FEBRUARY ADVISORY COMMITTEE MEETINGS

Shasta Valley Groundwater Advisory Committee Meeting

LARRY WALKER ASSOCIATES
science | policy | solutions

Stantec

Topics

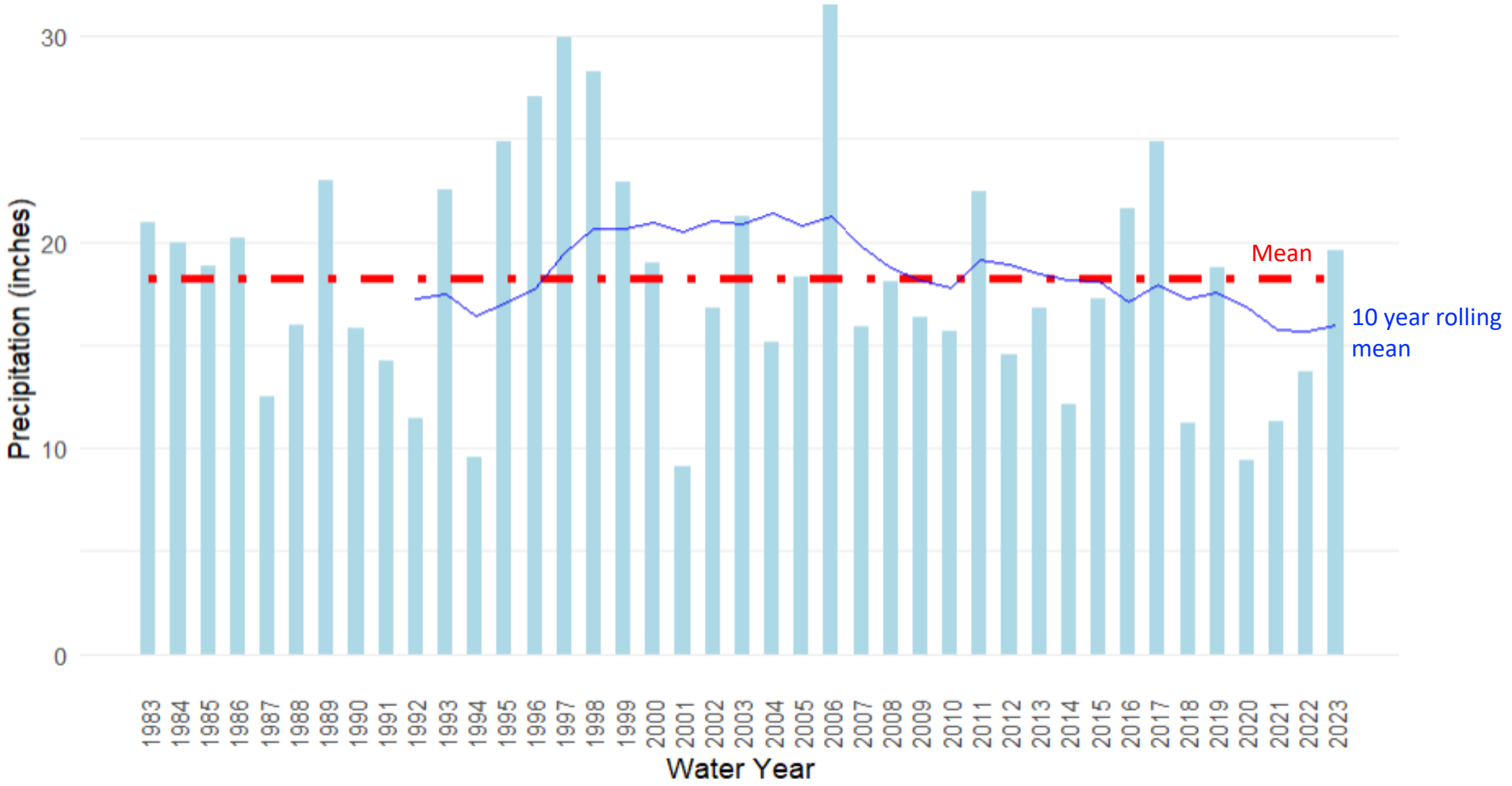
- Annual Report Updates (Water Year 2023)
- Monitoring data review, network expansion, and data gaps
- Model Updates
- Implementation Projects
- DMS Introduction and Summary
- Implementation Project Schedule Updates

Annual Report

Water Year 2023

Annual Report, Water Year 2023

- Annual reports are to be submitted each year on April 1st
- This report covers October 2022 to September 2023
- Annual Reports include:
  - GSA's progress in GSP implementation
  - Data collected from monitoring network (water level and water quality)
  - Groundwater extractions, surface water supply, total water use and changes in groundwater storage


Precipitation (inches)
30
20
10
0
Mean
10 year rolling mean
1983
1984
1985
1986
1987
1988
1989
1990
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1993
1994
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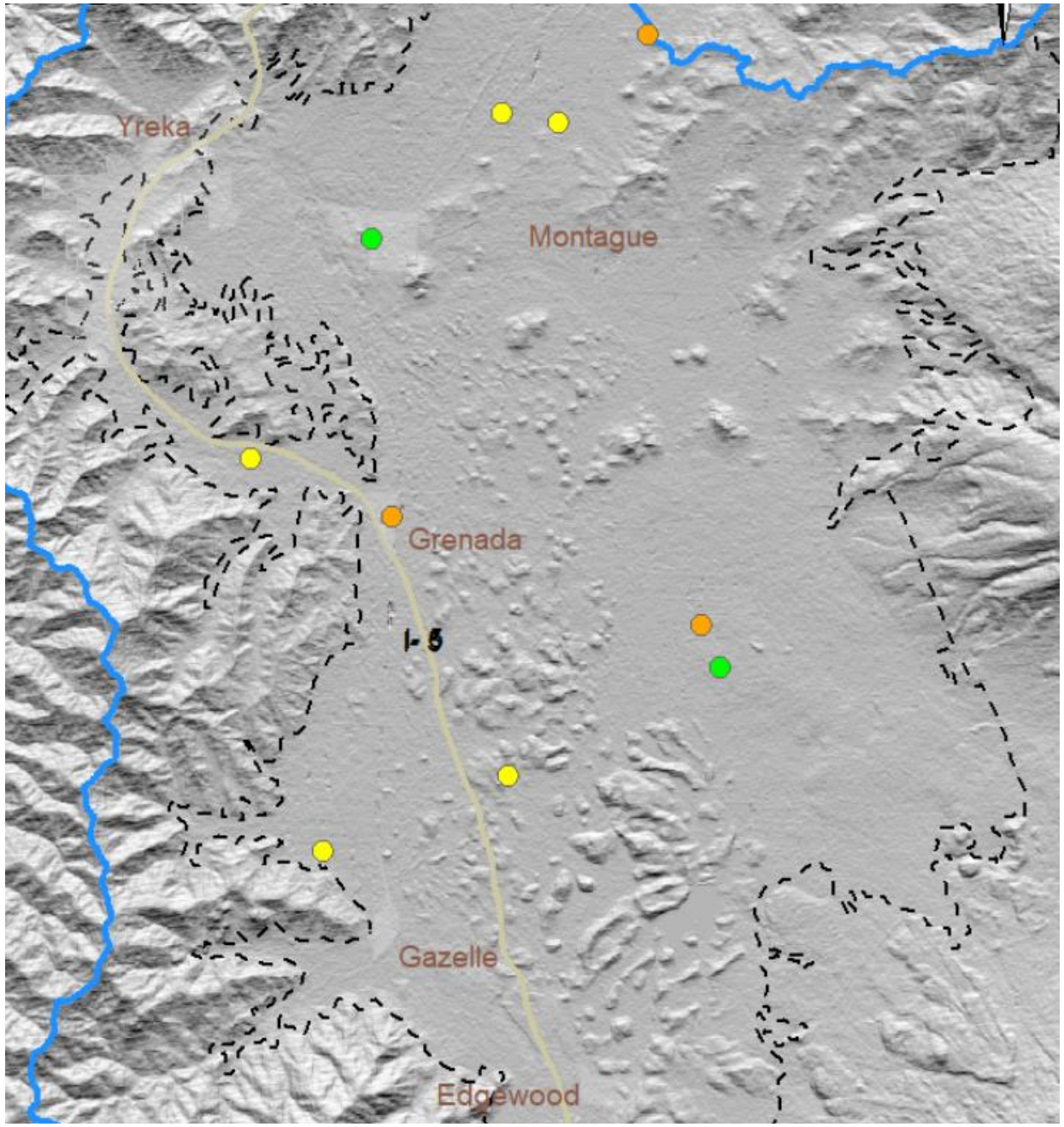
2021
2022
2023
Water Year



Fall 2023 RMP Status

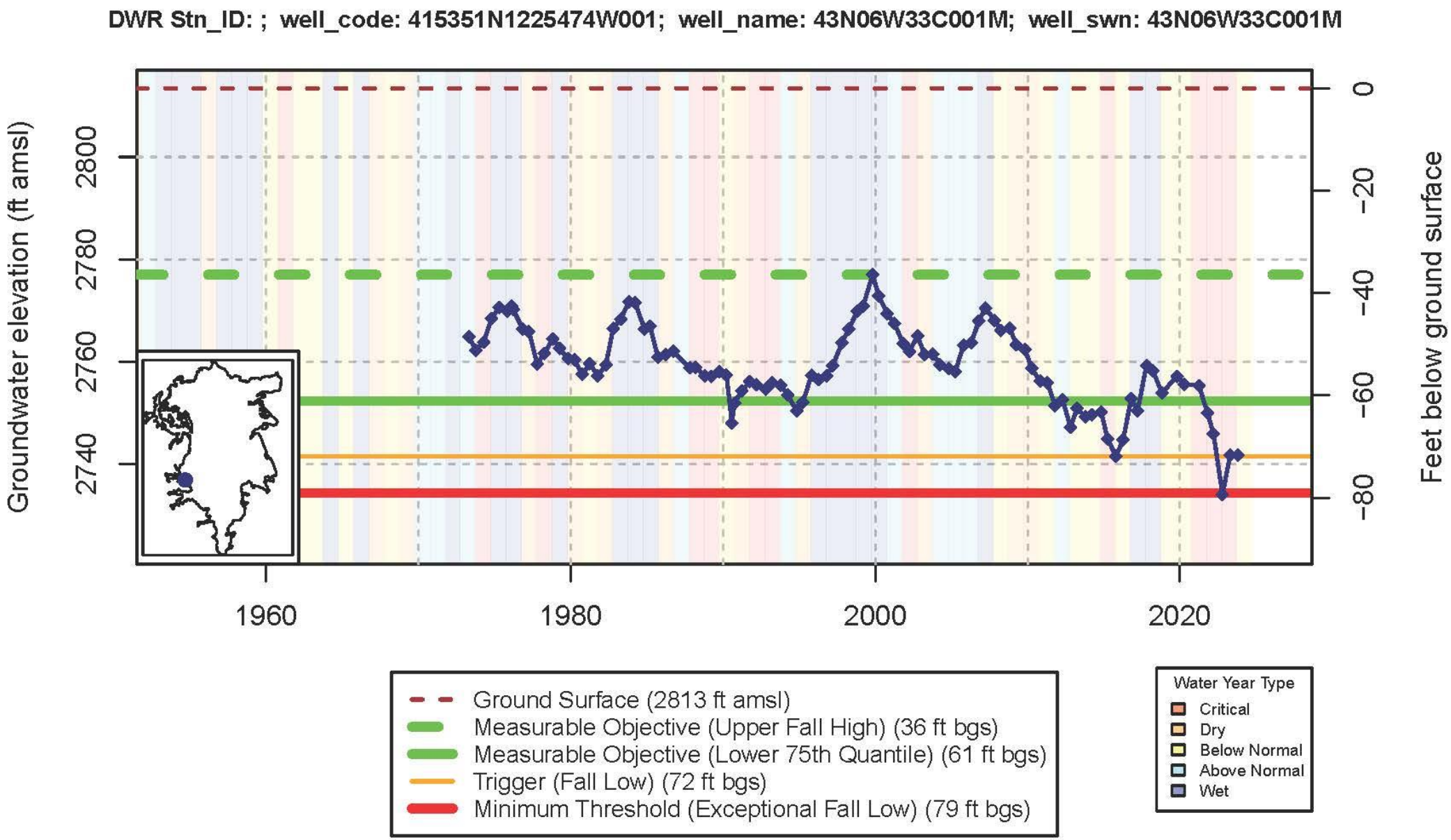
- Near or Above Measureable Objective
- Within Central Operational Range
- Near Minimum Threshold
- At or Below Minimum Threshold

- Watershed
- Groundwater Basin

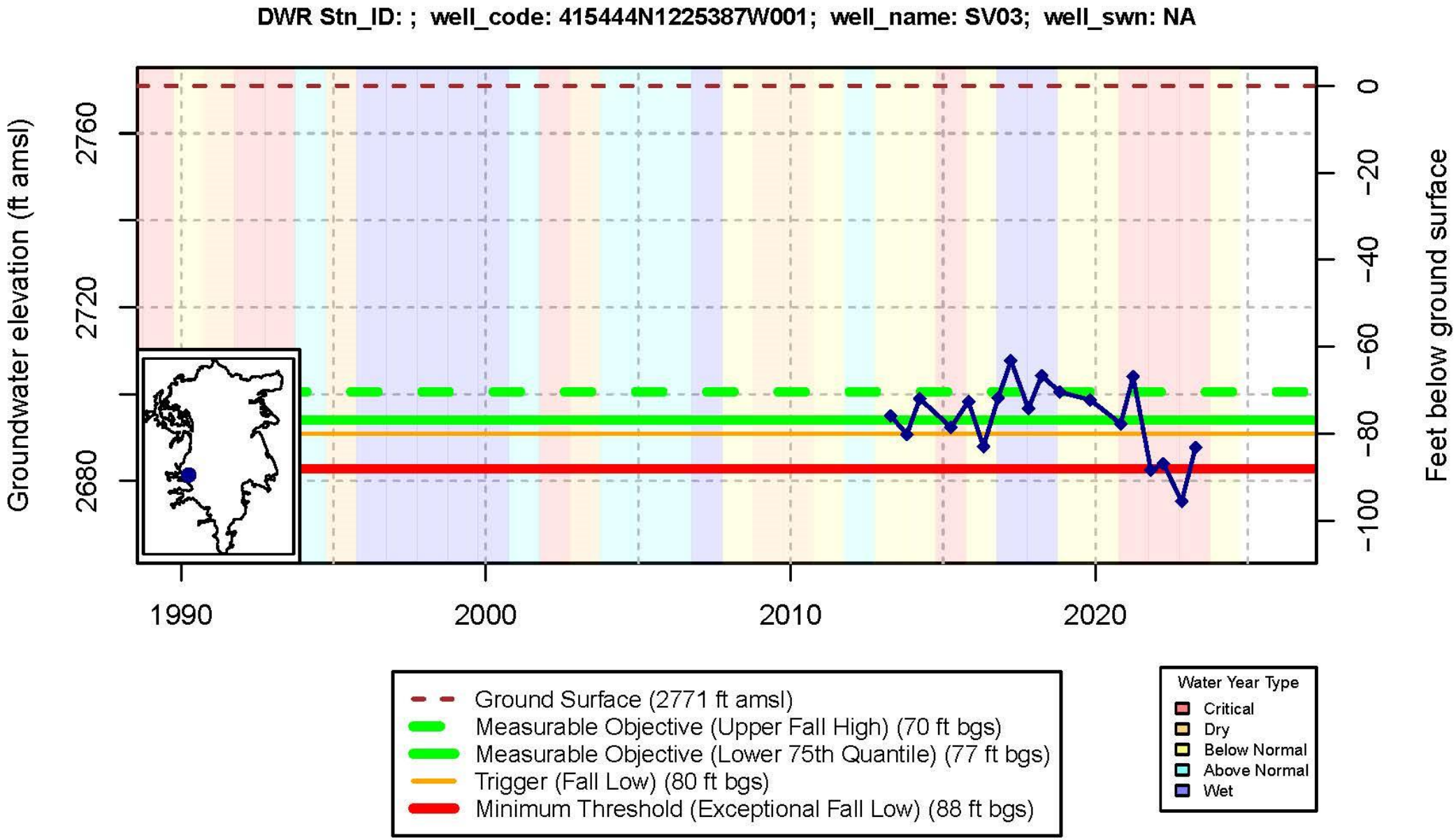
- Highway 97

RMP Hydrographs

Annual Report Water Year 2023



Water Year Types from WY 2019–2023 are preliminary results calculated based on SGMA Water Year Type Dataset Development Report. The results will be finalized once DWR updates the water year type dataset for these years.



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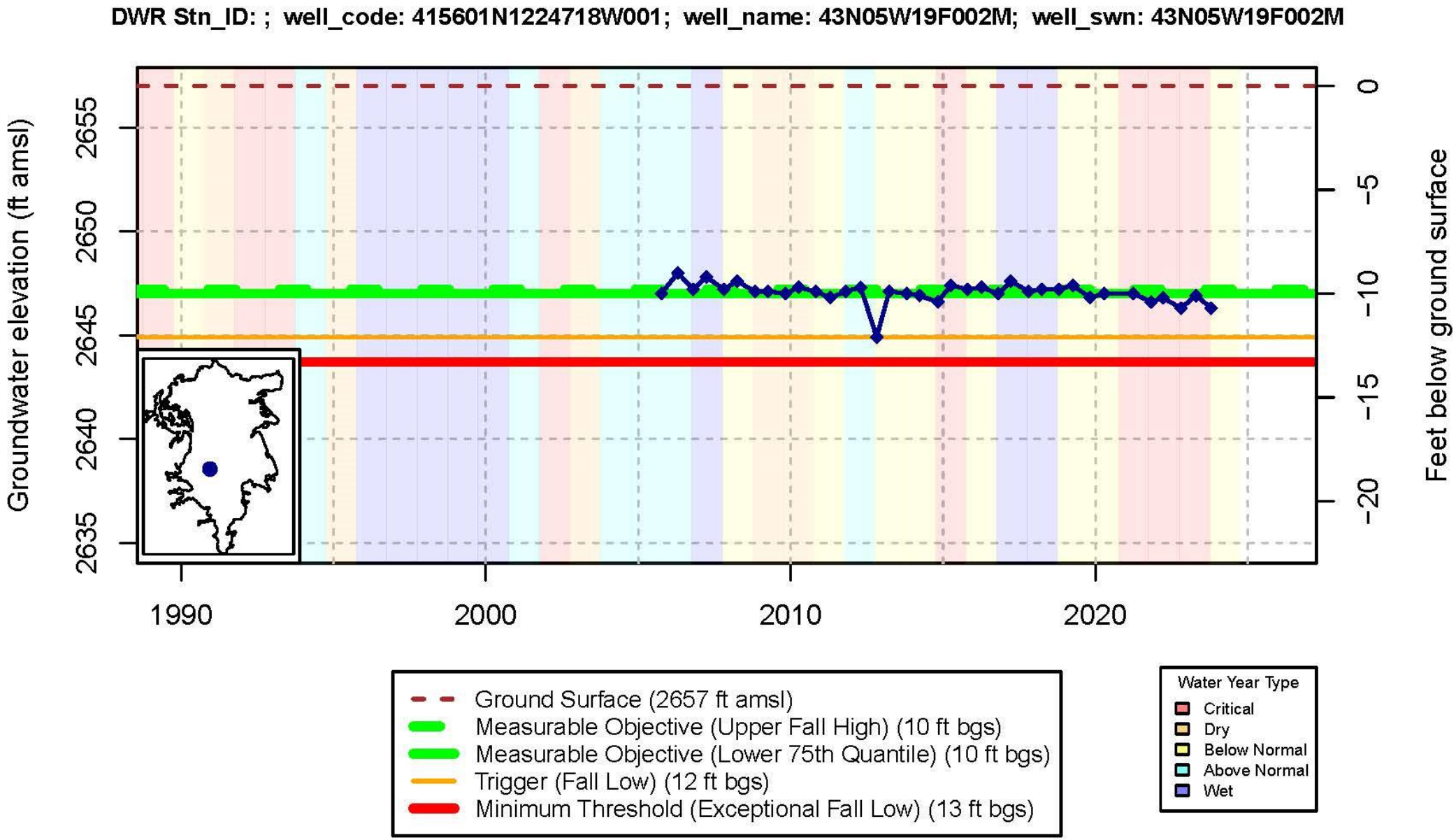

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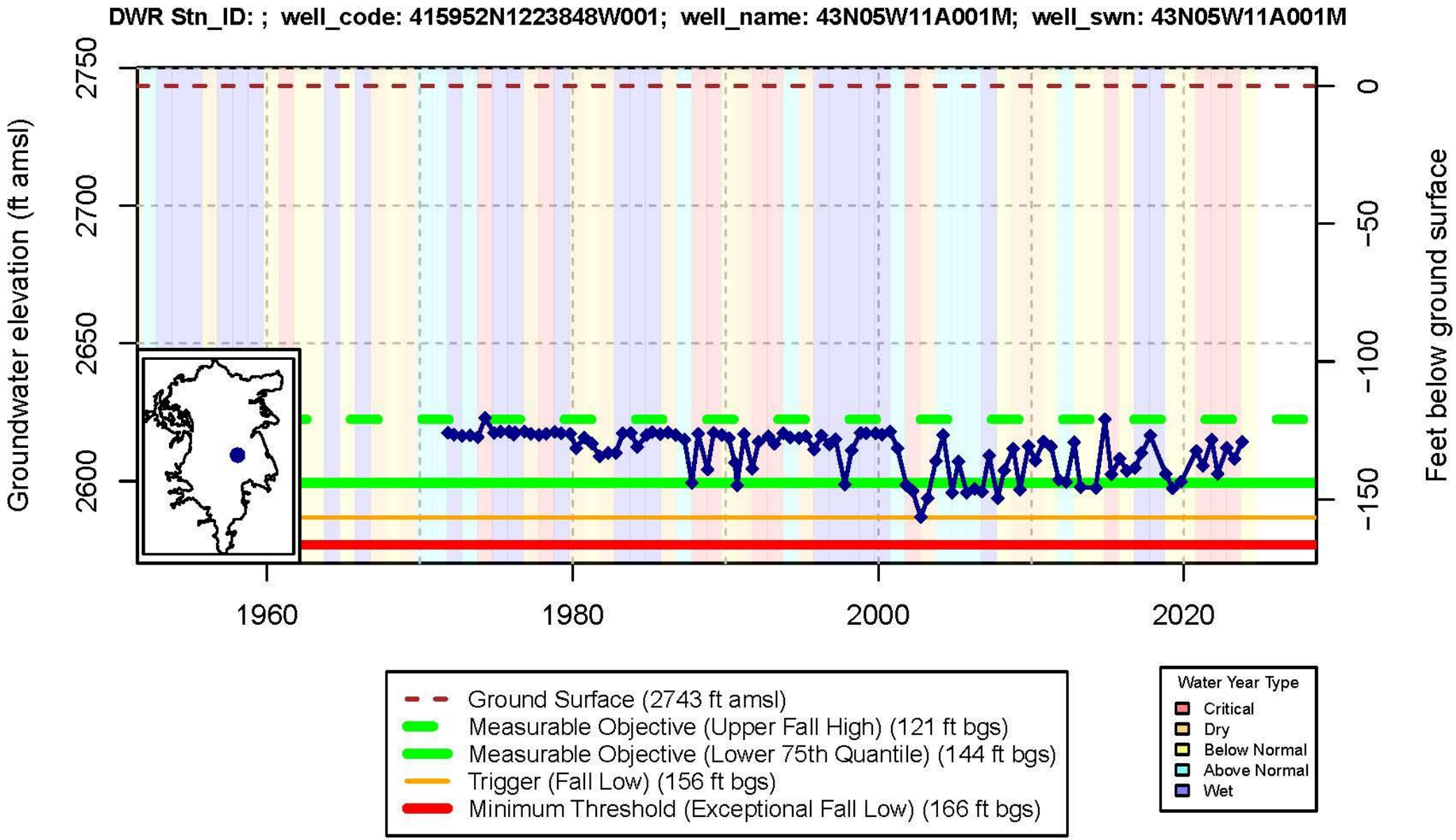

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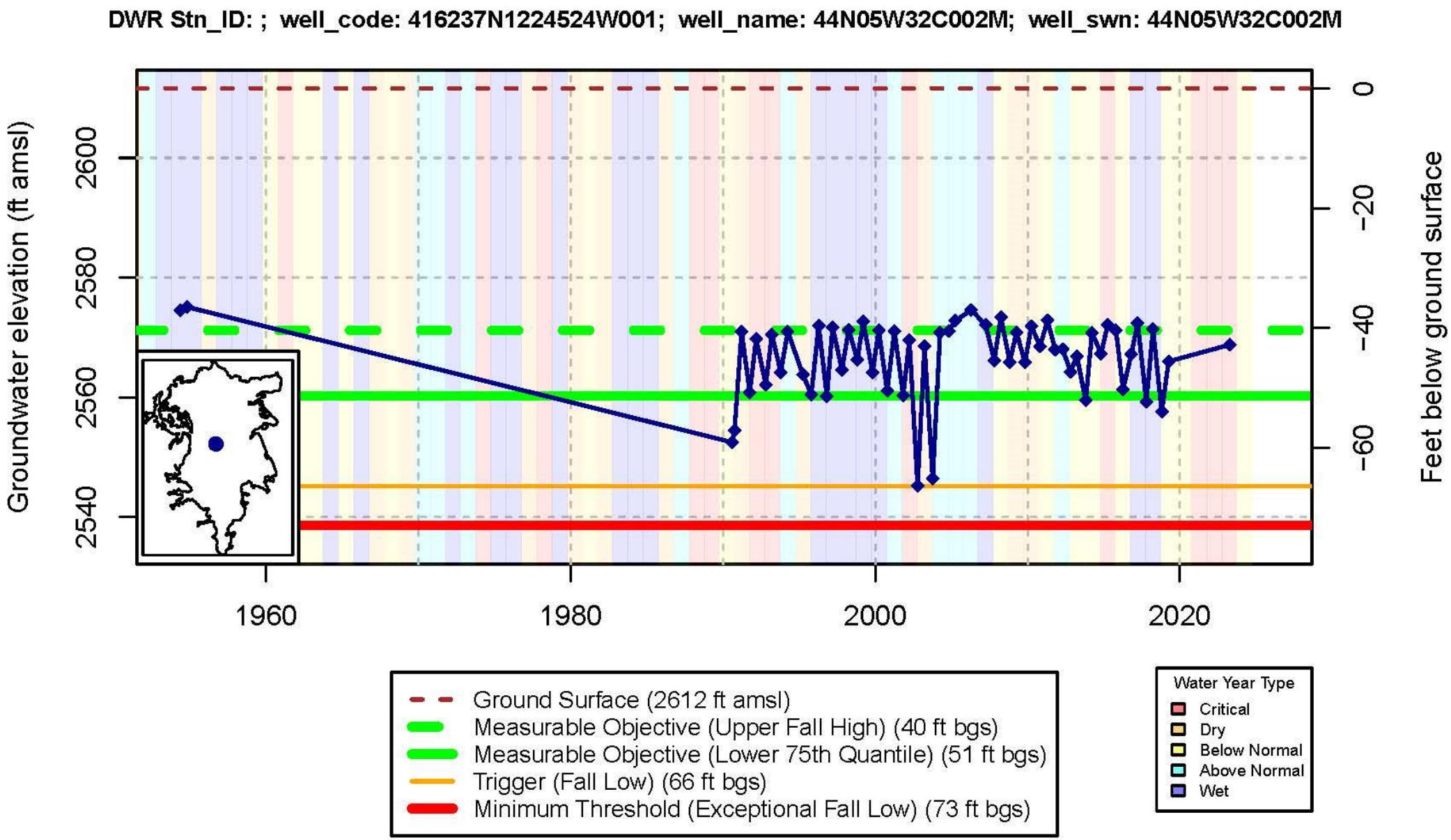

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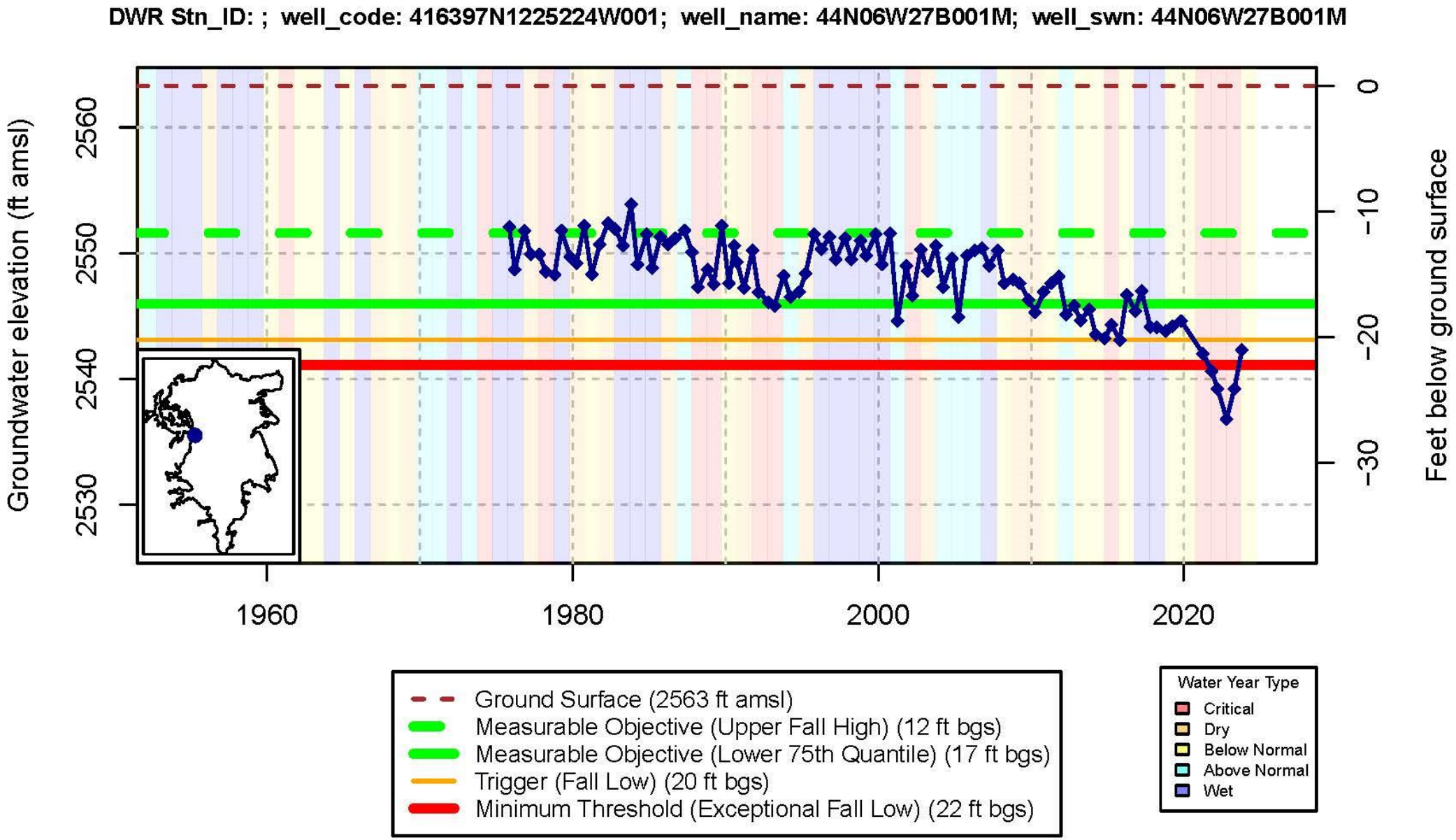

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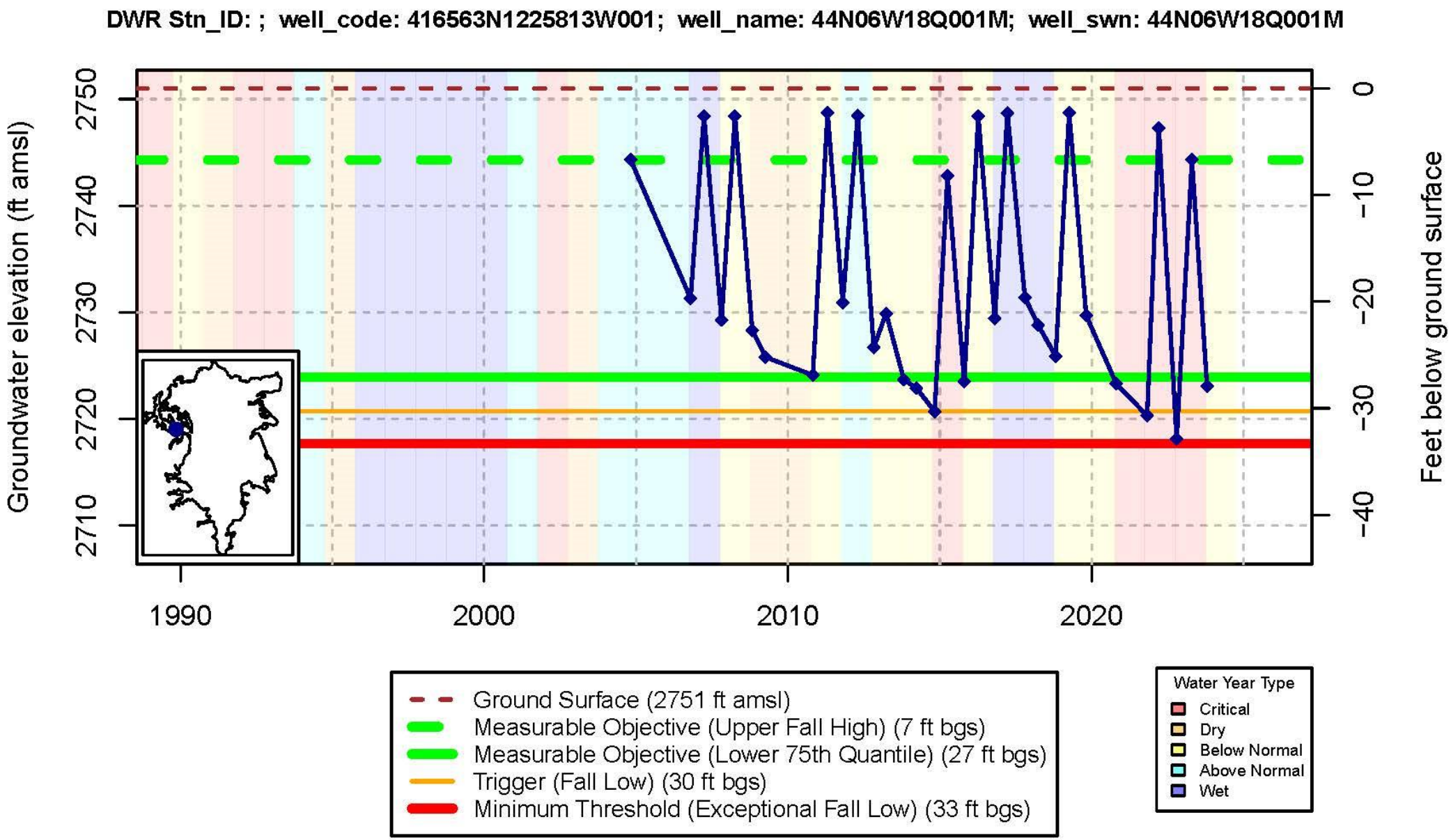

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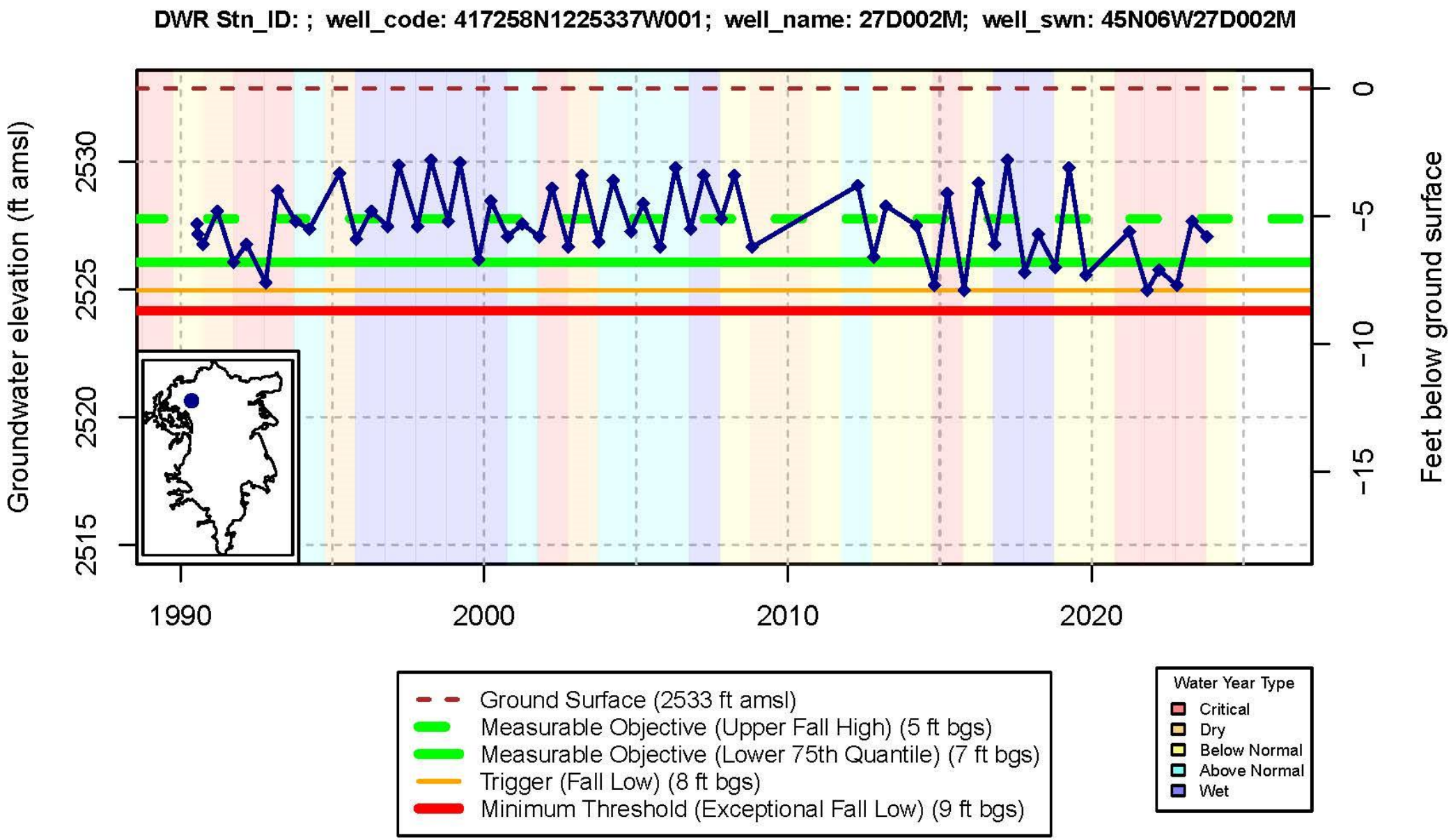

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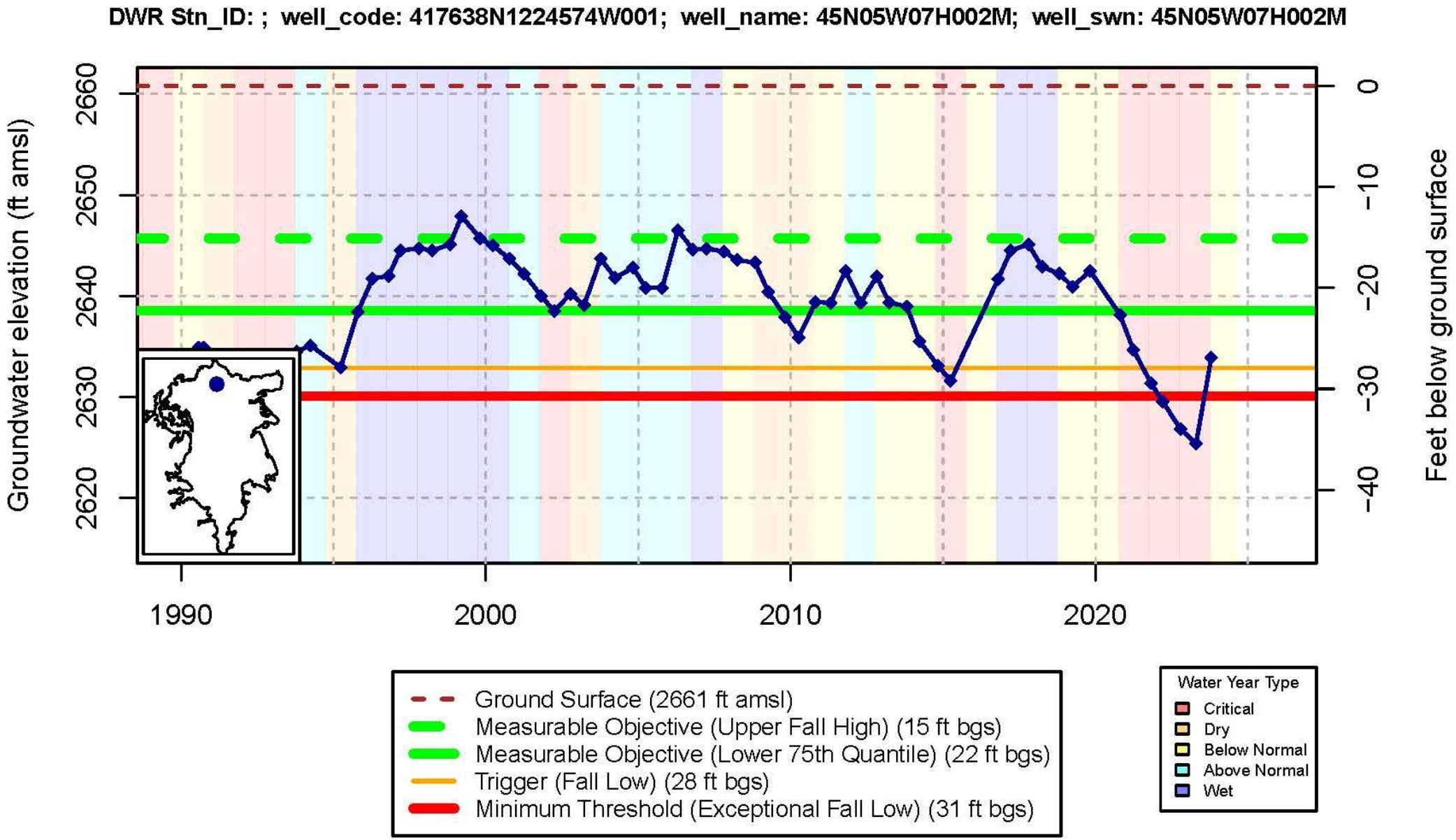

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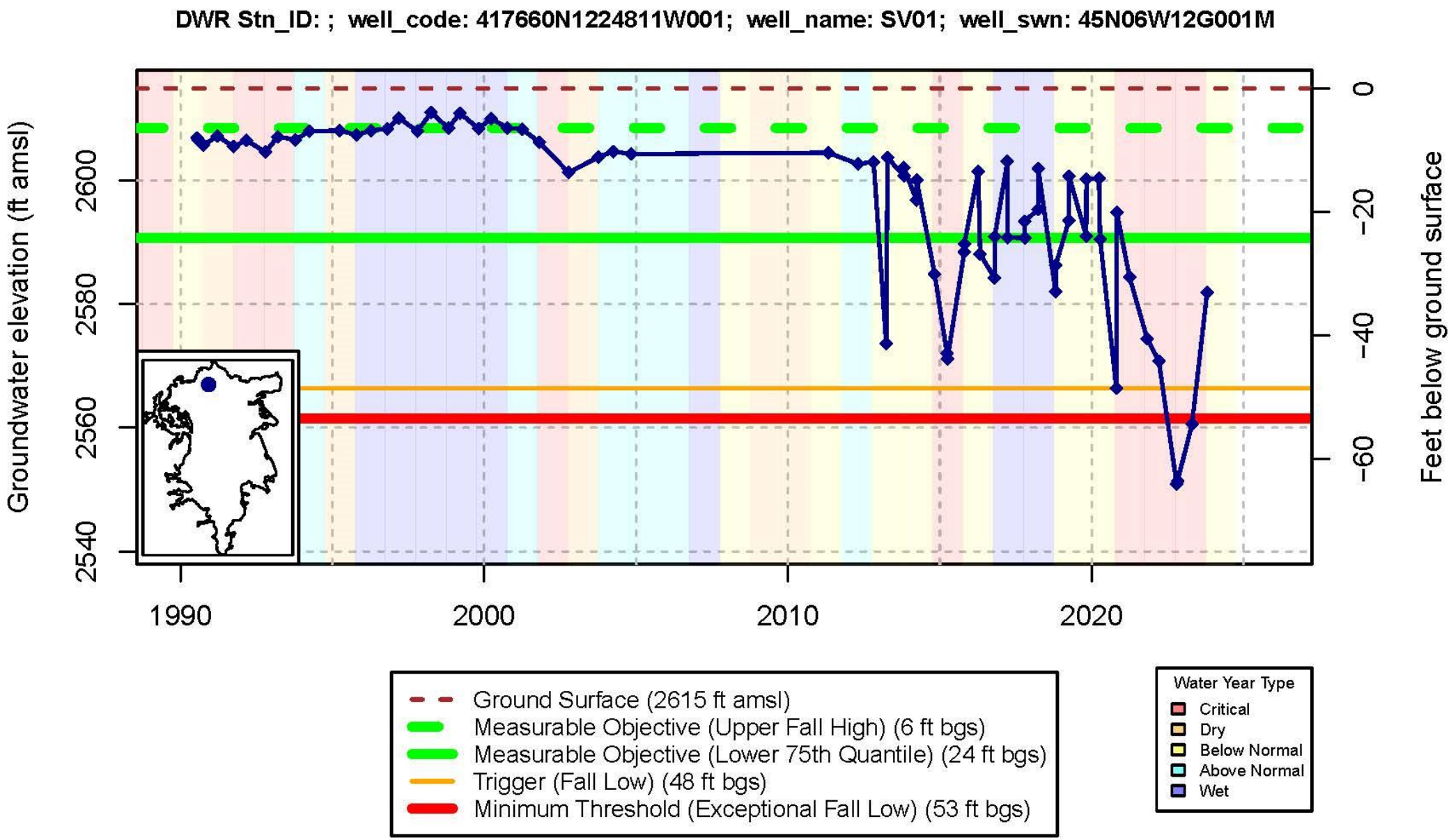

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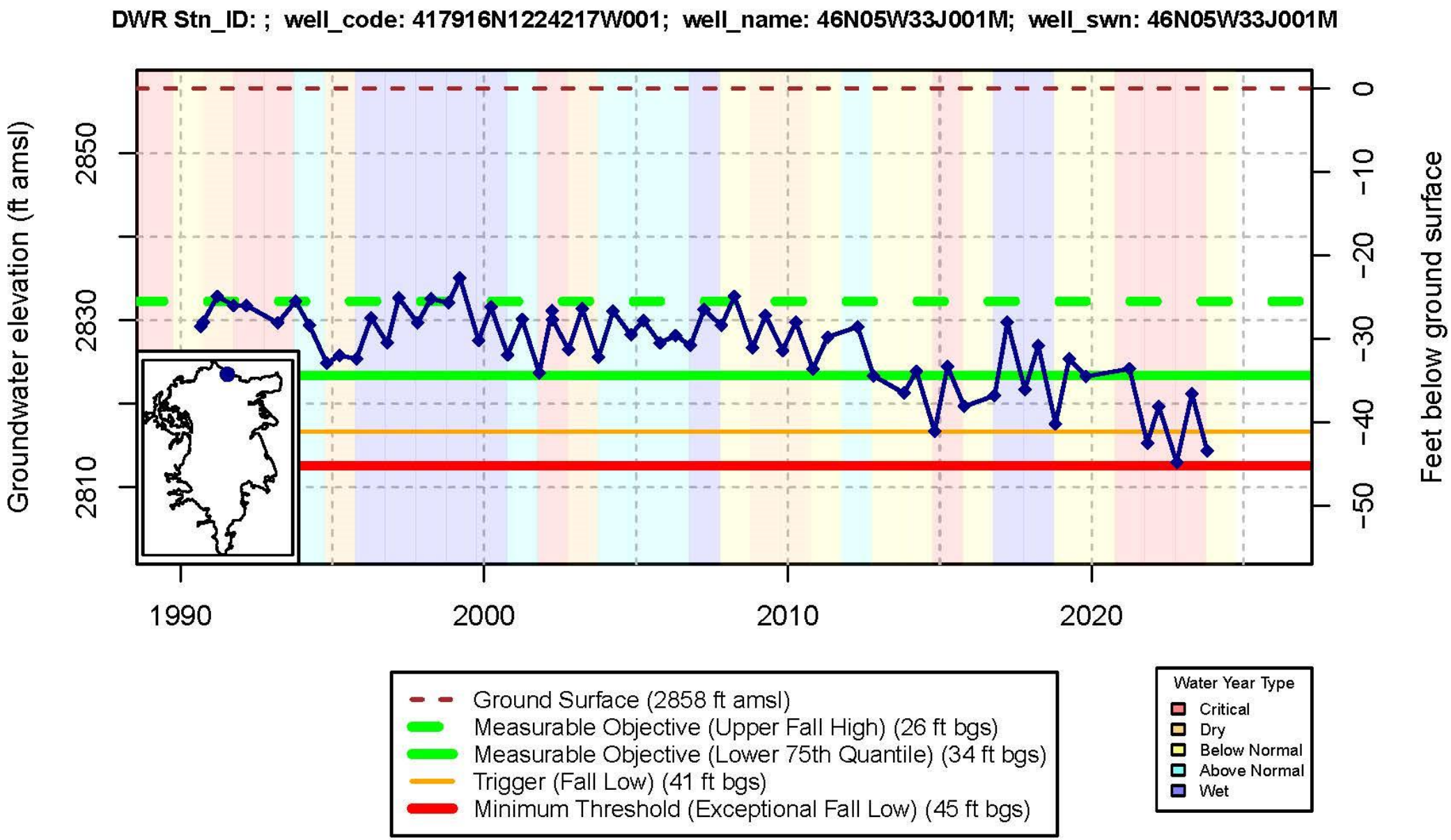

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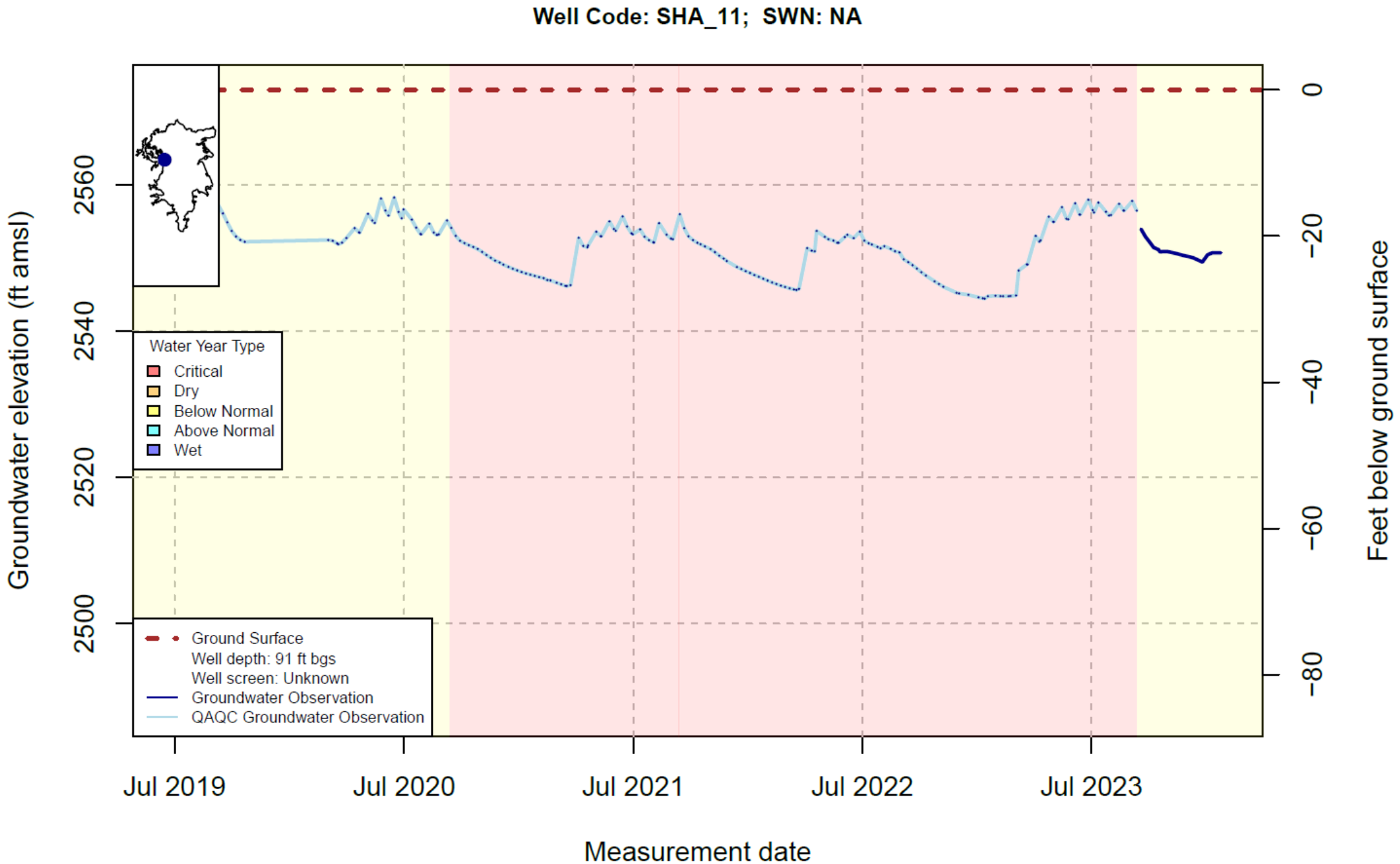
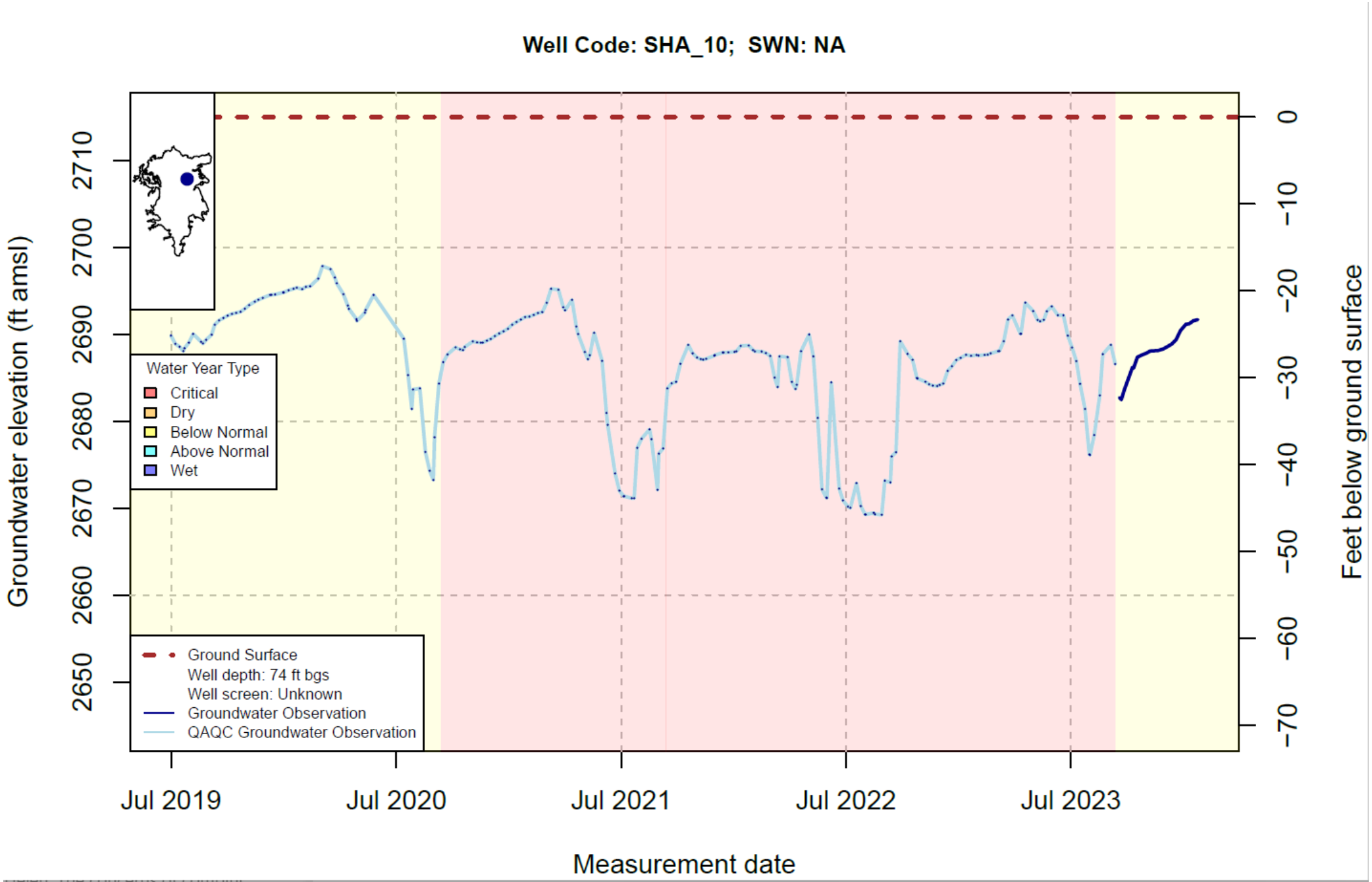
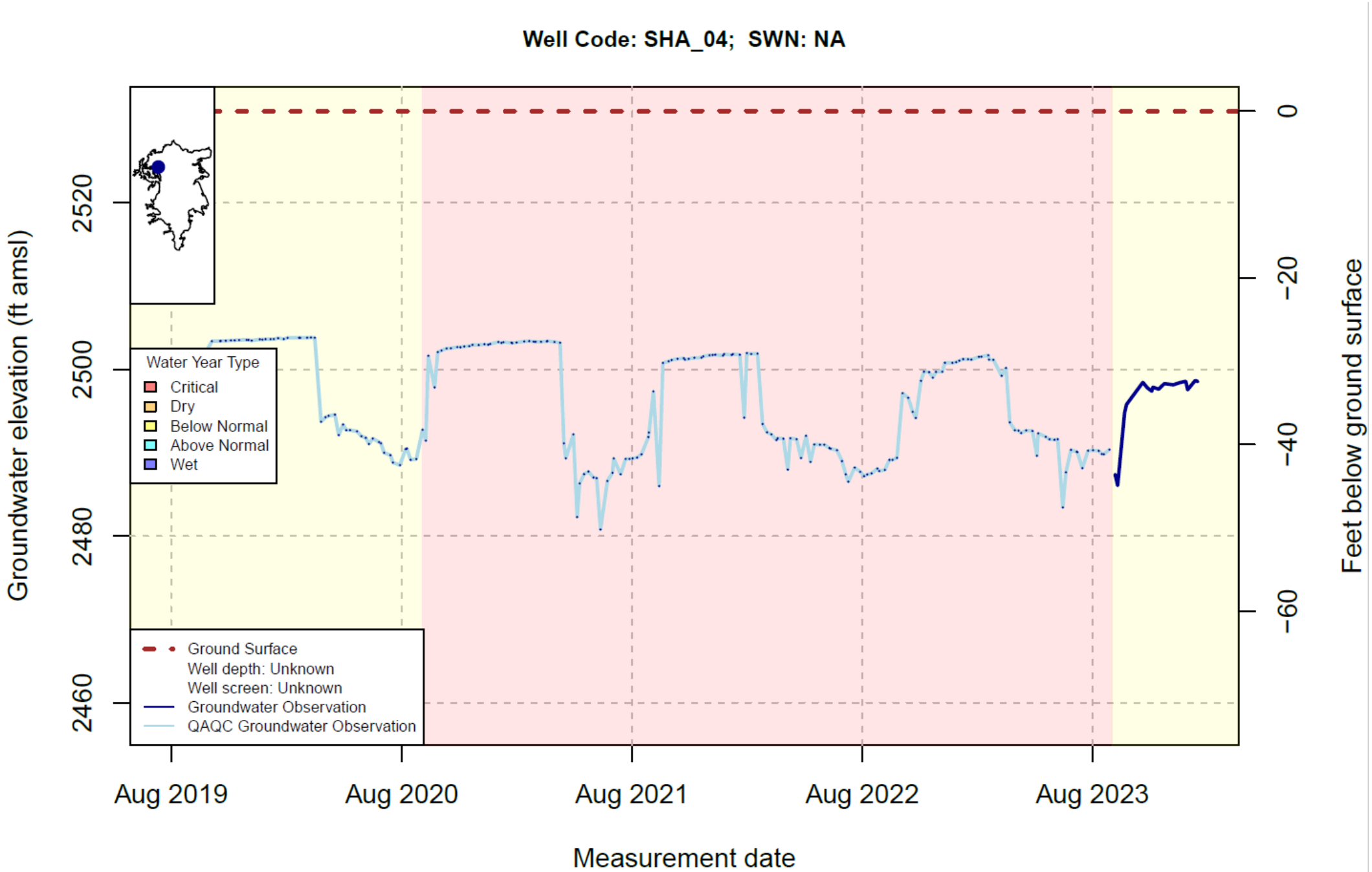
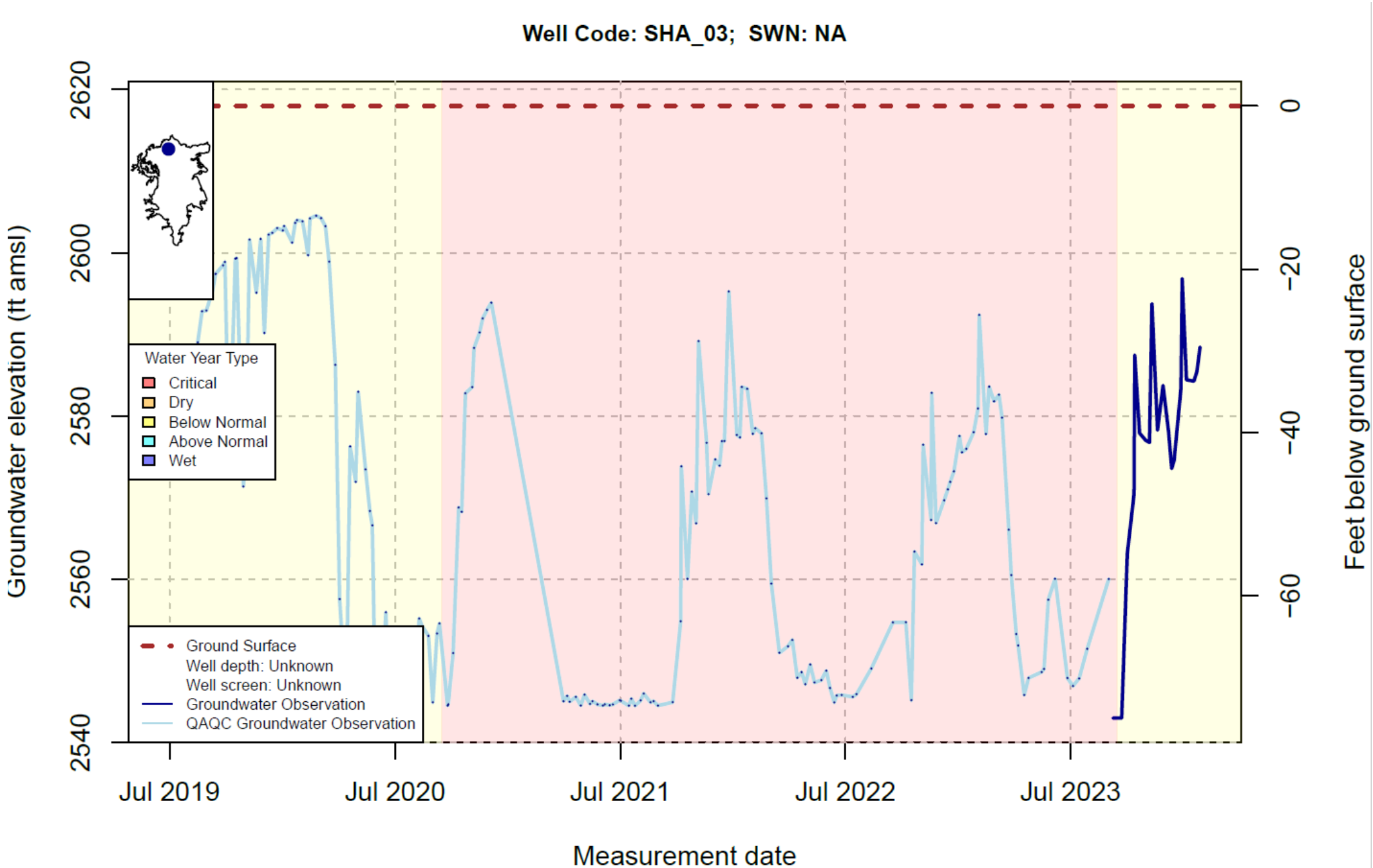
Additional Continuous Hydrographs

Annual Report Water Year 2023


Well Code: SHA_11; SWN: NA
Groundwater elevation (ft amsl)
2560
2540
2520
2500
Feet below ground surface
0
−20
−40
−60
−80
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 91 ft bgs
Well screen: Unknown
Groundwater Observation
QAQC Groundwater Observation
Jul 2019
Jul 2020
Jul 2021
Jul 2022
Jul 2023
Measurement date


Well Code: SHA_10; SWN: NA
Groundwater elevation (ft amsl)
2710
2700
2690
2680
2670
2660
2650
Feet below ground surface
0
−10
−20
−30
−40
−50
−60
−70
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 74 ft bgs
Well screen: Unknown
Groundwater Observation
QAQC Groundwater Observation
Jul 2019
Jul 2020
Jul 2021
Jul 2022
Jul 2023
Measurement date

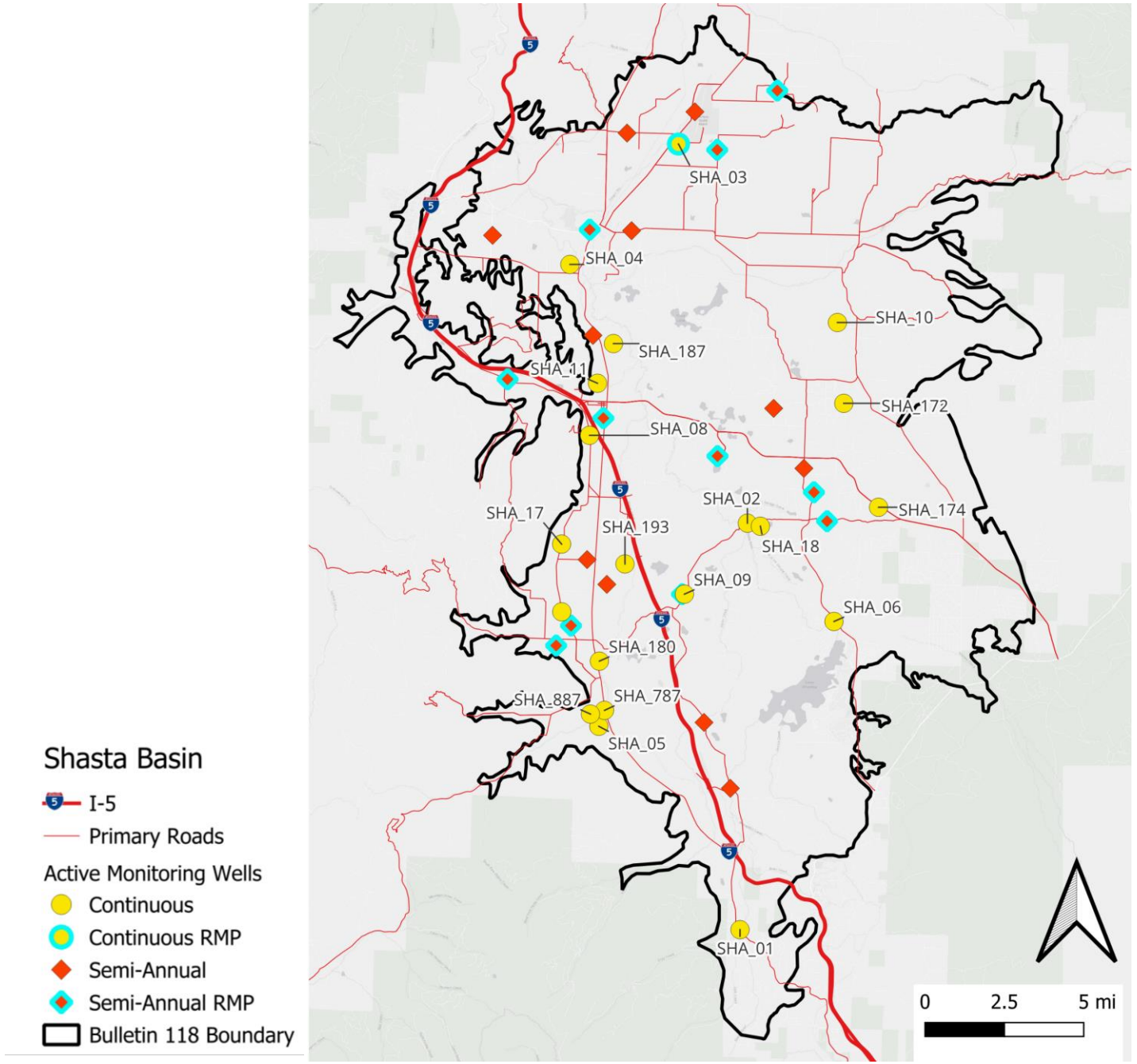

Well Code: SHA_04; SWN: NA
Groundwater elevation (ft amsl)
2520
2500
2480
2460
0
−20
−40
−60
Feet below ground surface
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: Unknown
Well screen: Unknown
Groundwater Observation
QAQC Groundwater Observation
Aug 2019
Aug 2020
Aug 2021
Aug 2022
Aug 2023
Measurement date


Well Code: SHA_03; SWN: NA
Groundwater elevation (ft amsl)
2620
2600
2580
2560
2540
0
−20
−40
−60
Feet below ground surface
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: Unknown
Well screen: Unknown
Groundwater Observation
QAQC Groundwater Observation
Jul 2019
Jul 2020
Jul 2021
Jul 2022
Jul 2023
Measurement date

Monitoring data review, network expansion, and data gaps

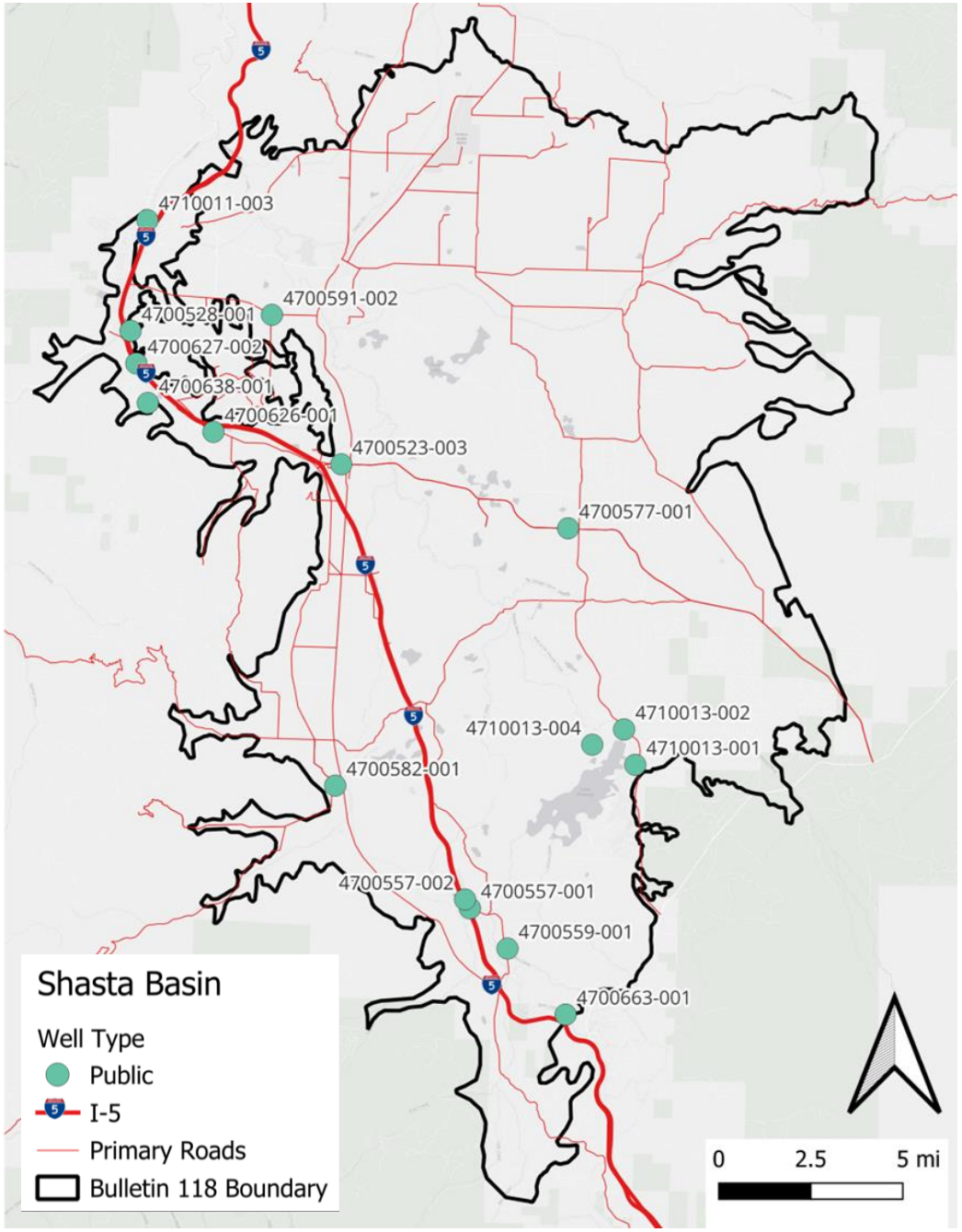
Groundwater Level Monitoring

- 20 wells measured continuously
  - 19 LWA:
    - 15 minutes intervals
    - Telemetered
  - 1 DWR
    - 1 hour intervals
- 22 CASGEM Wells
  - Measured twice per year



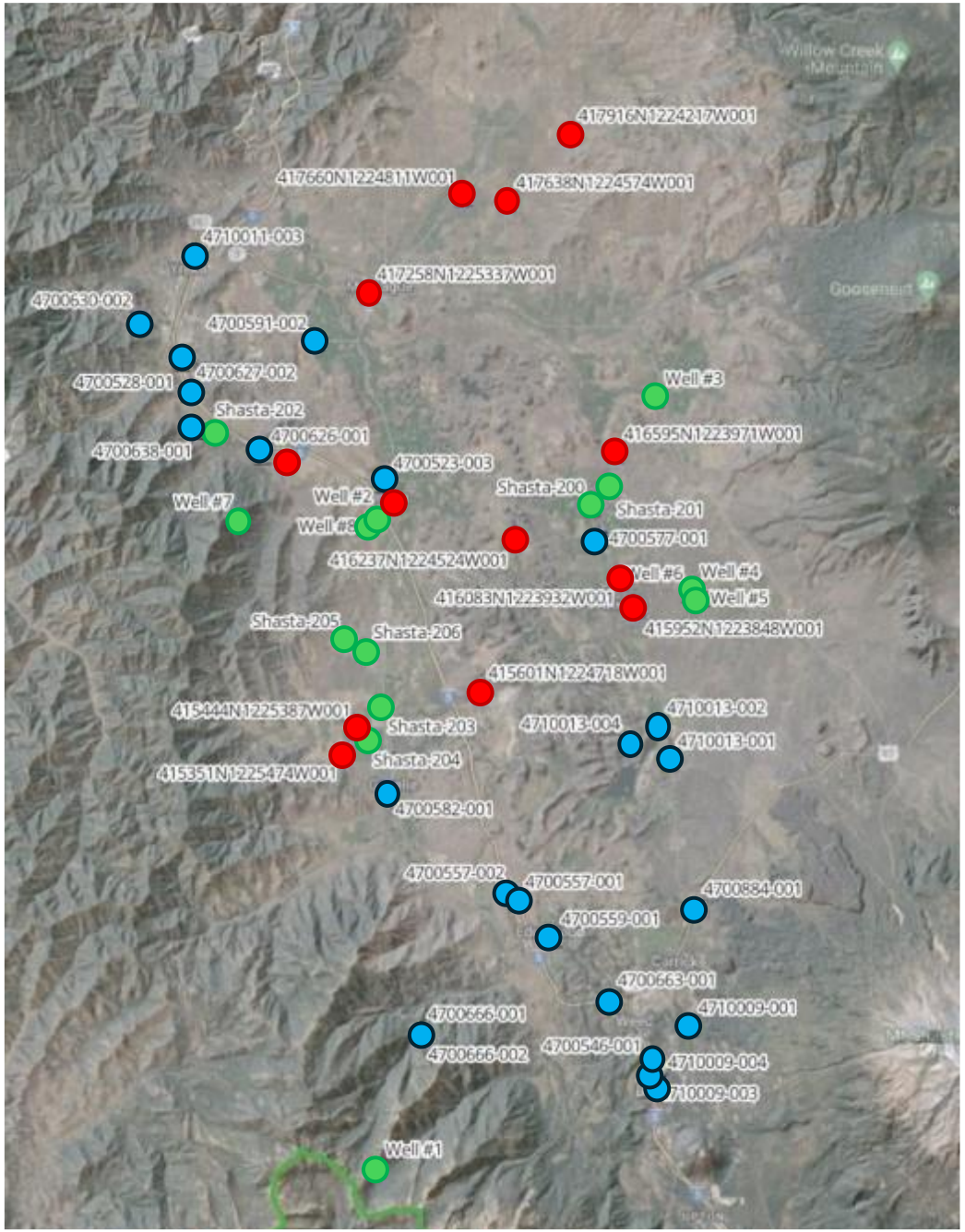
Groundwater Quality Monitoring

- 16 Municipal Wells
- Planned expansion of network

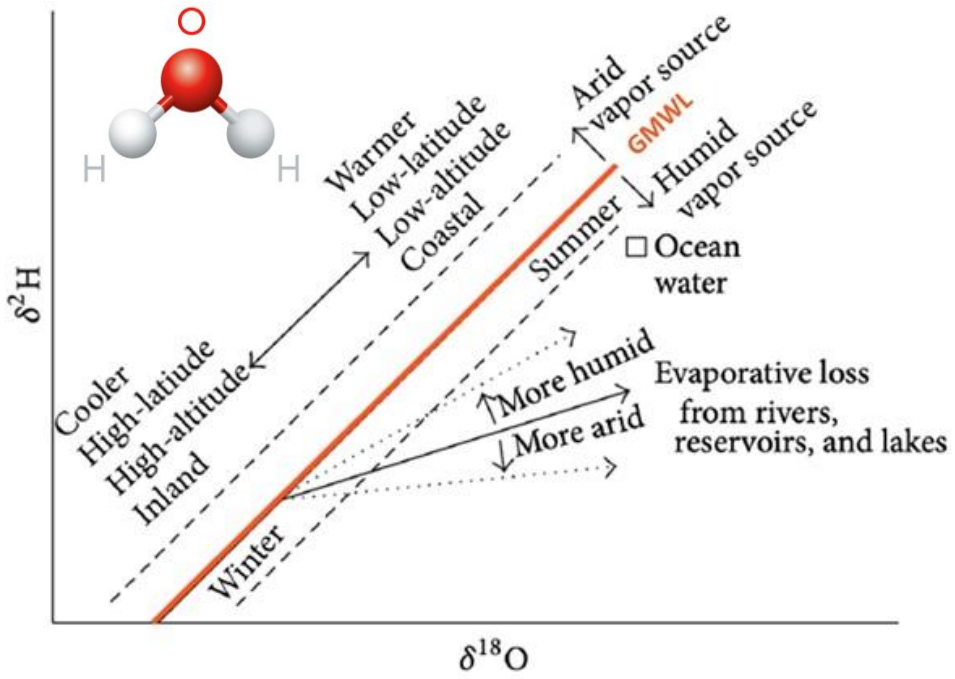


Groundwater Quality Monitoring

- Selecting additional water quality monitoring wells
  - Blue wells have historically been monitored for water quality
  - Red wells have historically been monitored for depth to water
  - Green wells have historically been monitored



What more can geochemistry tell us?



- Water isotopes and major ions
  - **Distinguish water sources**
  - **Identify mixing of different water sources**
- Radon
  - Helps to identify **gaining** and **losing** areas
  - Identify piezometers and shallow wells with very recent recharge
  - Can complement sensor data and other physical (temp, conductivity) and geochemical measurements to help understand streamflow dynamics through time
- Time series can be very informative

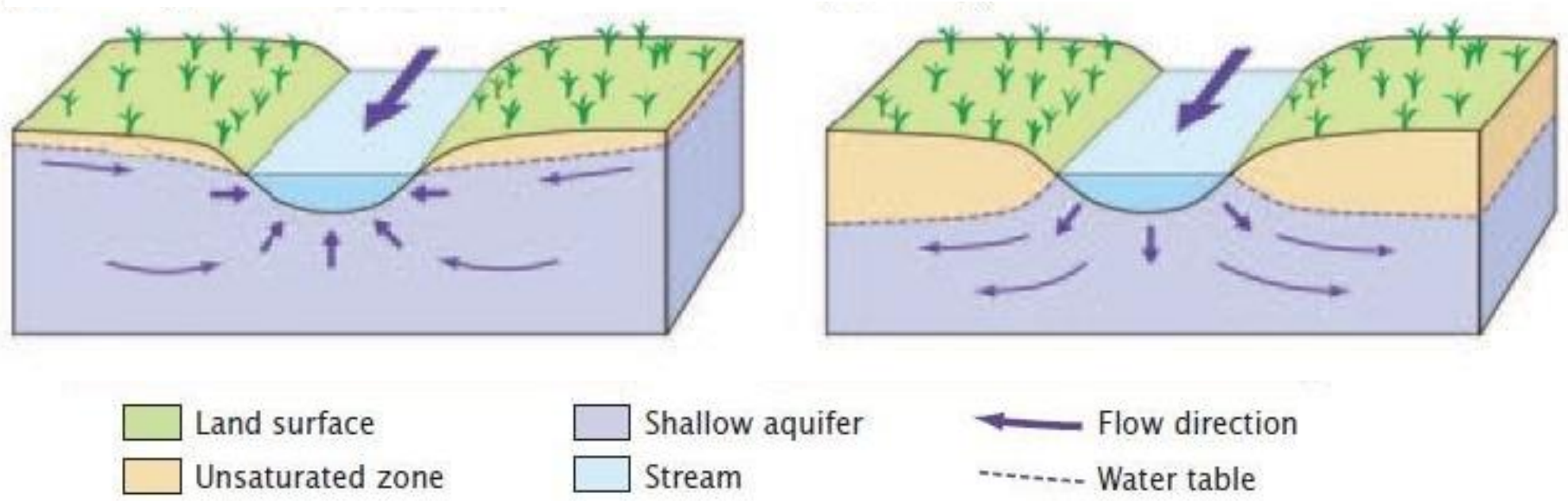
Radon Activity in Gaining vs. Losing Streams

Gaining Stream

High Radon Activity due to Localized Groundwater Influx

Losing Stream

Low Radon Activity due to Degassing, Decay, and Groundwater Recharge



Adapted from Berthane (2015)

Data Gaps and Monitoring Expansion

- Lacking surveyed elevations of some wells in the water level network
- Lacking flow data. Plans to install new flow monitoring gages:
  - Tributaries to Dwinnell reservoir
  - Diversions to irrigation ditches
  - Other possible locations: China Ditch, Parks Creek, Willow Creek
- Interconnected surface water
  - Plans to install two transects with up to 5 shallow wells
- Addition of water quality wells
- Pesticide sampling: two-time sampling of wells for pesticides
- Other monitoring station updates?
- Installation of monitoring instrumentation in existing wells (Big Springs Area)

Shasta Valley Basin
Hydrologic Model Updates

Shasta PRMS Updates

- Extend model to the end of WY2023
- Implement automatic updates with R scripting for extending the model in the future
- Change temperature and precipitation module to xyz_dist
  - Combine data from local monitoring stations and PRISM*
- Incorporate NLDAS* data for potential evapotranspiration module

* Parameter-elevation Regressions on Independent Slopes Model (PRISM)

* NASA North American Land Data Assimilation System (NLDAS)

Shasta PRMS

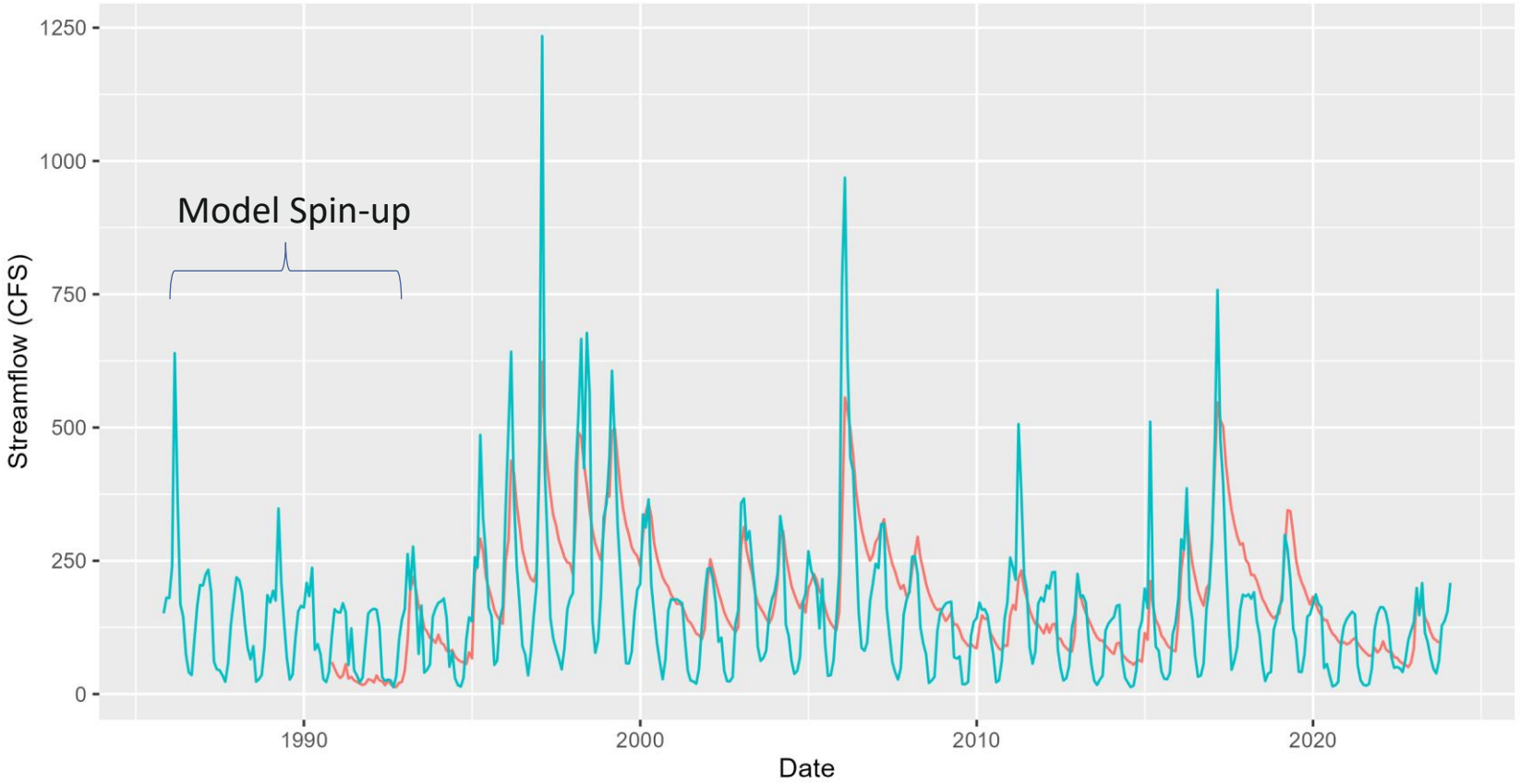
- Updating calibration to observed streamflow at nine stations
  - DWR and USGS streamflow stations
- Previous calibration only used one station at the outlet

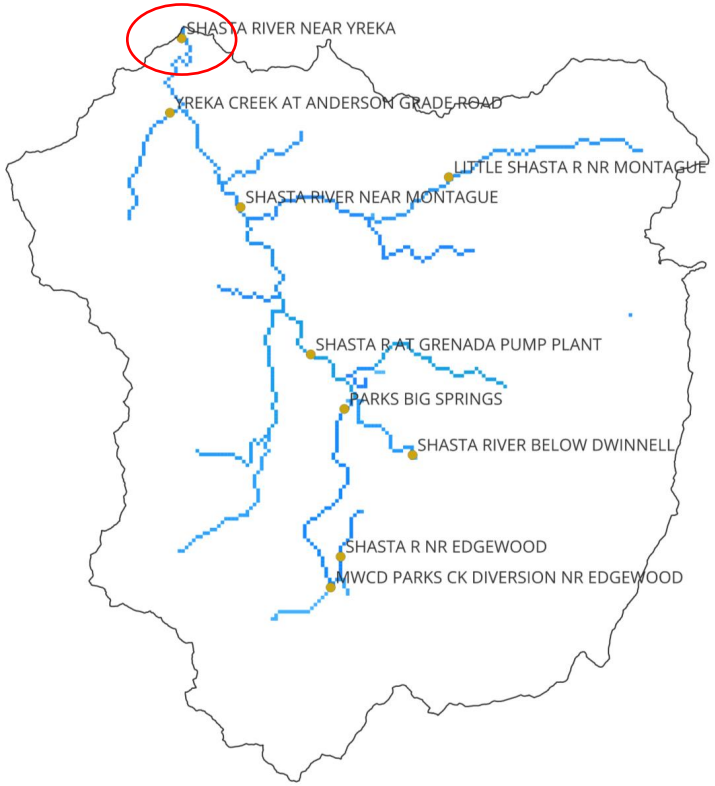
Shasta PRMS

- Calibration in progress

USGS Station : 11517500 (Shasta River Near Yreka) – Monthly Average

NSE: 0.455466972898034



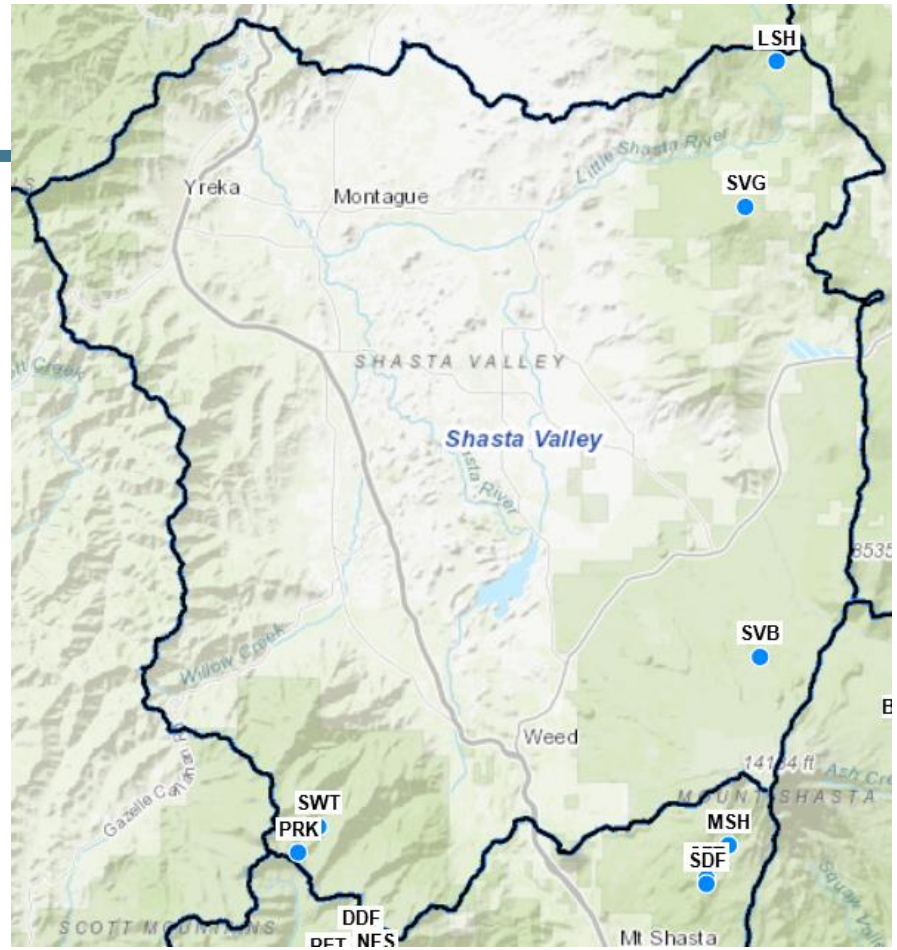


Snowpack Hydrology

- Updating calibration to observed snow
- Snow water equivalent (SWE) observed timeseries
  - Snow courses (manual measurements collected by skiers)
    - Little Shasta (LSH), Sweetwater (SWT), and Parks Creek (PRK)
  - Snow sensors (snow pillows measuring the weight of water in snow)
    - Goosenest (SVG) and Bolam (SVB) (operational since 8/25/20 after initial PRMS model development)

Source: DWR, 2020

Source: DWR, 2022

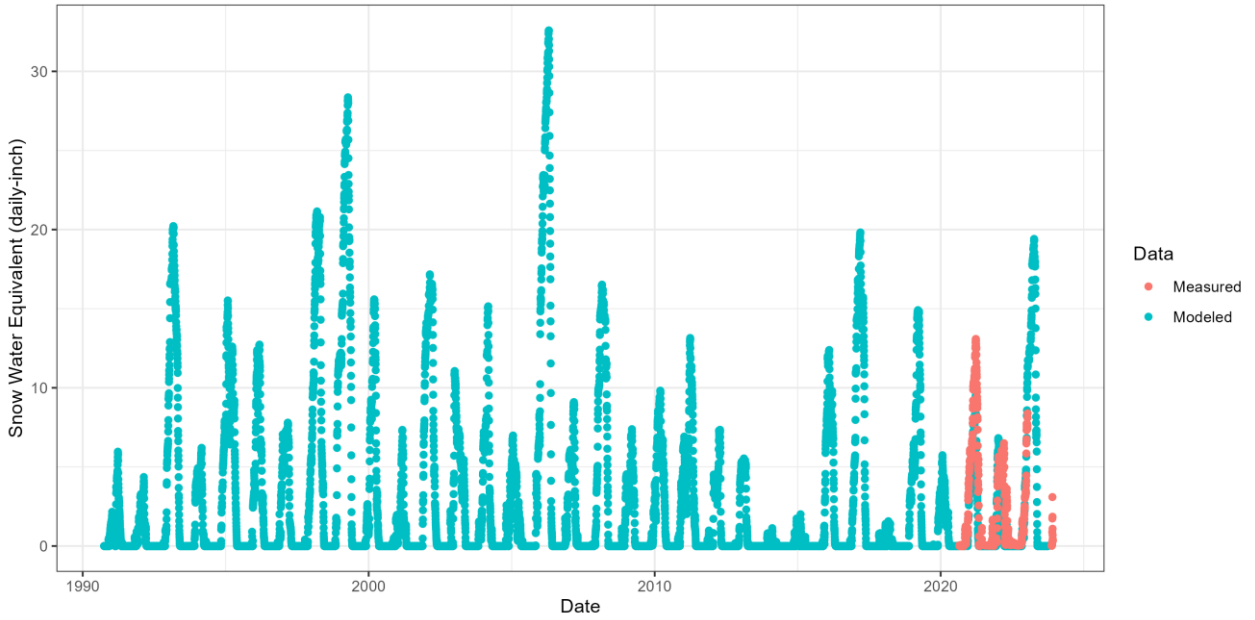


CDEC

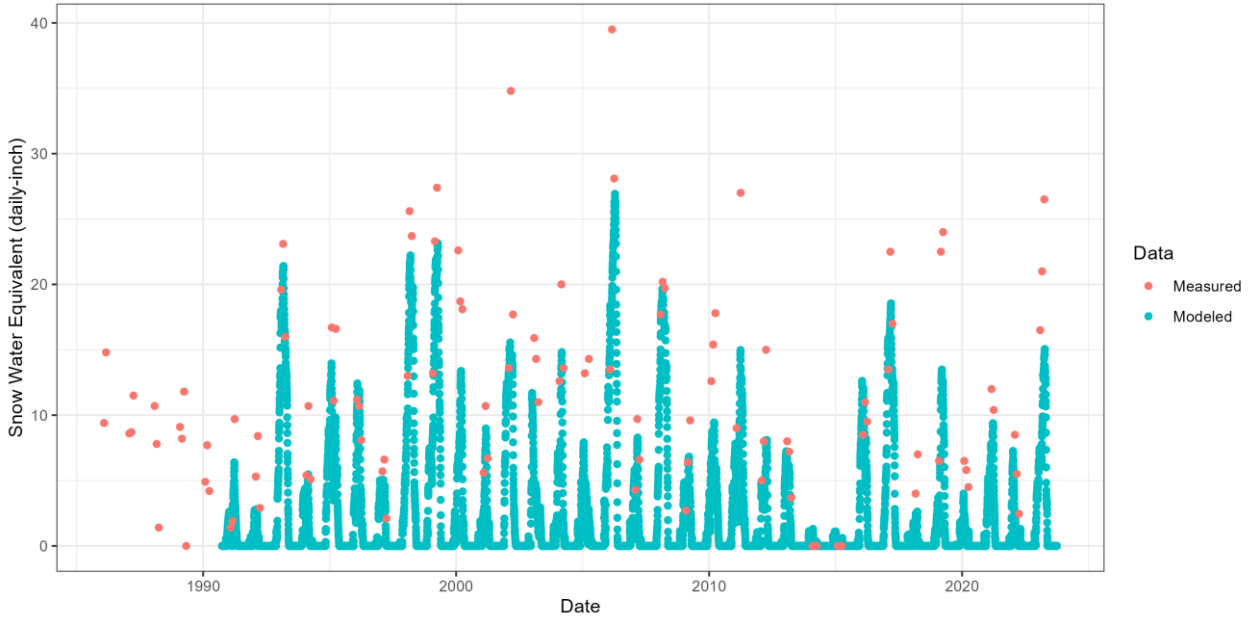
Snowpack Hydrology

- Adjustment of atmospheric & snowpack hydrology parameters to better align modeled and observed snow water equivalent (SWE)
- Key temporal variation in SWE:
  - Snow accumulation
  - Snow melt
- Revised parameterization:
  - Scaling of precipitation
  - **adjust_snow** changing the portion of precipitation falling as snow
  - **potet_sublim** changing the fraction of potential ET sublimated from snow

SVG – GOOSENEST (snow sensor)



SWT – SWEETWATER (snow course)



Shasta MODFLOW Model Updates

Extended model to 2023

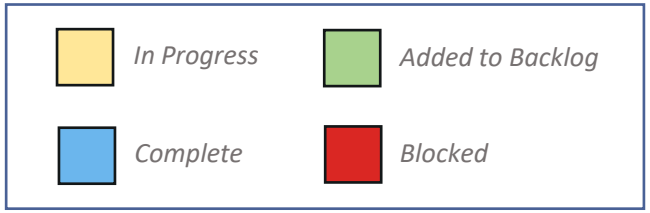
Extended all model packages to 2023.

Added new observations

Added new well and streamflow observations.

Developed new geology

Developed new geology using AEM data. It is ready to be incorporated into the MODFLOW model.

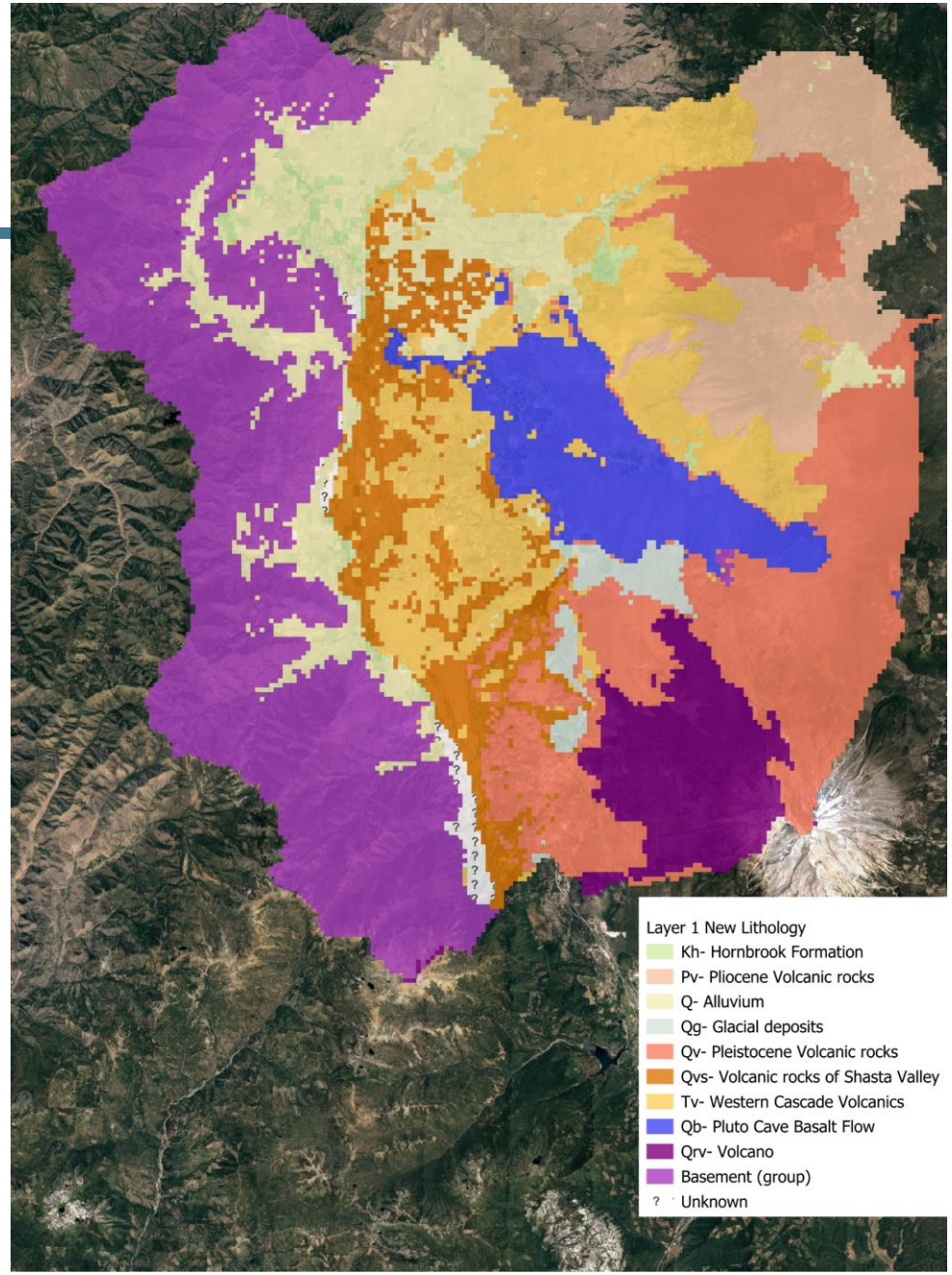


Model Priority Backlog *Through February 2024*

#	Feature	Description	Status
1	Extend model to 2023	Extend all MODFLOW packages to 2023 and run model	Complete
2	Update head observations	Update head observation data in HOB package	Complete
3	Update streamflow observations	Update streamflow observation data	Complete
4	Update geology	Update geology with newly available AEM from DWR	Complete
5	Update recharge	Incorporate updated PRMS recharge into MODFLOW model	In Progress
6	Update pumping	Incorporate soil water budget to estimate MODFLOW pumping	In Progress
7	Incorporate new geology	Incorporate new geology into MODFLOW model	Not Started
8	Update ditches	Convert ditch representation from GHB to SFR	Not Started
9	Remove steady state	Replace first stress period from steady state to transient	Not Started
10	Calibration	Recalibrate hydraulic parameters	Not Started
11			
12			

Geology Update

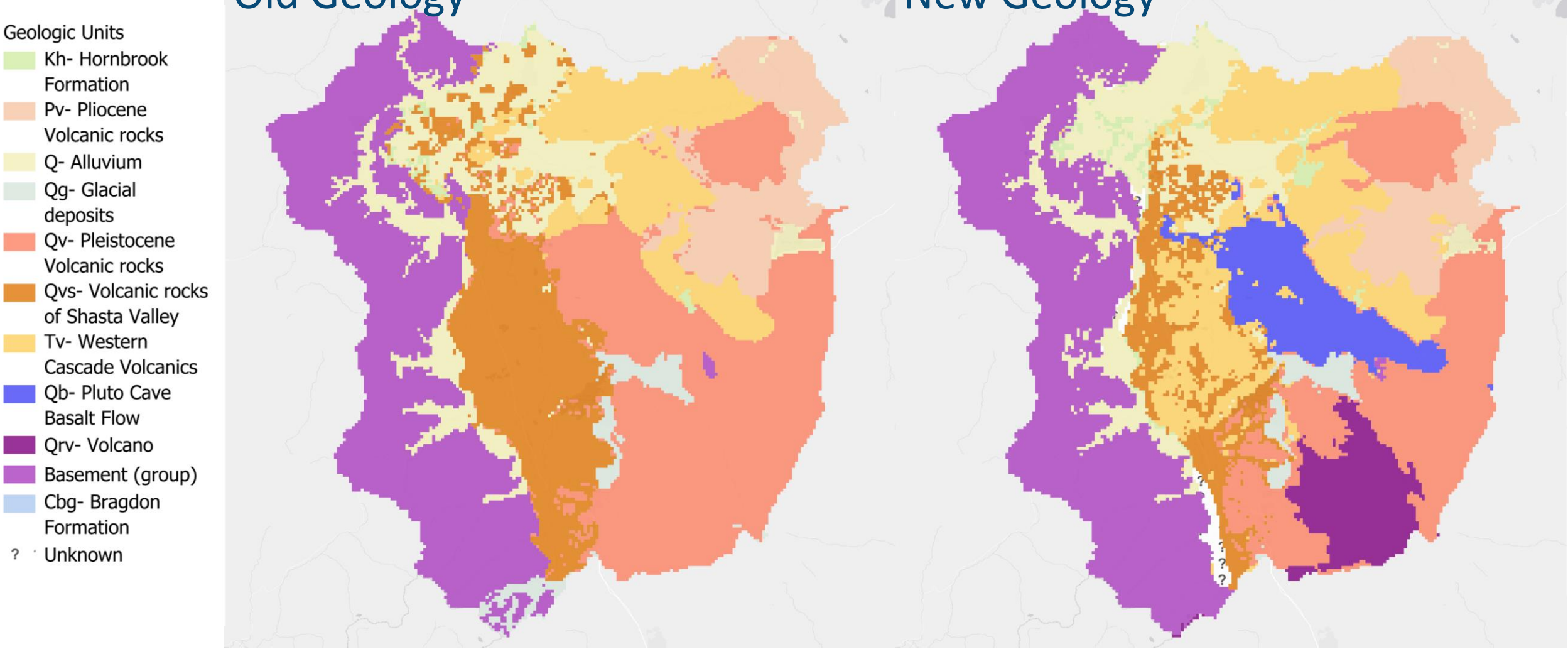
- Refining of digital elevation model
  - 24 m to 8 m
- Changes in lithology based on DWR's Airborne Electromagnetic Survey:
  - New lithology: Gb — Pluto Cave Basalt Flow, east of Big Springs
  - Larger presence of Tv — Western Cascade Volcanics in Big Springs



Geology Update – Comparison

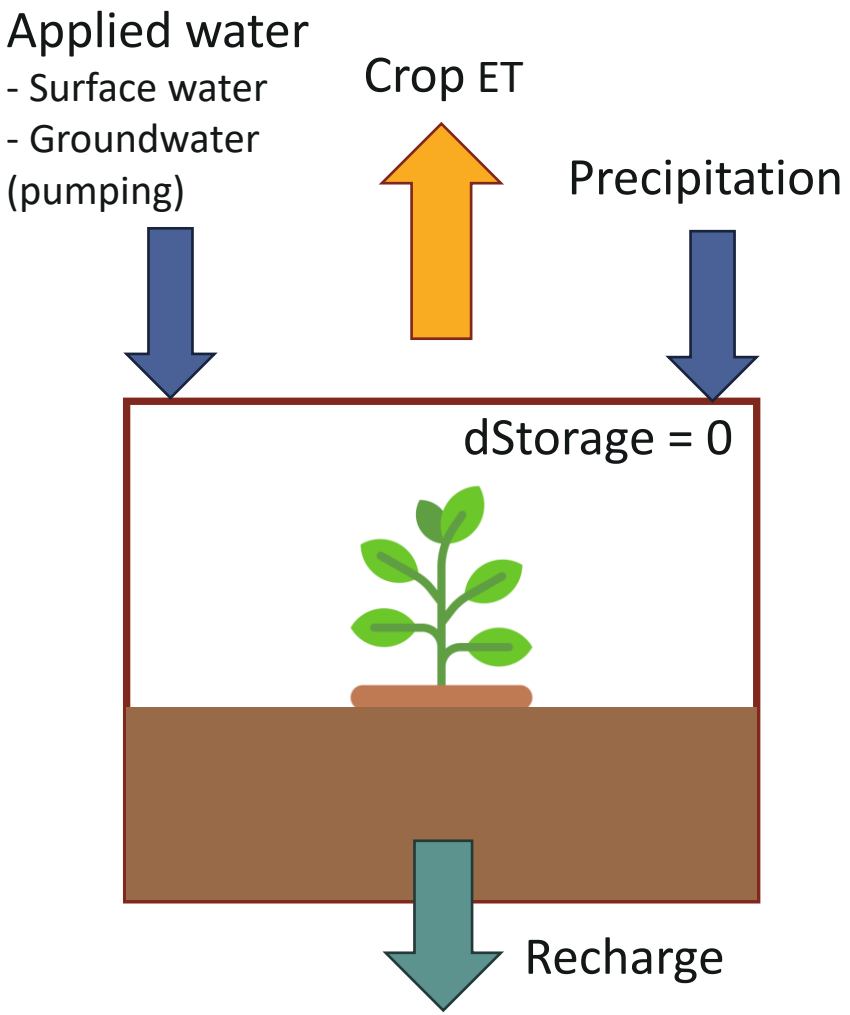
Old Geology

New Geology



Soil Water Budget

- Consumptive Use approach
  - Incorporating the latest land use and local monitoring stations from CIMIS and NOAA
    - Crop type/Water source/irrigation system
    - Reference evapotranspiration (ET_o)
    - Irrigation efficiency
    - Crop coefficient
    - Precipitation
    - Growing season for crops



Soil Water Budget

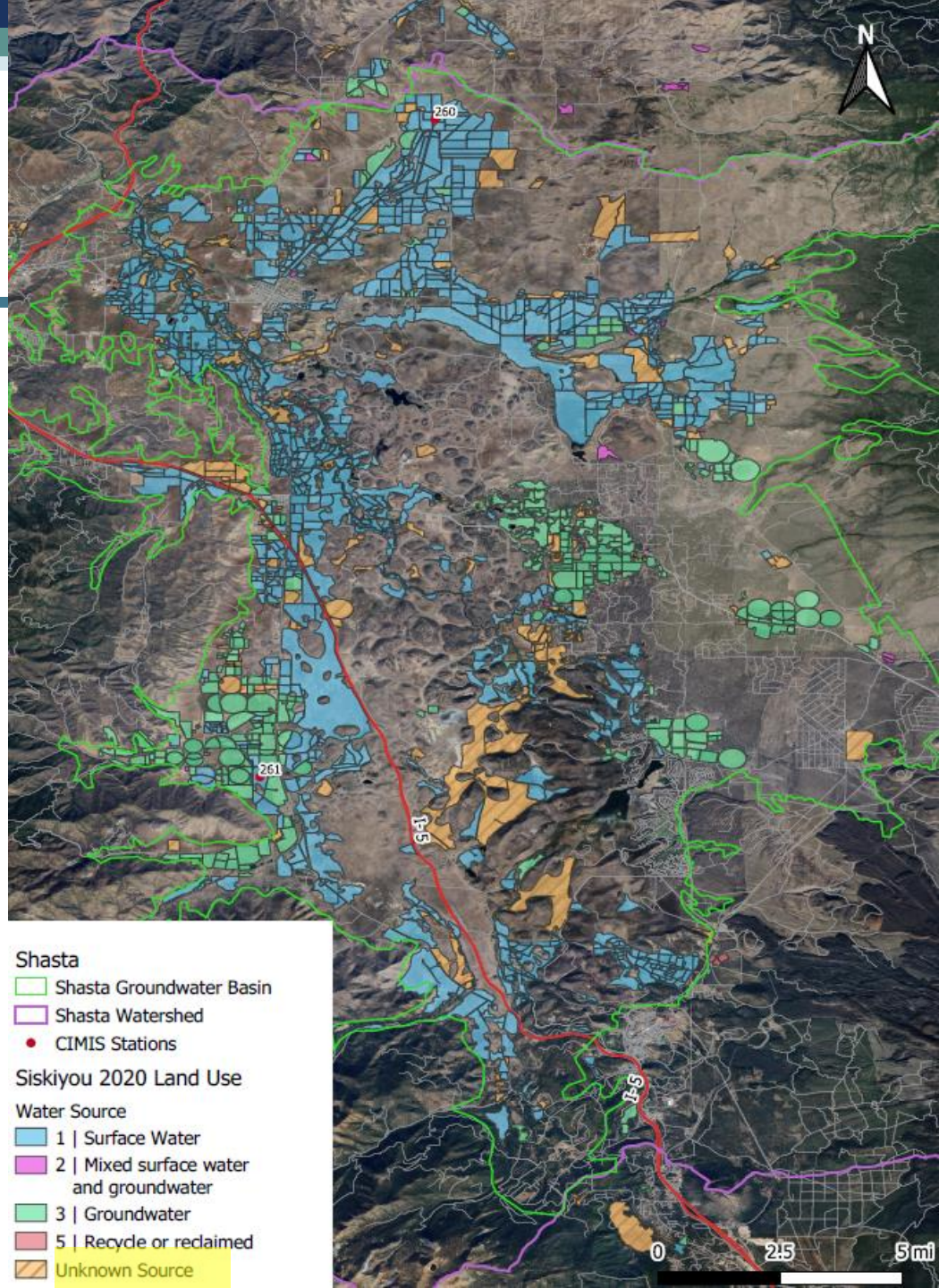
- Data gaps in the 2020 County Land Use Survey – water source
  - Assume surface water?

2010 Shasta Land Use – Water source

Water Source	Acres	Percentage
Surface water	49,827	78.9%
Mixed SW & GW	175.8	0.3%
Groundwater	12,933	20.7%
Recycled	52.3	0.1%
Total	62,988	100.0%

2020 Shasta Land Use – Water source

Water Source	Acres	Percentage
Surface water	36,218	64.3%
Mixed SW & GW	220.3	0.4%
Groundwater	10,906	19.4%
Recycled	51.8	0.1%
Unknown	8,974	15.9%
Total	56,371	100.0%



Next Steps

Update PRMS recharge and incorporate into MODFLOW

Finalize soil-water-budget pumping estimate

Calibrate hydraulic parameters

Implementation Grant Funded Projects

SGMA Compliance and GSP Updates

Fee Study and Economic Analysis

Well Inventory

GW/SW Connectivity Study

Upland Management

Implementation Approach

- Work group formation
- Work groups will oversee project design, progress, and evaluation of results
- Updates for each project will be provided to the larger group at quarterly advisory committee meetings

Timeline

2023 Q3

- Formation of work groups in August AC Meetings
- Work groups approve draft project scope and schedule
- Final grant awards expected in September

2023 Q4

- October AC Meetings- review of final funding awards
- Detailed scope and schedule for funded projects provided to Advisory Committee

2024 Q1

- February AC Meetings- updates from project work groups, updates depend on individual project schedules
- SGMA Compliance- Annual Report for WY 2023

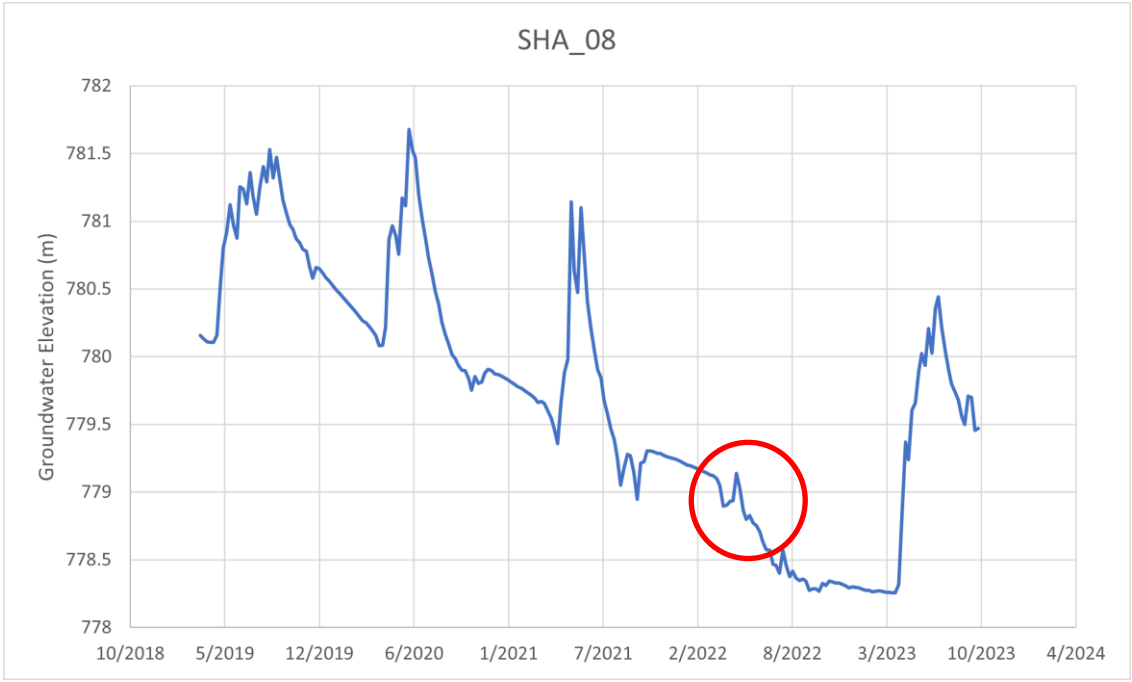
In Progress | Added to Backlog | Complete | Blocked

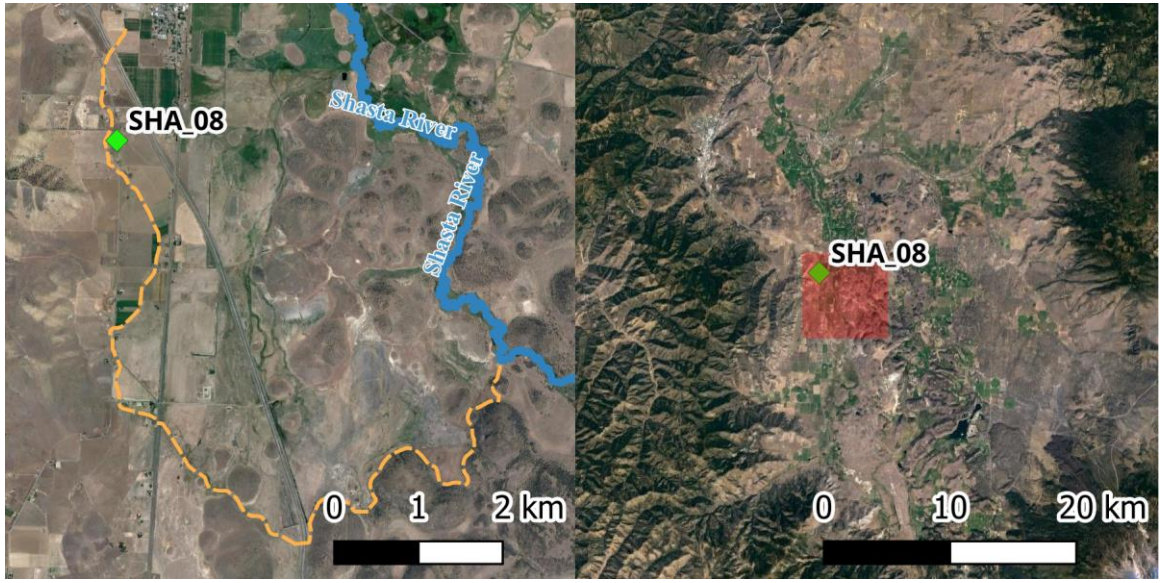
Implementation Grant Progress *Through February 2024*

#	Component	Notes	Status
1	**SGMA Compliance and GSP Updates**		
1.1	GSP Revisions	Due January 2027	In Progress
1.2	Reporting (Data and Annual Report)	Annual Reports due April 1 of each year	In Progress
1.3	Model Updates and Scenario Evaluation		In Progress
1.4	Data Gaps and Monitoring Expansion and DMS		In Progress
2	**Fee Study and Economic Analysis**		
2.1	Evaluation of Fee/Rate Options and Schedule Development		Not Started
2.2	Parcel scale groundwater use estimate		In Progress
2.3	Economic Analysis		Not Started
3	**Well Inventory**		
3.1	Database Development and Well Risk Assessment		In Progress
3.2	Monitoring Well Construction or Well Instrumentation		Not Started
4	**Groundwater-Surface Water Connectivity Study**		
4.1	Monitoring and data analysis	Identify new wells, install stream gauges, pumping tests	In Progress
5	**Upland Management**		
5.1	Project Planning and Environmental Documentation	Develop workplan	Not Started
5.2	Monitoring Design, Data Collection, and Data Analysis	Assess monitoring needs,	Not Started

Potential groundwater recharge projects: why to implement those?

- Well SHA_08
- No seasonal spike on 2022
- Likely due to dry irrigation ditch





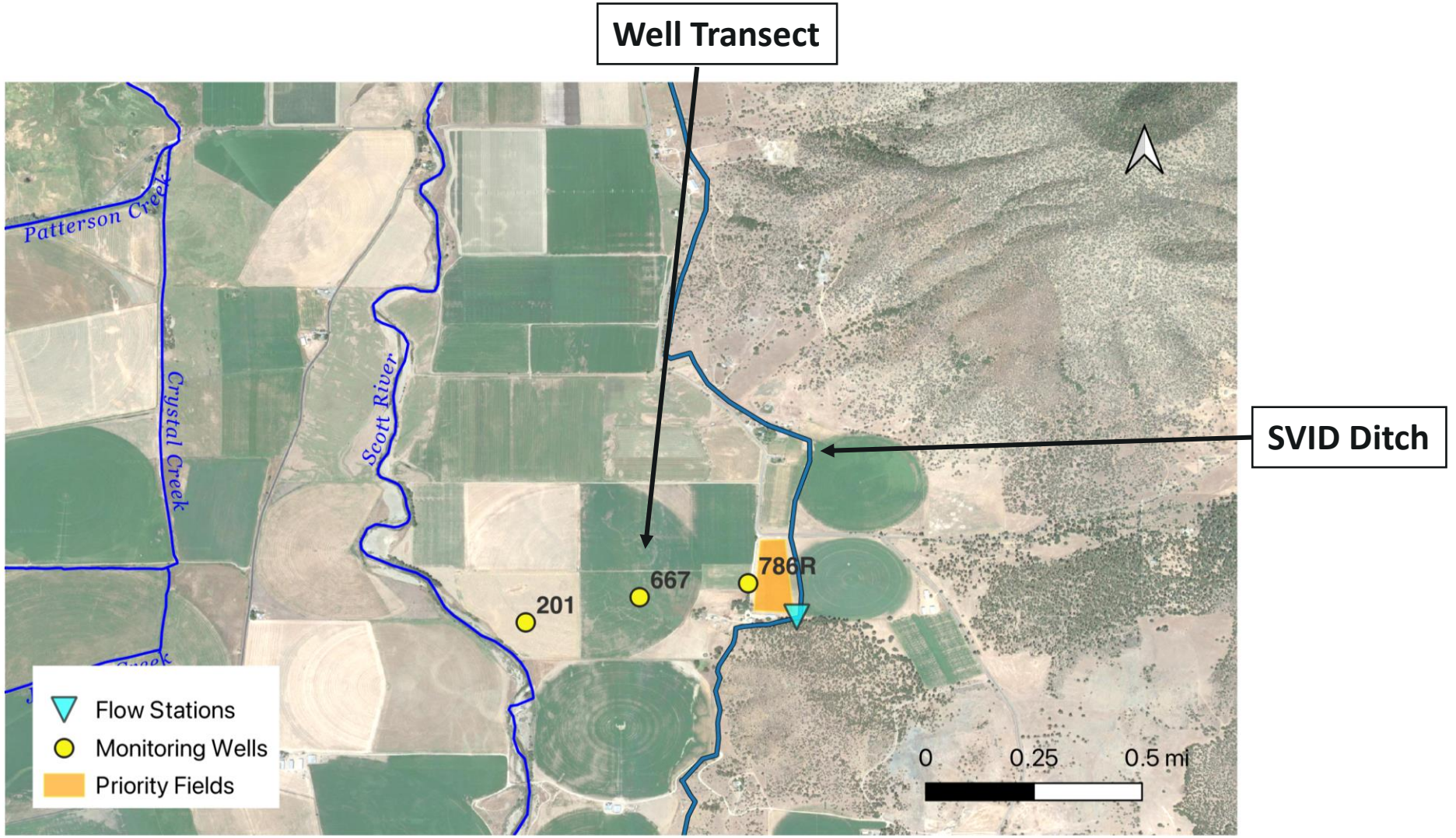
Potential Benefits

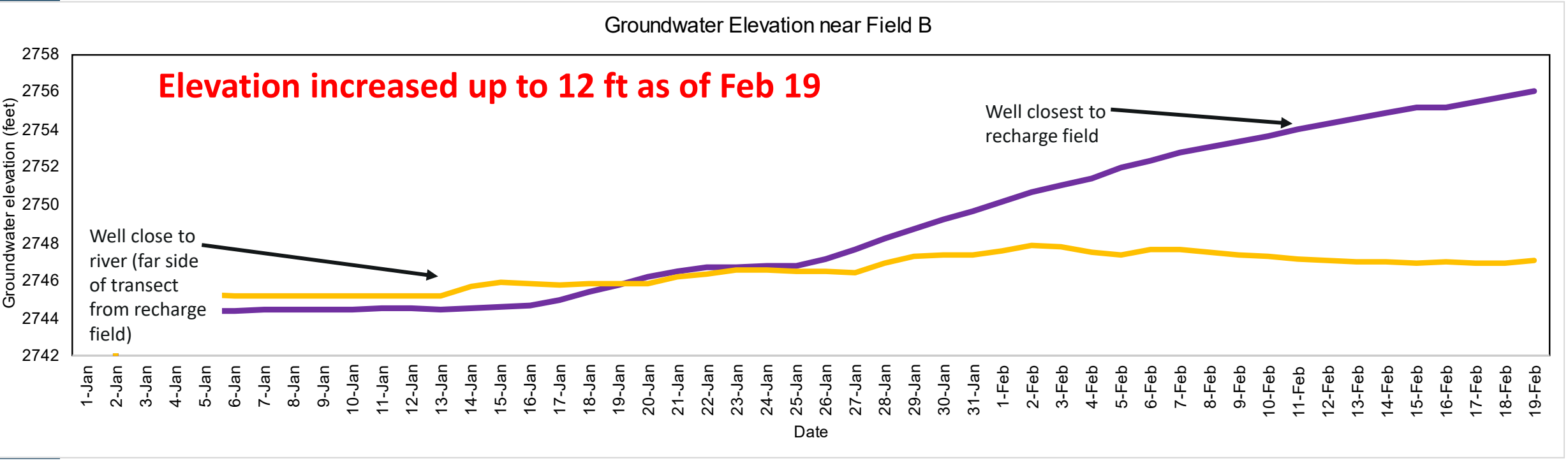
- Utilize water during periods of high flow (winter months) to:
  - Support groundwater resources in the Basin/ drought resiliency
  - Augment instream flows, particularly in critical summer and fall months

- Example: Scott Valley Irrigation District Recharge Project

Lesson learned from SVID Recharge Project

Continuous data snapshot at Field B




Groundwater Elevation near Field B
Elevation increased up to 12 ft as of Feb 19
Well closest to recharge field
Well close to river (far side of transect from recharge field)
Groundwater elevation (feet)
2758
2756
2754
2752
2750
2748
2746
2744
2742
1-Jan
2-Jan
3-Jan
4-Jan
5-Jan
6-Jan
7-Jan
8-Jan
9-Jan
10-Jan
11-Jan
12-Jan
13-Jan
14-Jan
15-Jan
16-Jan
17-Jan
18-Jan
19-Jan
20-Jan
21-Jan
22-Jan
23-Jan
24-Jan
25-Jan
26-Jan
27-Jan
28-Jan
29-Jan
30-Jan
31-Jan
1-Feb
2-Feb
3-Feb
4-Feb
5-Feb
6-Feb
7-Feb
8-Feb
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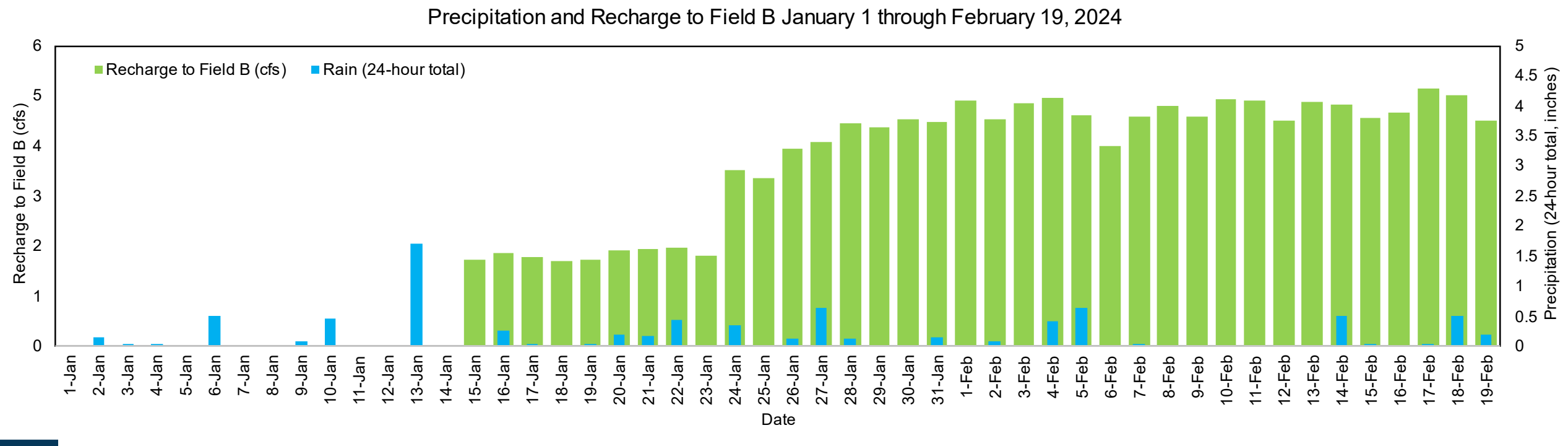
11-Feb
12-Feb
13-Feb
14-Feb
15-Feb
16-Feb
17-Feb
18-Feb
19-Feb
Date


Precipitation and Recharge to Field B January 1 through February 19, 2024
Recharge to Field B (cfs)
Rain (24-hour total)
Recharge to Field B (cfs)
6
5
4
3
2
1
0
Precipitation (24-hour total, inches)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1-Jan
2-Jan
3-Jan
4-Jan
5-Jan
6-Jan
7-Jan
8-Jan
9-Jan
10-Jan
11-Jan
12-Jan
13-Jan
14-Jan
15-Jan
16-Jan
17-Jan
18-Jan
19-Jan
20-Jan
21-Jan
22-Jan
23-Jan
24-Jan
25-Jan
26-Jan
27-Jan
28-Jan
29-Jan
30-Jan
31-Jan
1-Feb
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16-Feb
17-Feb
18-Feb
19-Feb
Date

SVID Recharge Project: 2024 Progress

Modelled Benefits- Streamflow Depletion Reversal

Scenario Type	Scenario ID	Scenario Depletion Reversal, Sep-Nov '91-'18 (TAF)	Relative Depletion Reversal, Sep-Nov '91-'18
	MAR (Managed Aquifer Recharge) in Jan-Mar	13	10%

Scenario depletion reversal (average/year) = **464 AF**

On-Farm Recharge so far:

2024 cumulative on-farm recharge ~ **247 AF**

Still need to consider:

1. Still need to consider the rest of the recharge period
2. Water recharged through ditch infiltration

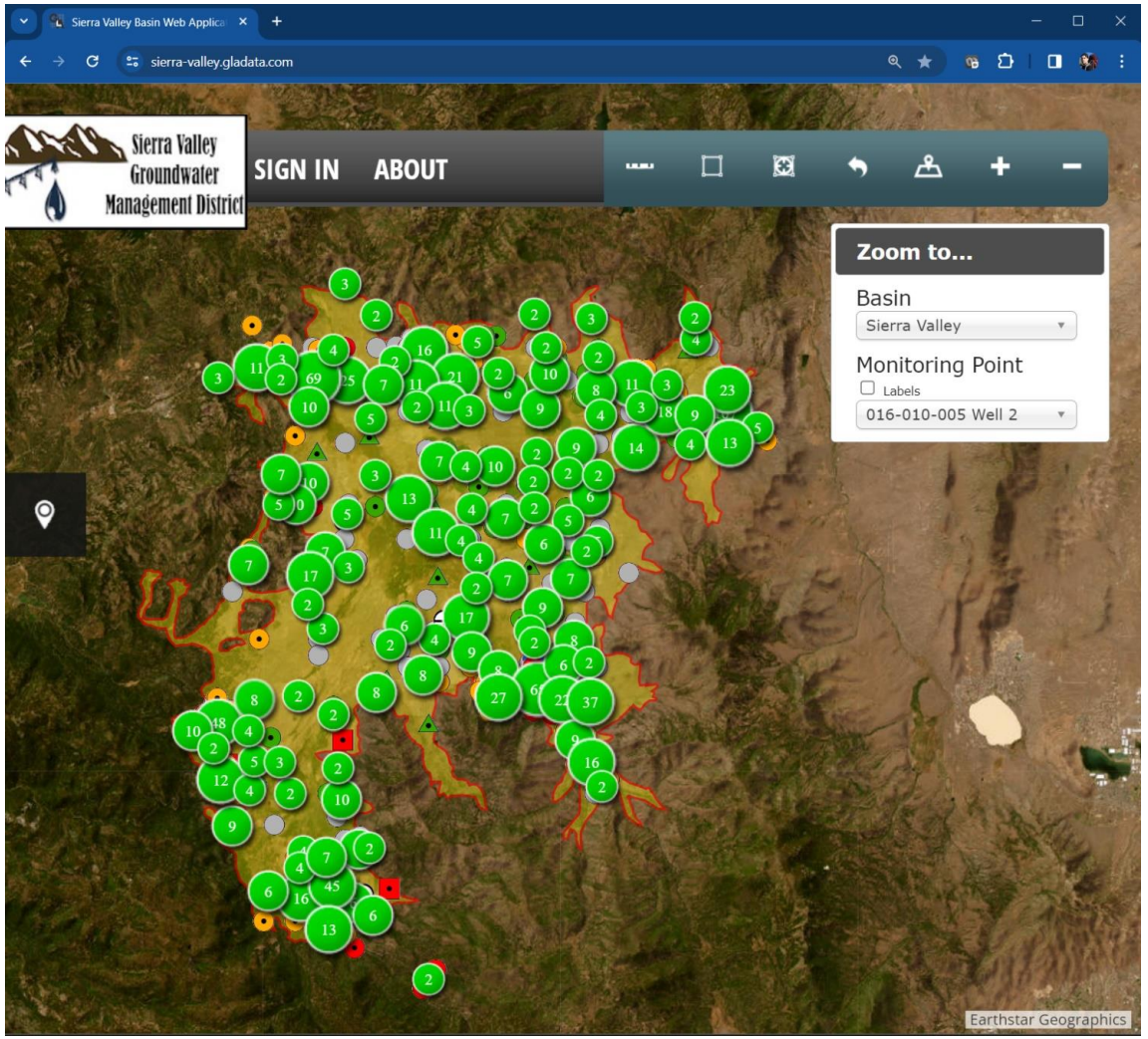
Total Volume Recharged in 2024 through SVID Recharge Project

SVIHM

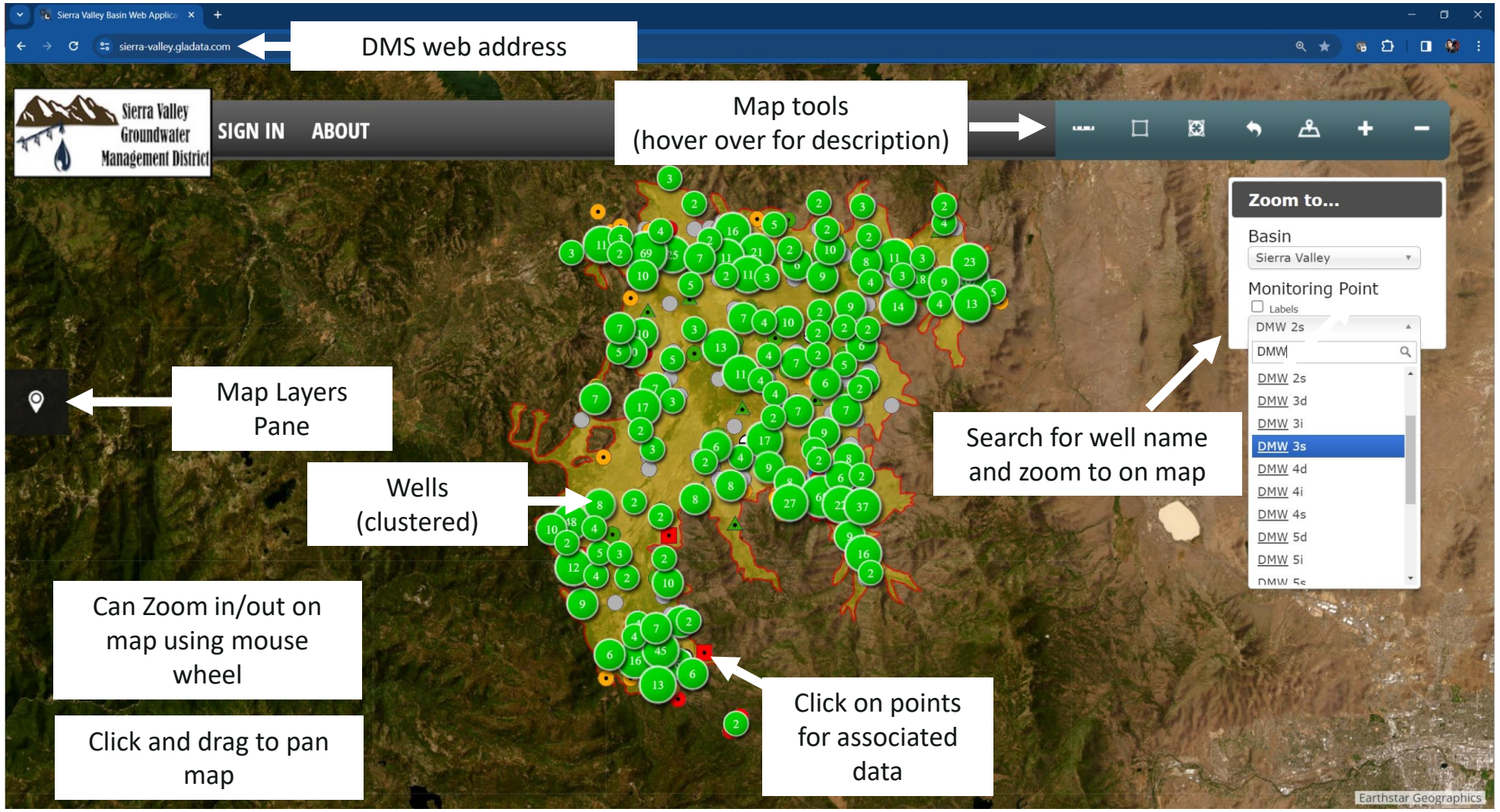
Depletion Reversal achieved in 2024 due to MAR

Data Management System (DMS)

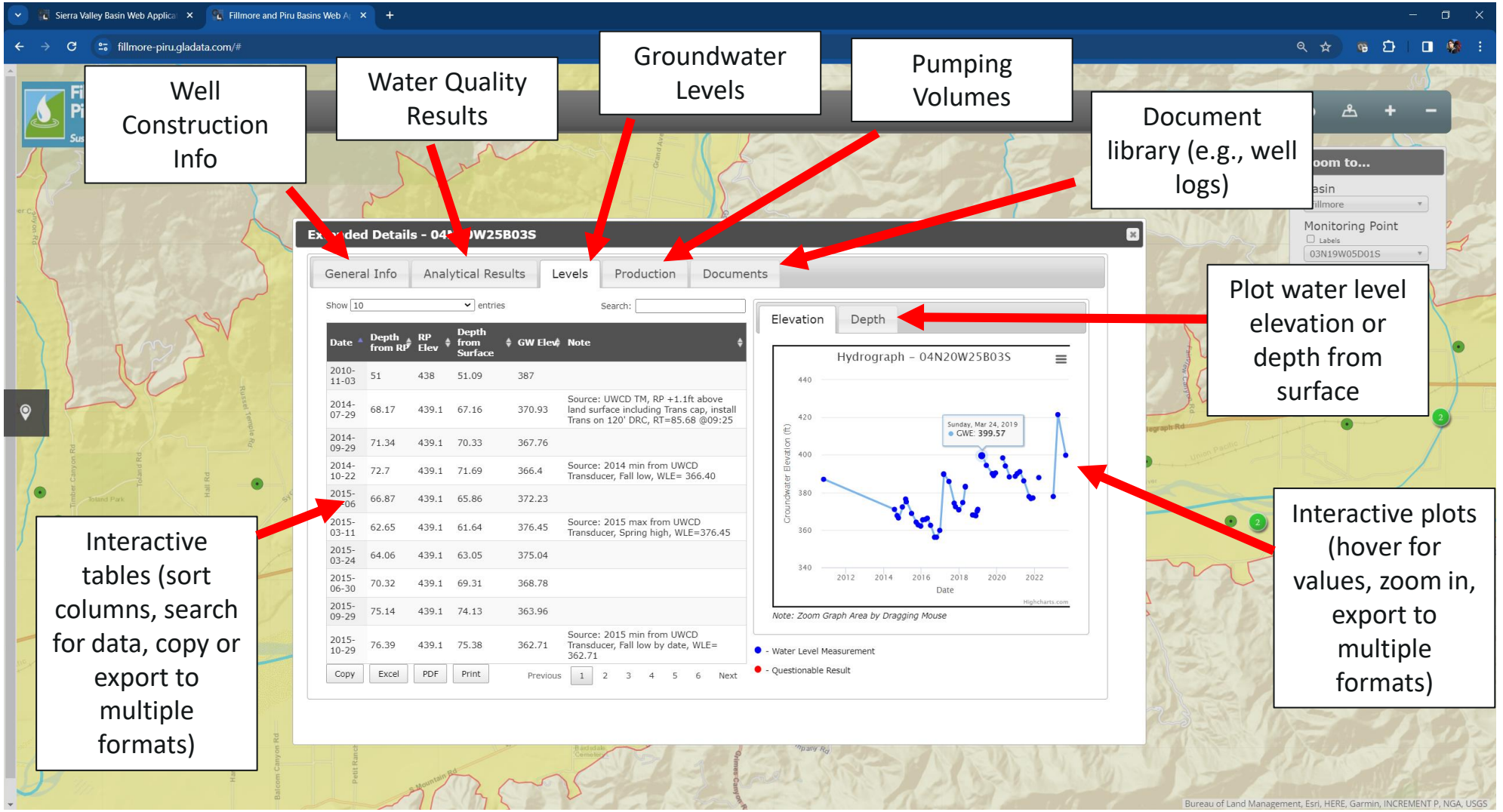
- Data SGMA DMS
- Automated management of reporting and monitoring data.
- Provides an effective and affordable option for storing, visualizing, and managing basin data.
- Web accessible, map-based user interface (front end).
- SQL-server relational database (backend).



Data Management System (DMS)



Data Management System (DMS)



Data Management System (DMS)

Active Data SGMA DMS

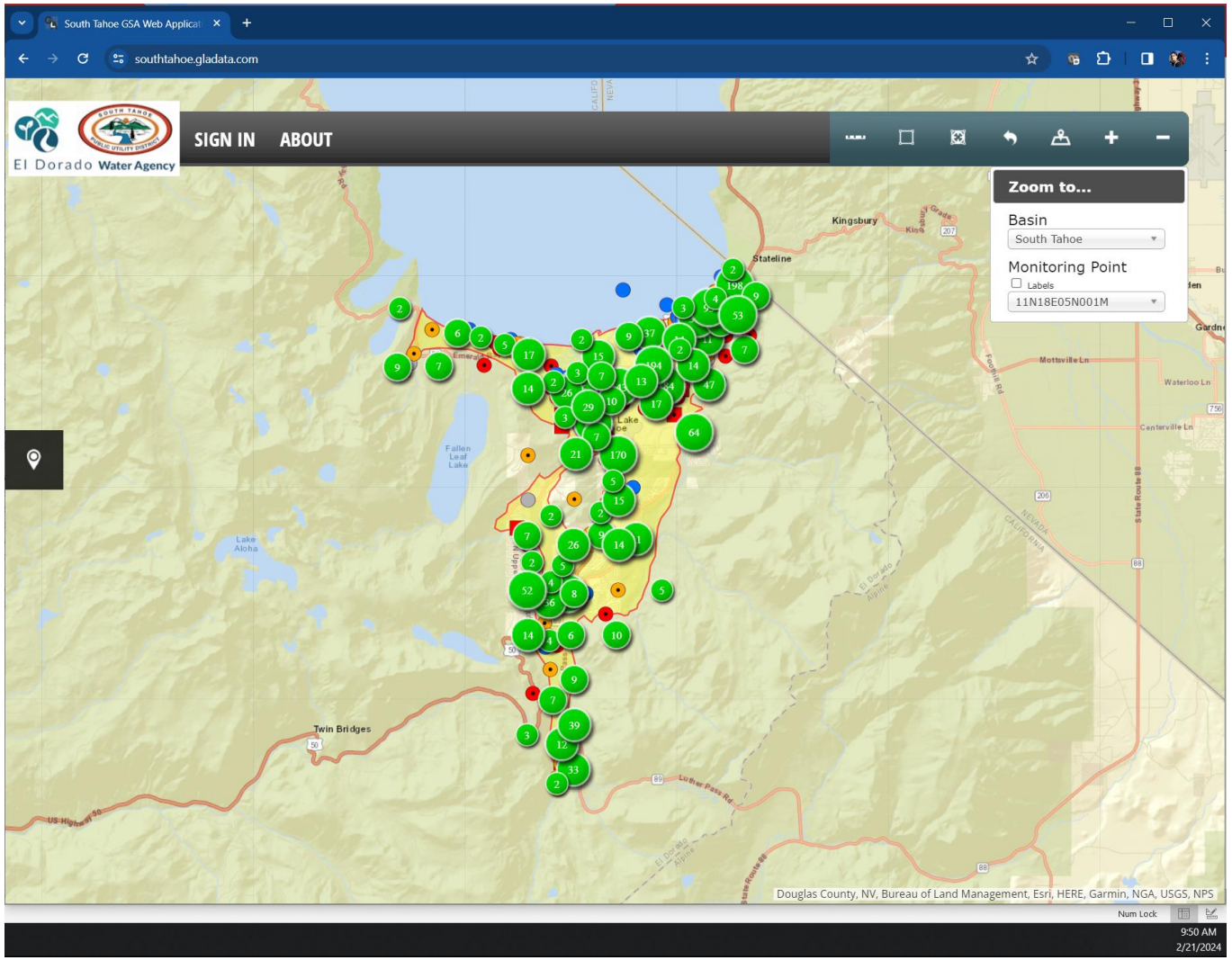
https://sierra-valley.gladata.com

https://fillmore-piru.gladata.com

https://owens.gladata.com

https://bigvalley.gladata.com

https://southtahoe.gladata.com



Upcoming Irrigation Efficiency Workshop

- “Workshop on Efficient Water Management for Forage Crops”
- Wednesday March 13th, 1-5pm, Montague Community Hall
- UC Davis, UC ANR, Tehama County RCD, LWA, Siskiyou County, Tulelake Irrigation District
- Free Registration: https://mailchi.mp/181f31fc2c0f/march13

Thank You