Biological Restoration of Fallowed Lands in Borrego Valley, California

Borrego Springs Watermaster

Open House

March 19, 2025

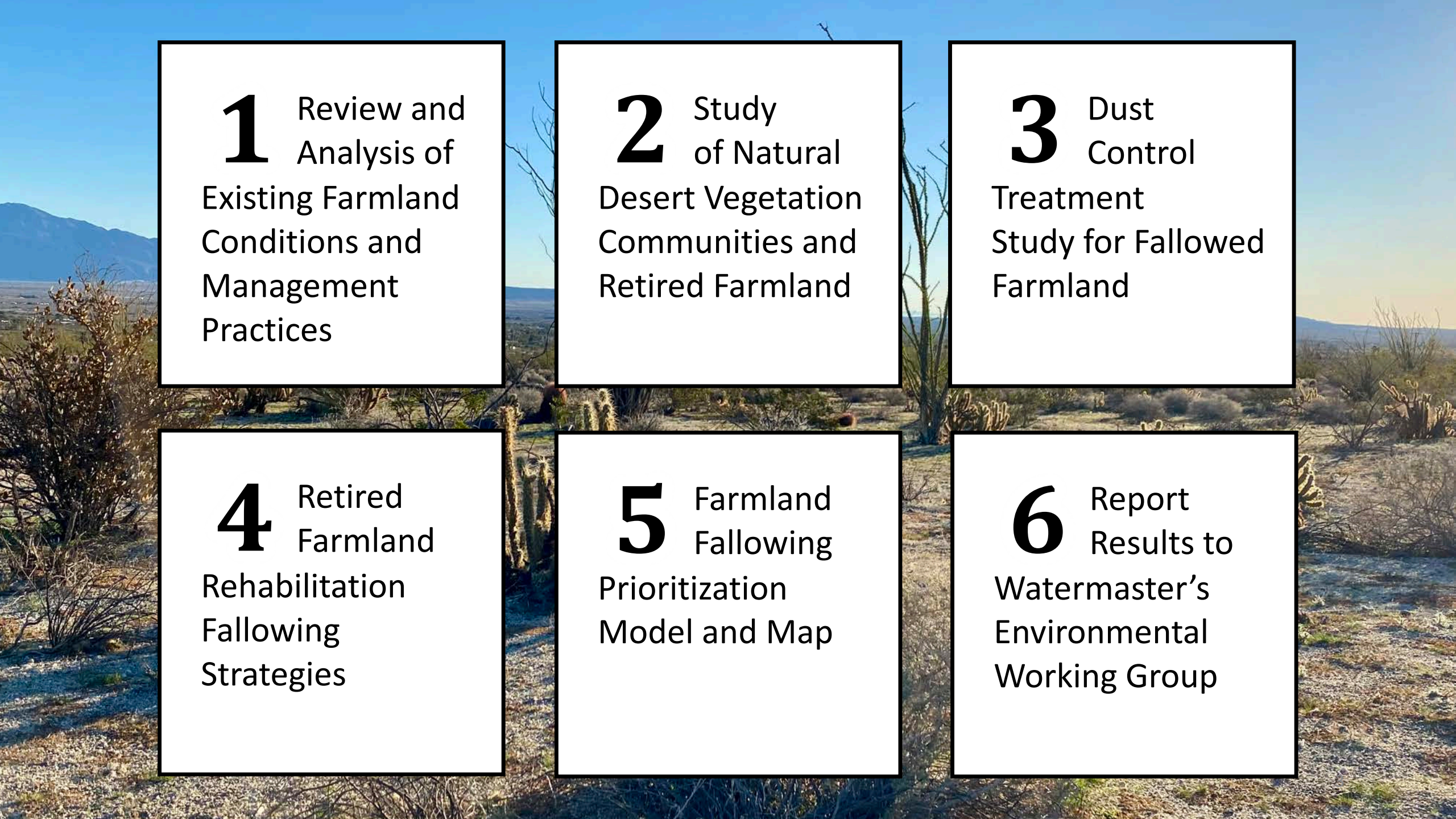
by Travis Brooks, Restoration Ecologist, Land IQ











1 Review and Analysis of Existing Farmland Conditions and Management Practices

2 Study of Natural Desert Vegetation Communities and Retired Farmland

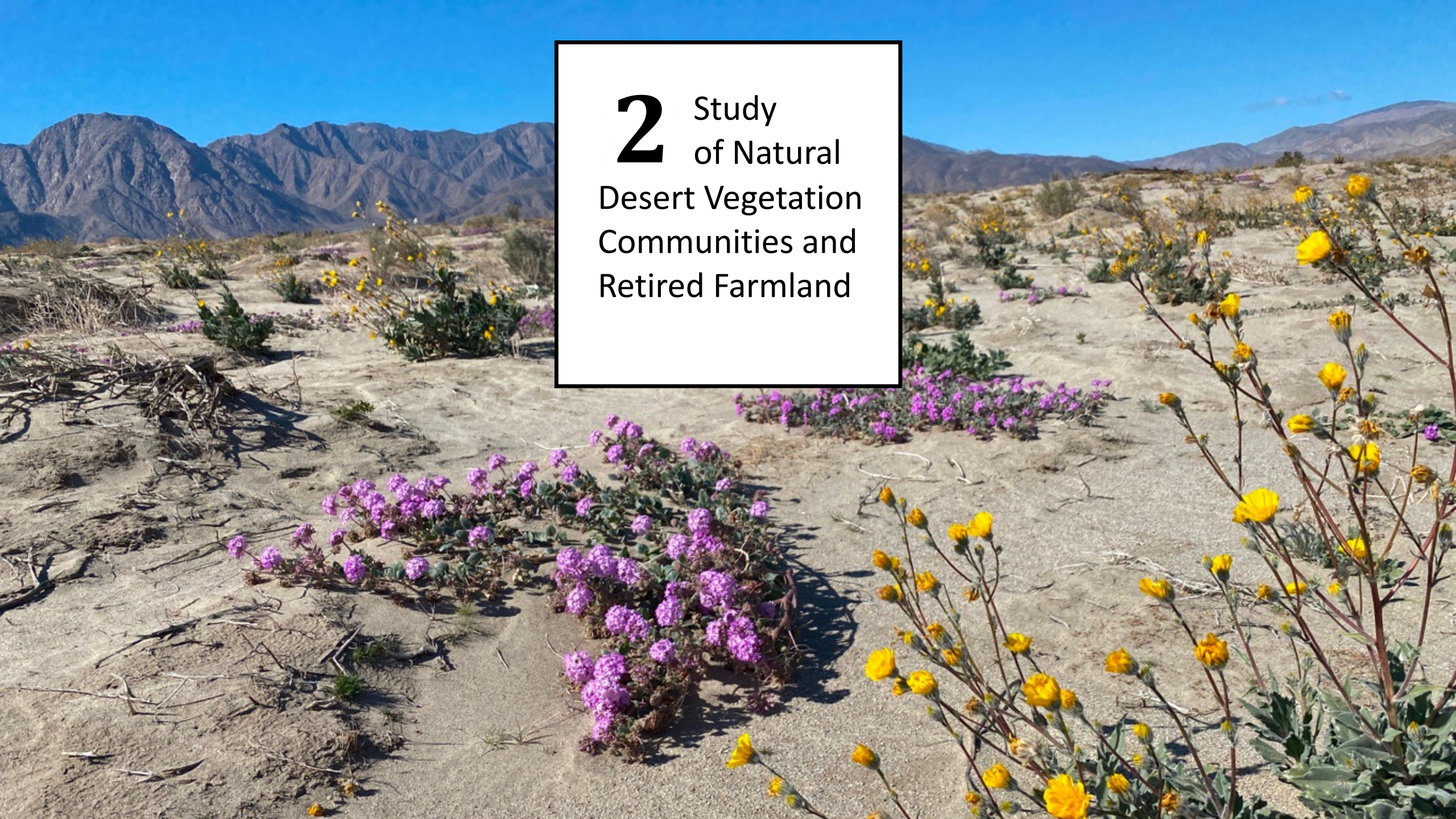
3 Dust Control Treatment Study for Fallowed Farmland

4 Retired Farmland Rehabilitation Fallowing Strategies

5 Farmland Fallowing Prioritization Model and Map

6 Report Results to Watermaster's Environmental Working Group

1 Review and Analysis of Existing Farmland Conditions and Management Practices



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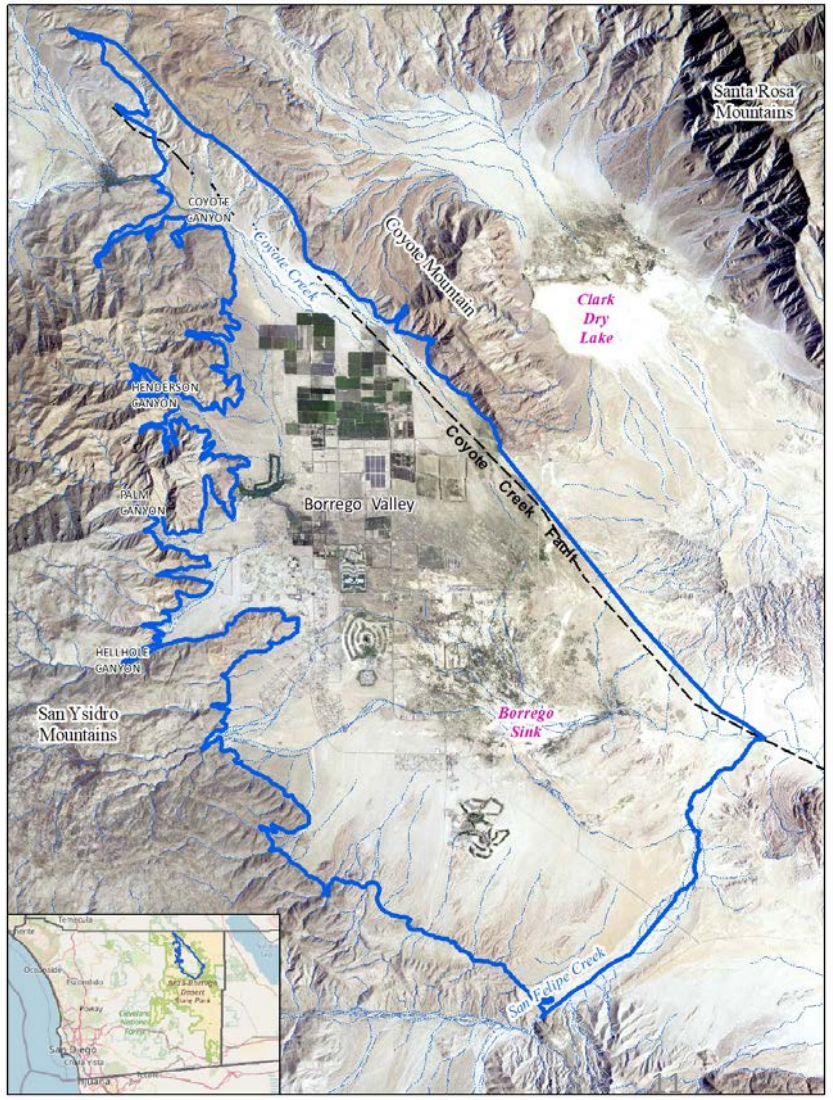
1 Review and Analysis of Existing Farmland Conditions and Management Practices

Background

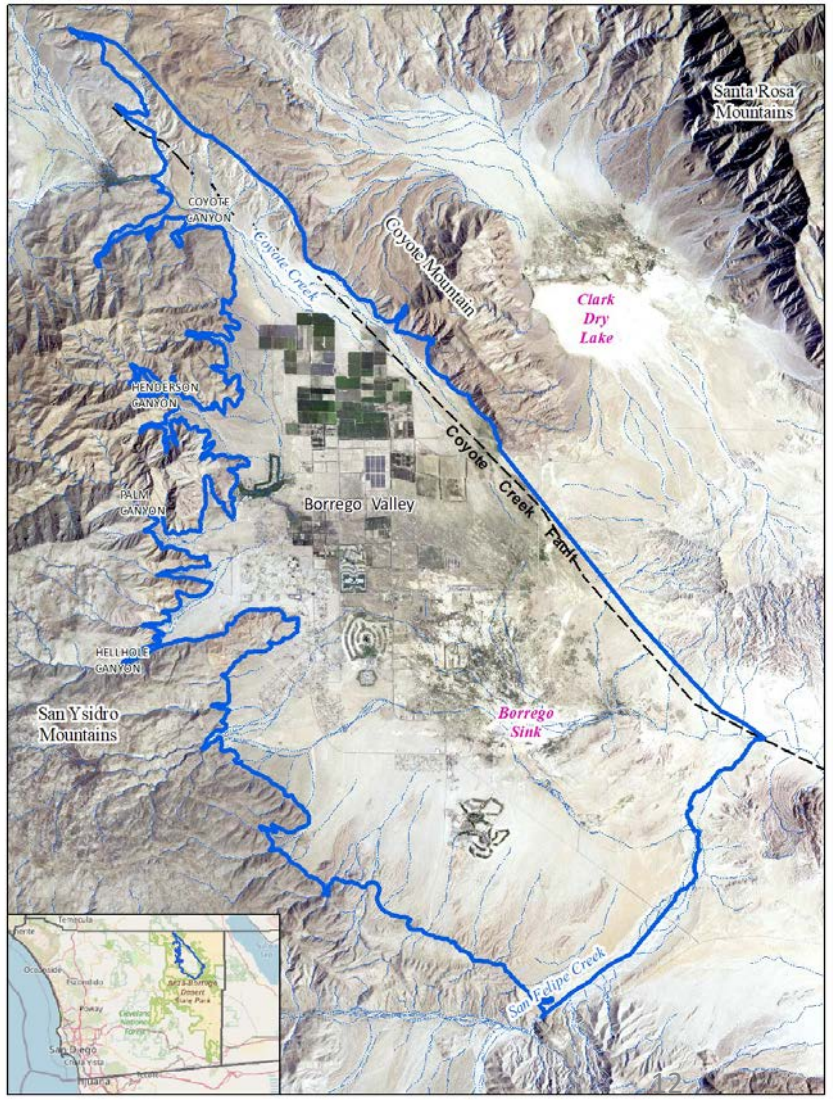
- **Borrego Springs Groundwater Subbasin**
  Sole water source for Borrego Springs and surrounding areas
- **Groundwater rights adjudication**
  Groundwater Management Plan (GMP) and Judgment
- **Borrego Springs Watermaster**
  Responsible for managing and implementing the GMP



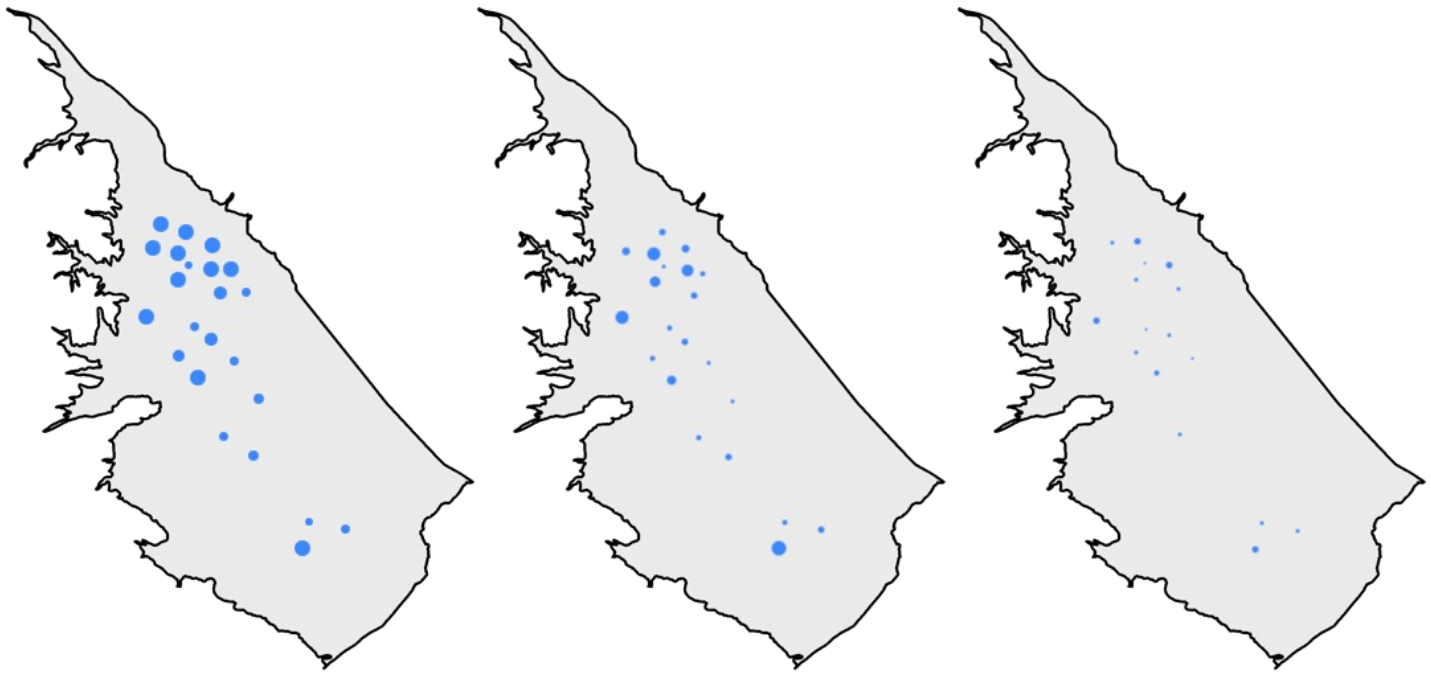
Background

- **GMP Purpose**
  Maintain a viable water supply for current and future users
- **Sustainability Goal**
  Operate the Basin within sustainable yield by 2040 with a ~67% reduction in groundwater pumping demands*

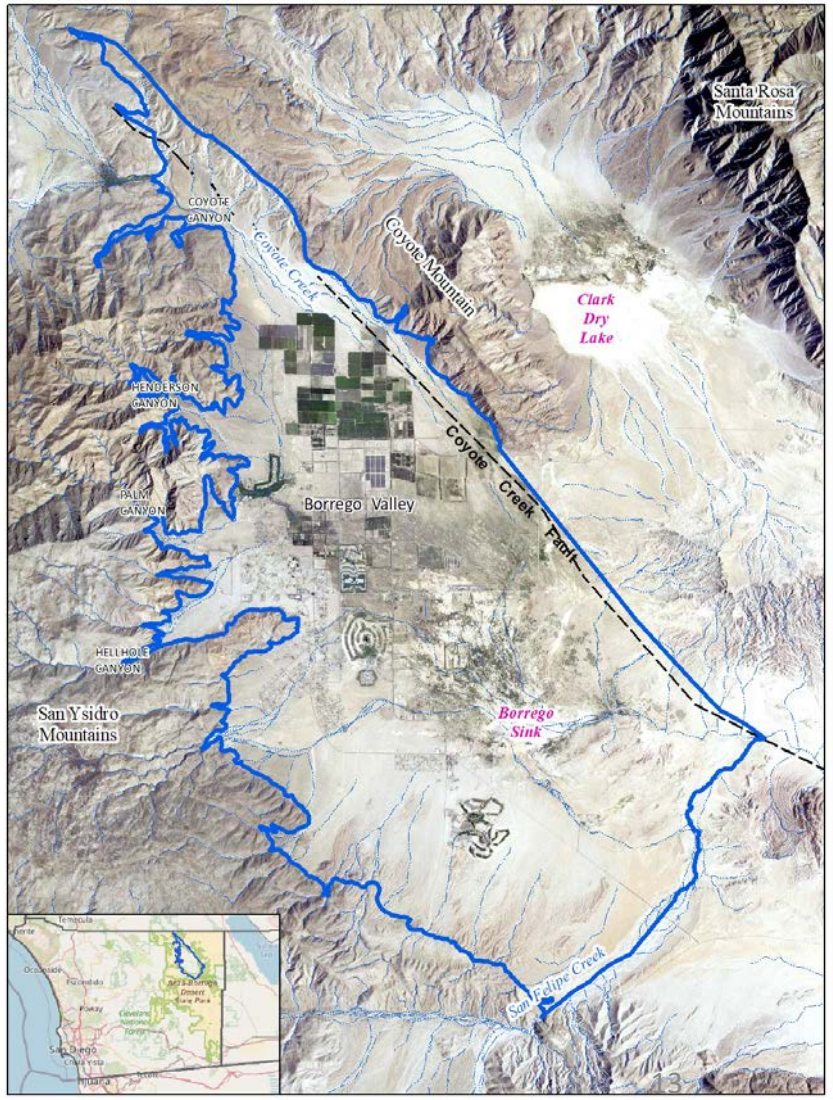
*Based a redetermined sustainable yield of 7,952 acre feet per year (AFY), adjusted up from 5,700 AFY and adopted by the Watermaster in December 2024.



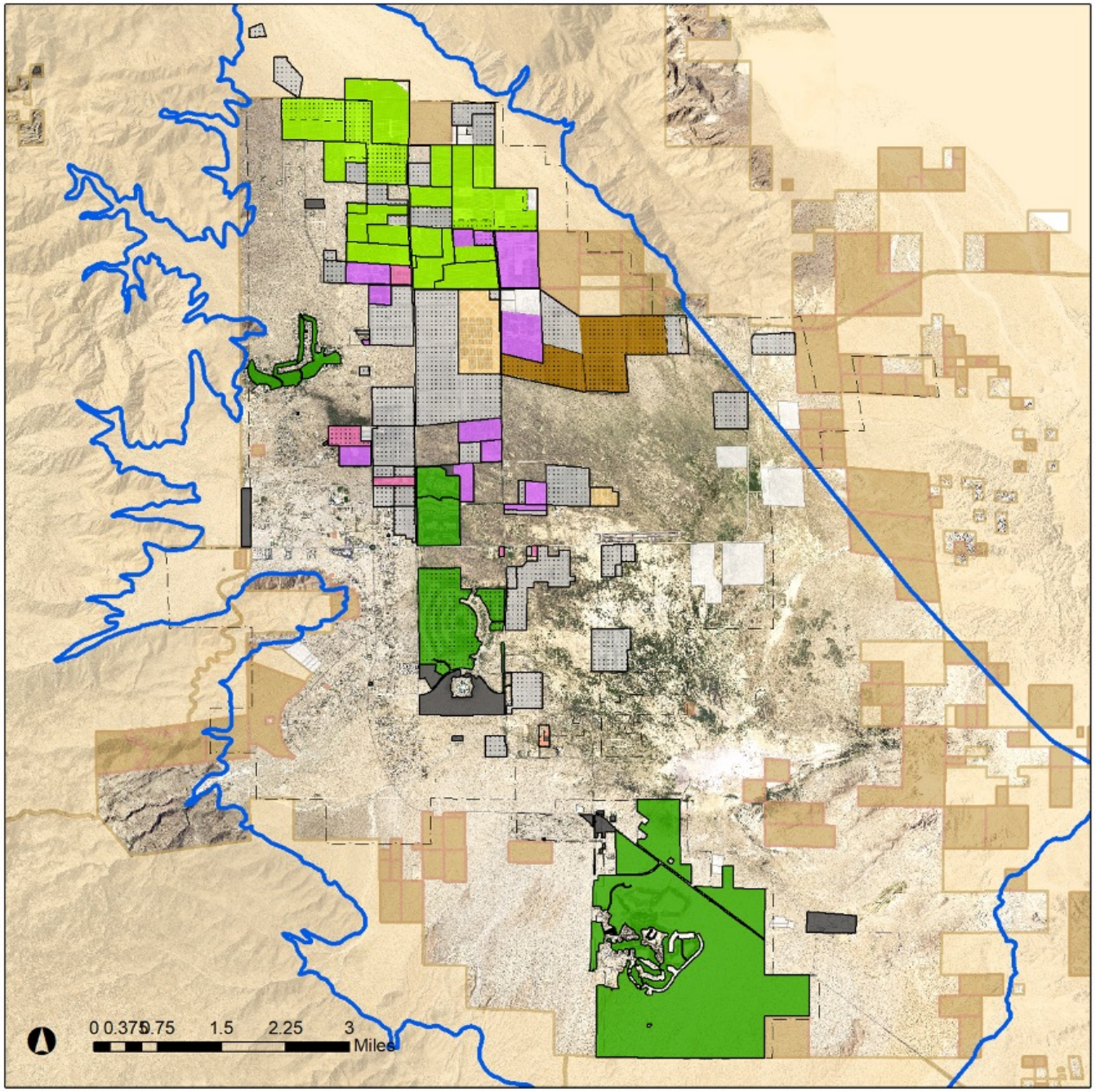
Background



Water Year **2020** **2030** **2040**



Land Use: Farmland & Parcels with Baseline Pumping Allocation (BPA) Water Rights in 2022



Biological Restoration of Fallowed Lands Project

Borrego Springs Groundwater Subbasin

- Borrego Springs Groundwater Subbasin

Land Use with BPA

- Citrus
- Palms
- Nursery, Herbs
- Golf Course Resort
- Other Water Use

Fallowed and Abandoned Land with BPA

- Fallowed/Abandoned Citrus
- Fallowed/Abandoned Palms
- Fallowed/Abandoned Nursery, Herbs
- Fallowed/Abandoned Crops
- Fallowed/Abandoned Potato
- Fallowed Golf Course

Land Use without BPA

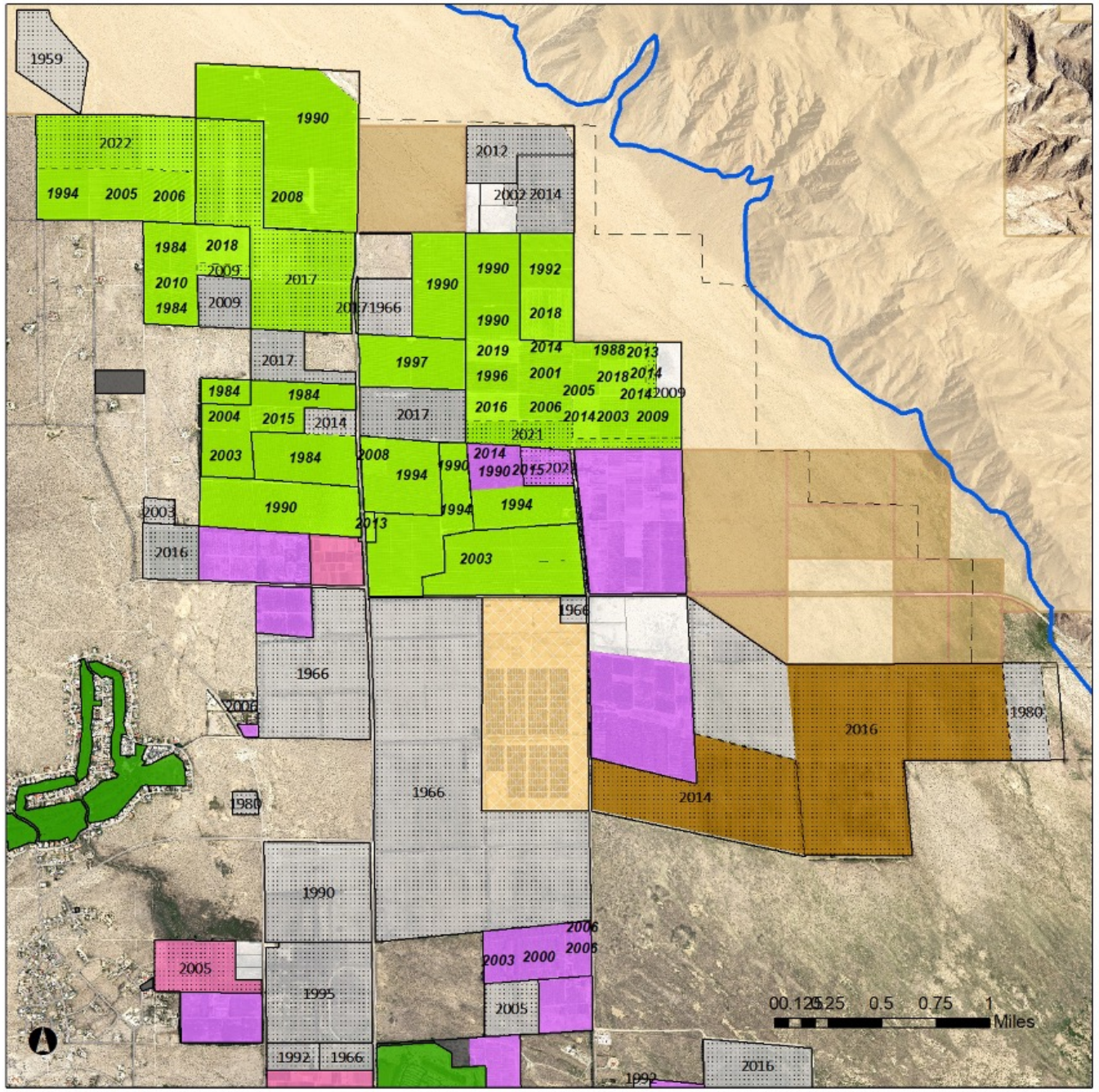
- Disturbed or Cleared (Not Cultivated)
- Fallowed
- Solar Energy Project
- Borrego Water District
- Anza-Borrego State Park
- Anza-Borrego Foundation Property

Types of Retired Farmland

- 2,480 acres have been retired (fallowed or abandoned) prior to the GMP/Judgment
- “Fallowed” = cultivated in one of the past 5 years, unless:
  - Enrolled in Habitat Conservation Program
  - Not cultivated in 5 years per accepted farm management practice
  - Not cultivated in 5 years because of government requirement
- ”Abandoned” = not cultivated in over 5 years

Current Minimum Fallowing Standards

- Tree crop destruction: Chipping or burning
- Surface irrigation equipment removal
- Soil stabilization: Mulching with chips or ash
- Limitations: While addressing temporary dust emissions and soil erosion, current standards may not address other environmental and socioeconomic concerns



Crop Type (2021)	Acres
Citrus	1,622
Dates	76
Flowers, Nursery and Christmas Trees	571
Young Perennials[1]	27

Biological Restoration of Fallowed Lands Project

Borrego Springs Groundwater Subbasin
- Borrego Springs Groundwater Subbasin

Land Use with BPA
- Citrus
- Palms
- Nursery, Herbs
- Golf Course Resort
- Other Water Use

Fallowed and Abandoned Land with BPA (Year of Fallowing Labeled)
- Fallowed/Abandoned Citrus
- Fallowed/Abandoned Palms
- Fallowed/Abandoned Nursery, Herbs
- Fallowed/Abandoned Crops
- Fallowed/Abandoned Potato
- Fallowed Golf Course

Land Use without BPA
- Disturbed or Cleared (Not Cultivated)
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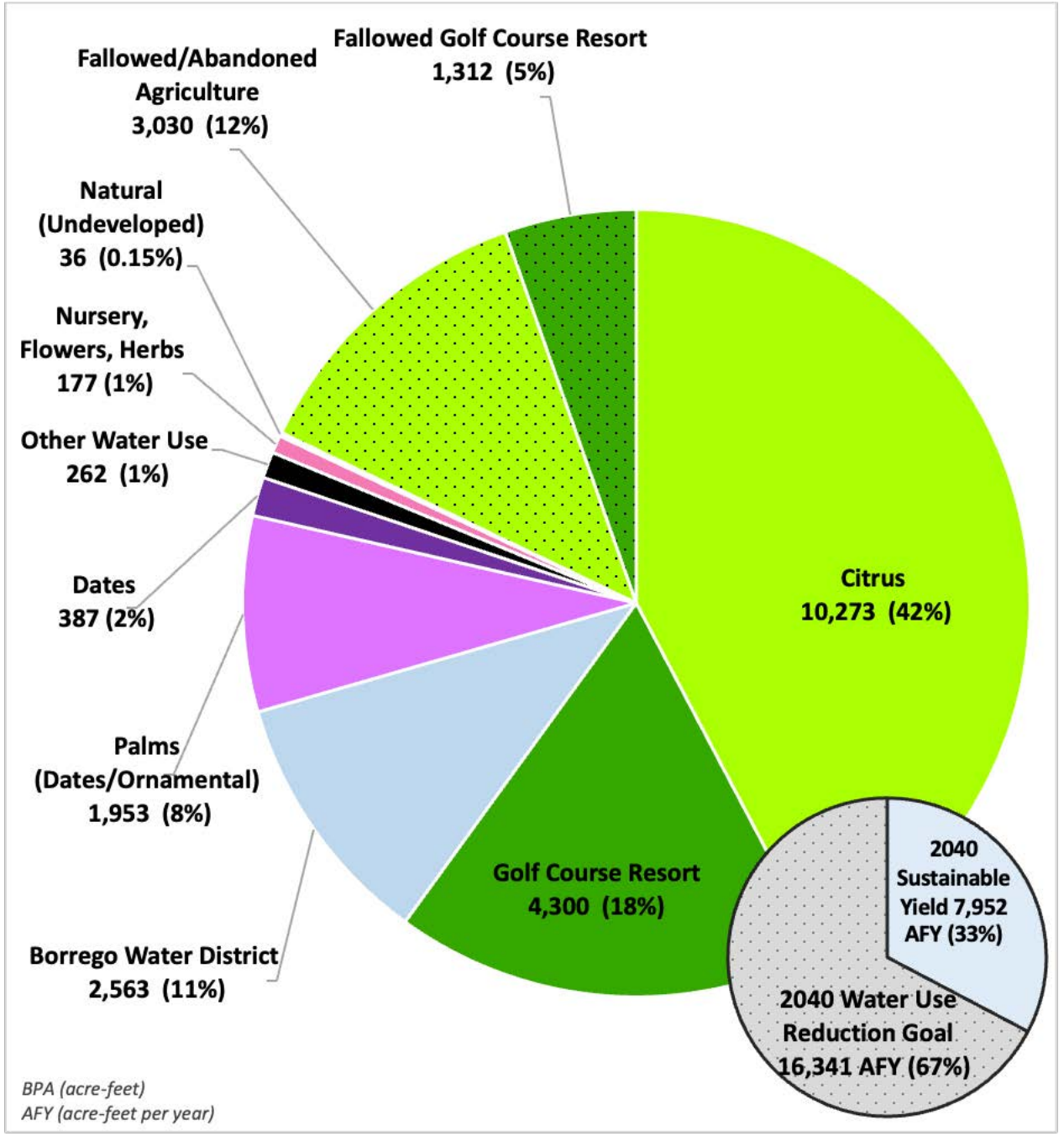
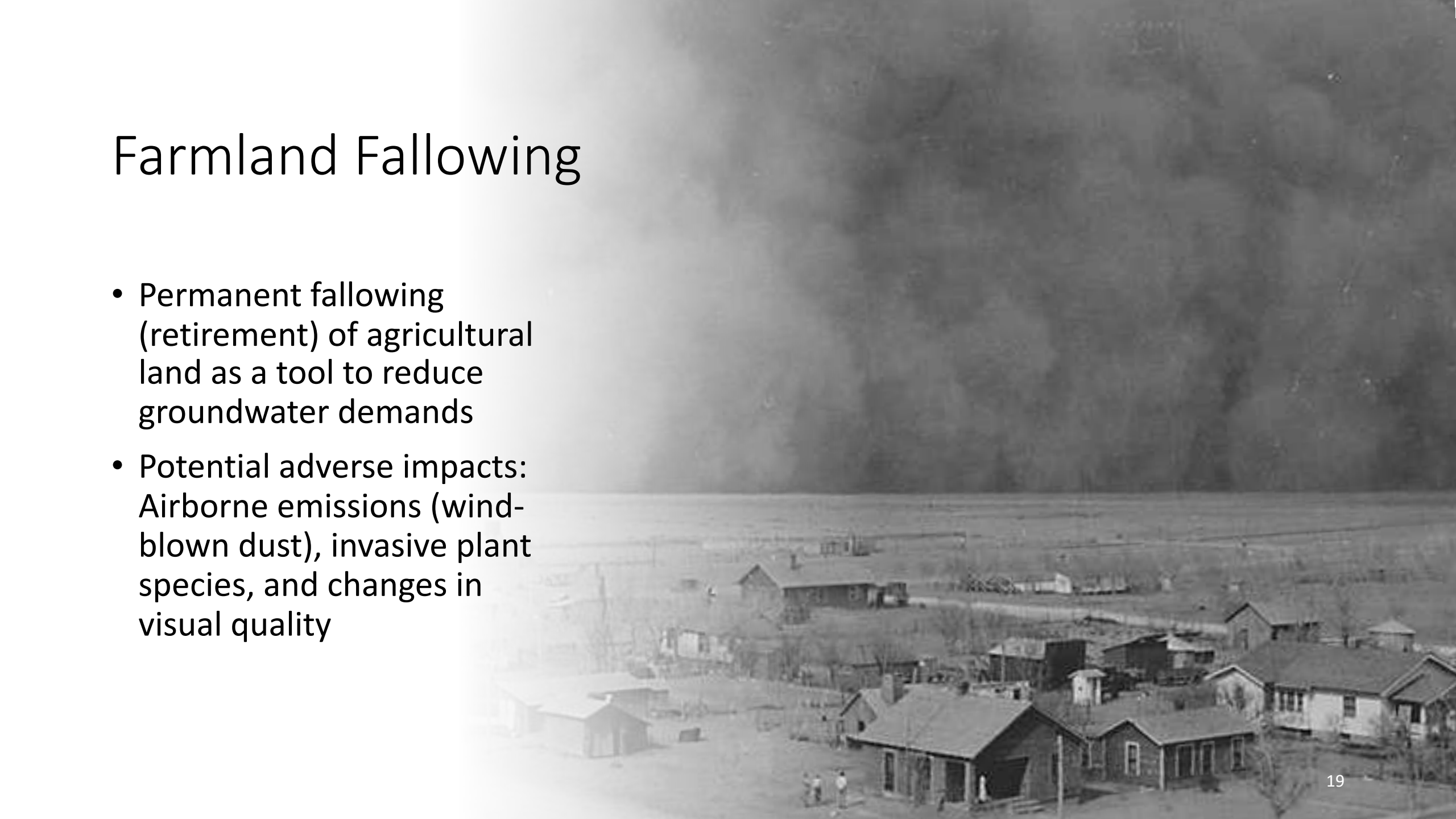
2022 Land Use
for Parcels with
BPA Water Rights



Farmland Fallowing

- Permanent fallowing (retirement) of agricultural land as a tool to reduce groundwater demands
- Potential adverse impacts: Airborne emissions (wind-blown dust), invasive plant species, and changes in visual quality



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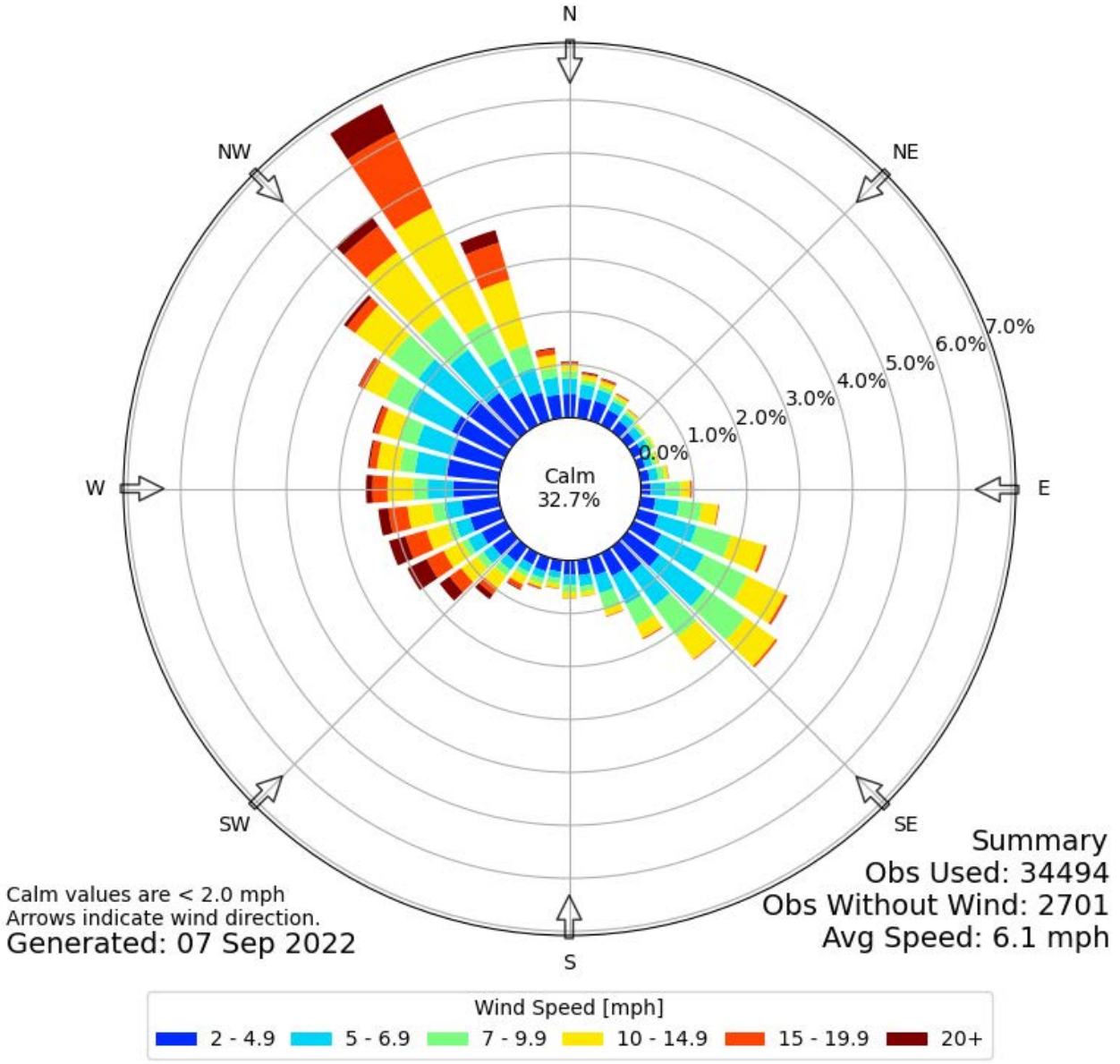
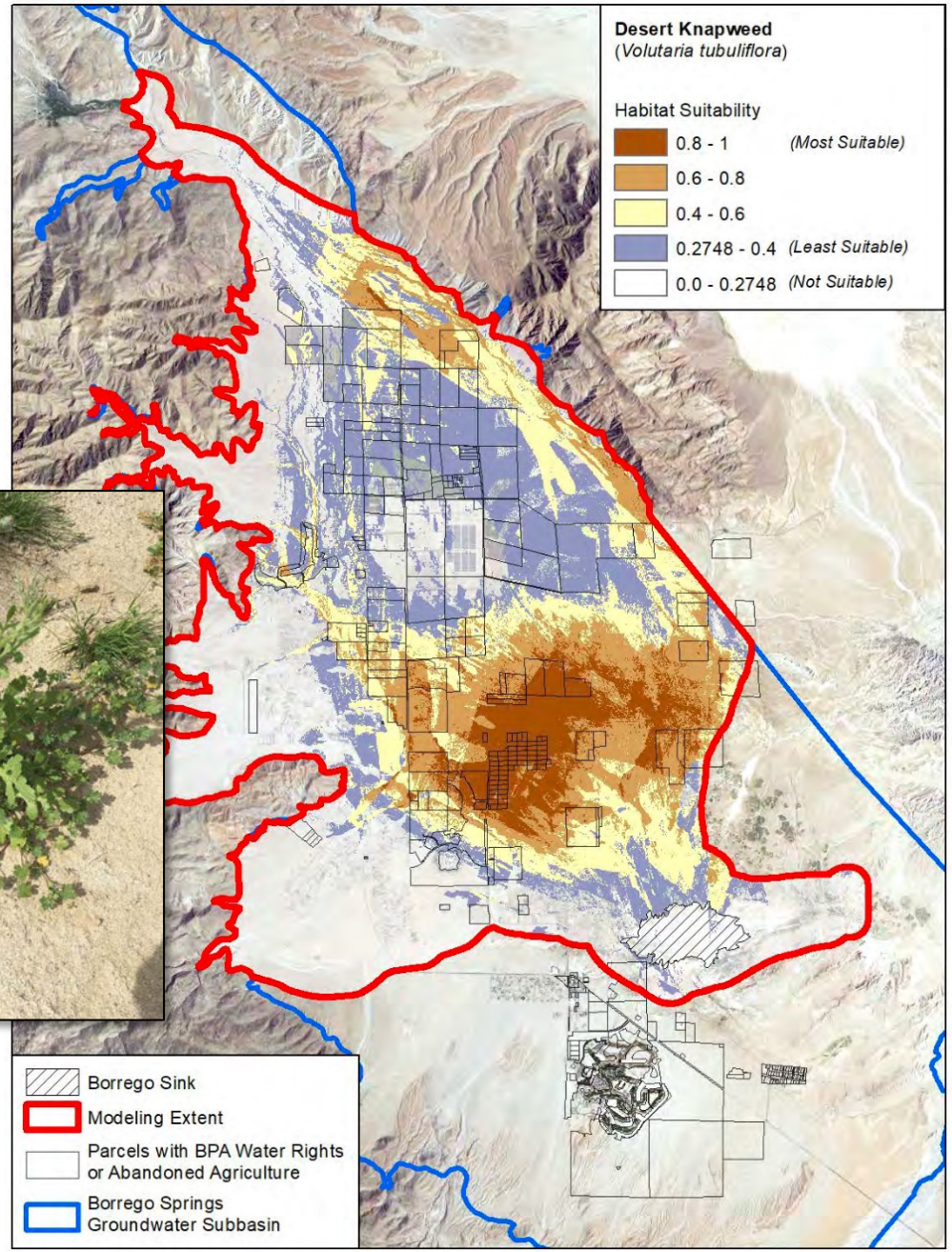


Invasive Plant Habitat Suitability Models

Desert Knapweed



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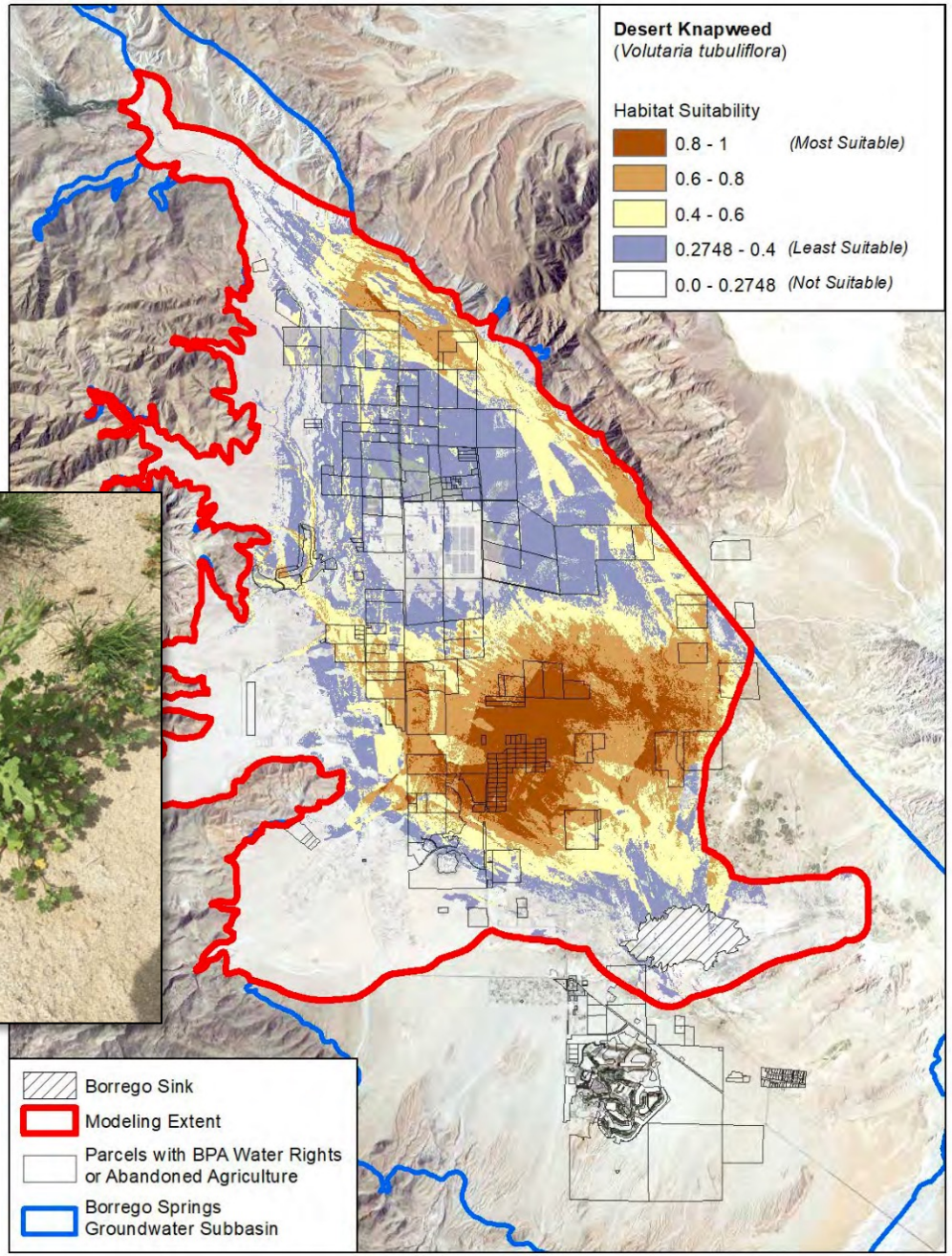
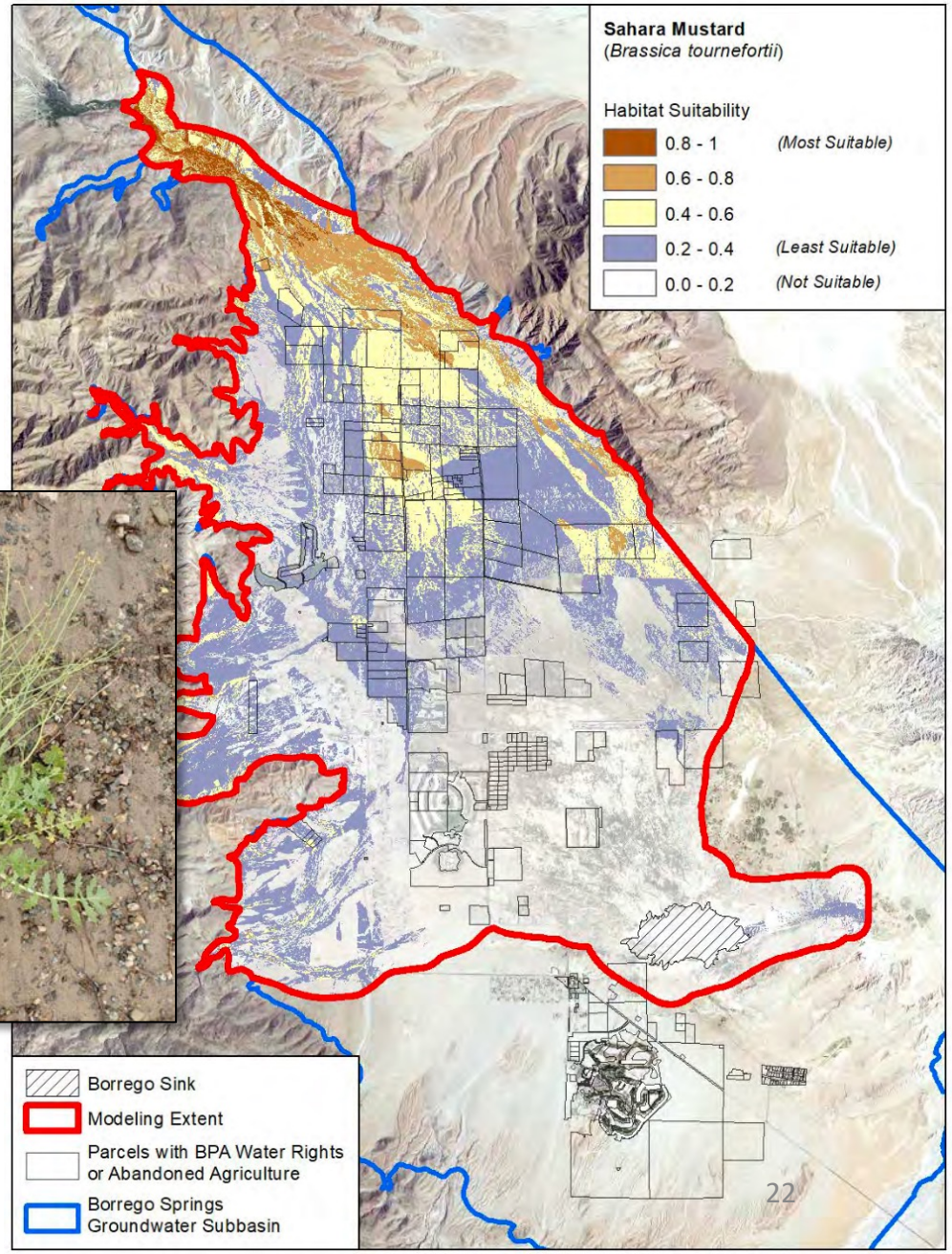


Sahara Mustard

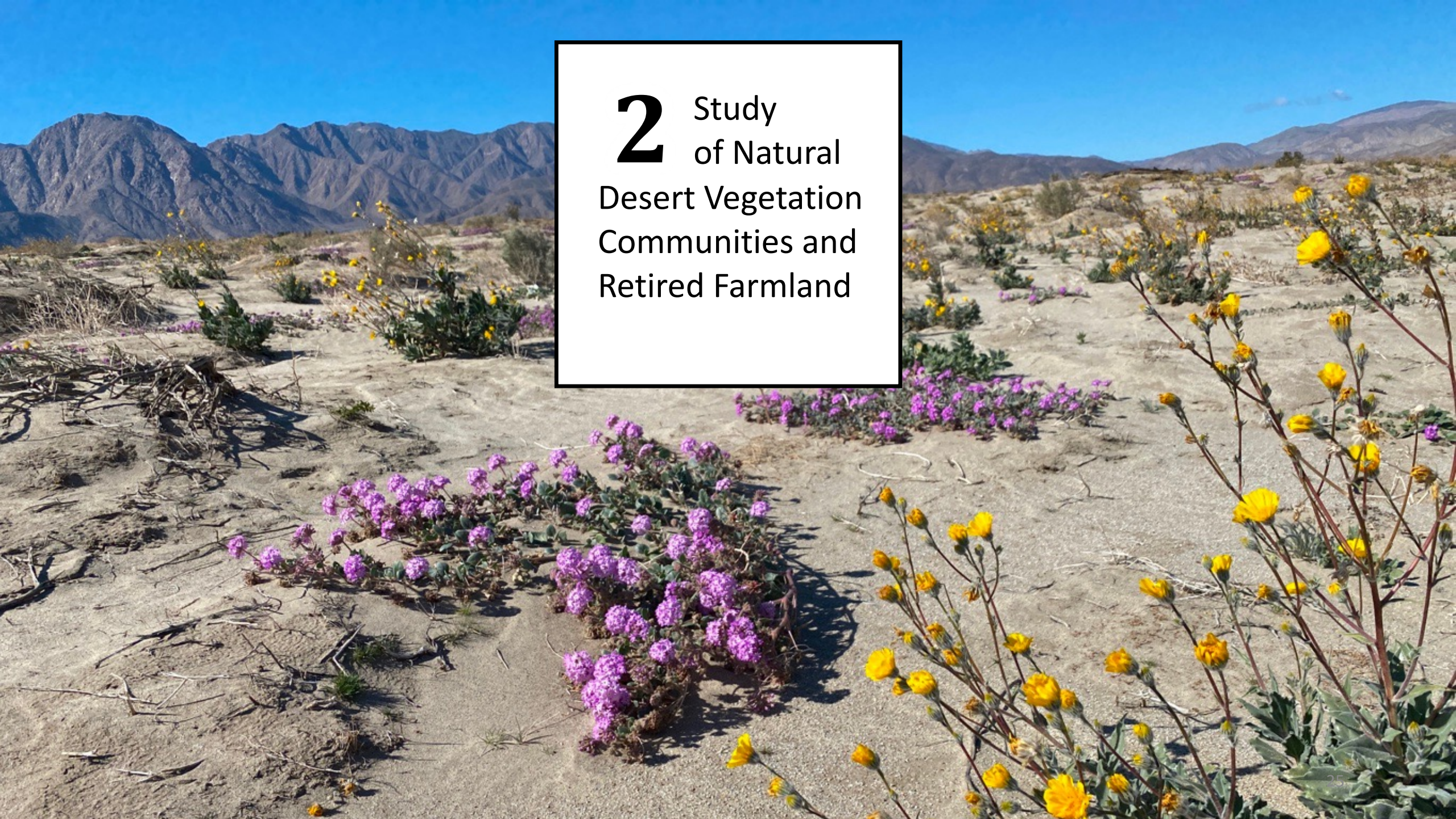


Solution

- Biological rehabilitation of current and future permanently fallowed lands to protect human health, environment, and community well-being
- Address barriers to establishing native habitat on fallowed lands

Rehabilitation of Retired Farmland

- Dryland systems take longer to recover; stochastic processes
- Cultivated soils require more intervention than other land uses and may recover as novel plant communities
- Some form of active intervention necessary without fluvial processes
- High Variability in Outcomes
  - *Spatial heterogeneity; islands of fertility*
  - *Temporal seasonal and interannual climatic variability*
  - *Land Management History*



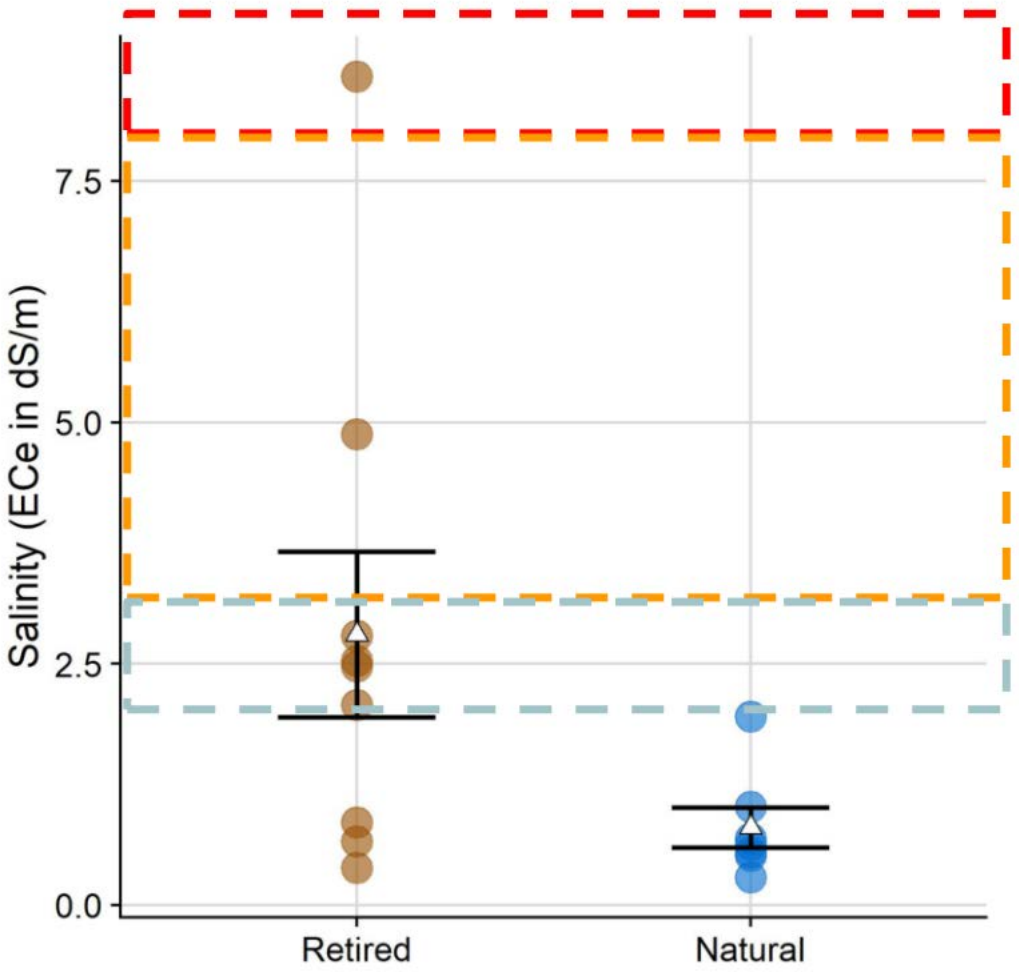
2 Study of Natural Desert Vegetation Communities and Retired Farmland

Retired Agricultural

Natural Reference

Retired Agricultural

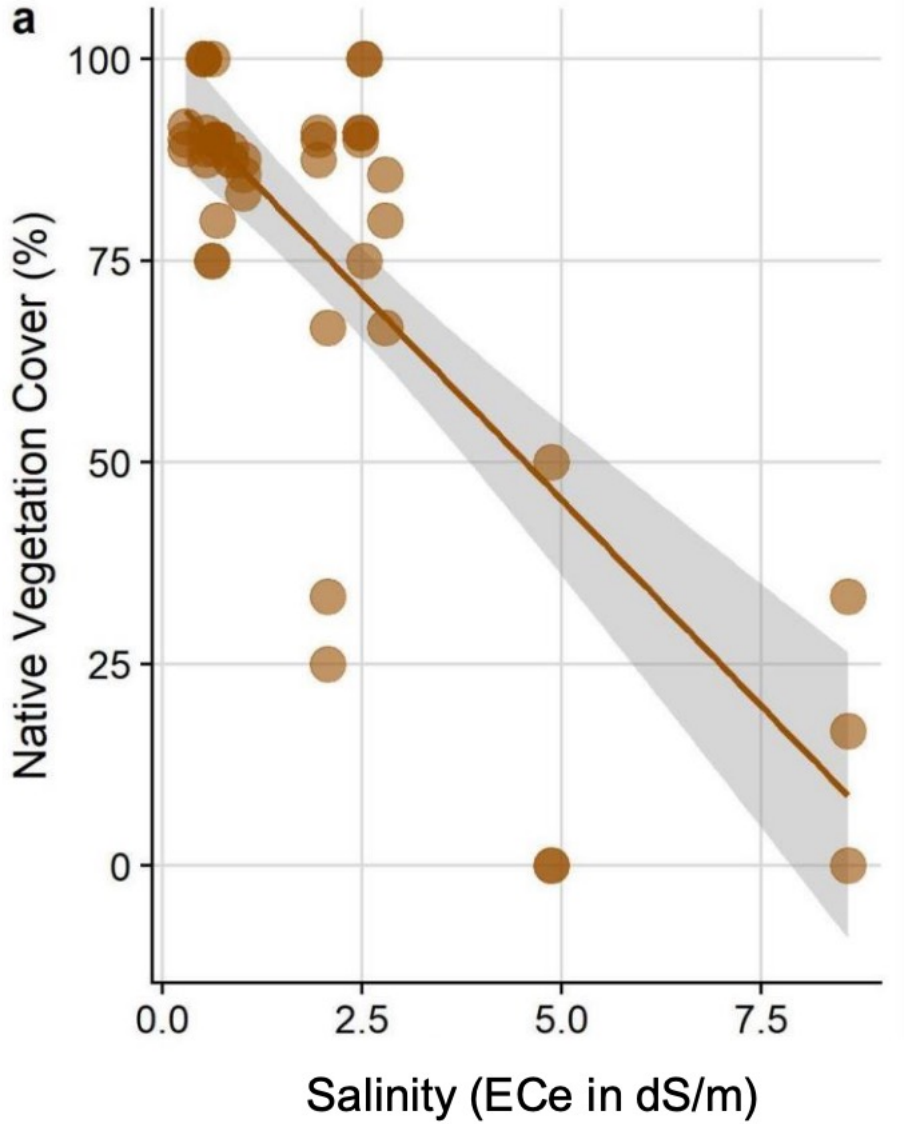
Natural Reference

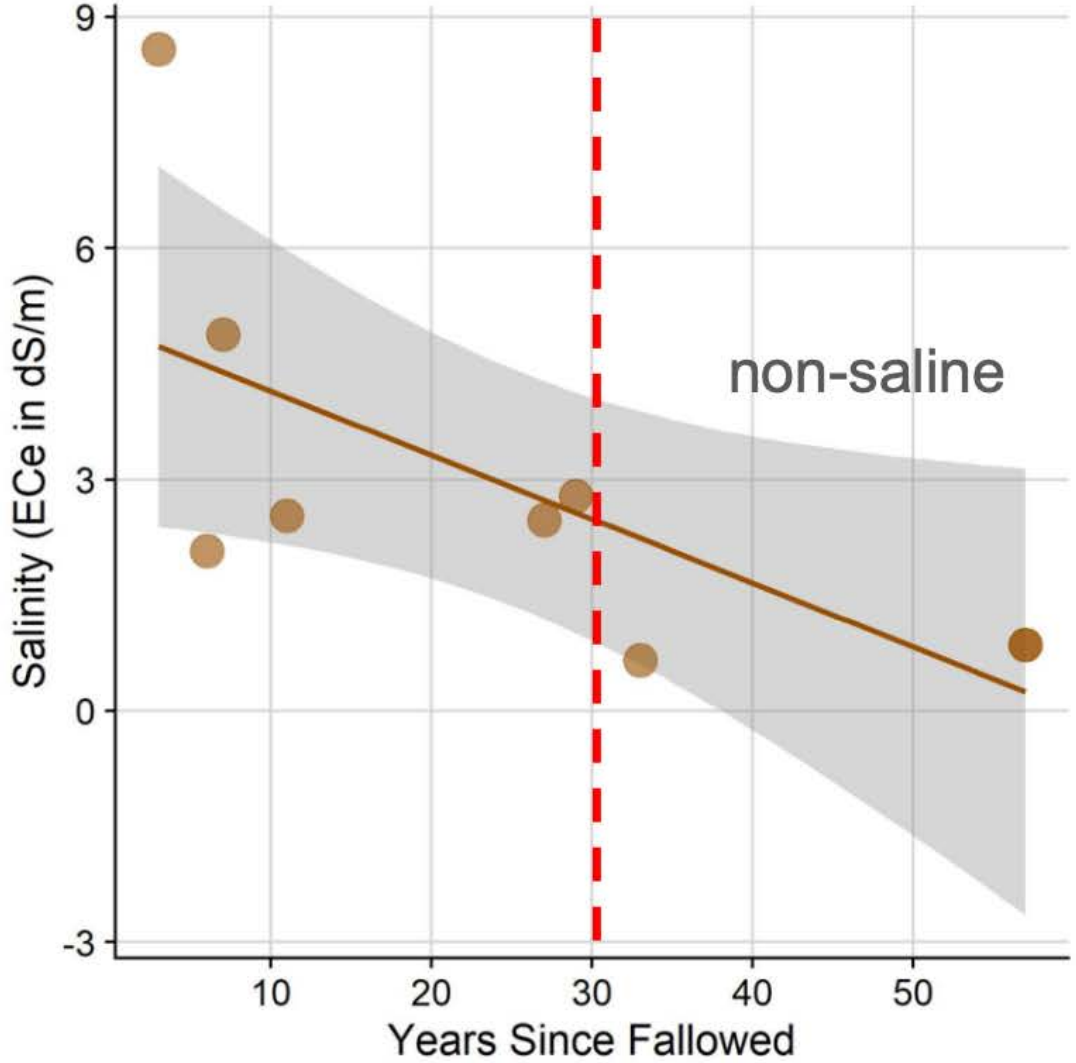


Highly saline

Moderately saline

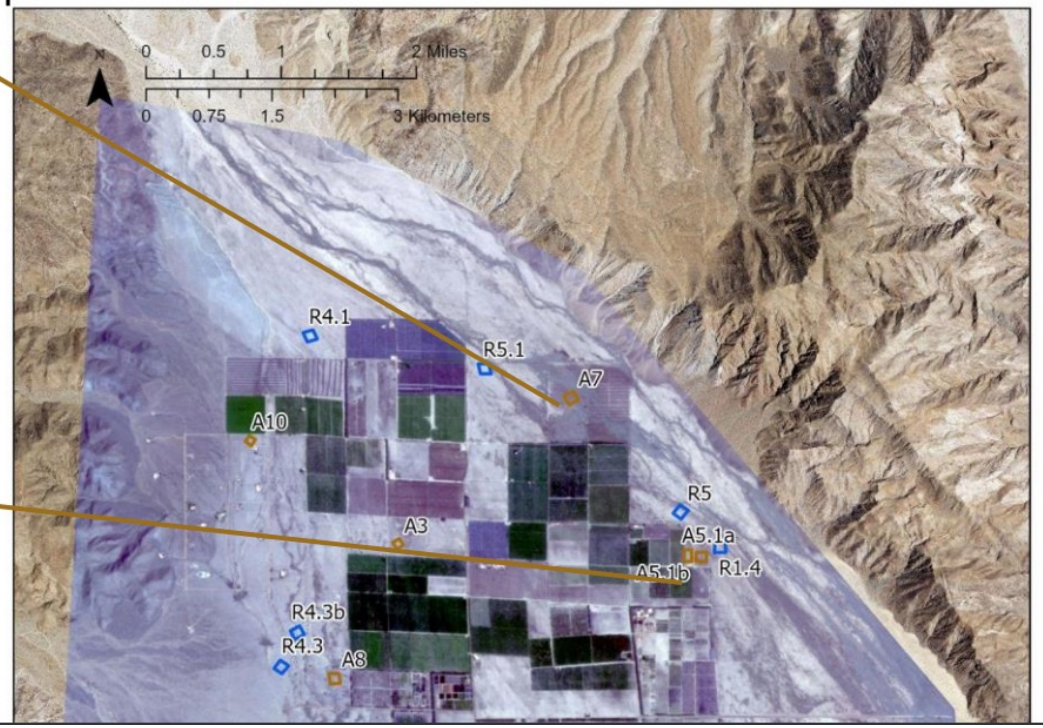
Slightly saline


a
100
75
50
25
0
Native Vegetation Cover (%)
0.0
2.5
5.0
7.5
Salinity (ECe in dS/m)


9
6
3
0
-3
Salinity (ECe in dS/m)
non-saline
10
20
30
40
50
Years Since Fallowed

- Retired sites closer to the flow of water had higher microtopography, larger and greater cover of patches

False color aerial imagery from 21 Aug 2023, following a monsoon rainfall event. Flowing water, pooling water, and wet soil = dark spots.



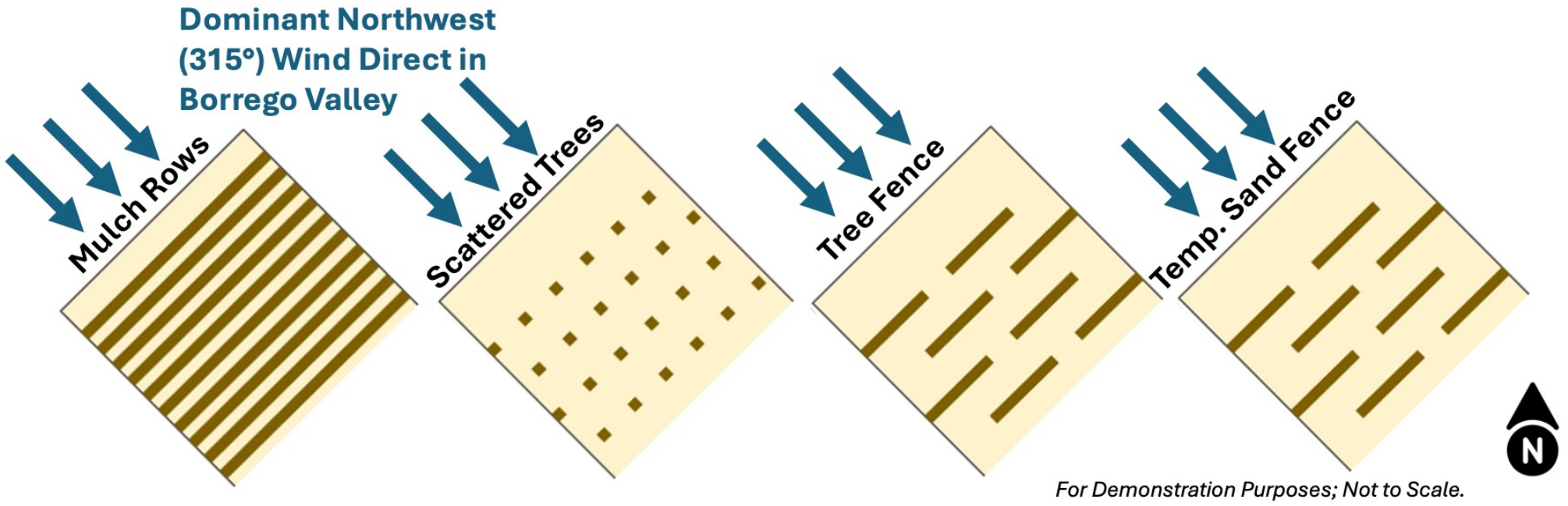
Potential Outcomes of Retired Farmland without Intervention

1. Little to no vegetation establishment and high sand transport
2. Invasive plant (e.g., *Volutaria, Brassica*) infestations; high sand transport
3. Natural succession to Saltbush Scrub (*Atriplex* spp.), in response to soil salinization from farm management of high water use crops
4. Natural succession to Creosote Bush Scrub over long time scales, decades to hundreds of years (**unless there are fluvial processes**)

3 Dust Control Treatment Study for Fallowed Farmland

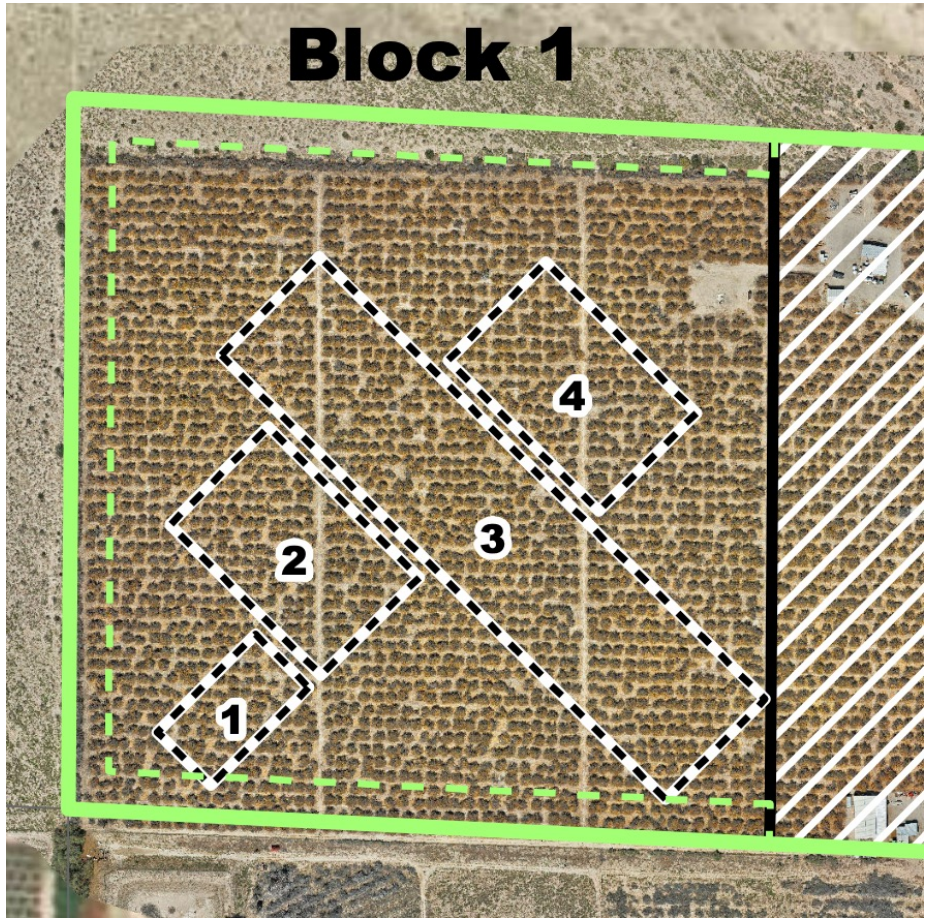
Evaluated 4 Dust Control Strategies

1. **Mulch**
2. **Scattered Trees**
3. **Tree Fence**
4. **Temporary Sand Fence**

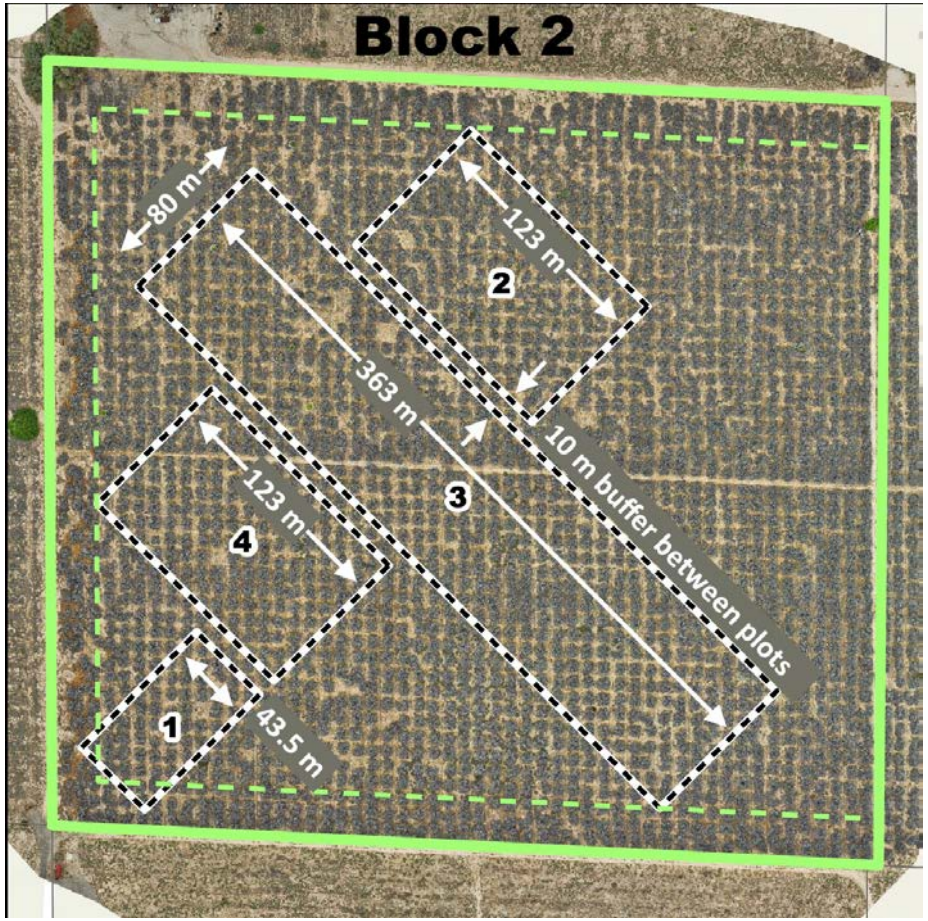


Dust Control Strategies Constructed at 2 Sites

Borrego Water District



T2 Borrego LLC




DEERE

Dust Control Treatments

1. Mulch (rows or spread mulch)

Dust Control Treatments

2. Citrus Scattered Trees

Dust Control Treatments

3. Citrus Tree Sand Fence

Dust Control Treatments

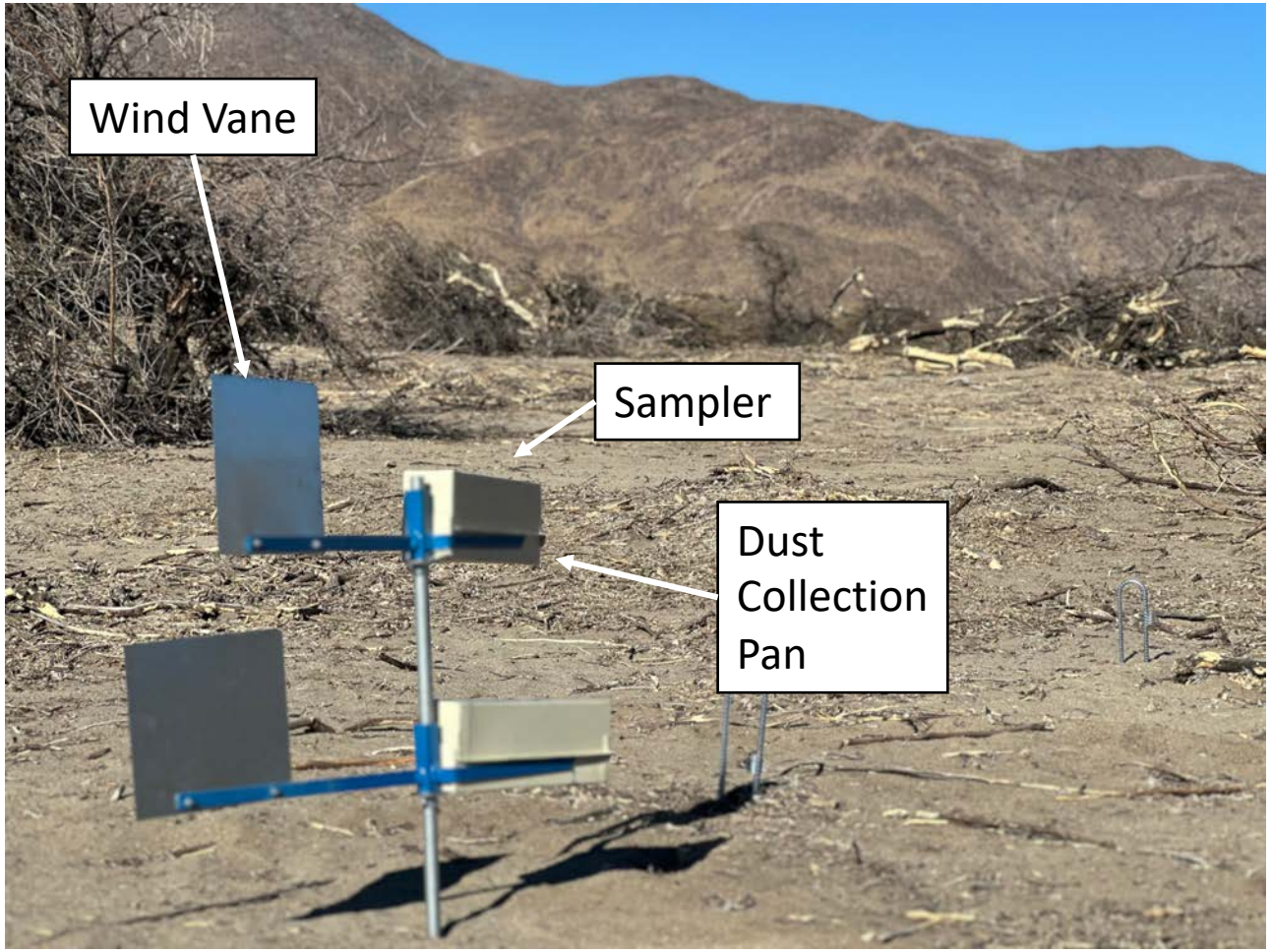
4. Temporary Sand Fence

Dust Monitoring Equipment

Erosion Pins

- Distance from top to soil surface measured over time to indicate erosion or deposition

Dust Monitoring Equipment



Big Spring Number Eight (BSNE) Dust Collector

- Swivel 360°
- Collection at 2 Heights (20 cm; 50 cm)

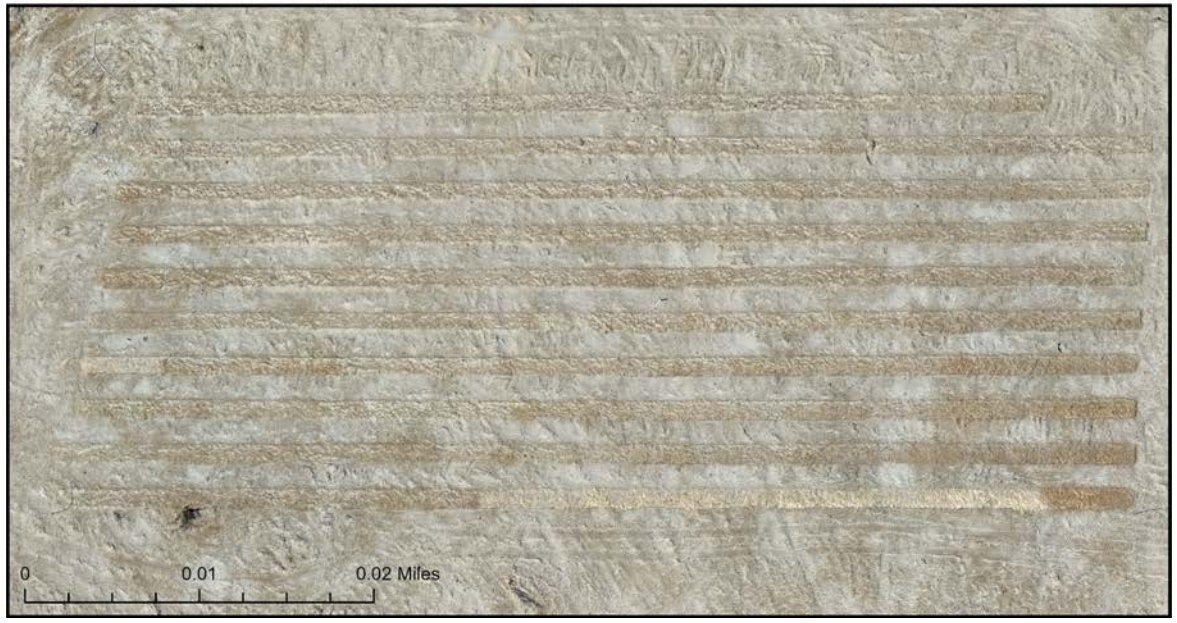
Drone Imagery of Constructed Study

Borrego Water District

T2 Borrego LLC

T2 Mulch Rows Treatment: February 2025

T2 Mulch Rows Treatment: March 2025



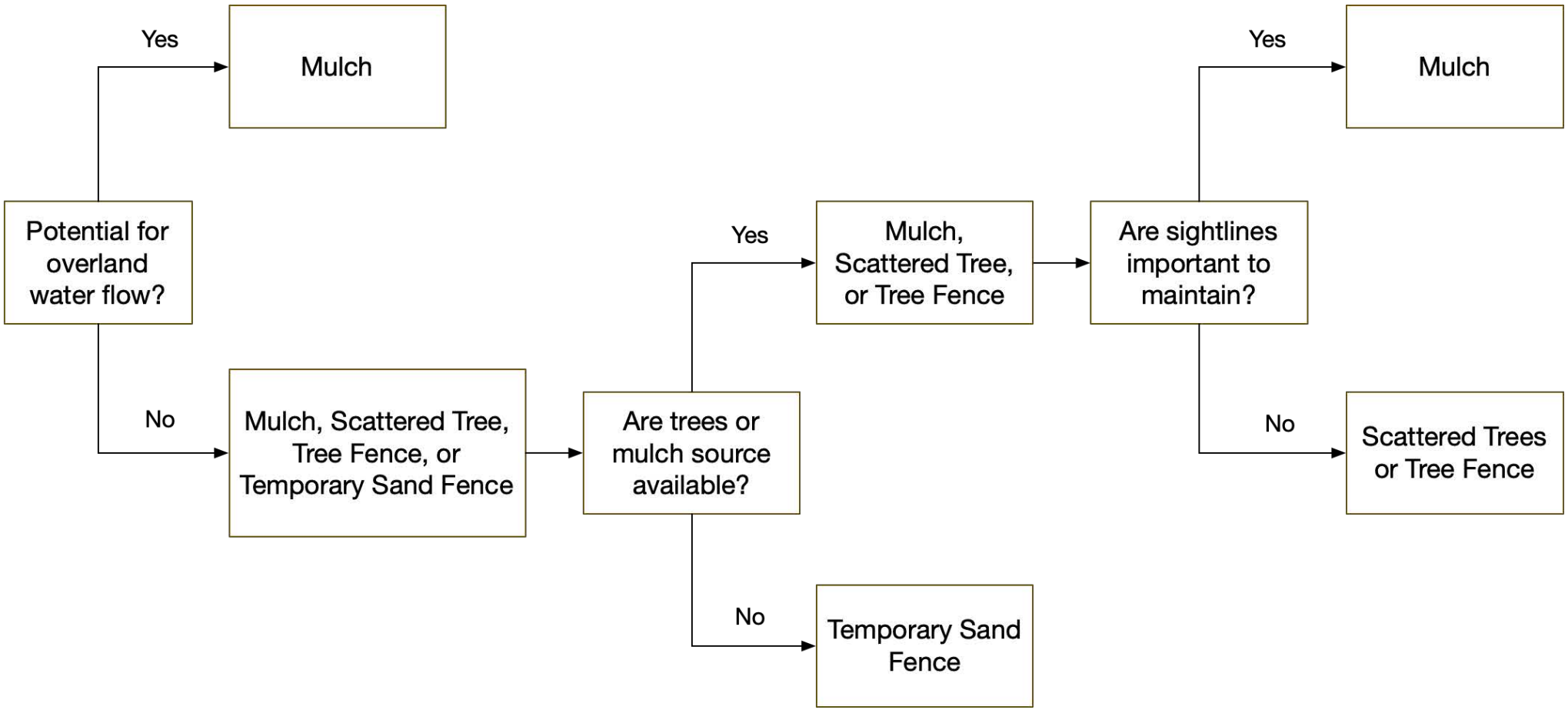
Treatment	Dust Control Effectiveness	Habitat Value	Cost
1. Mulch (Current GMP Standard)	 High wind velocity and sand transport; Low soil stabilization with short term benefits	 Lack of microsites; Very low native seed and litter deposition	 Moderate cost to chip trees and use mulch on site (~$2,500 to $3,750 per acre). Alternatively burn tree material and spread ash for cost savings, if a burn permit is available.
2. Scattered Trees	 Optimal wind management; potential for more complex wind movement on site for microsites.	 Mimic natural wind breaks; create diverse microsites for native plant recruitment and litter; buffer climate within structure of branches.	 Moderate cost to cut and place about 40% of the trees in a staggered grid. The remaining trees can be chipped into mulch and spread or burned to ash and spread. Cost of ~$2,500 to $3,250.
3. Tree Fence	 Optimal wind management	 Create diverse microsites for native plant recruitment and litter; buffer climate within structure of branches.	 Moderate cost to cut and about 60% of cut trees in rows with regularly spaced wildlife movement openings. The remaining trees can be chipped into mulch and spread or burned to ash and spread. Cost of ~$2,500 to $3,250.
4. Temporary Sand Fence	 Optimal wind management	 Manage wind to create conditions for native seed and litter deposition but does not provide habitat structure like tree treatments.	 High cost to buy materials and install temporary sand fence (~8,000 to $11,000 per acre). If sand fences are used on a site with trees, then the cost of chipping or burning and spreading the chips/ash would be additional.


4 Retired Farmland Rehabilitation Fallowing Strategies

Recommended Fallowing Strategies

Can be used separately or in combination:

1. Mulch
2. Scattered Tree
3. Tree Fence
4. Temporary Sand Fence
5. Invasive Plant Management



Site Suitability Decision Tree

Optimizes Dust Control Effectiveness, Biological Benefits, and Regulatory Compliance on Fields or Parts of Fields

5 Farmland Fallowing Prioritization Model and Map

Farmland Fallowing Prioritization

Model Effort to Rehabilitate Ecosystem Values

The prioritization model and corresponding maps estimate the level of effort required to rehabilitate the ecosystem values of permanently fallowed farmland

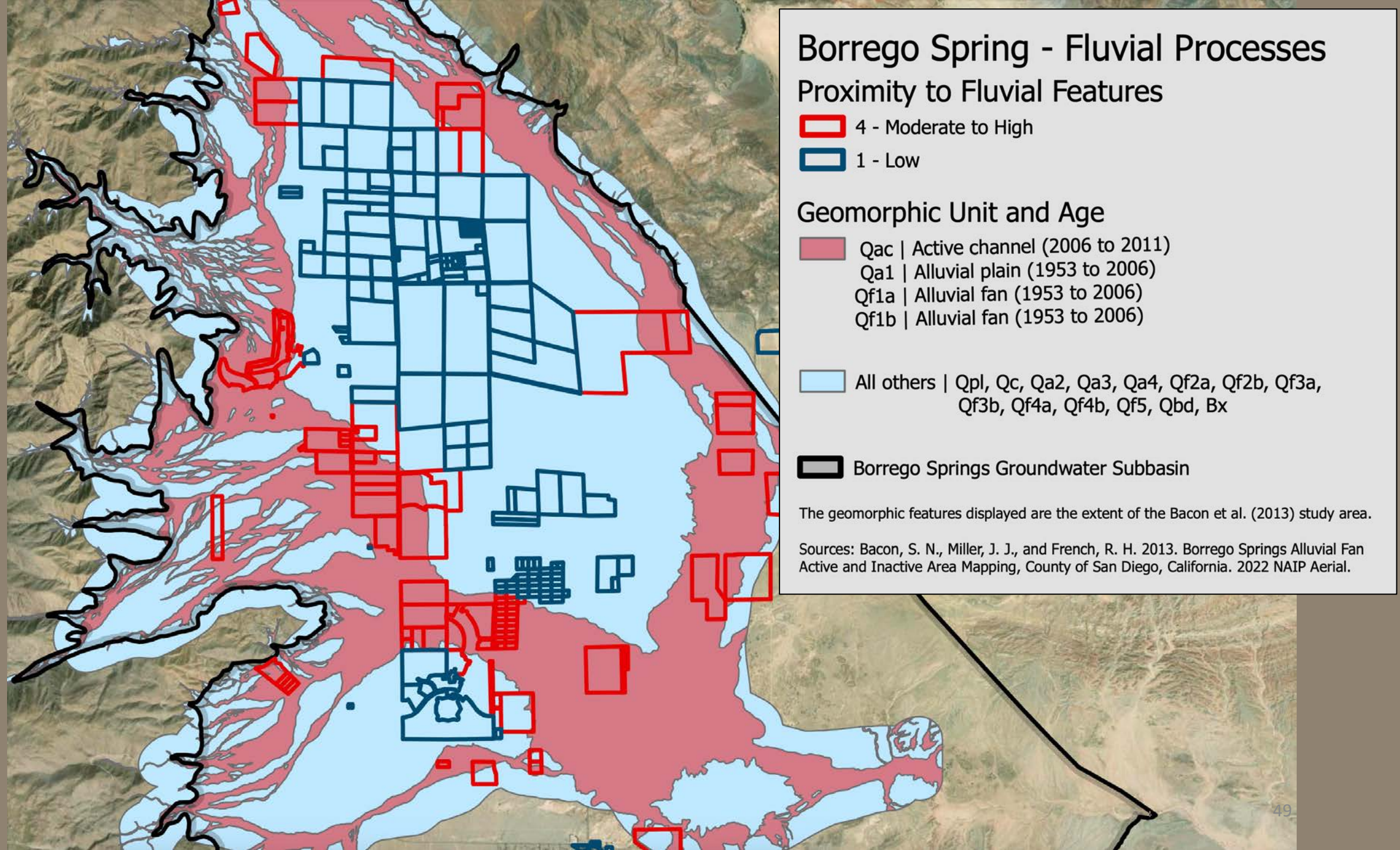
FIND LOW HANGING FRUIT

Environmental Factors Influencing Level of Intervention Required

1. Fluvial Processes
2. Aeolian Processes (Wind Breaks)
3. Soil Stability (Soil Erodibility)

Cultural Factor

1. Proximity to Conserved Land


Borrego Spring - Fluvial Processes
Proximity to Fluvial Features
4 - Moderate to High
1 - Low
Geomorphic Unit and Age
Qac | Active channel (2006 to 2011)
Qa1 | Alluvial plain (1953 to 2006)
Qf1a | Alluvial fan (1953 to 2006)
Qf1b | Alluvial fan (1953 to 2006)
All others | Qpl, Qc, Qa2, Qa3, Qa4, Qf2a, Qf2b, Qf3a, Qf3b, Qf4a, Qf4b, Qf5, Qbd, Bx
Borrego Springs Groundwater Subbasin
The geomorphic features displayed are the extent of the Bacon et al. (2013) study area.
Sources: Bacon, S. N., Miller, J. J., and French, R. H. 2013. Borrego Springs Alluvial Fan Active and Inactive Area Mapping, County of San Diego, California. 2022 NAIP Aerial.

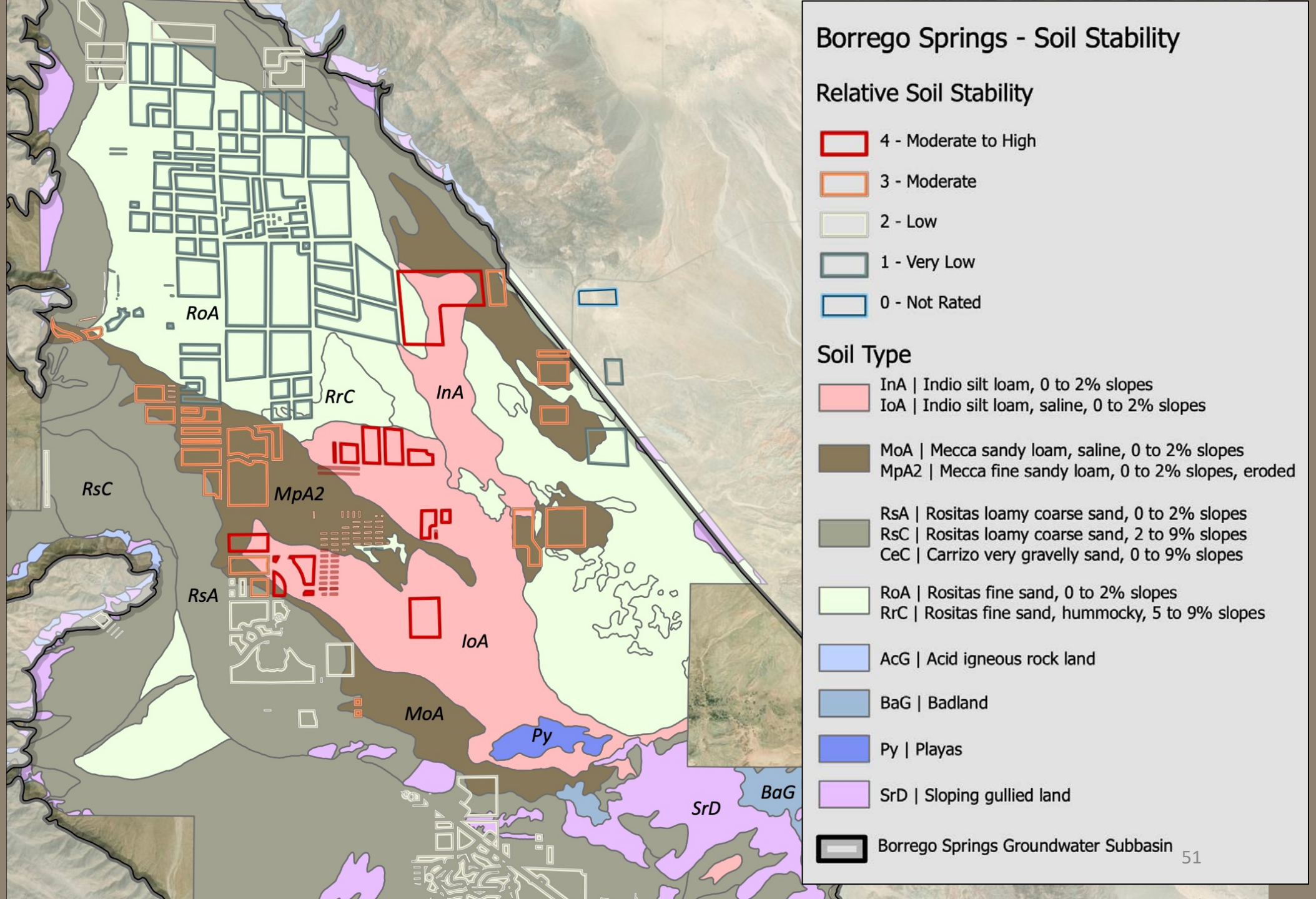
Farmland Fallowing Prioritization

Model Effort to Rehabilitate Ecosystem Values

Soil Stability

Soil Erodibility

Soil Type	Erodibility (tons/ac/yr)	Relative Soil Stability	Score
IoA, InA	56	Moderate to High	4
MpA2, MoA	86	Moderate	3
RsA, RsC, Cec	134	Low	2
RoA, RrC	250	Very Low	1


Borrego Springs - Soil Stability
Relative Soil Stability
4 - Moderate to High
3 - Moderate
2 - Low
1 - Very Low
0 - Not Rated
Soil Type
InA | Indio silt loam, 0 to 2% slopes
IoA | Indio silt loam, saline, 0 to 2% slopes
MoA | Mecca sandy loam, saline, 0 to 2% slopes
MpA2 | Mecca fine sandy loam, 0 to 2% slopes, eroded
RsA | Rositas loamy coarse sand, 0 to 2% slopes
RsC | Rositas loamy coarse sand, 2 to 9% slopes
CeC | Carrizo very gravelly sand, 0 to 9% slopes
RoA | Rositas fine sand, 0 to 2% slopes
RrC | Rositas fine sand, hummocky, 5 to 9% slopes
AcG | Acid igneous rock land
BaG | Badland
Py | Playas
SrD | Sloping gullied land
Borrego Springs Groundwater Subbasin
RoA
RrC
InA
RsC
MpA2
RsA
IoA
MoA
Py
BaG
SrD

Borrego Springs - Soil Stability

Relative Soil Stability

- 4 - Moderate to High
- 3 - Moderate
- 2 - Low
- 1 - Very Low
- 0 - Not Rated

Soil Type

- InA | Indio silt loam, 0 to 2% slopes
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- AcG | Acid igneous rock land
- BaG | Badland
- Py | Playas
- SrD | Sloping gullied land
- Borrego Springs Groundwater Subbasin

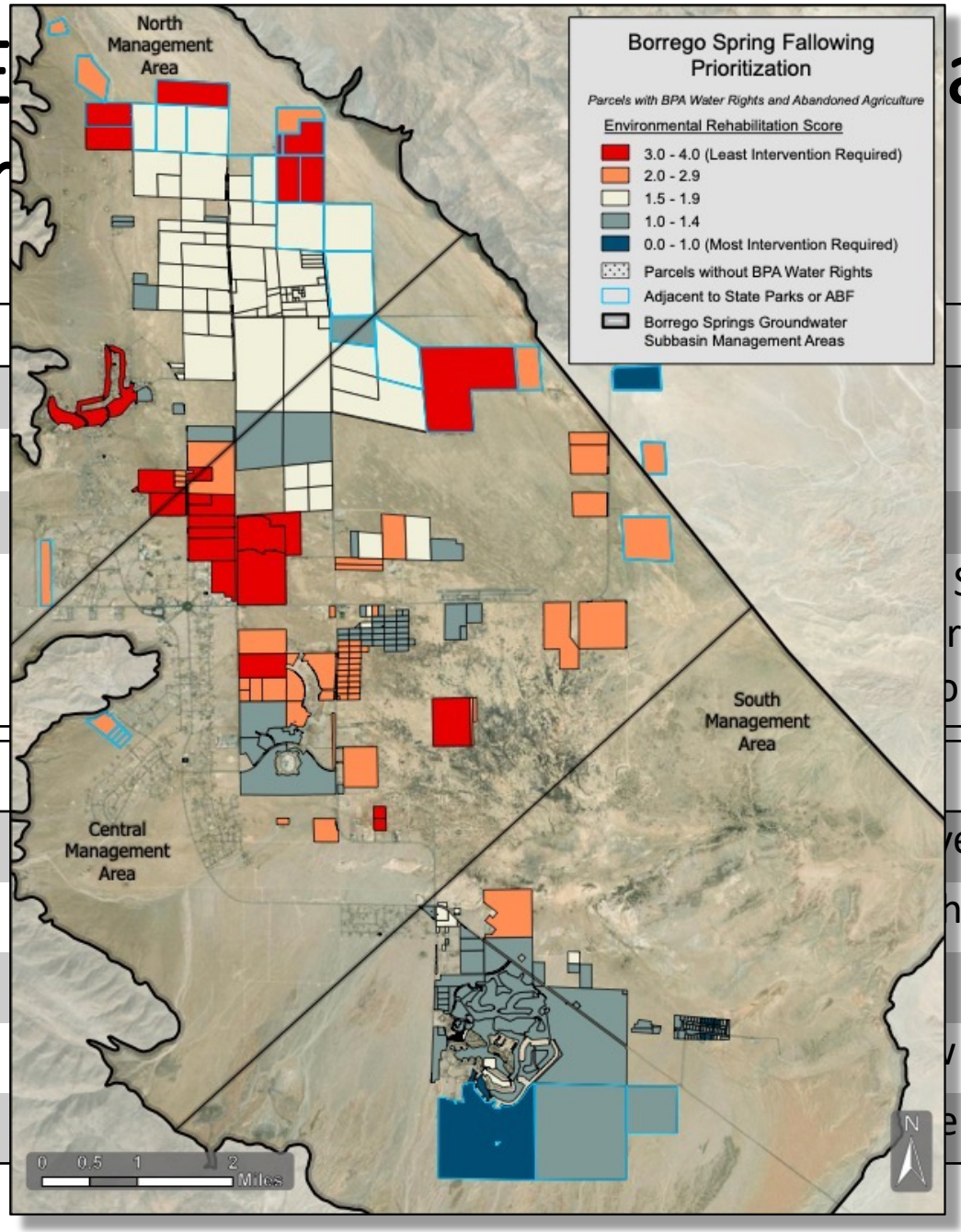
Cumulative Environmental Rehabilitation Score Level of Intervention Required

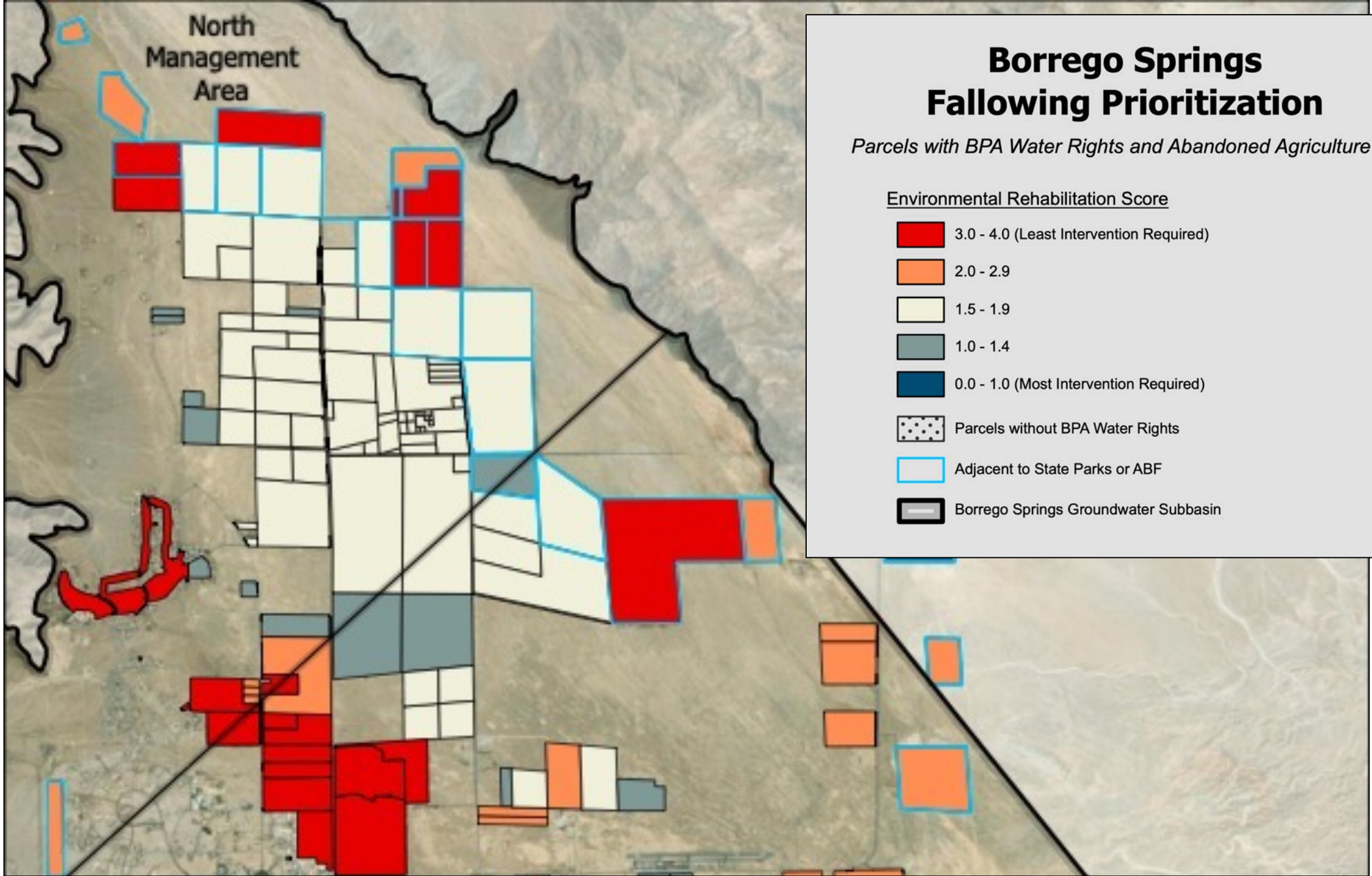
Criterion	Weight
Fluvial Processes	0.5
Wind Protection	0.3
Soil Erodibility	0.2
Total Environmental Score	Sum = (Fluvial Processes Score* 0.5) + (Wind Protection Score * 0.3) + (Soil Erodibility Score *.2)

Environmental Score Range	Priority Rank
3.0 – 4.0	High (Most suitable for passive approaches)
2.0 – 2.9	Moderately high
1.5 – 1.9	Moderate
1.0 – 1.4	Moderately low
0.0 – 0.9	Low (Most suitable for active approaches)

Cumulative E ation Score Level of Inter

Criterion	
Fluvial Processes	
Wind Protection	
Soil Erodibility	
Total Environmental Score	Score* 0.5) + re * 0.3) + ore *.2)
Environmental Score Range	
3.0 – 4.0	e approaches)
2.0 – 2.9	n
1.5 – 1.9	
1.0 – 1.4	
0.0 – 0.9	e approaches)





Borrego Springs Fallowing Prioritization

Parcels with BPA Water Rights and Abandoned Agriculture

Environmental Rehabilitation Score

- 3.0 - 4.0 (Least Intervention Required)
- 2.0 - 2.9
- 1.5 - 1.9
- 1.0 - 1.4
- 0.0 - 1.0 (Most Intervention Required)
- Parcels without BPA Water Rights
- Adjacent to State Parks or ABF
- Borrego Springs Groundwater Subbasin

6 Report Results to Watermaster's Environmental Working Group

EWG Projects

Biological Restoration of Fallowed Lands

- Biological Restoration of Fallowed Lands Workplan
- Task 1 Report: Literature Review
- Task 2: Existing Retired Farmland and Natural Habitat Field Study

EWG Meetings

- **January 23, 2025**: Agenda — Minutes — Presentation — Recording
- **November 20, 2024**: Agenda Package — Minutes — Presentation
- **July 16, 2024**: Agenda Package — Minutes — Presentation — Recording
- **September 26, 2023:** Agenda Package — Minutes — Presentation — Recording


Questions?

WEST YOST
Water. Engineered.

Borrego Springs Watermaster

Open House

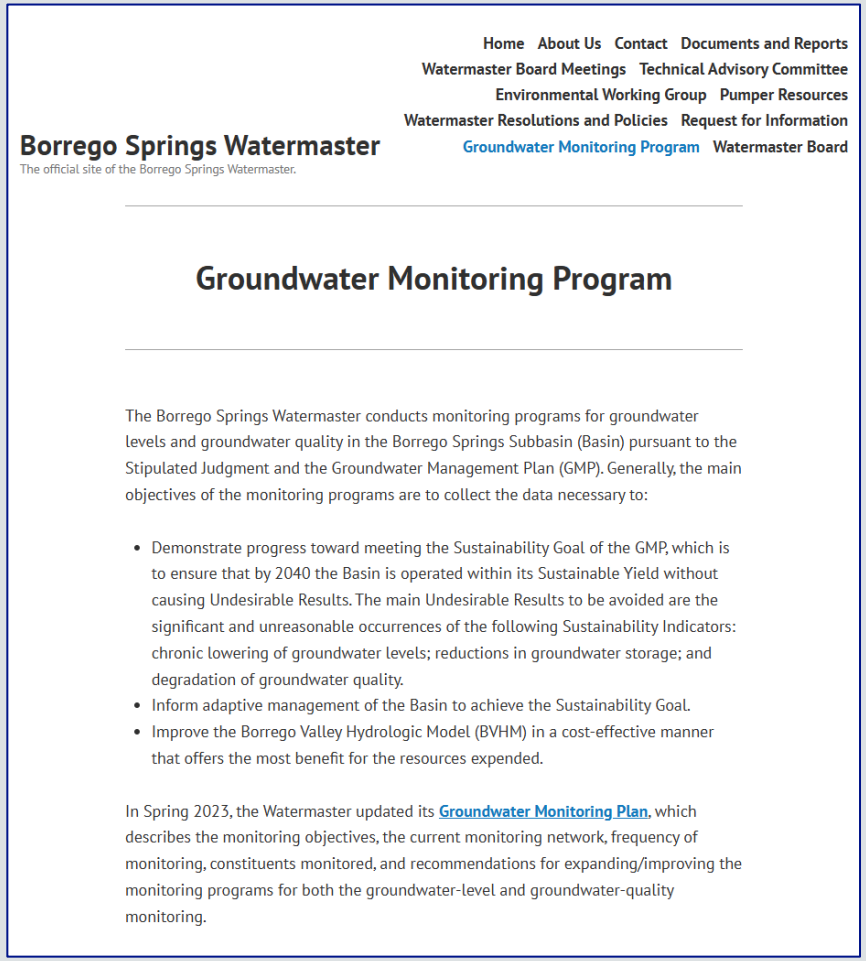
March 19, 2025

Today's Presentation:
Highlighting Successful Monitoring Outcomes from the DWR SGM Implementation Grant

1. Expansion of the Watermaster's Groundwater Monitoring Program
2. Addressing Abandoned Wells
3. Fall 2024 Groundwater Monitoring Results
4. Q&A

Monitoring Network Data Gaps and the Inactive/Abandoned Wells Conversion Program

- GWMP was published in April 2023
- Identified objectives of monitoring program:
  - Demonstrate progress towards meeting the Sustainability Goals for the Basin for groundwater levels, quality, and storage
  - Inform adaptive management
  - Improve the groundwater model (BVHM)
- Recommended areas for additional monitoring to ensure the goals of the monitoring program are met



Groundwater Monitoring Program – Borrego Springs Watermaster

Methods for Expanding Monitoring Program

1. **Use an existing well**
2. **Convert an abandoned well into a monitoring well**
3. Construct a new monitoring well

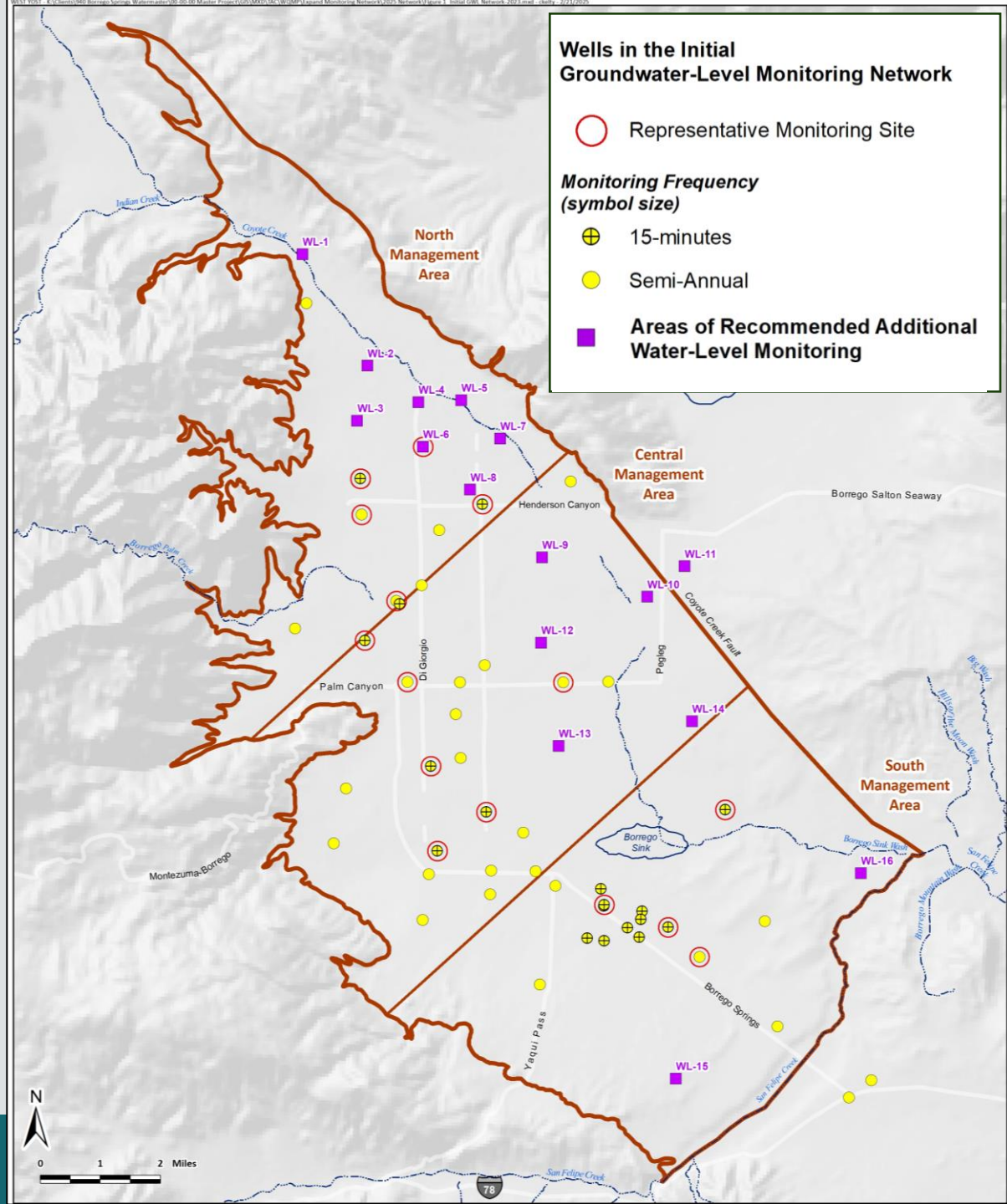
*current efforts focused on identifying existing wells in the Basin

Efforts to Expand Monitoring Program

- Performed desktop analysis to determine which wells to pursue
- Performed public outreach to identify owners willing to participate - **Based on Public Input at an Open House Event - Thank you!**
- Gathered well construction information
- Canvassed **34** wells to evaluate condition (4 site visits)
- Added Borrego Landfill wells to network (data available through GeoTracker)
- Converted **4** abandoned wells into new monitoring wells
- Rehabilitated **4** wells in existing monitoring program
- Secured **15** wells in monitoring program to make safer

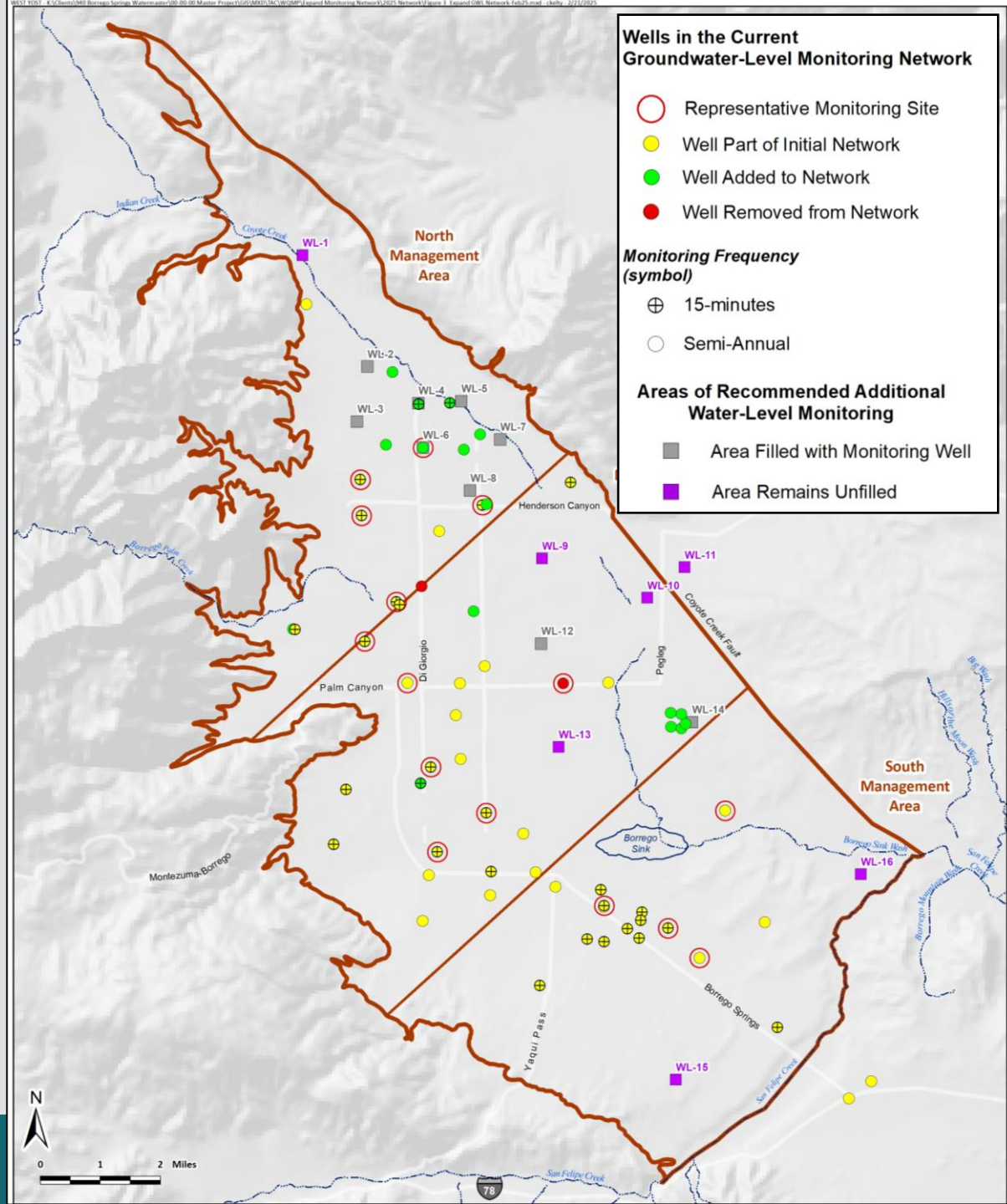
Initial Groundwater-Level Monitoring Network

- 48 wells monitored for groundwater-levels:
  - 29 wells – manual measurements
  - 19 wells – transducer measurements
- 16 locations where additional monitoring is recommended



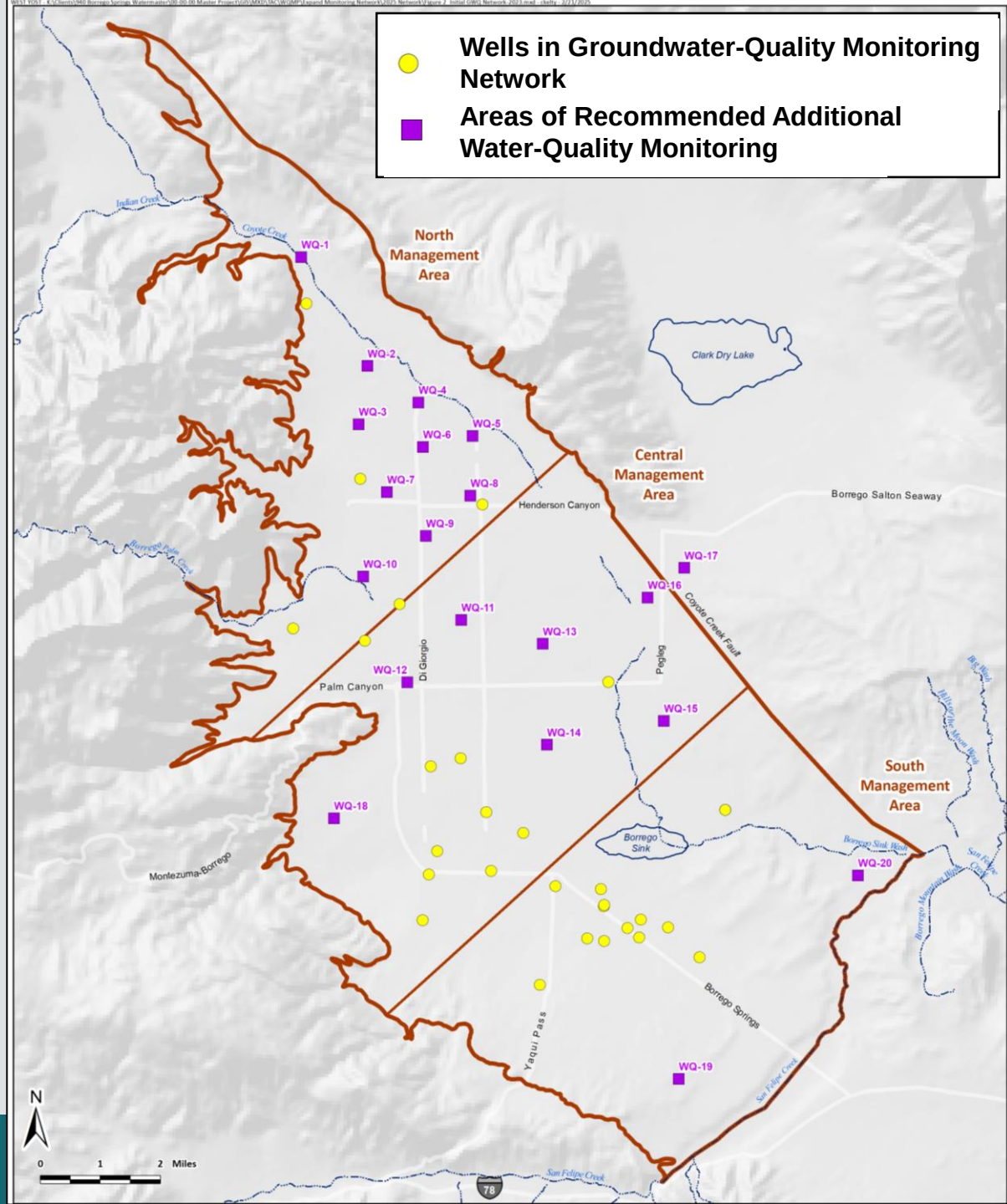
Expanded Groundwater-Level Monitoring Network

- 63 wells monitored for groundwater-levels:
  - 33 wells – manual measurements
  - 30 wells – transducer measurements
- 17 wells added to network
- 2 wells removed
- 9 areas filled; 7 areas remain where additional monitoring is recommended



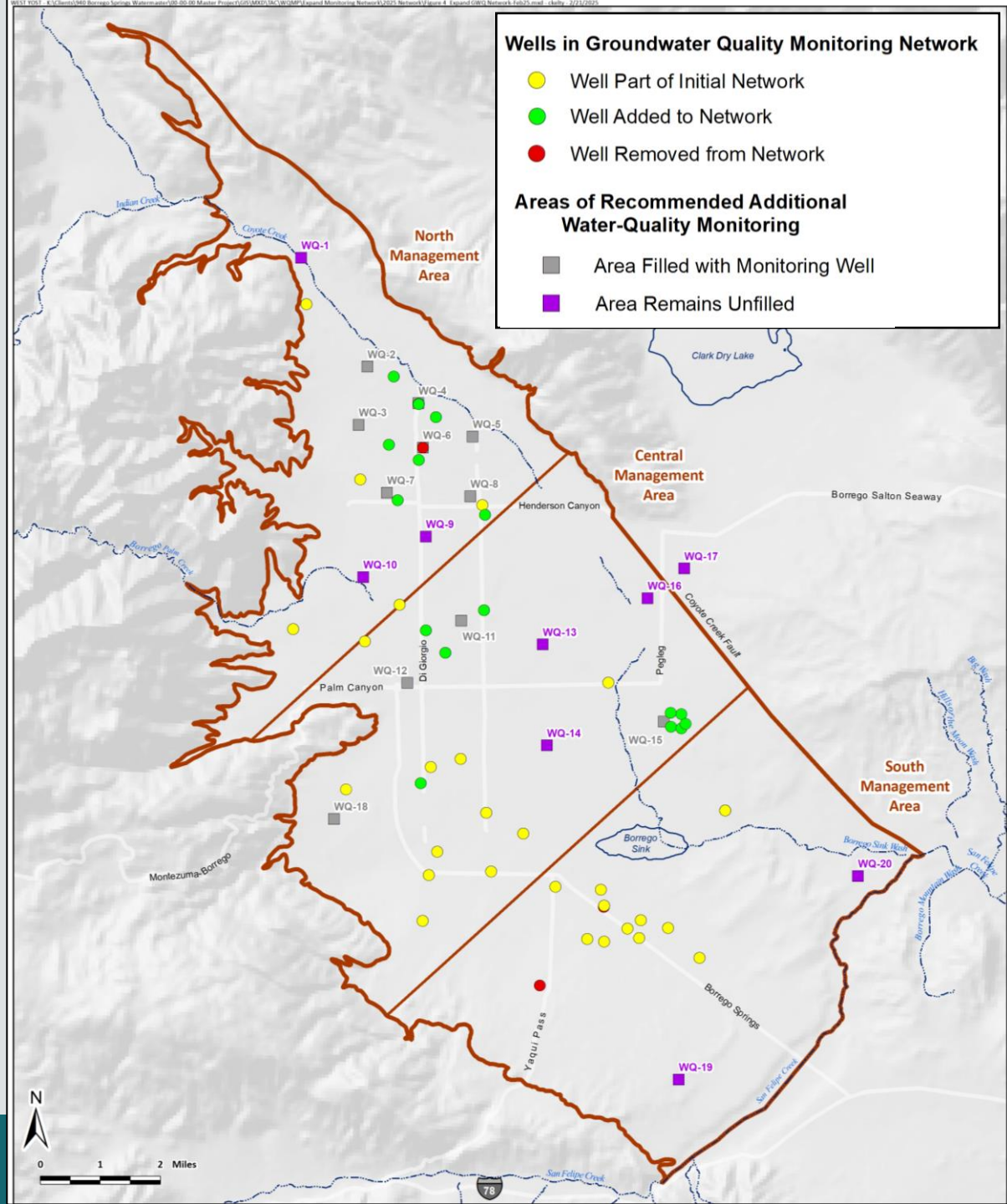
Initial Groundwater-Quality Monitoring Network

- 29 wells monitored for water-quality
- 20 locations where additional monitoring is recommended



Expanded Groundwater-Quality Monitoring Network

- 45 wells monitored for water-quality
- 18 wells added to network
- 3 wells removed
- 11 areas filled; 9 areas remain where additional monitoring is recommended



Addressing Abandoned Wells

- **Abandoned Well**: A well that not been pumped or used for at least one year, and the well owner has no plans to use it again
- Abandoned wells can lead to safety and environmental hazards:
  - Physical hazards to humans and wildlife at the well head
  - Pathways for groundwater contamination
- Pursuant to State/County regulations, abandoned wells must be properly destroyed or converted to monitoring wells
- The Watermaster and the County of San Diego Department of Environmental Health & Quality collaborate on addressing abandoned wells
- The Watermaster used SGM grant funding to identify and convert/secure abandoned wells to improve its long-term groundwater monitoring network

Abandoned Well (converted)

Before

After

Abandoned Well (converted)

Before

After

Abandoned Well (secured)

Before

After

Abandoned Well (secured)

Before

After

Abandoned Wells

- What happens if we were not able to convert an abandoned well?

What is an Abandoned Well?

A well is considered abandoned when it has not been pumped or used for supplying water for at least one year, and the well owner has no plans to use it again. Oftentimes, abandoned wells are left unsecured and open at the wellhead.

Example of an uncovered Abandoned well

Example of an Abandoned well with pump still intact

Dangers of Abandoned Wells

Abandoned wells can lead to many safety and environmental hazards such as:

- Physical hazards to humans and wildlife at the well head
- Well collapse and sink hole risks
- Debris and contaminants can enter the well at the ground surface and potentially pollute the underlying groundwater basin
- If toxic chemicals reside in abandoned well, such as oils, such toxic chemicals can also contaminate the groundwater basin
- If the well penetrates multiple aquifers, then the well can provide a pathway for cross-contamination between aquifers

Regulations for Abandoned Wells

Abandoned wells in Borrego Springs are regulated by the state of California and San Diego County.

State Regulations:
More Information on State of California regulations on wells can be found here: California Health & Safety Code

County Regulations:
More Information on County of San Diego regulations on wells can be found here: Chapter_4_Well_Ordinance.pdf

Options for Addressing Abandoned Wells

There are two potential options to address abandoned wells: (1) properly destroy the abandoned well or (2) convert the abandoned well into a monitoring well.

Process to Properly Destroy a Well

- Obtain a Permit: Obtain a written permit from the San Diego County Department of Environmental Health and Quality (DEHQ). The necessary forms and applications are here.
- Inspection: After applying for the permit, an inspection by a licensed contractor will be conducted to assess the well's location, condition, construction, and any potential obstructions.
- Licensed Contractor: Once a thorough inspection is conducted, the well destruction must be performed by a licensed contractor.
- Filling and Sealing: Proper well destruction typically involves filling and sealing of the well casing. These requirements may vary based on the well location and condition.

Process for Converting to Monitoring Well

The Borrego Springs Watermaster conducts groundwater monitoring of the Borrego Springs Groundwater Subbasin and is actively looking to expand the monitoring network of wells. If an owner of an abandoned well is interested in volunteering the well for Watermaster monitoring (and thereby avoiding the cost to properly destroy the abandoned well), the following is required:

Review Watermaster Information. The Borrego Springs Watermaster maintains a webpage here that describes its Groundwater Monitoring Program and opportunities for private well owners to participate.

Notify Borrego Springs Watermaster. Inform the Borrego Springs Watermaster of your interest to participate in the monitoring program by completing and returning a Potential Participant Form.

Provide Well Information. The following information must be submitted to the Watermaster:

- Well completion report and/or a Well Driller's Log
- Borehole logs
- Well construction information (e.g., depth of well screens)
- Historical water-level and/or water-quality data
- Site Visit: The Watermaster will then conduct a site visit to inspect, assess, and document information such as site access, wellhead conditions, and current well use.
- Entry Permit: If the well is deemed suitable for Watermaster's monitoring program after inspection, an Entry Permit must be executed between the Watermaster and the well owner.
- Data Confidentiality agreement: If requested by the well owner, a Data Confidentiality Agreement will be developed between the well owner and the Watermaster.

Resources to Learn More about Abandoned Wells

- Further details on San Diego County's Requirements for Wells can be found here: https://www.sandiegocounty.gov/content/dam/sdc/deh/lwqd/Chapter_4_Well_Ordinance.pdf
- Information on the San Diego County's DEHQ Monitoring Well Program Permits: https://www.sandiegocounty.gov/content/sdc/deh/lwqd/sam_monitoring_well_page.html#ProgramInformation
- Further details on the destruction of water wells can be found in the California State Department of Water Resources Bulletin No. 74-90:
  - https://water.ca.gov/Programs/Groundwater-Management/Wells/Well-Standards/Combined-Well-Standards/Bulletin-74-90-Intro
  - https://water.ca.gov/Programs/Groundwater-Management/Wells/Well-Standards/Combined-Well-Standards/Water-Destruction
  - https://water.ca.gov/Programs/Groundwater-Management/Wells/Well-Standards/Combined-Well-Standards/Monitoring-Destruction

Interested in learning more?
Scan me to visit the Borrego Springs Watermaster Website

Scan to view the Particpant form

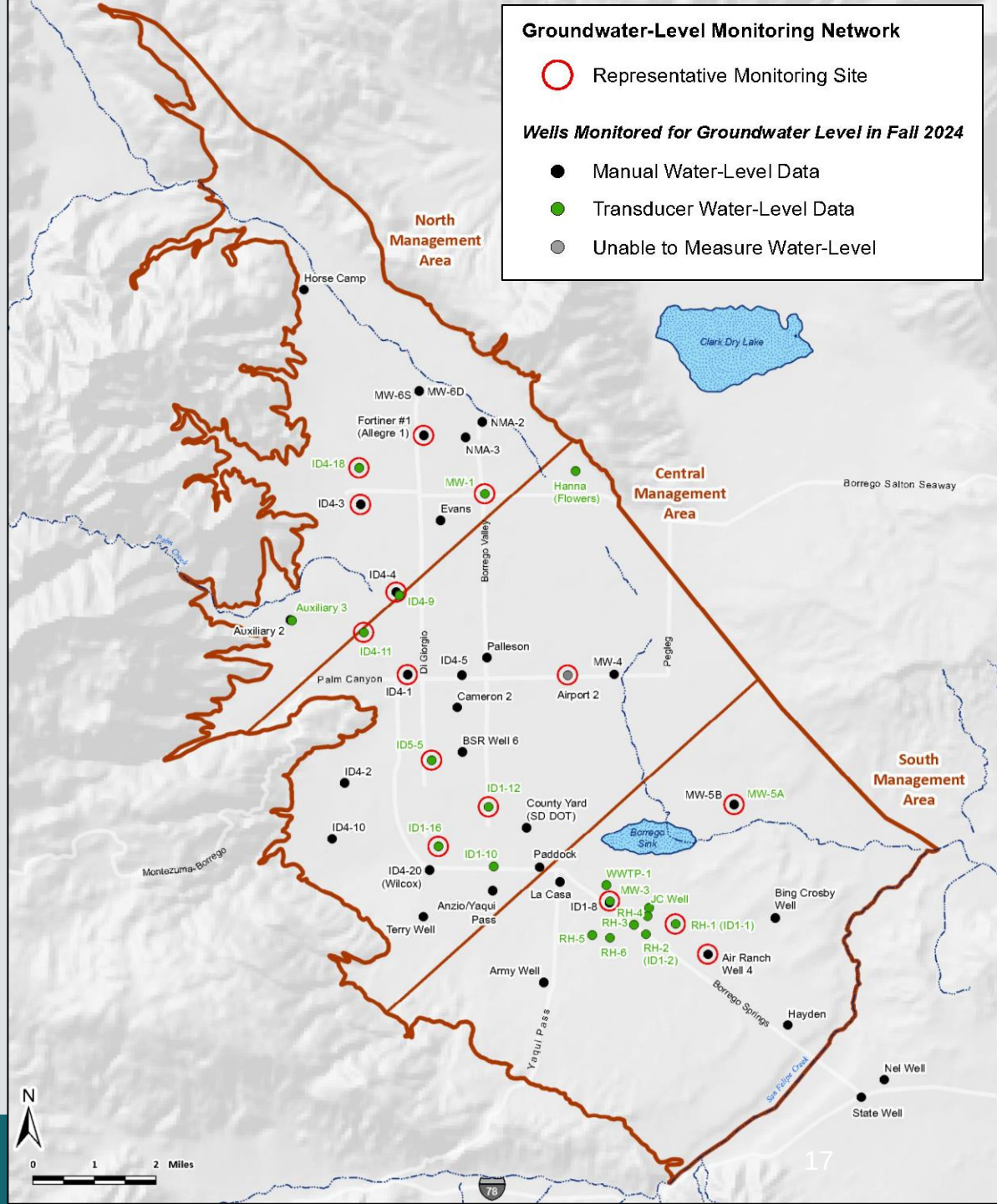
Scan to view water.ca.gov

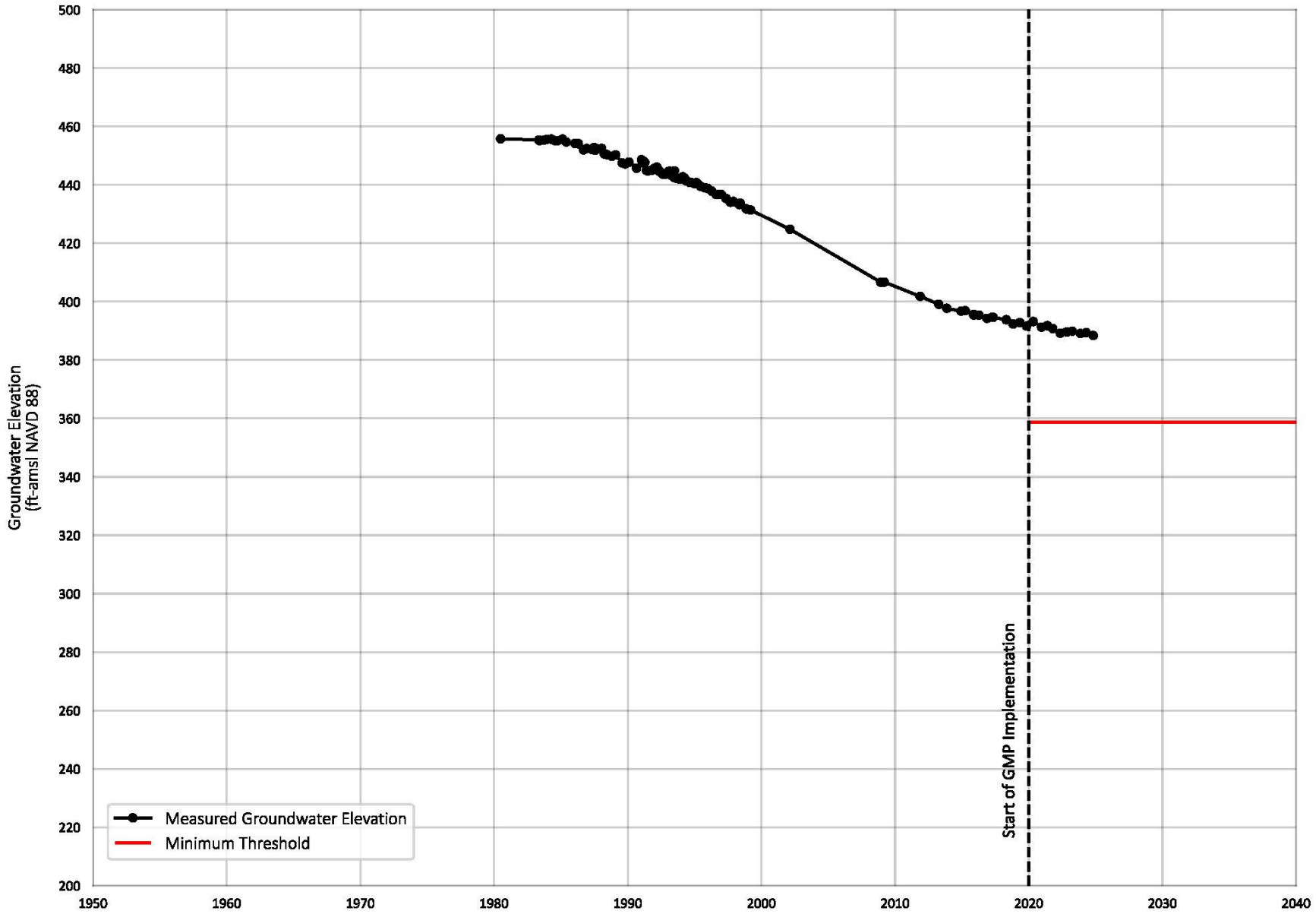
DRAFT

Semi-Annual Monitoring

Borrego Springs Watermaster

- Watermaster conducts semi-annual monitoring of groundwater conditions in Spring and Fall:
  - **Groundwater Levels**
  - Groundwater Quality
- Groundwater pumping at wells is monitoring more frequently
- Fall 2024 Monitoring Event
  - **Groundwater levels** were measured at **52 wells**





Prepared by:

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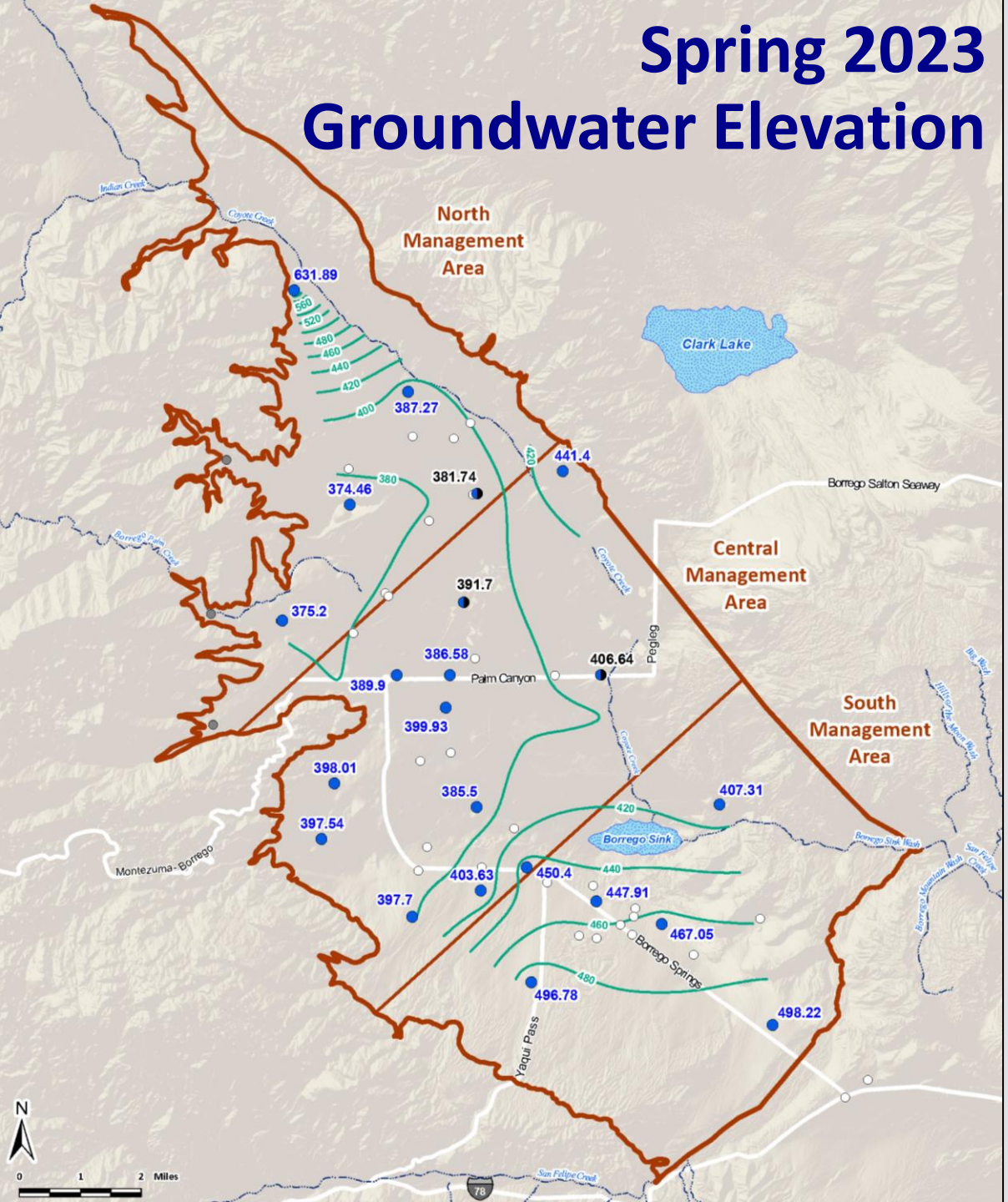
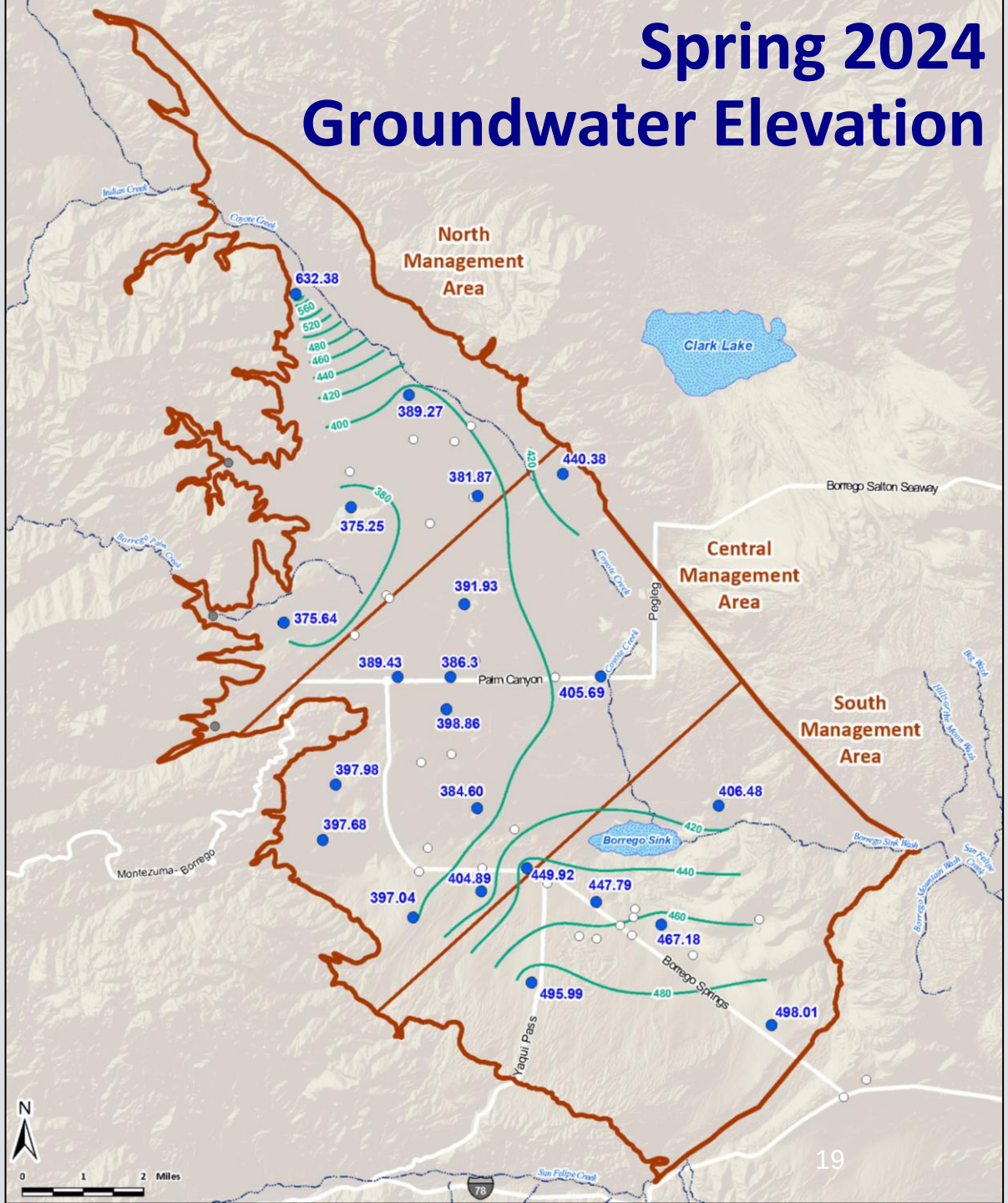
Figure 13-g

Groundwater Level and Sustainable Management Criteria
at Representative Monitoring Well ID4-1

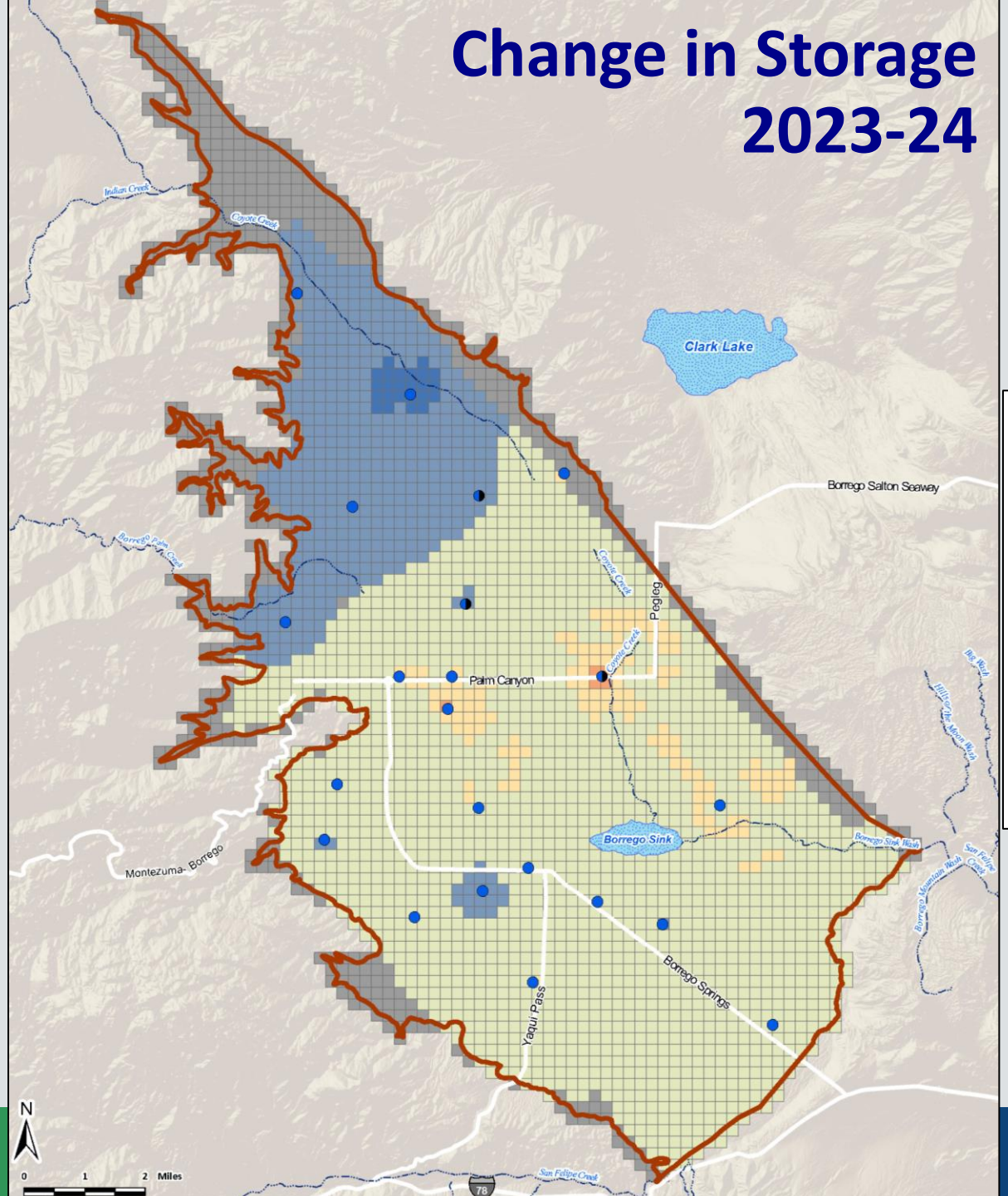
Spring 2023 Groundwater Elevation



Spring 2024 Groundwater Elevation



Change in Storage 2023-24



Groundwater Monitoring Wells with Measured Groundwater Elevation in Spring 2023 and Spring 2024

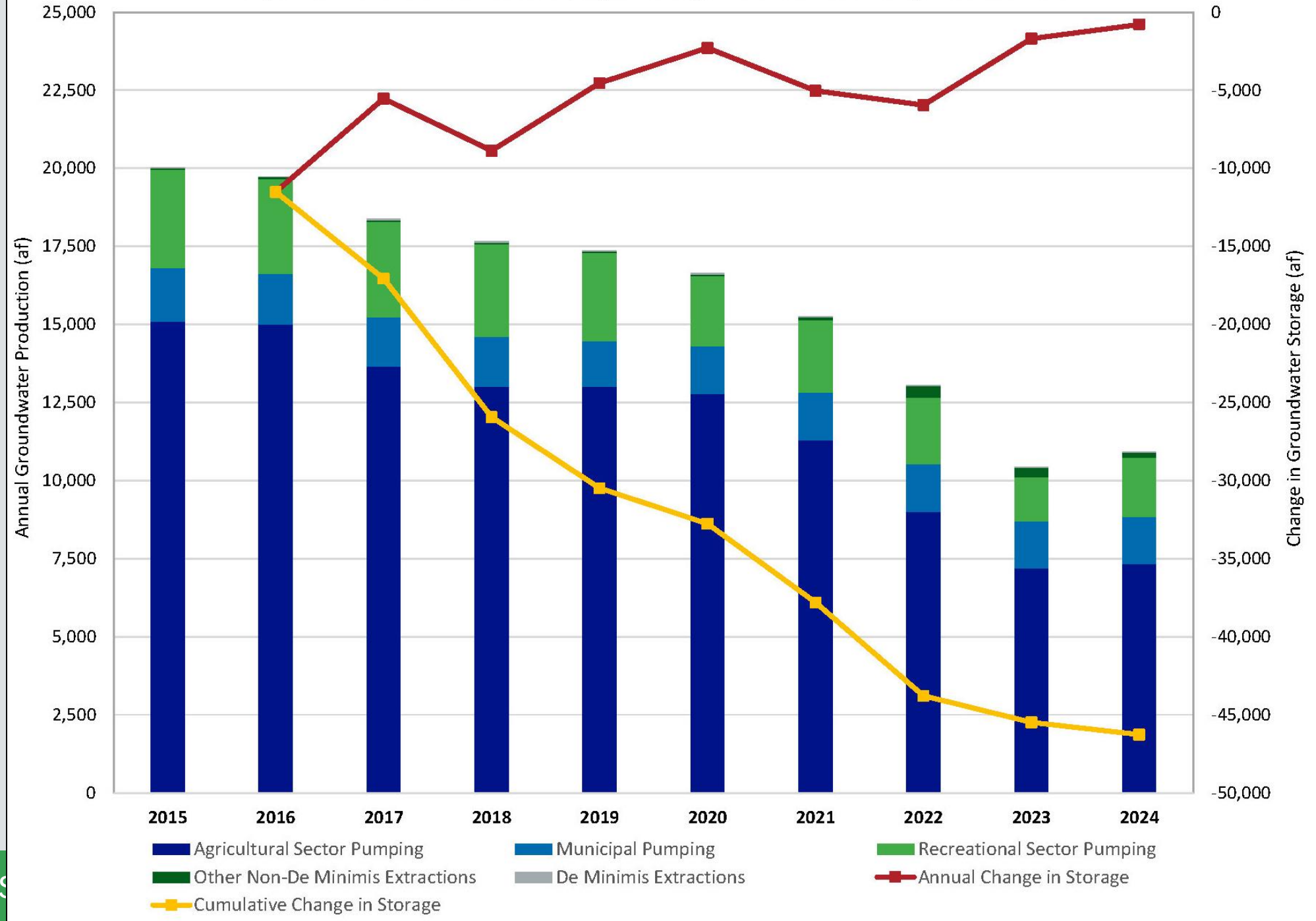
- True static groundwater elevation (ft-amsl)
- Estimated static groundwater elevation (ft-amsl)

Groundwater Storage Change

Spring 2023 to Spring 2024 (af)

> - 4	-1 to 0
-4 to -3	0
-3 to -2	0 to 1
-2 to -1	1 to 2

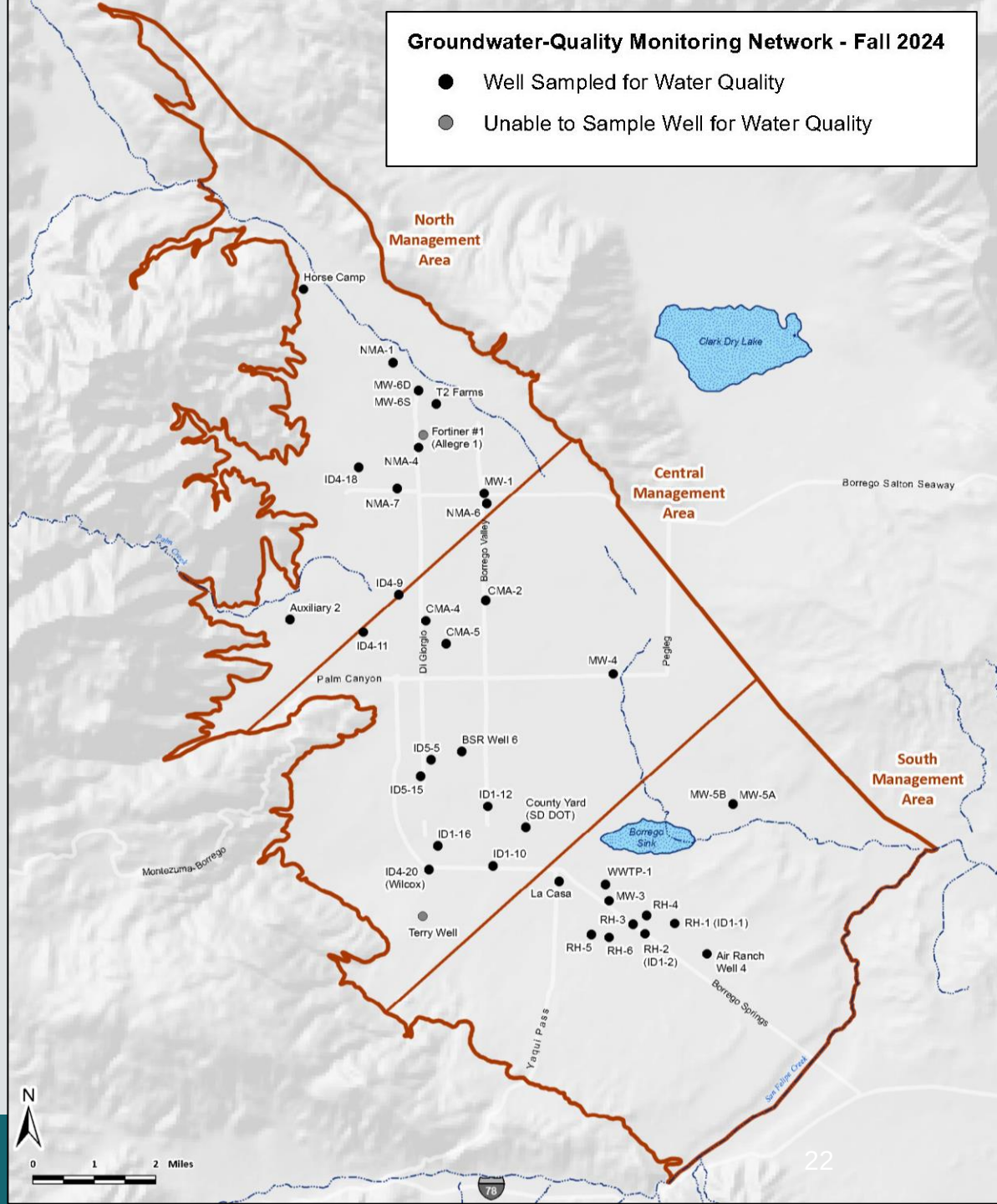
Figure 18. Annual Groundwater Pumping and Change in Groundwater Storage – 2015 to 2024



Semi-Annual Monitoring

Borrego Springs Watermaster

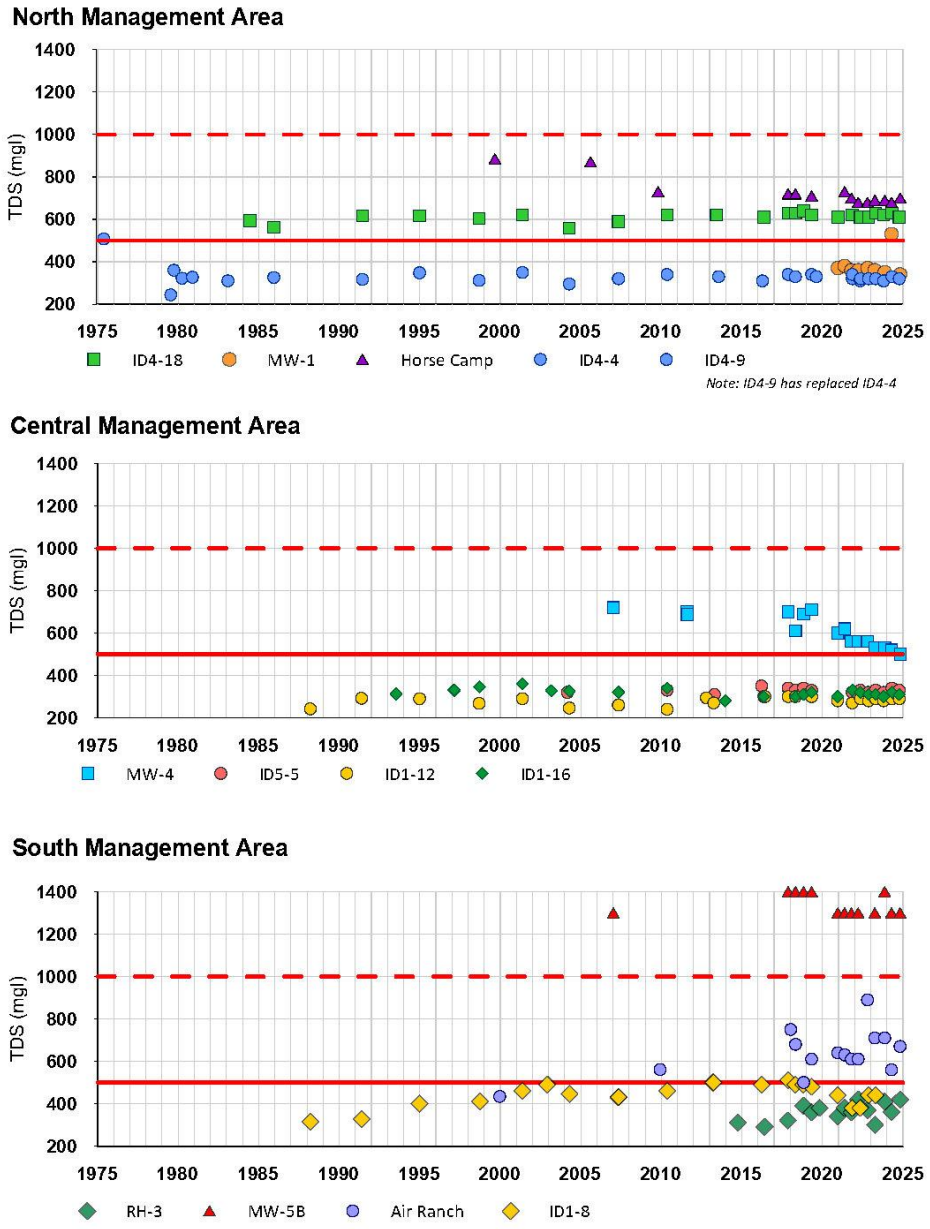
- Watermaster conducts semi-annual monitoring of groundwater conditions in Spring and Fall:
  - Groundwater Levels
  - **Groundwater Quality**
- Groundwater pumping at wells is monitoring more frequently
- Fall 2024 Monitoring Event
  - **Groundwater quality** sampled/analyzed at **37 wells**

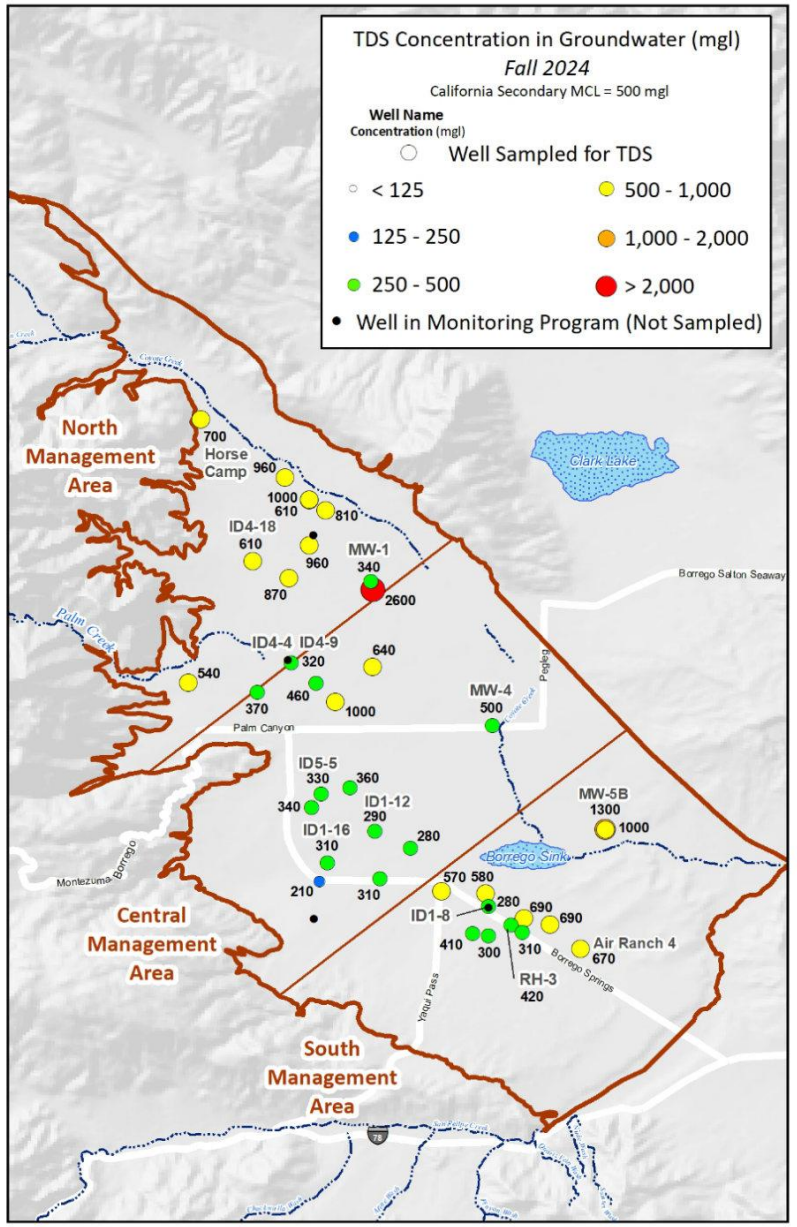


TDS

Total Dissolved Solids

- TDS is a measure of the total dissolved salt content of water
  - Naturally occurring
  - Can be introduced by overlying land uses and water uses
- California secondary drinking-water MCLs are established for TDS based on "consumer acceptance levels"
  - 500 mg/L "recommended"
  - 1,000 mg/L "upper limit"
  - 1,500 mg/L "short term"
- TDS concentrations:
  - Generally lower than the upper MCL
  - Higher in the NMA and near the Borrego Sink
  - Generally higher in the shallow aquifer; lower in the deep aquifer





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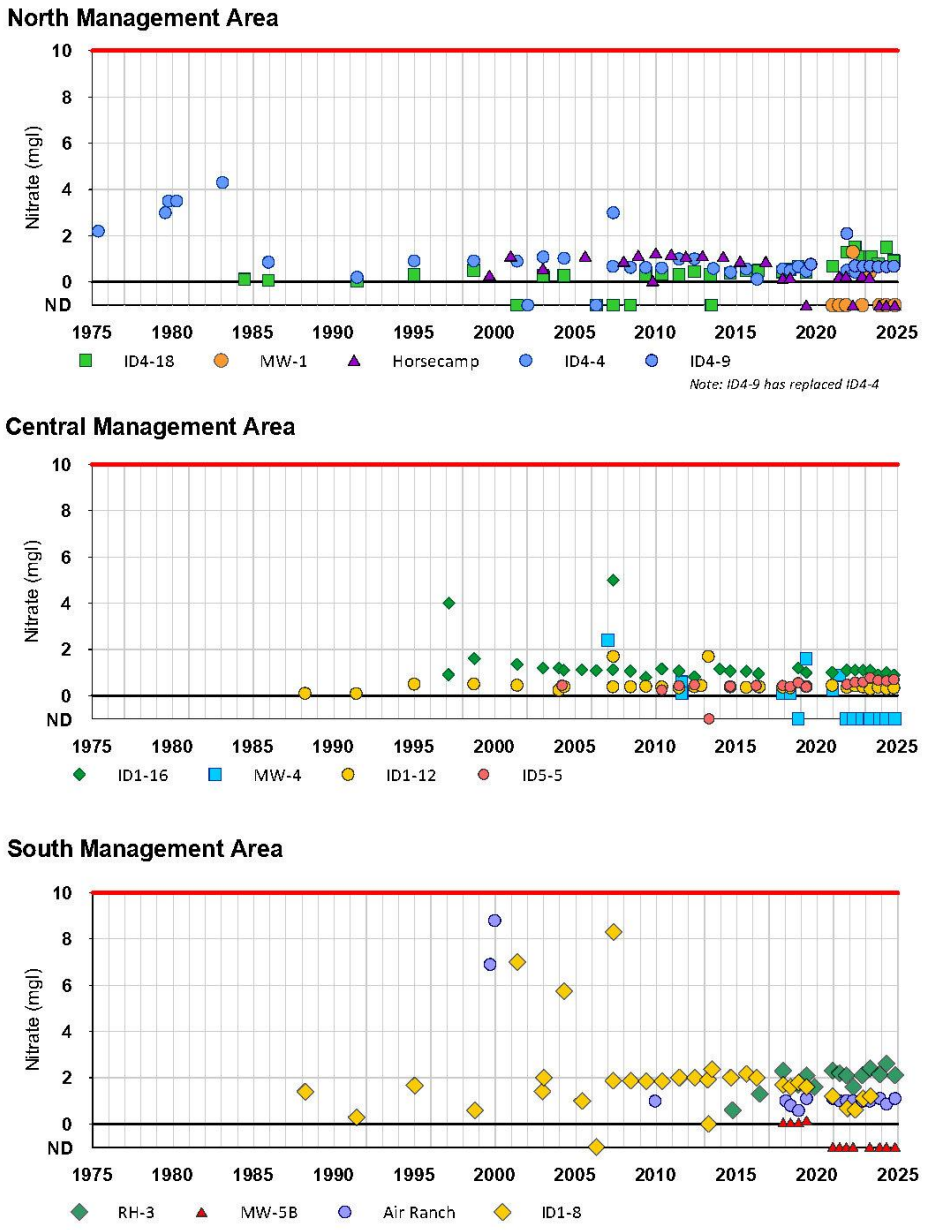
Author: CK
Date: 20250121
File: TDS

Figure 5

Total Dissolved Solids (TDS) in Groundwater

Nitrate
(as Nitrogen)

- The most common form of nitrogen in oxygenated surface water and groundwater
  - Naturally occurring
  - Can be introduced by overlying land uses, outdoor water uses, wastewater disposal, septic tanks, and others
- US EPA primary drinking-water MCL is 10 mg/L
- Nitrate-N concentrations:
  - Generally lower than the MCL
  - Higher in the NMA
  - Generally higher in the shallow aquifer; lower in the deep aquifer



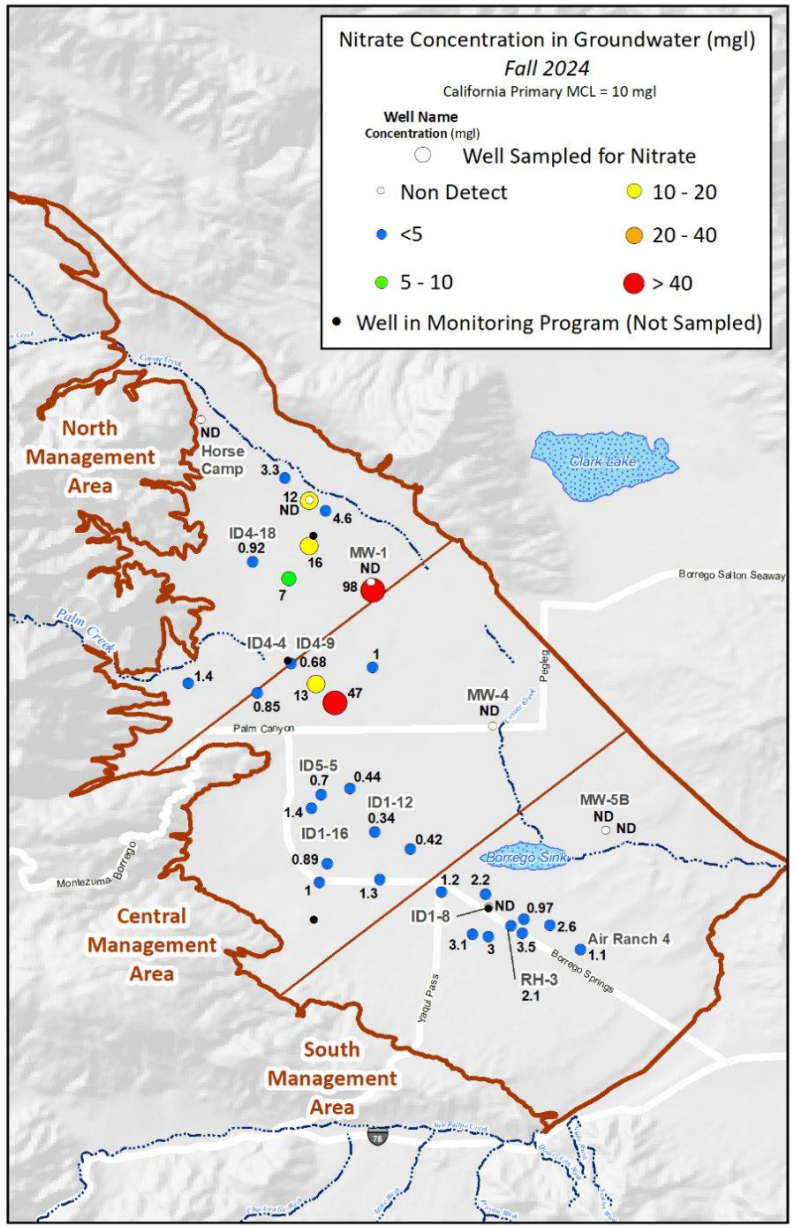
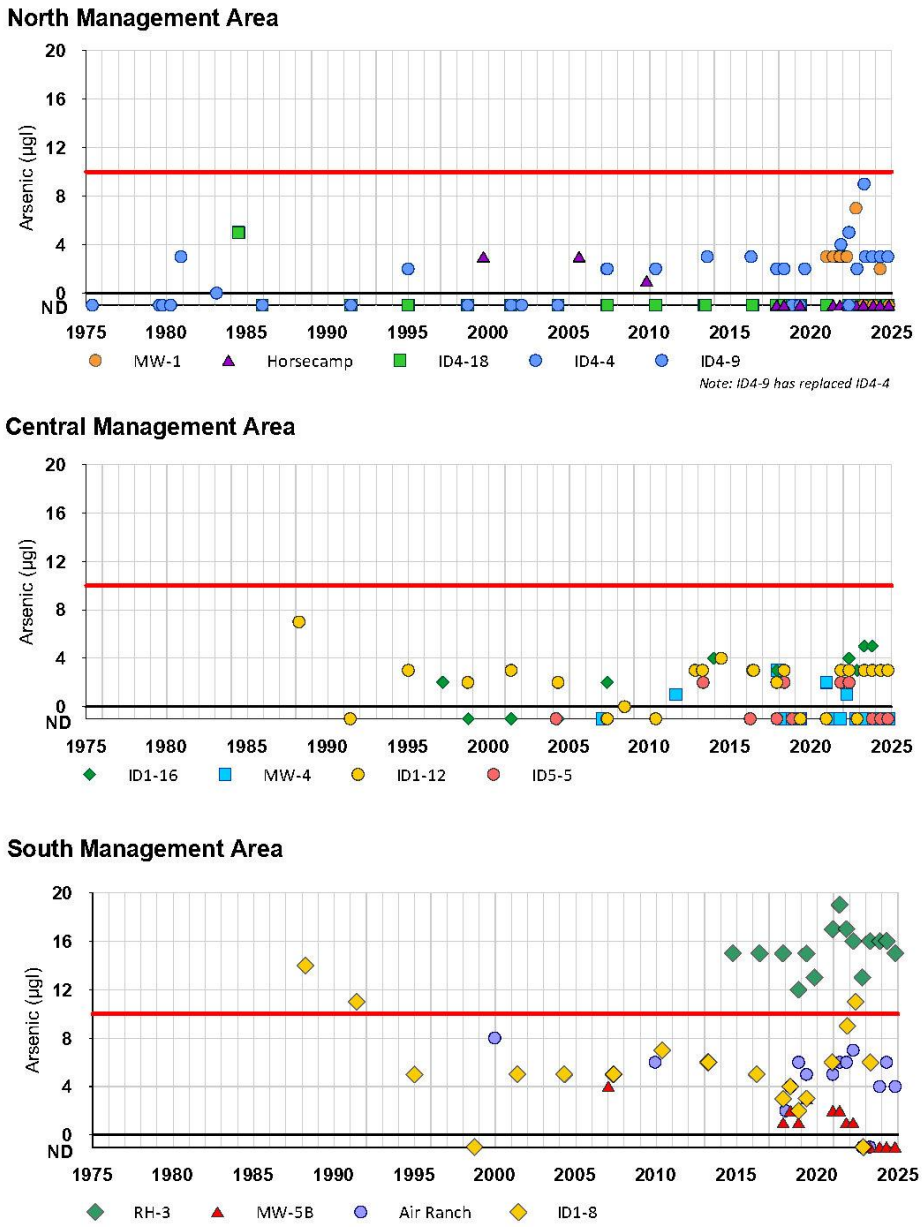


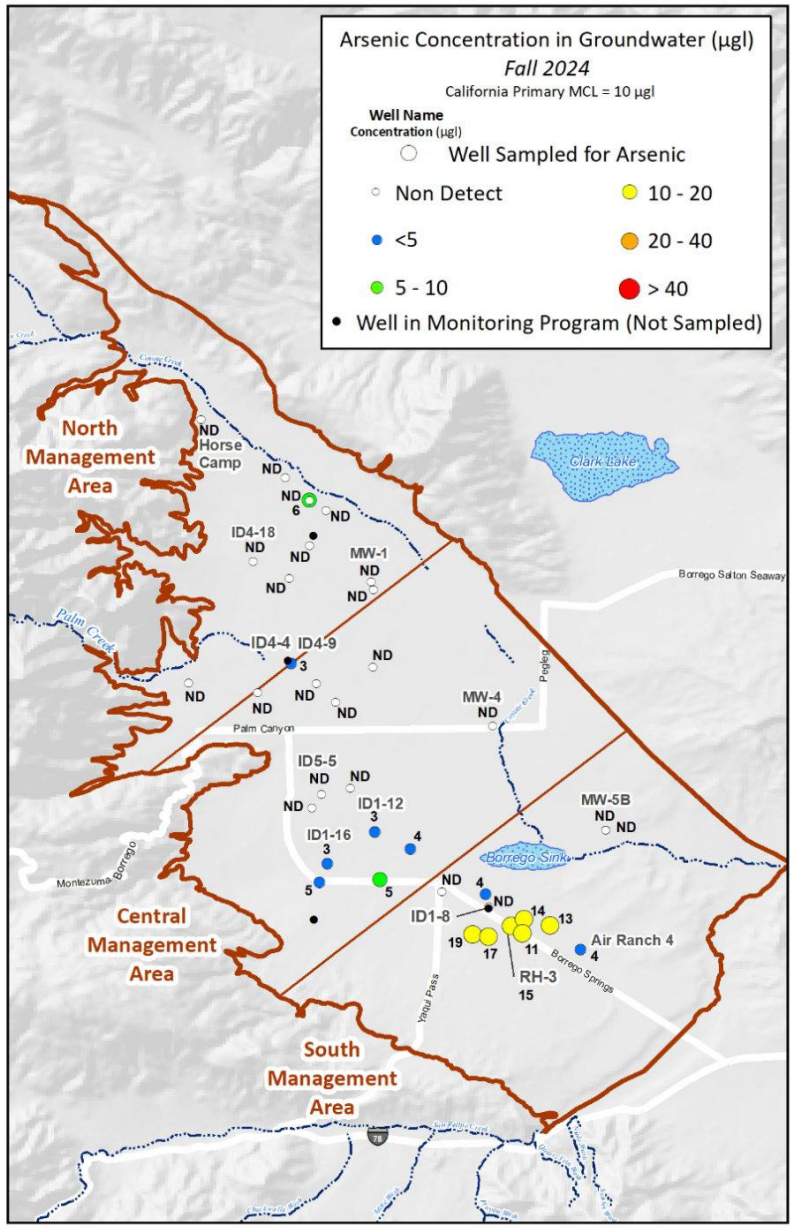
Figure 6

Nitrate (as Nitrogen) in Groundwater

Arsenic

- A naturally occurring, toxic metal that can be found in the air, surface water, soil, and groundwater
- US EPA primary drinking-water MCL is 0.010 mg/L
- Arsenic concentrations:
  - Generally lower than the MCL or not detected in drinking water wells
  - Higher in the SMA in non-potable wells
  - Generally higher in the deep aquifer; lower in the shallow aquifer





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Date: 20250121
File: Arsenic

Figure 7

Arsenic in Groundwater

Questions & Answers