Harney Basin Rulemaking Update

Oregon Water Resources Commission

December 13, 2024

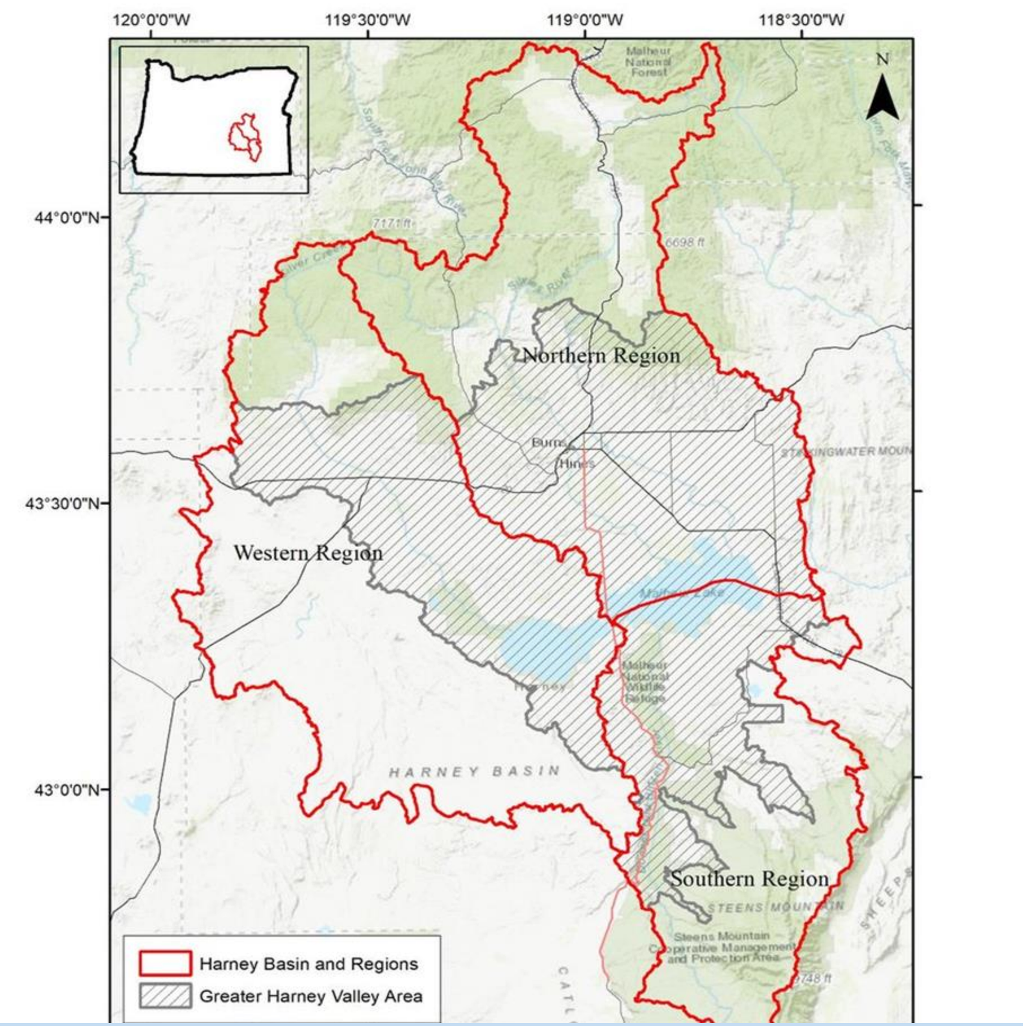
Agenda

- Background
- Summary of the Harney Basin Groundwater Model (HBGM)
- Modeling defined management scenarios
- Optimizing management scenarios
- Key takeaways by management element
- Next steps

Background

The Harney Basin

- Located in southeastern Oregon in the Northern Great Basin
- Closed basin
- Malheur and Harney Lakes lie in the center of the basin and receive water from all the streams in the basin
- One of the more severe areas of groundwater level decline in the state



Rules Advisory Committee (RAC)

2 RAC meetings held since last WRC meeting

<u>Topics:</u>

- Evaluating success
- Management scenario development
- Results of management scenarios
- Results of optimization runs
- Serious Water Management Problem Area (SWMPA)
- Voluntary agreement guidance
- Fiscal impact

Discussion Group

8 discussion groups hosted

Topics:

- Development of management scenarios
- Fiscal impact
- Measuring success/indicators of success
- Adaptive management
- SWMPA

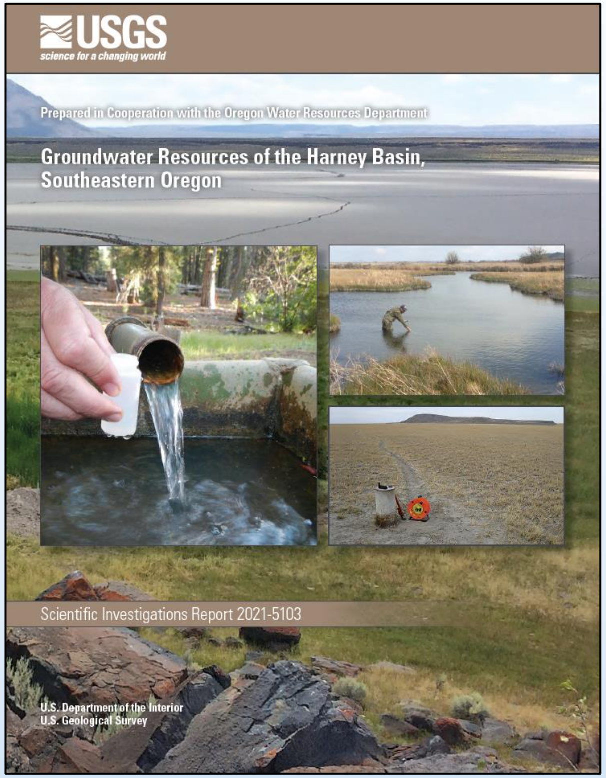
Goal: Stabilizing Water Levels

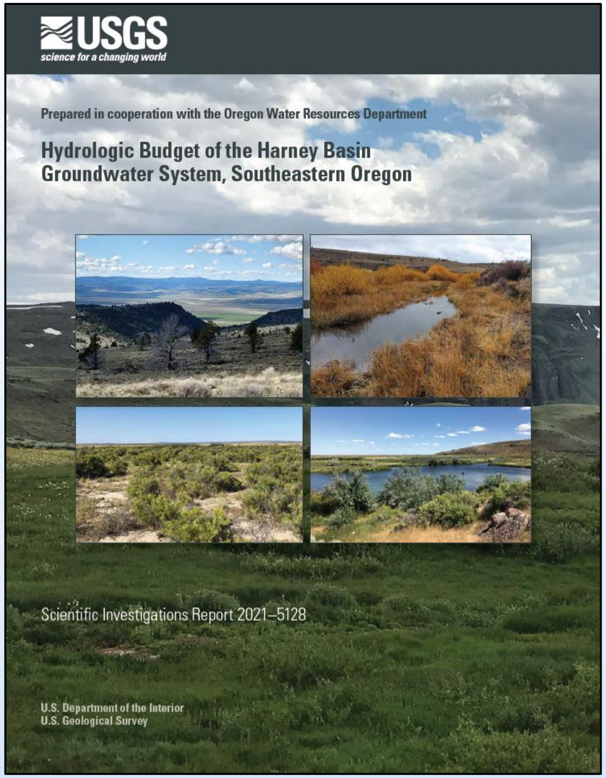
OWRD's current position is that all areas need to achieve a minimum target water level trend of no decline, meaning:

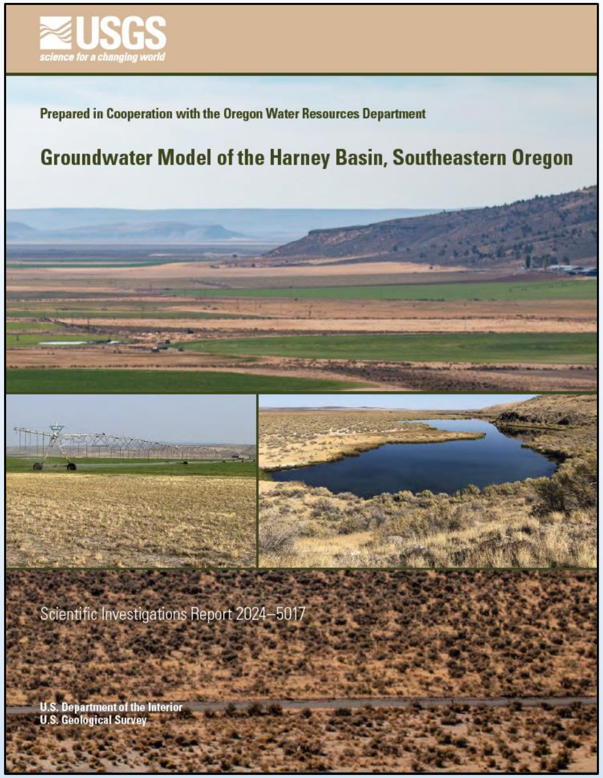
- Water levels do not show long-term declines
- Water levels should exist in a dynamically stable range
- Some wells will show declines, some will be stable, some will show recovery
- No individual well should exceed some defined rate or magnitude of decline (how do we handle extremes?)

Summary of the Harney Basin Groundwater Model

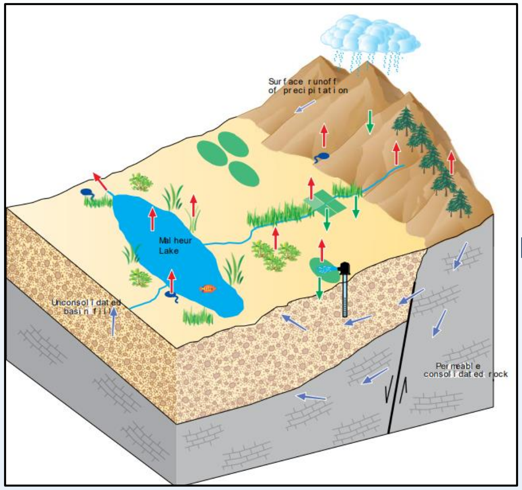
Summary of the Groundwater Model



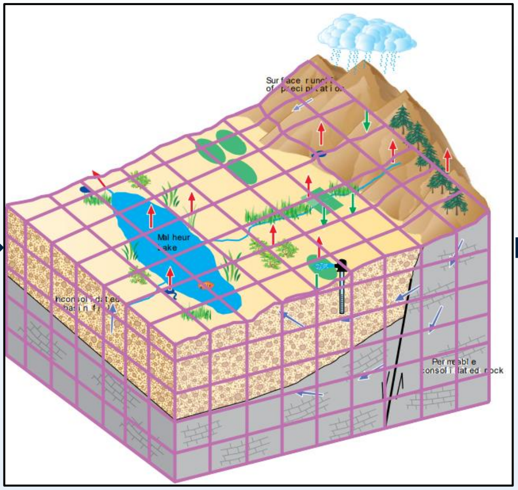




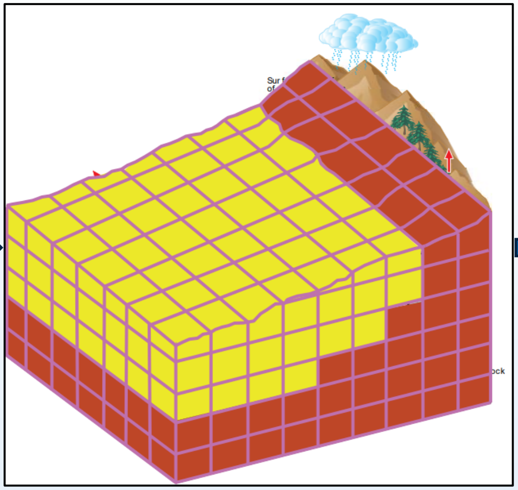
Groundwater Model Basics



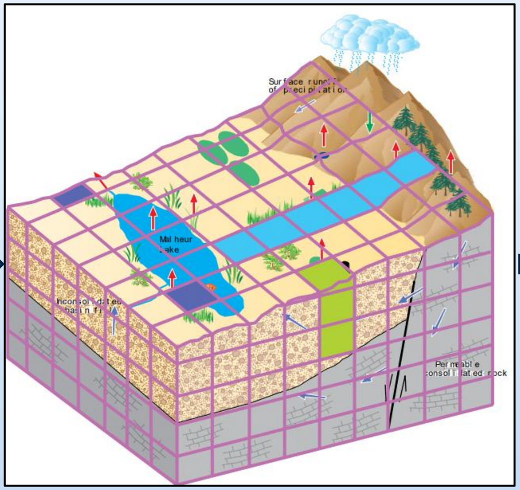
Hydrostratigraphic Framework



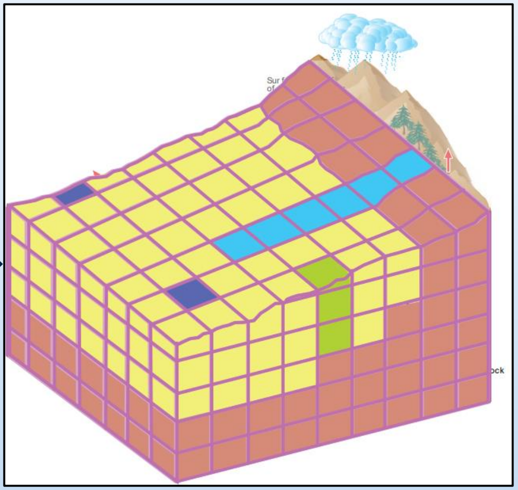
Uniform Grid



Assign Hydraulic Properties



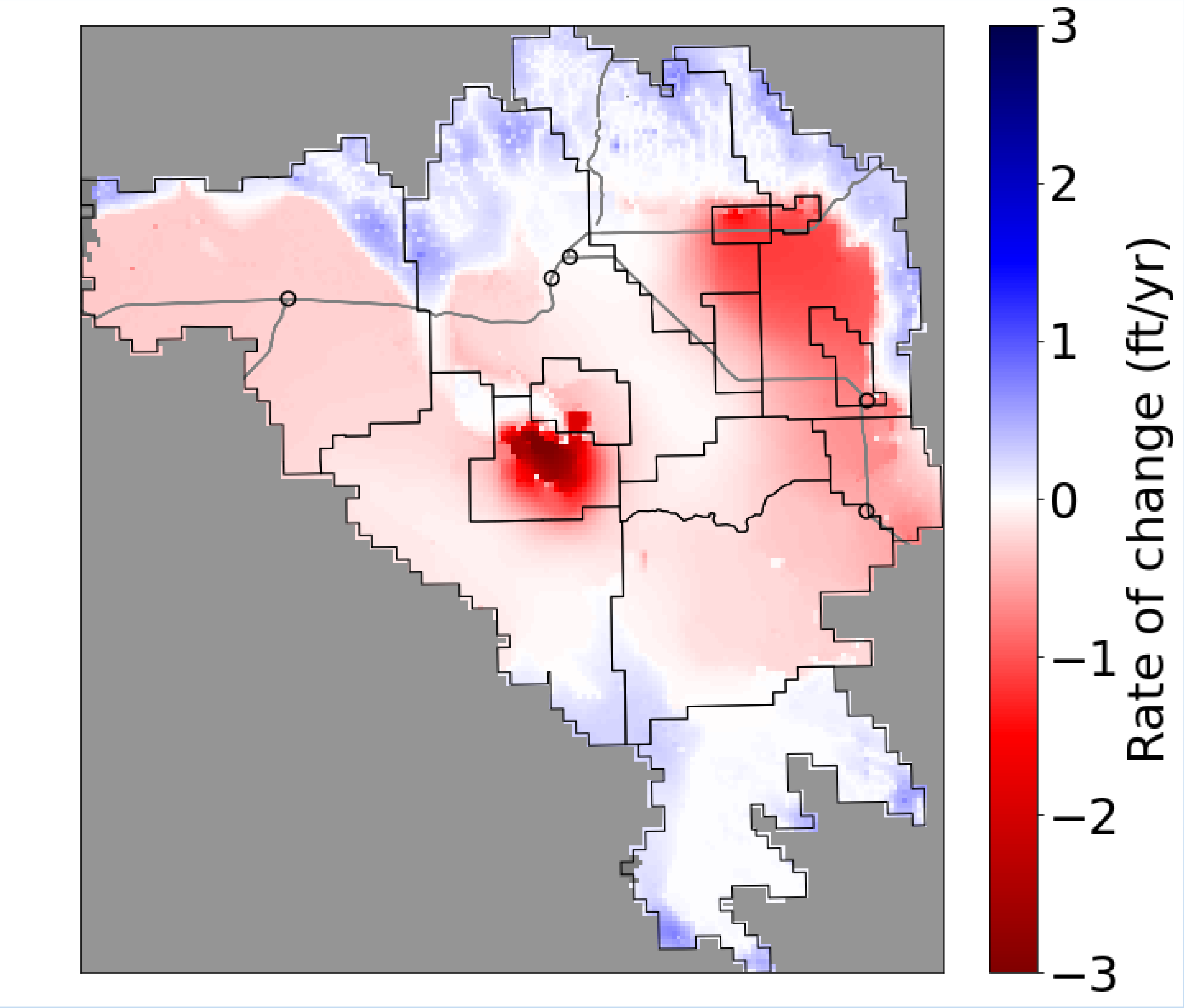
Represent Hydrologic Features



Complete model representing the physics of the hydrologic system

Image credit: S. Gingerich, U.S. Geological Survey

Start of Simulation – Water Level Rate of Change



Modeling Defined Management Scenarios

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Model Inputs

- To run the model, a management scenario needs to define:
  - Where pumping will occur
  - How much pumping will occur
  - When pumping will occur
- Permissible Total Withdrawal (PTW)
  - The amount of water allowed to be pumped within a geographic area
- All scenarios use 2018 as the baseline from which pumpage changes are made

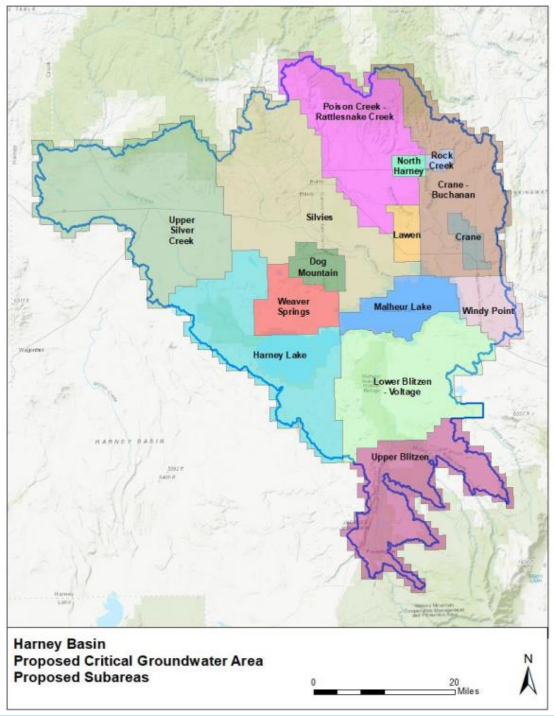
Management Scenarios

Defined management scenario objectives:

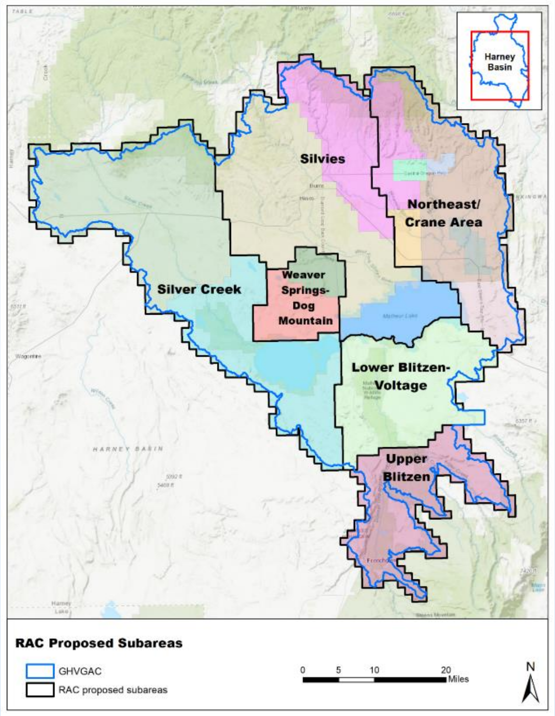
A. Targeted reductions immediately using 15 subareas
B. Balanced reductions phased in over 30 years
C. Balanced reductions, minimize impacts to ecosystem and exempt uses, phased in over 30 years
D. Balanced reductions, recover supply for ecosystem and exempt uses
E. Reductions to 1990 pumpage

Model Inputs – Where

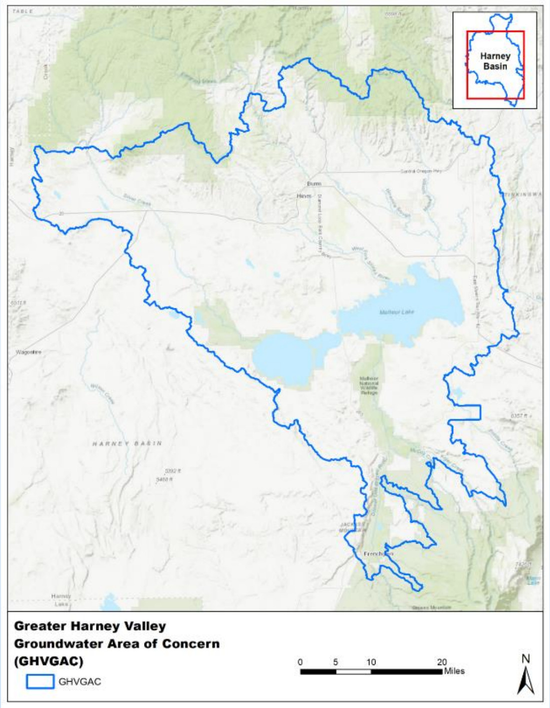
Scenario A
15 subareas



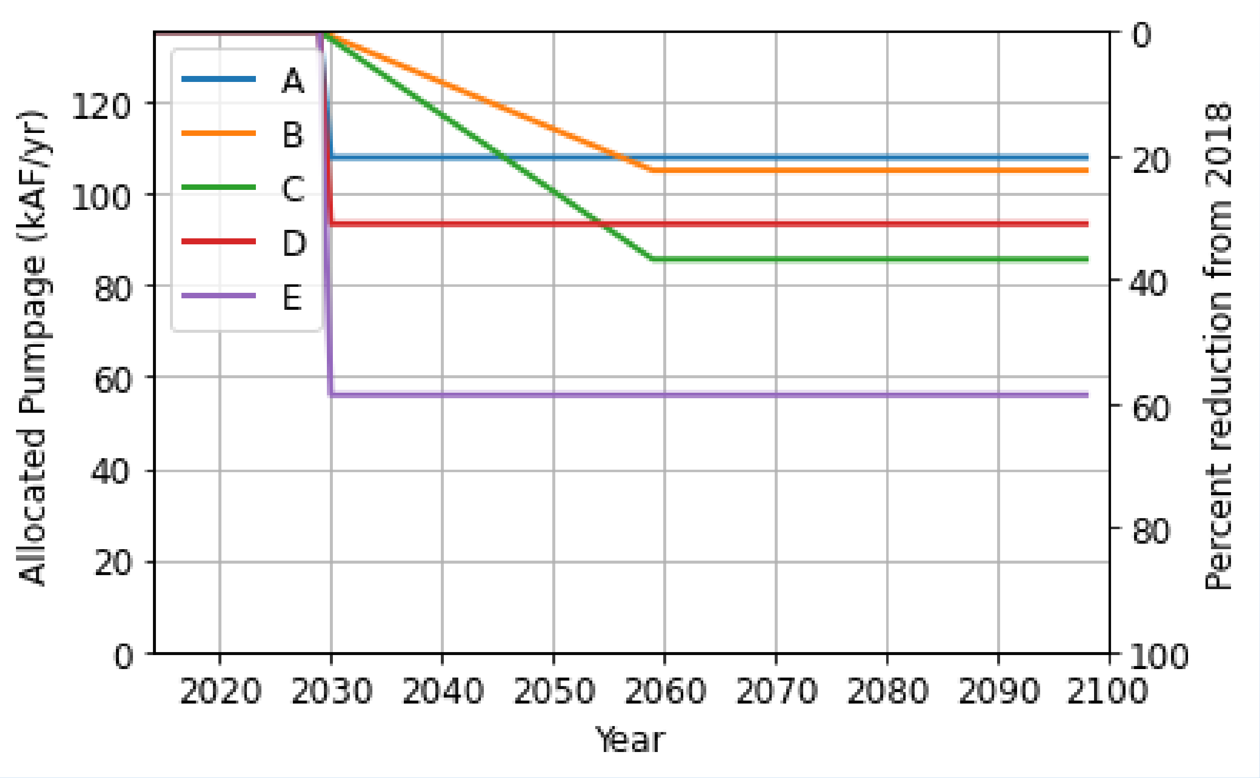
Scenarios B, C, & D
6 subareas



Scenario E
1 area



Model Inputs – How Much and When



Scenario	% reduction from 2018 pumpage basin-wide
A	19%
B	22%
C	37%
D	31%
E	59%

Measuring Success – Defined Management Scenarios

- Goal: Target water level trend of zero decline
- Did we achieve the goal?
  - Only scenario E (immediate 59% basin-wide curtailment) achieves success in all subareas
- What did we learn?
  - Proposed PTWs in scenarios A-D wasn't enough cut
  - Proposed PTW in scenario E was too much cut
  - We need an optimized approach for defining PTW

Defined Management Scenarios

- What else did we learn?
  - The timeline to achieve success is directly impacted by the amount of curtailment and the timeline for phasing in reductions
  - Shorter timelines for phasing in reductions result in higher final water levels
  - Shorter timelines for phasing in reductions stabilize natural discharge sooner

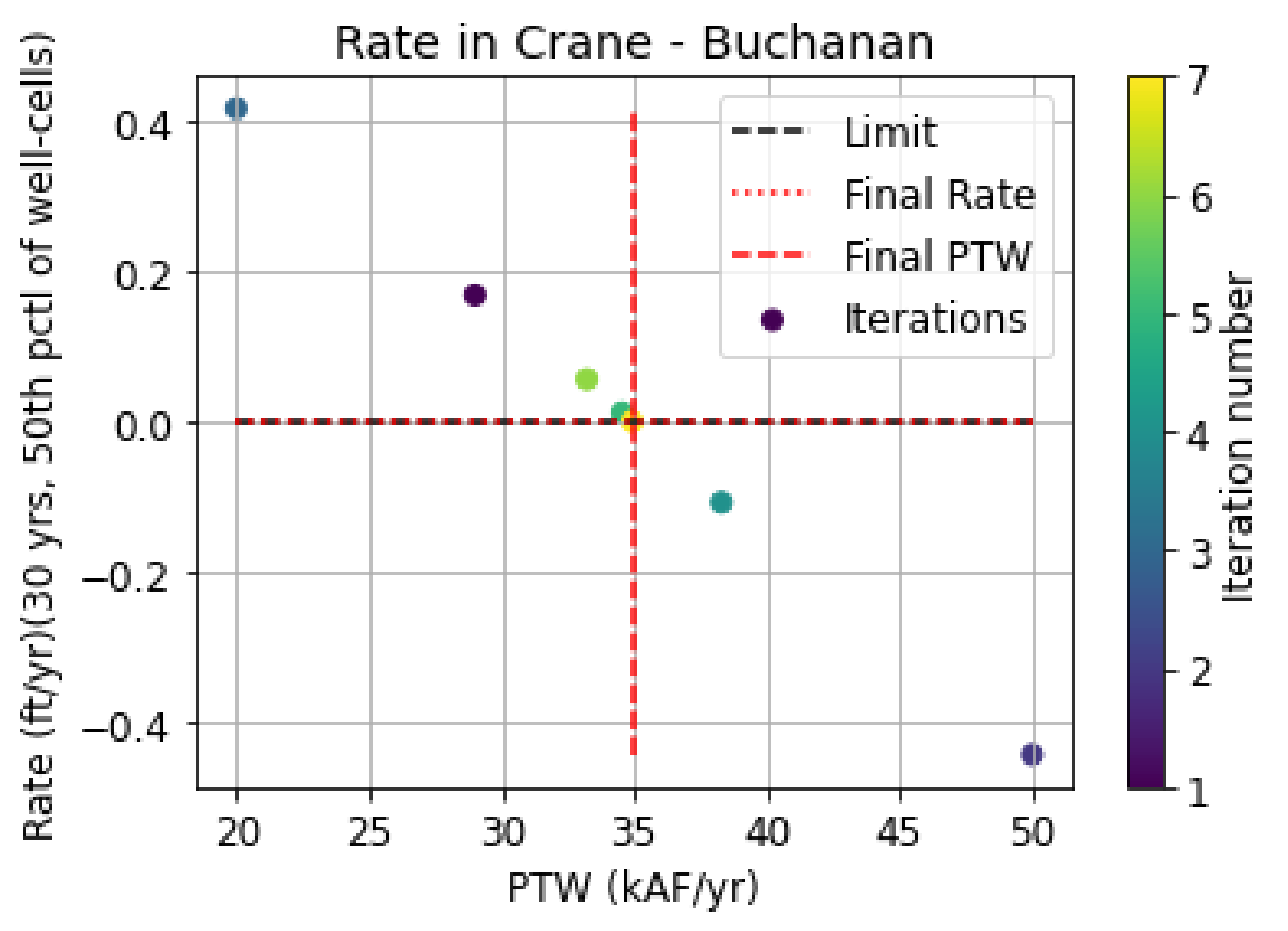
Optimizing Management Scenarios

Optimization Method

Goal: maximize PTW while requiring stability

- Set parameters for optimization:
  - Timeline for achieving success = 30 years
  - Timeline for phasing in reductions = 10 years
  - Success metric = median (50th percentile)
- Optimization software will iteratively run the model choosing new PTW values until success is achieved in all subareas

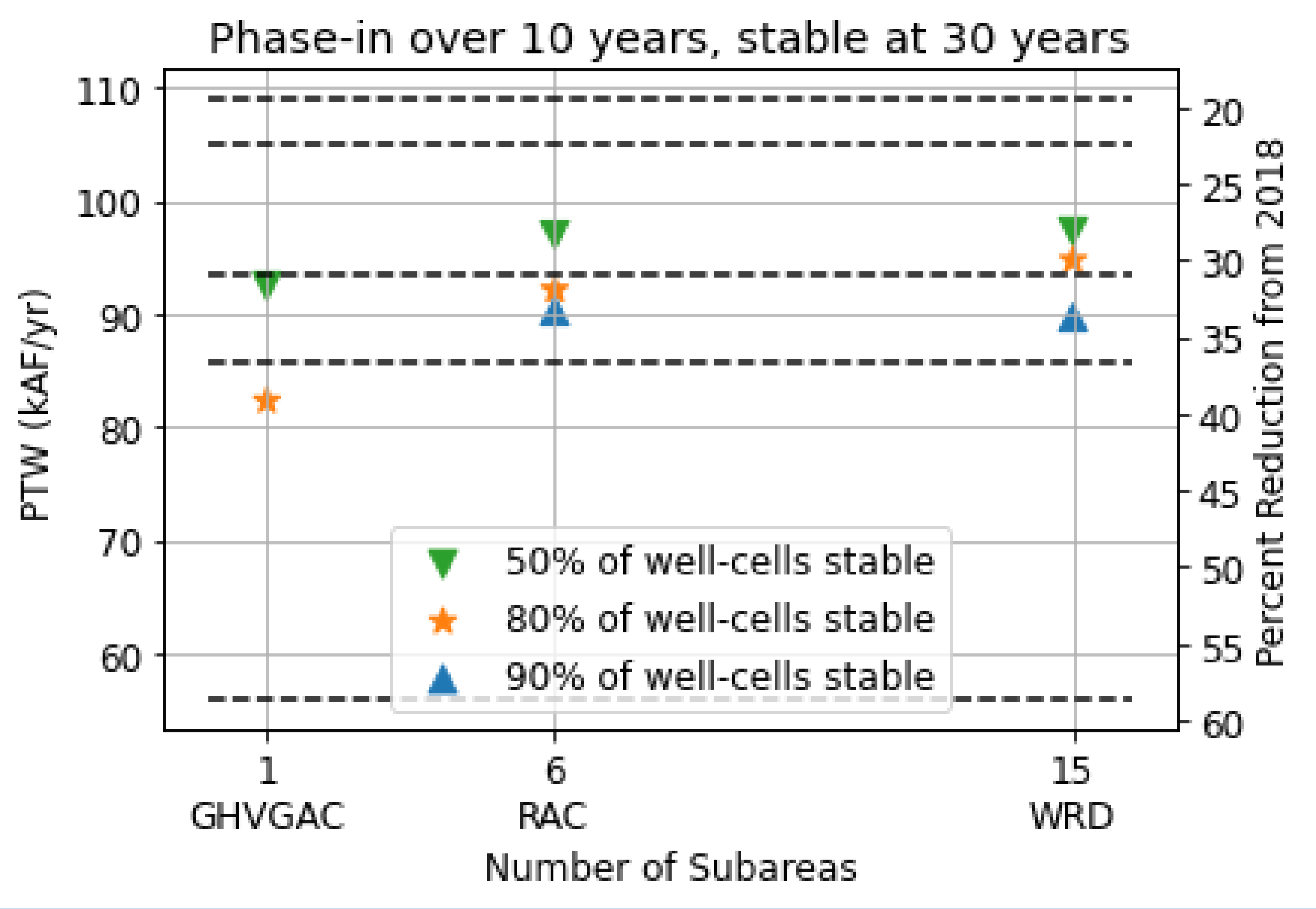
Rate vs. PTW in Crane-Buchanan



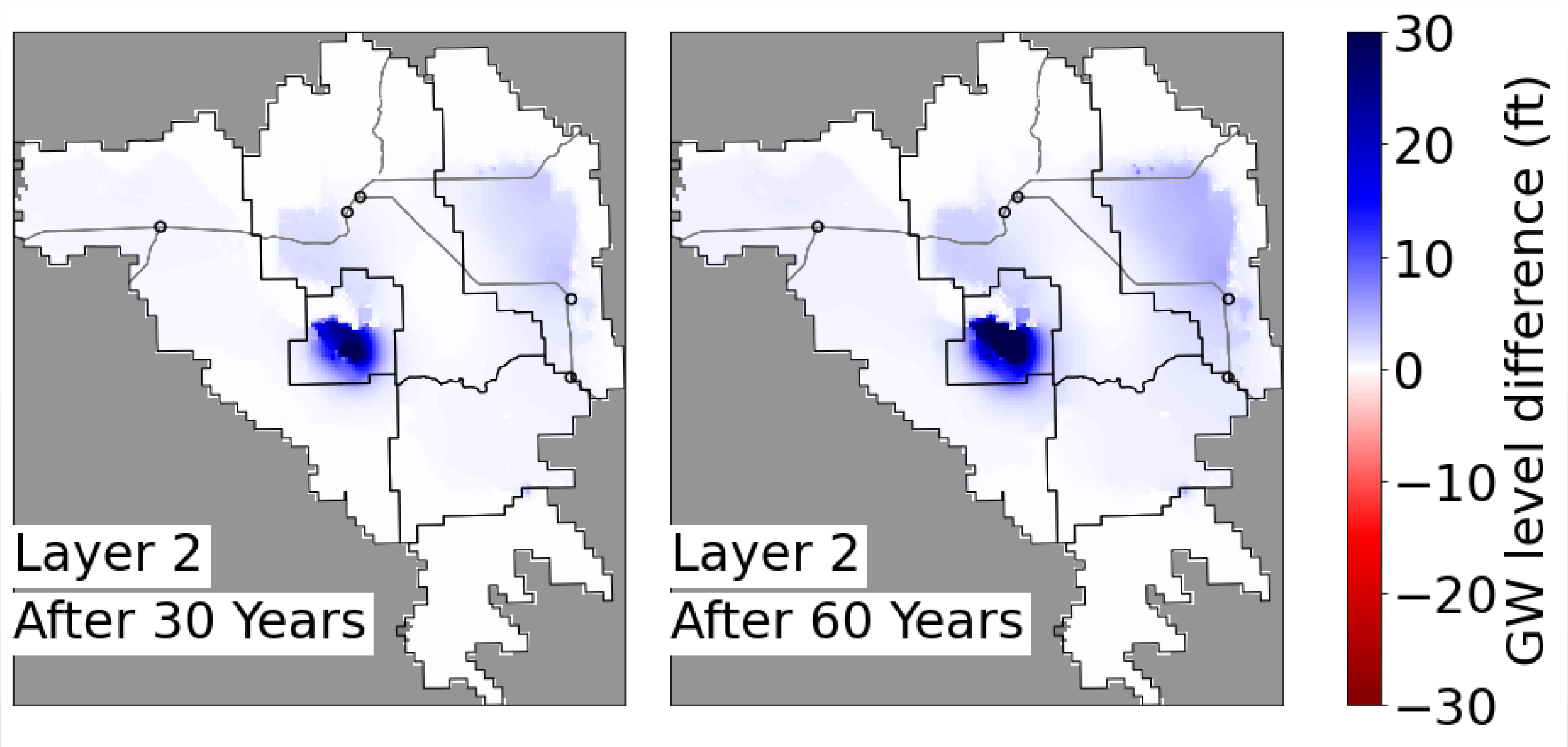
Optimized Scenarios

- Goal: Target water level trend of zero decline
- Did we achieve the goal?
  - Yes, by definition optimization achieves the goal
- What did we learn?
  - Optimization reduces overall curtailment
  - Using a more stringent success metric increases curtailment and results in higher final water levels
  - Using more subareas can reduce overall curtailment

Optimization Comparison



Success Metric – Comparing 50% vs 80% stability



- More stringent success metrics result in higher final water levels (less decline)

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Optimization Curtailments by Subarea – 15 Subareas

- Optimization identifies the optimal level of pumping in each subarea to achieve the goal

Subarea	Scenario A	Optimized	Difference
Crane	60%	66%	5%
Crane - Buchanan	0%	10%	10%
Dog Mountain	24%	47%	23%
Harney Lake	1%	20%	19%
Lawen	60%	63%	3%
Lower Blitzen - Voltage	1%	36%	35%
Malheur Lake	0%	0%	0%
North Harney	64%	66%	2%
Poison - Rattlesnake	0%	6%	6%
Rock Creek	43%	49%	6%
Silvies	0%	6%	7%
Upper Blitzen	0%	0%	0%
Upper Silver Creek	0%	31%	31%
Weaver Springs	74%	35%	-38%
Windy Point	0%	14%	14%
All	20%	28%	8%

*Difference in values due to rounding

Key Takeaways by Management Element

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Key Takeaways – Spatial Extent

- How the basin is divided for management has direct impacts on:
  - Ability to target curtailment
  - Amount of curtailment required to achieve success
  - Spatial variability of water level trends
  - Potential conflicts with the doctrine of prior appropriation
- More subareas means
  - Better ability to target curtailment at most severe areas of decline
  - Less total curtailment to achieve success
  - Less spatial variability of trends (more, smaller groups of wells)
  - More potential conflicts with prior appropriation
  - Less flexibility for voluntary agreements

Key Takeaways – Success Metric

- Options discussed with the RAC:
  - Median (50th percentile) – half the wells show zero decline or a positive trend; half are still declining
  - Median+ (50th percentile plus an outlier threshold) – same as median plus no individual well has a decline rate greater than a threshold value
  - 80th percentile – 80% of wells are showing zero decline or a positive trend; 20% are still declining
- A more stringent success metrics results in more curtailment and higher final water levels in the basin

Key Takeaways – Timeline for Achieving Success

- A longer timeline for success results in:
  - Higher PTW (less curtailment)
  - Lower final water levels in the basin (more decline)
  - More reductions in natural discharge
  - More opportunity for adaptive management

Key Takeaways – Timeline for Phasing in Reductions

- A longer timeline for phasing in reductions:
  - Longer economic adjustment period
  - More opportunity for adaptive management
  - Lower final water levels in the basin (more decline)
  - More reduction in natural discharge

Key Takeaways – Adaptive Management

Defining the term:

Adaptive management is a systematic and iterative approach for improving resource management by emphasizing learning from management outcomes (Holling, 1978; Bormann et al., 2007).

- Balance certainty with adaptability with:
  - How often curtailment is modified
  - Strength of adaptation of curtailment:
    - Magnitude of curtailment
    - Timeline to full implementation
- More adaptability and less certainty with:
  - Modifying curtailment more often
  - Larger-magnitude changes in curtailment
  - More drastic changes to the timeline for full implementation

Next Steps

Next Steps - RAC

- Future topics for RAC discussion:
  - What is a reasonable timeframe for achieving the goal of a target water level trend of zero decline?
  - Should pumpage reductions be phased-in to allow time for economic adjustment? If so, how long should that phase-in period be?
  - What size of subareas should be used to manage the basin?
  - What success metric (median, 80th percentile, etc.) should be used to define success?
  - How should impacts to natural discharge, groundwater storage, domestic wells, and the economy be considered when optimizing a management scenario?

Next Steps – Commission

- Future decisions:
  - We plan to bring proposed rules to the Commission in December 2025
  - Guidance for voluntary agreements is in progress and rulemaking will also be needed in the future

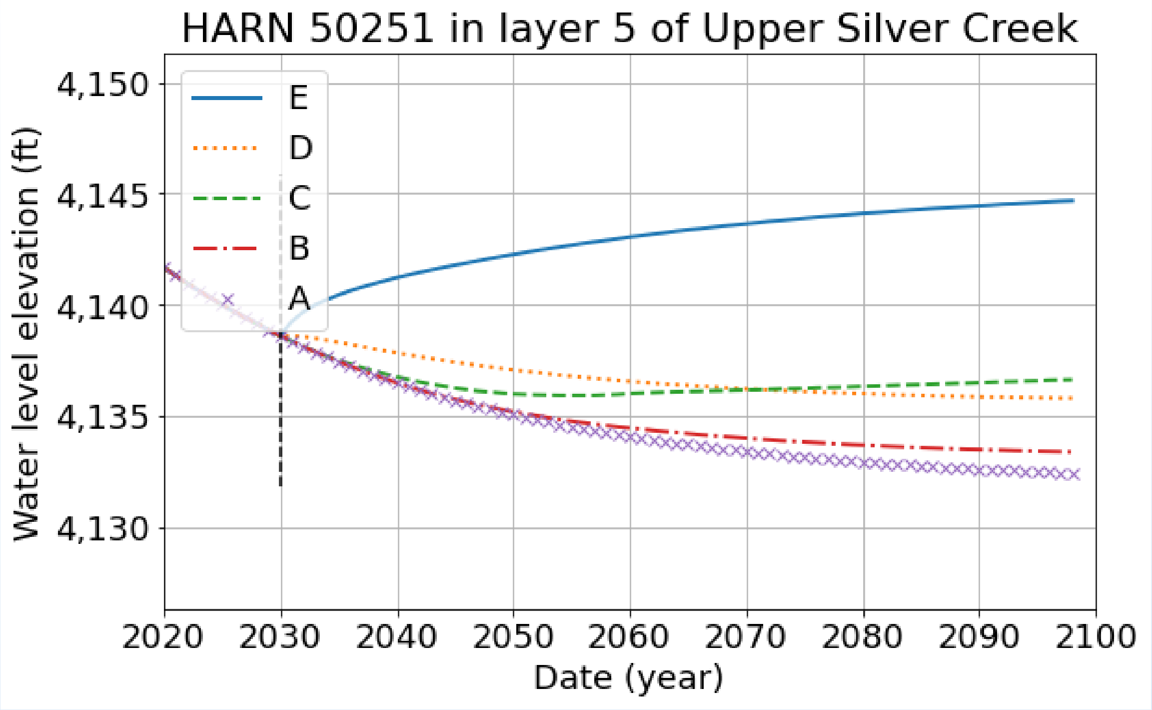
- Considerations when making those decisions:
  - PTW – How voluntary agreements fit into future management
  - Timelines for curtailment and reaching groundwater level goal
  - Other impacts – domestic wells, springflow, etc.

Appendix

Model Layers

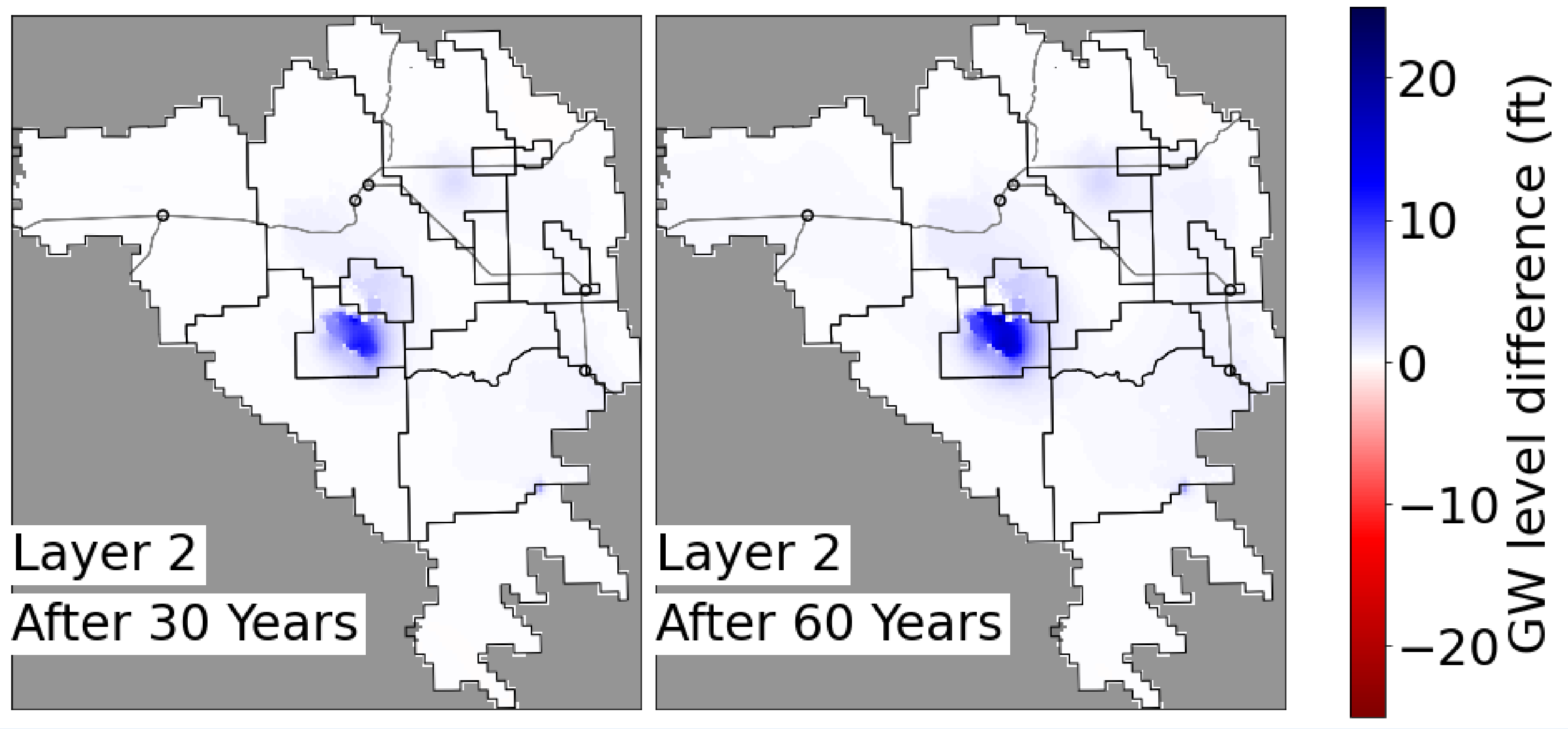
- 10 layers in the model representing different depths
  - Layers 1-5 are each 100 feet thick
  - Layers 6-10 vary in thickness from 135 – 1,397 feet thick
  - Bottom of model grid is at 2,085 ft elevation

Compare Scenarios: hydrographs



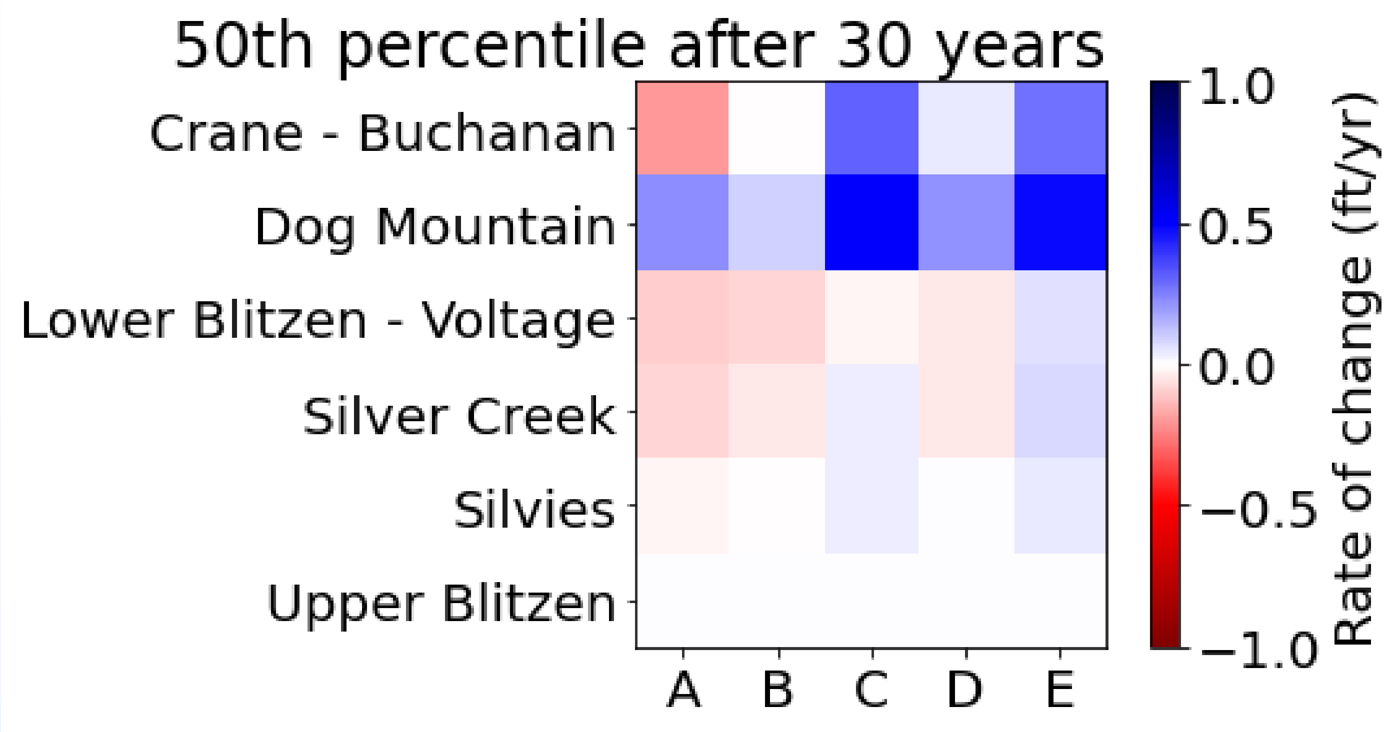
- This area of the basin is seeing broad, slow declines and so pumpage reductions result in more muted water level responses
- Only scenarios E and C achieve the goal in this area of the basin

Compare 50% vs 80% stability - 15 Subareas



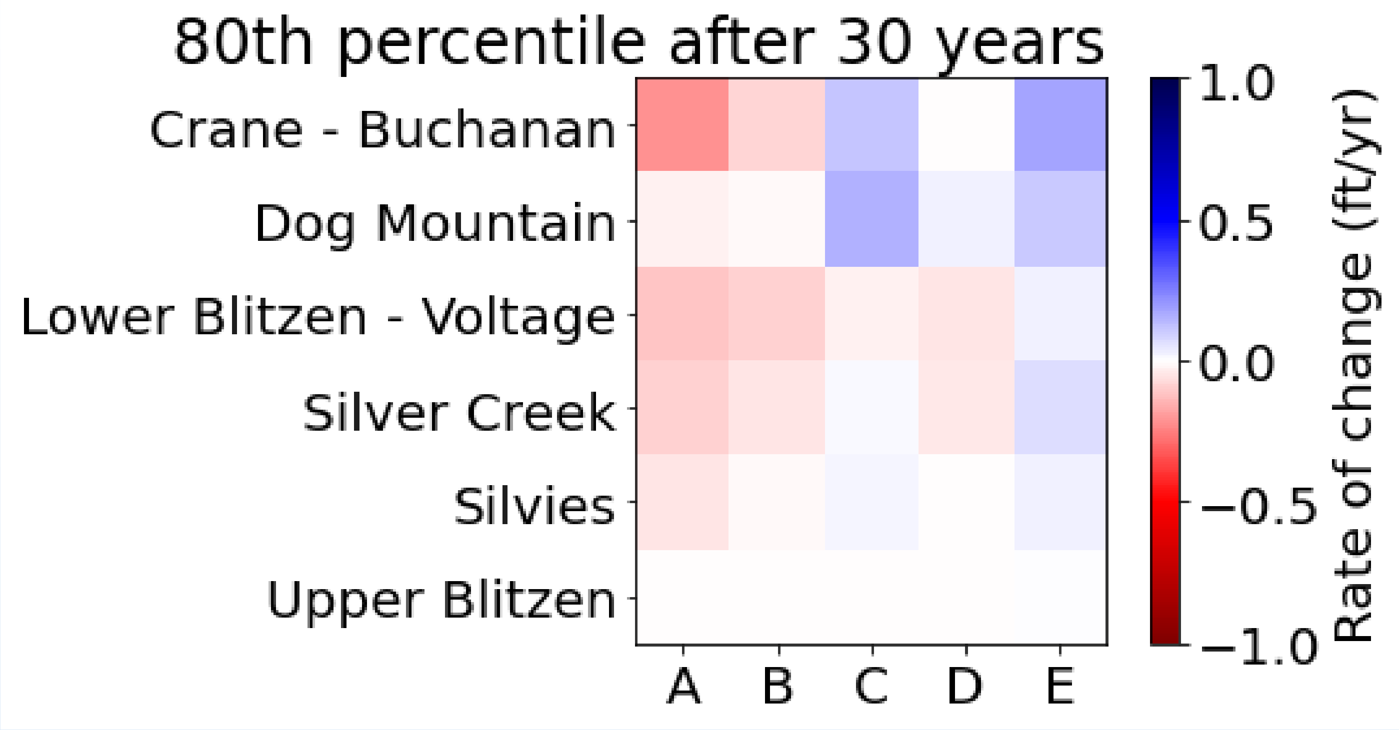
- More stringent success metrics result in higher final water levels (less decline)

Comparing Rates Between Subareas



- Scenario E achieves the goal using a median success metric
- Scenario C almost achieves the goal

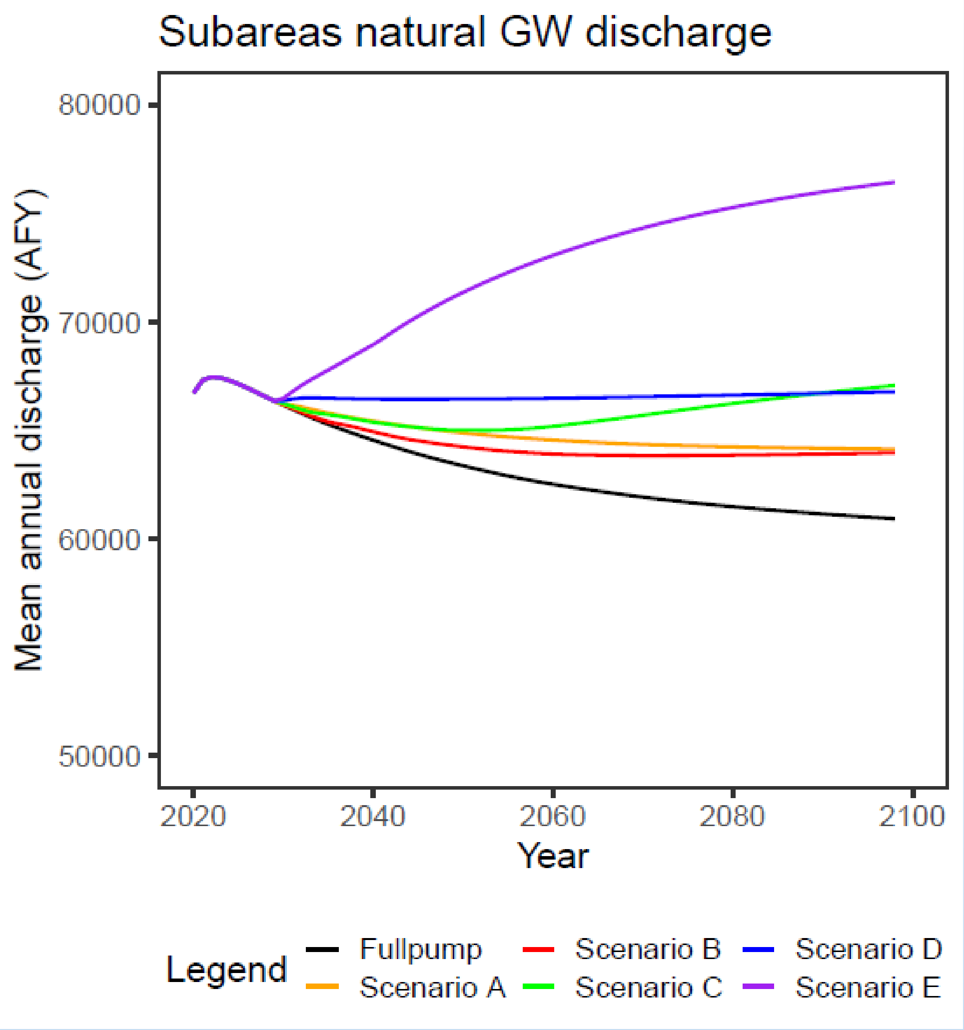
Comparing Rates Between Subareas



- Only scenario E achieves the goal using an 80th percentile success metric
- A more stringent success metric reduces the number of subareas that achieve success

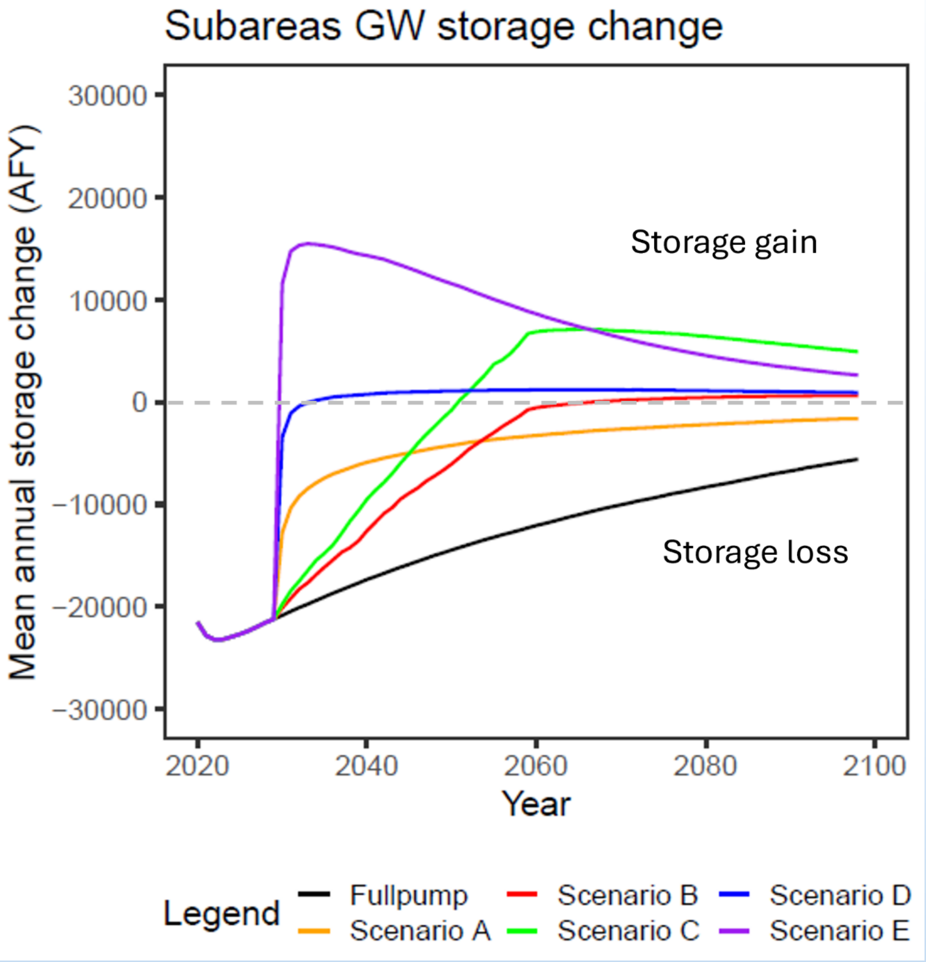
Water Budget – Natural Groundwater Discharge

- Impacts to natural discharge can be prevented or reversed with pumping reductions
- Phase in period for reductions impacts quantity of natural discharge

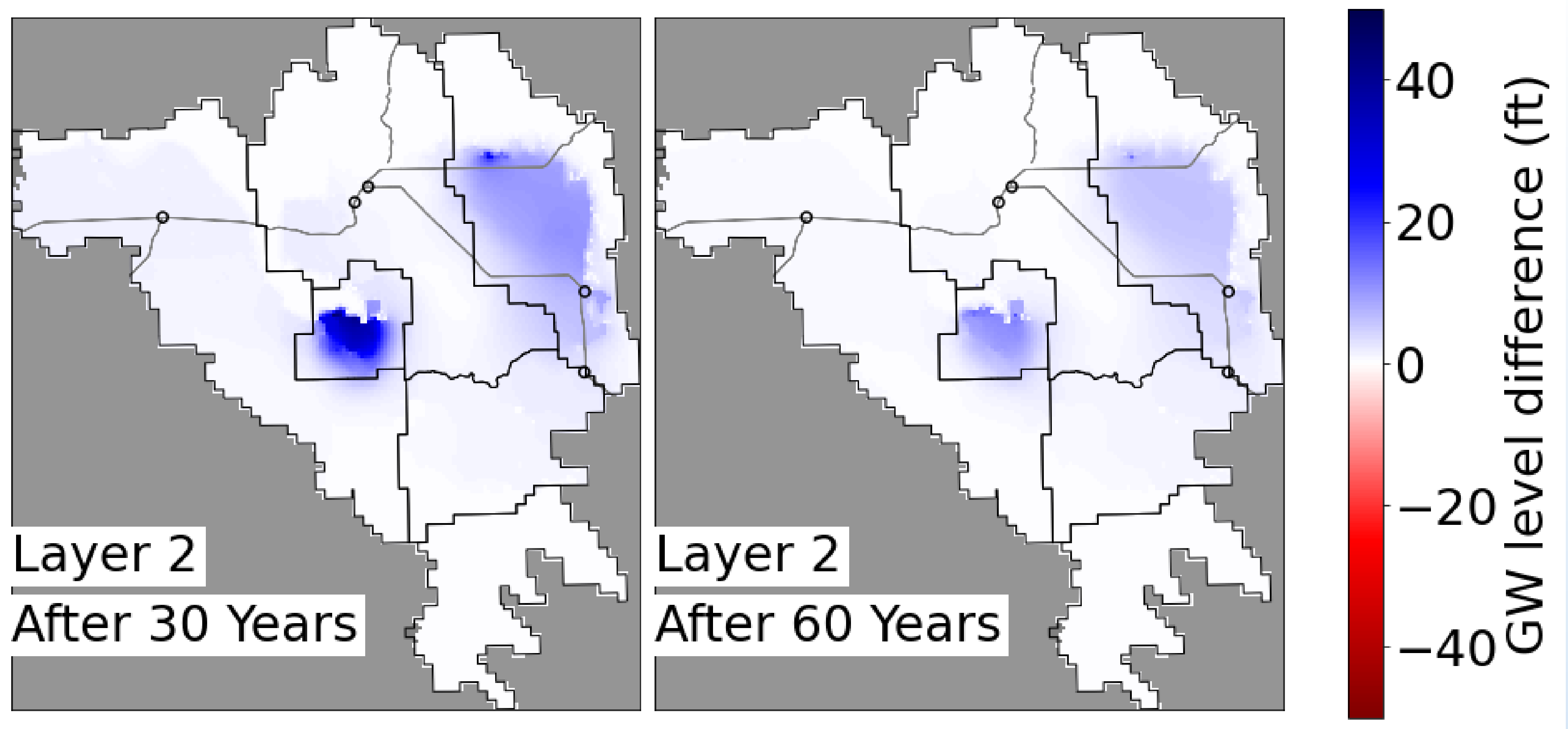


Water Budget – Change In Groundwater Storage

- Storage gain = water level recovery
- Storage loss = water level decline
- No change = water level stability
- Longer timelines for phasing in reductions result in more groundwater storage losses (lower water levels)

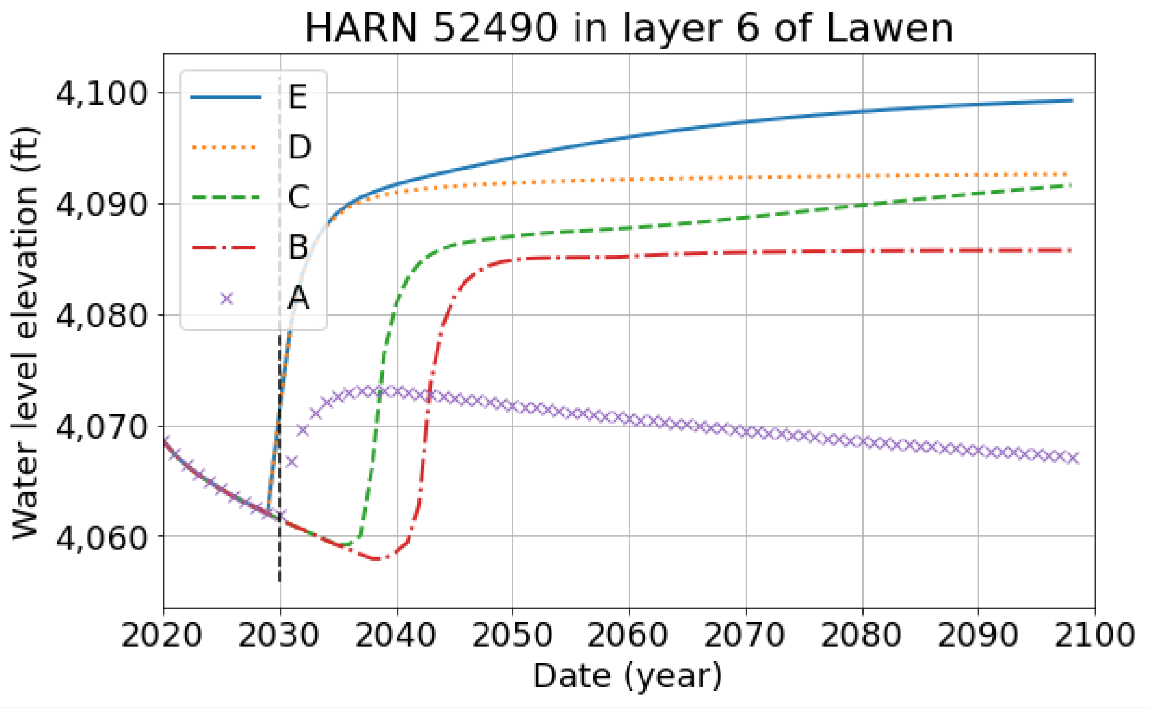


Water Level Differences – 10-year vs 30-year Phase-in Period



- Same amount of curtailment in both scenarios, only the timeline for phase-in is changed
- Shorter phase-in periods result in higher final water levels (blue)

Compare Scenarios: hydrographs



- Improvements in water level trends can be short lived if overall reductions in an area are not sufficient to stabilize long-term trends (scenario A)
- The time at which success is achieved can be moved forward or backward through time based on the total amount of curtailment and the phase in period (scenarios B, C, D, & E)

Optimization Curtailments by Subarea – 6 Subareas

Subarea	B	C	D	Optimized
Crane - Buchanan	30%	45%	40%	34%
Dog Mountain	54%	75%	65%	38%
Lower Blitzen - Voltage	0%	9%	5%	31%
Silver Creek	9%	24%	18%	31%
Silvies	0%	9%	5%	5%
Upper Blitzen	0%	0%	0%	0%
All	**22%**	**37%**	**31%**	**29%**

- Optimization achieves stability with 8% less curtailment than the only prescribed scenario that got close (scenario C).

Evaluating Model Results

- Considerations when evaluating results:
  - Did the management scenario achieve success?
  - What are the affects of different management elements on outcomes?
    - Spatial extent
    - Success metric
    - Timeline for achieving success
    - Timeline for phasing in reductions
    - Adaptive management

Management elements

- There are five main management elements:
  - Spatial extent
  - Success metric
  - Timeline for achieving success
  - Timeline for phasing in reductions
  - Adaptive management

Management Scenarios

Scenario	A. Targeted reductions immediately using 15 subareas	B. Balanced reductions phased in over 30 years	C. Balanced reductions, minimize impacts to ecosystem and exempt uses phased in over 30 years.	D. Balanced reductions, recover supply for ecosystem and exempt uses	E. Reductions to 1990 pumpage
Where - Management Areas	15 subareas	6 subareas			One area
How Much - Volume of pumping reductions	Pumping reductions for 6 subareas; 9 subareas with no reduction from 2018 estimated pumpage	Pumping reductions focused in 3 subareas	Pumping reductions spread across all but 1 subarea	Pumping reductions spread across all but 1 subarea	Reduce pumping to 1990 estimated pumpage
When - Start time and intervals of reduction	2030 start; no phasing	2030 start; phased reductions over a 30-year period		2030 start; no phasing	

Scenarios B, C, & D Pumpage Reductions

6 Subareas	B. Balanced reductions phased in over 30 years	C. Balanced reductions, minimize impacts to ecosystem and exempt uses phased in over 30 years.	D. Balanced reductions, recover supply for ecosystem and exempt uses
Weaver Springs/Dog Mountain	54%	75%	65%
Northeast/Crane Area	30%	45%	40%
Silver Creek	9%	24%	18%
Silvies	0%	9%	5%
Lower Blitzen/Voltage	0%	9%	5%
Upper Blitzen	0%	0%	0%