



## Aquifer Storage and Recovery, From Local to Regional

Presented to

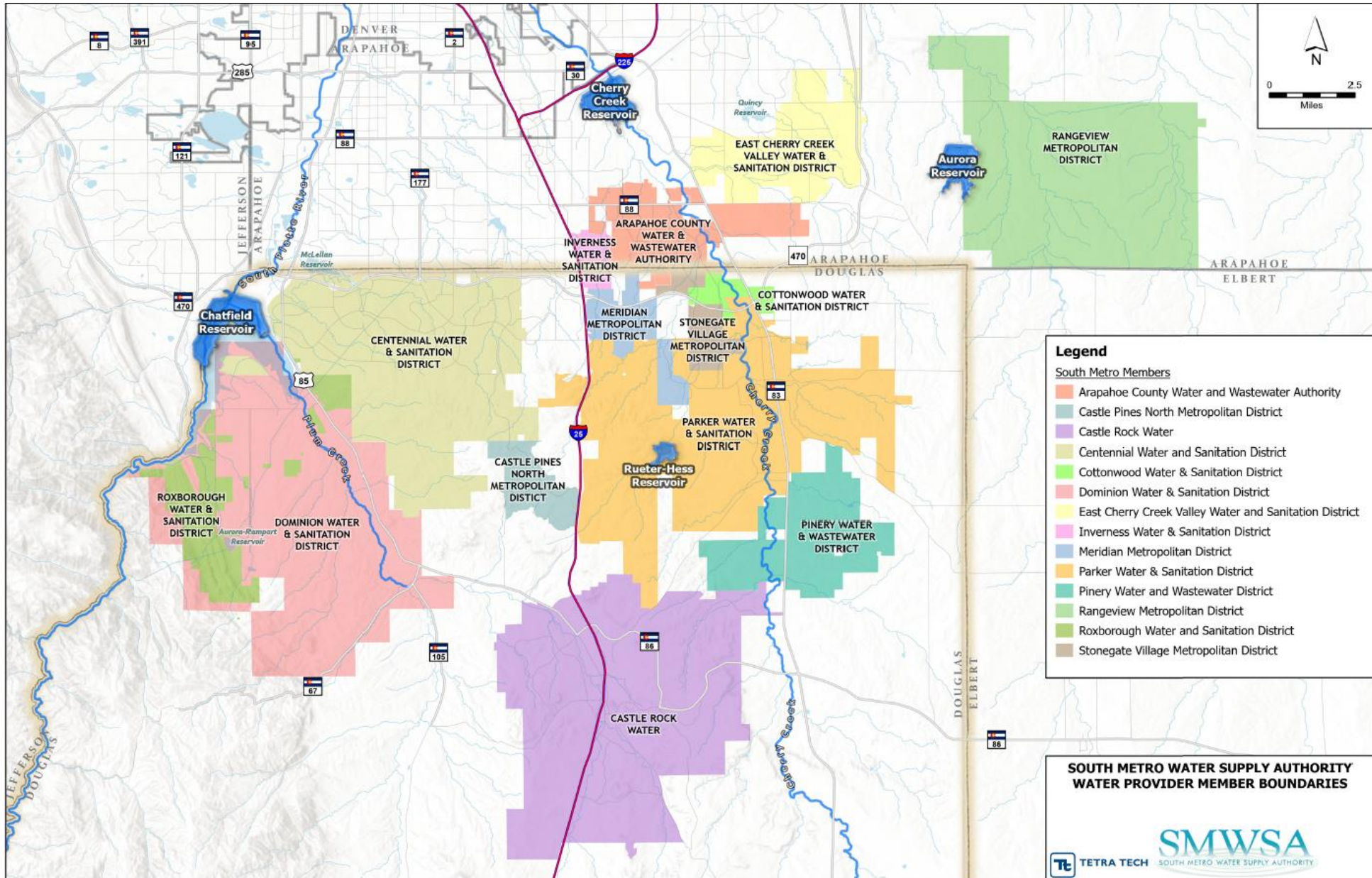
Subsurface Water Storage Symposium

February 24, 2024



# INTERA

# SMWSA Member Boundaries



# Potential Benefits of Regional ASR

## STRENGTH THROUGH PARTNERSHIPS

Leading the way toward a renewable water supply future  
for the South Denver Metro region

Since the formation of SMWSA, members have been interested in ASR because:

1. The need for more storage in the area and provide more drought resiliency
2. No evaporative losses
3. Address reduction in wells yields and groundwater levels

Regional storage benefits include:

1. Optimize storage potential based on local geology / district storage potential
2. Economic savings – less construction costs, and extraction savings
3. Already have the ability to trade water amongst our members

# Optimization through Conjunctive Use

## Wet Periods



Utilize renewable supplies and store when possible

### District Renewable Goals:

Centennial – 85% surface water

ECCV - 7 in 10 yrs. ASR injections

Castle Rock – 75% renewable by 2050

## Surface Water

### Chatfield



### Reuter-Hess



## Dry Periods

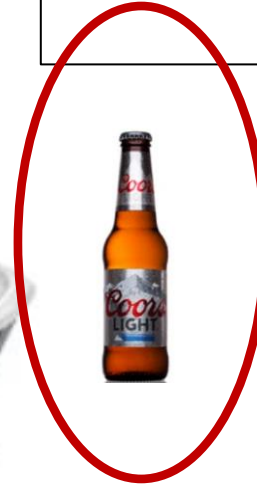
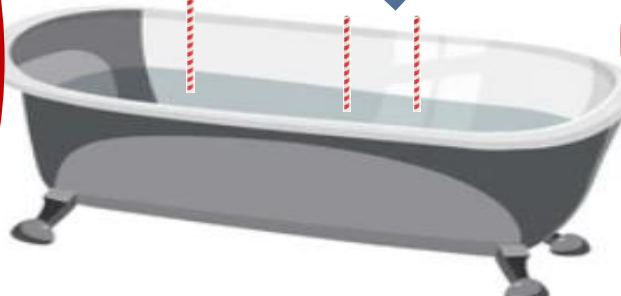


Utilize Denver Basin groundwater to meet demands

ASR  
Injections



## Groundwater



ASR  
Extractions

# Approach to South Metro Regional ASR

## 1) Is it worth it?

Develop the conceptual baseline and approach

### Phase 1 Conceptual Study

- Conceptual framework
- Groundwater conceptual model
- How to move forward

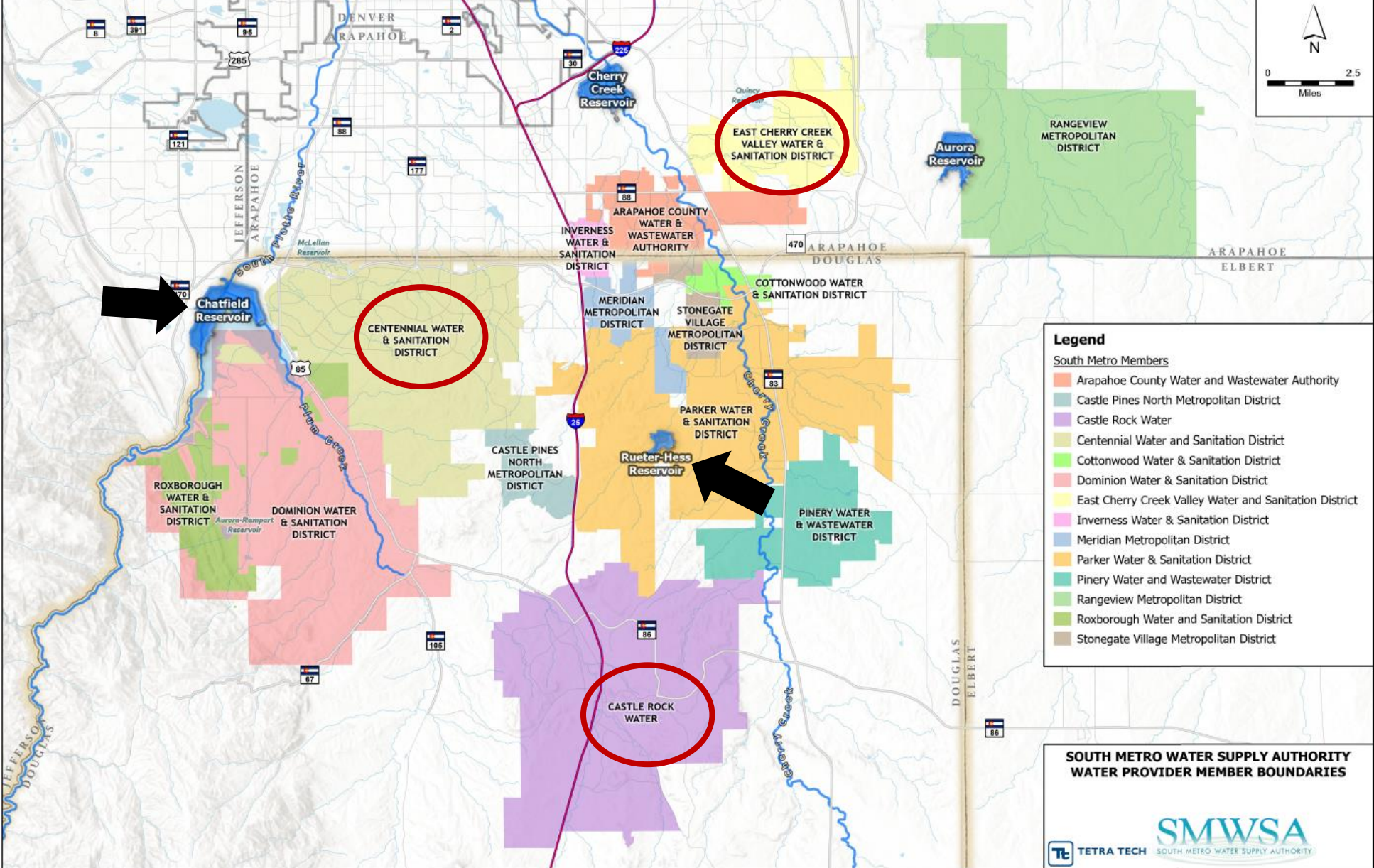
## 2) How do we create a Win-Win Situation for the region while benefiting individual local needs?

Develop the knowledge and tools for informed decision making

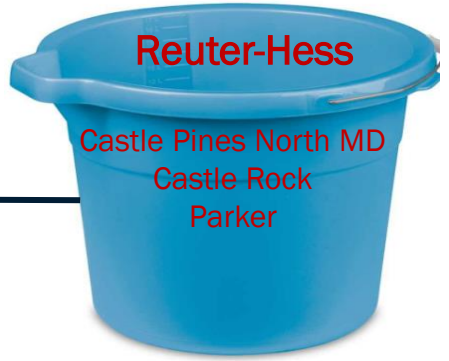
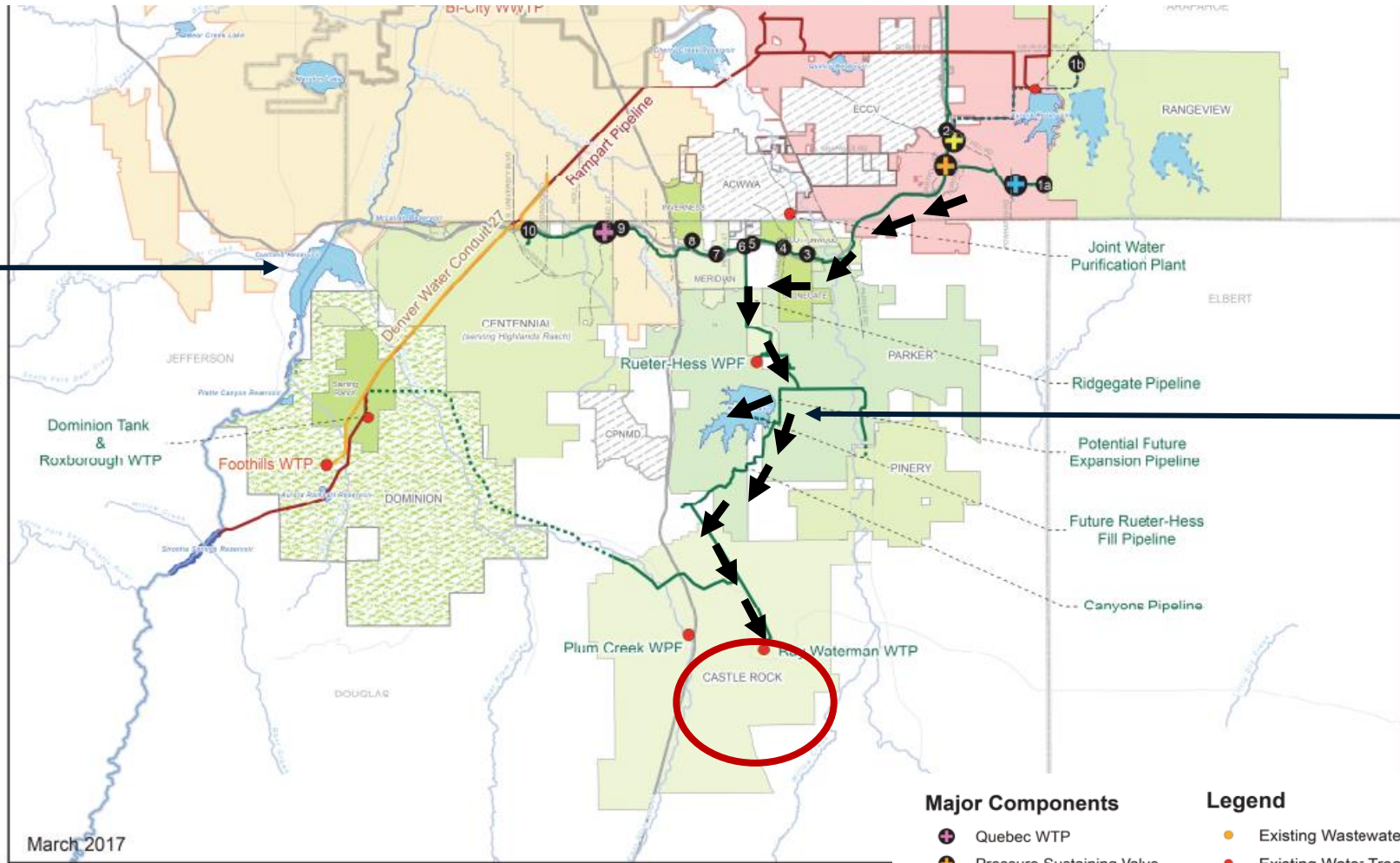
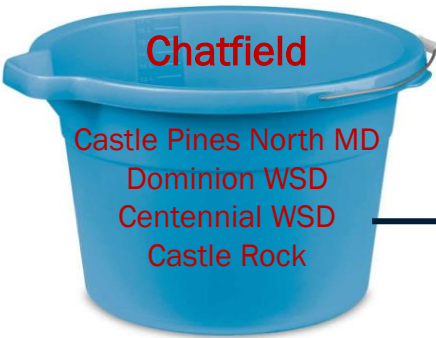
### Optimization Study

### Numerical Groundwater Model

# South Metro Region & ASR Hubs



# Example: Southern Delivery



	WISE	Percent
Centennial	1,000	10.00%
Cottonwood	400	4.00%
Dominion	1,325	13.30%
Inverness	500	5.00%
Meridian	775	7.80%
Parker	1,600	16.00%
Pinery	500	5.00%
Rangeview	900	9.00%
Stonegate	1,000	10.00%
Castle Rock	2,000	20.00%

**Major Components**

- Quebec WTP
- Pressure Sustaining Valve
- Smoky Hill Tank
- Aurora Temporary Connection

**Legend**

- Existing Wastewater Treatment Plants
- Existing Water Treatment Plants
- Pipeline Connections
- Existing/ Under Construction Pipeline
- Proposed Pipeline
- Highways
- Proposed Reservoirs
- SMWSA & WISE Members
- SMWSA Only Members
- Counties

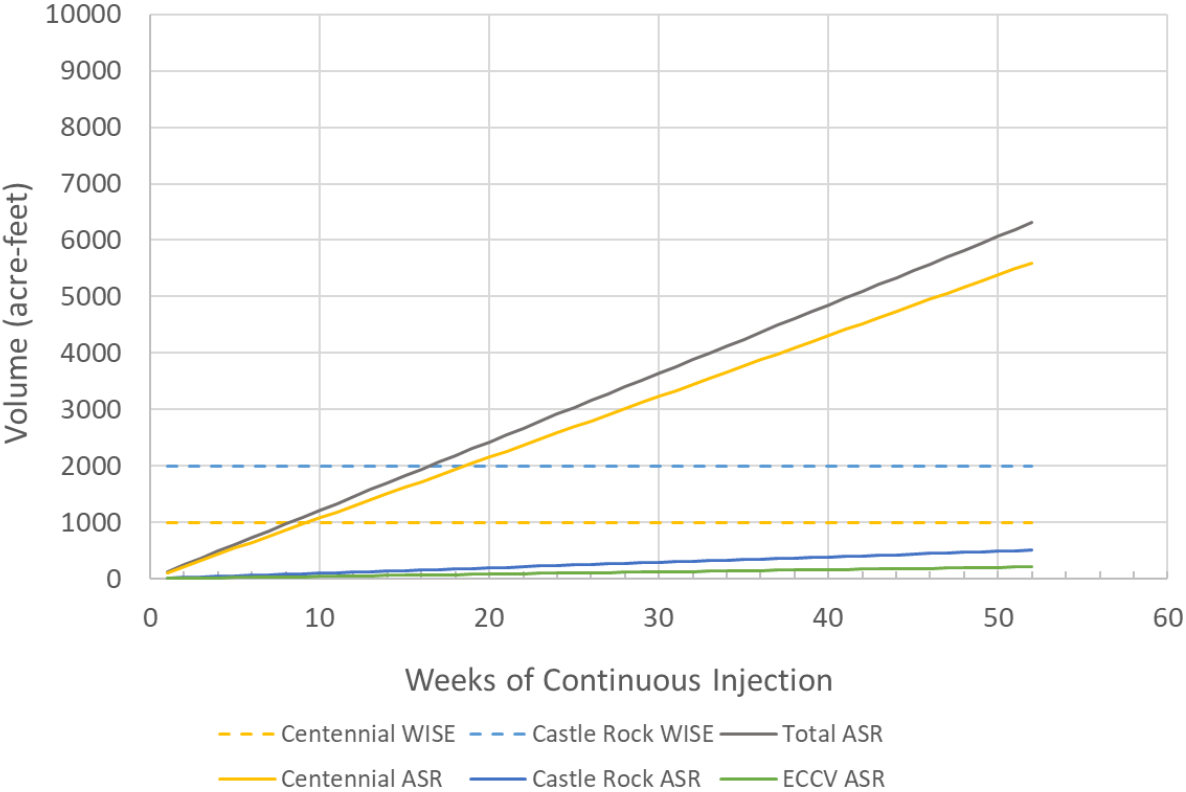
March 2017

# Preliminary Injection Capacity and WISE

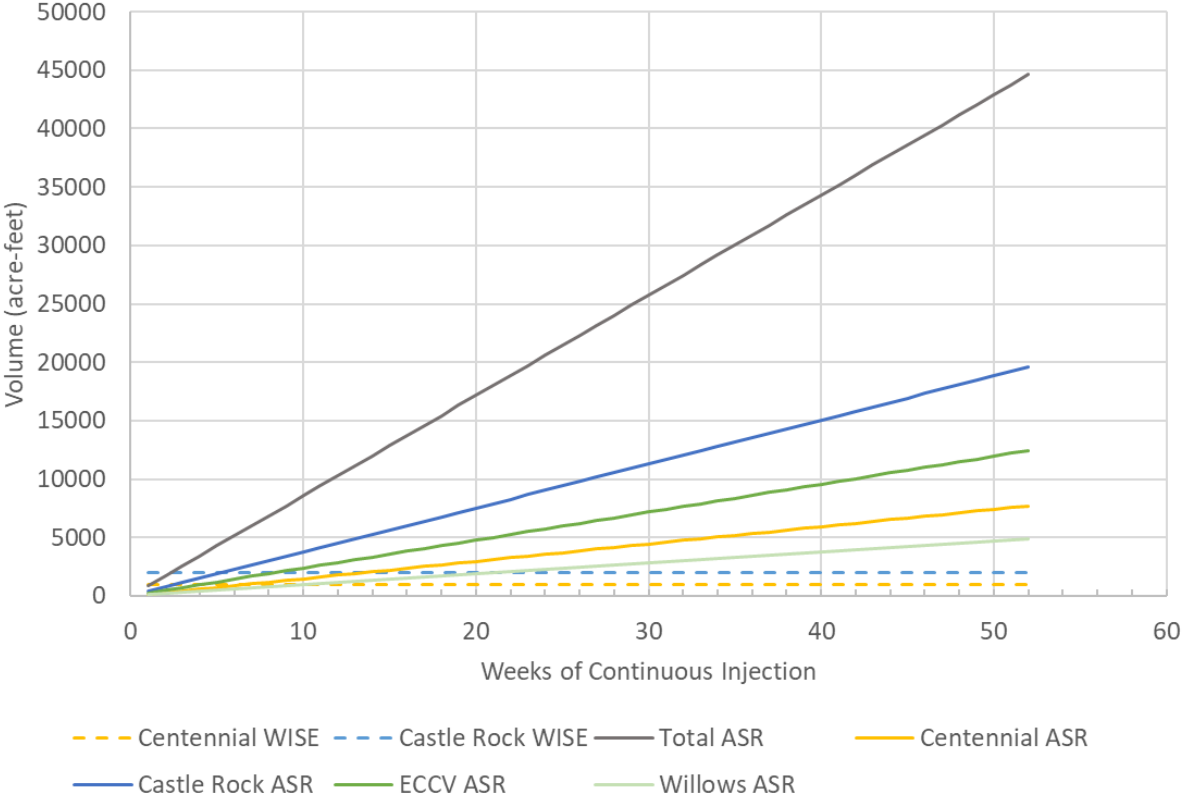
## Existing Infrastructure

## “Dream Scenario”

HUB ASR Injection Capabilities vs. WISE Subscriptions



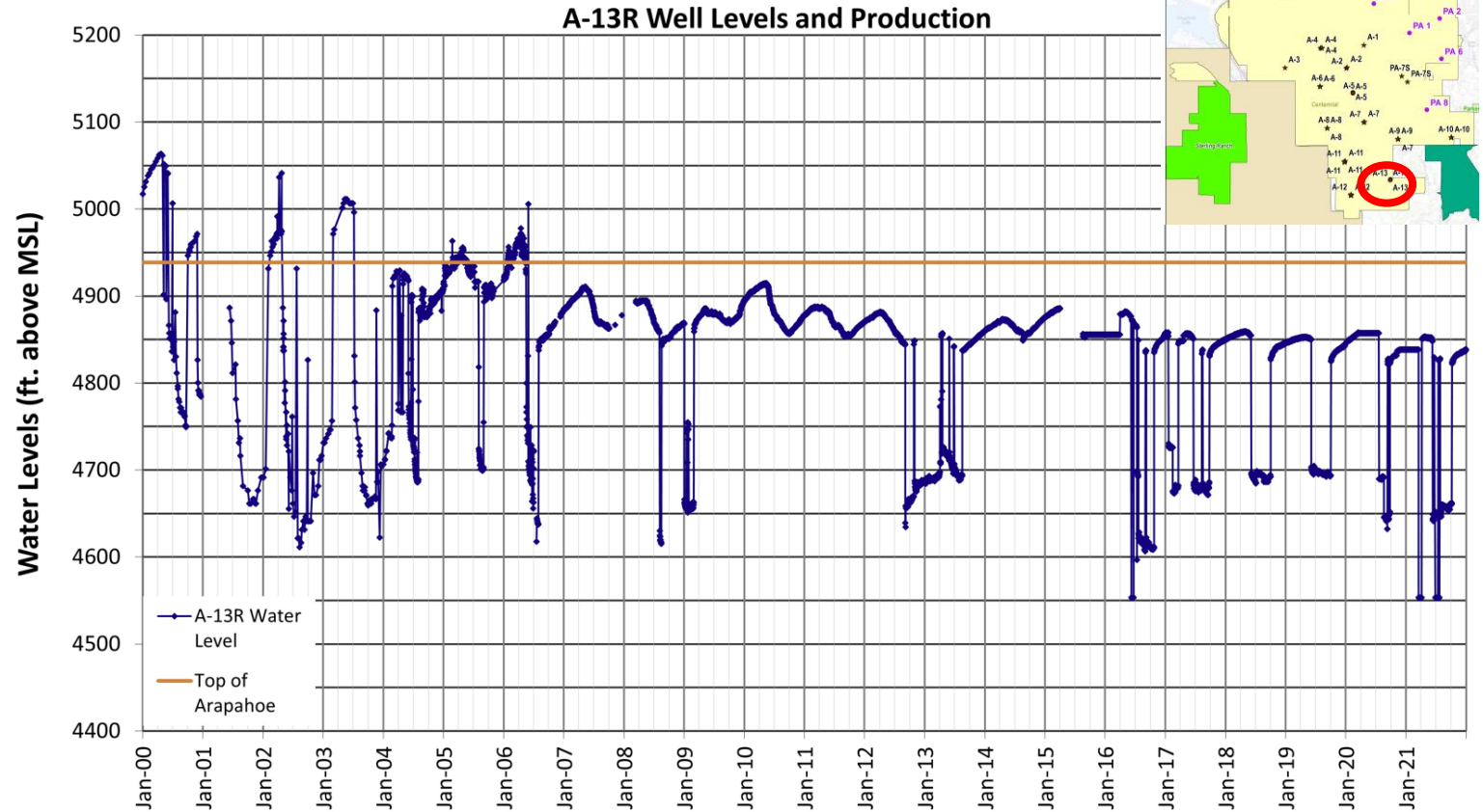
HUB Wells Injection Capabilities vs. WISE Subscriptions





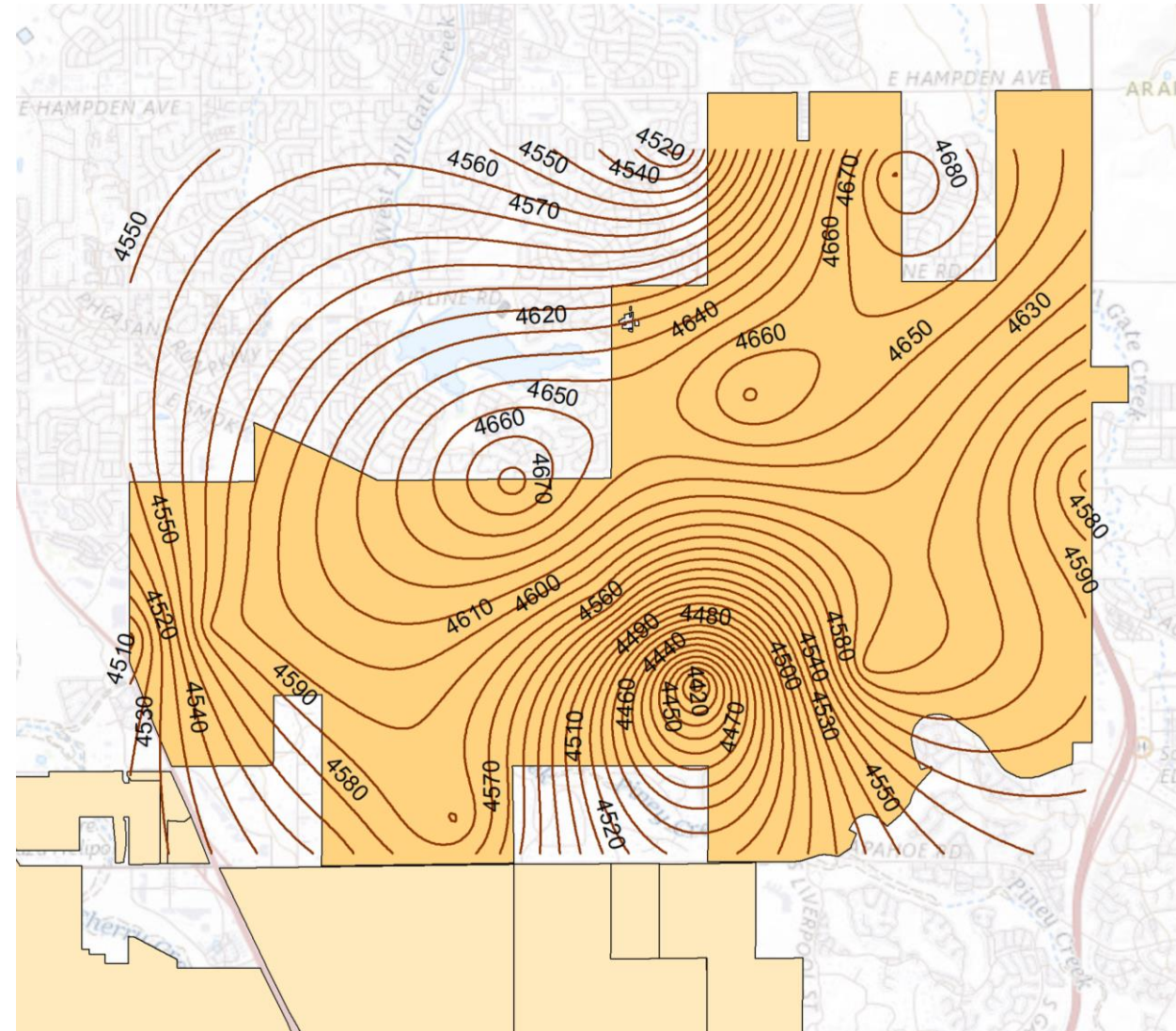
# Groundwater Conceptual Model

- Geologic and hydrogeologic maps
- Groundwater level contour maps
- Groundwater flow depictions (regional & local)
- Aquifer properties – transmissivity, well yields, etc.
- Hydrographs
- Well locations & extractions
- Any relevant water quality concerns

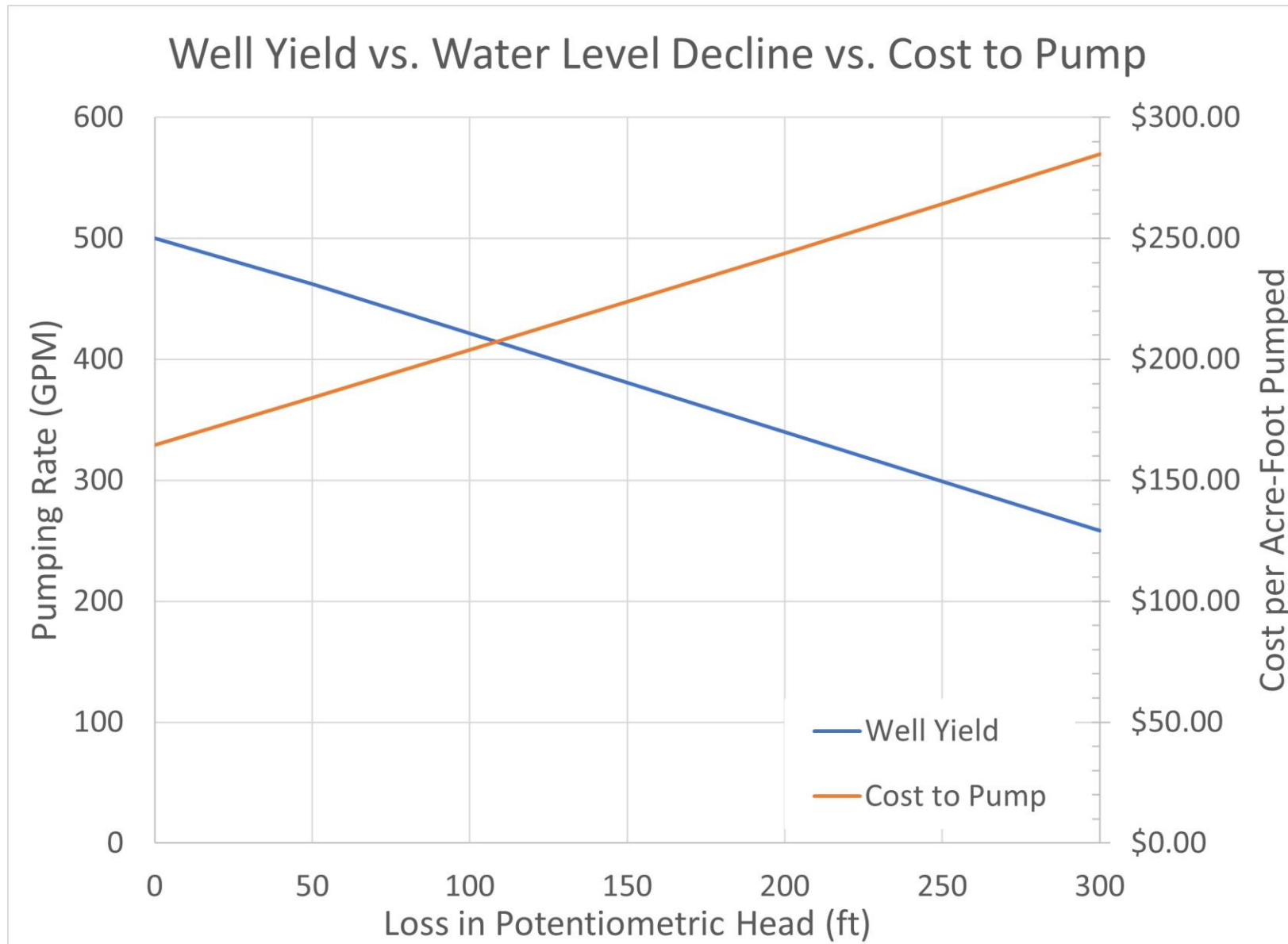


# Preliminary Findings of the Conceptual Model

1. Storage capacity
2. Aquifer properties
3. Injection & extraction capacity
4. Groundwater level and well yield declines

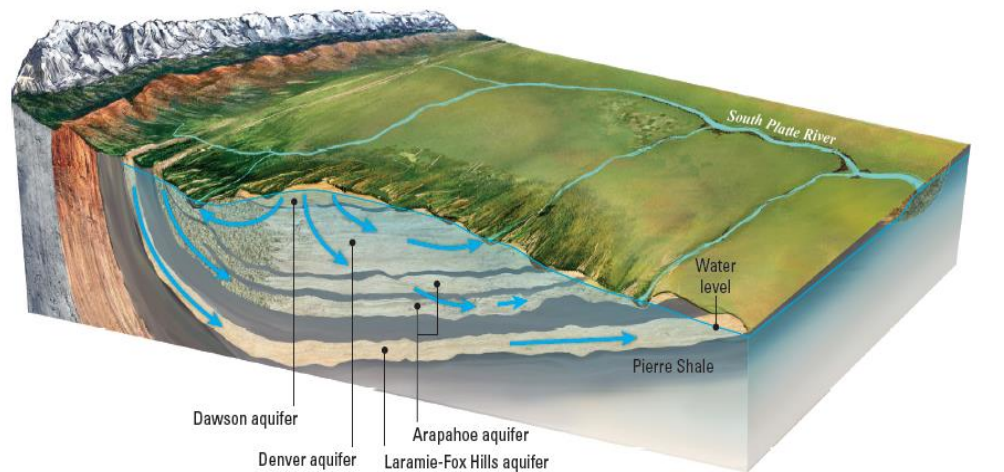


# Preliminary Findings of the Conceptual Model

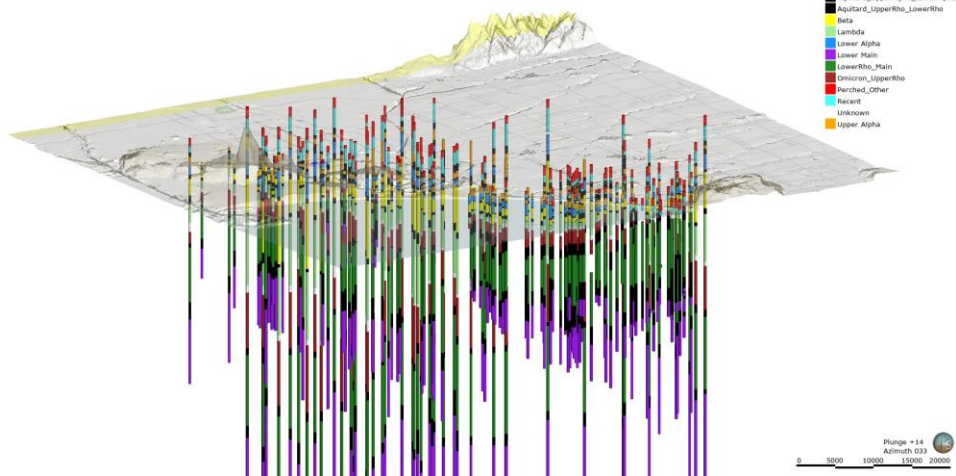


# Next Steps: Groundwater Numerical Model

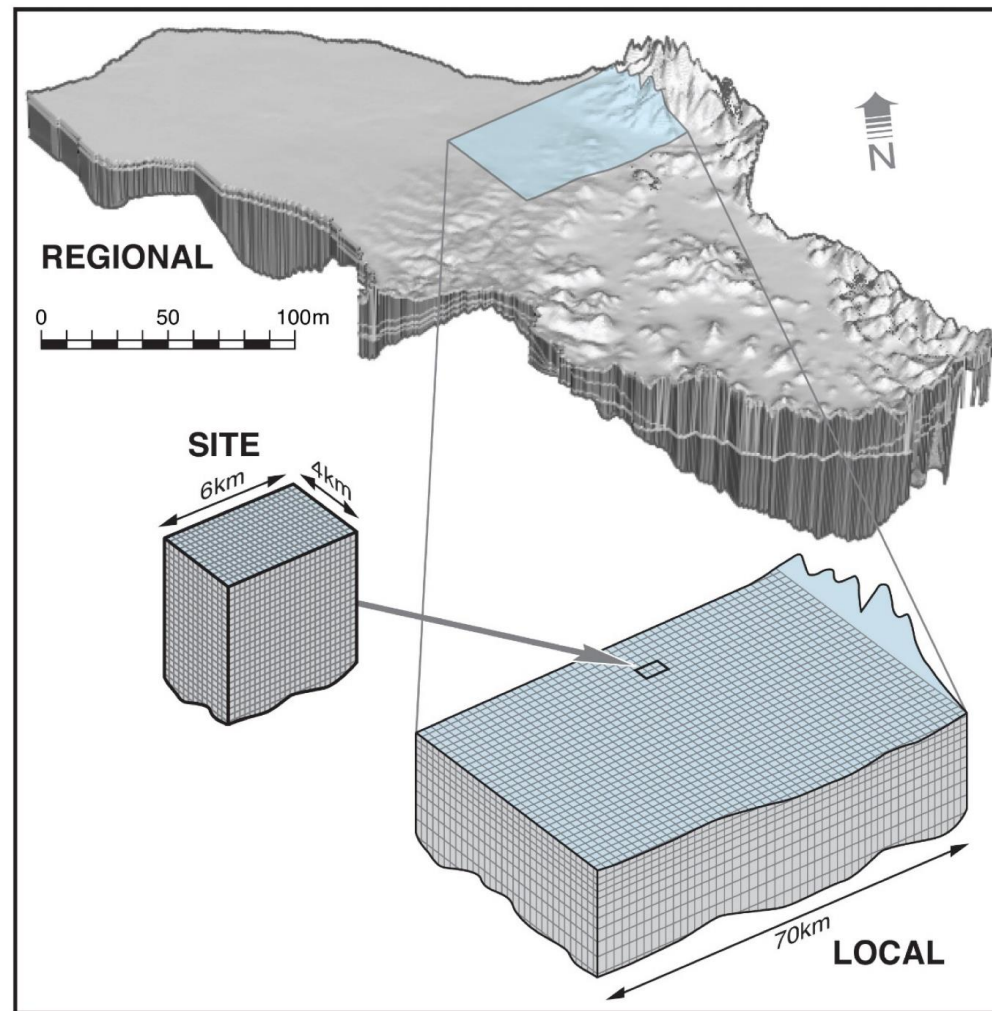
## Step 1 - Conceptual Model



leapfrog

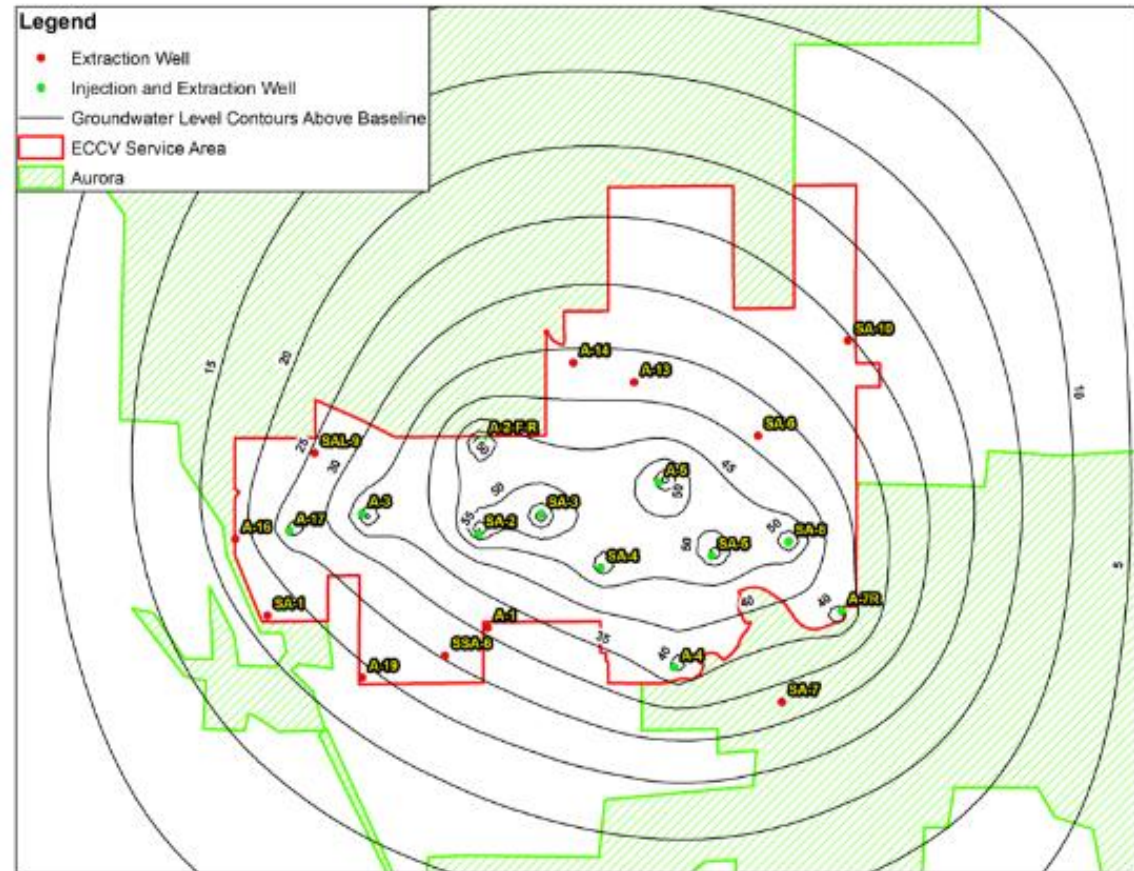


## Step 2 - Numerical Model



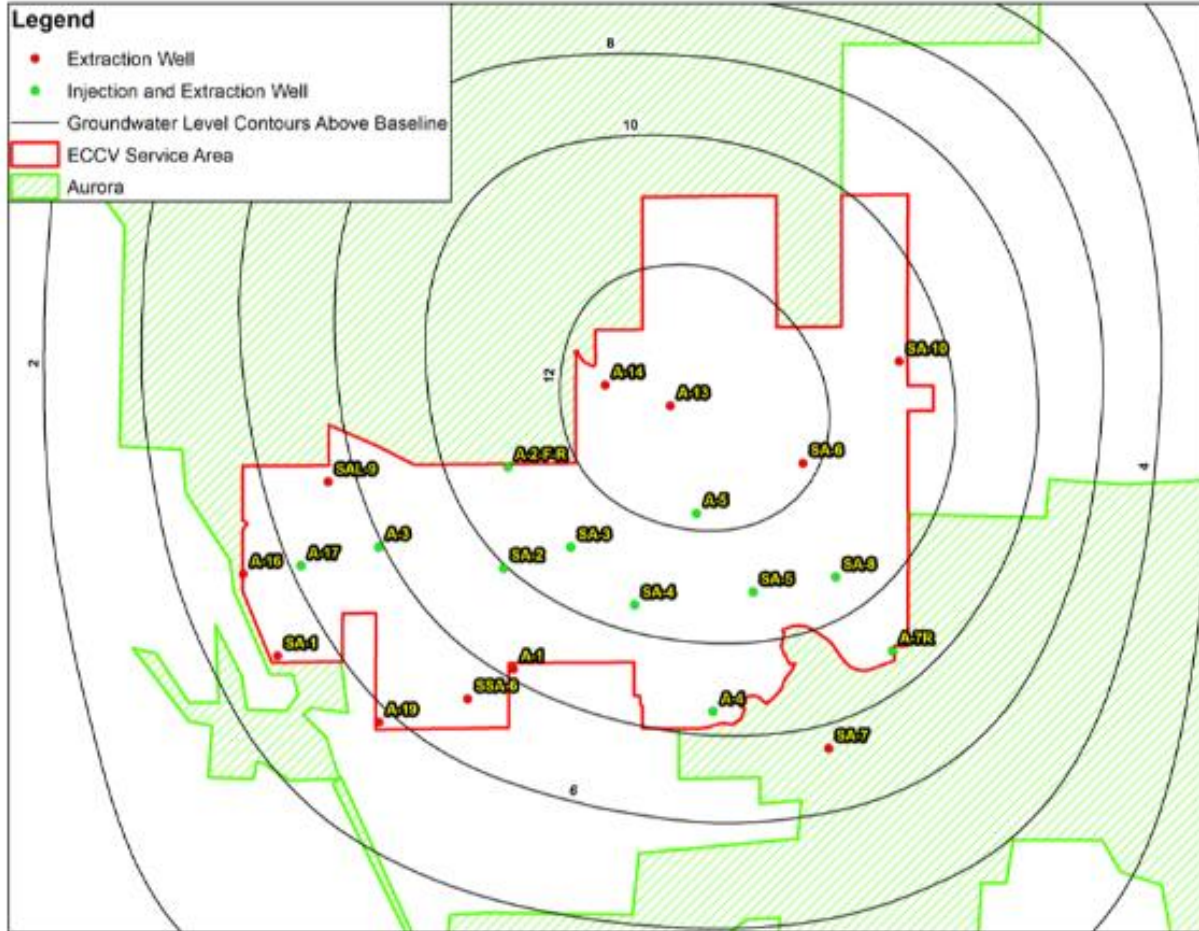
# Next Steps: Groundwater Numerical Model

- Groundwater levels in response to ASR
  - How big is the mound?
  - How durable is the mound?
  - How will the mound dissipate?
- Ability for regional ASR to mitigation groundwater level declines?
- Enhance ability to optimize regional ASR operations by understanding sub-surface interactions



ECCV - Mound Distribution at End of Seven Years of Injection

# Next Steps: Mound Dissipation



ECCV - After One Year of No Injection or Pumping

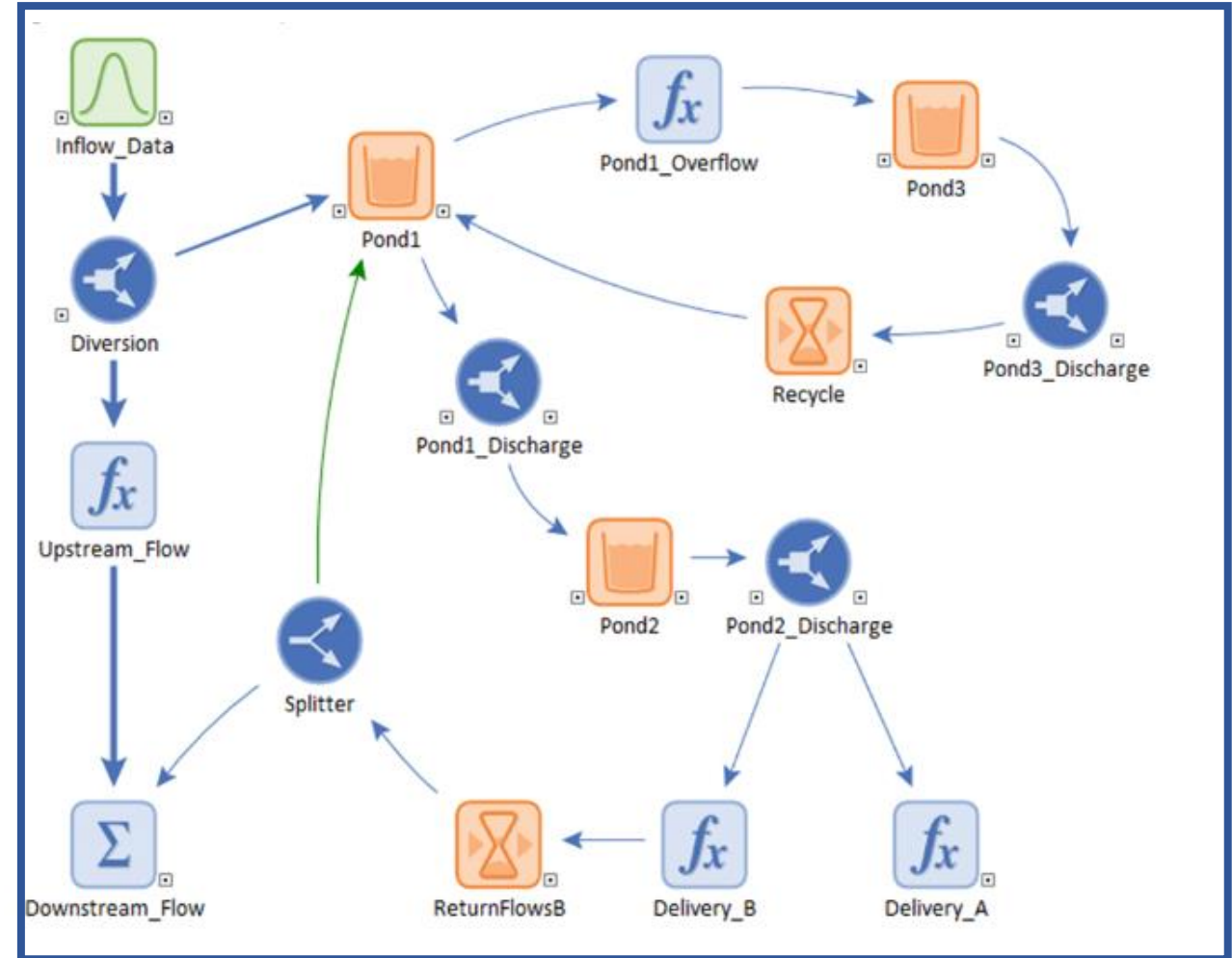


ECCV - After Two Years of No Injection or Pumping

# Next Steps: Optimization Study

## Key first step questions

1. What supplies and what is availability?
2. Is there enough injection capacity?
3. How is water moved around and where is it “parked”?
4. Can water be extracted to meet full demands at the right time?
5. What does the accounting involve, and would it generally pass in water court?



# Next Steps: Optimization Study

## Other Critical Questions

1. Water quality & treatment
2. Permitting
3. Water rights and accounting
4. Administration of program





# Questions!

## STRENGTH THROUGH PARTNERSHIPS

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