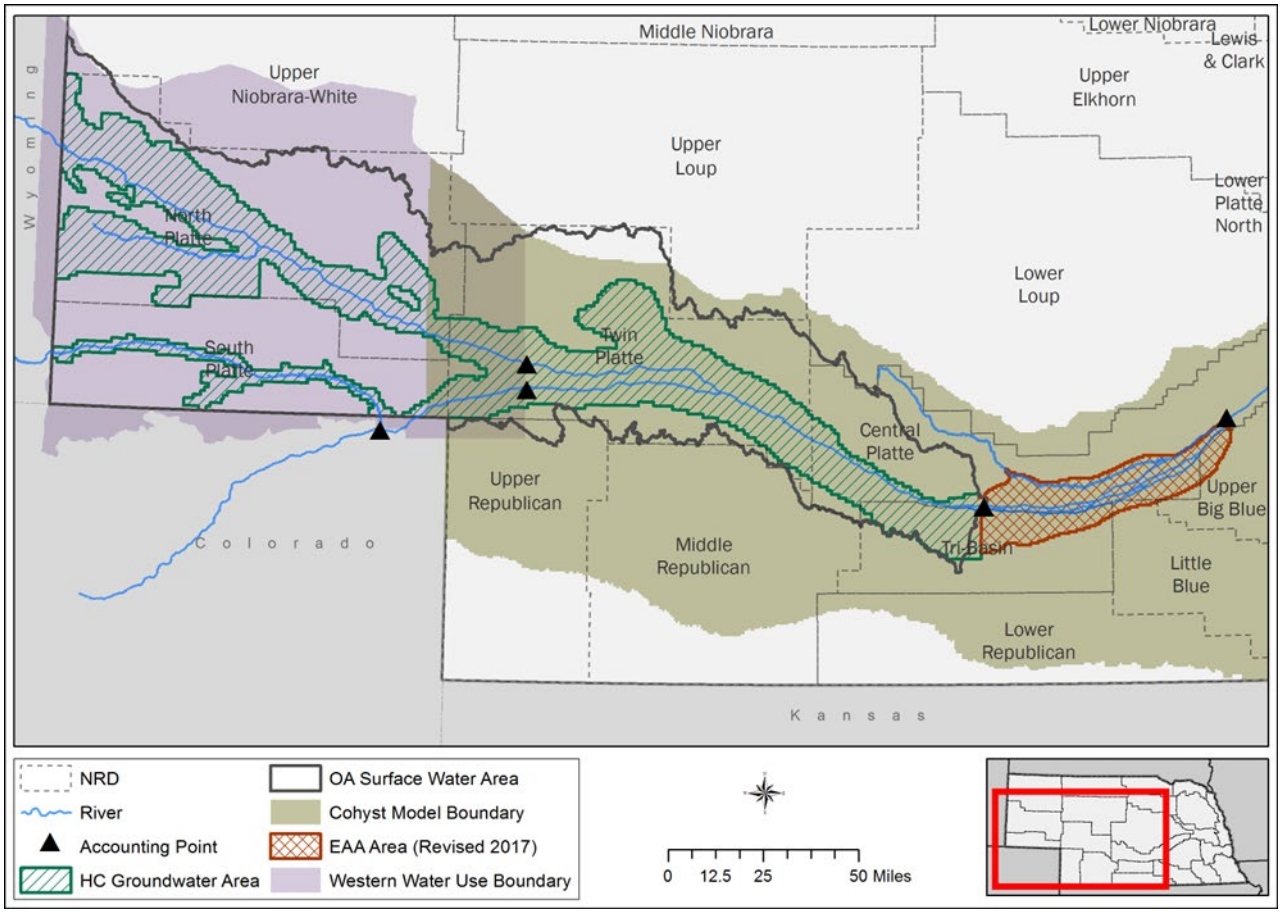
Robust Review Introduction

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
- NPNRD Scenario repeat:
  - 2015-2019
  - Includes full allocation cycle
  - Captures a wetter than average climate period
- Results are summarized for:
  - 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**

CropSim

- Climate Data
- Run CropSim
- Output

ESC Model

Input Data

- CropSim files
- Landuse
- Canals
- Diversions
- Wells
- Model Grid
- Soils
- Pumping

Model Run

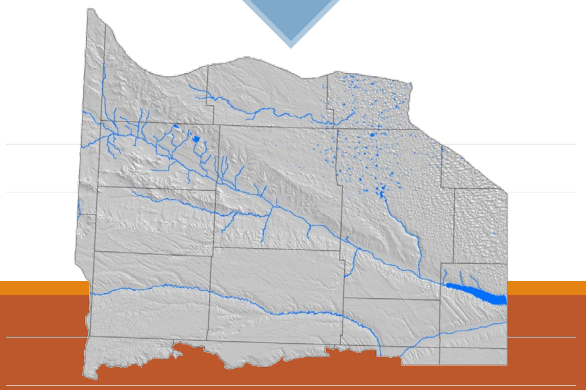
- Model is parcel based for irrigation, climate, crops
- WSPP from previous runs was recreated
- Many Options available, historical, Steady State, Post97 options

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

GW Model

- 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

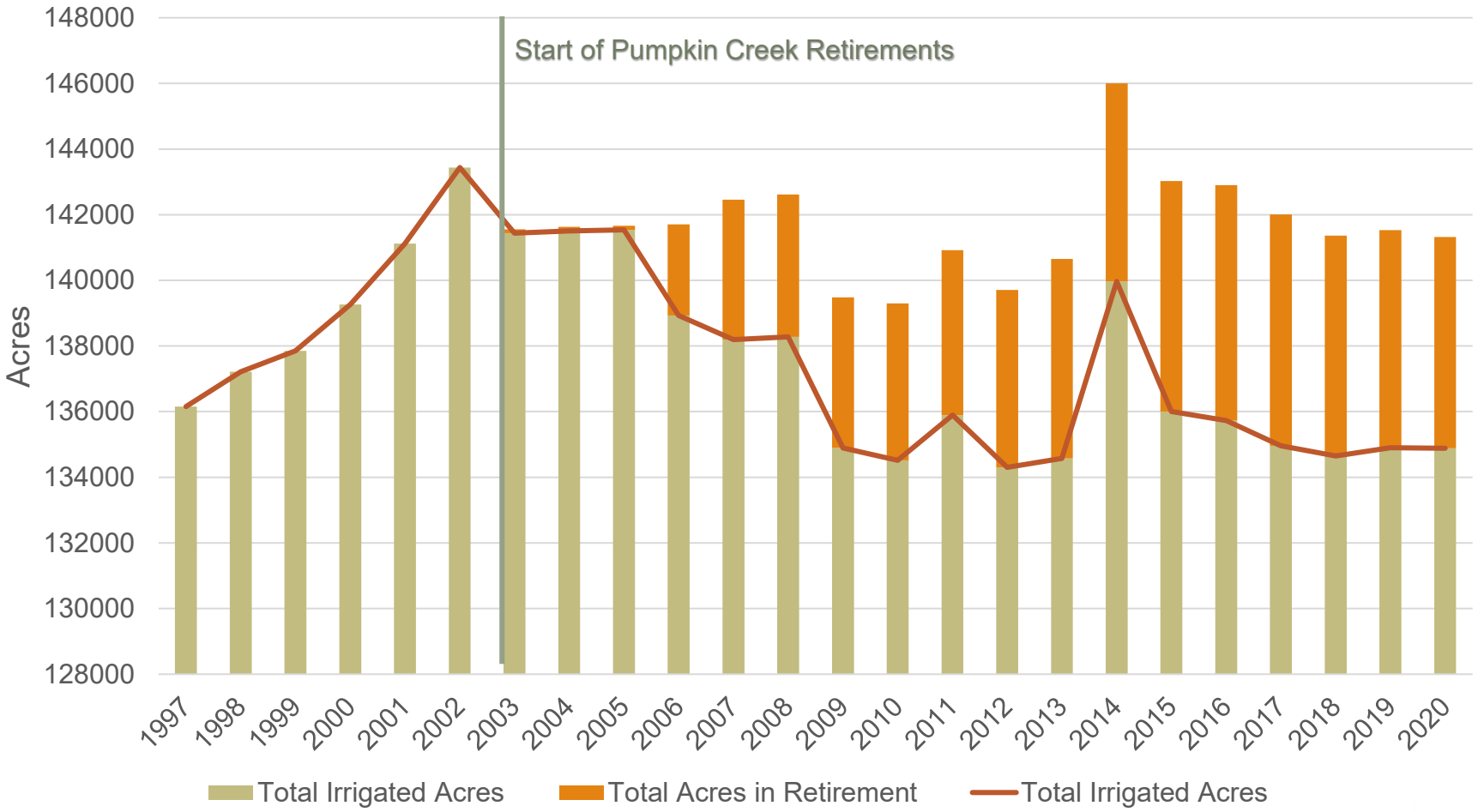
- Model performs comparatively well to the prior model
  - Underestimates groundwater levels in the vicinity of the South Platte River
  - Overestimated heads and underestimated baseflows in the last 10-15 years of the calibration period along the North Platte River in the western half of the model domain

- Recalibration is suggested before next robust review

2023 Robust Review: Management Actions & Other Inputs

Management Action & Model Input:

Net Change in Groundwater-Only Irrigated Acres 1997 to 2020



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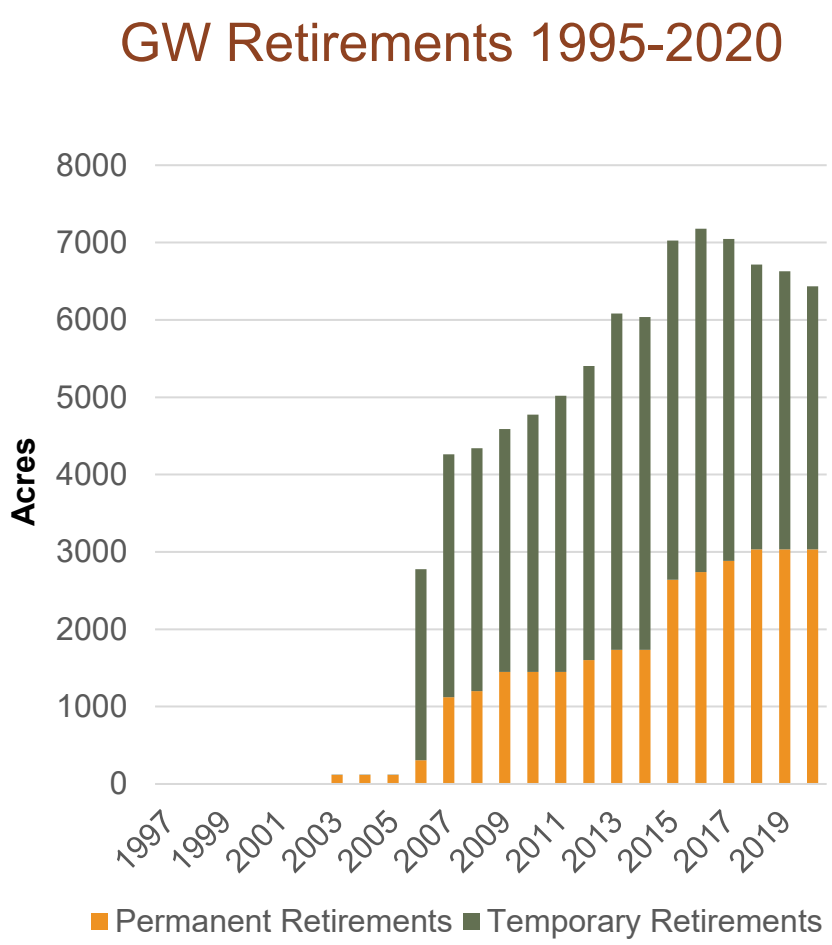
Management Action & Model Input:
Decertified groundwater only irrigated acres



- Retirements began in 2003
- Modeled as net pumping
  - Allocation*efficiency*acres
- Average NRD-wide change in CU
  - ~10 Inches/Acre/Year

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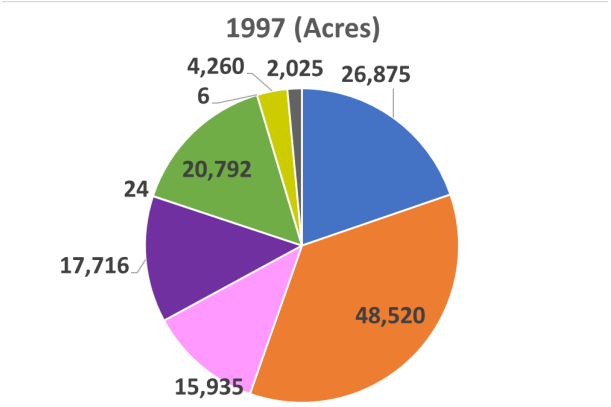
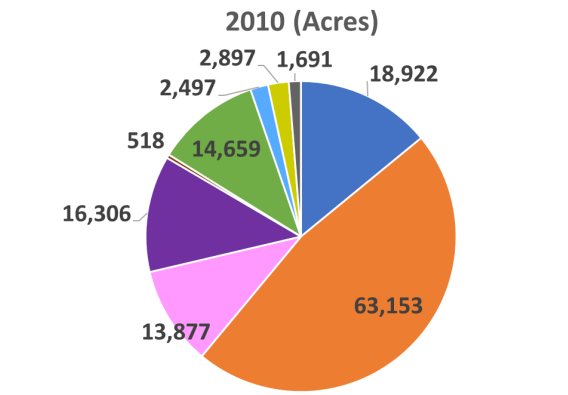
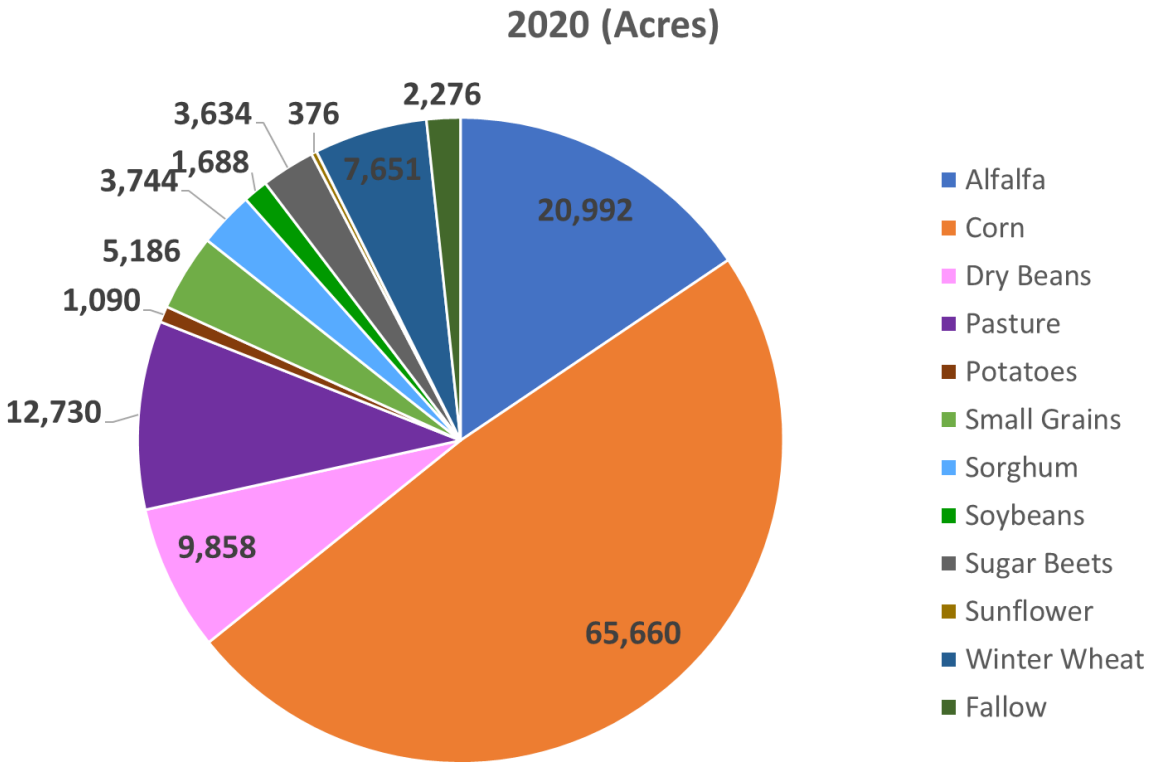
Management Action & Model Input:

Change in Groundwater-Only Irrigated Crop Types







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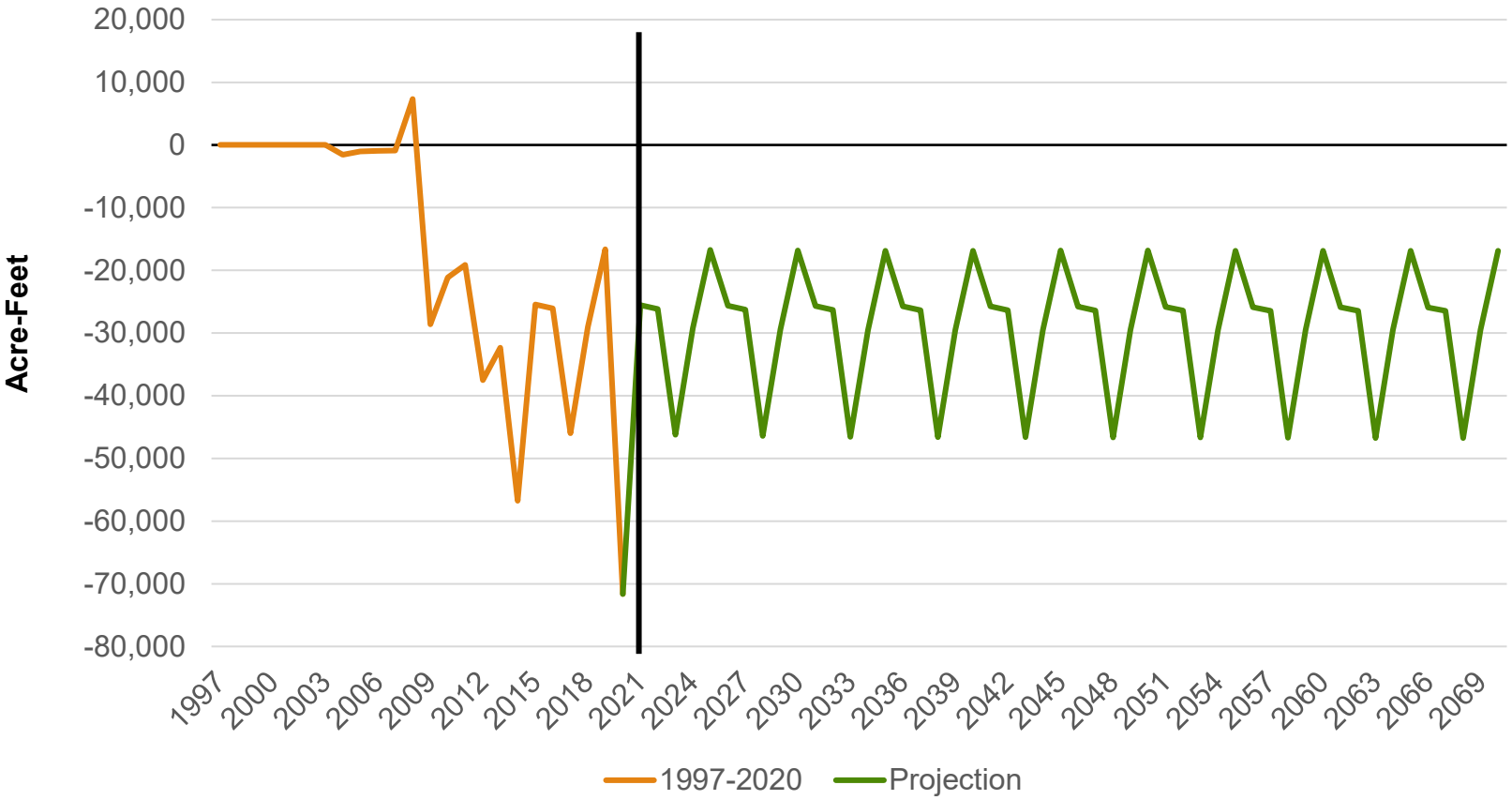
Management Action & Model Input: Allocations

Change in Groundwater-Only Irrigation **Pumping**: Allocations



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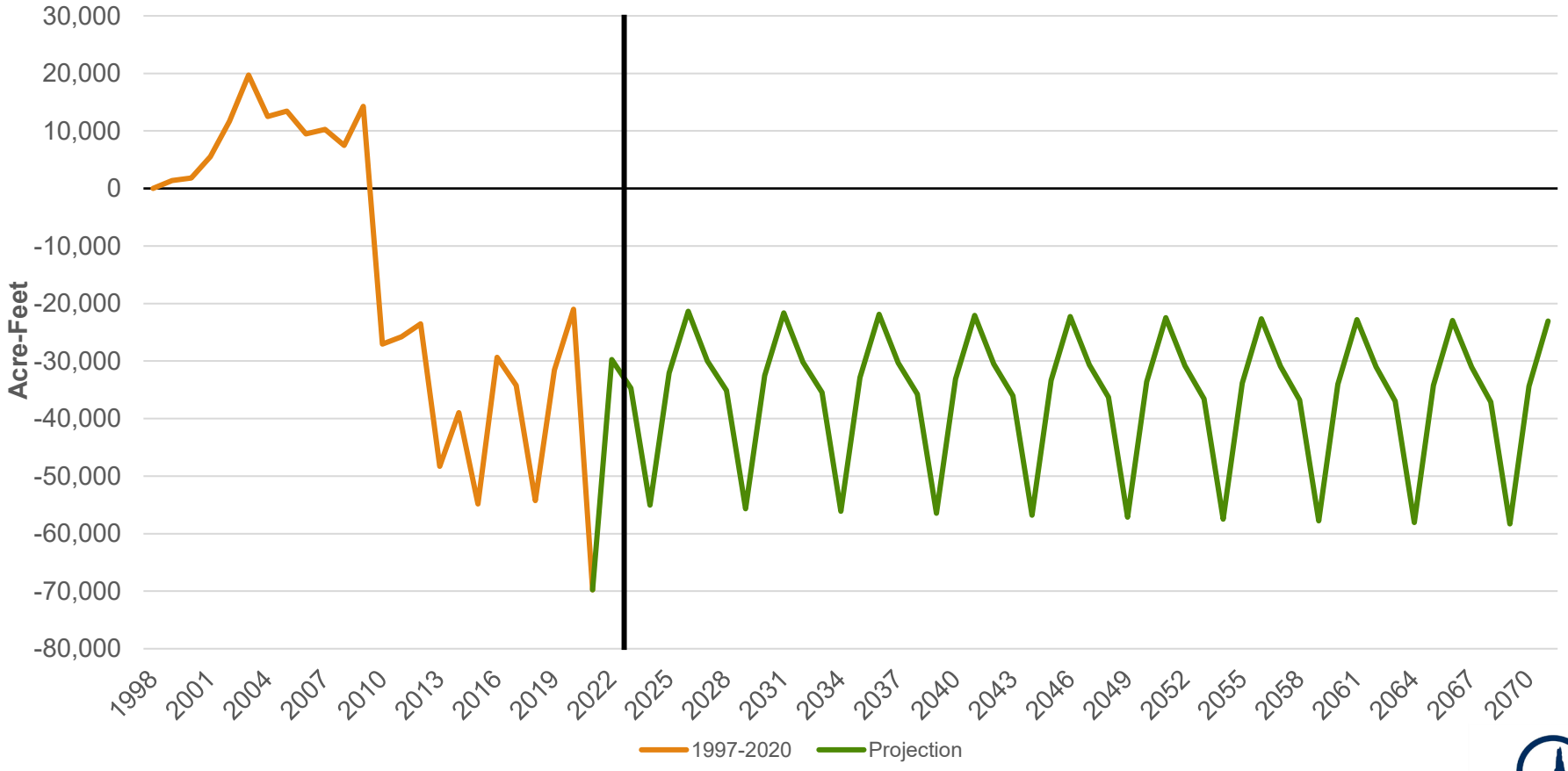
Management Action & Model Input:

Change in Groundwater-Only Irrigation **Pumping**: Total



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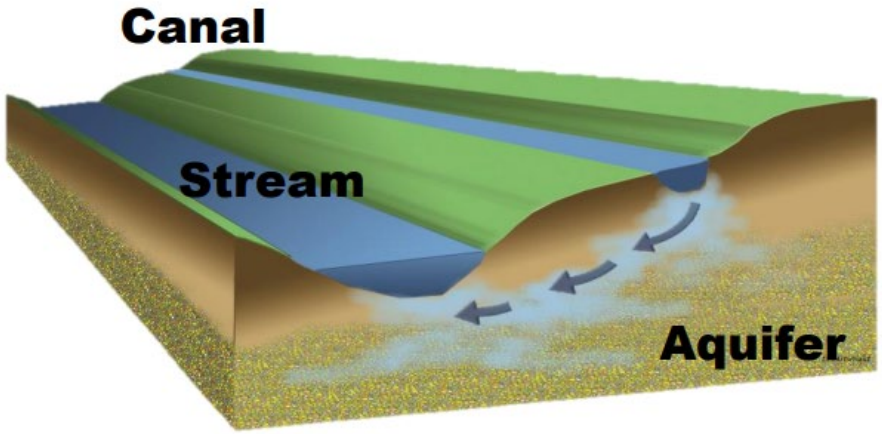
Management Action: Conjunctive Water Management (CWM)



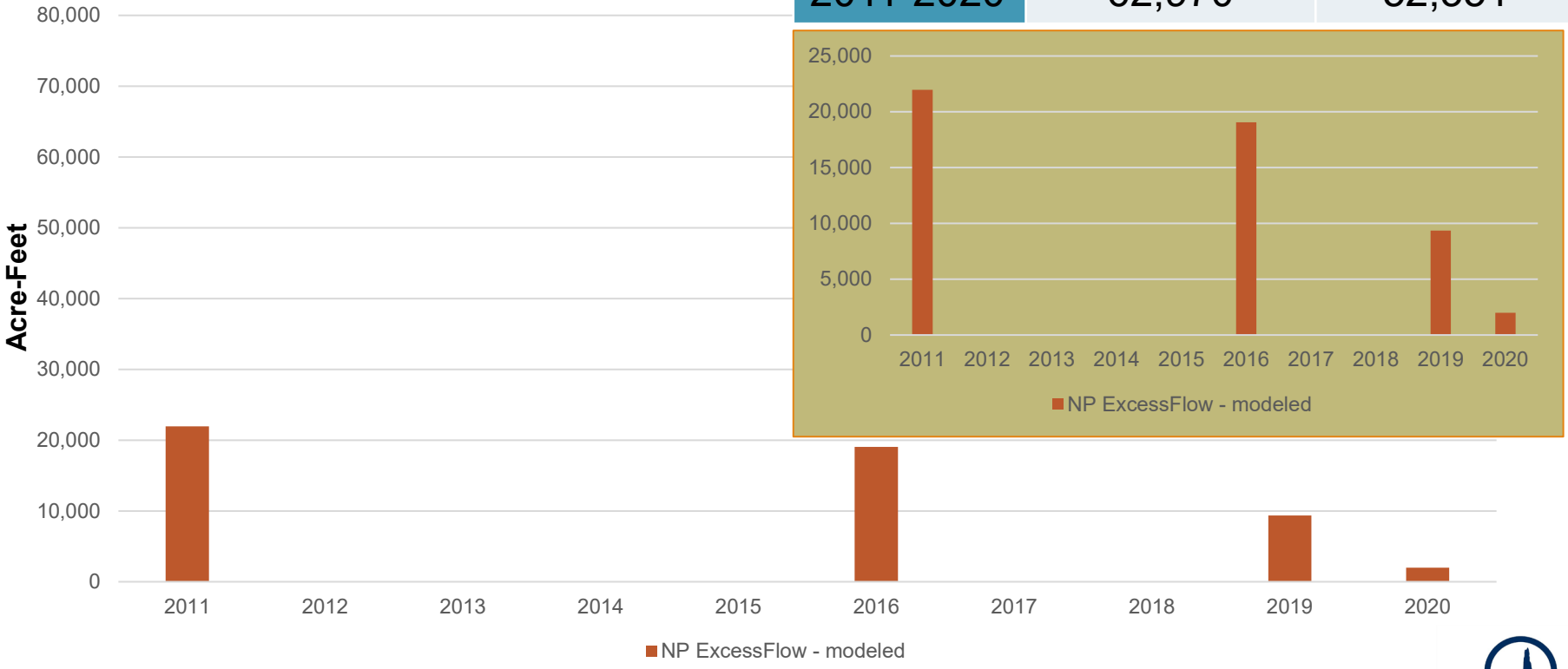
Conjunctive Water Management is an *adaptive process* that utilizes the *connection* between surface water and groundwater to *maximize water use*, while *minimizing impacts* to streamflow and groundwater levels in an effort to increase the overall water supply of a region and improve the reliability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

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

Management Action: CWM / Excess Flows

NPNRD	Acre-Feet of Excess Flow	
	Diversion	Recharge
2011-2020	62,970	52,351

Excess Flow Recharge



Recharge values for 2011, 2016 do not match historic records due to modeling limitations

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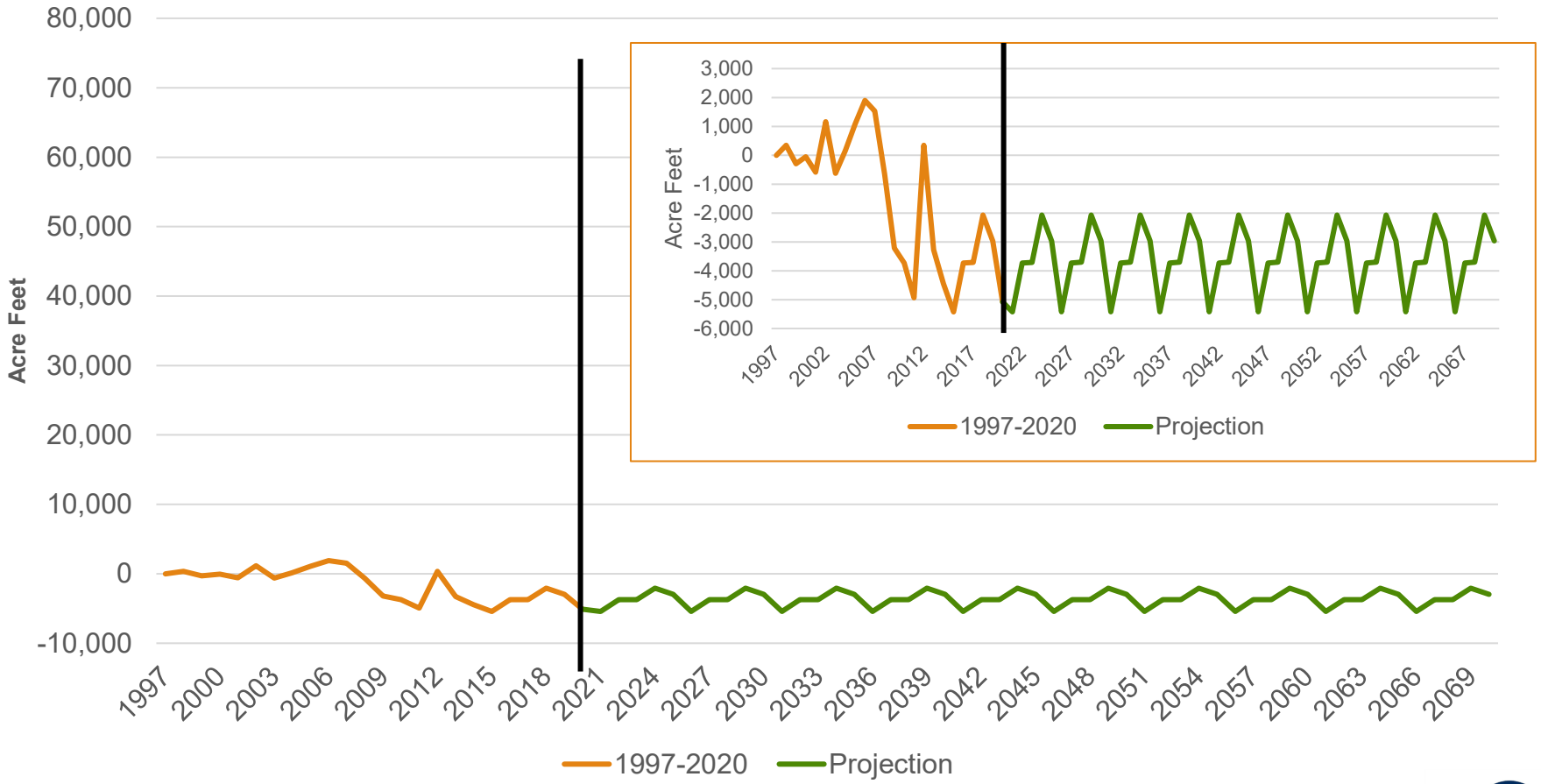
Management Action & Model Input:

Change in Municipal and Industrial Pumping from 1997



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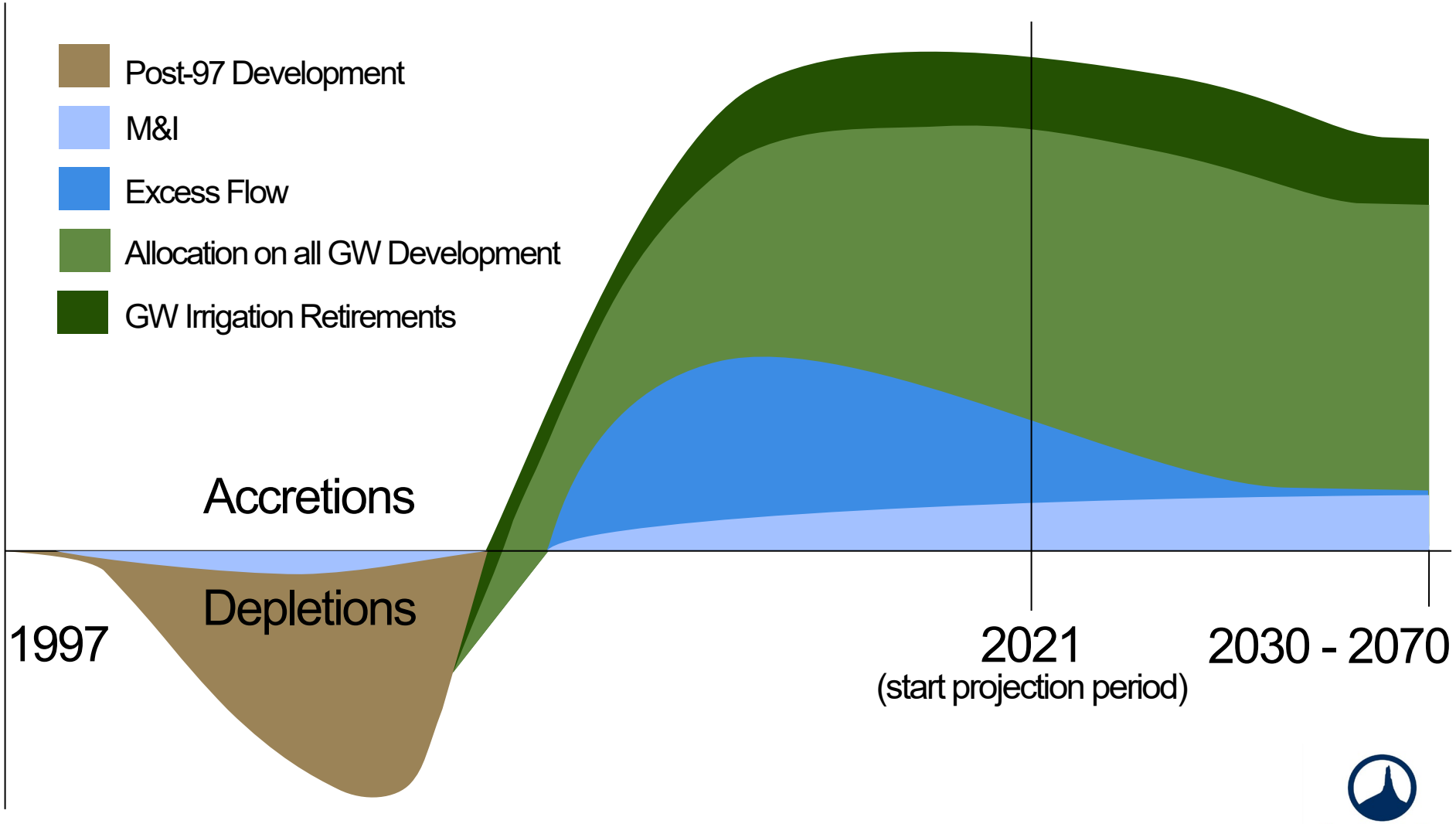
2023 Robust Review: Analysis – NPNRD Results

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)
  - Allocation Effect Analysis (New to RR)
  - Ground Water Irrigation Retirements Analysis (New)
  - M&I Analysis (Same as last RR)
- Total Depletions Analysis (Same as last RR)
- Livestock Analysis (Same as last RR)
- Surface Water Retirements Analysis (New) – In progress

Model-Wide Streamflow Impacts for Post-1997 Management Actions



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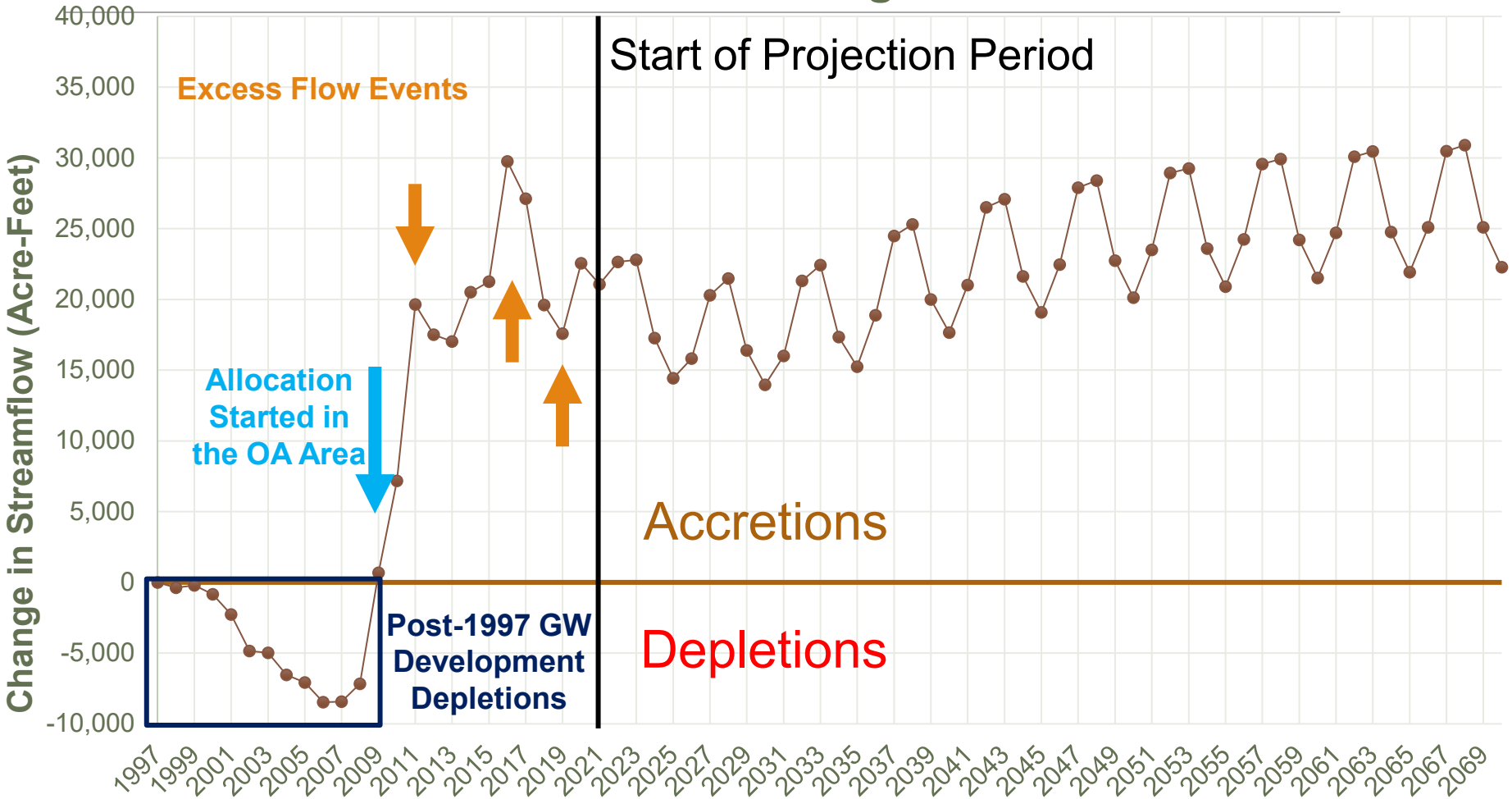
North Platte River

Combined Post-1997 Impacts- Robust Review Analysis Results

North Platte NRD: Change in Streamflow



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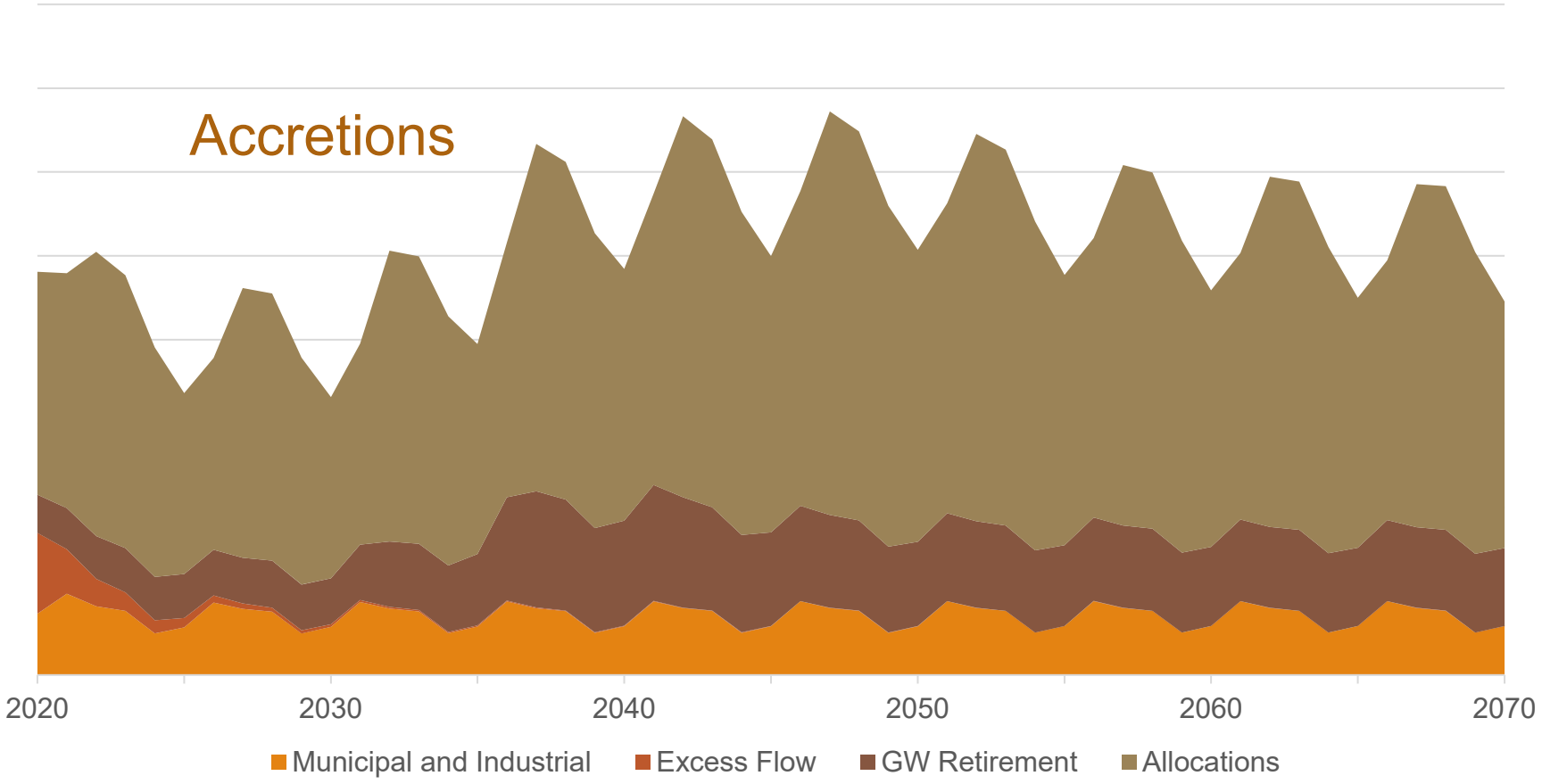
NPNRD Results

Future Projection Generalized Components



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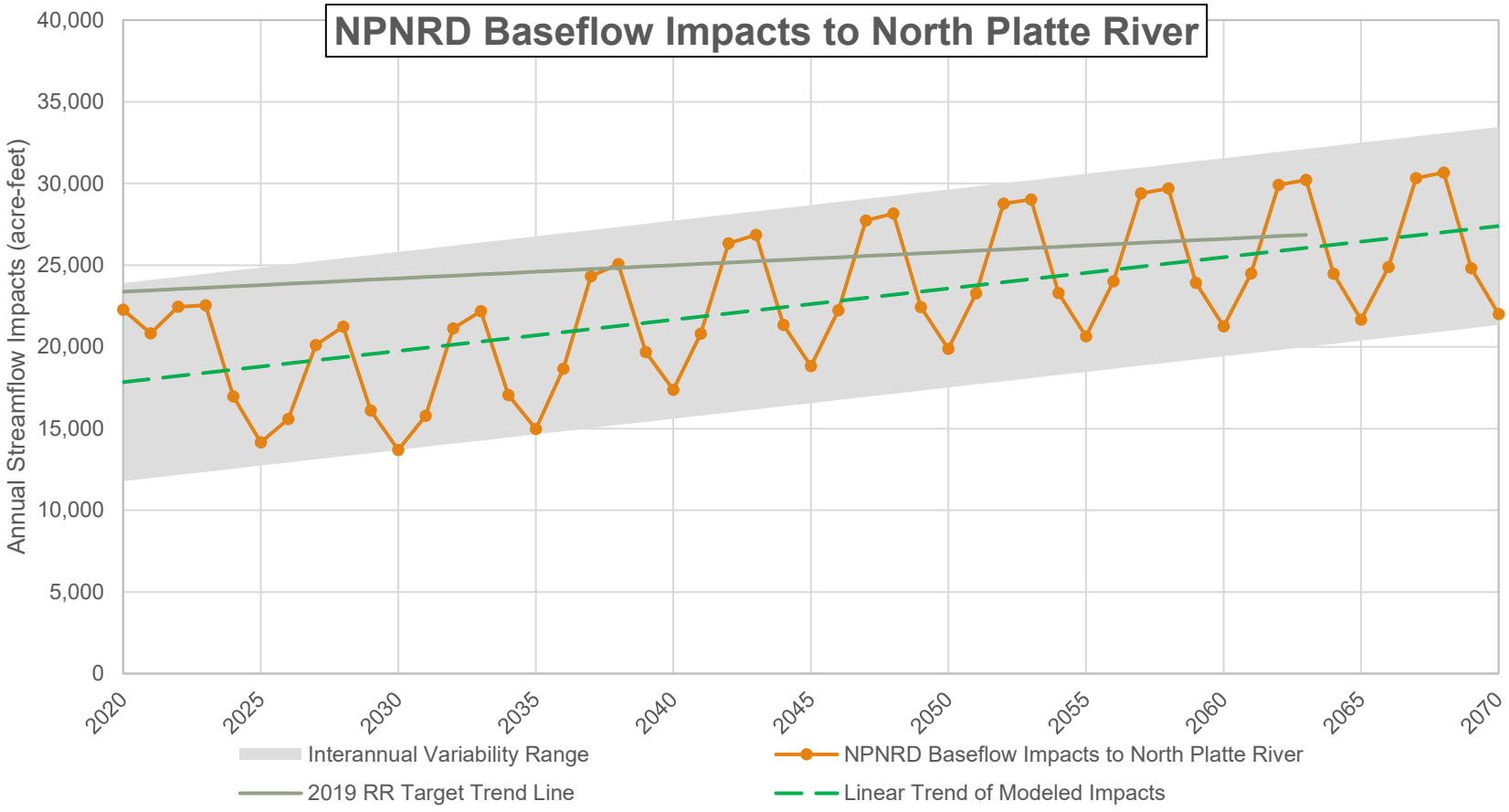
Updated Targets North Platte River



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Indicator* Review: North Platte River

Arial	Current IMP Targets	2023 Robust Review Targets
2019	23,300	17,600
2020	23,400	17,800
2021	23,500	18,000
2022	23,500	18,200
2023*	23,600	18,400
2024	23,700	18,600
2025	23,700	18,800
2026	23,900	19,000
2027	23,900	19,200
2028	24,000	19,400
2029	24,100	19,600

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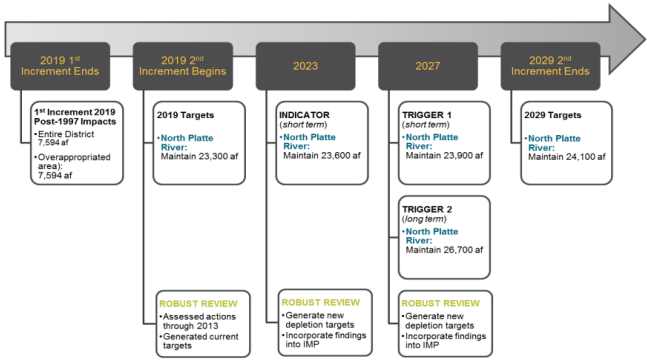
IMP Target Summary

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 NPNRD maintains their management actions."



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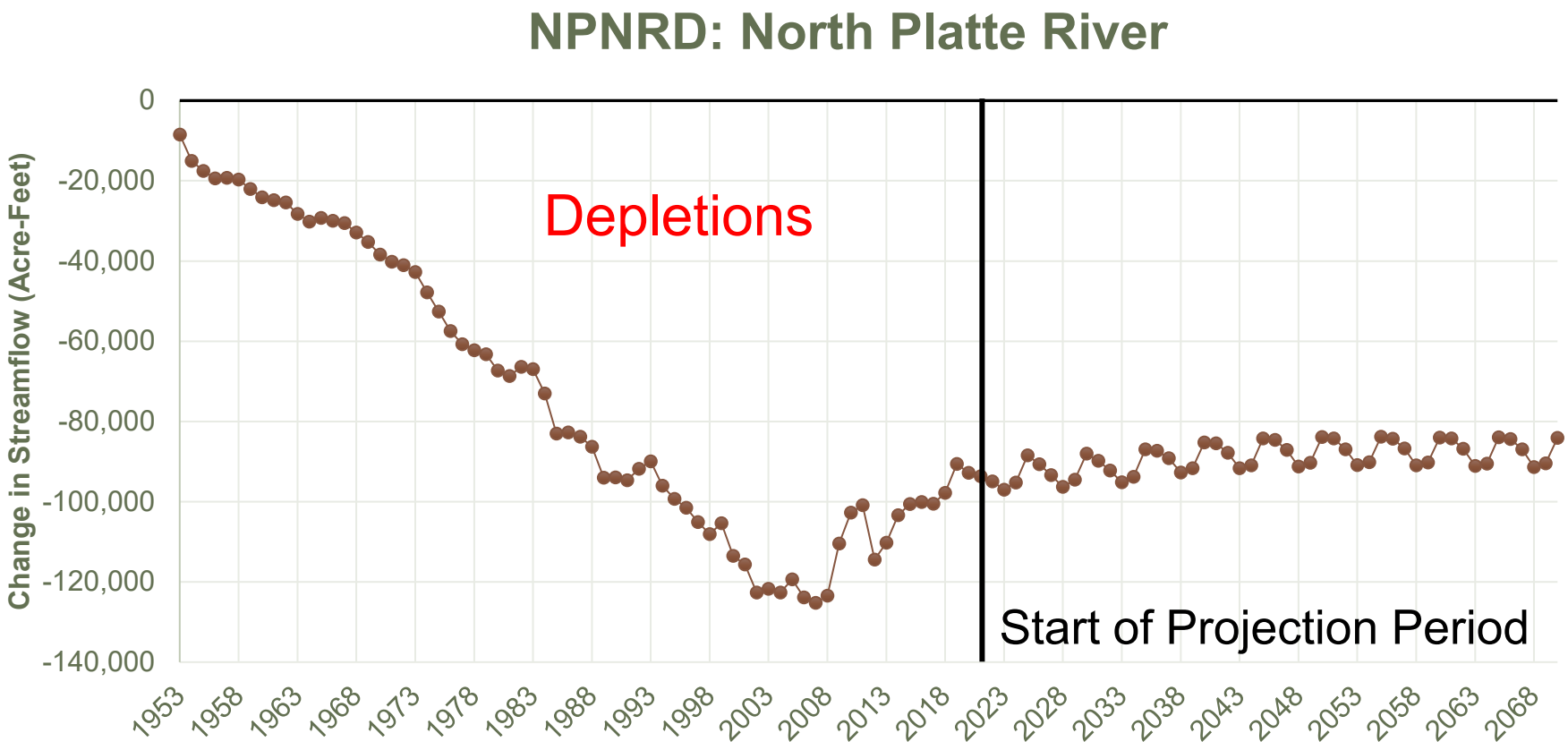
NPNRD Results – Total Depletions

Impacts from all Groundwater Pumping



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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

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THANK YOU

Jennifer Schellpeper, Water Planning, NeDNR

NPNRD Results – Management Actions

Impacts from Surface Water Decertification

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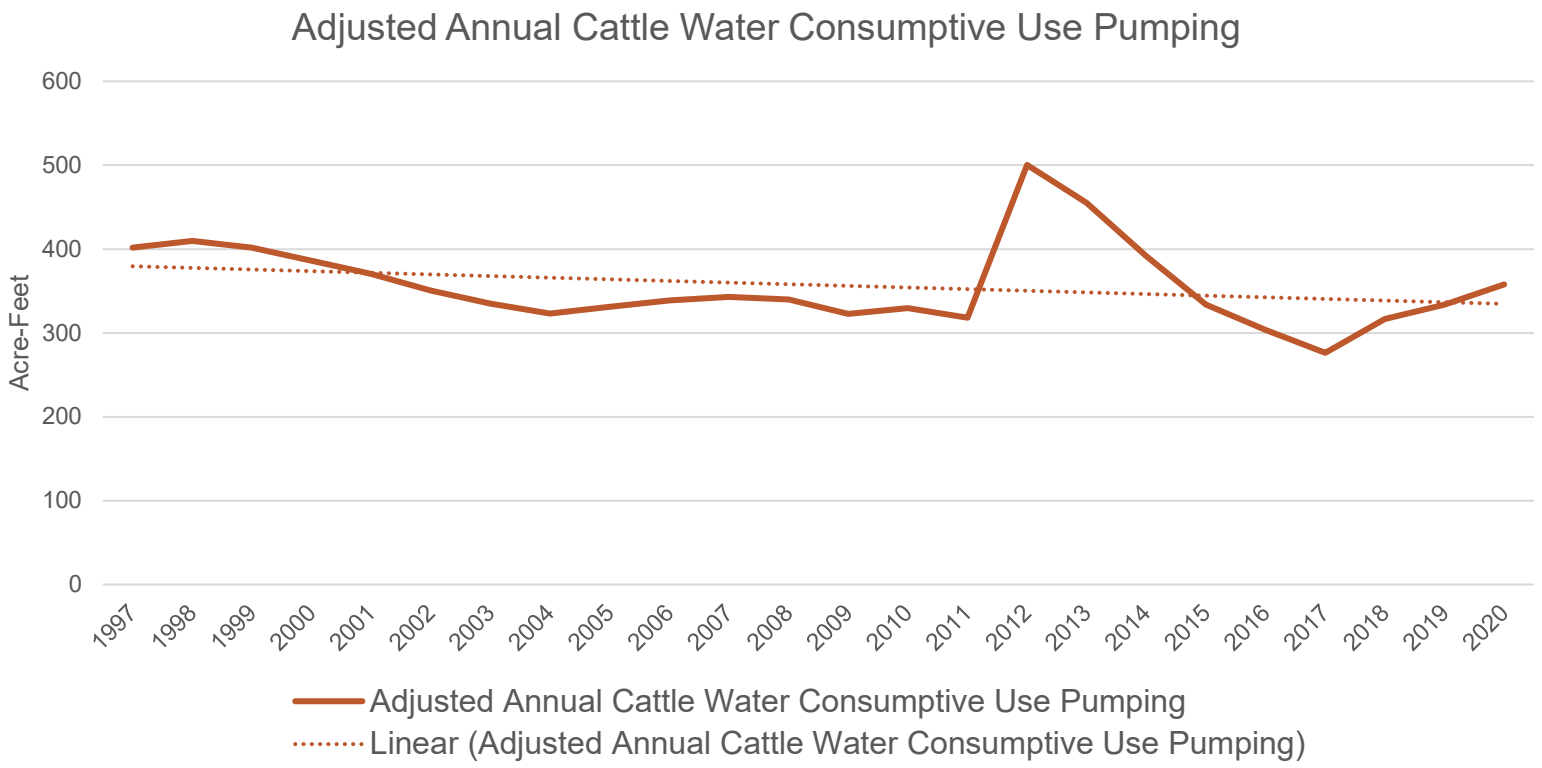
NPNRD Results – Management Actions

Livestock analysis Results:

There has not been significant changes in livestock numbers 1997-2020



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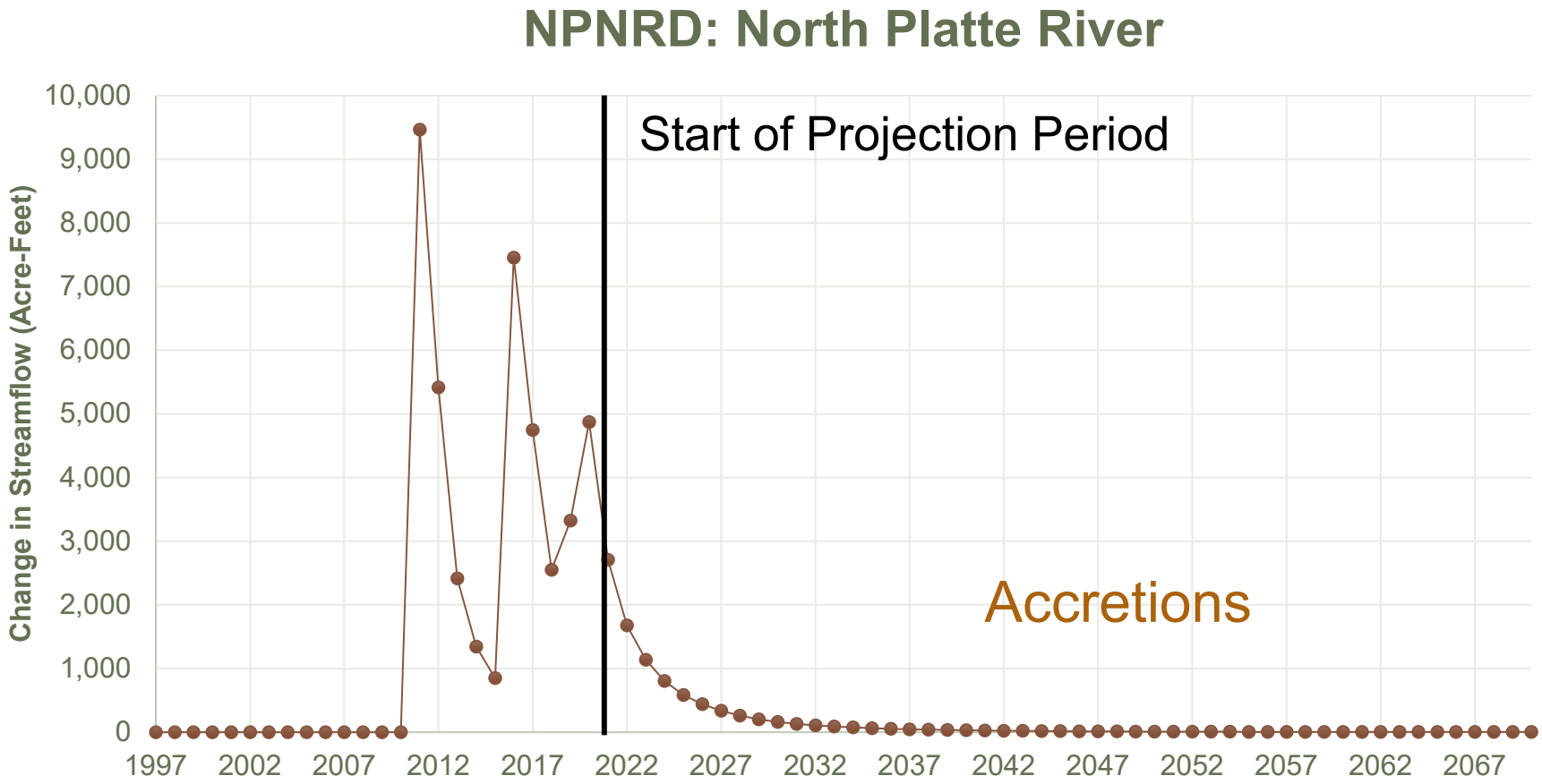
NPNRD Results – Management Actions

Impacts from Excess Flow Recharge



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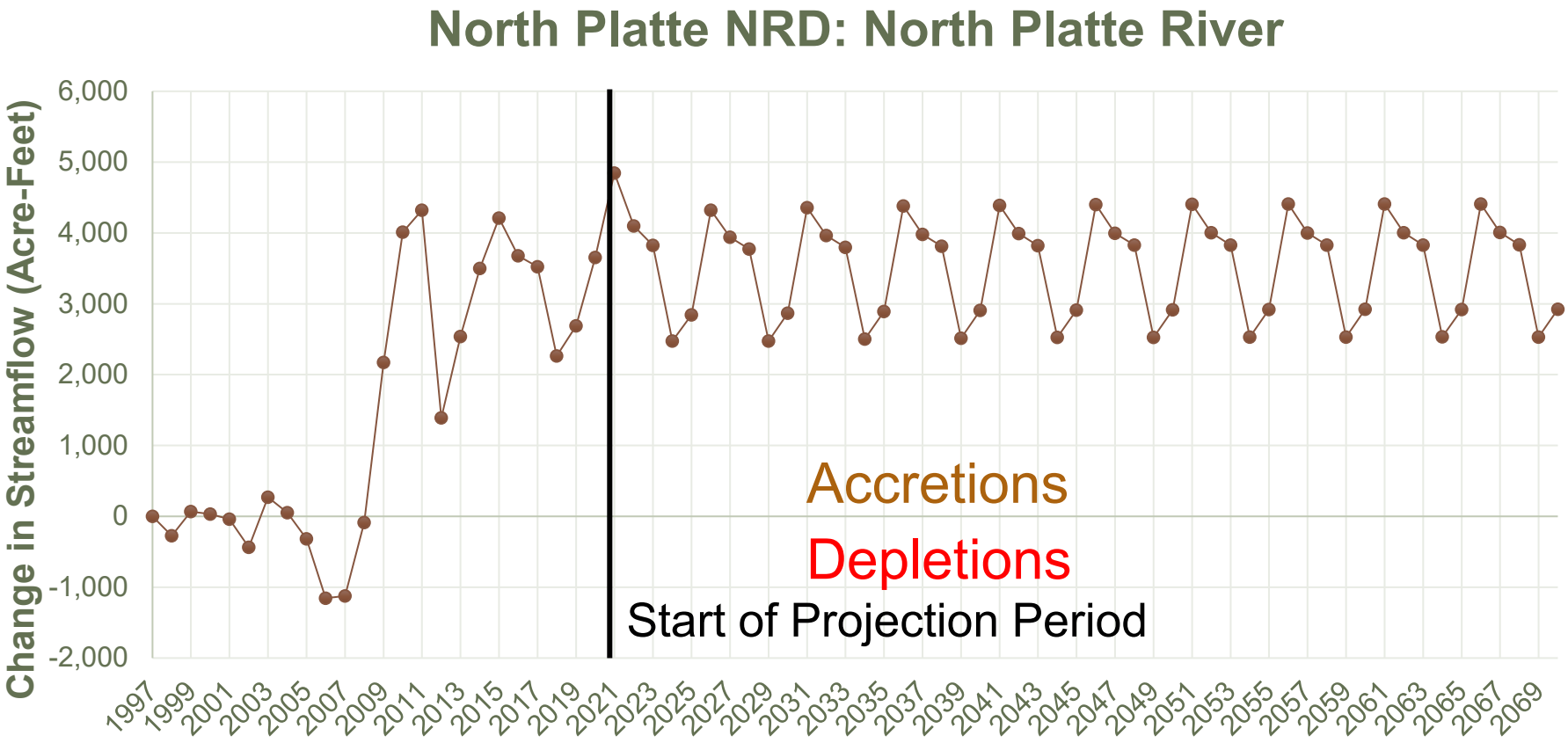
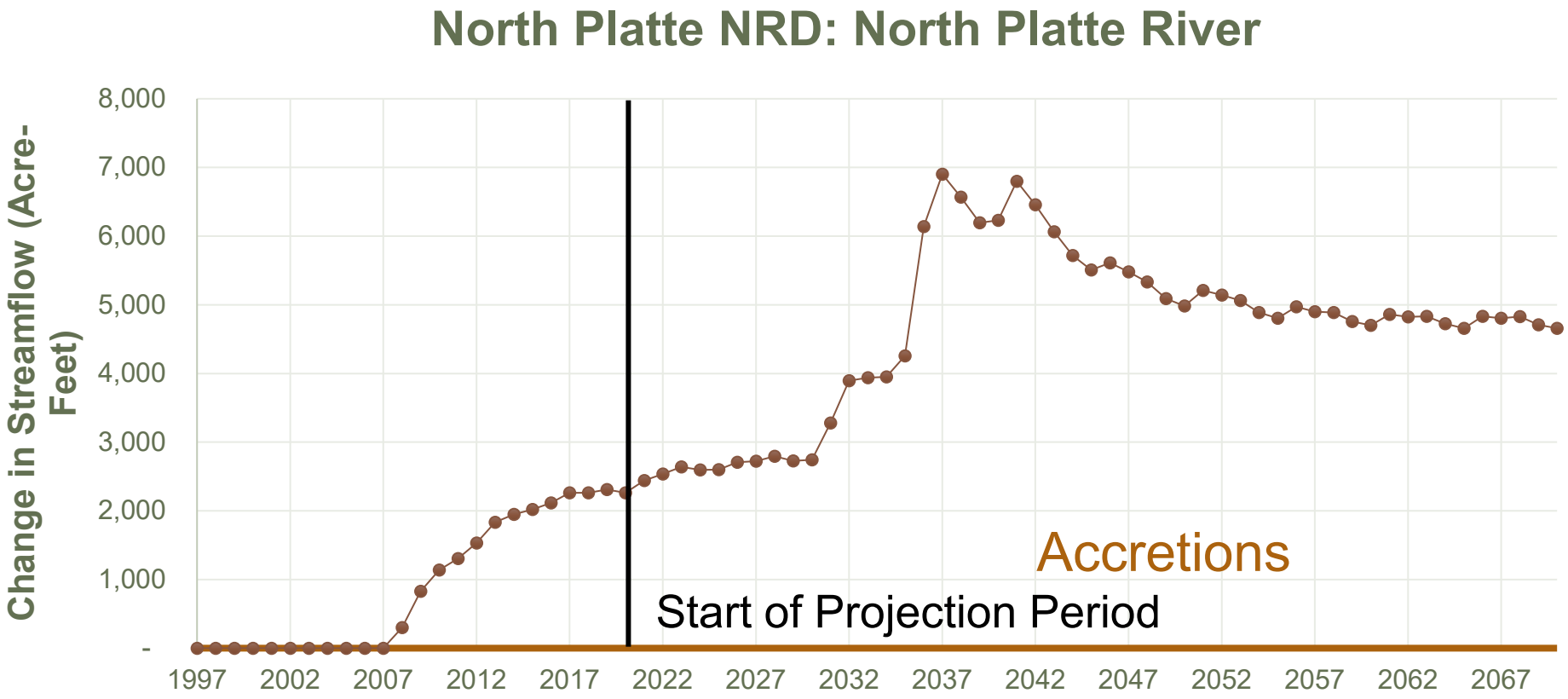
NPNRD Results – Management Actions

Impacts from Post-1997 Municipal and Industrial Changes



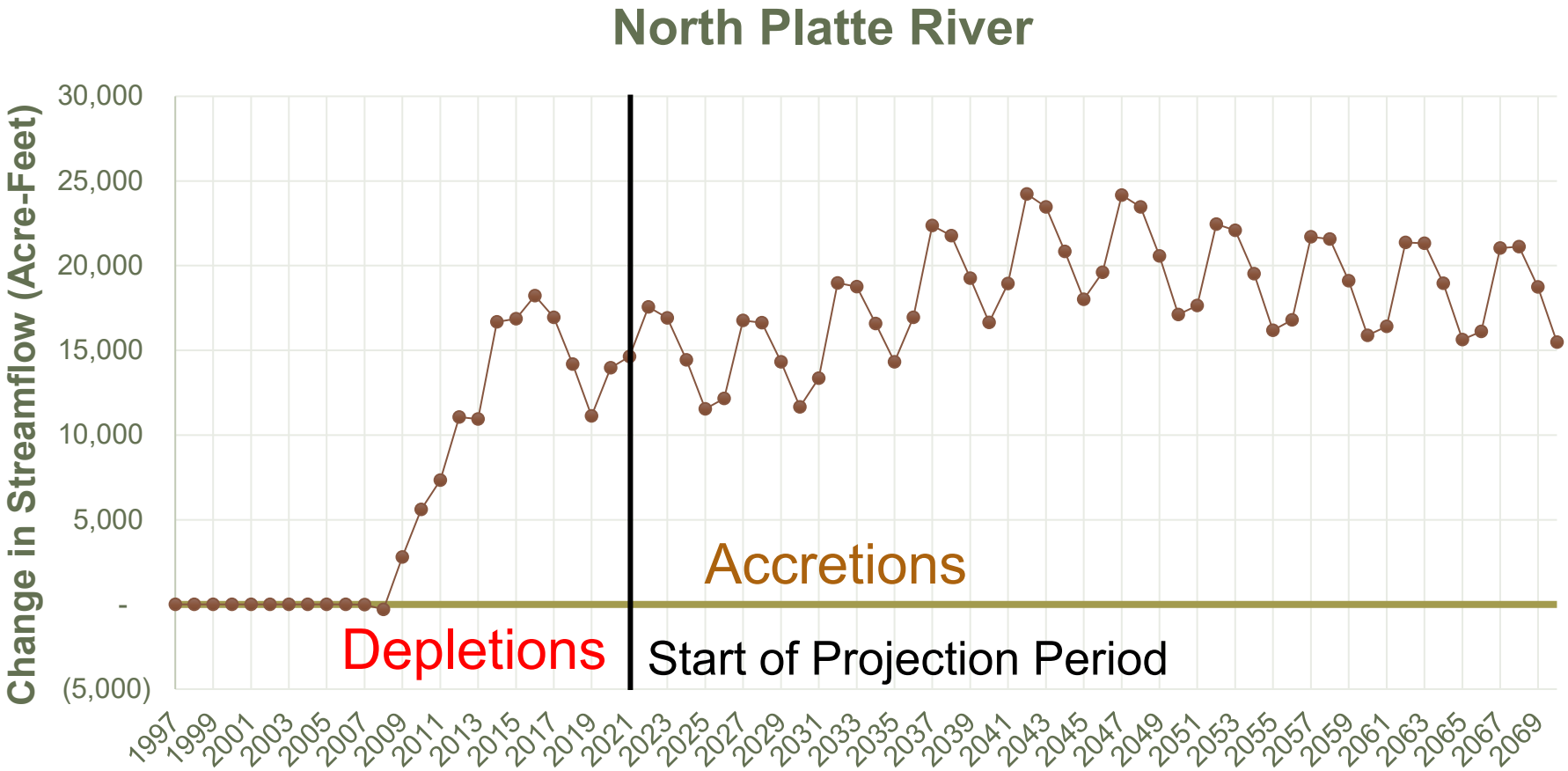
NPNRD Results – Management Actions

Impacts from Groundwater Retirements



NPNRD Results – Management Actions

Impacts from Allocations



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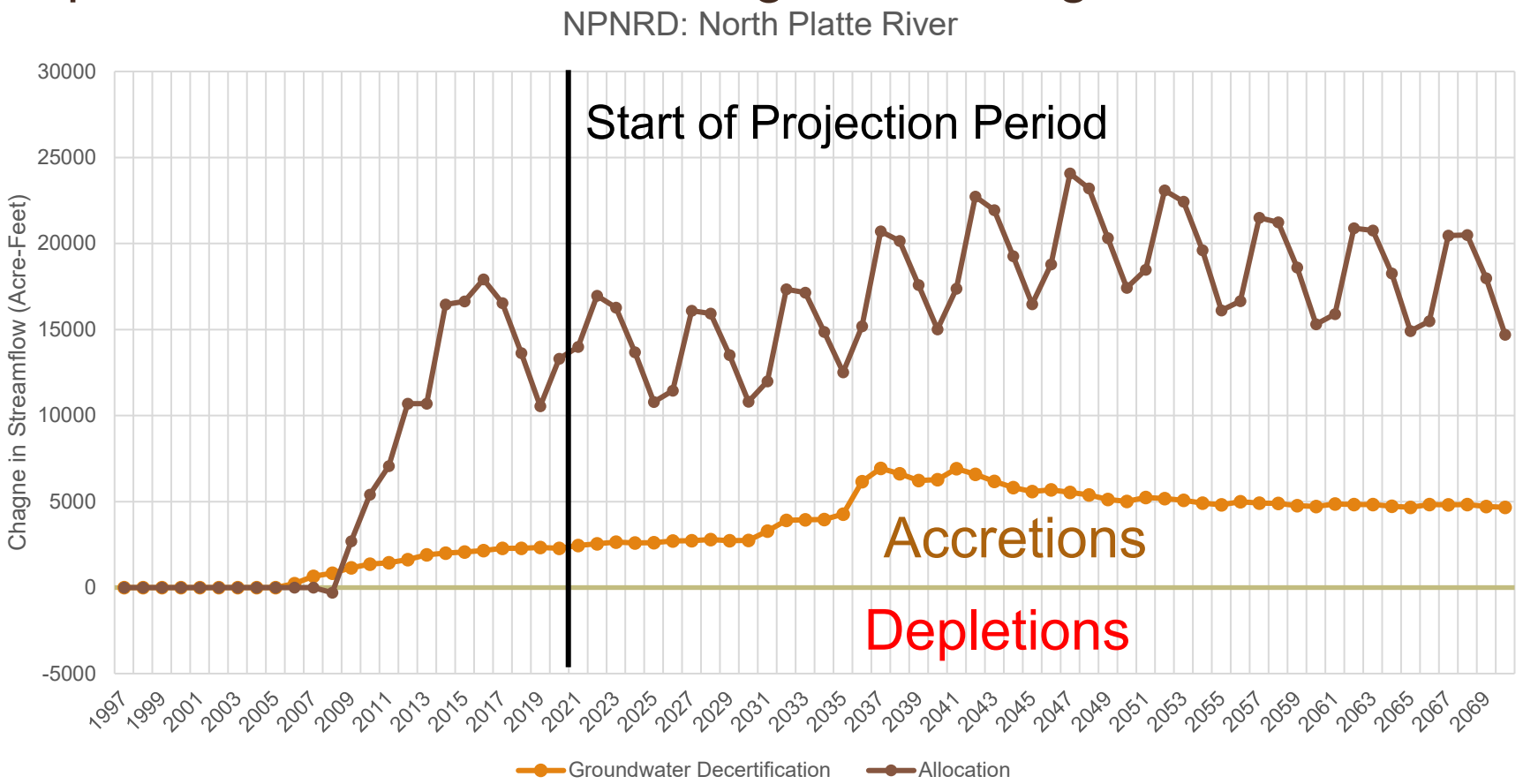
NPNRD Results – Management Actions

Impacts from Groundwater Irrigation Changes



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