

Appendices

Appendix A Hydrographs of RMP Wells in the Sierra Valley Groundwater Basin

Appendix B Timeseries of Water Quality Analyses in the Sierra Valley Groundwater Basin

Appendix C Outreach Materials: Plumas-Sierra County Fair Outreach Materials

Appendix D Outreach Materials: Well Sounder Flyer

Appendix E Outreach Materials: Guide to Measuring Depth to Groundwater

Appendix A

Hydrographs of RMP Wells in the Sierra

Valley Groundwater Basin

Well 12: 395808N1203851W001

Sierra Valley Groundwater Basin, Plumas County, CA

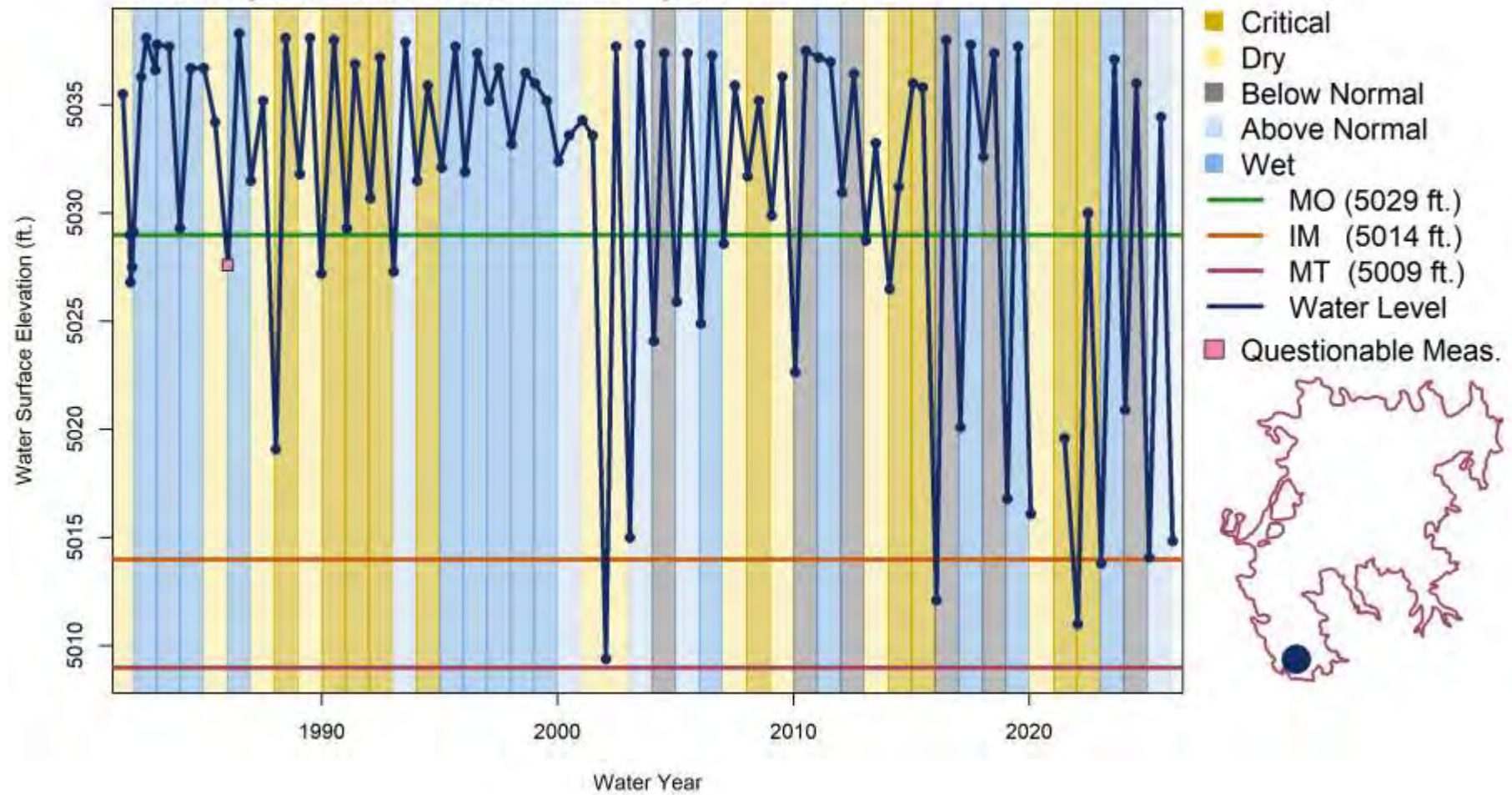


Figure A- 1

Well 31: 396391N1203667W001

Sierra Valley Groundwater Basin, Plumas County, CA

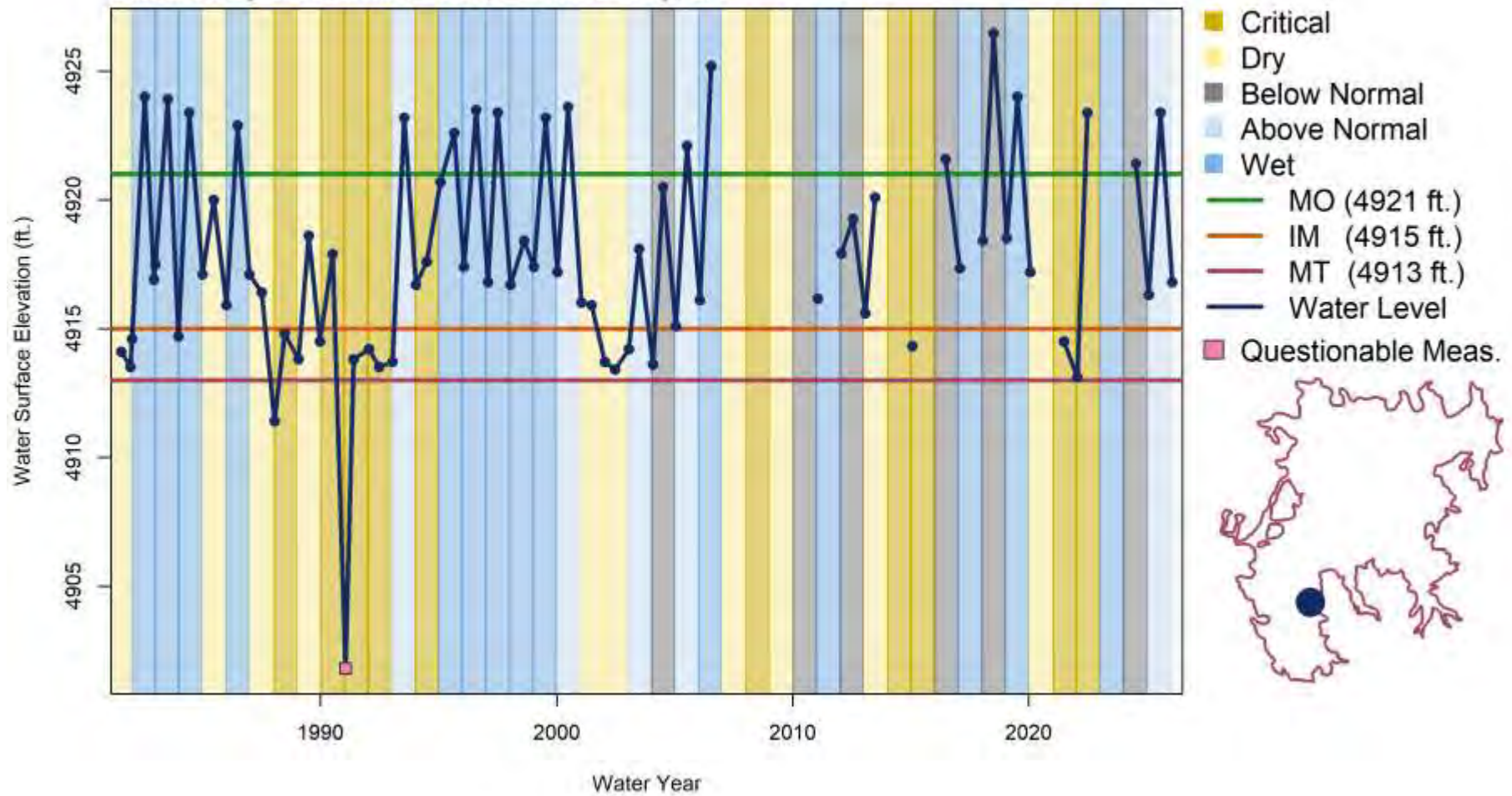


Figure A- 2

Well 43: 396970N1202916W001

Sierra Valley Groundwater Basin, Plumas County, CA

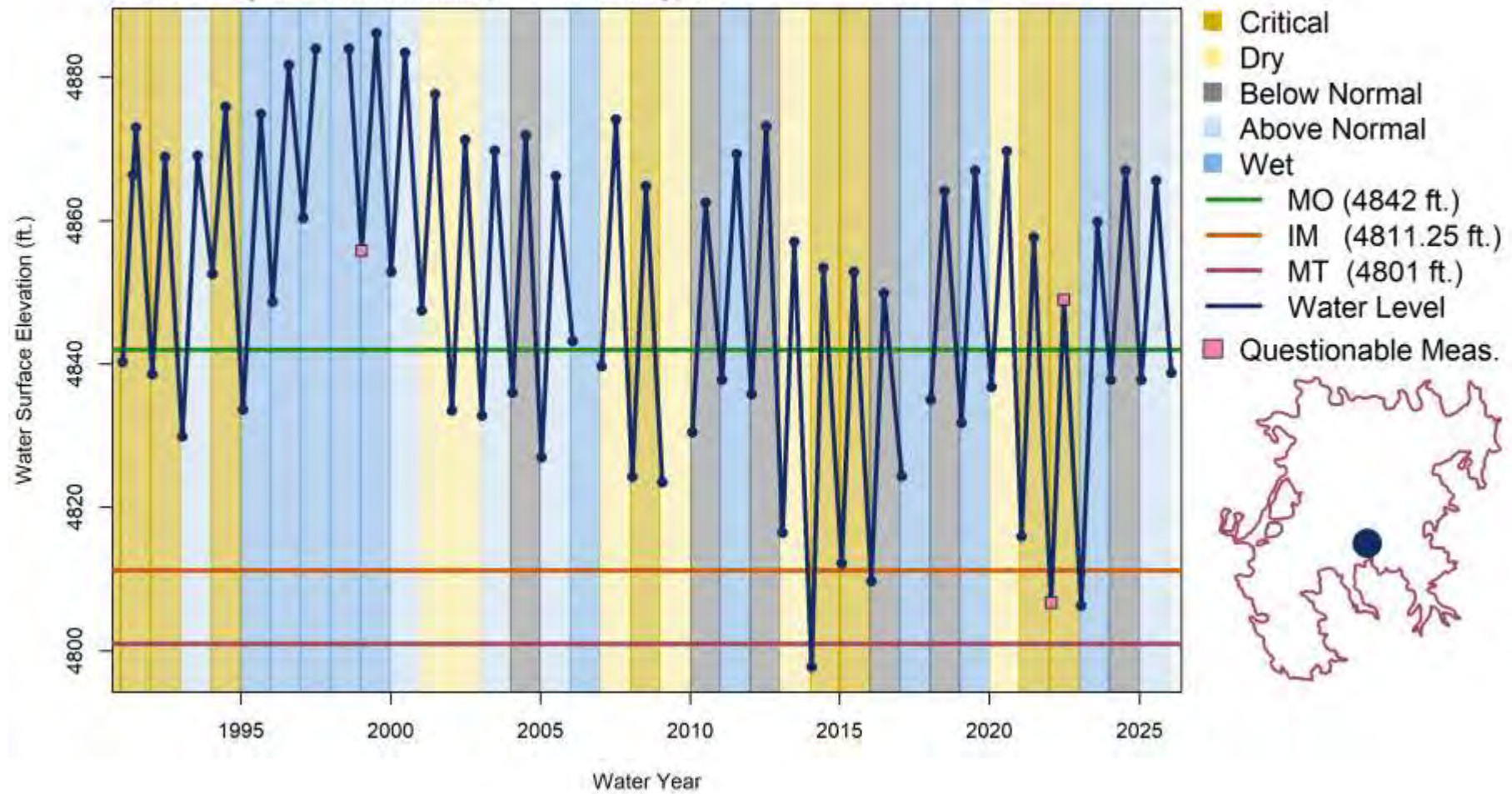


Figure A- 3

Well 56: 396814N1202407W001

Sierra Valley Groundwater Basin, Plumas County, CA

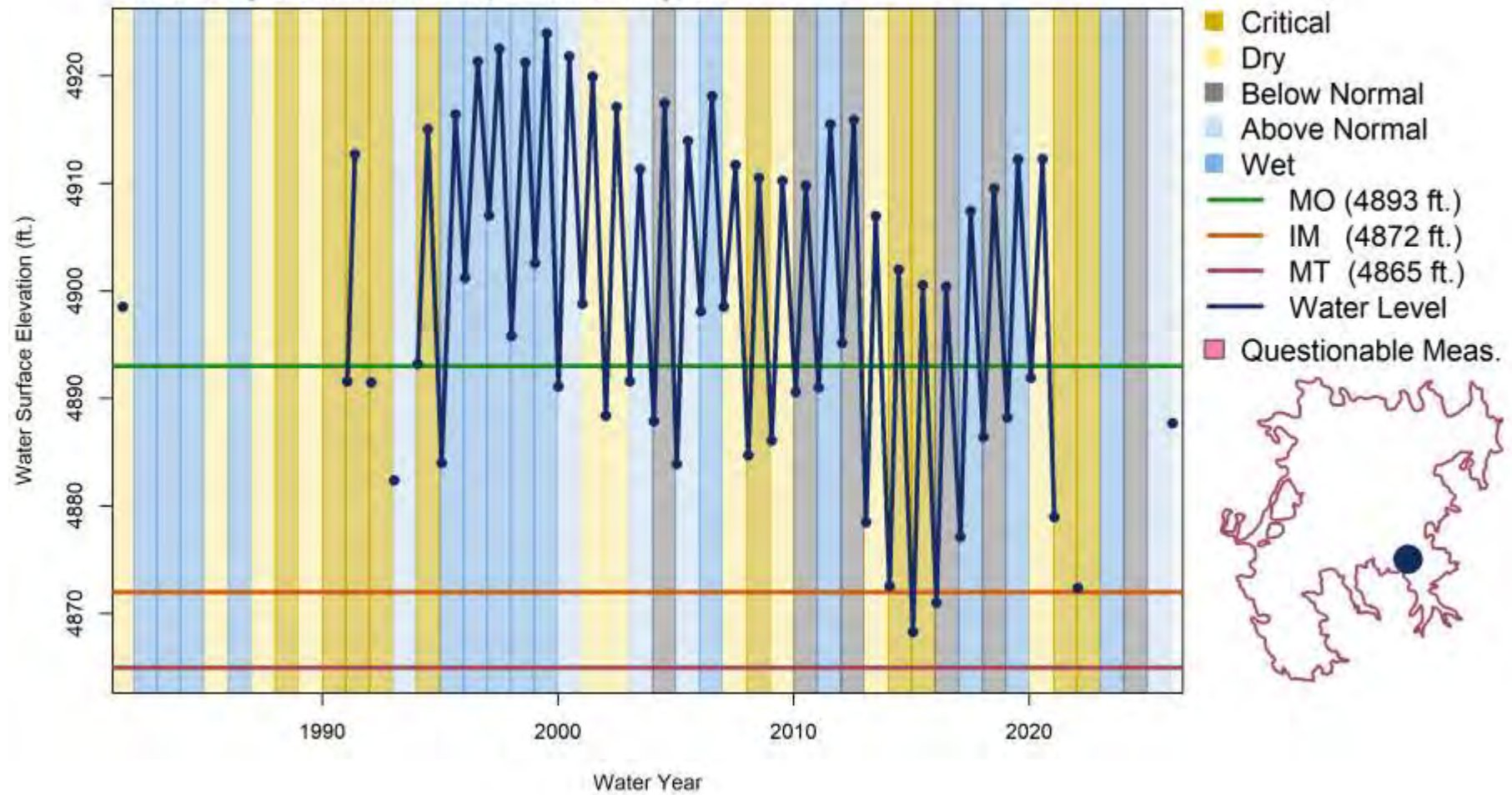


Figure A- 4

Well 67: 396934N1202234W001

Sierra Valley Groundwater Basin, Plumas County, CA

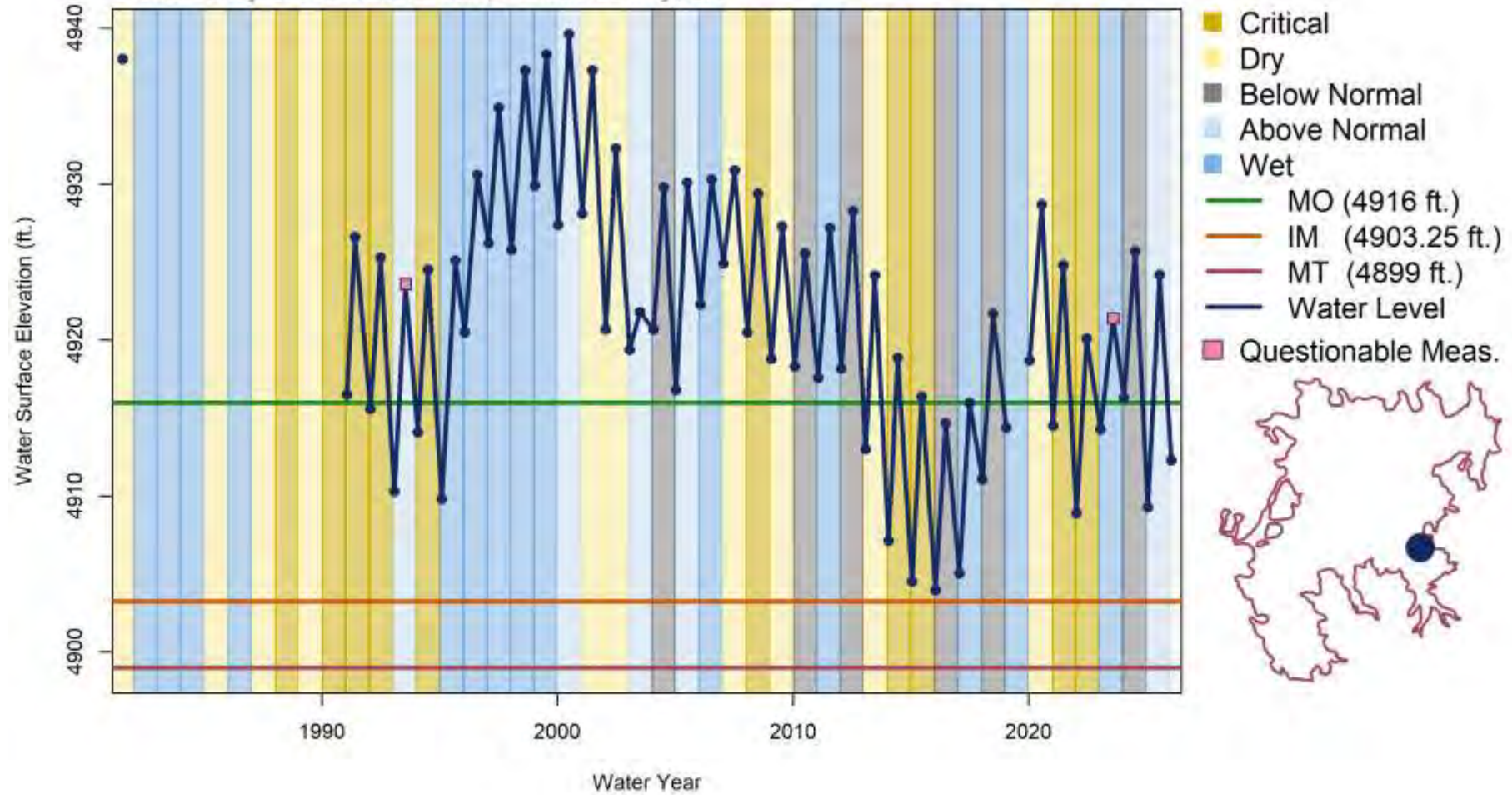


Figure A- 5

Well 70: 396864N1202299W001

Sierra Valley Groundwater Basin, Plumas County, CA

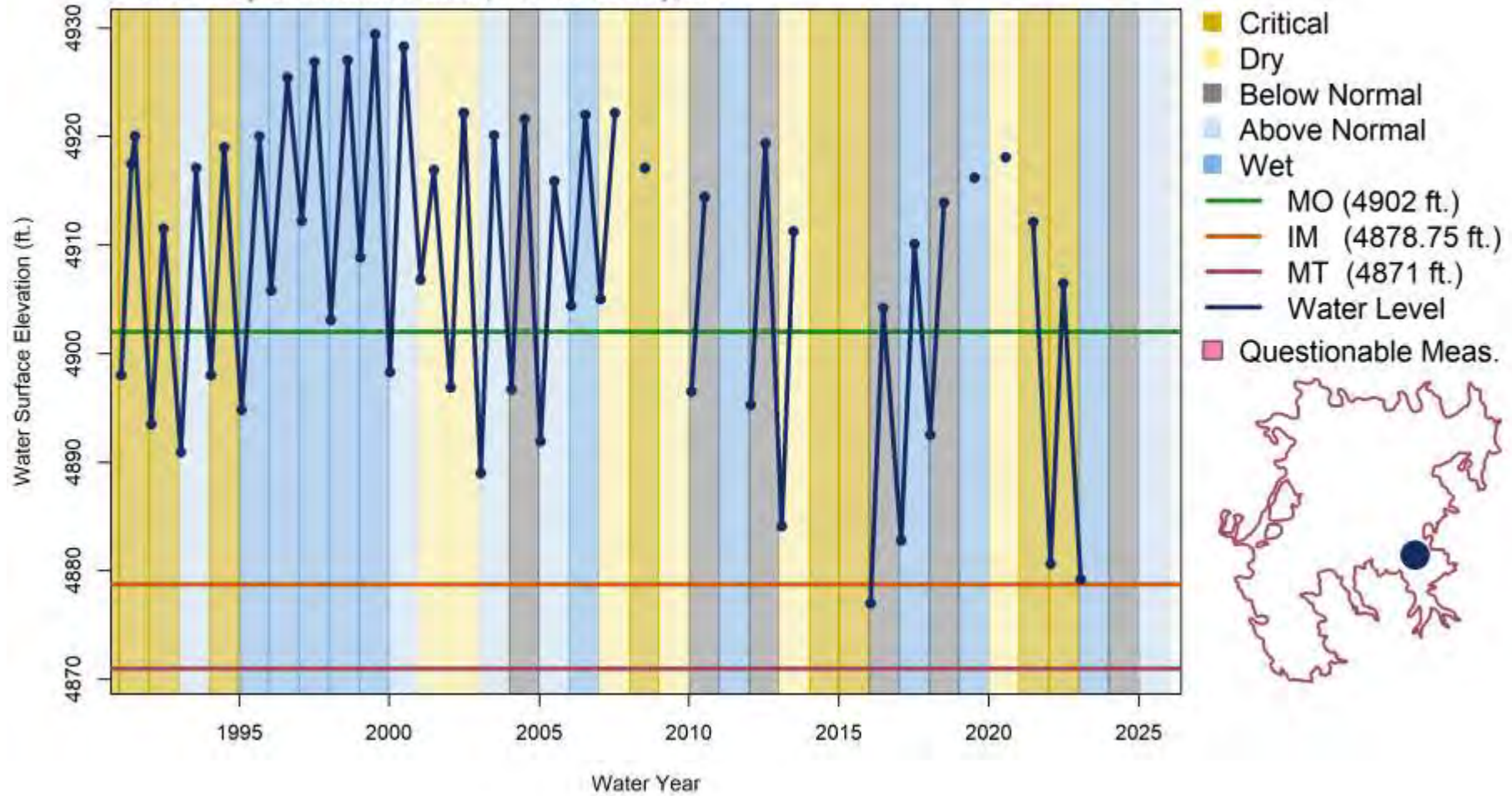


Figure A- 6

Well 73: 396744N1202282W001

Sierra Valley Groundwater Basin, Plumas County, CA

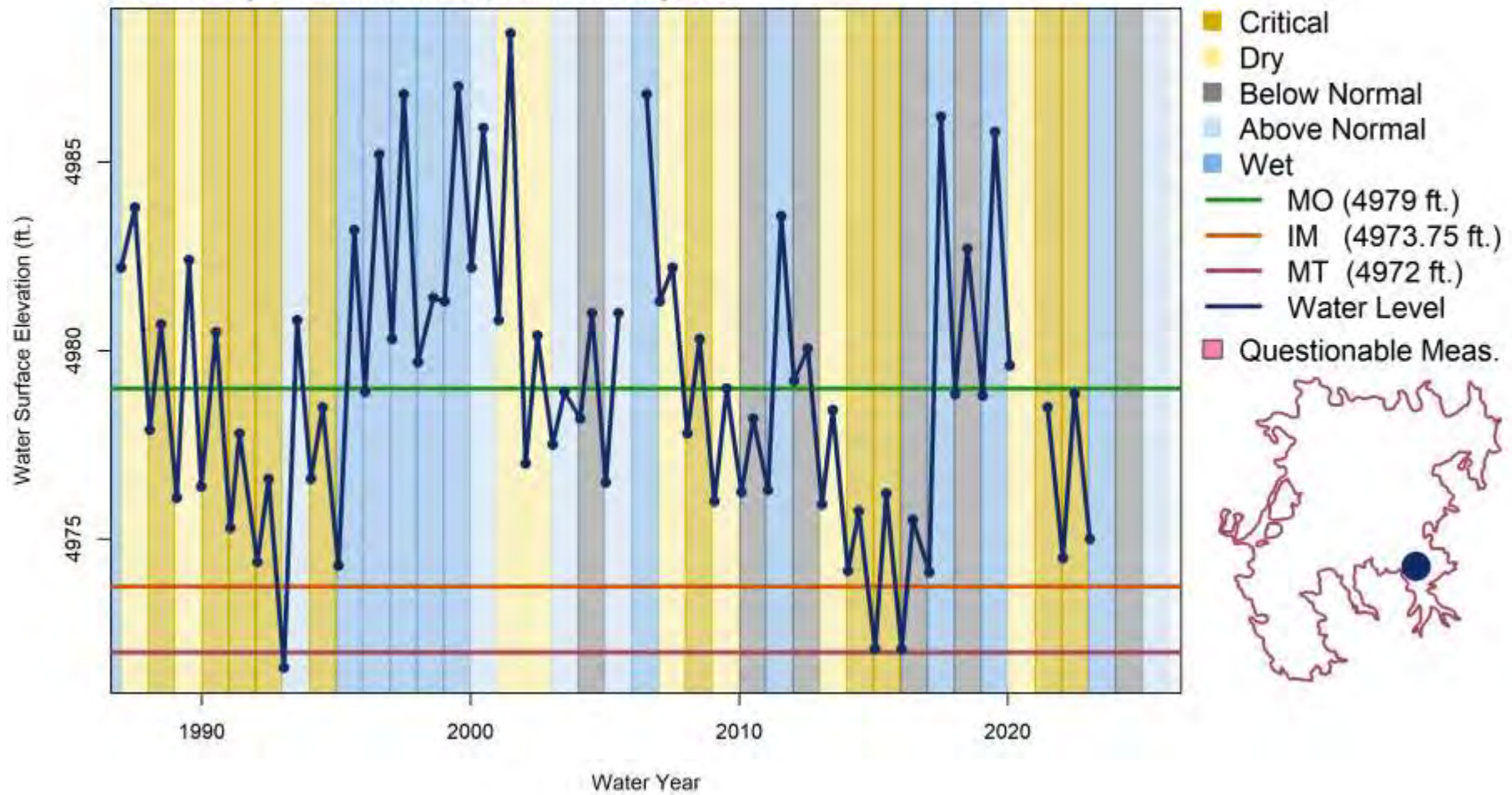


Figure A- 7

Well 78: 396599N1202229W001

Sierra Valley Groundwater Basin, Plumas County, CA

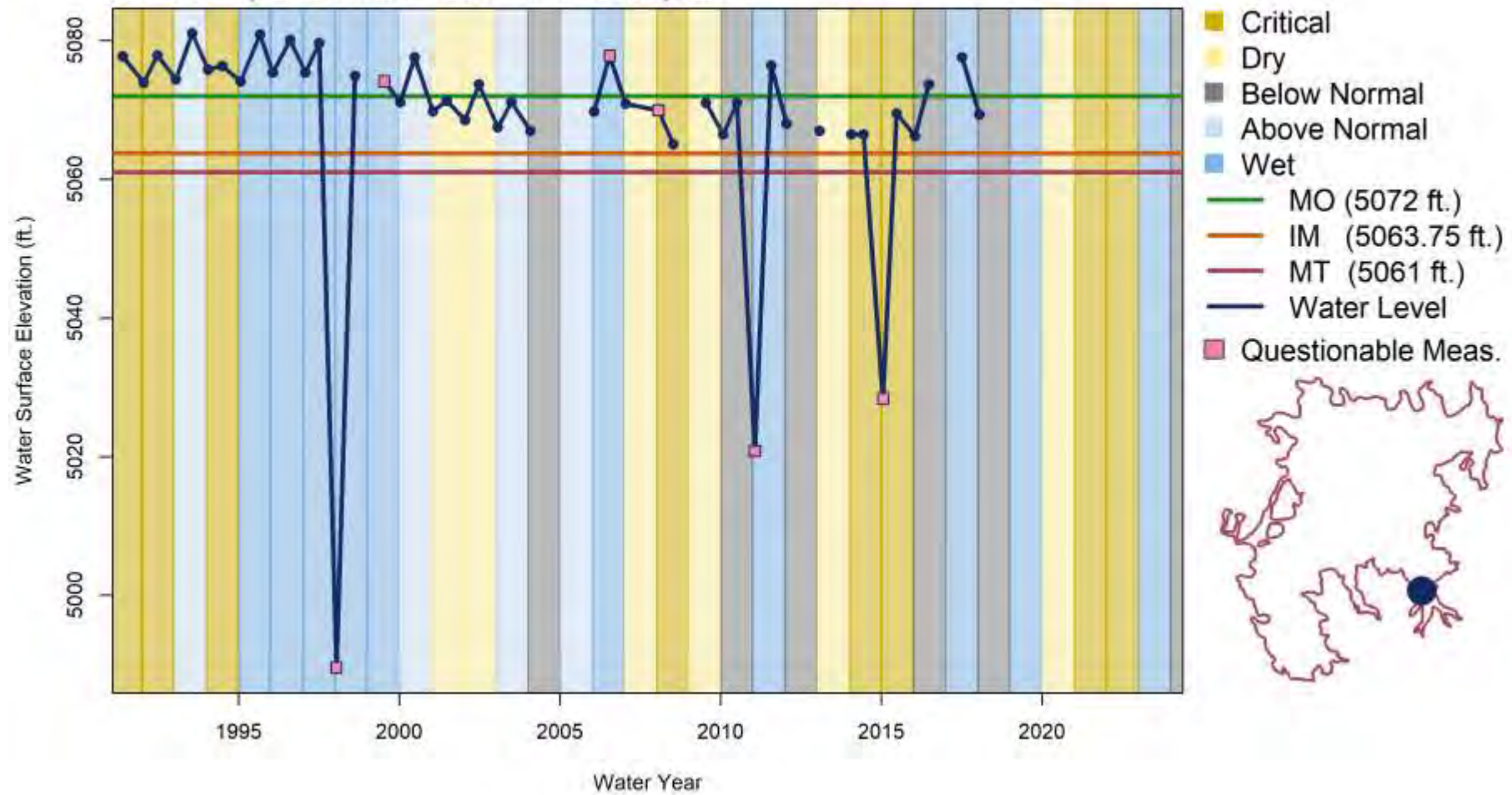


Figure A- 8

Well 93: 397667N1203238W001

Sierra Valley Groundwater Basin, Plumas County, CA

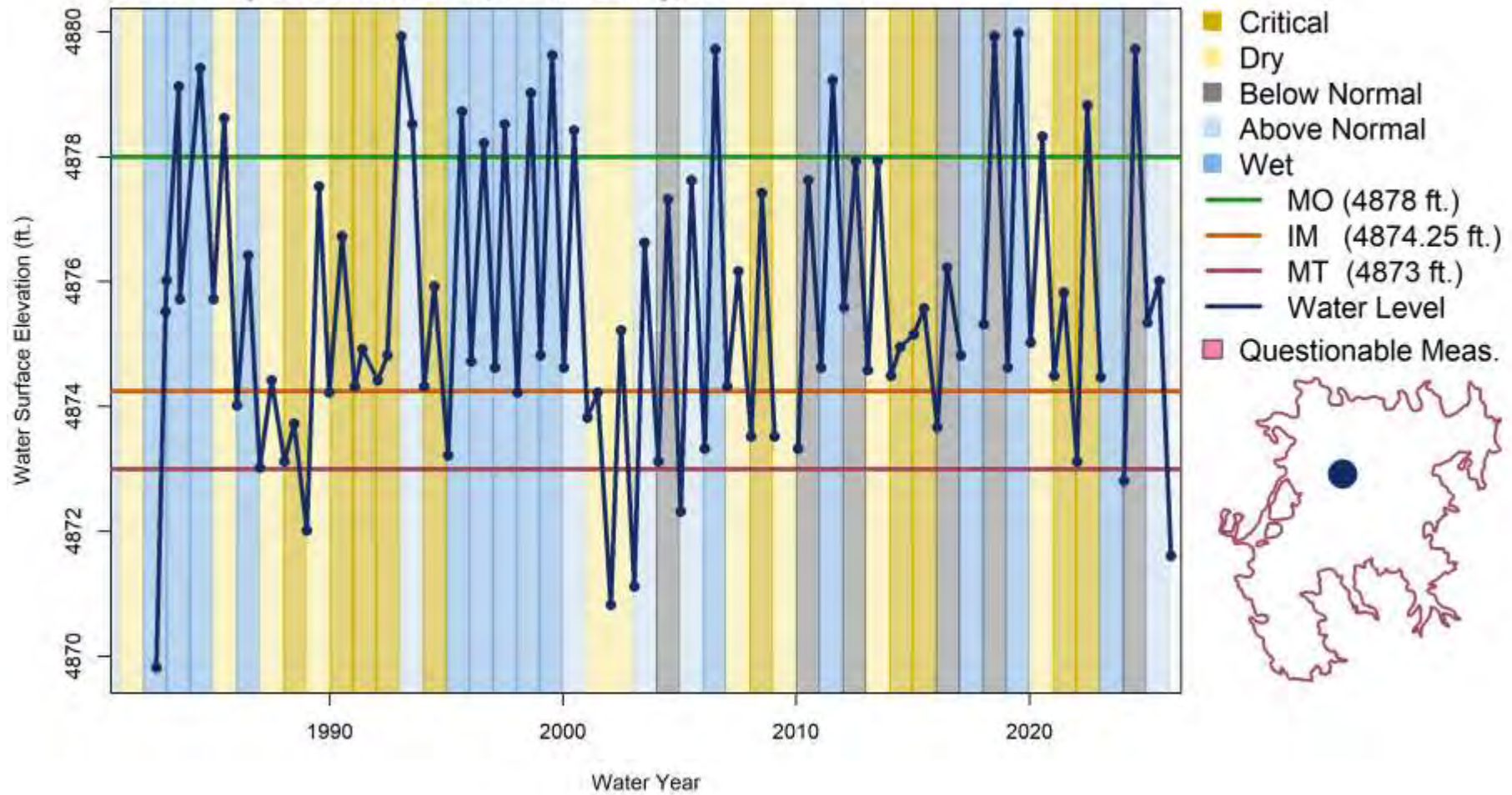


Figure A- 9

Well 94: 397808N1202893W001

Sierra Valley Groundwater Basin, Plumas County, CA

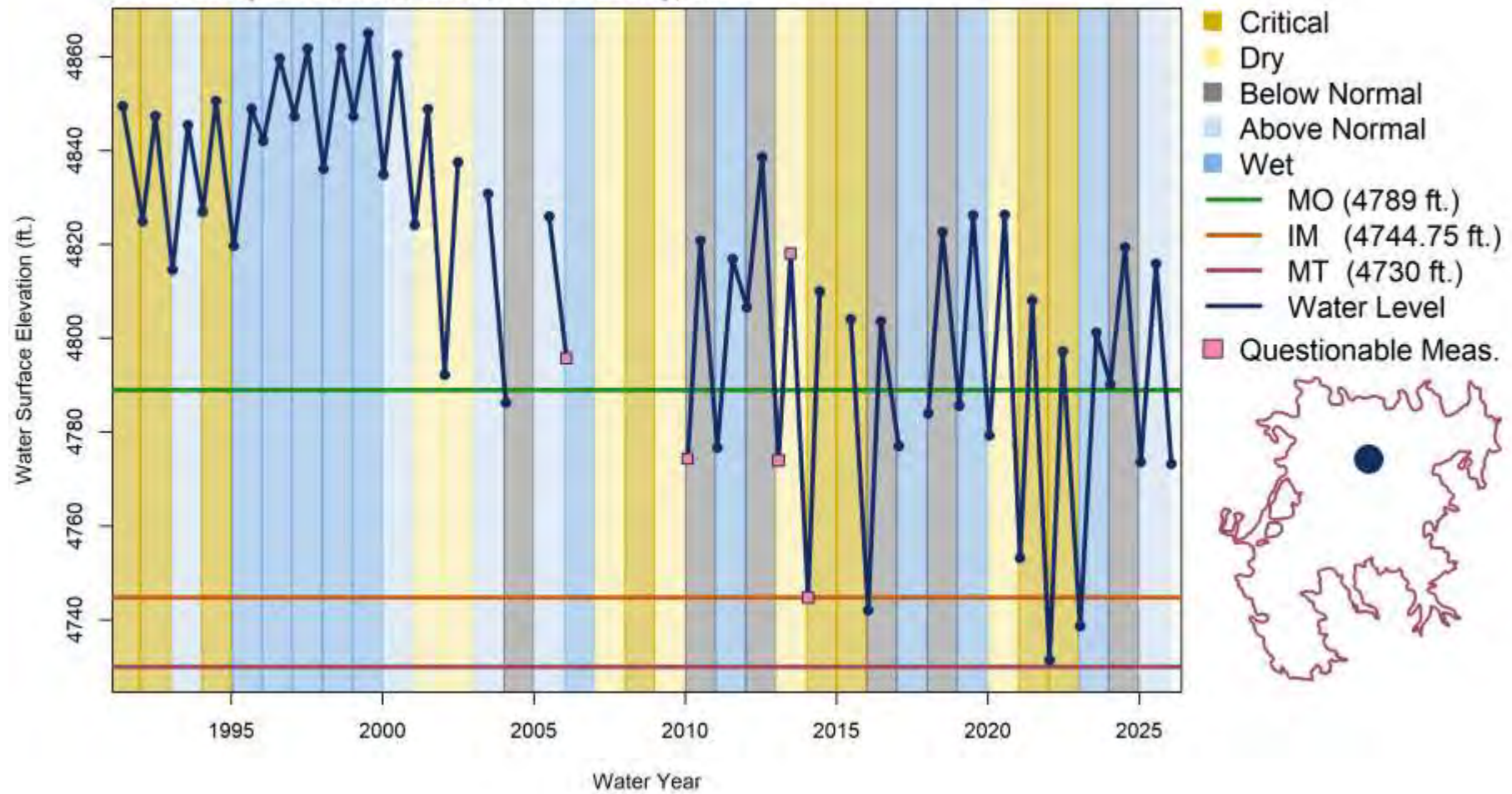


Figure A- 10

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Sierra Valley Groundwater Basin, Plumas County, CA

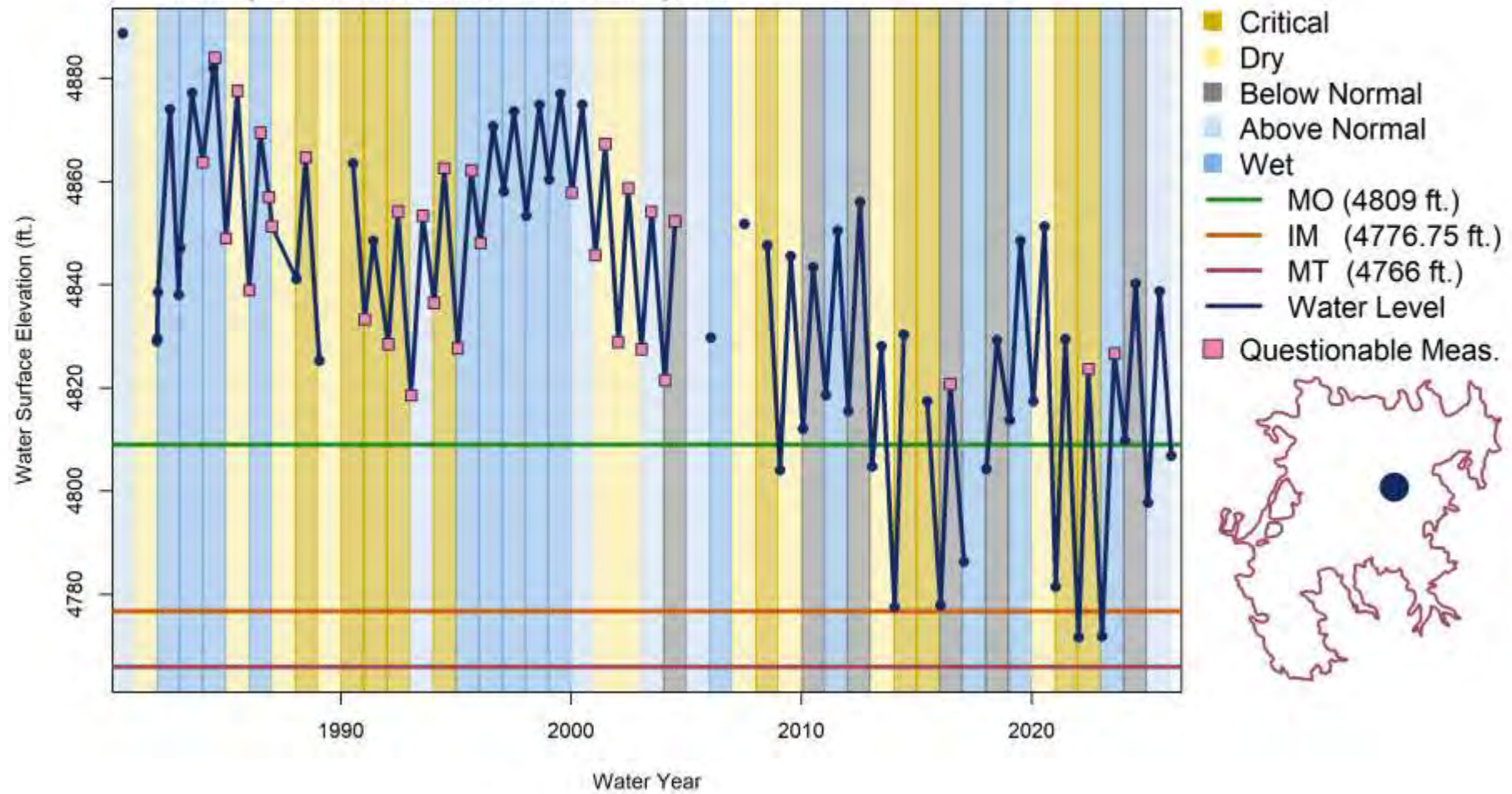


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Well 112: 397403N1202870W001

Sierra Valley Groundwater Basin, Plumas County, CA

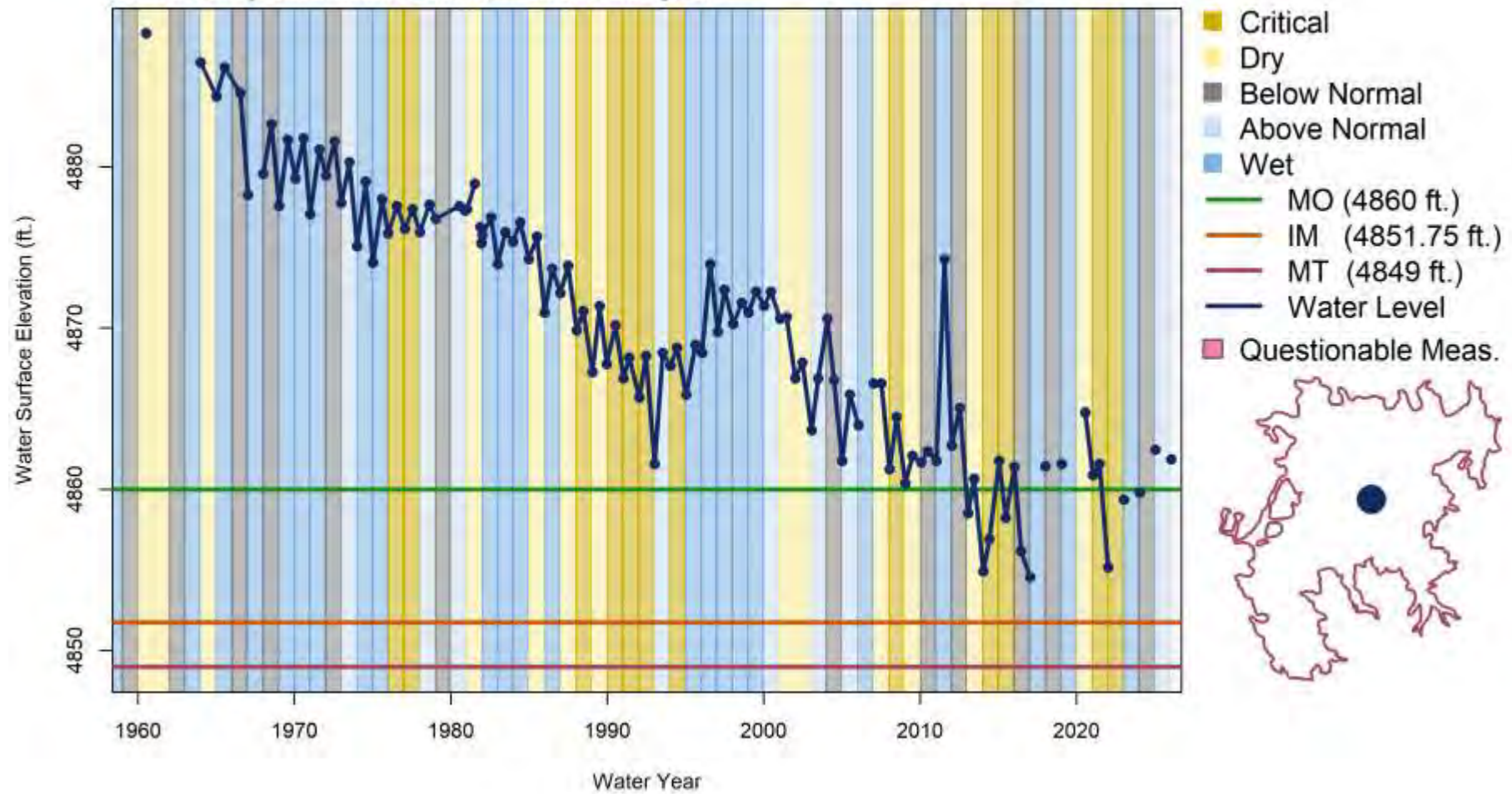


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Well 124: 397106N1202878W001

Sierra Valley Groundwater Basin, Plumas County, CA

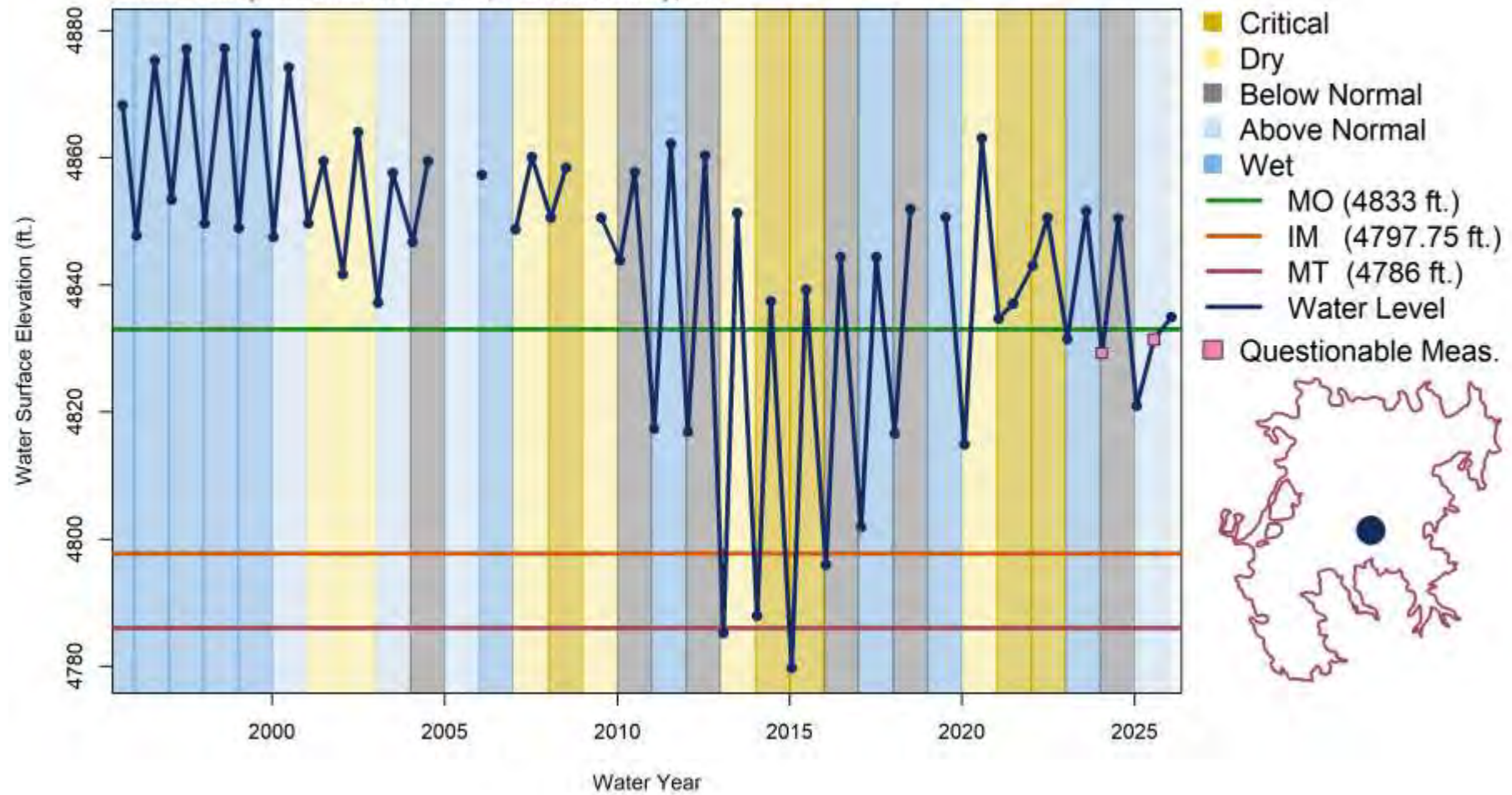


Figure A- 13

Well 130: 397081N1202449W001

Sierra Valley Groundwater Basin, Plumas County, CA

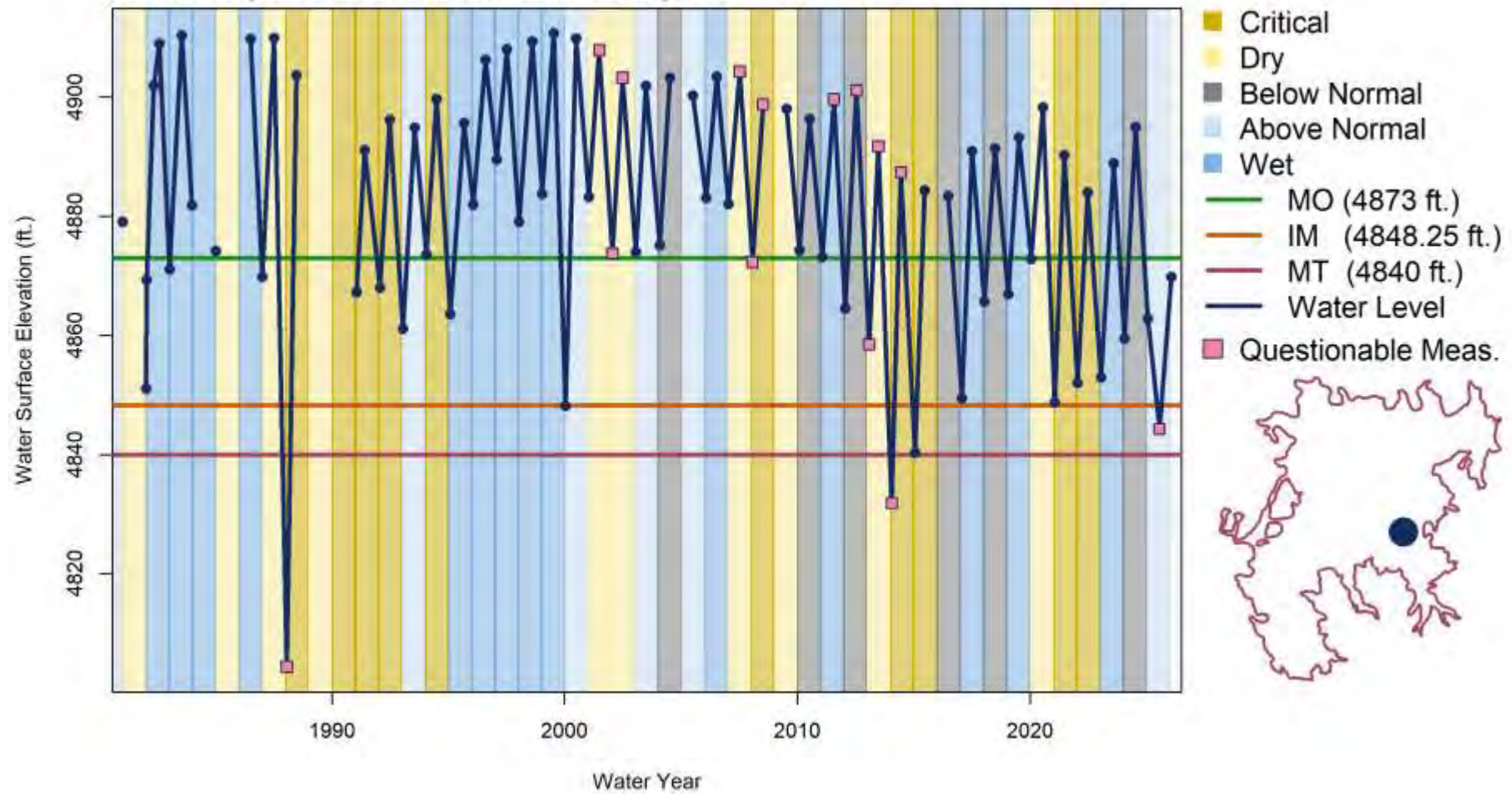


Figure A- 14

Well 131: 397927N1201294W001

Sierra Valley Groundwater Basin, Plumas County, CA

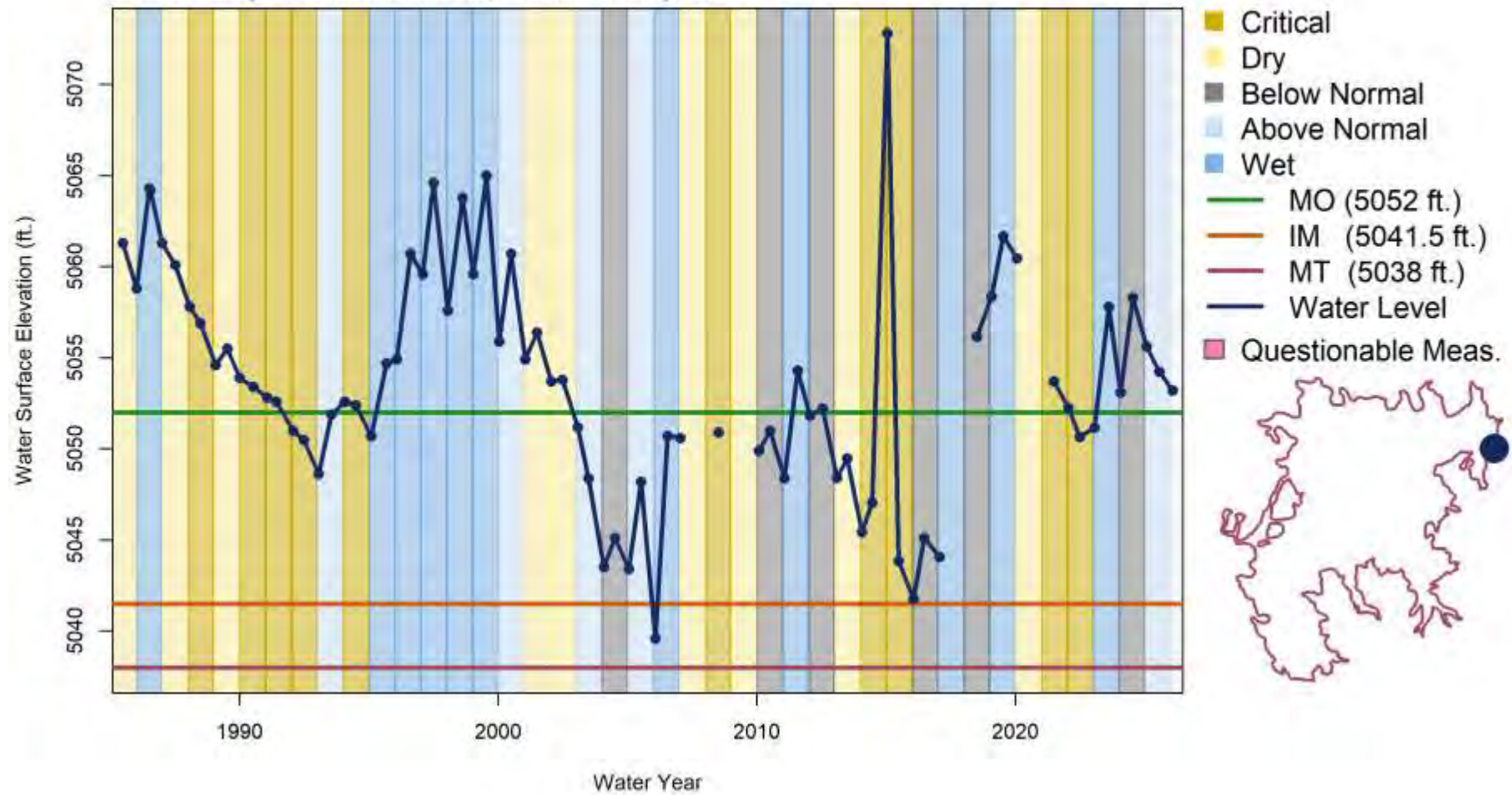


Figure A- 15

Well 132: 397945N1201920W001

Sierra Valley Groundwater Basin, Plumas County, CA

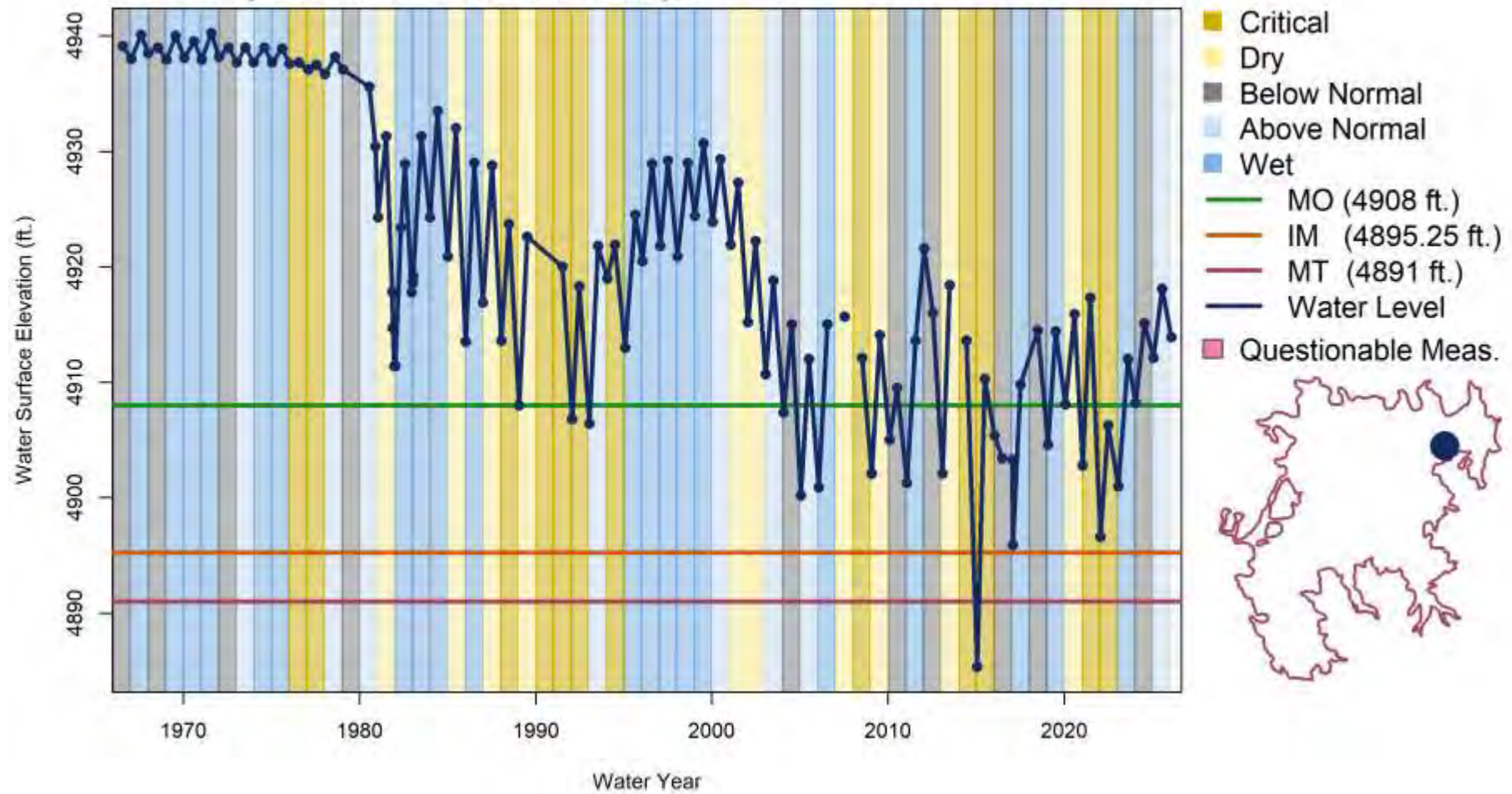


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Well 136: 397831N1202245W001

Sierra Valley Groundwater Basin, Plumas County, CA

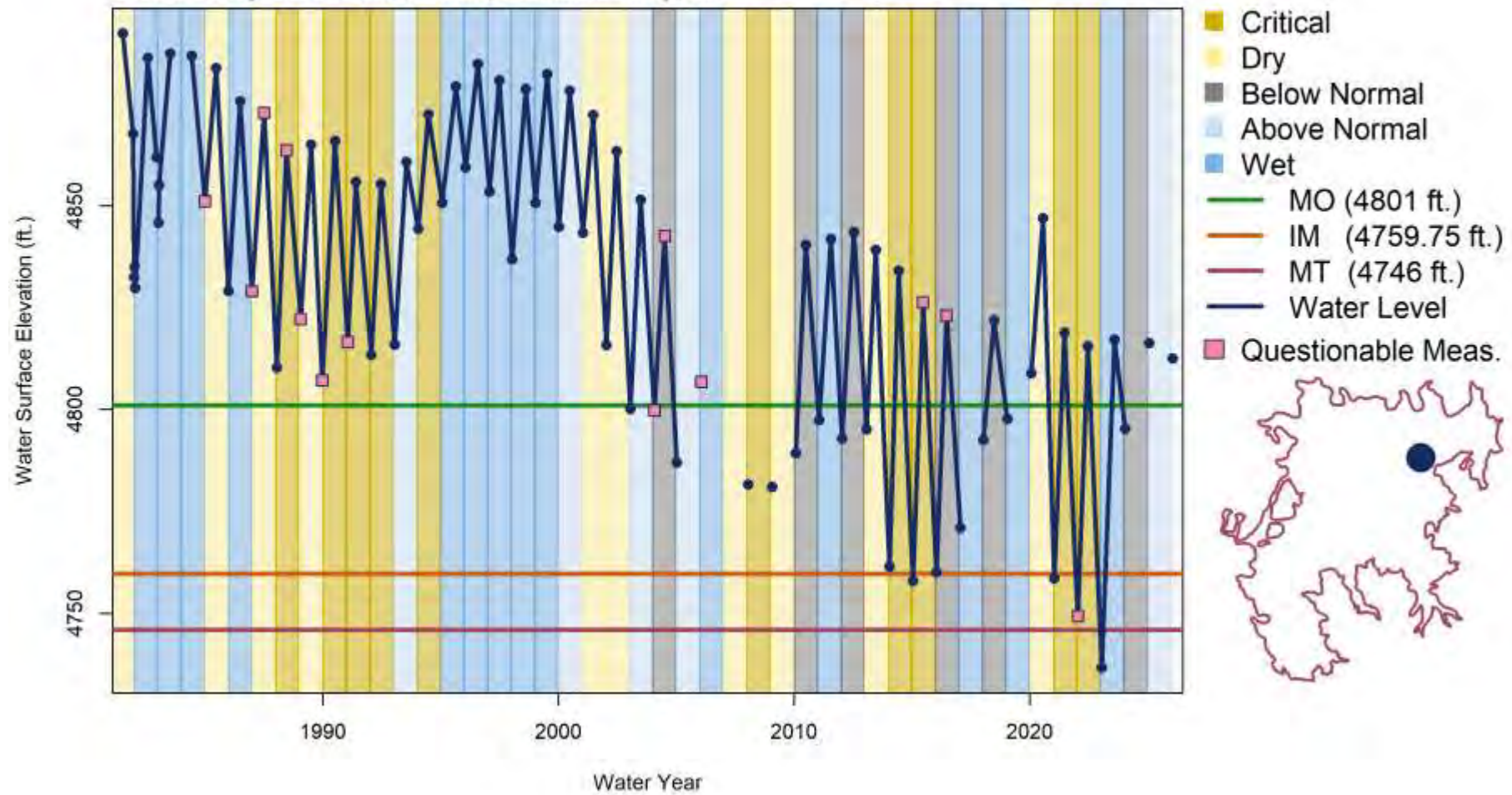


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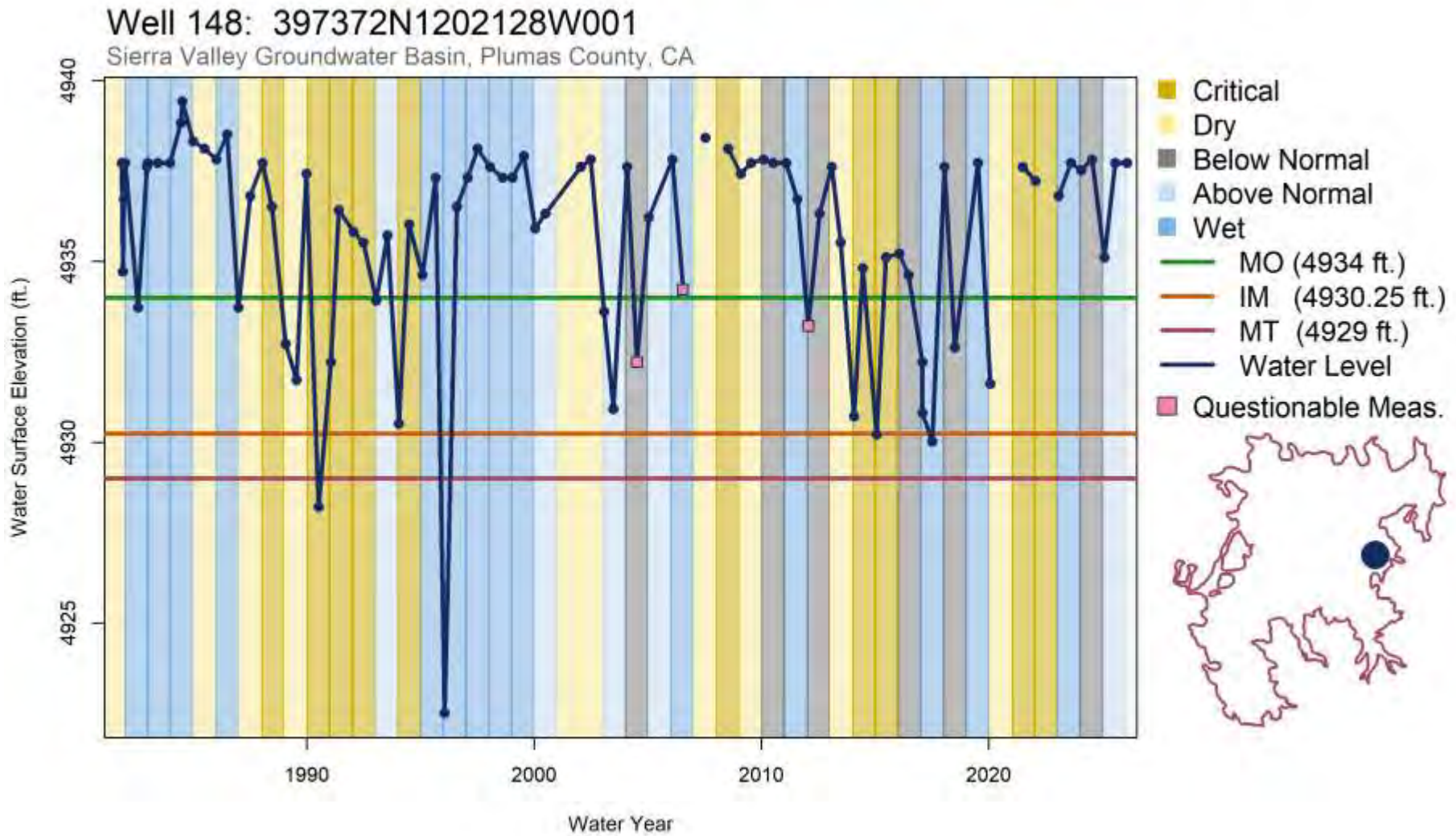


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Well 161: 398020N1203815W001

Sierra Valley Groundwater Basin, Plumas County, CA

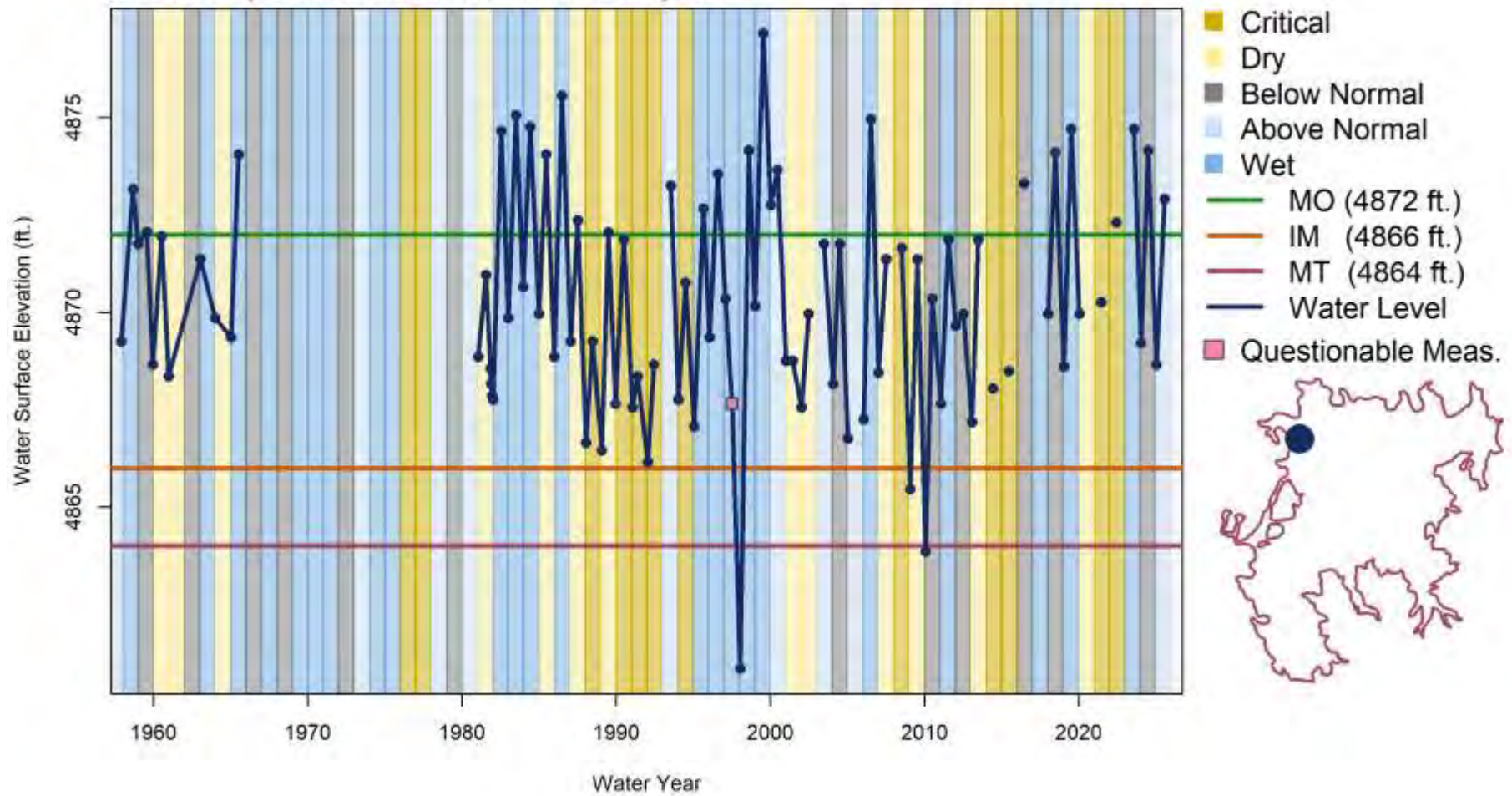


Figure A- 19

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Sierra Valley Groundwater Basin, Plumas County, CA

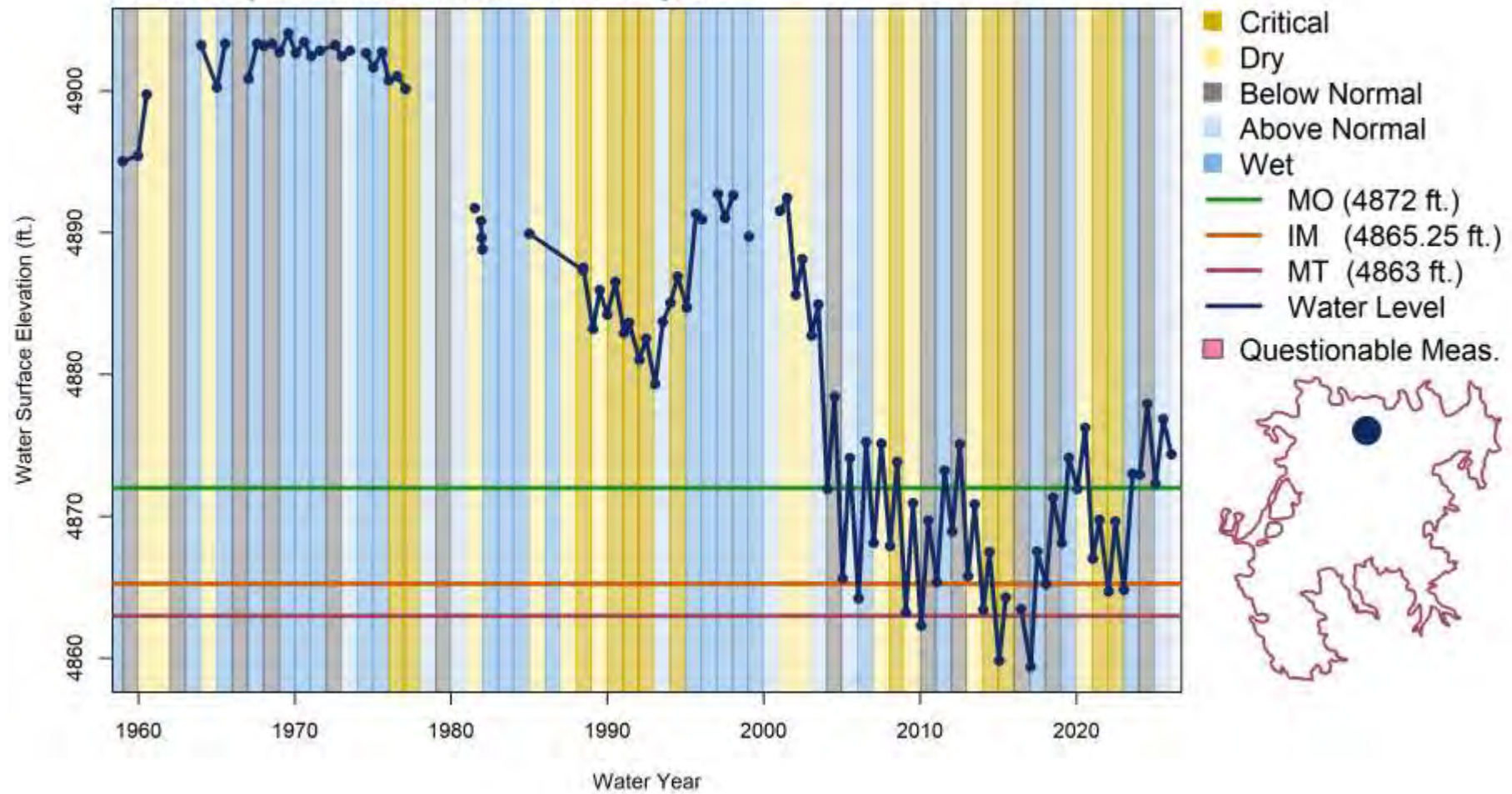


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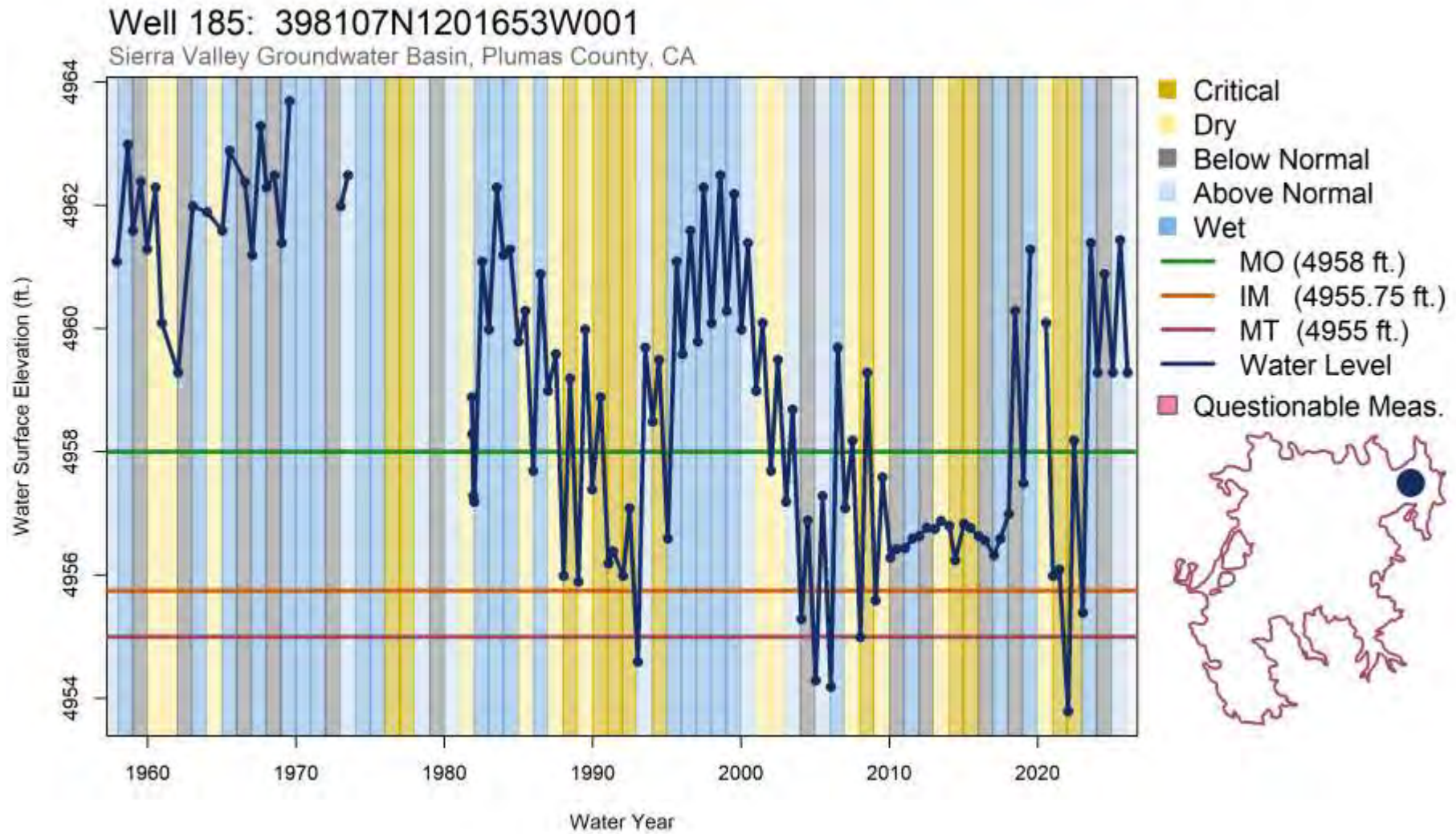


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Well 187: 398165N1201934W001

Sierra Valley Groundwater Basin, Plumas County, CA

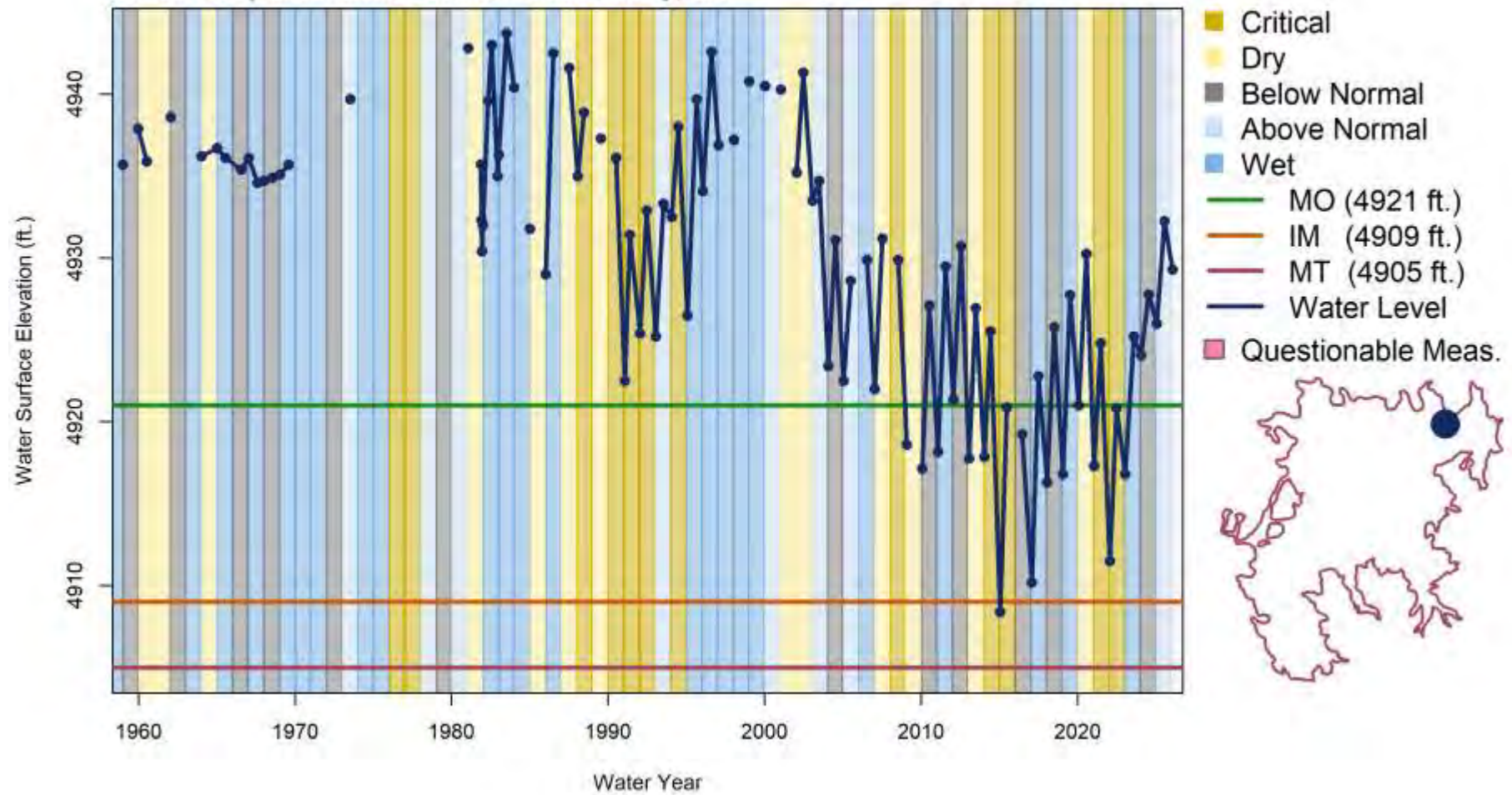


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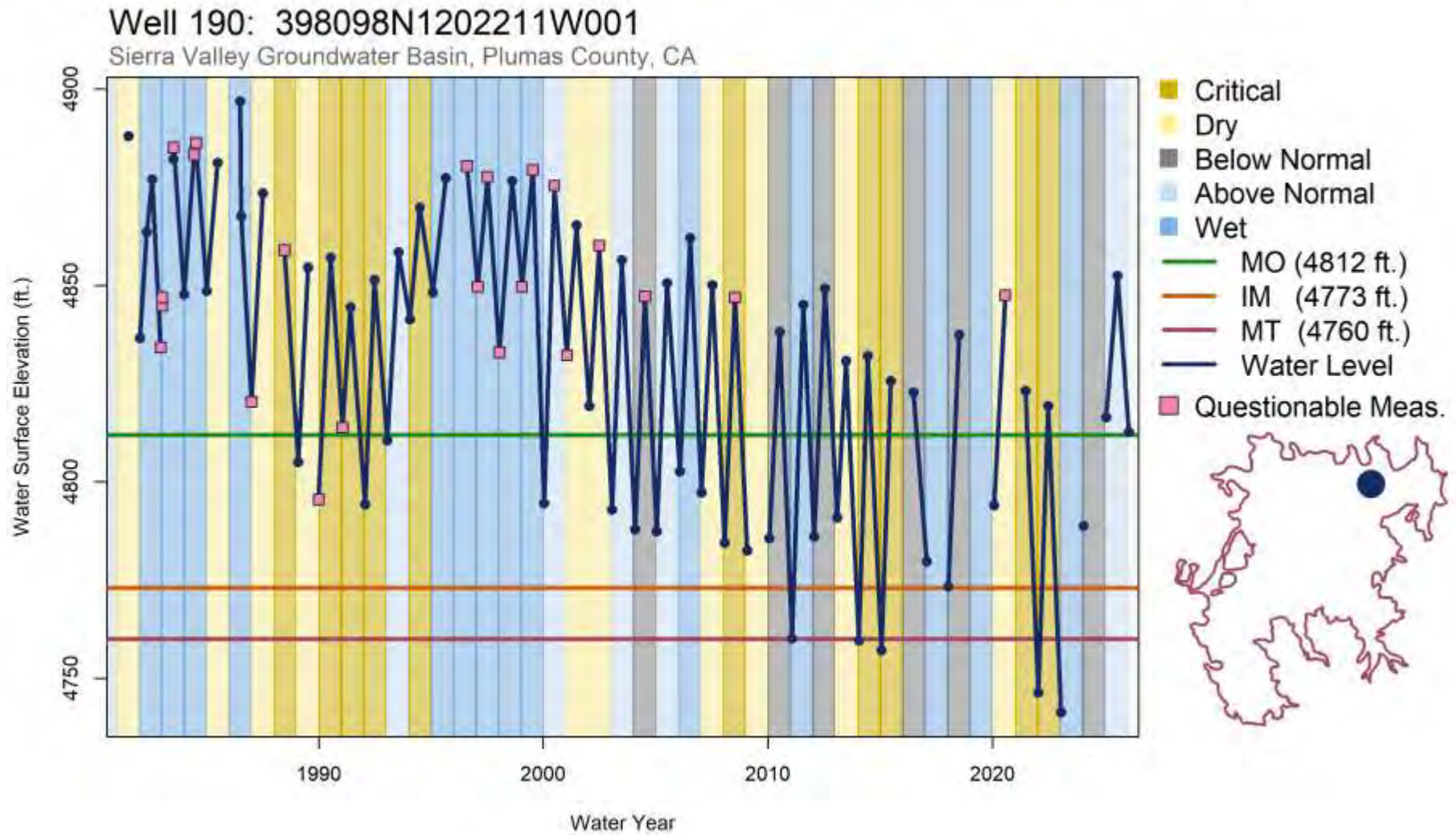


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Well 194: 398059N1201862W001

Sierra Valley Groundwater Basin, Plumas County, CA

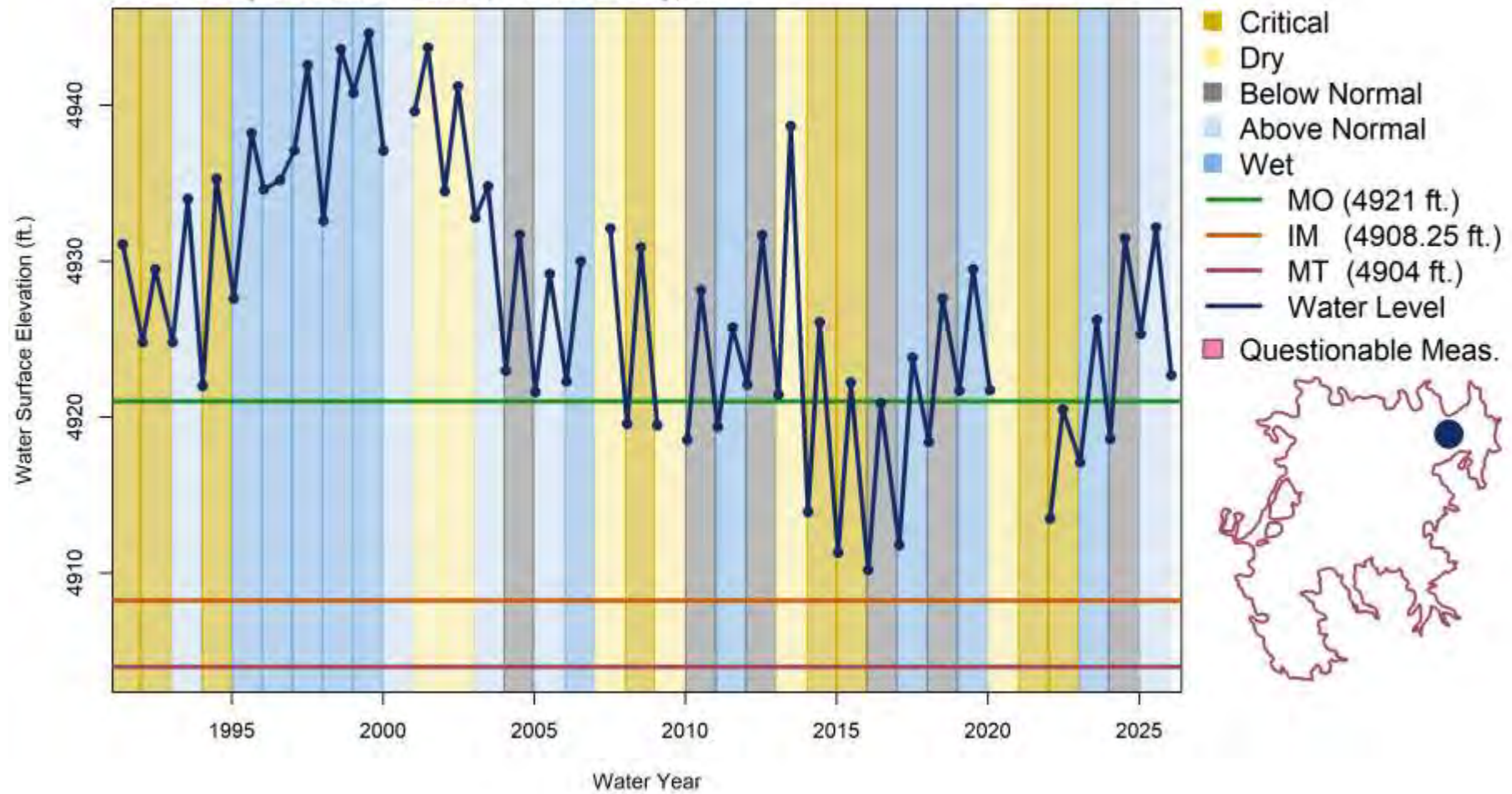


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Well 206: 398024N1201371W001

Sierra Valley Groundwater Basin, Plumas County, CA

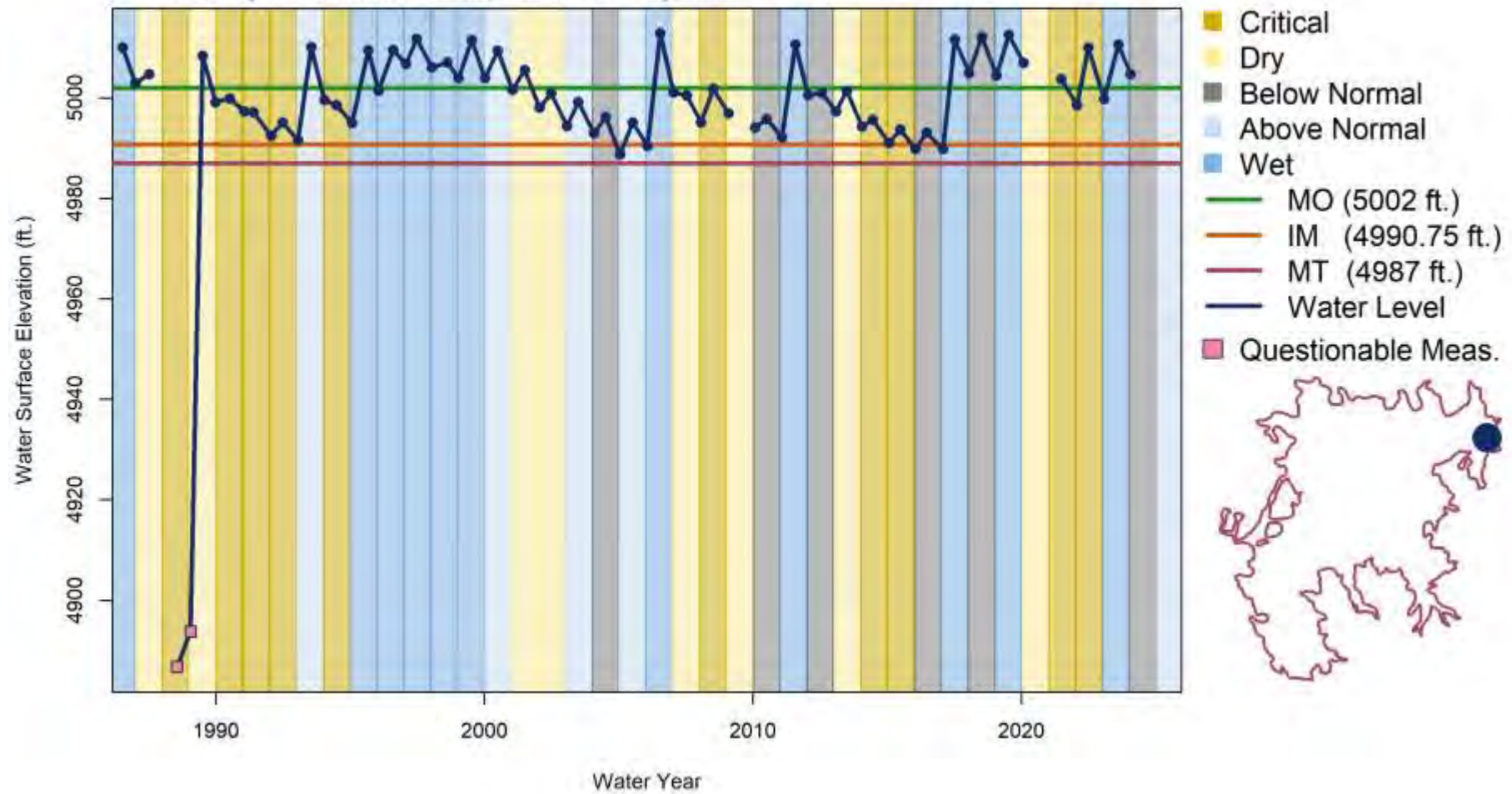


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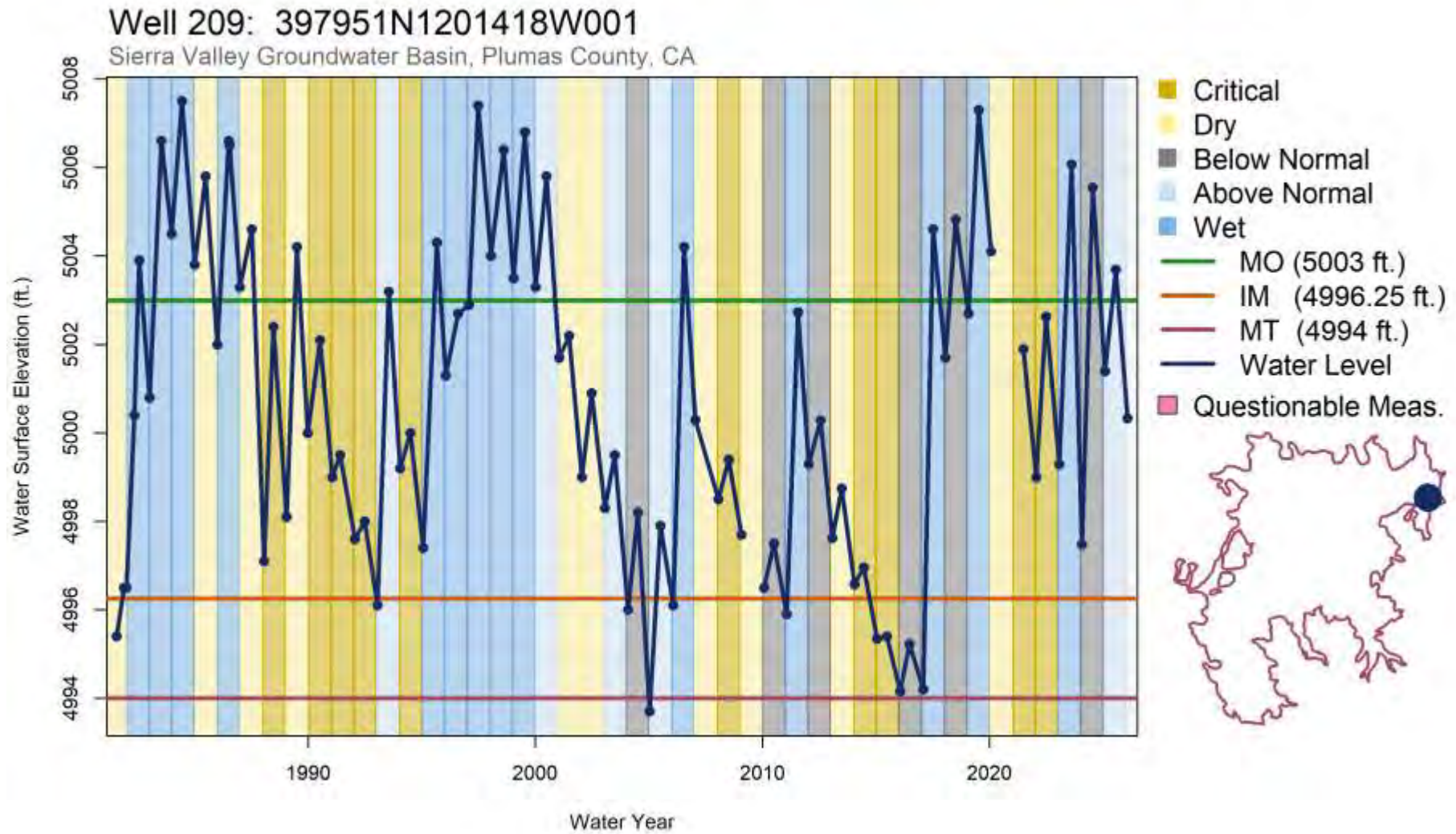


Figure A- 26

Well 289: 395951N1203910W003
Sierra Valley Groundwater Basin, Plumas County, CA

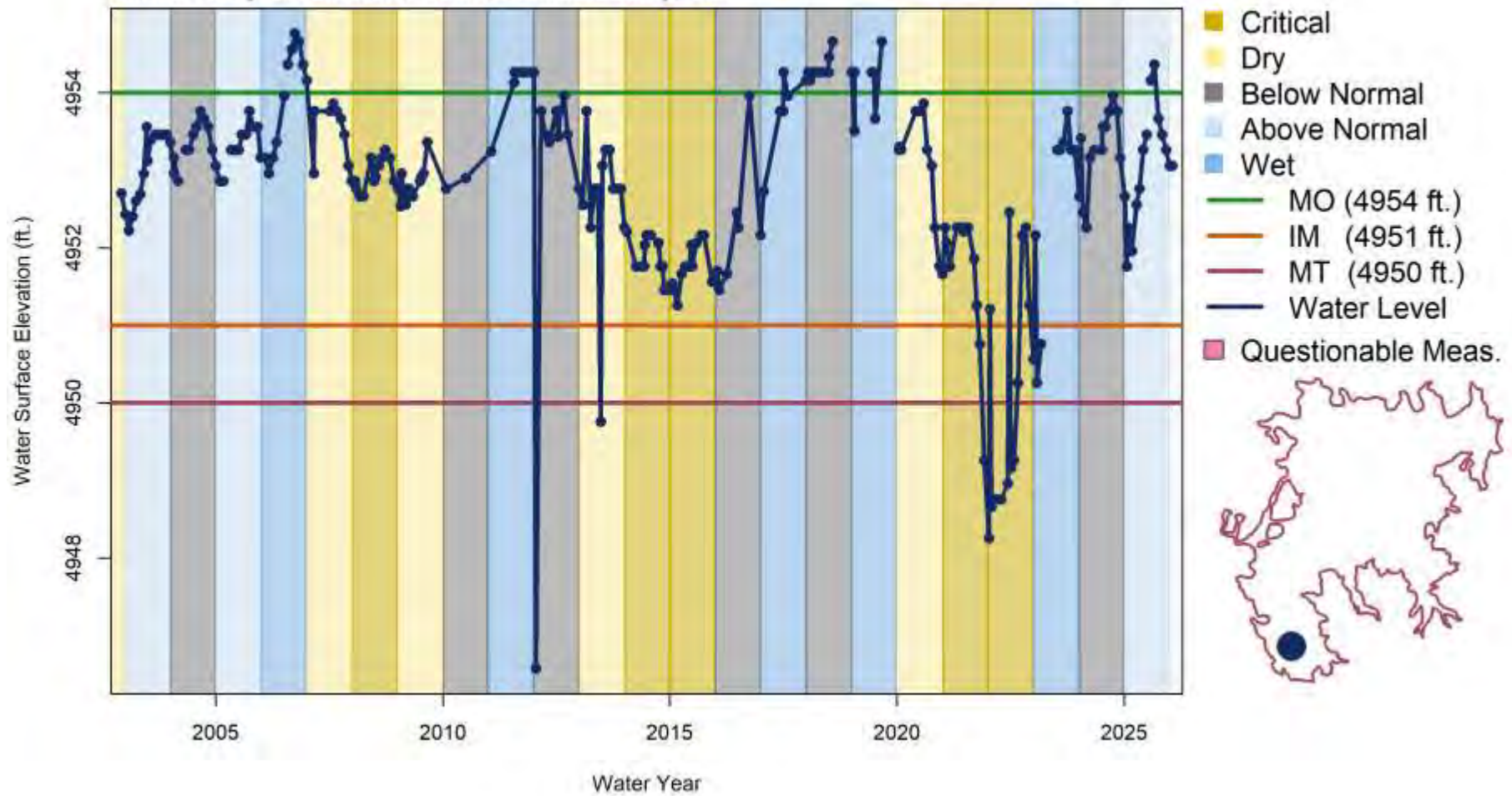


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Well 291: 395951N1203910W001

Sierra Valley Groundwater Basin, Plumas County, CA

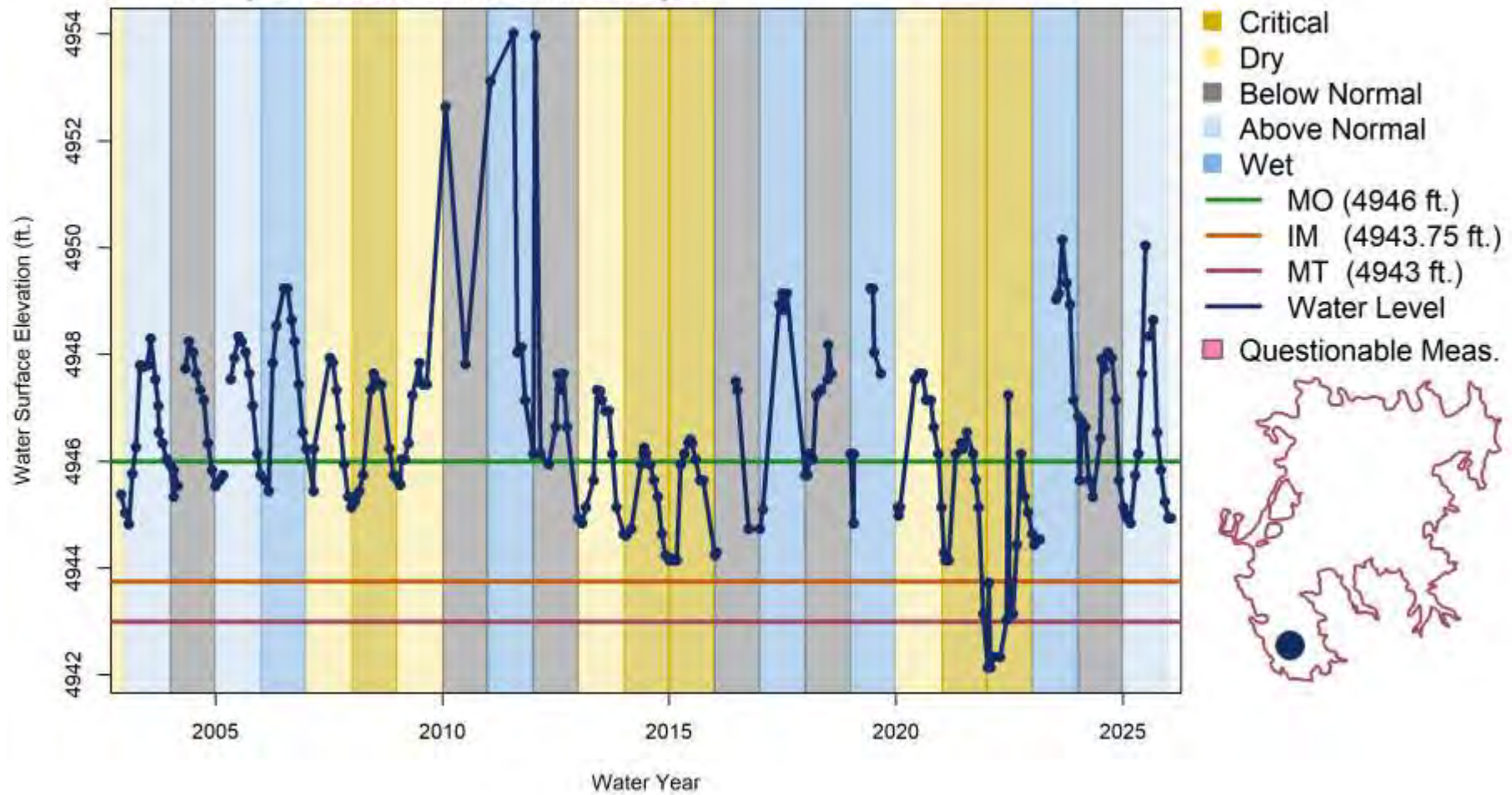


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Sierra Valley Groundwater Basin, Plumas County, CA

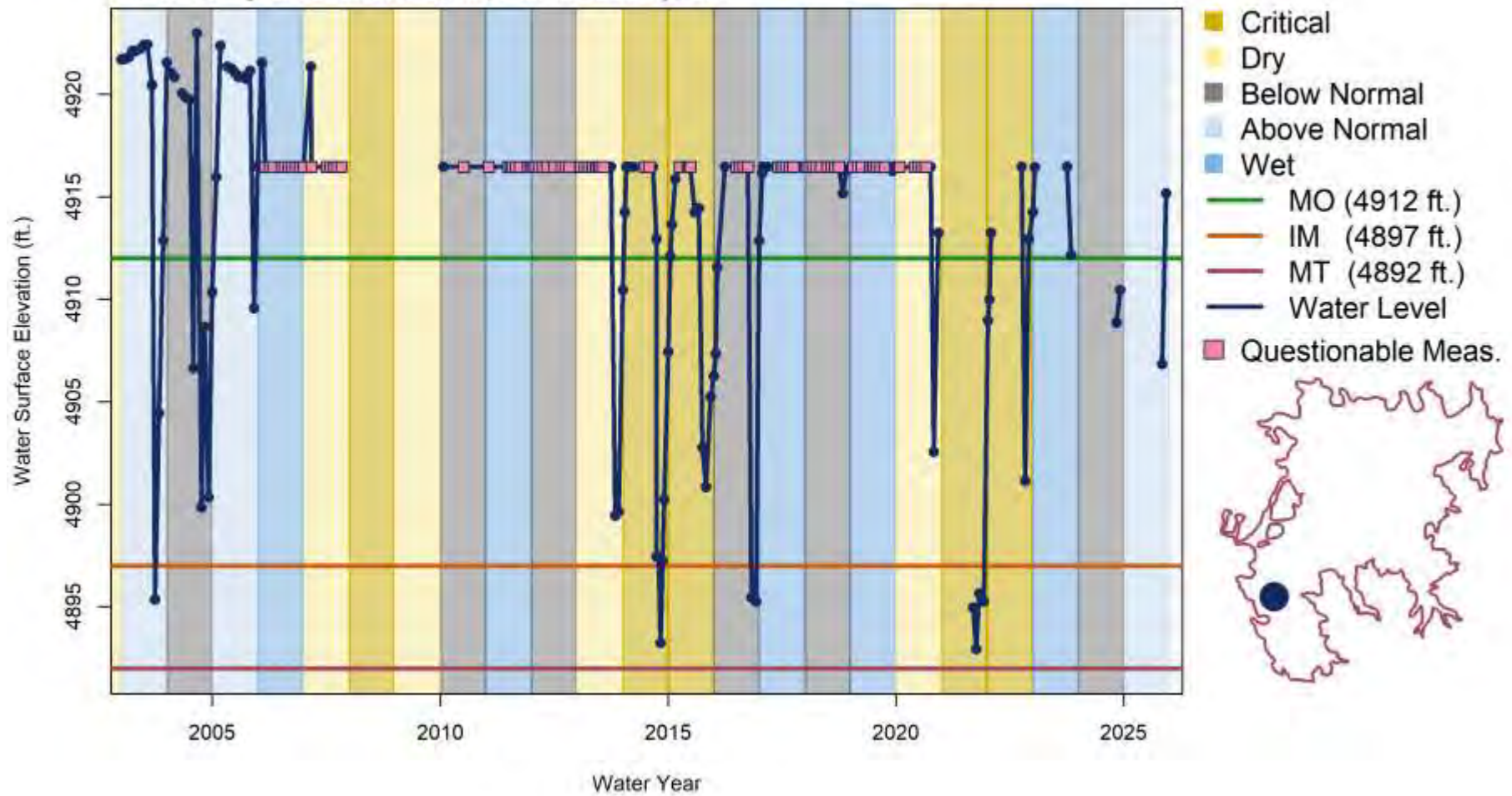


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Well 294: 396444N1204137W001

Sierra Valley Groundwater Basin, Plumas County, CA

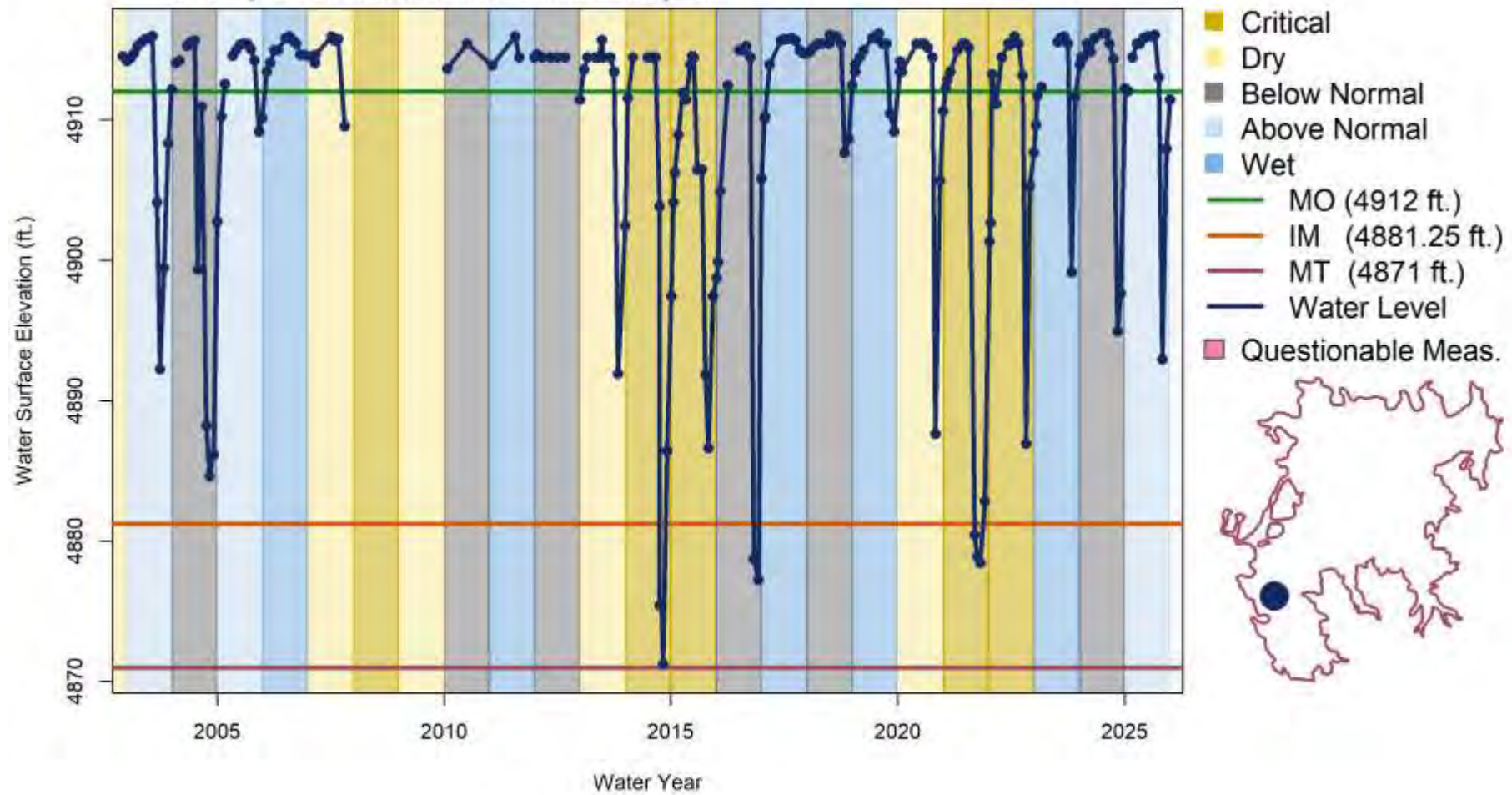


Figure A- 30

Well 296: 396722N1204095W002
Sierra Valley Groundwater Basin, Plumas County, CA

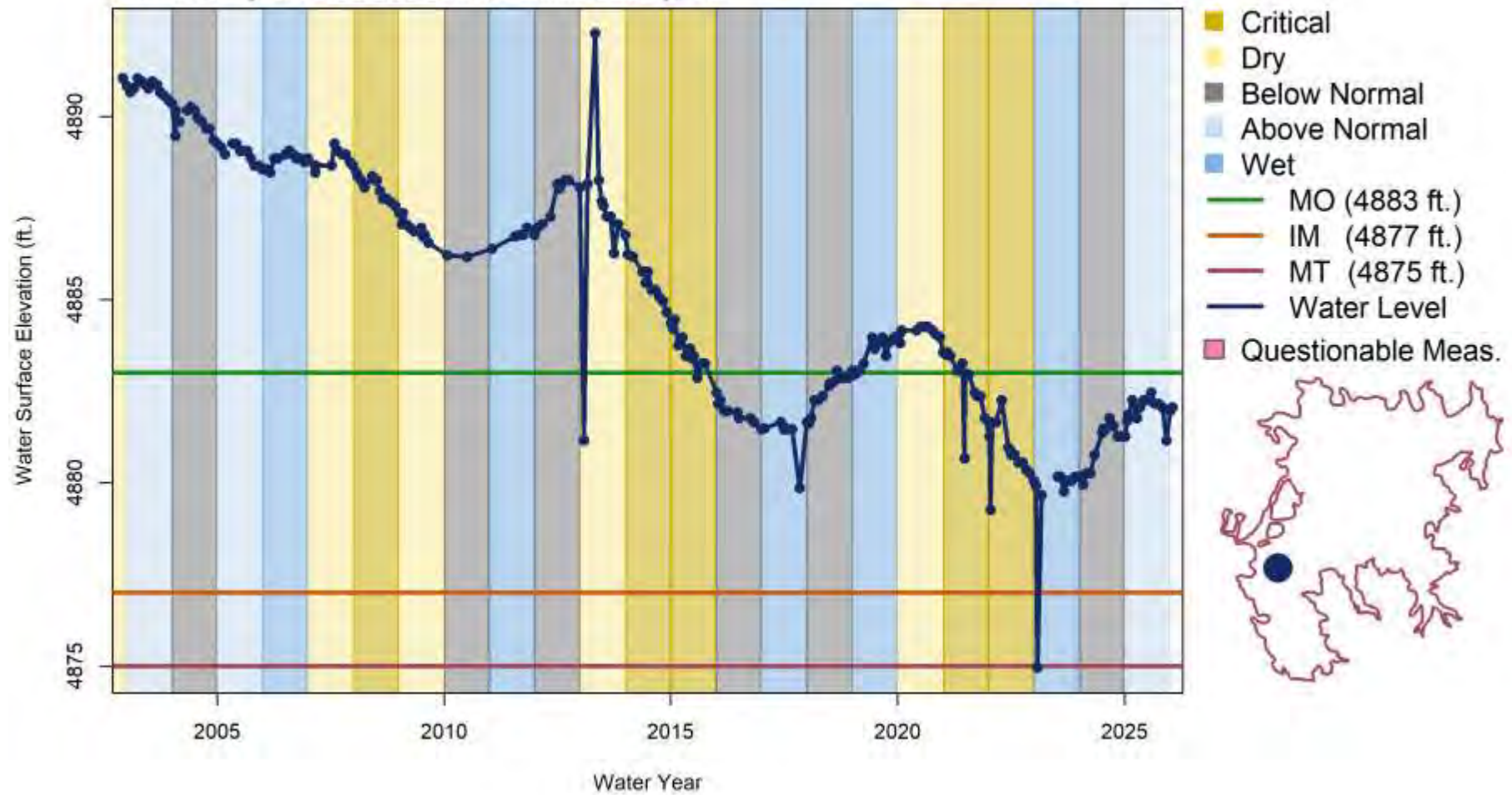


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Sierra Valley Groundwater Basin, Plumas County, CA

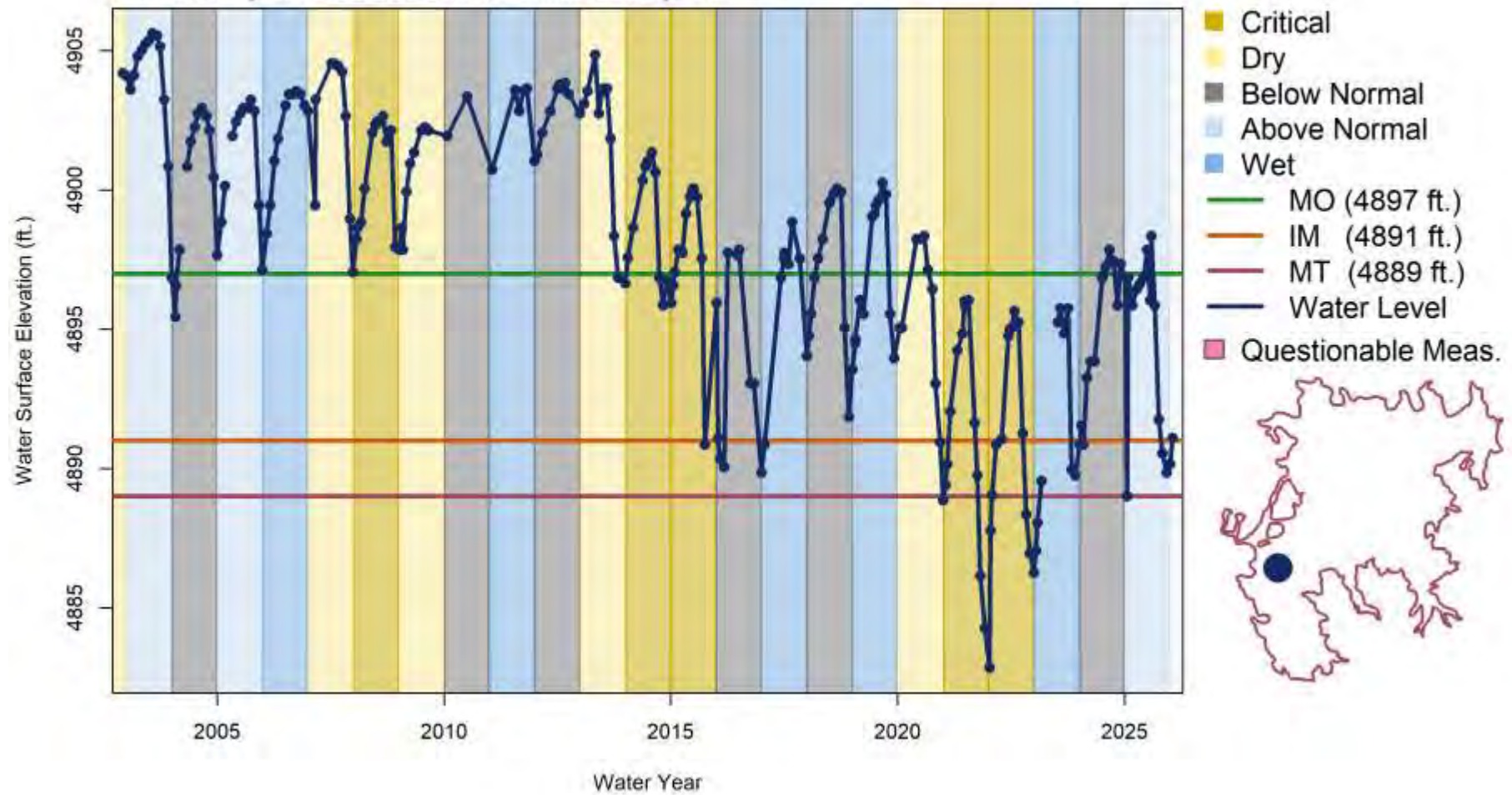


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Well 298: 397956N1201417W001

Sierra Valley Groundwater Basin, Plumas County, CA

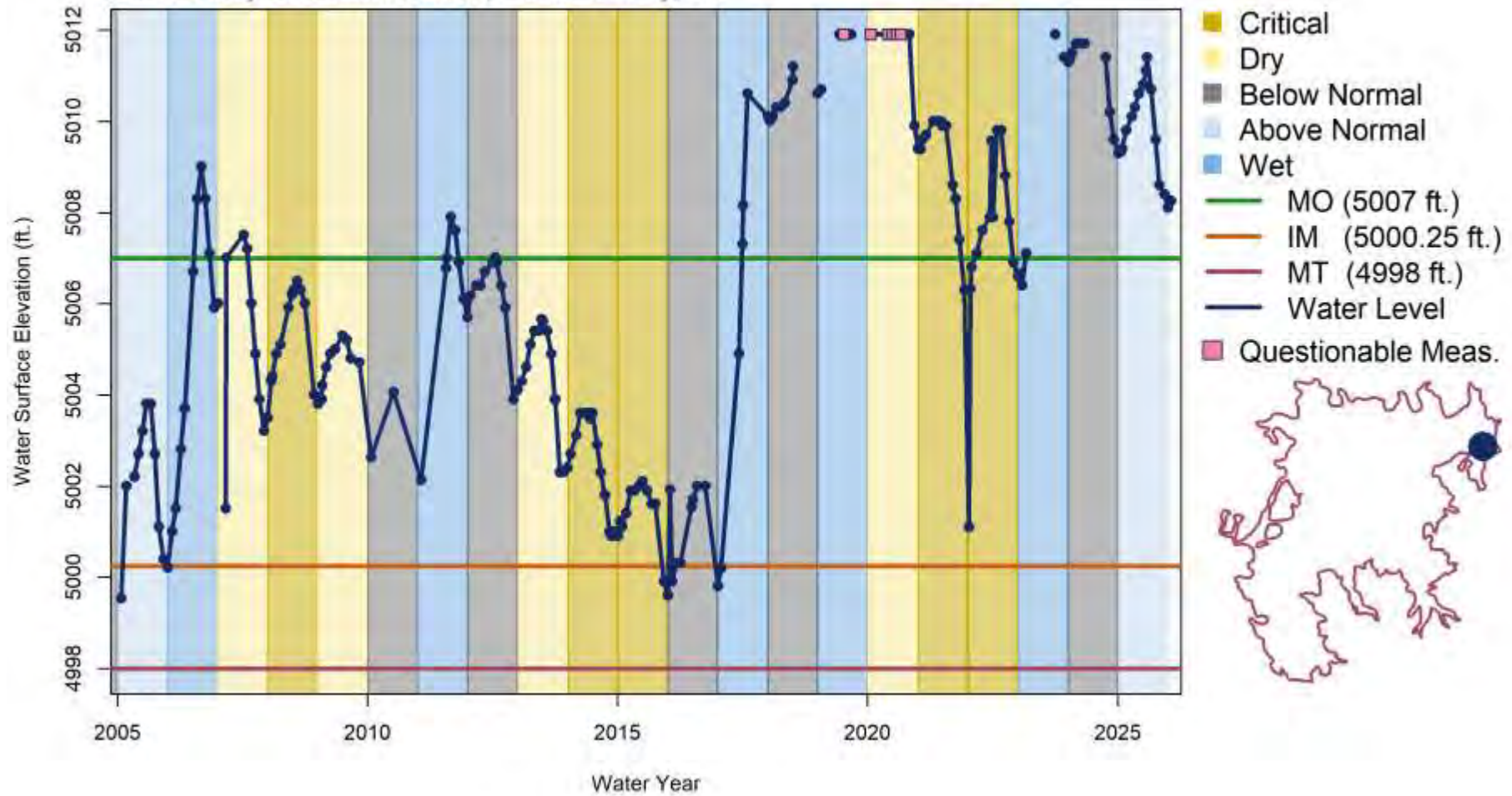


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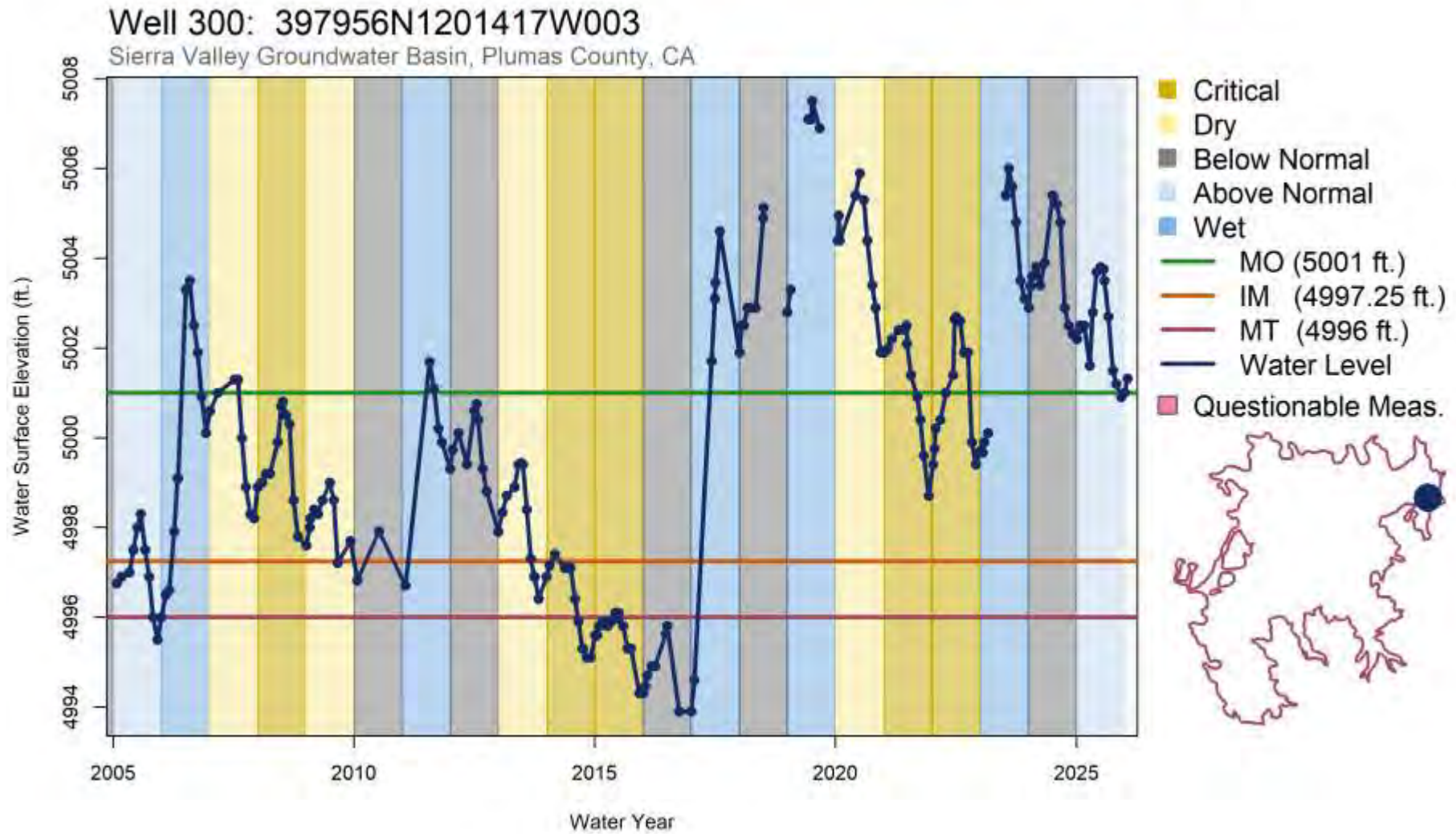


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Well 301: 398170N1203478W001

Sierra Valley Groundwater Basin, Plumas County, CA

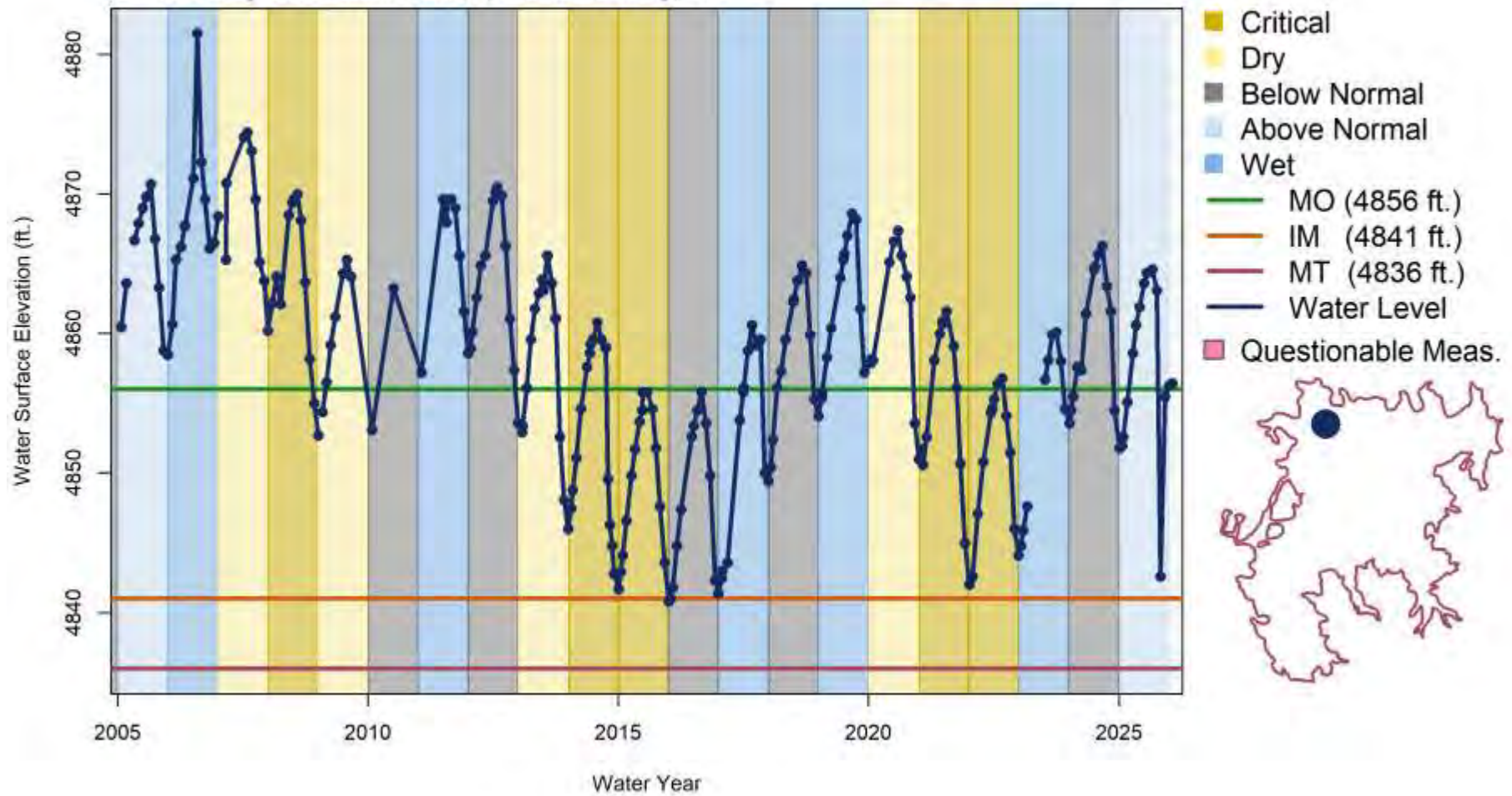


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Well 302: 398170N1203478W002

Sierra Valley Groundwater Basin, Plumas County, CA

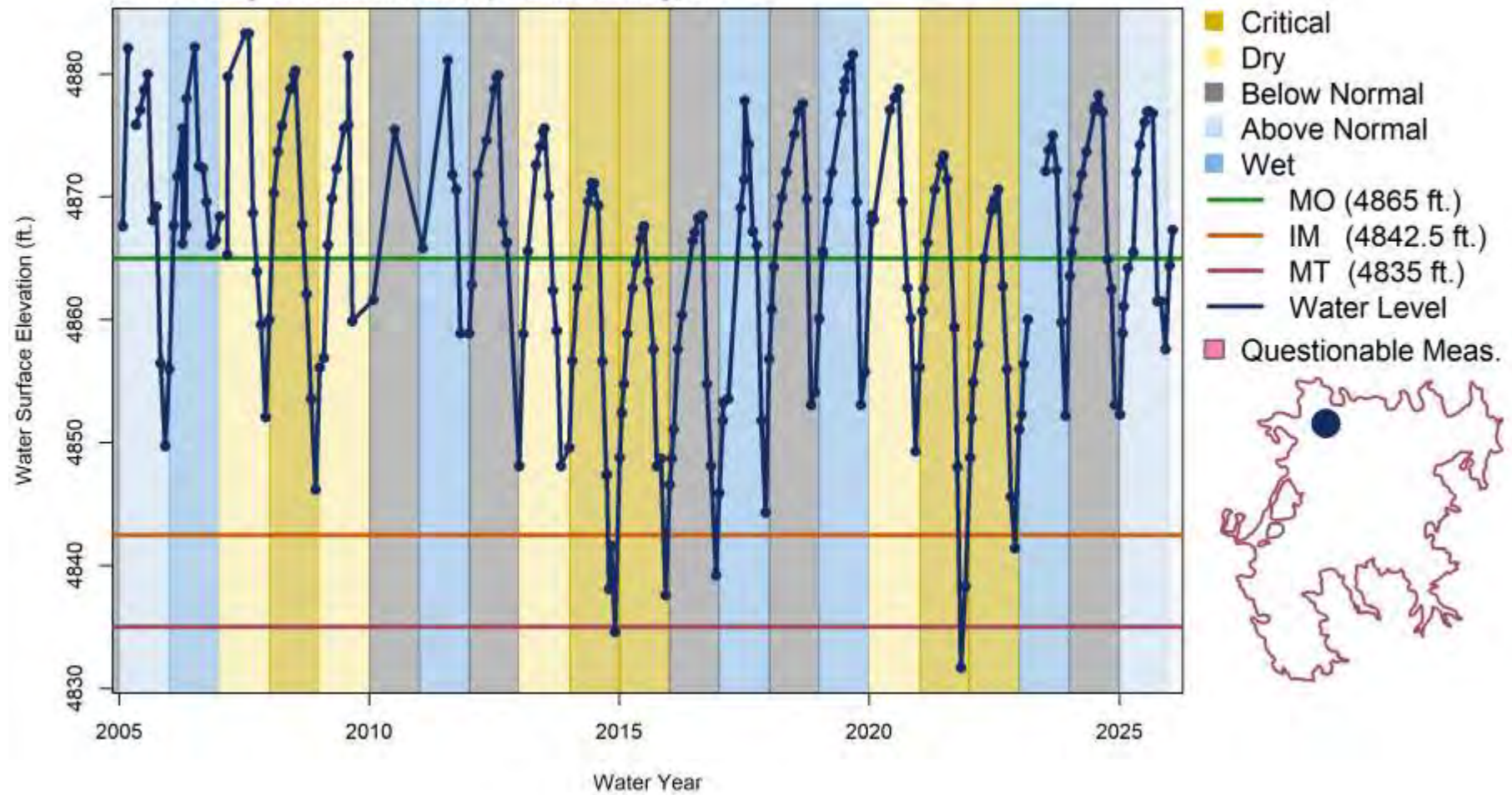


Figure A- 36

Appendix B

Timeseries of Water Quality Analyses in the Sierra Valley Groundwater Basin

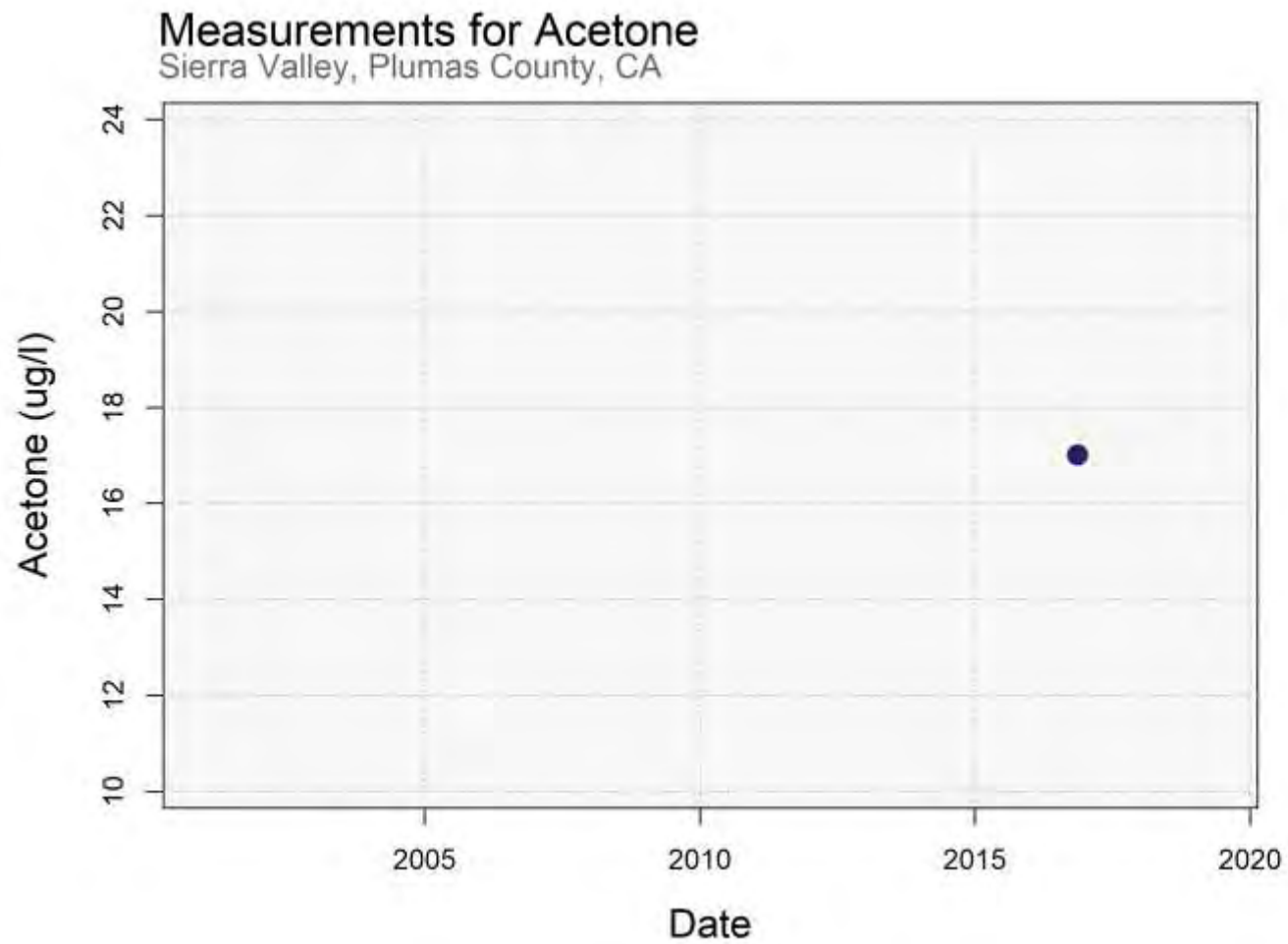


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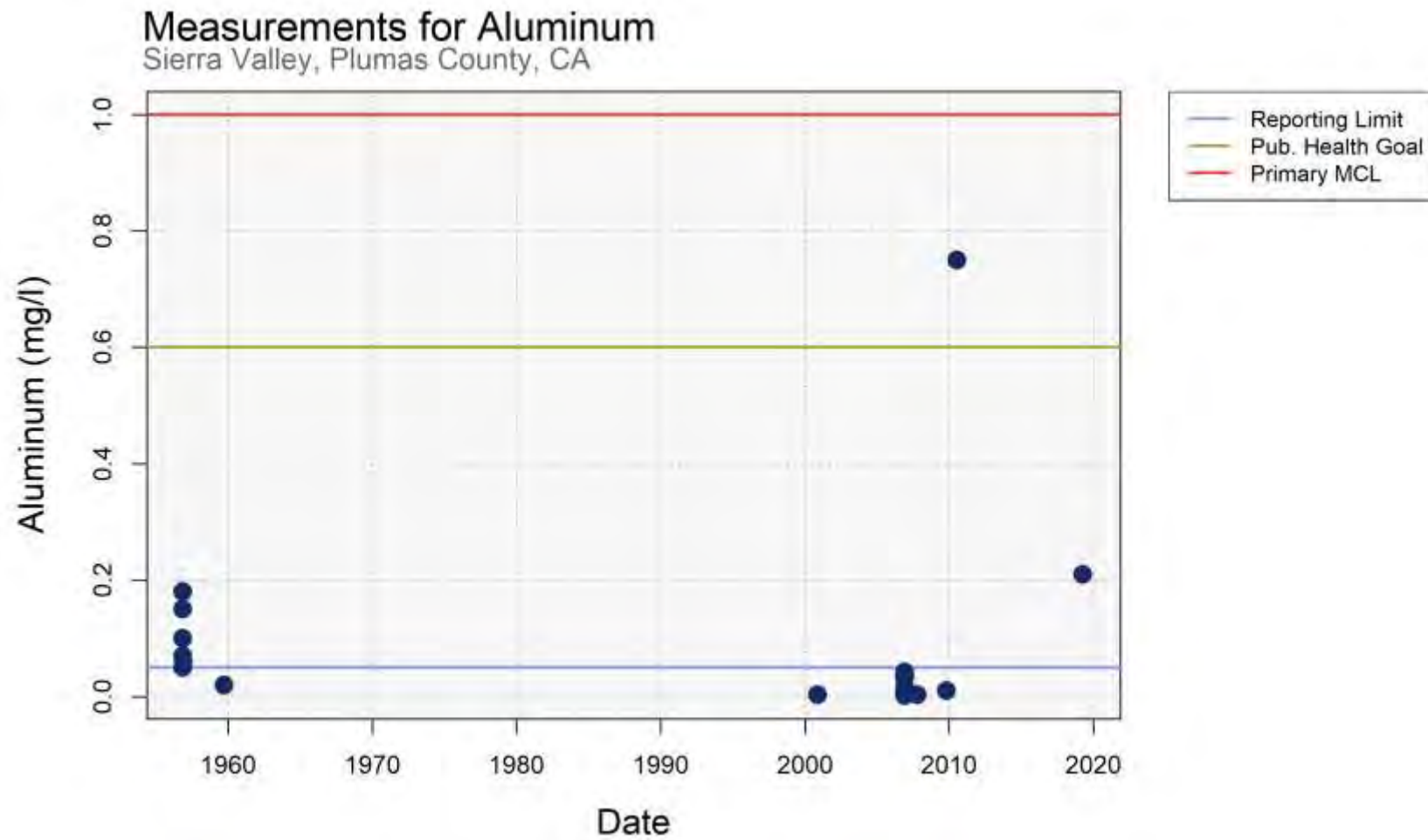


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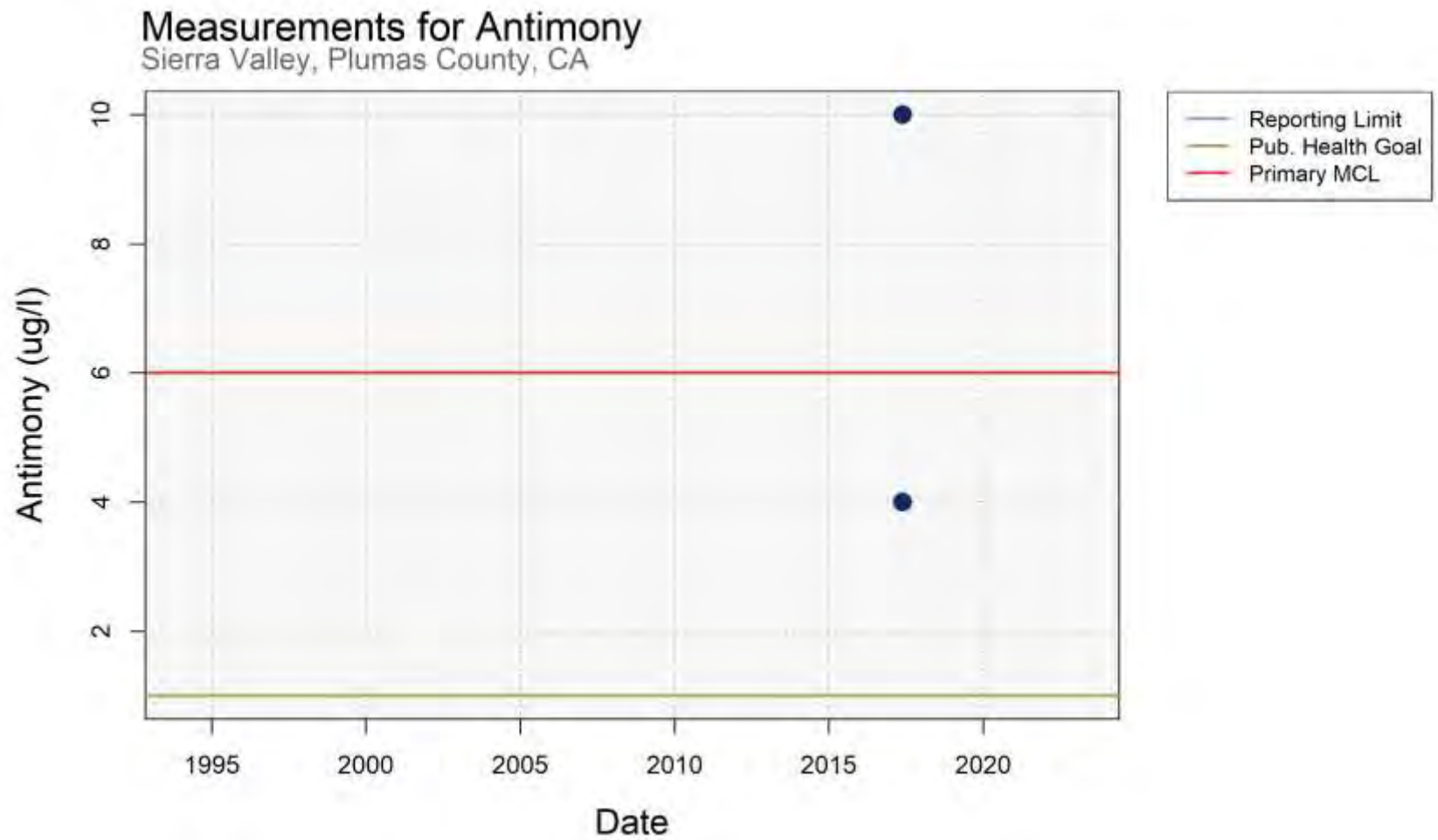


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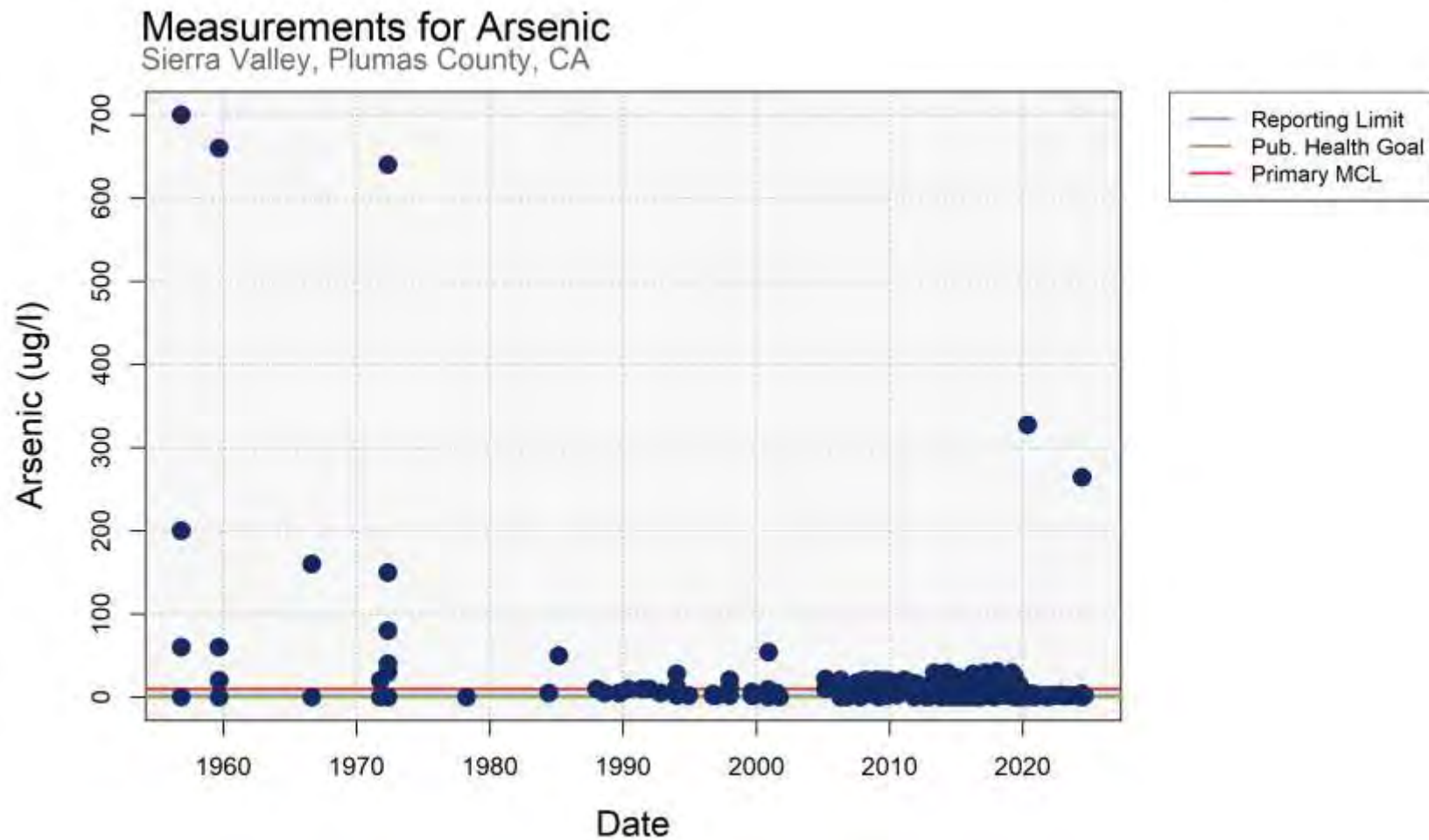


Figure B- 4

Measurements for Bicarbonate Alkalinity (CaCO3) Sierra Valley, Plumas County, CA

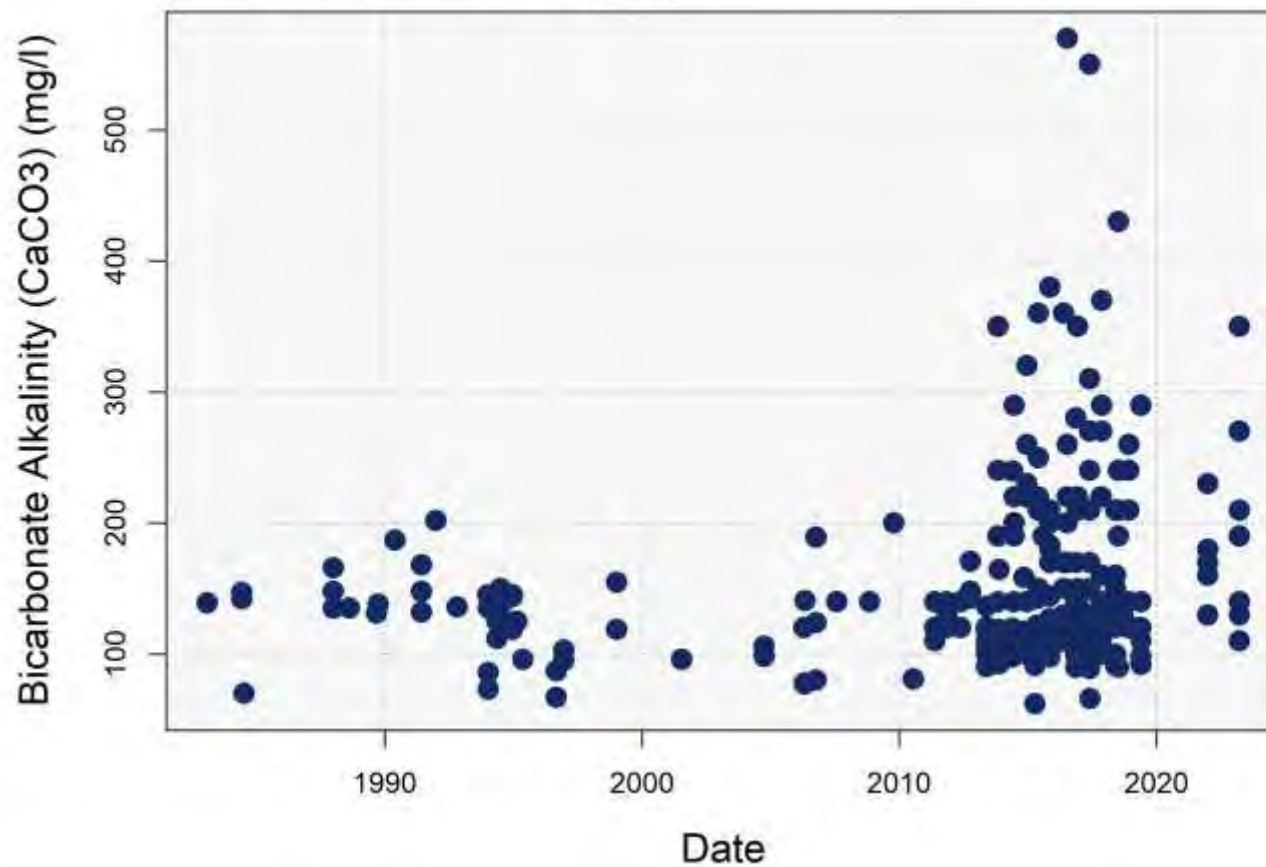


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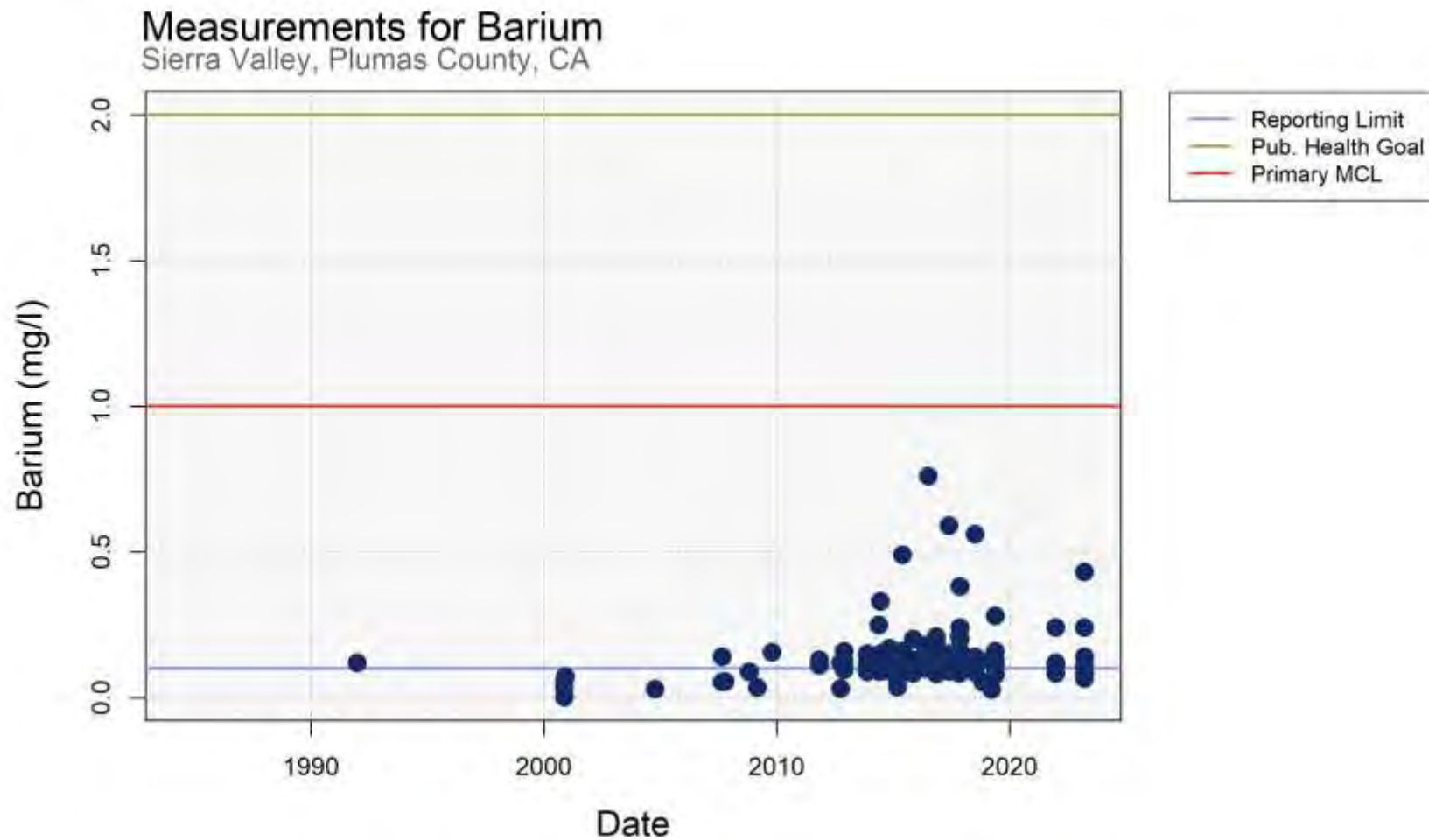


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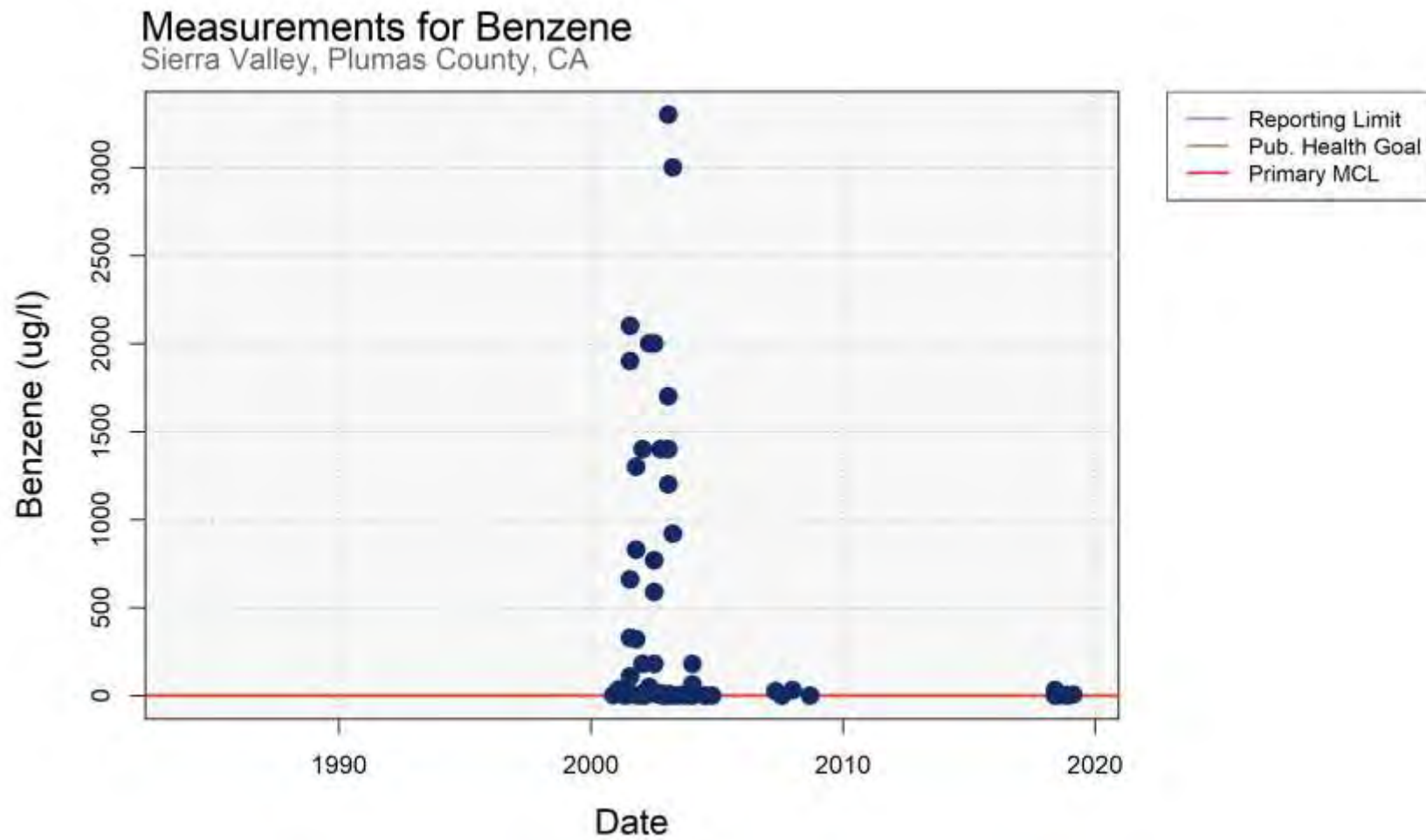


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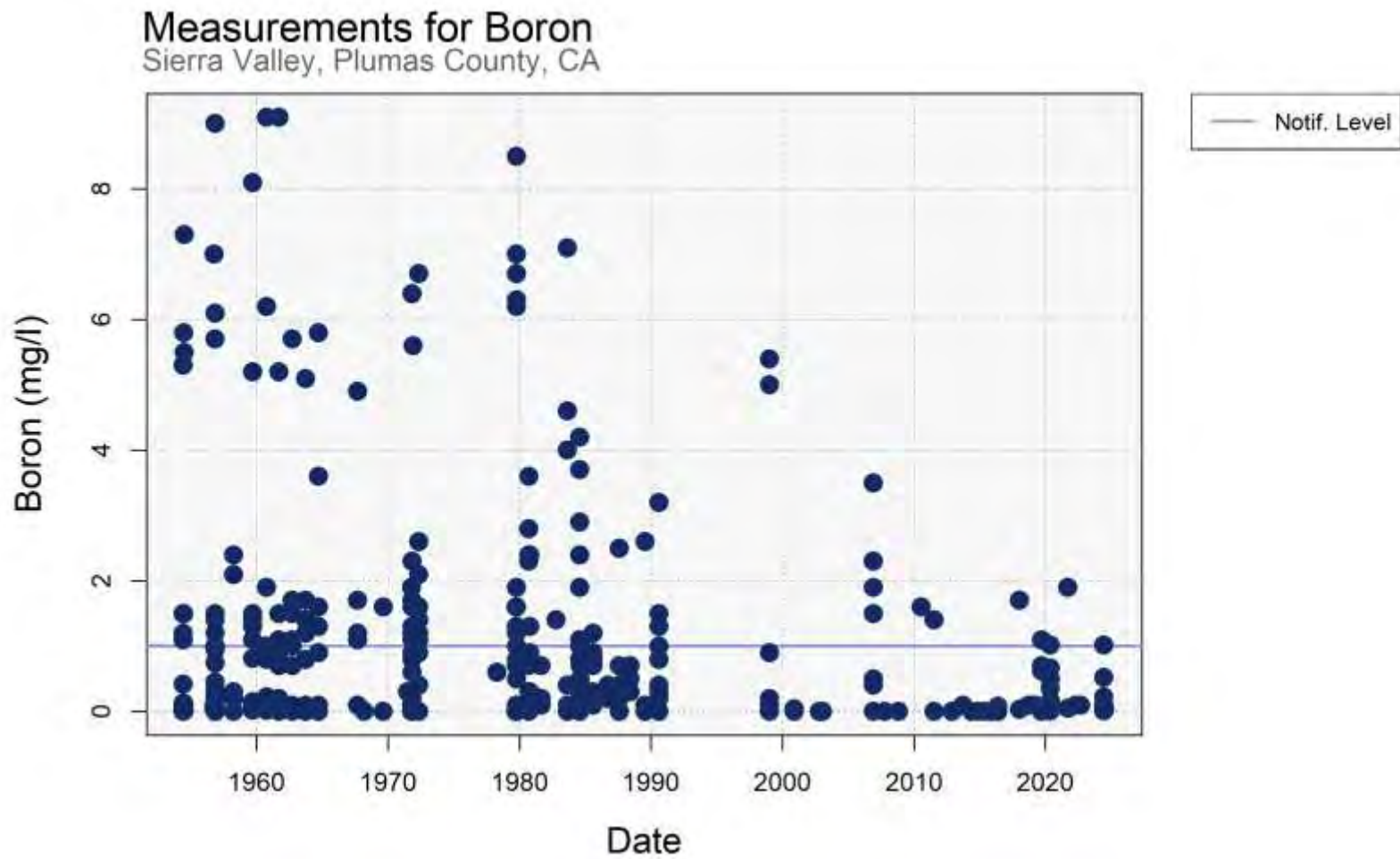


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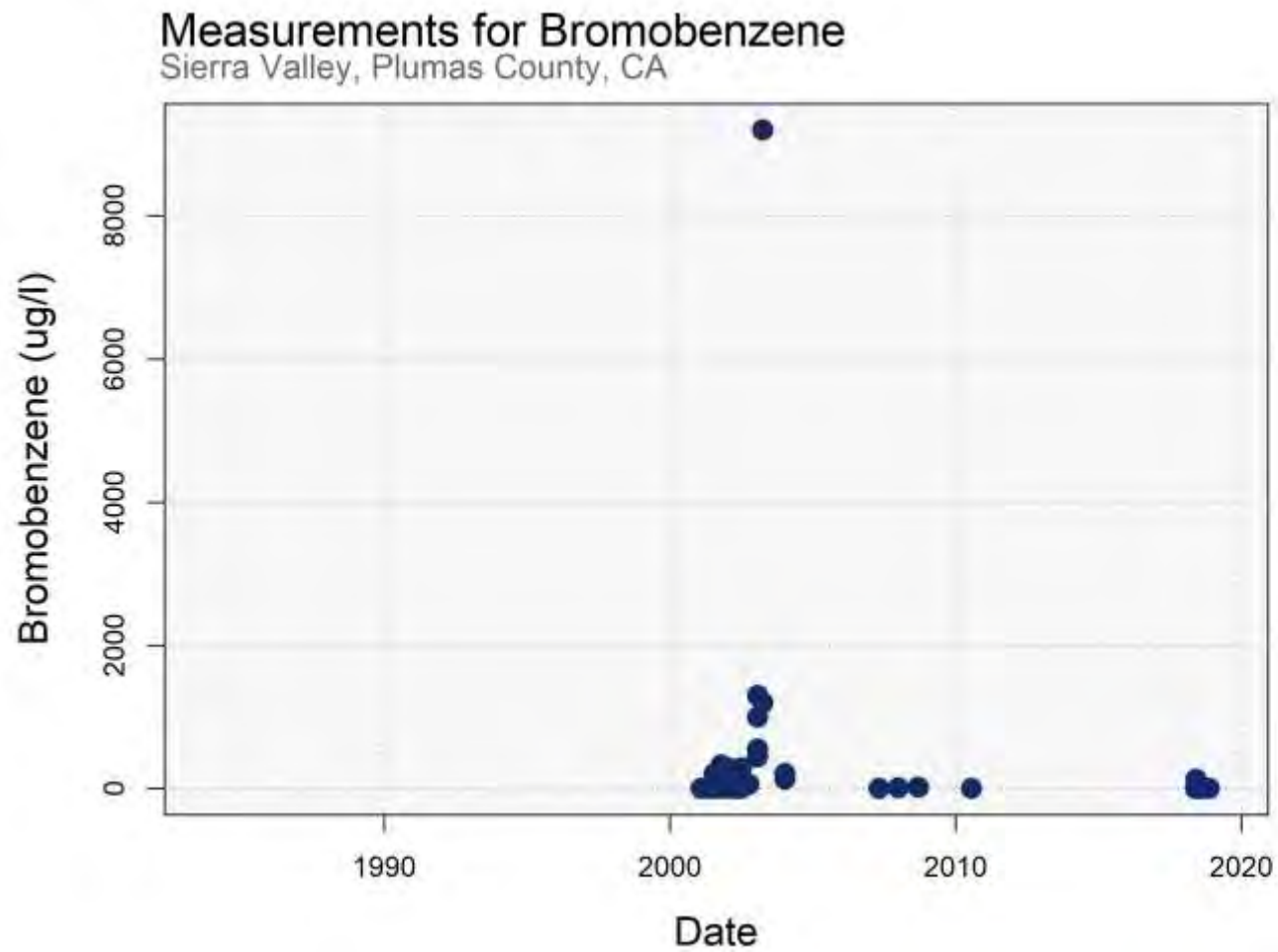


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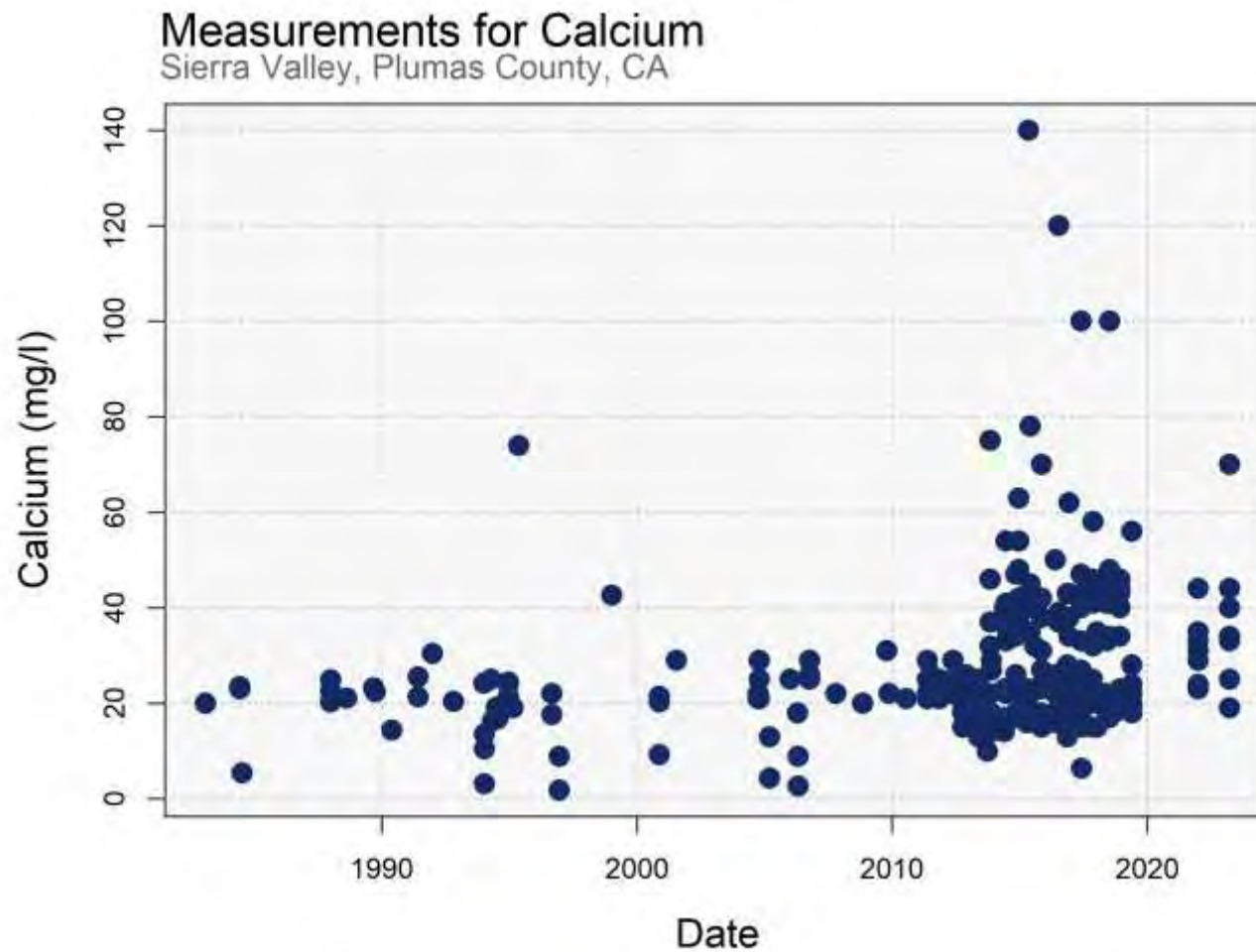


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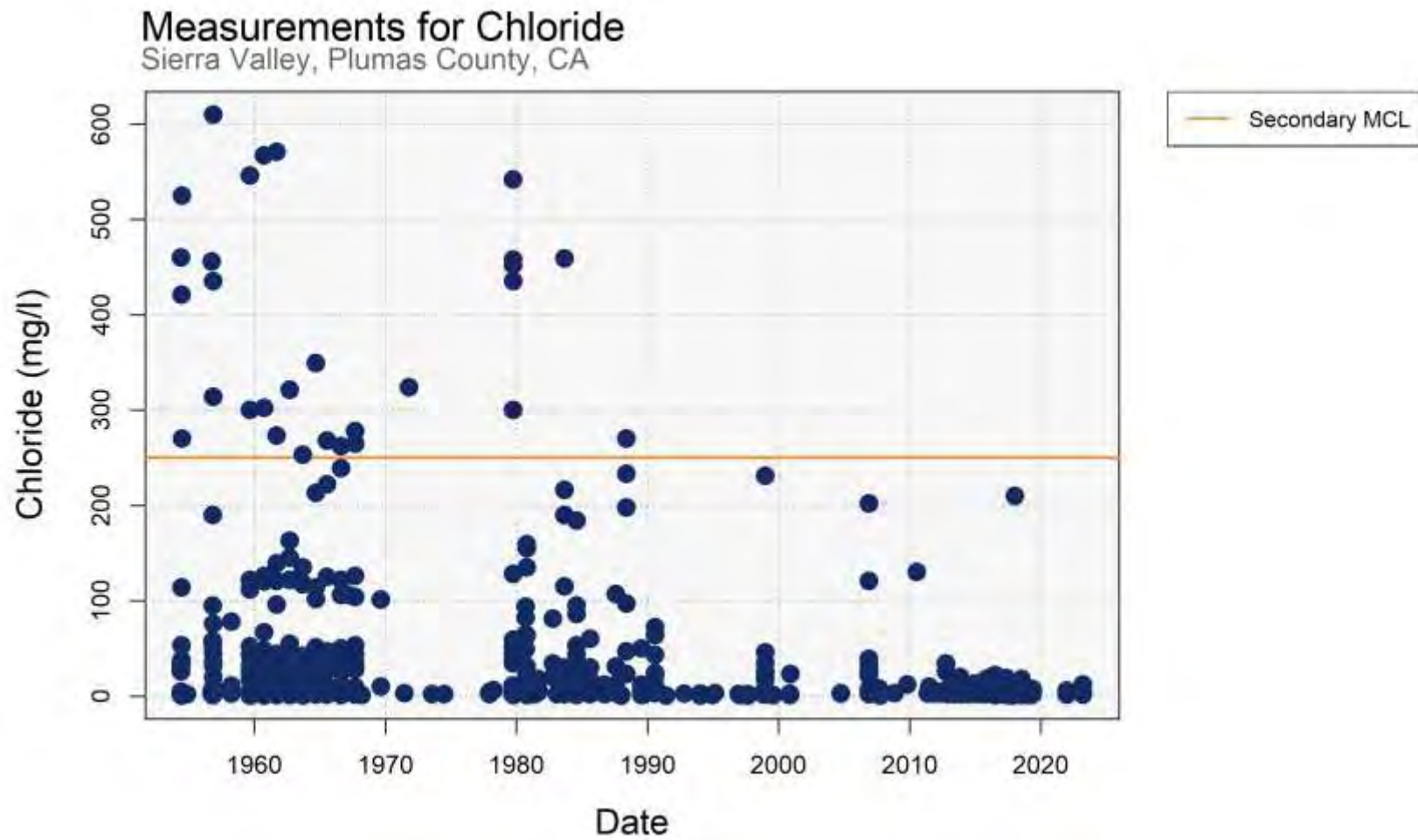


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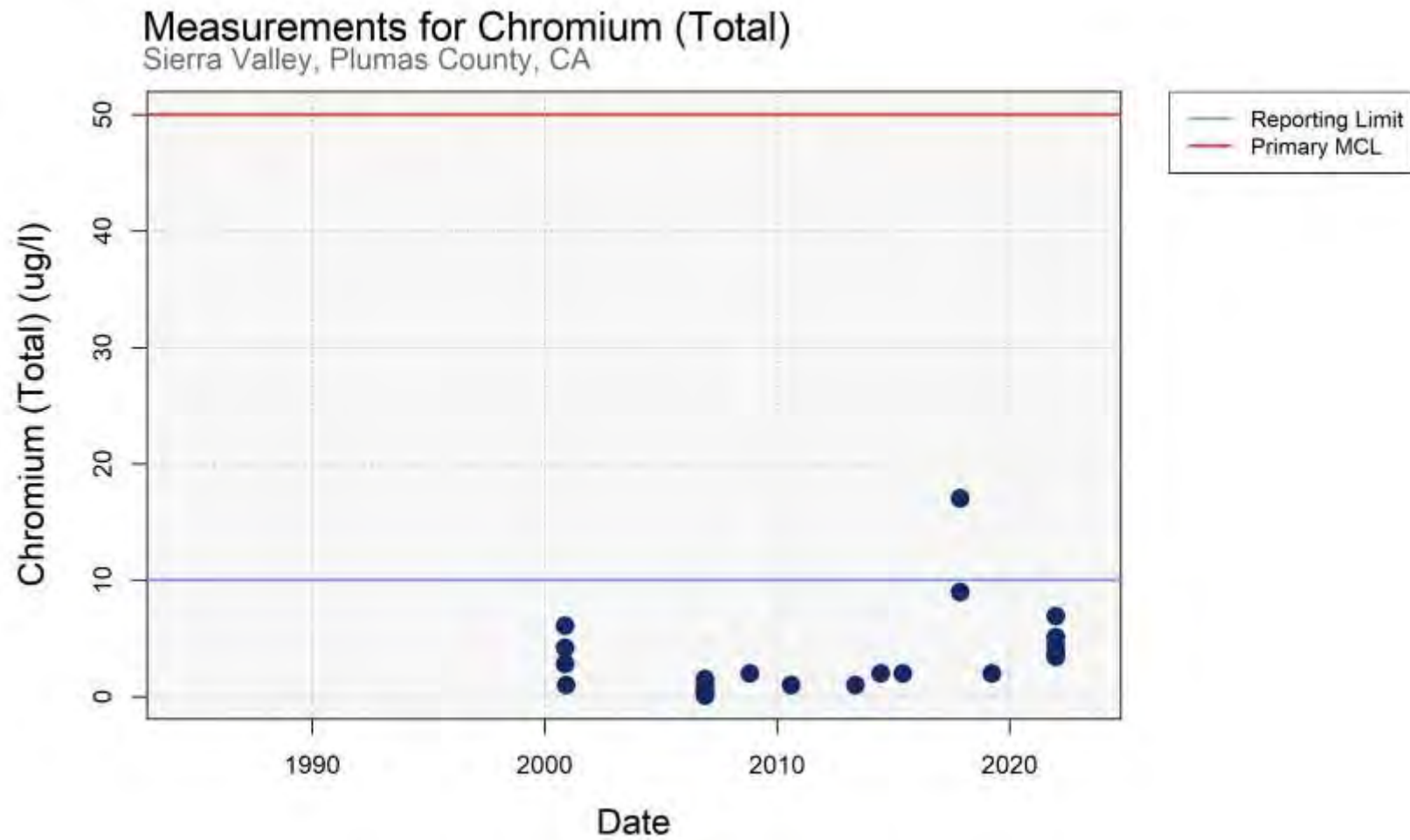


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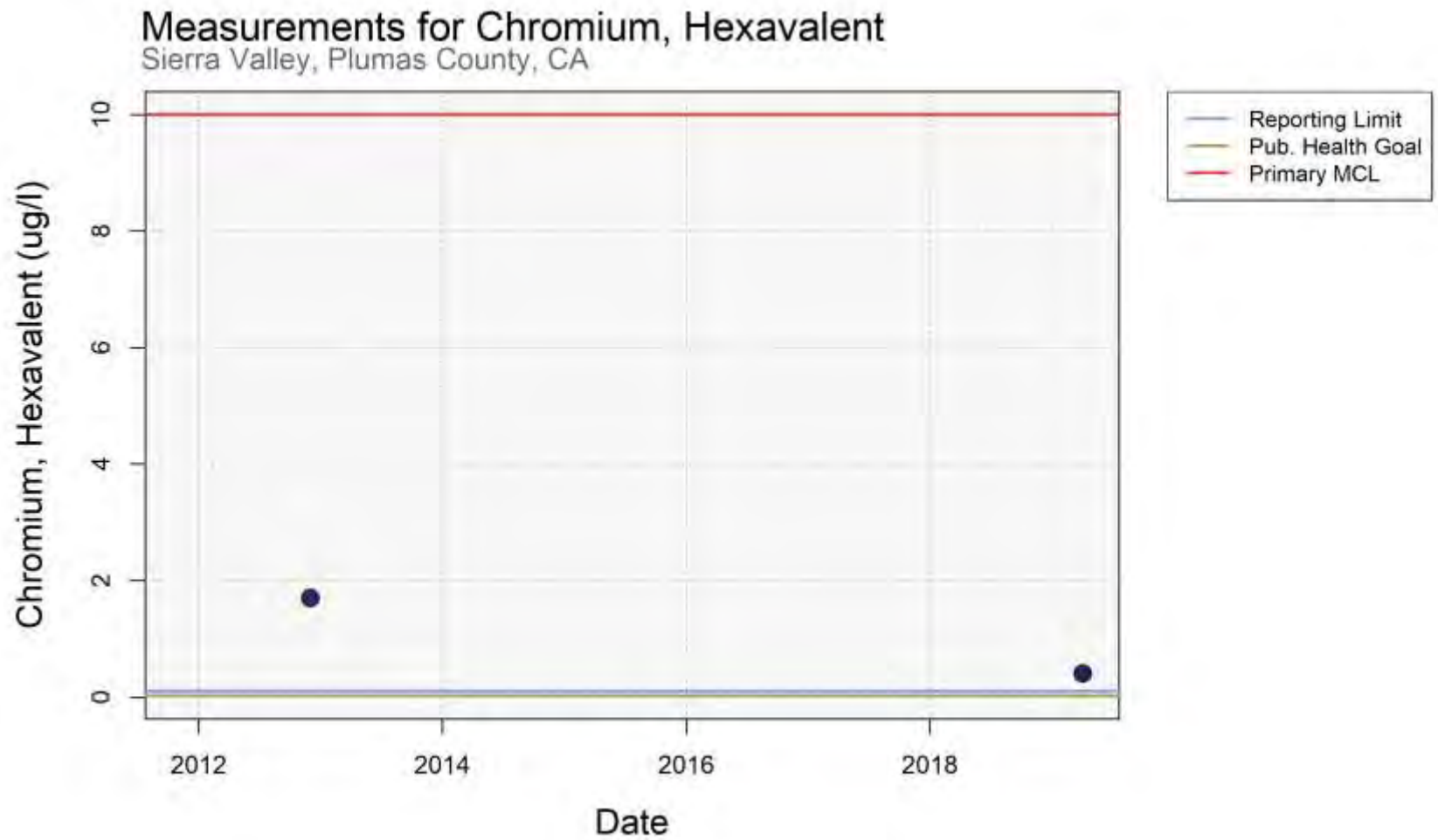


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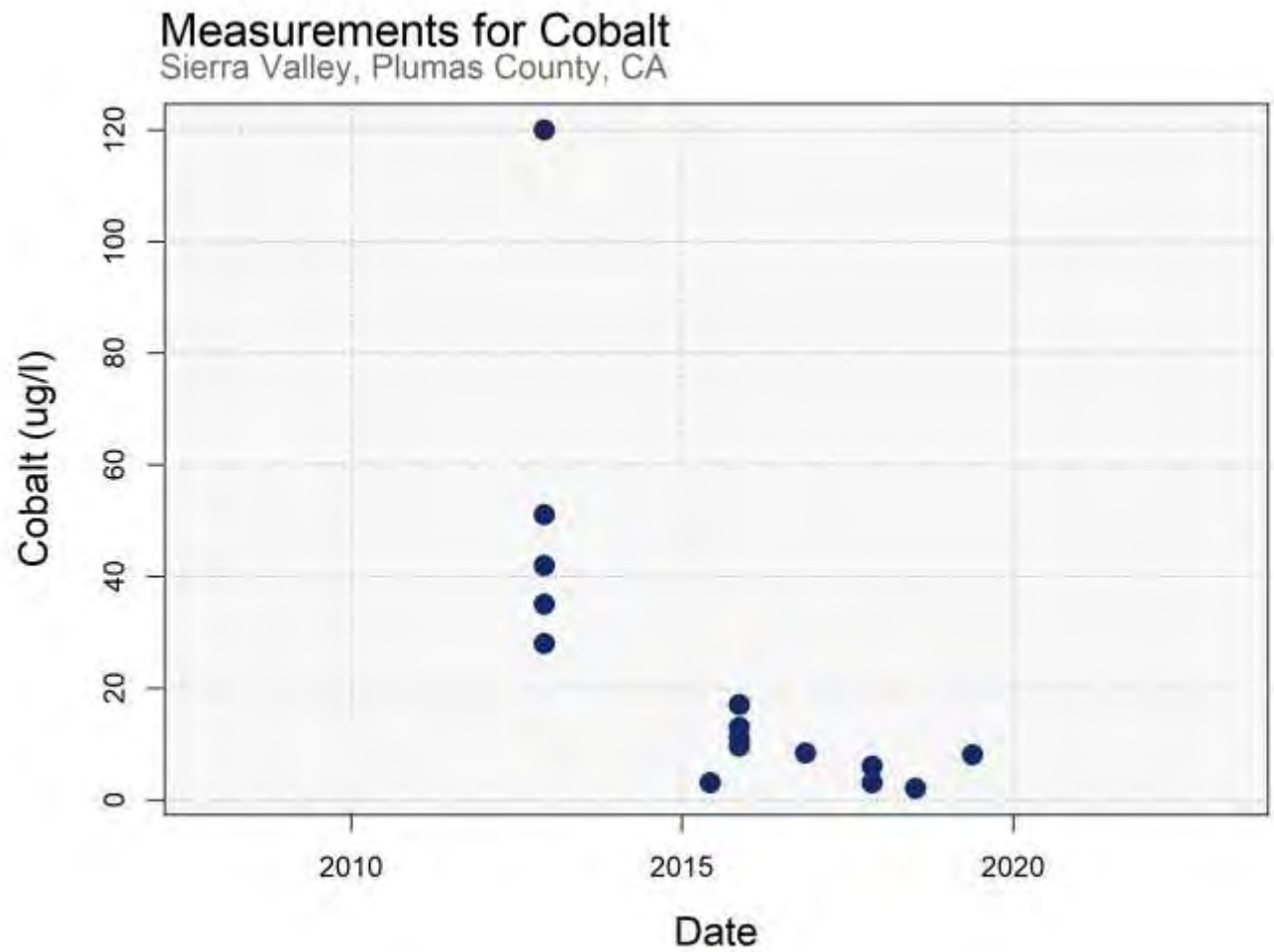


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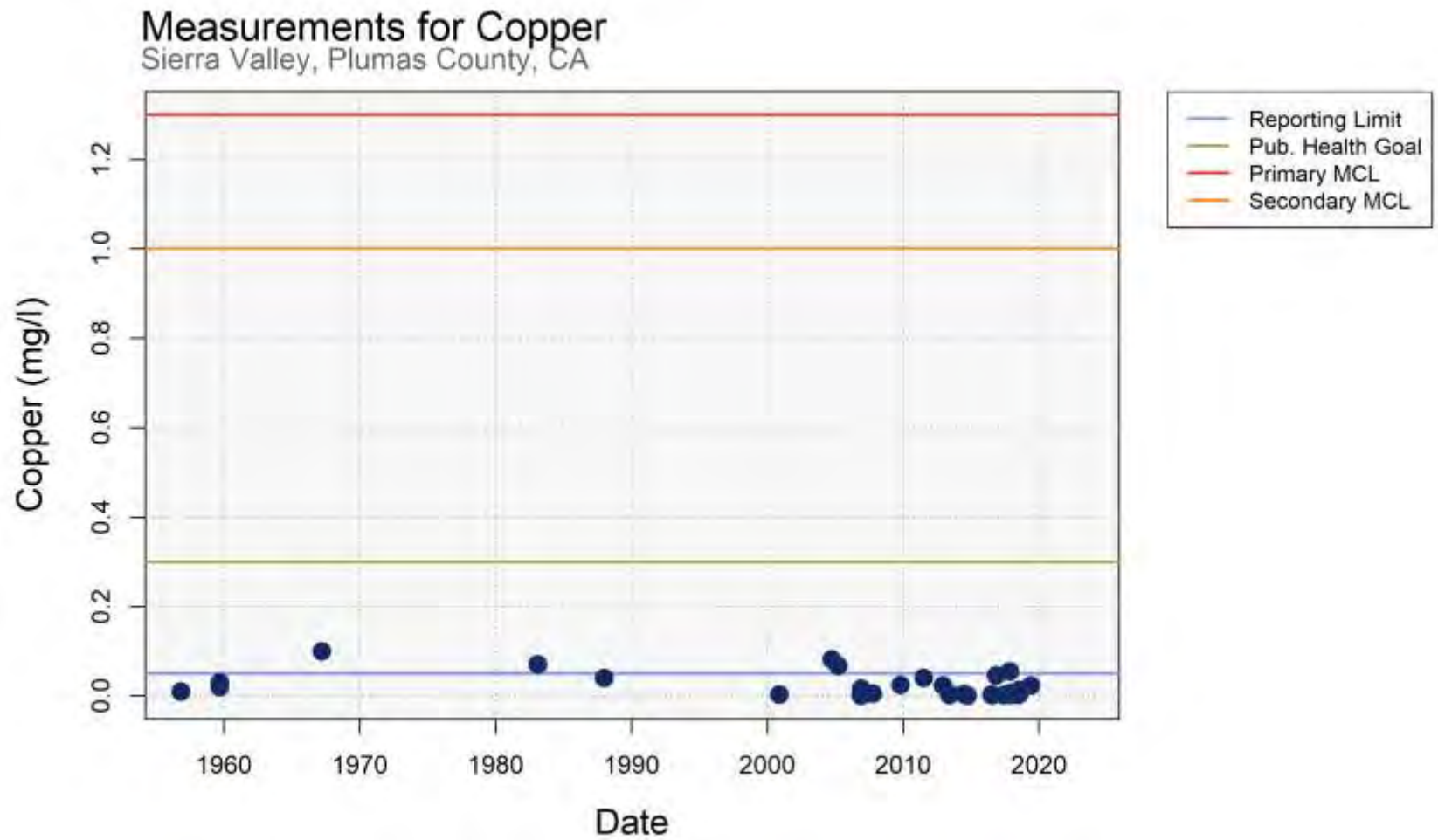


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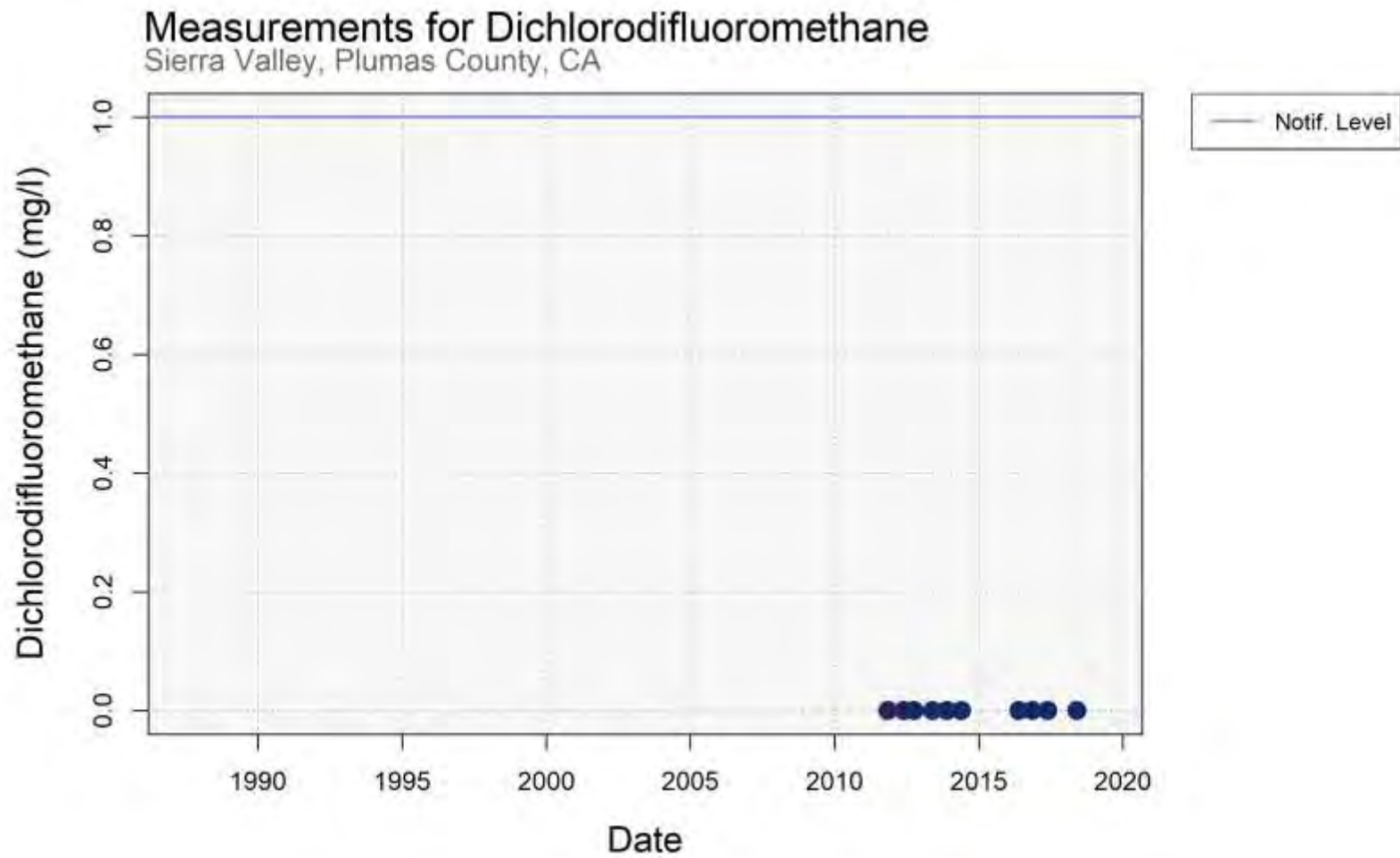


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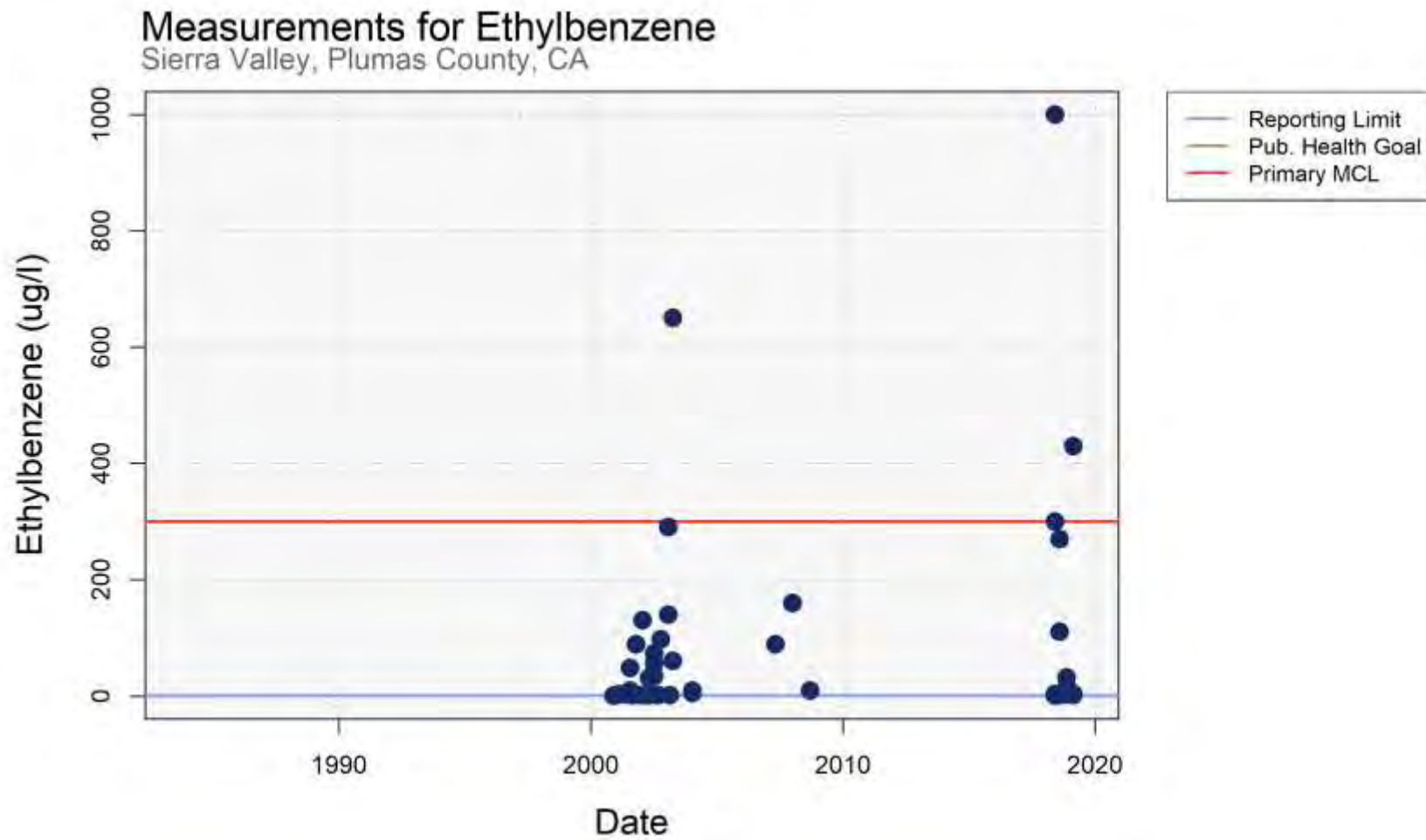


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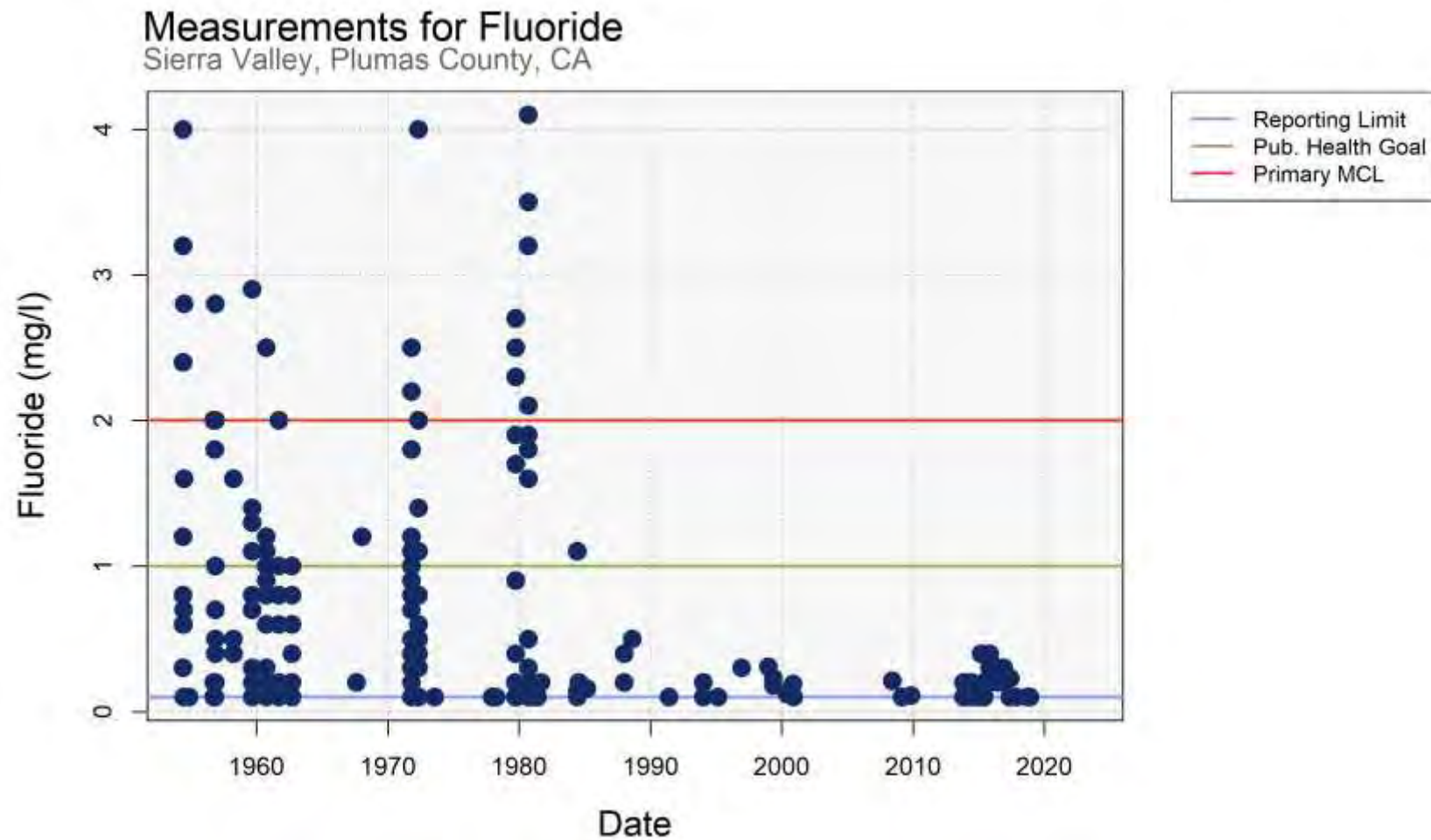


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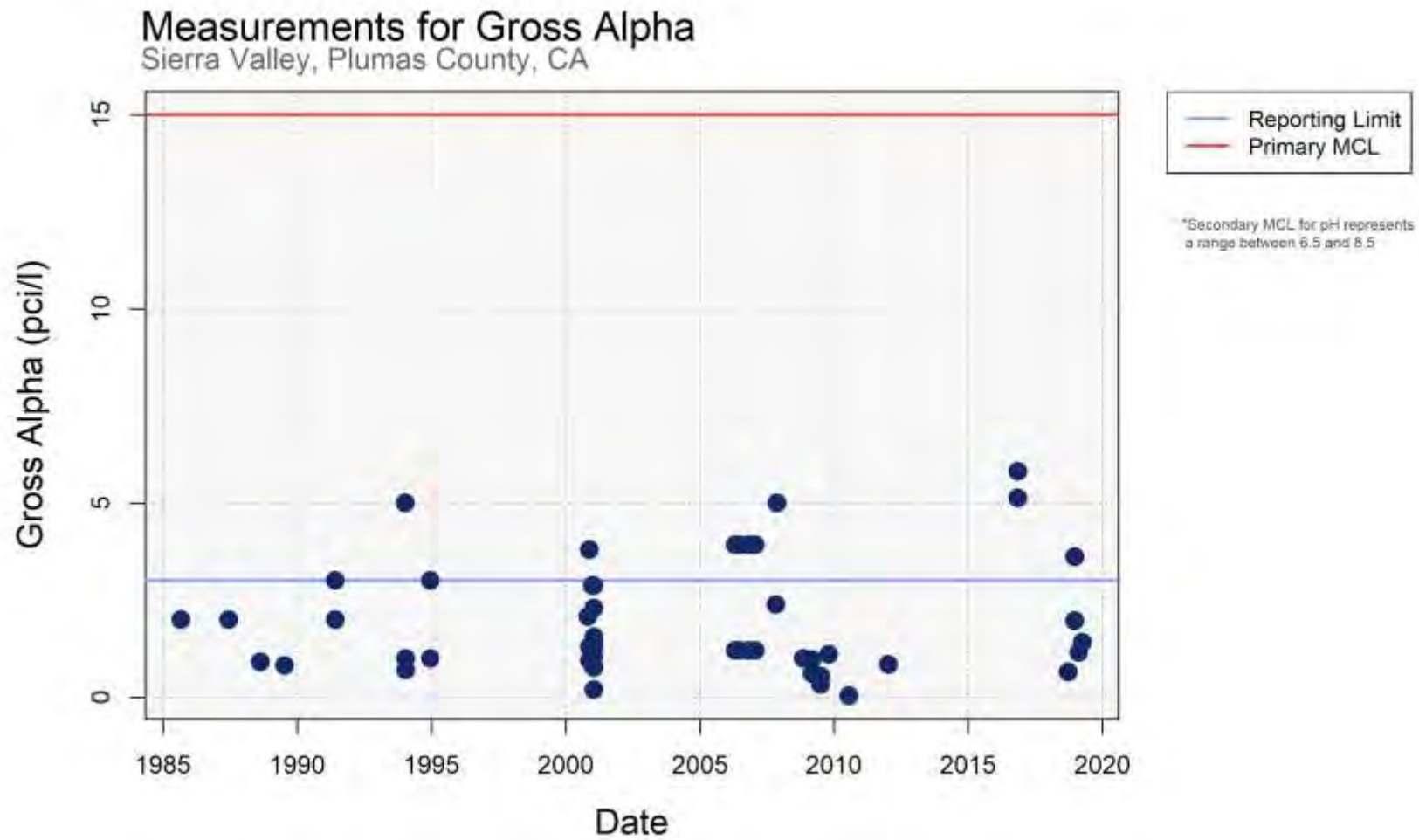


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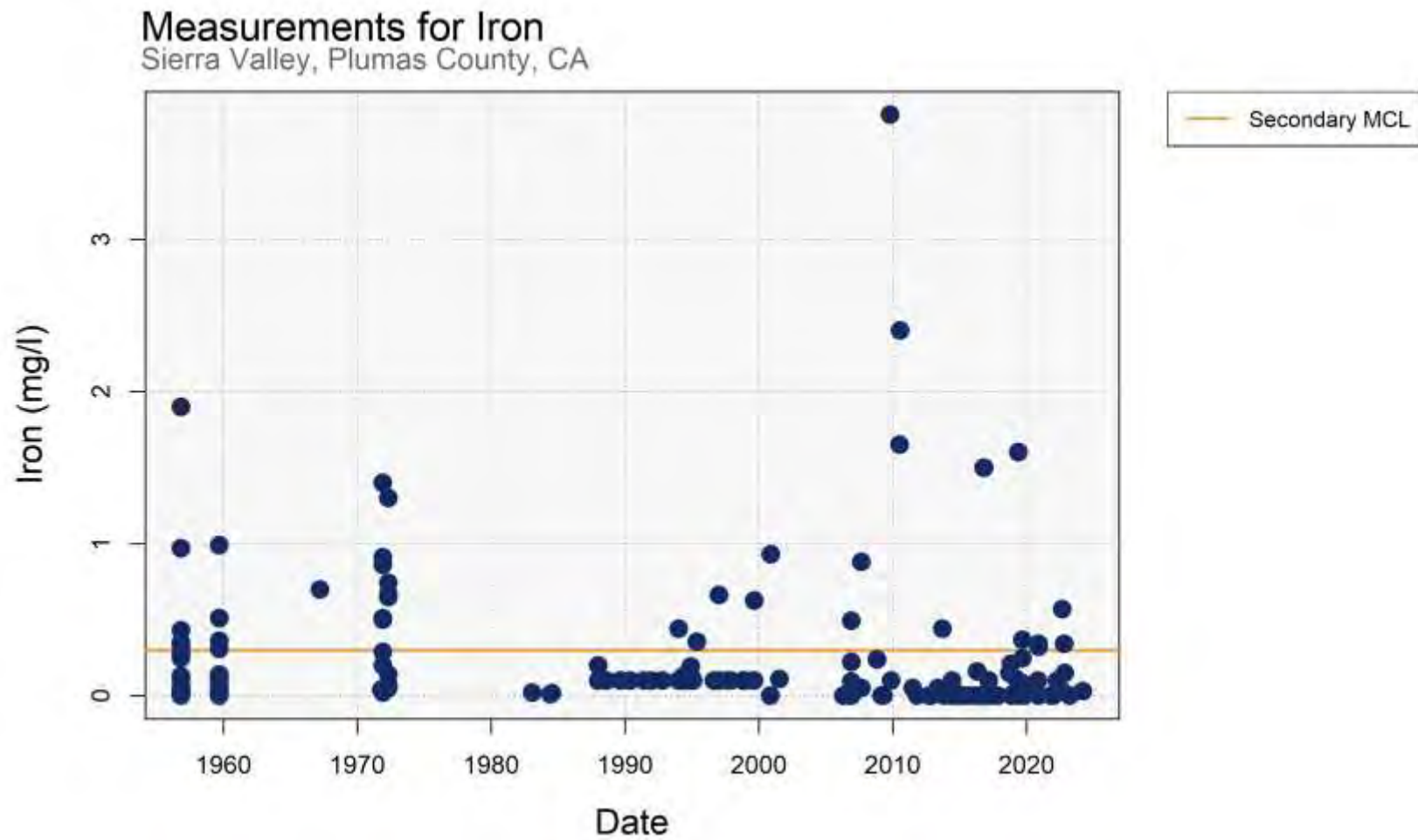


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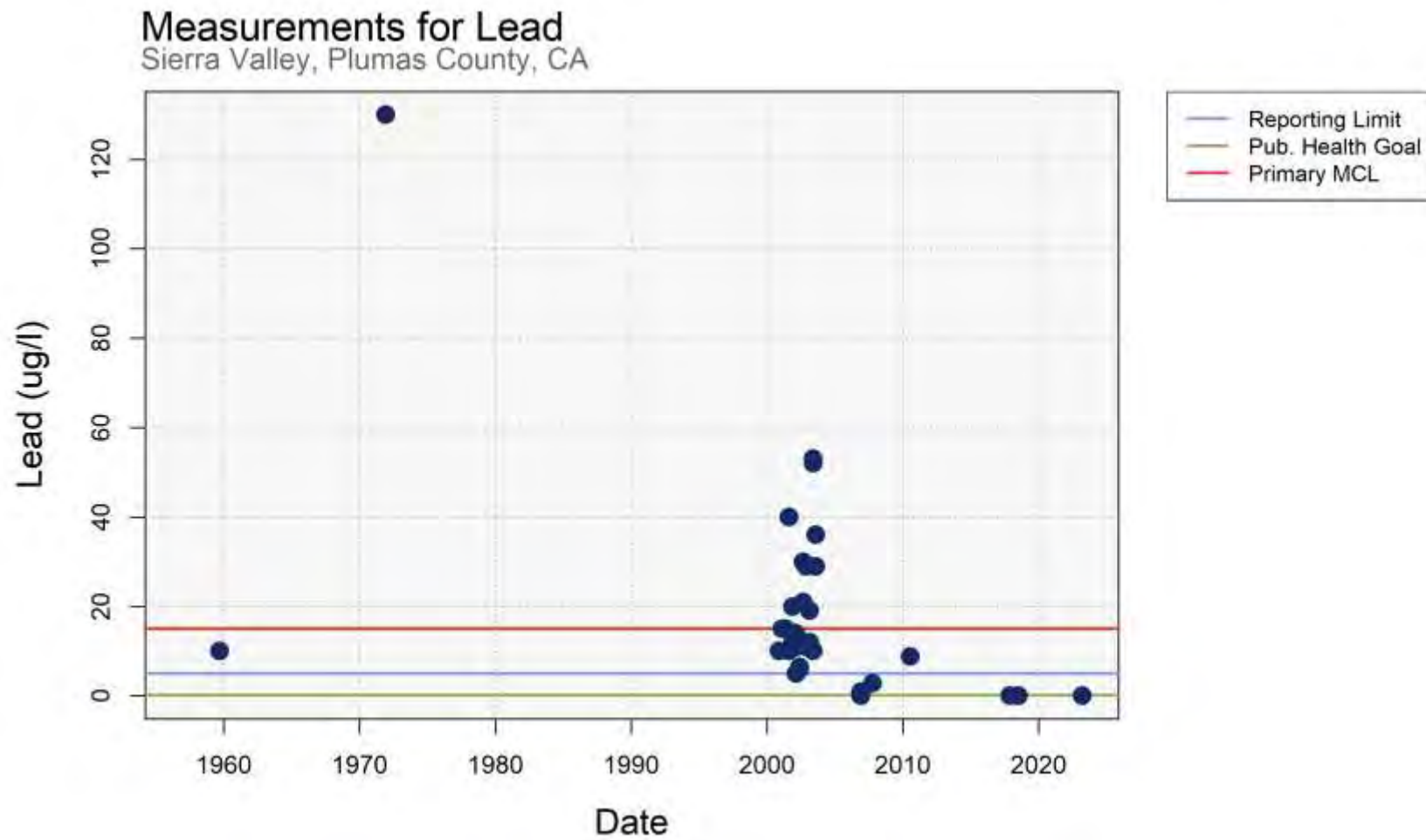


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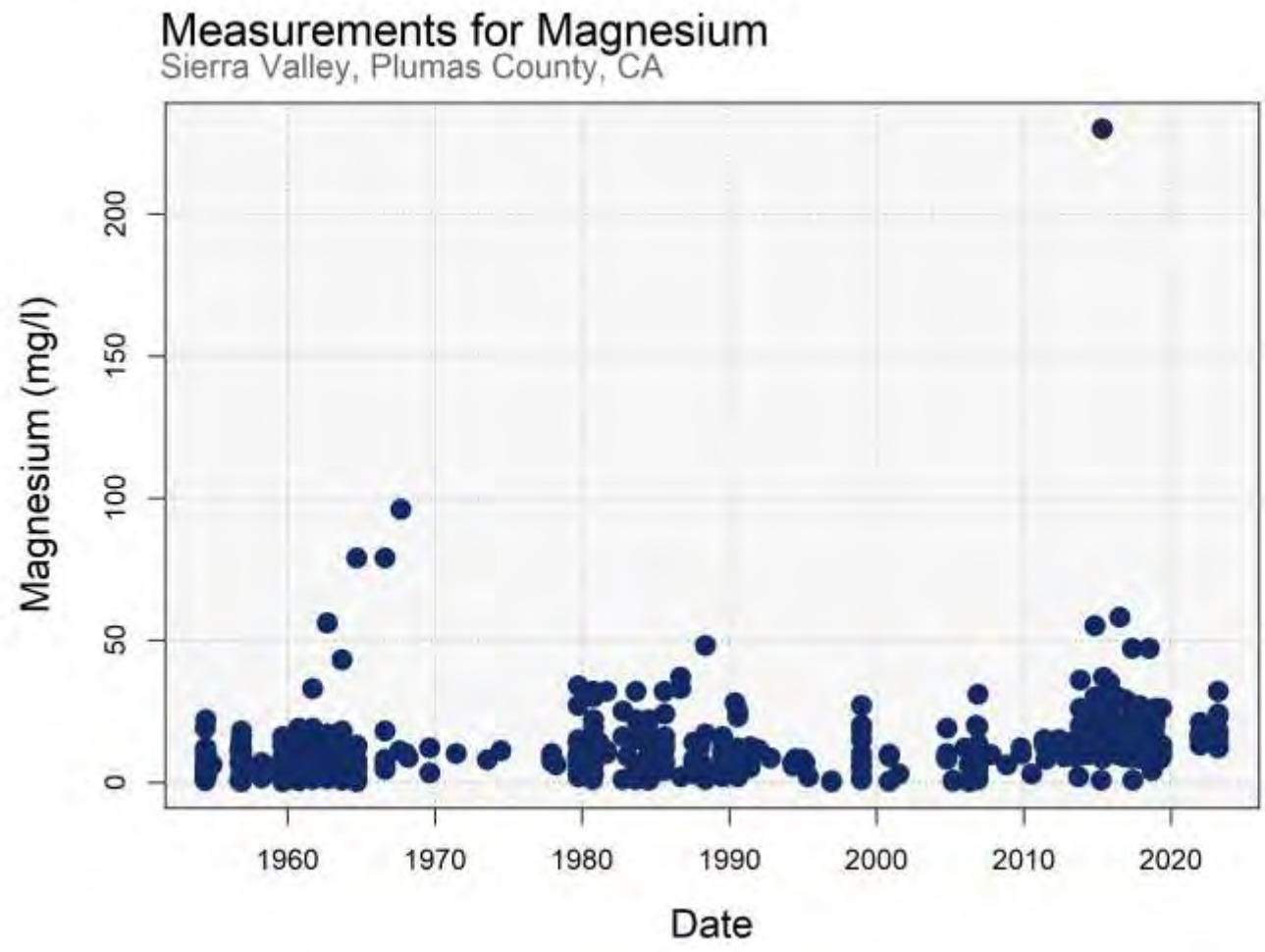


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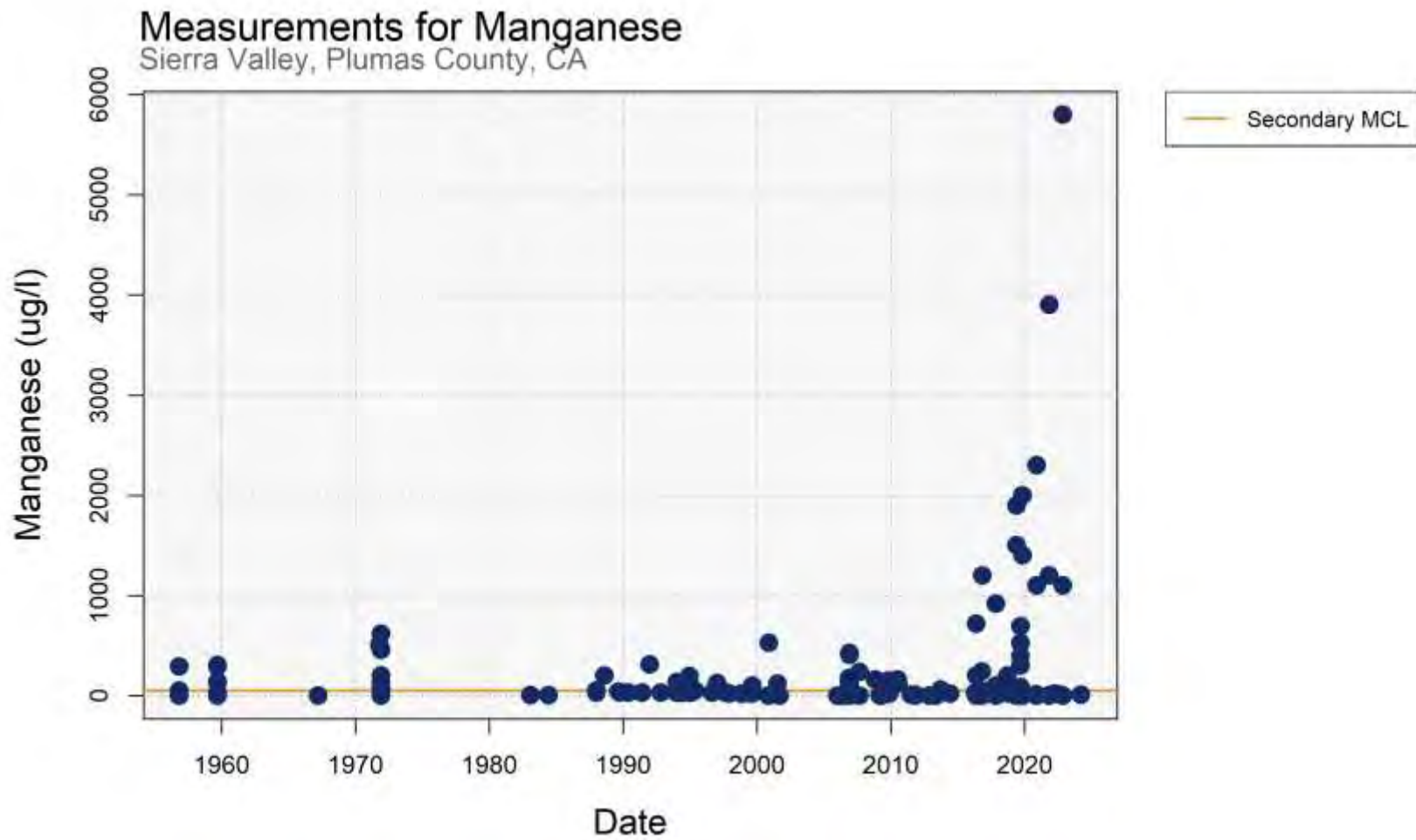


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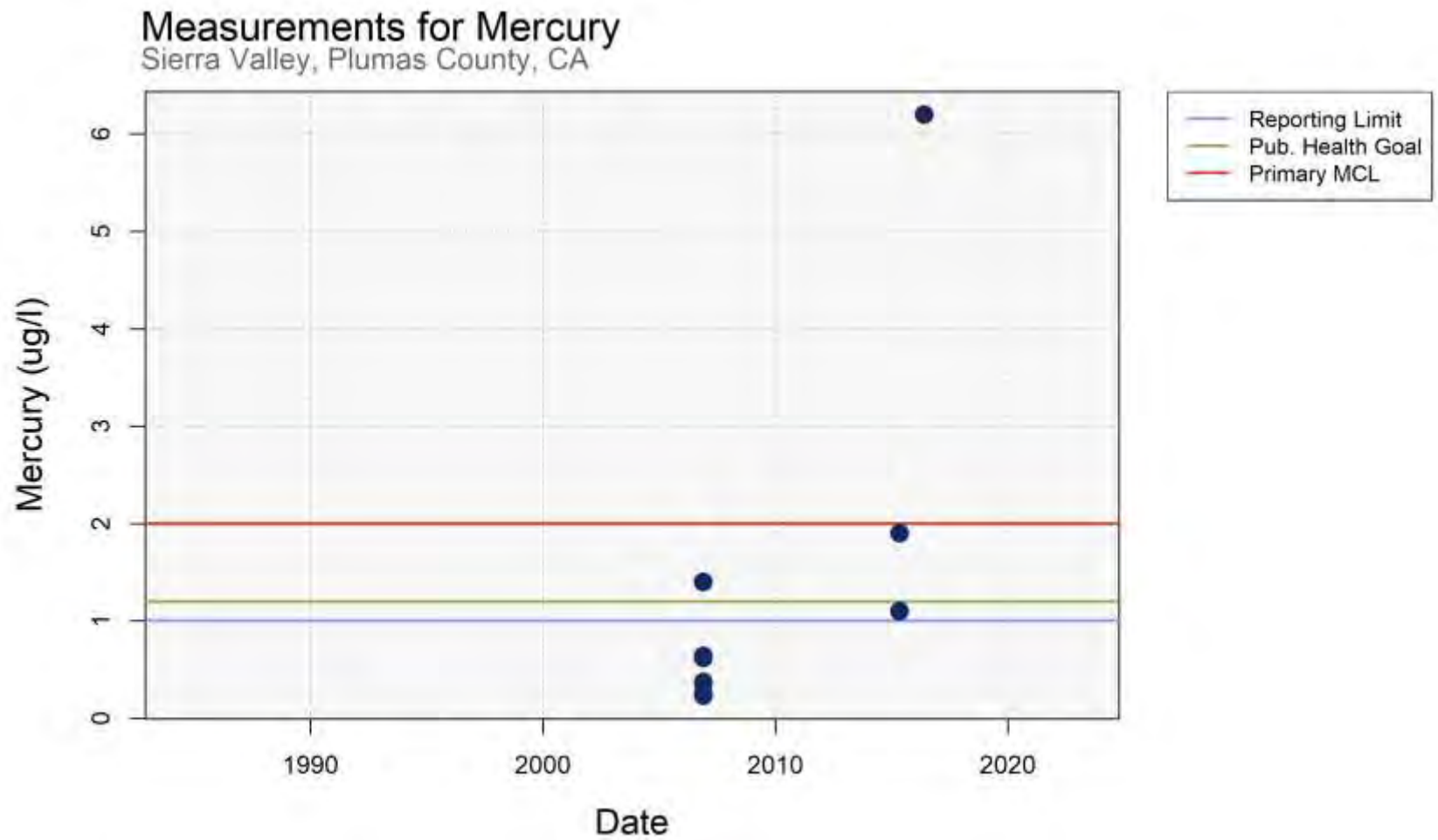


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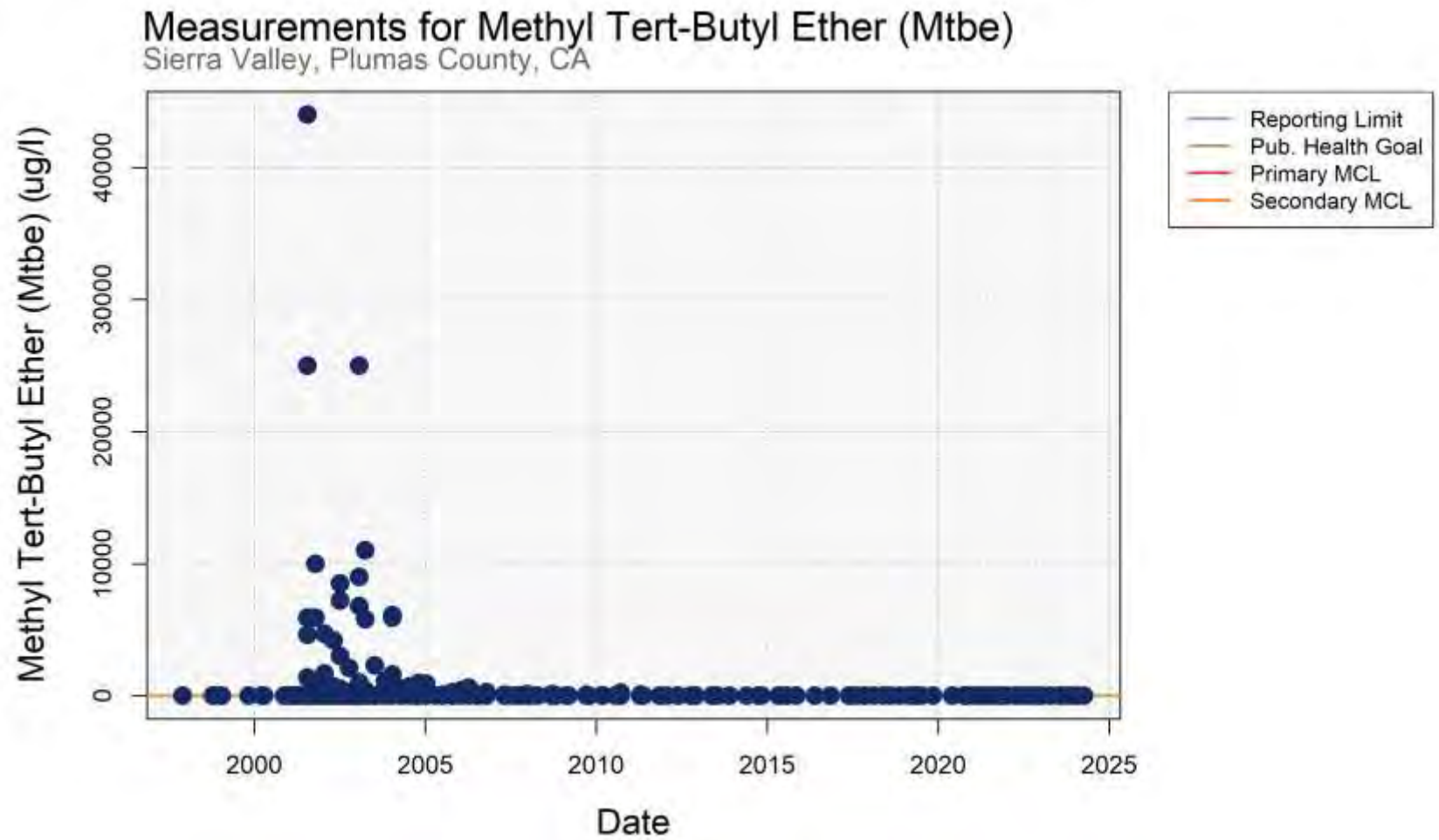


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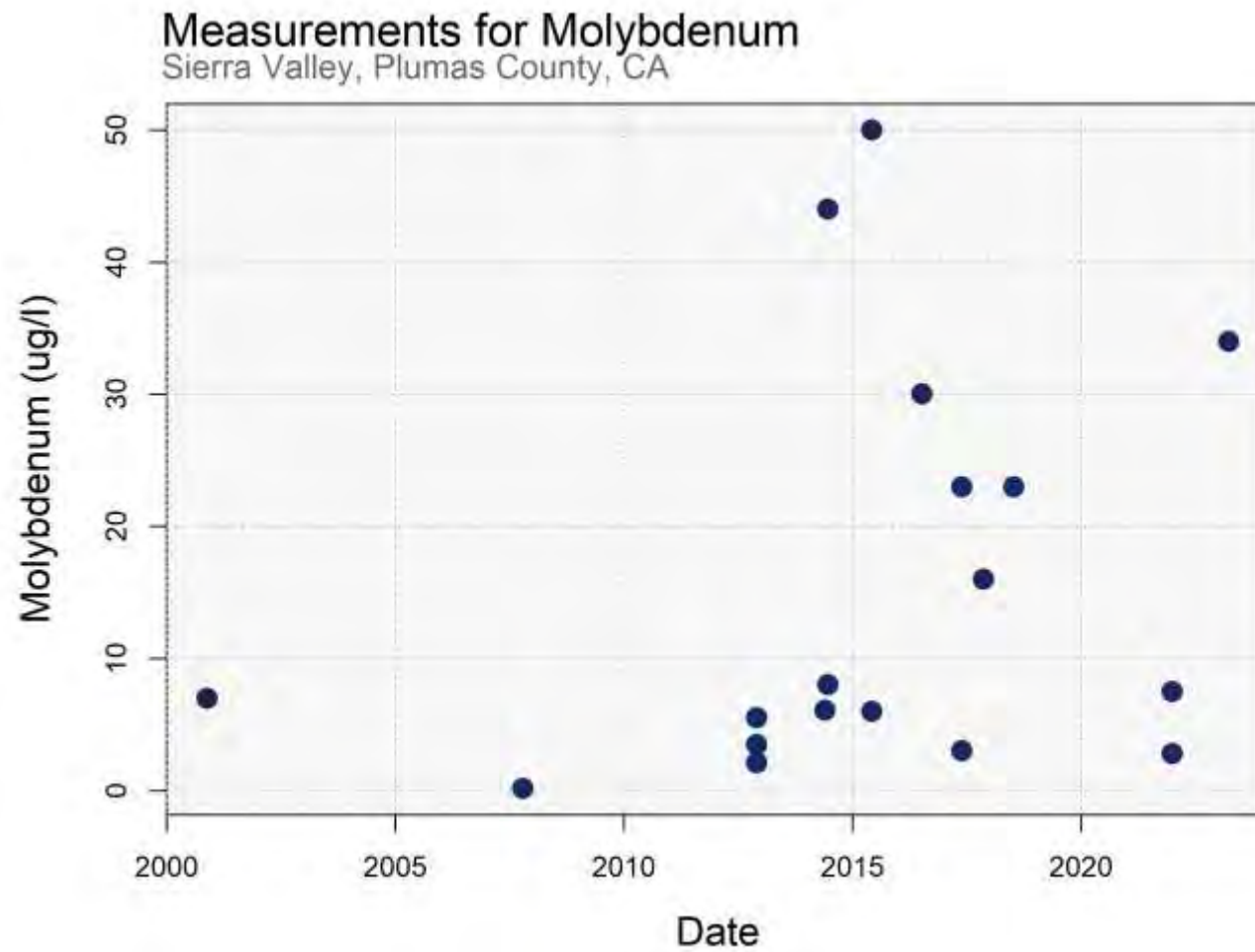


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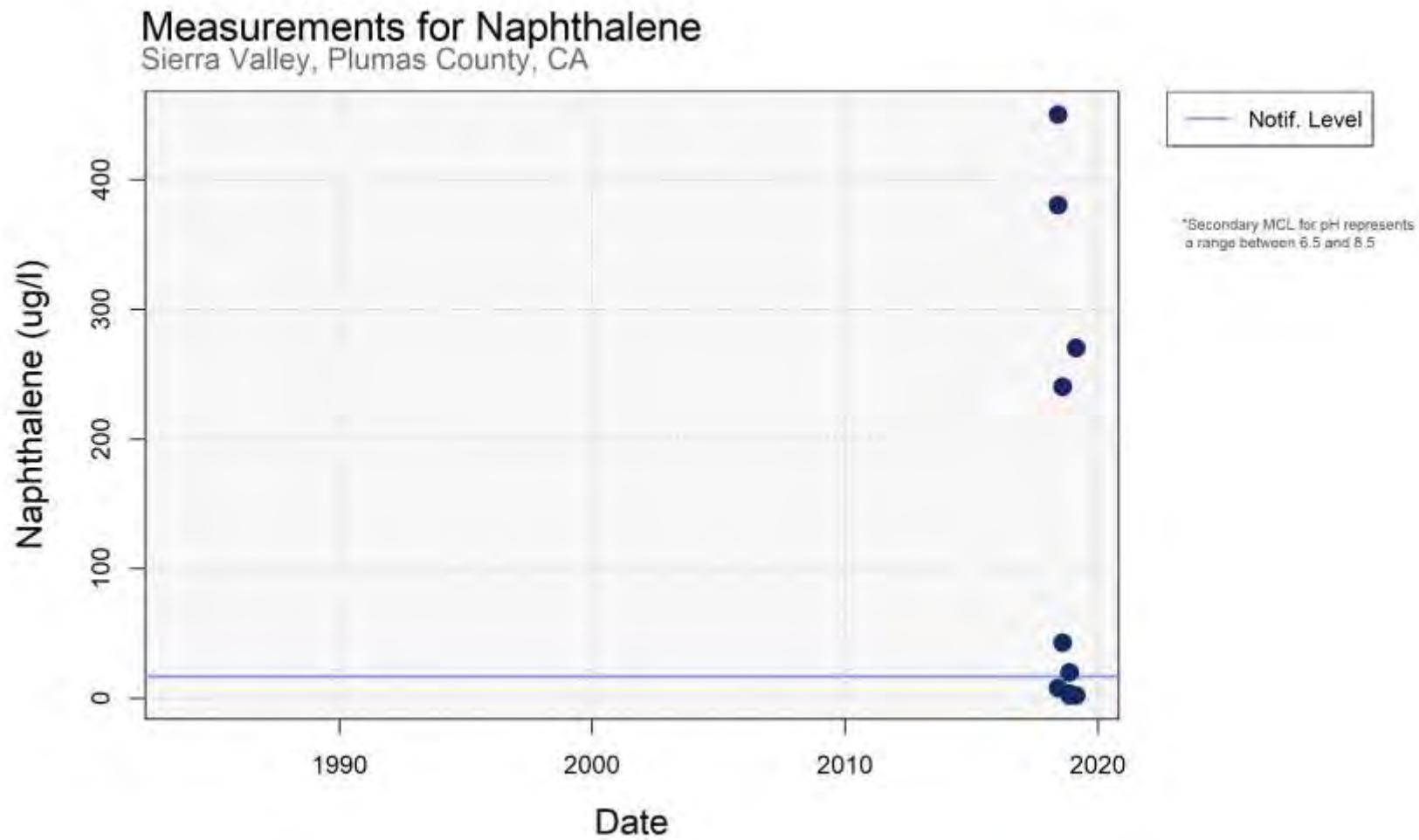


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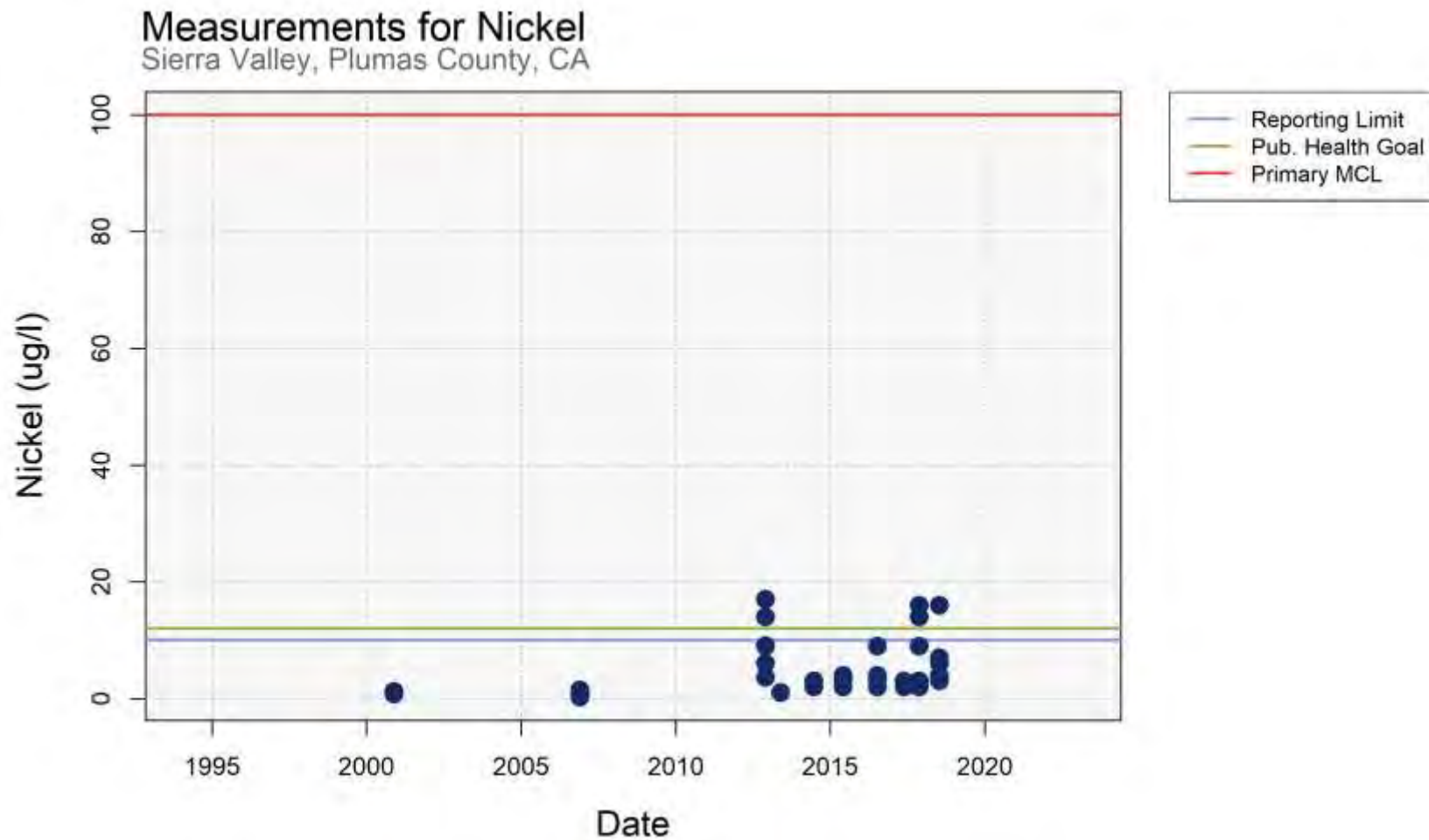


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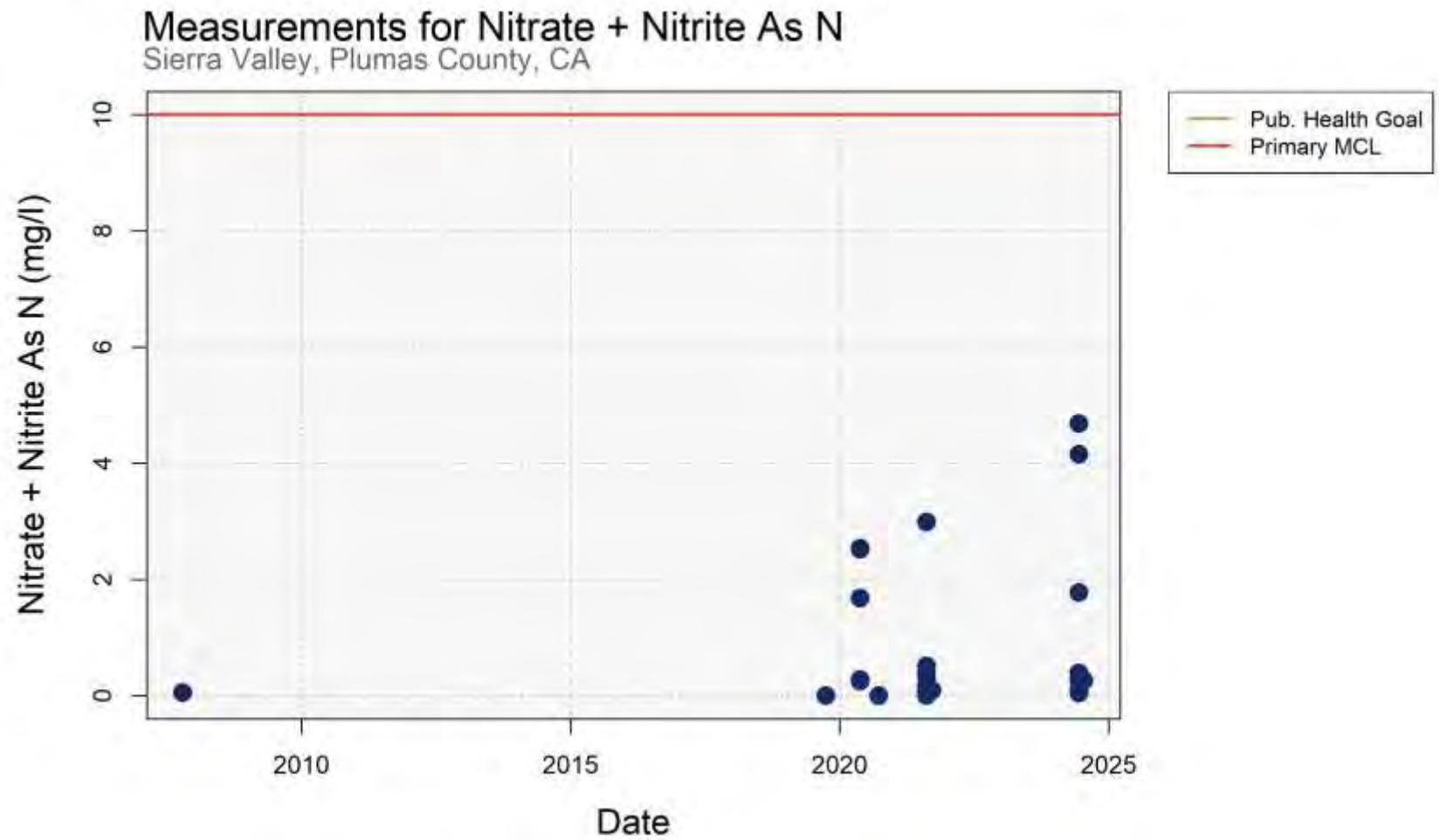


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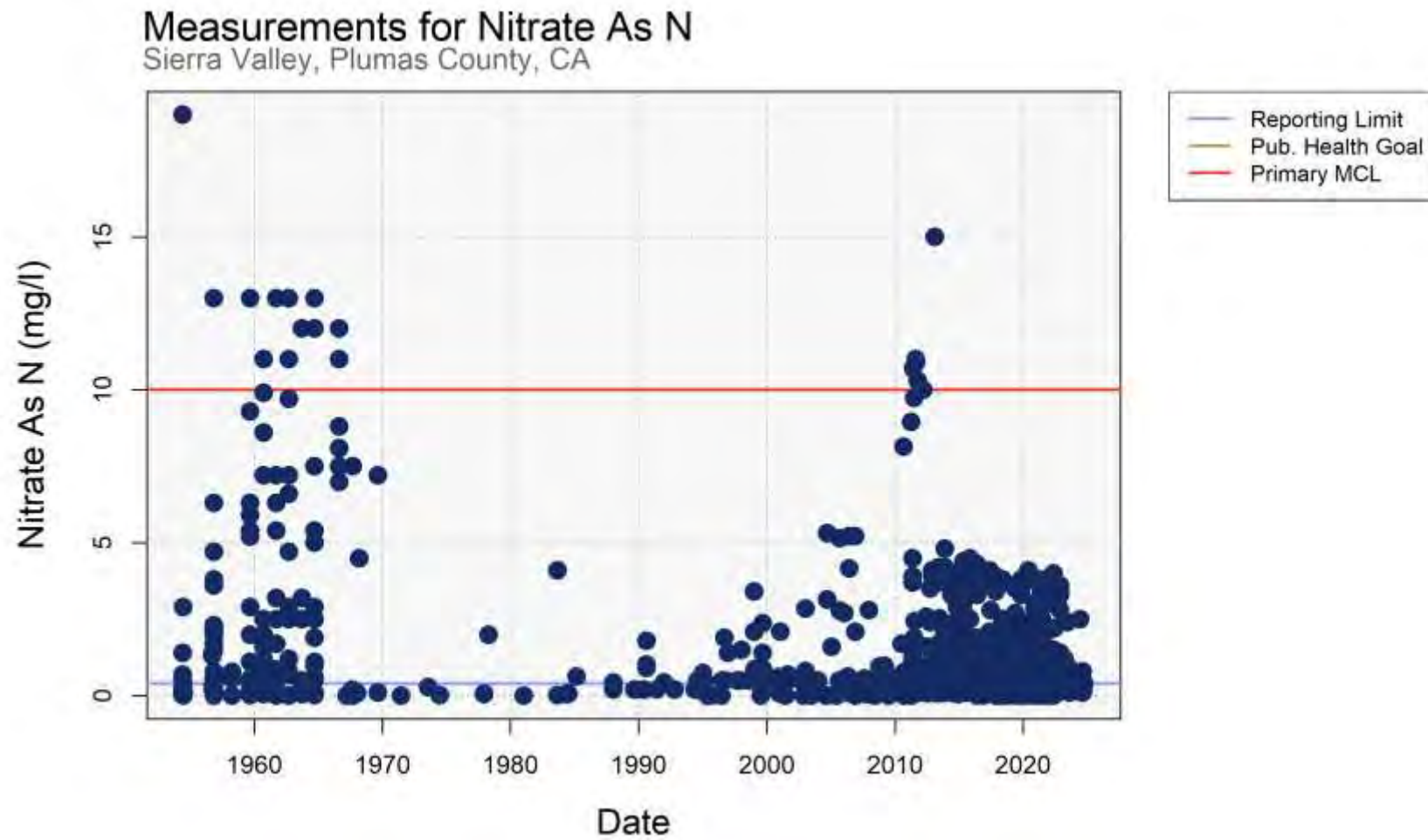


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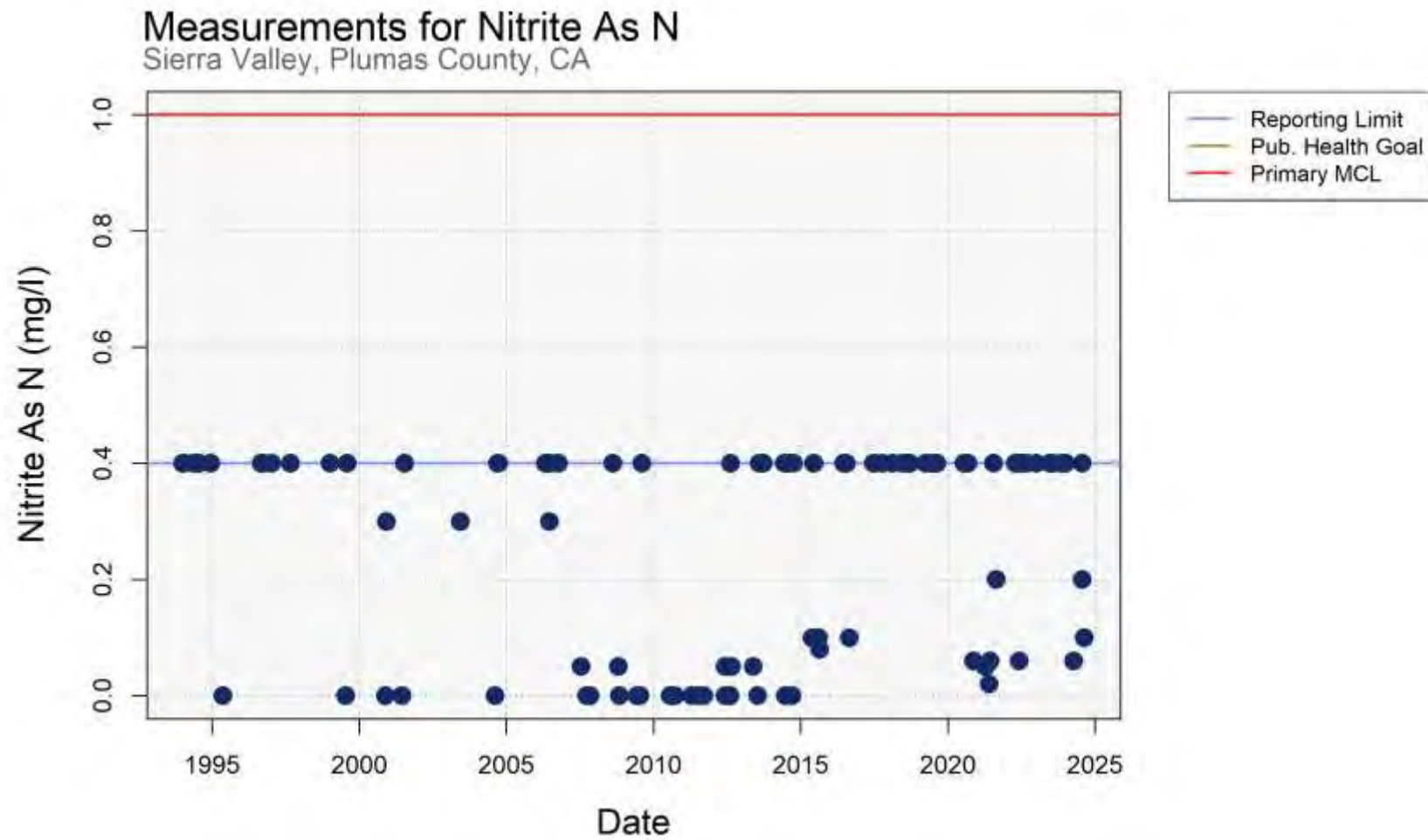


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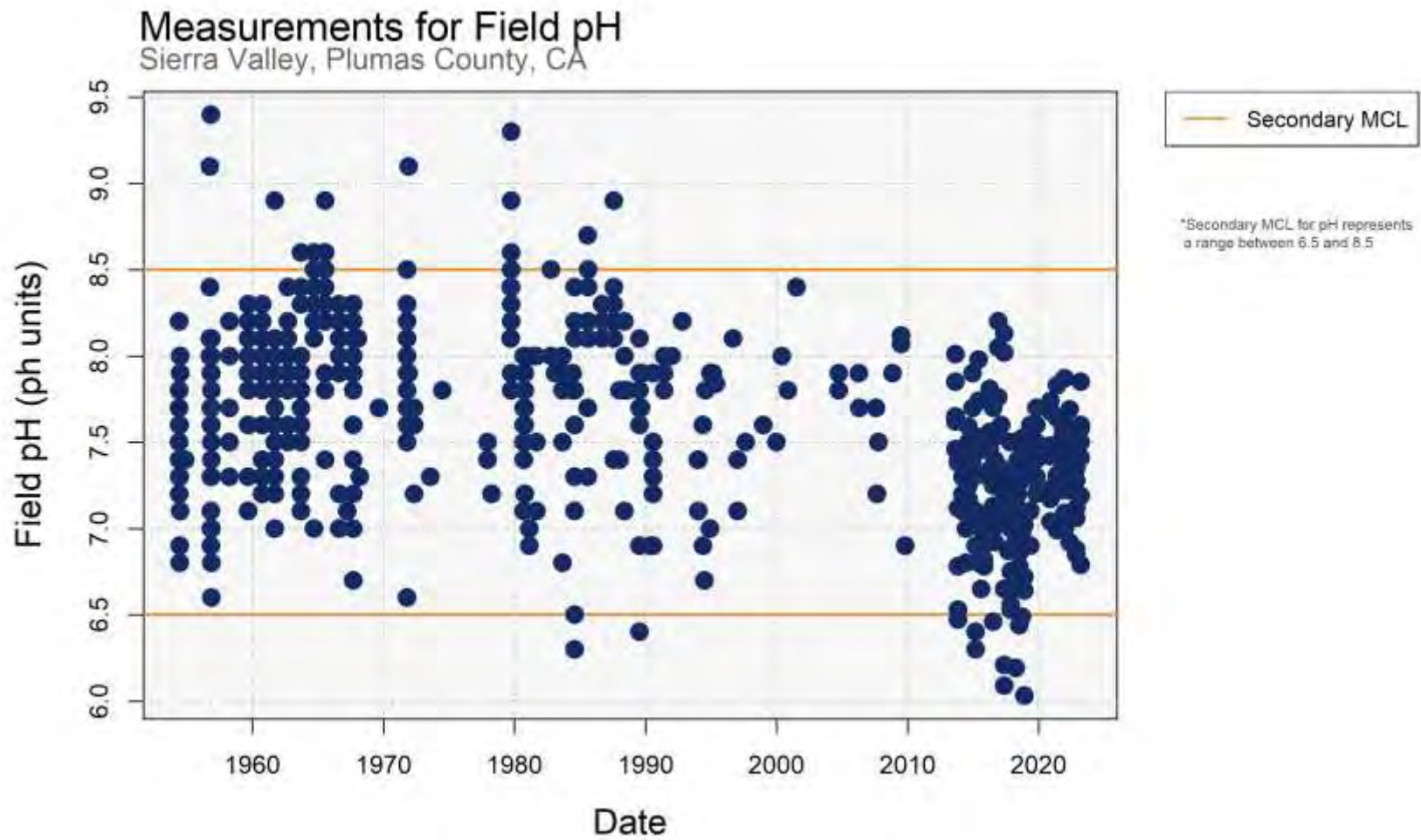


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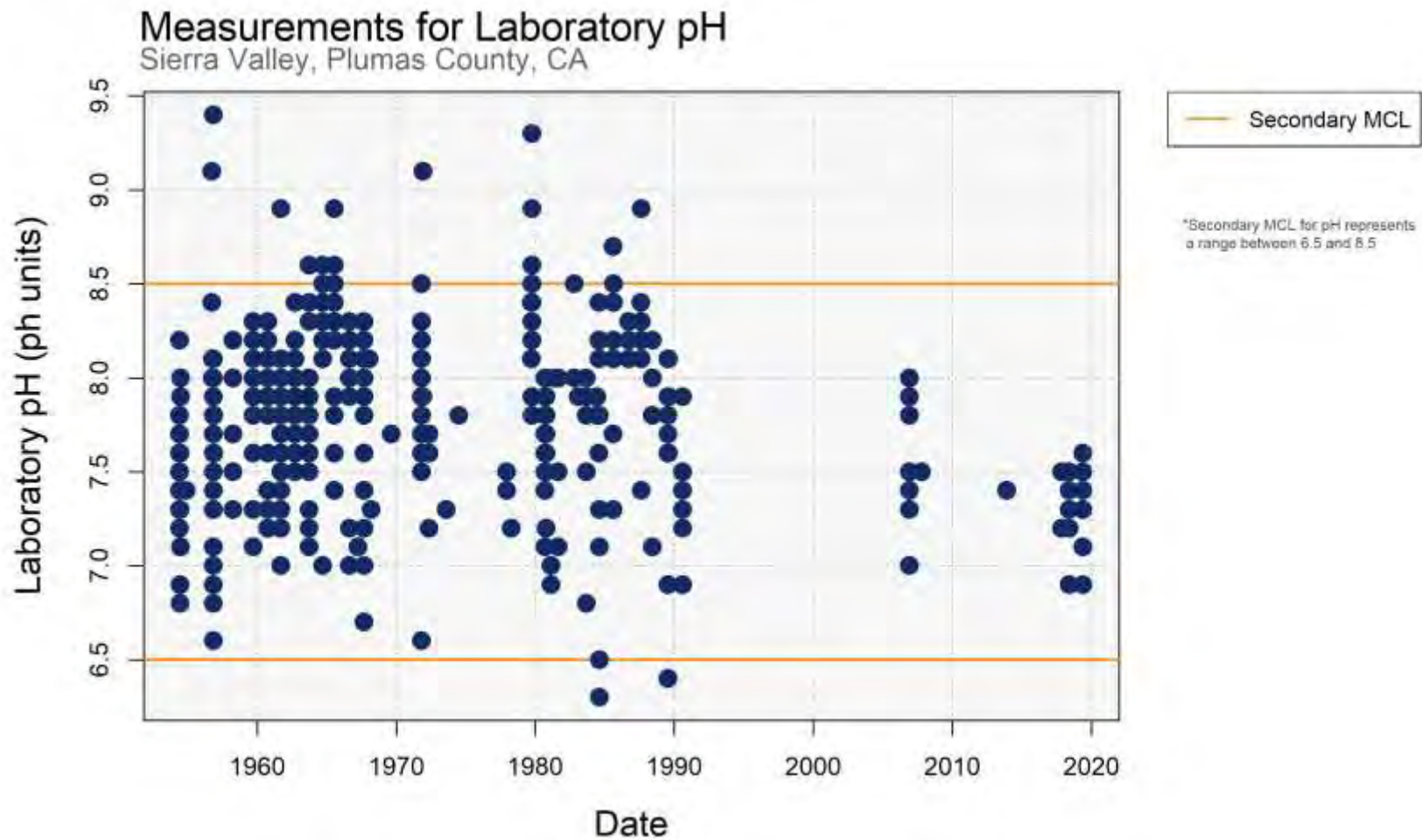


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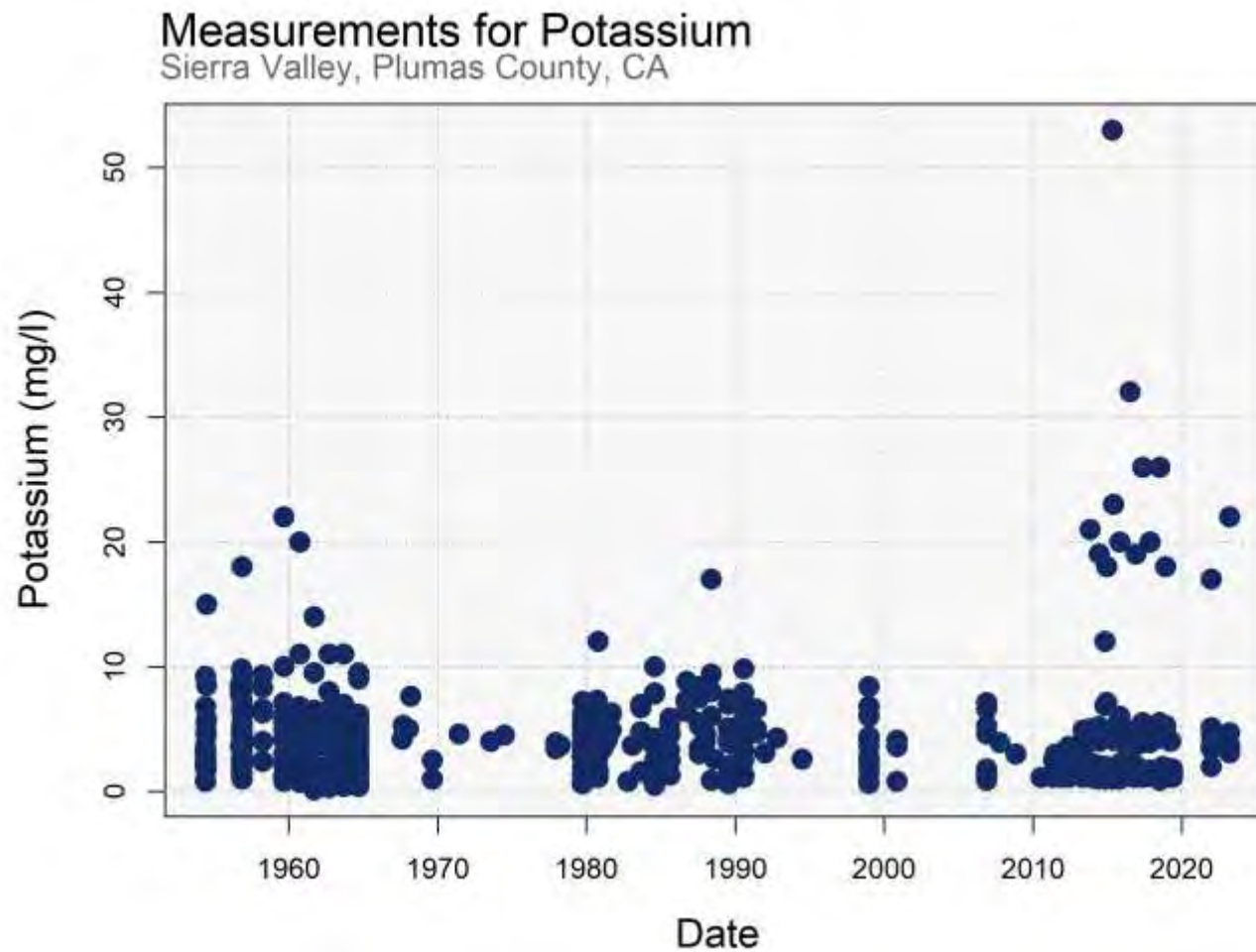


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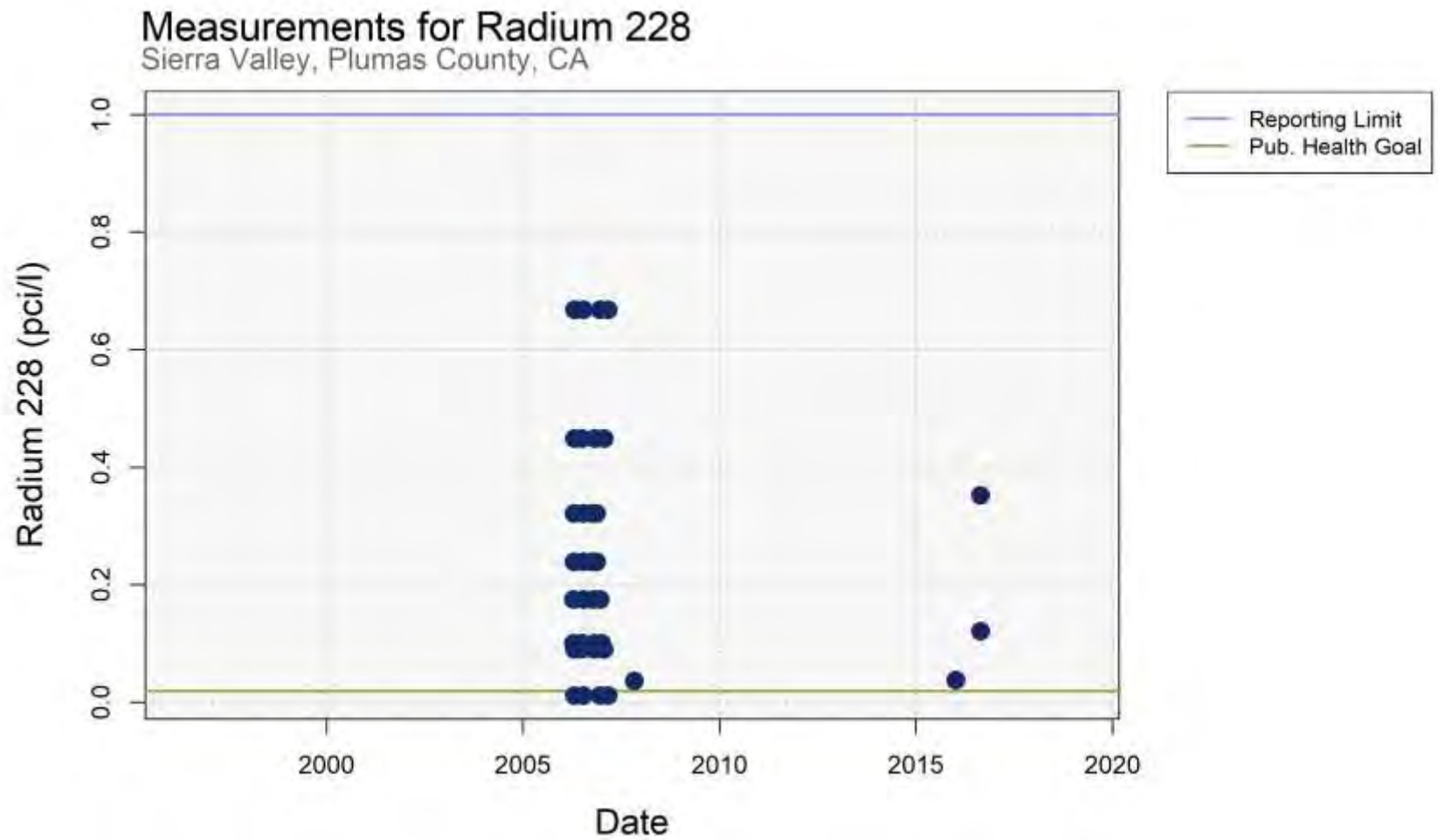


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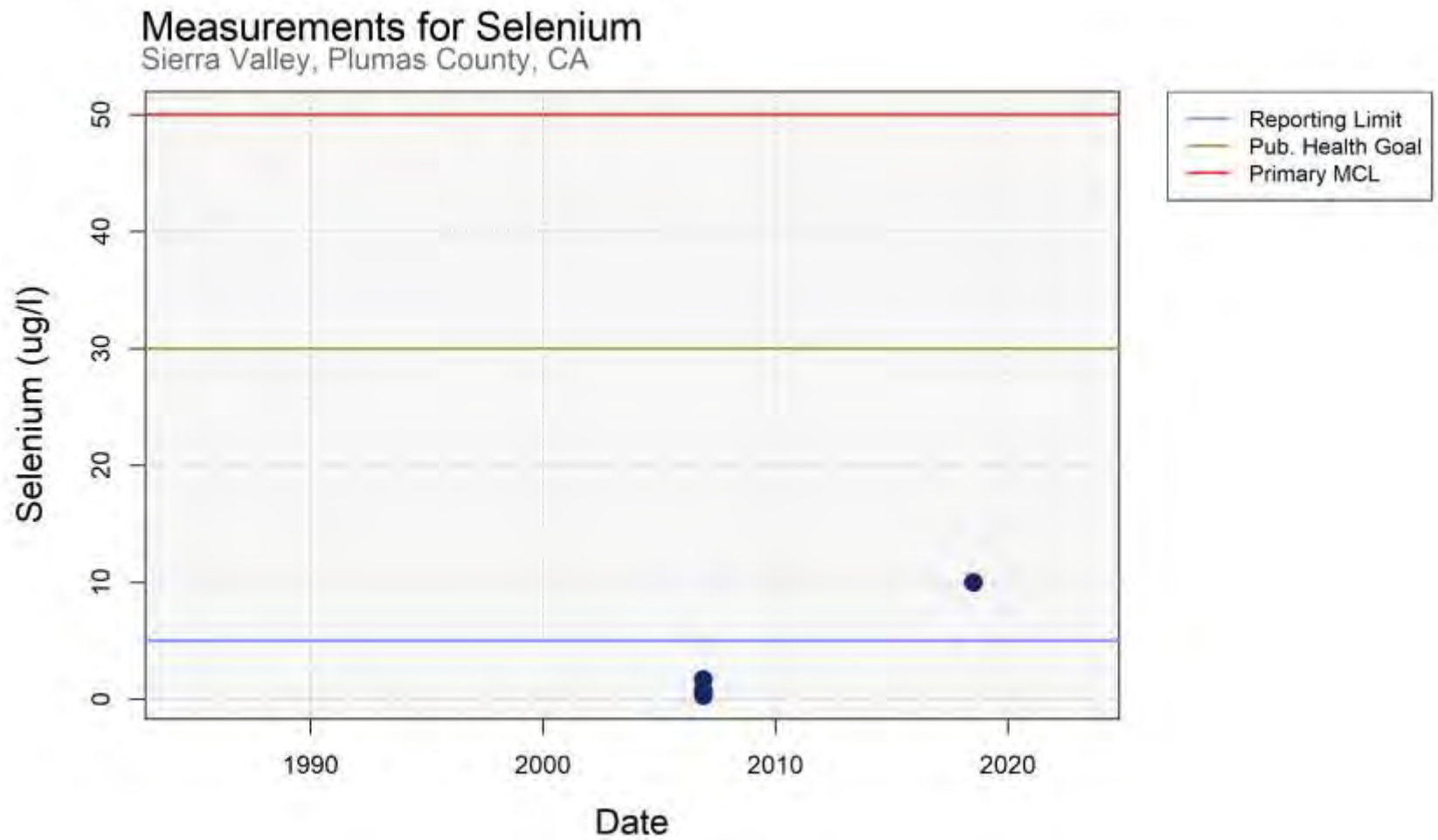


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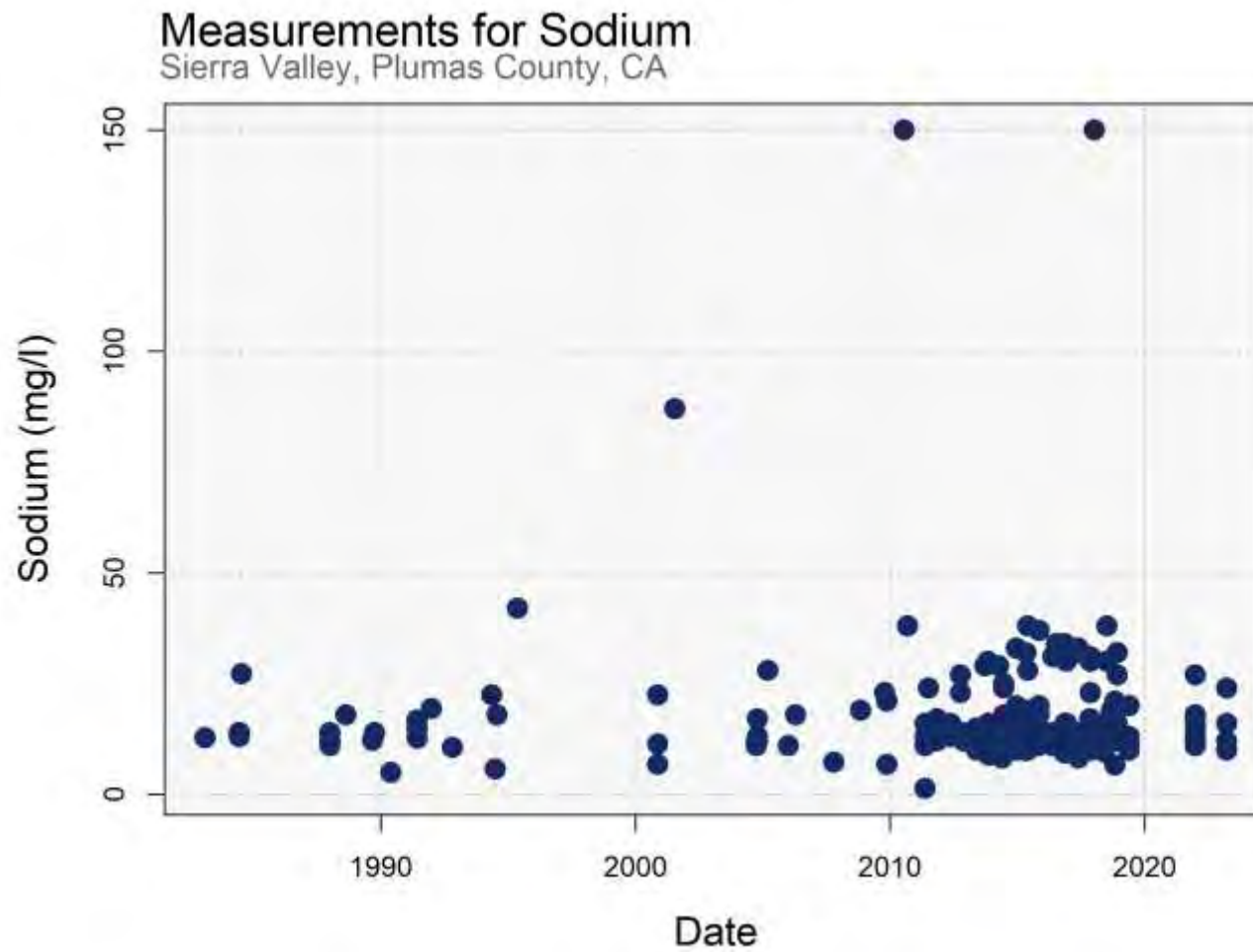


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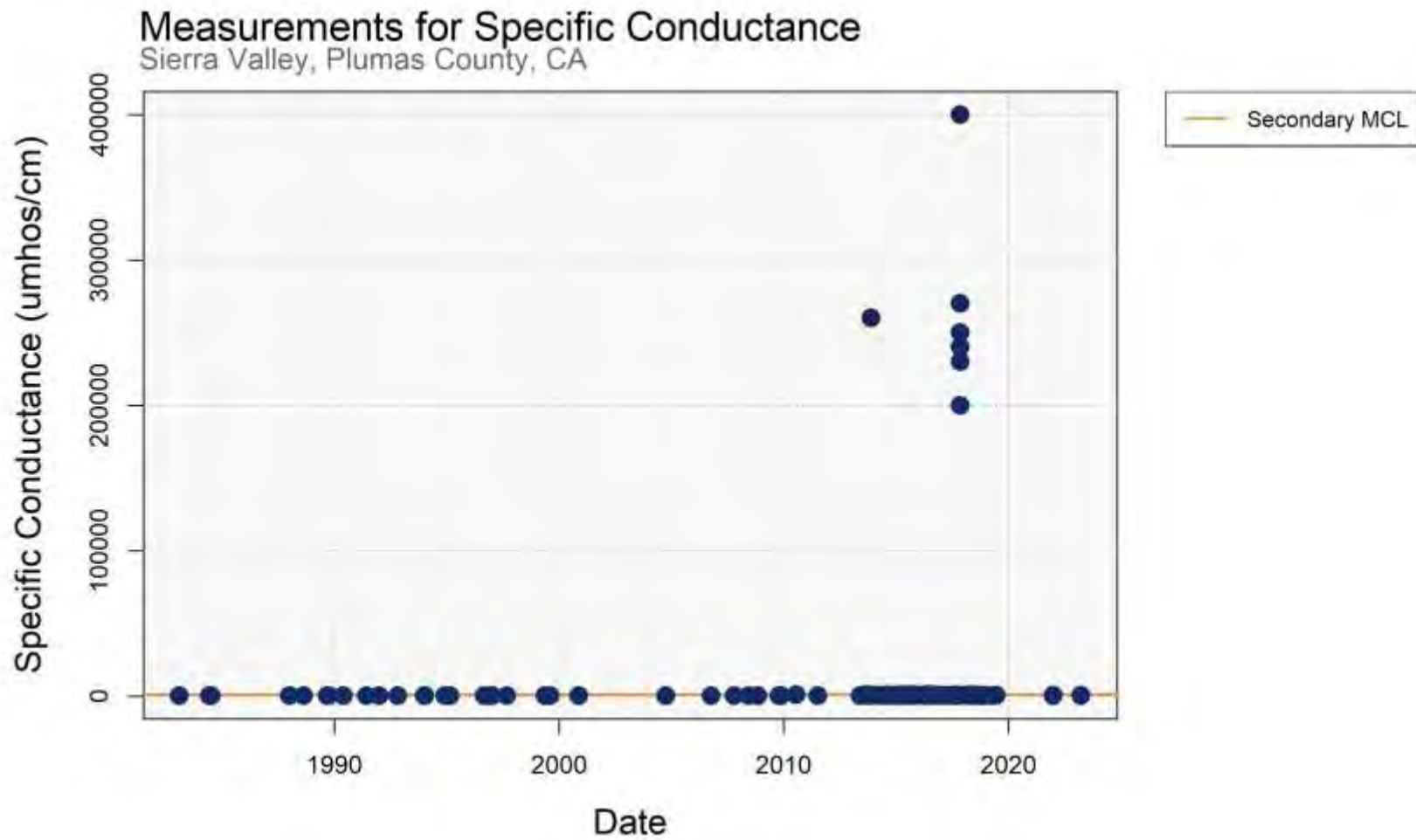


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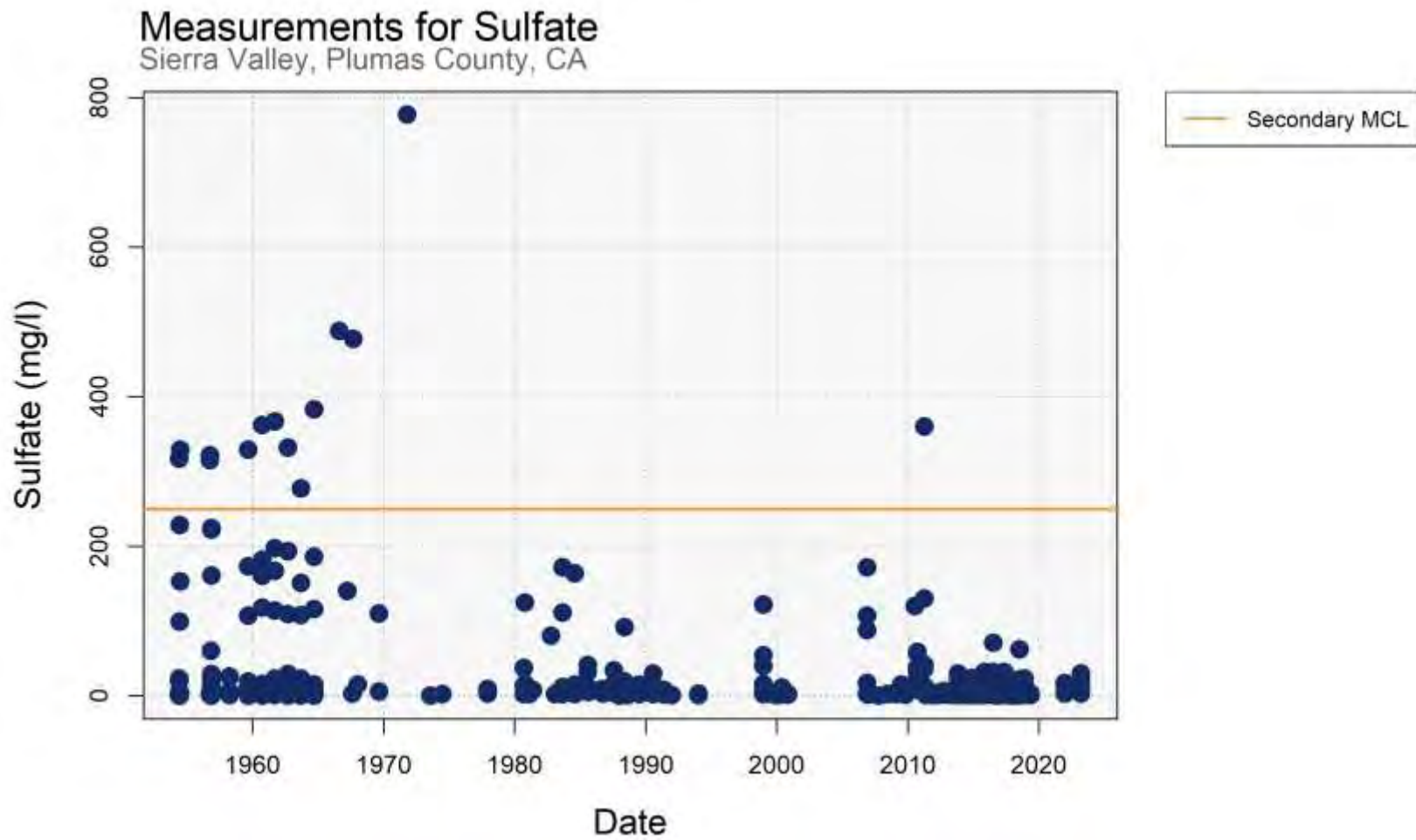


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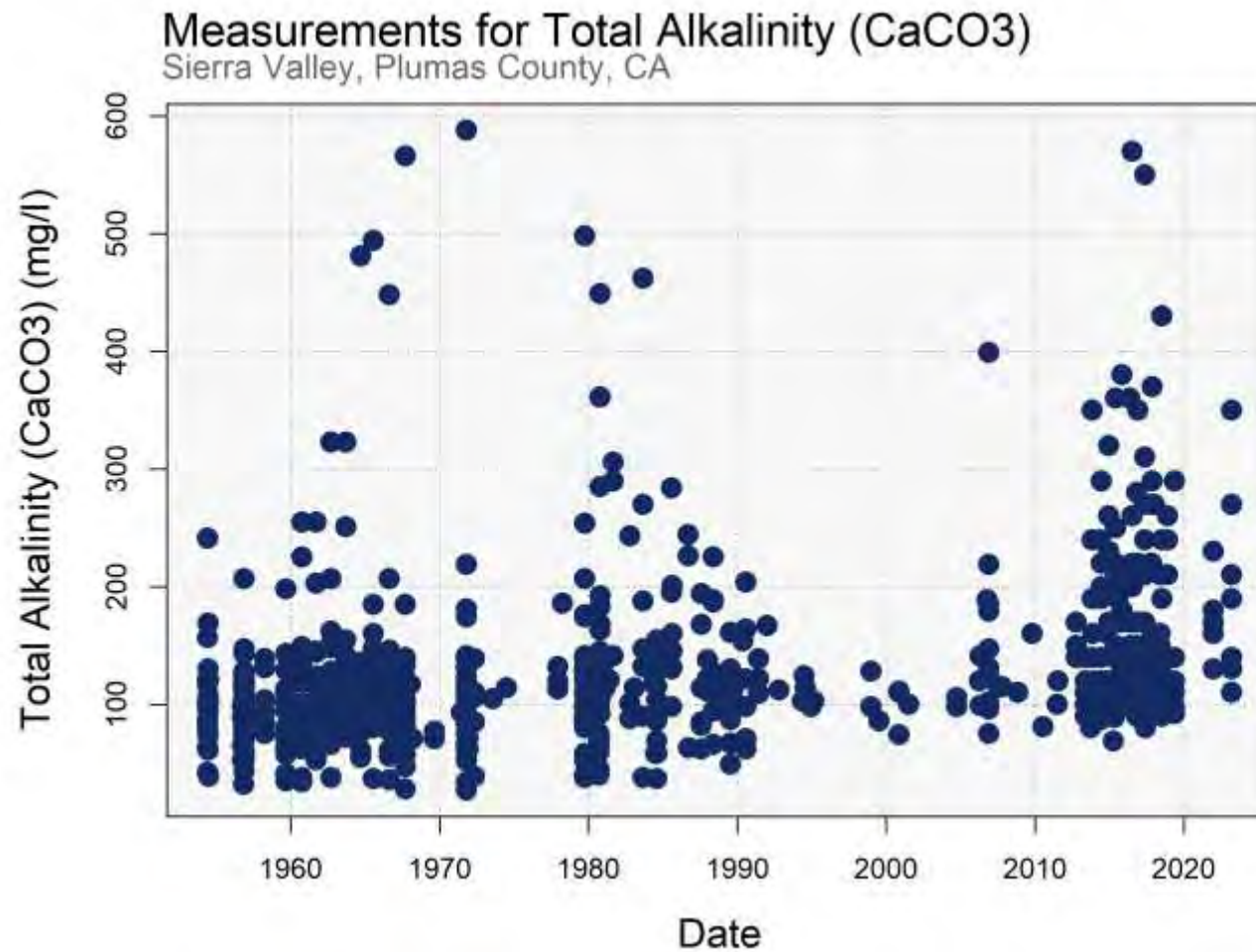


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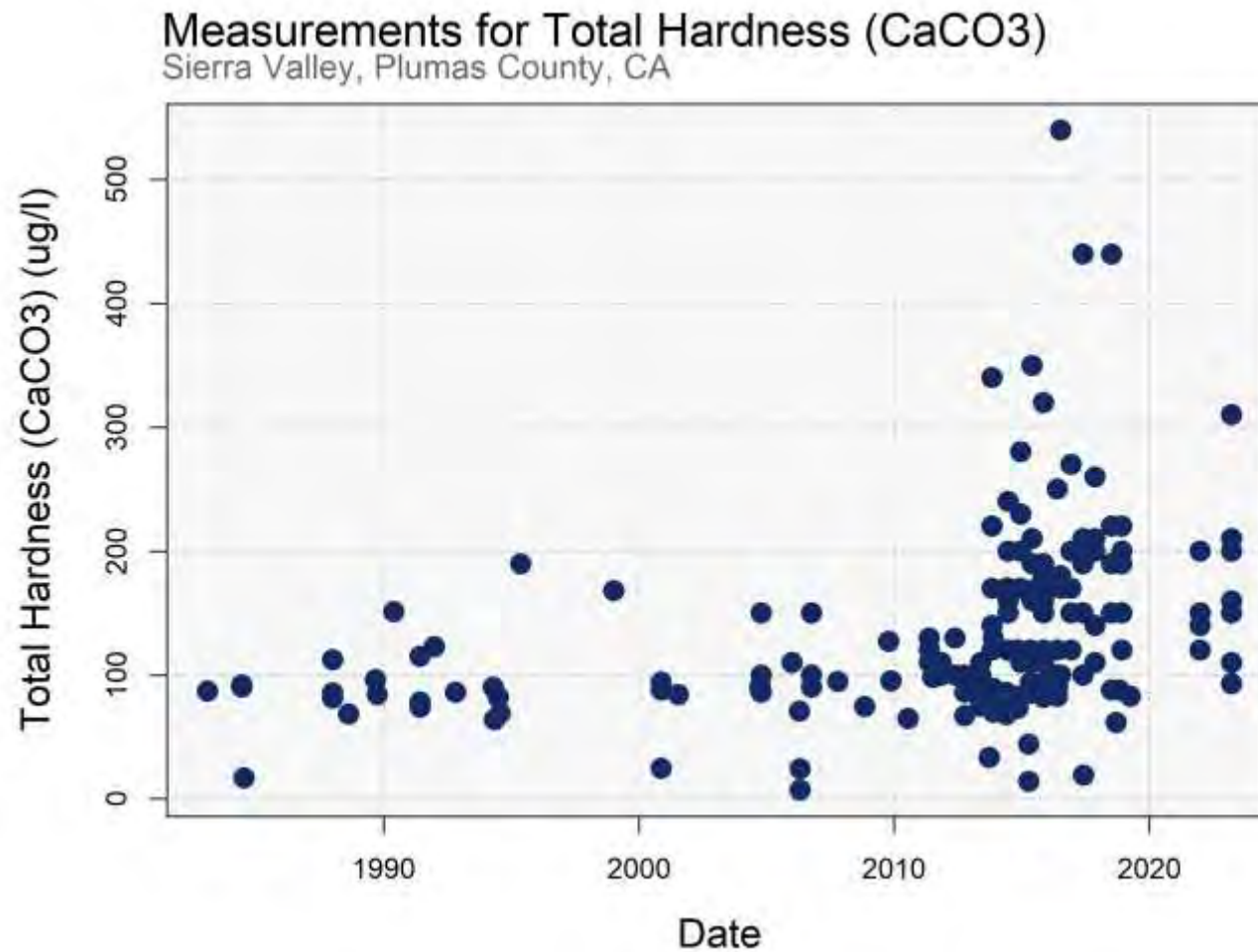


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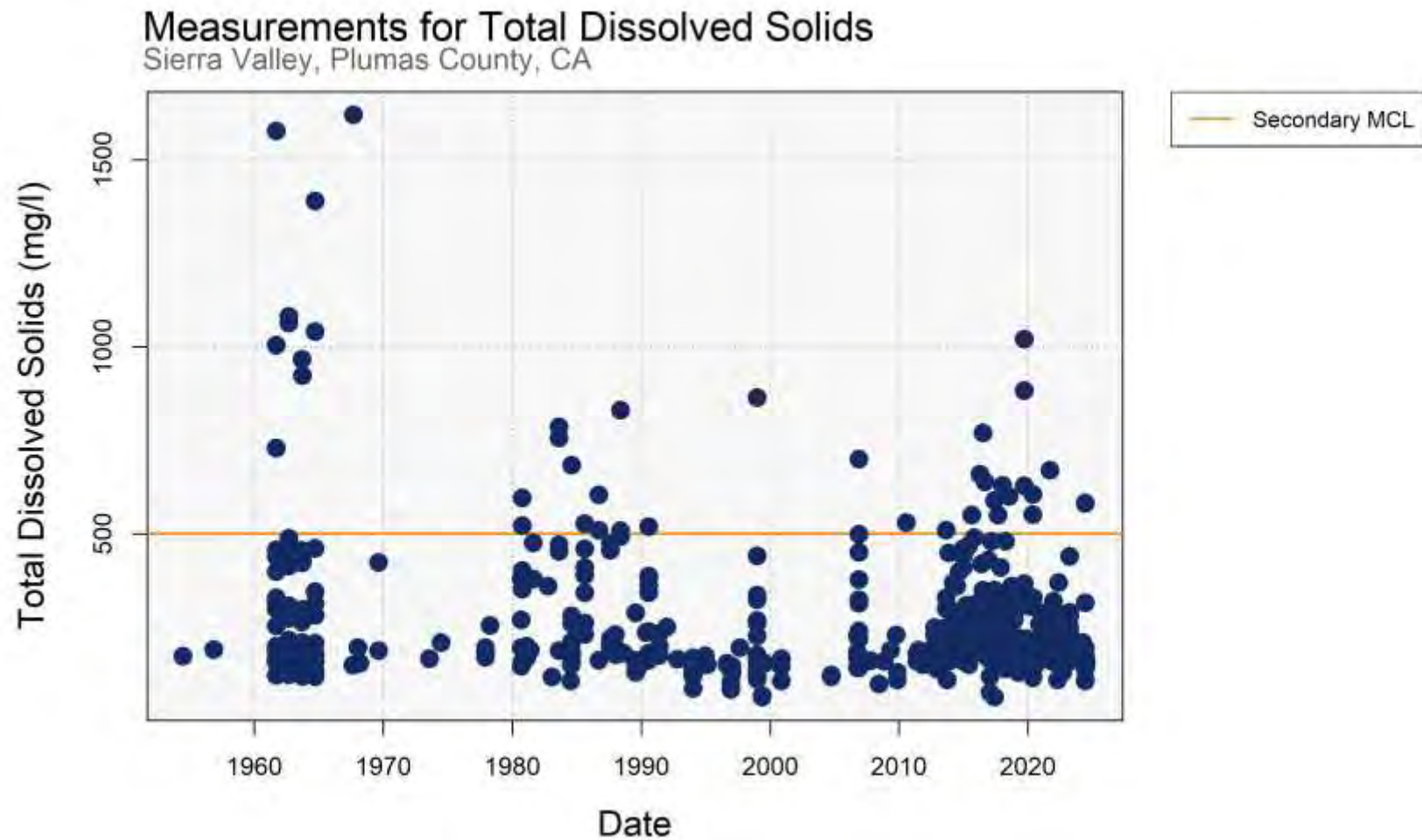


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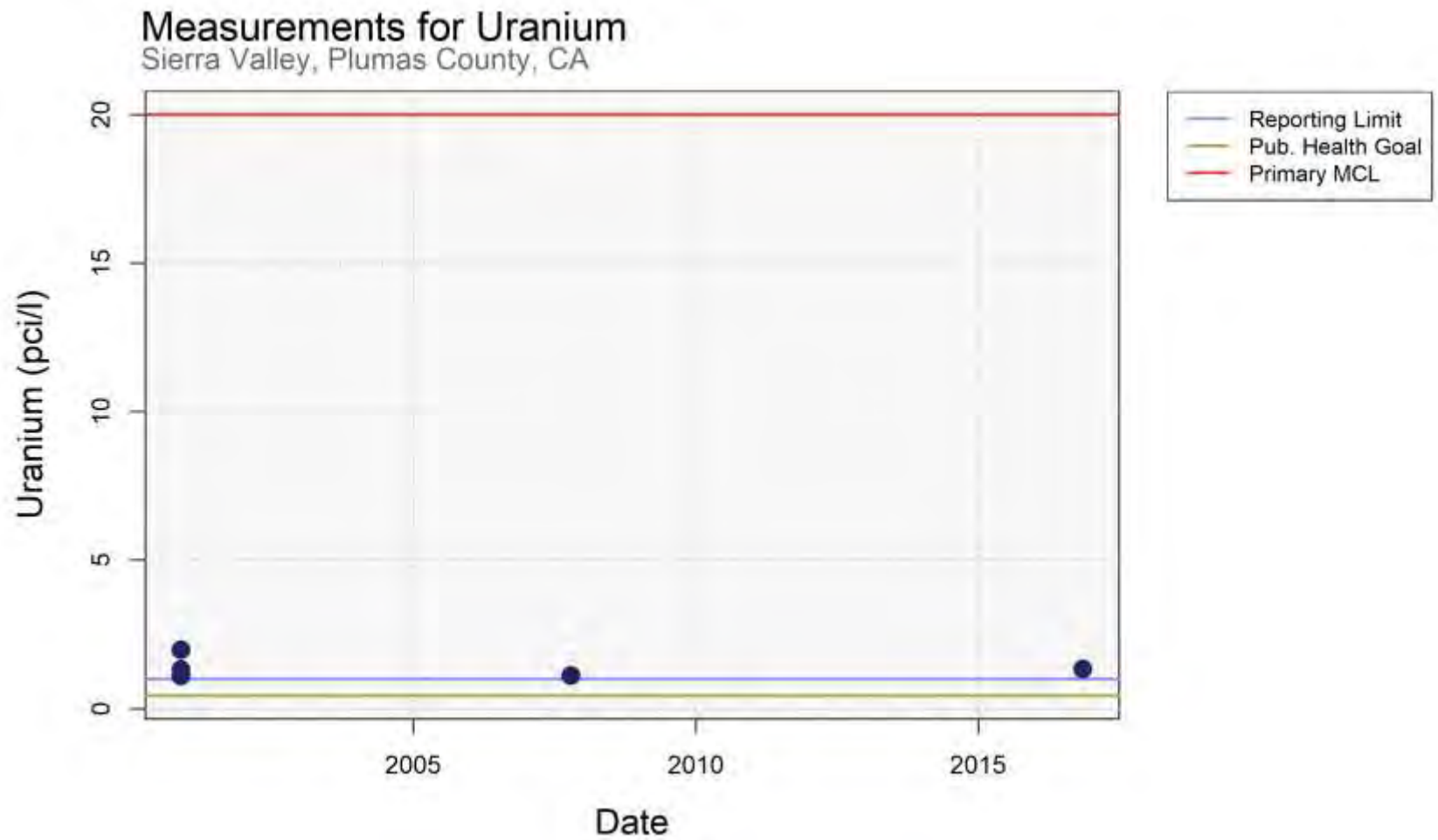


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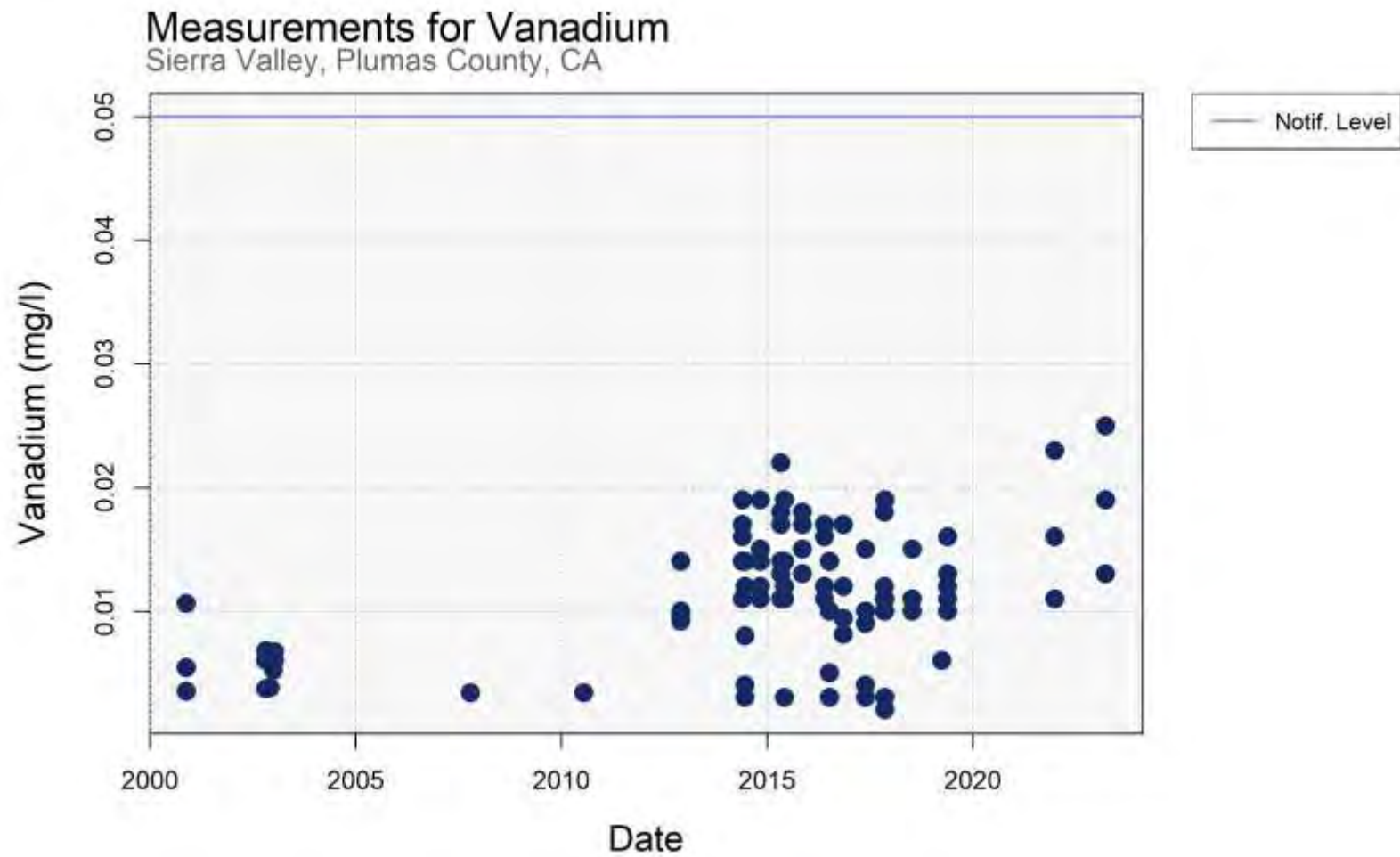


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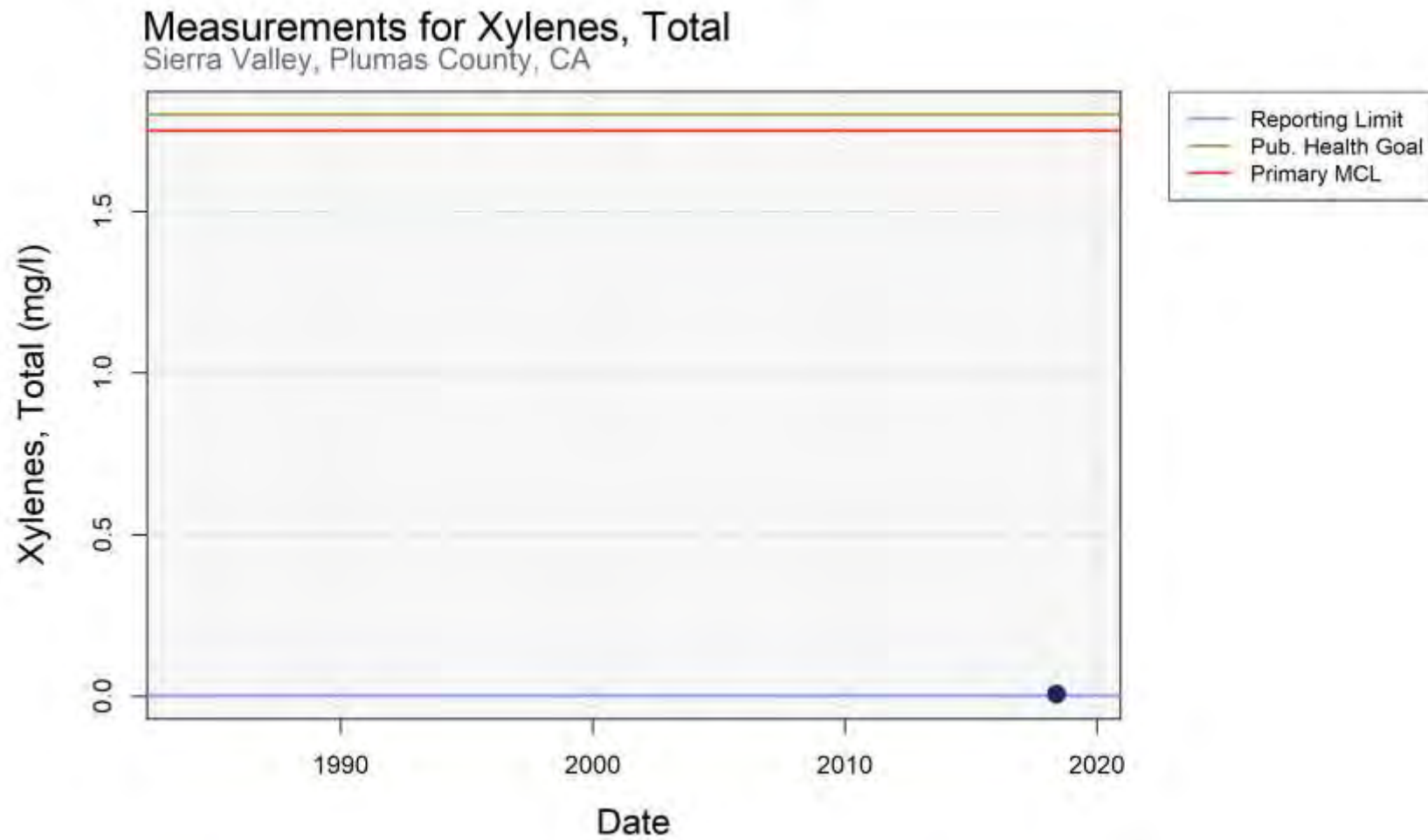


Figure B- 45

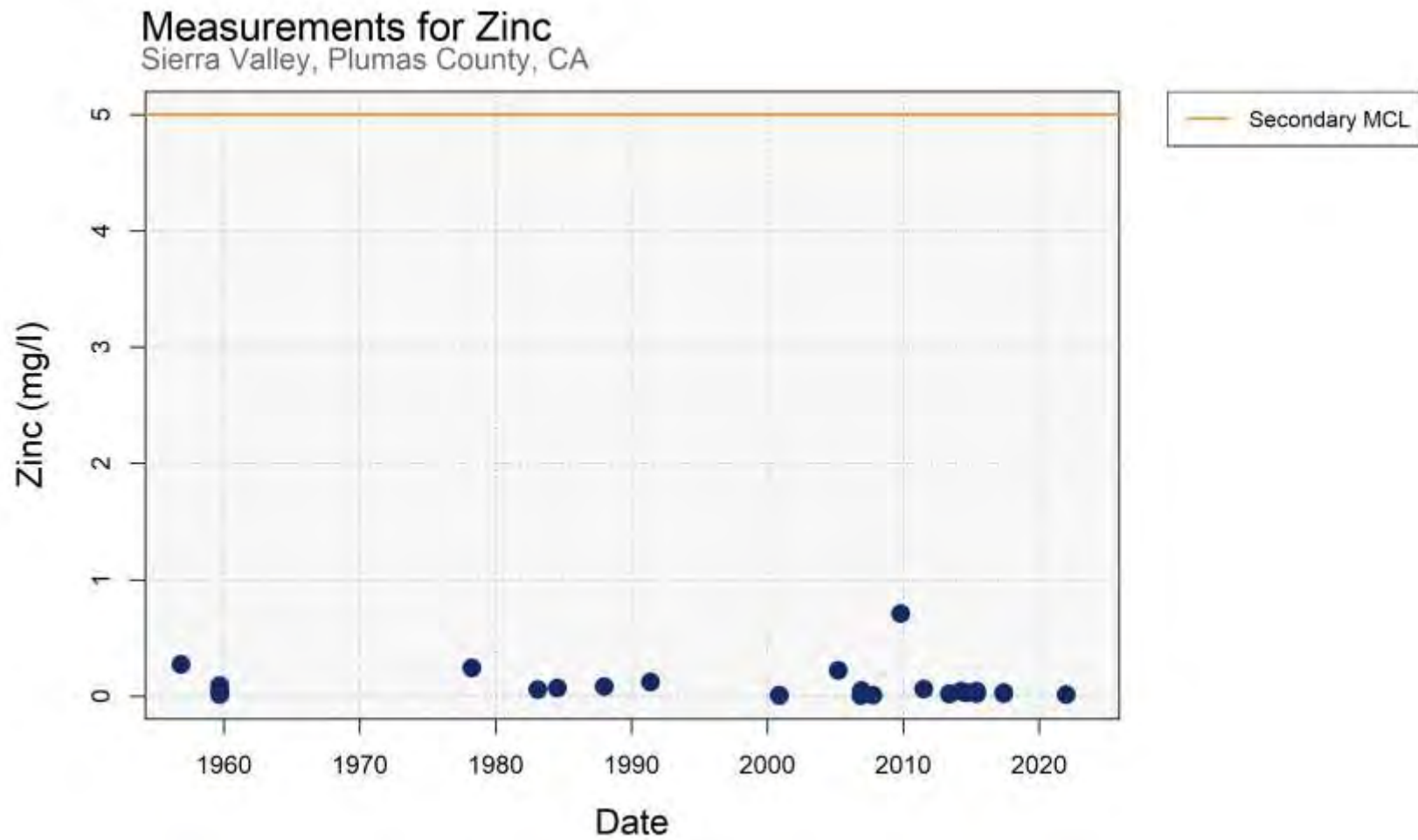


Figure B- 46

Appendix C

Outreach Materials: Plumas-Sierra County

Fair Outreach Materials

Sierra Valley Groundwater Sustainability Plan Outreach Plumas-Sierra County Fair July 24-27, 2025



As part of the outreach and engagement efforts for the Sierra Valley Groundwater Sustainability Plan (SVGSP), the Groundwater Sustainability Agencies (Sierra Valley Groundwater Management District and Plumas County) co-sponsored an informational booth at the Plumas-Sierra County Fair.

The booth was staffed by the facilitator and technical team project manager, with members of the Sierra Valley Groundwater Management District and Technical Advisory Committee also stopping by.

Engaging Fair Attendees

To promote interactions with fair-goers, the booth included:

- A map asking passers-by to place a pin and show where they were from (this helped us tailor our initial speaking points for each individual)



- A sign with a recognizable visual graphic and a play on words



- Activities for kids: a “fishing pond” and coloring materials (a “Water Fun” coloring and activity booklet from the American Water Works Association and a 4-pack of crayons) – getting children to stop by meant getting the adults to stop too!



It's not always as easy as it seems



Fun while learning about water



Rainbow trout and whitefish

- Fact sheets and brochures for youth and adults (see attached)



- DWR SGMA Brochure
- SVGSP Executive Summary
- Sustainable Groundwater Management in Sierra Valley
- Sustainability Indicators
- Expanded Monitoring Network
- Groundwater Recharge
- Agricultural Irrigation Efficiency
- Kids Activity Handout: How is Water Important to You?
- The Water Cycle & Water Budget

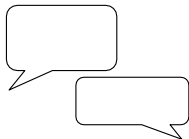
Foot Traffic and Number of Visitors

The level of foot traffic was helped along each day by a brief period of rain, encouraging people to walk through the indoor booth and exhibits.

- Approximately 150 people stopped by the booth,
- generating about 75 conversions.
- Roughly 55 of those conversations were casual discussions, with
- the remaining 20 conversations representing in-depth discussions.

While the number of in-depth discussions is comparable to that of a public workshop or open house, the booth at the fair allowed us to reach an additional 55 people who were not familiar with SGMA or the efforts of the two GSAs better manage groundwater resources in Sierra Valley.

What We Heard



- People are glad to see that attention is being given to groundwater:
 - Many commended the Sierra Valley GSAs in addressing the issue now, to avoid the level of impact seen in other parts of the State.
 - Visitors appreciated that the Sustainability Goal prioritizes maintaining the rural essence and natural settings of Sierra Valley
 - Some wanted to know why their area didn't have a GSP. This allowed us to talk about the larger SGMA process, basin prioritization and the requirements for high- and medium-priority basins.
 - Several residents of Sierra Valley spoke about the sporadic nature of water quality in the basin. It is generally excellent, with occasional pockets of high iron content (typically near the basin boundary).

- There is interest in:
 - Applying the lessons learned in Sierra Valley to other nearby areas
 - Learning more about water quality in specific areas
 - Volunteering to become a part of the monitoring network
 - Sharing information about Sierra Valley hydrology through the local school. The focus for Grade 6 is “The Year of the Watershed.”
 - Being added to the interested parties email list
 - Holding a meeting for TAC members and the public to describe recent SVGSP implementation activities

Overall Assessment of Engaging the Public at the Fair



Success!

ATTACHMENTS

Fact Sheets:
Sustainable Groundwater Management in Sierra Valley
Sustainability Indicators

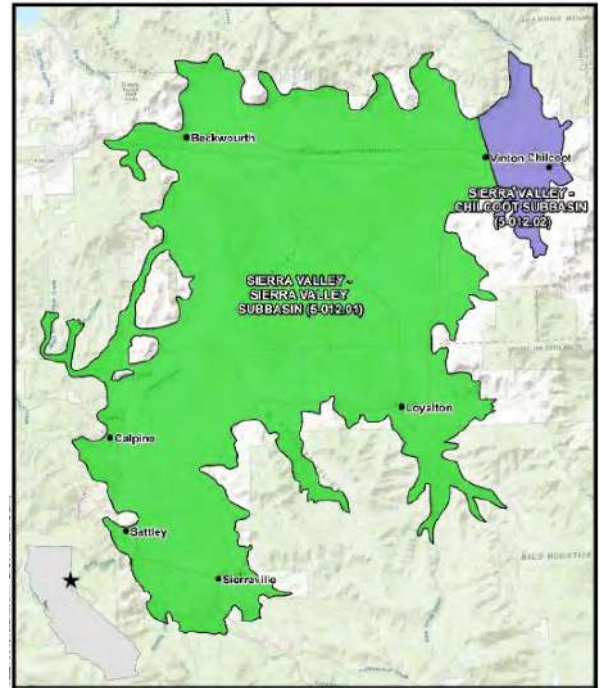
SUSTAINABLE GROUNDWATER MANAGEMENT IN SIERRA VALLEY



Groundwater resources in Sierra Valley are overseen by the Sierra Valley Groundwater Management District (SVGMD) in cooperation with Plumas County. The SVGMD Board of Directors itself is composed of Supervisors and appointees of both Sierra and Plumas counties.

SVGMD responsibilities involve different activities to help make sure that groundwater is not over-drafted (or over-used):

- ✓ Monitoring groundwater conditions (groundwater levels, quality and use)
- ✓ Reviewing new well applications
- ✓ Implementing policies for groundwater management
- ✓ Reporting on the condition of groundwater resources
- ✓ Taking actions to protect groundwater resources



The SVGMD Board meets monthly, at 6 p.m., usually on 3rd Mondays.

Agendas and meeting materials are posted online at SierraValleyGMD.org.

All meetings are open to the public.

California's Sustainable Groundwater Management Act (SGMA) also required SVGMD and Plumas County to create a formal Groundwater Sustainability Plan (GSP) that describes:

- ✓ The groundwater basin and groundwater resources
- ✓ Monitoring networks and practices
- ✓ Projects and Management Actions (PMAs) that help manage groundwater – such as recharge projects to increase groundwater supplies, or improving agricultural irrigation efficiency to reduce the demand for groundwater pumping

The Sierra Valley GSP (2022) was developed with input from a Technical Advisory Committee, composed of local stakeholders.

The GSP is available online at: <https://sgma.water.ca.gov/portal/gsp/preview/125>

WHAT DOES SUSTAINABILITY LOOK LIKE?

California passed the Sustainable Groundwater Management Act (SGMA) in 2014 to provide a framework for protecting groundwater resources. SGMA evaluates regional sustainability by measuring “Sustainability Indicators” – or undesirable trends that can occur with chronic lowering of groundwater levels (which can happen if a region does not receive enough precipitation to fully recharge groundwater, if a region uses too much groundwater, or a combination of both).

THE FOLLOWING SUSTAINABILITY INDICATORS ARE DEFINED BY SGMA:



When there is less groundwater, groundwater levels move down (compared to the surface of the ground itself). For people with wells, this could mean wells going dry at some point – and the expense of drilling the well deeper to reach the water level.



Being farther away from ground level also means that groundwater is less connected to surface water – such as streams and springs. The volume of streams and springs becomes reduced, with less water available for plants and animals.



Water has connections both above-ground (in streams and springs) and below-ground (in the aquifer). When less water is present, chemicals in the water (like salts and nitrogen) can become more concentrated. Also, changes in water pressure can change the direction of water flow. This can sometimes affect water quality.



When there is less groundwater in the aquifer, there is less water being stored below ground. This means that there is less groundwater supply and less groundwater available to use.



Groundwater is stored in the small spaces between rocks and grains of soil. Different soils are harder (like sand) or softer (like clay). As softer soils dry out, they can compress or flatten out – and the soil shrinks since the water was helping it keep its shape. Ground levels can become lower as a result.

See other side for an overview of groundwater sustainability in Sierra Valley.

Fact Sheet: Expanded Monitoring Network

PROJECTS AND MANAGEMENT ACTIONS: EXPANDED MONITORING

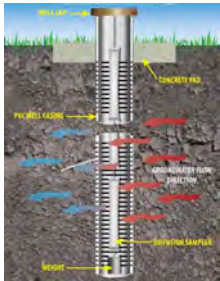
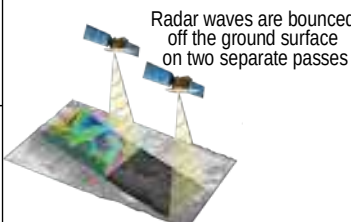
WHAT IS IT?

Different approaches are used to monitor groundwater-related conditions:

- **Groundwater levels** are directly measured for depth to water level (or elevation above sea level) using meters called “sounders”. Groundwater levels from multiple wells can indicate the direction of groundwater flow. Specialized tubes (piezometers) measure groundwater levels and flow direction.
- **Groundwater quality** involves sending water samples to laboratories for analysis.
- **Land subsidence** (compaction of clay soils that lower the land surface) can be measured using land elevation survey markers or satellite data (InSAR).
- **Interconnected surface water** refers to the interactions between groundwater and surface water (for example: as with springs, marshes and streams). This can be difficult to directly and precisely measure. To get a better understanding of how groundwater and surface water interact, instream measurements can be paired with nearby shallow groundwater levels.

NOTE: Shallow groundwater (located relatively close to the ground surface) can be a main source of water for plants – and the animals that use those plants as habitat. These areas are called groundwater-dependent ecosystems (GDEs) and indicate that groundwater is not too far from ground level.

TYPES OF MONITORING APPROACHES

Stream flow  Stream gauge	Water Quality  Sampling and analysis
Groundwater Levels  Monitoring well/piezometer	Ground Elevation Radar waves are bounced off the ground surface on two separate passes  InSAR (satellite) data  Survey monuments

WHY DO IT?

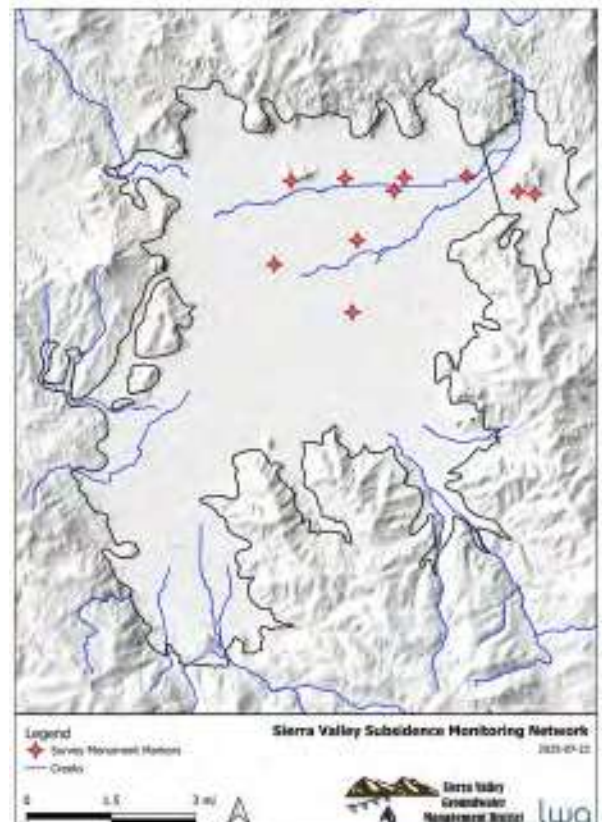
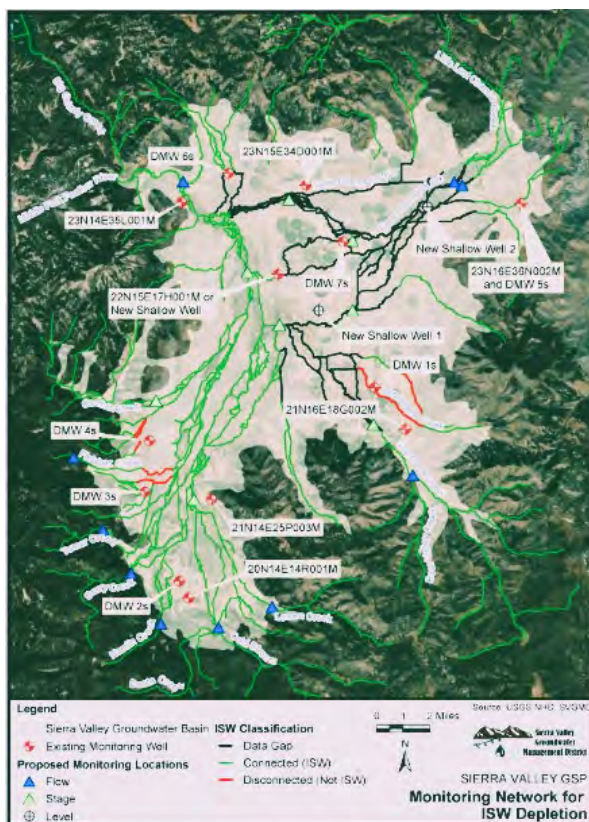
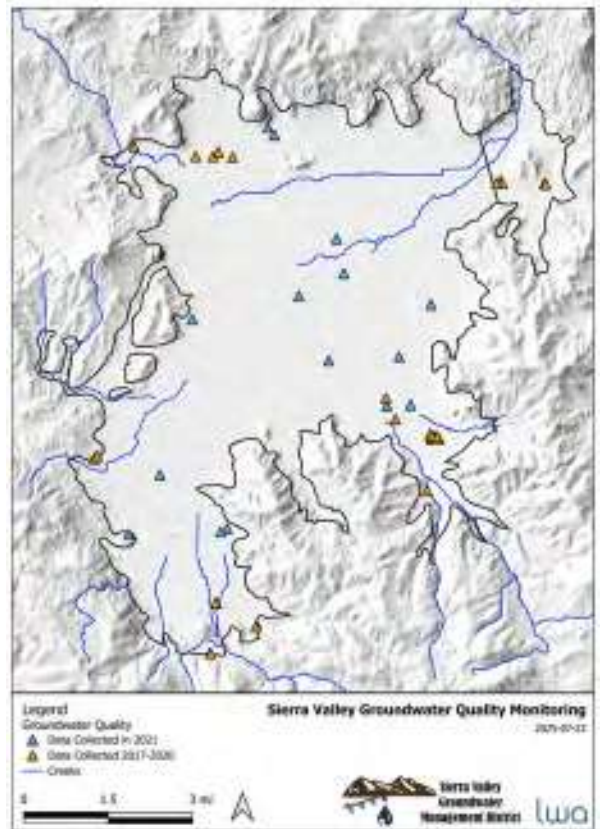
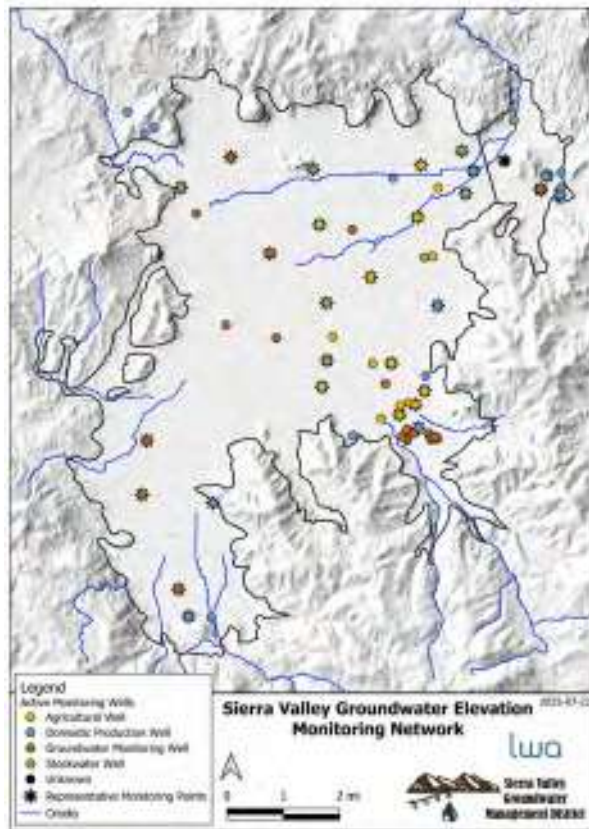
- Monitoring efforts tell the story of current groundwater conditions and trends in those conditions.
- Better understanding of groundwater conditions informs decisions related to groundwater use (such as where to locate a well, how much water is available) and how to sustainably manage groundwater resources.
- Monitoring results provide data for the Sierra Valley groundwater model. The model calculates Sierra Valley water inflows and outflows (the water budget).
- Monitoring helps track the results from groundwater recharge and ag irrigation efficiency projects.

See other side for maps of monitoring networks



EXPANDED MONITORING NETWORK

SIERRA VALLEY MONITORING NETWORKS



Source: Balance Hydrologics

See other side for overview of expanded monitoring



Fact Sheet: Groundwater Recharge

PROJECTS AND MANAGEMENT ACTIONS: **MANAGED GROUNDWATER RECHARGE**

WHAT IS IT?

Managed groundwater recharge moves surface water to areas where the water can seep down to recharge the aquifer. This supplements natural recharge and increases water supplies.

In Sierra Valley this approach directs excess (high water) winter stream flows through existing drainages to areas where the geology provides a path for recharge water to reach the aquifer.

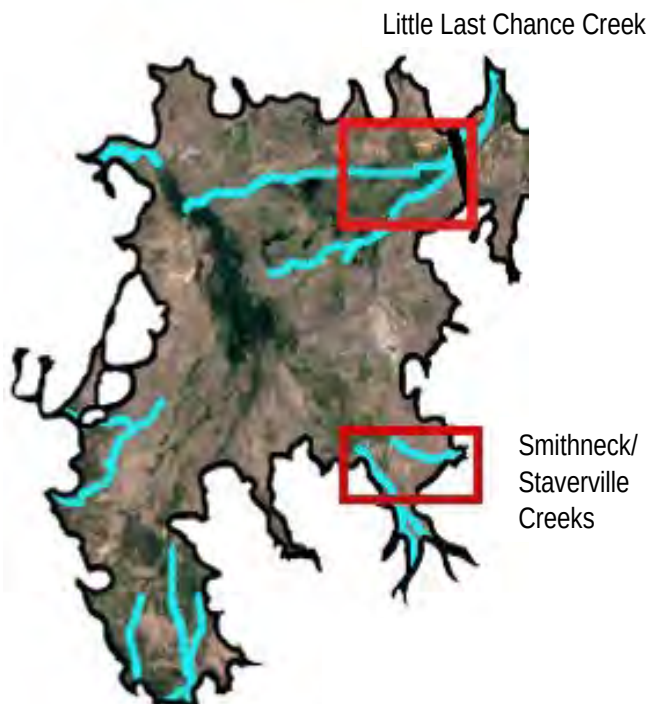
Recharge areas are located in the upslope grades found at the edges of Sierra Valley (see red boxes below). In the valley floor, layers of clay soils prevent recharge to the deep aquifer.

WHY DO IT?

High stream flows can occur due to heavy rains, snow-on-rain events or rapid snow melt. These high-water conditions can cause flooding. Using excess water for recharge can help reduce flood risks while improving local groundwater supplies.

Managed aquifer recharge will direct peak flood flows 1) away from the main river channel – helping to reduce flood risks and 2) towards areas where the waters can slow down and seep down into the aquifer – keeping excess flows available for future use and enhancing long-term water supply.

POTENTIAL RECHARGE AREAS IN SIERRA VALLEY



PROTECTING WATER RIGHTS

Authorization to use excess (high water) winter flows comes from temporary permits issued by the State Water Resources Control Board. These temporary permits are not water rights and only allow use of water that is not claimed by a water right holder.

All groundwater recharge pilot projects in Sierra Valley are coordinated with the Watermaster. This ensures that use of excess flows (capped at 20% of streamflow under high flow conditions and only during the winter season) does not impair any existing water rights.

GROUNDWATER RECHARGE PILOT PROJECT

In 2024, an application was submitted to the State Water Resources Control Board for a temporary permit to use excess (high level) winter flows for a groundwater recharge pilot project. The project was located on Staverville Creek. Here's what was done:

1. An existing point of diversion was upgraded with a new headgate.



2. To slow water flow, concrete retaining blocks were installed in the adjacent irrigation ditch. Removable check boards further control flow and the subsequent amount of ponding



3. During high flow winter events, excess flows are directed through the headgate to the retention area. The ponded water has time to seep into the ground, providing additional recharge to Sierra Valley groundwater. During the test period, streamflow conditions allowed recharge diversions on several occasions.



Results are provided in annual recharge reports.

Fact Sheet: Agricultural Irrigation Efficiency

WHAT IS IT?

Improving agricultural irrigation efficiency helps to reduce demand for groundwater – by optimizing effective use of water.

Equipment and information technology contribute to increasing water use efficiency in agricultural settings.

Irrigation efficiency improvements help reduce the amount of water “lost” (or not available for crops) due to:

- Leaky pipes
- Blocked sprinkler heads
- Strong winds
- Overwatering

WHY DO IT?

Too much water... not enough water... irrigating too soon or waiting too long... all of these can stress crops!

Increasing ag irrigation efficiency helps to conserve water supplies – while also helping ranchers and farmers apply the right amount of water, at the right time, to their crops. Efficient irrigation can save water and improve crop production.

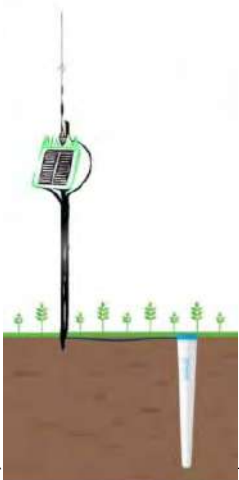
In **Sierra Valley**, individual farm assessments were conducted to identify possible opportunities for improving efficiencies on pivot and wheel line irrigation systems.

TIMING – WHEN TO IRRIGATE

Irrigation schedules must take a number of factors into account: soil types, soil moisture levels, crop needs (related to evapotranspiration), weather and farm activities such as planting and harvesting.

Multi-level soil moisture sensors precisely measure and transmit data on soil moisture at different depths – up to 4 feet below ground level.

This provides greater certainty about when and how much to irrigate.



EQUIPMENT – APPLICATION SYSTEMS

Irrigation efficiency improvements work to effectively provide adequate and consistent application of water – in a way that best uses every drop!

Farm assessments help identify where irrigation efficiency can be improved. This may involve:

- Eliminating leaks
- Updating older irrigation equipment provides better efficiency
- Increasing the consistency of water distribution to crops



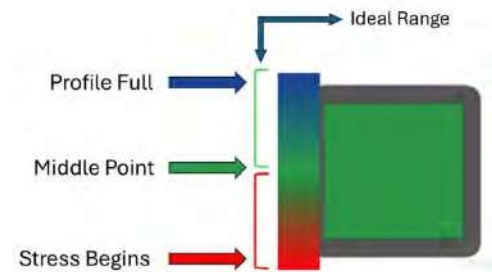
AG IRRIGATION EFFICIENCY DEMONSTRATION/PILOT PROJECTS

TIMING – WHEN TO IRRIGATE

Eight soil moisture stations have been installed throughout Sierra Valley. These units are placed in pairs, to provide redundancy – in case a sensor malfunctions. During the 2025 growing season, these sensors will collect baseline data on: current soil moisture levels under existing irrigation practices, real-time soil moisture depletion, and irrigation performance.

In 2026, soil moisture readings will inform recommendations on:

- 1) when to begin irrigating,
- 2) how to optimize irrigation for cuttings, and
- 3) pivot scheduling and speed.

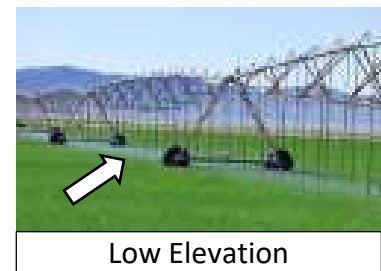
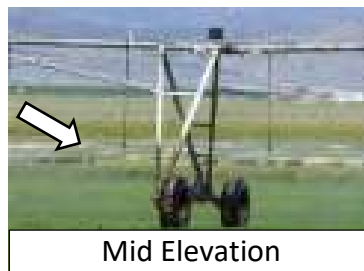


Phone app dashboard for soil moisture.

EQUIPMENT – APPLICATION SYSTEMS

Wind drift can contribute to significant losses of applied water (in terms of how much water actually reaches the crop).

Lowering the elevation of sprinkler heads reduces water use.



Other irrigation efficiency improvements involve:

- Installing high-efficiency sprinkler heads or inline filters to reduce clogging
- Upgrading well pumps with variable frequency drives (VFDs): these electric controllers provide more consistent output of water by changing the speed of pump motors, as needed, to adjust to changes in water flow or pressure
- Installing soil moisture meters – or sharing soil moisture data – to understand soil moisture response to irrigation in different soil types
- Metering irrigation heads to better monitor water volume
- For wheel lines, more efficient sprinklers more consistently distribute water

Kids Activity Handout:
How is Groundwater Important to You?

HOW IS WATER IMPORTANT TO YOU?

Water is a necessary part of our lives! It is important in many different ways.



For cleaning



For cooking



For drinking



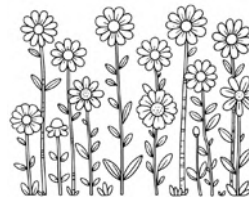
For fun



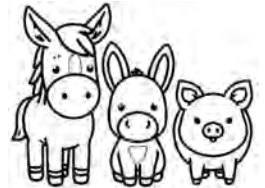
For food



For plants



For animals



*images from colourbox.com and rainbowcoloringpages.com

HOW DO YOU USE WATER?

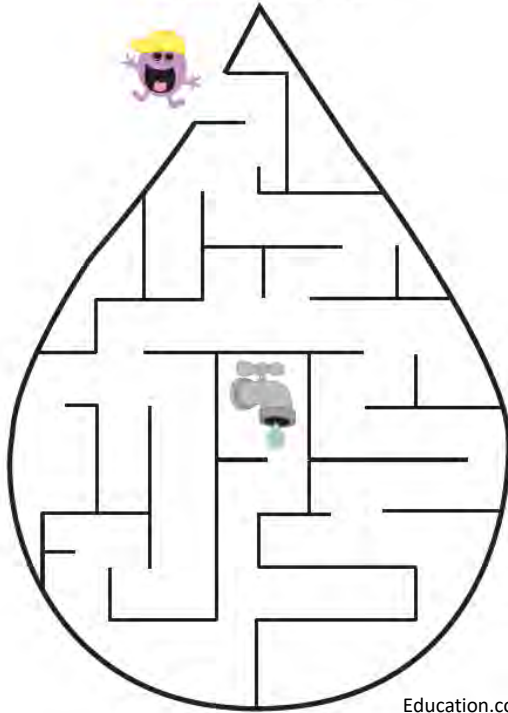
Solutions (see mazes on other side)

Hose #c will reach the plant

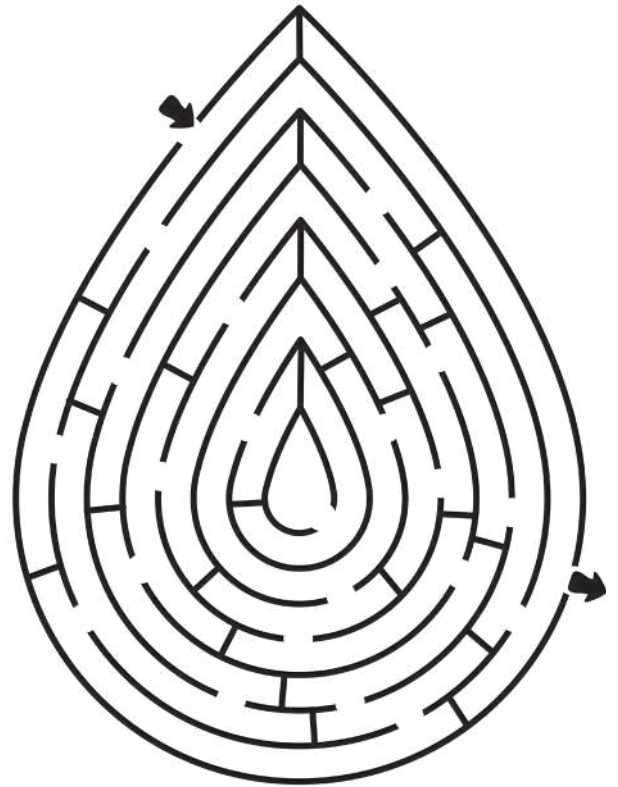


WATER IS A-MAZE-ING!

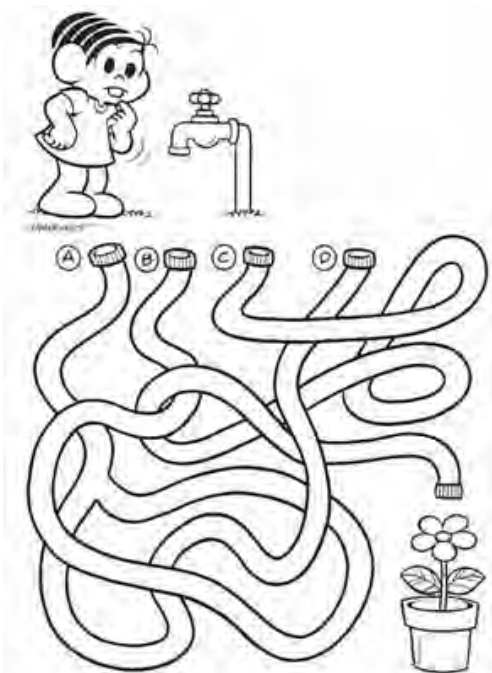
Help Hydro turn off the leaky faucet!



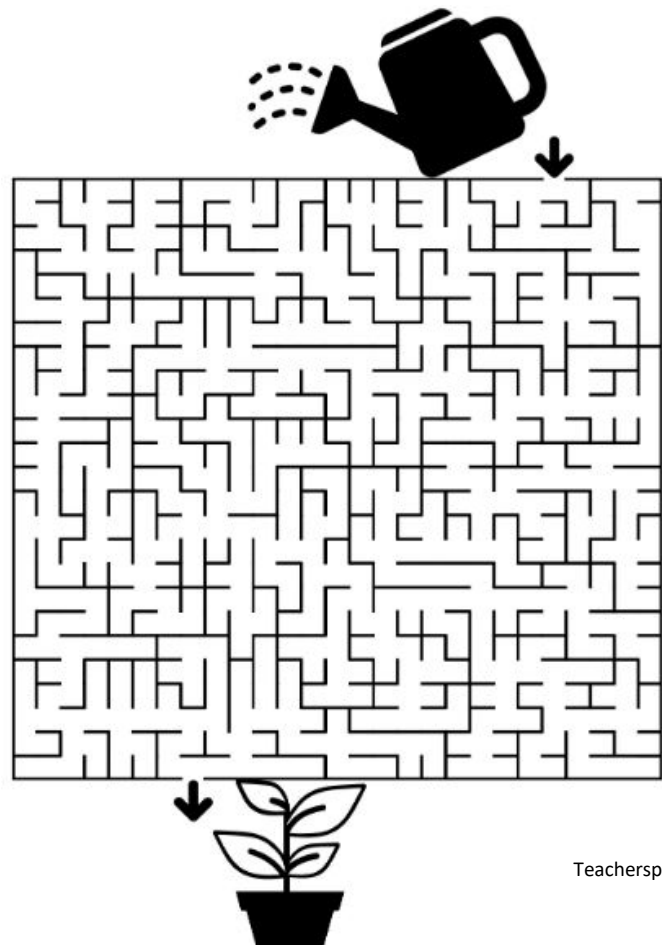
Education.com



Teacherspayteachers.com



Tulamama.com



Teacherspayteachers.com

Solutions on other side

Fact Sheet: The Water Cycle and Water Budget

THE “WATER CYCLE”

Water is always on the move. This movement is called the water cycle.

AROUND IT GOES

Water is all around us. It is underground. It is on the Earth's surface.
It is in the air. Water changes as it moves from place to place.

Water can turn to ice if the weather is cold enough. Water can turn into a vapor if the weather is warm enough. As vapor, it floats into the air. It falls back to Earth as rain or snow. Then the cycle starts all over again.

This diagram shows the process of the water cycle.

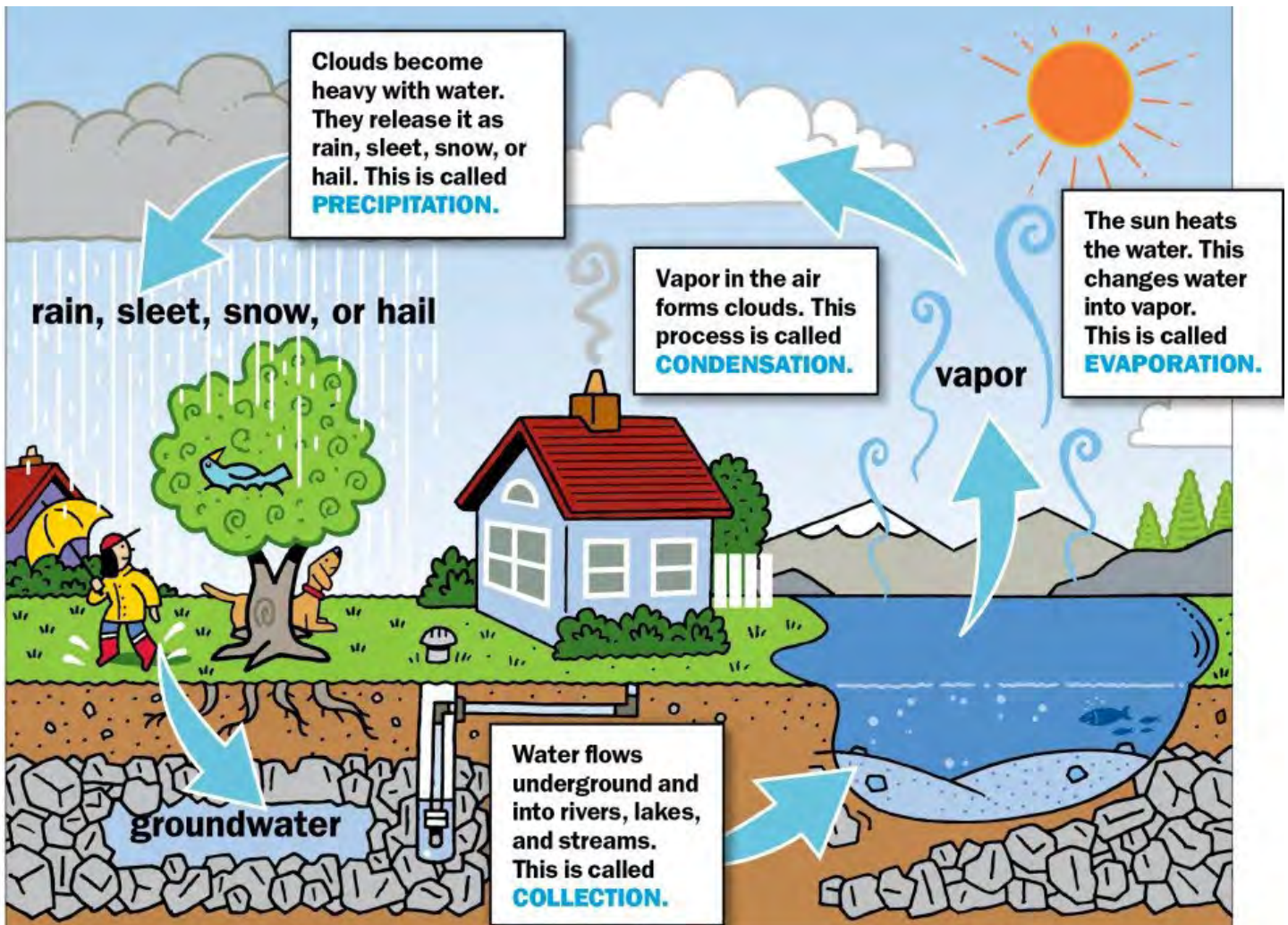


ILLUSTRATION BY CHRIS REED FOR TIME FOR KIDS

KEEPING TRACK OF WATER – THE “WATER BUDGET”

Just like keeping track of money, **water can be tracked by using a budget.**

Budgets look at how much water (or money) is coming in, and how much is going out.

Water is found:

- At the surface of the ground (surface water) – where we see it as lakes and streams.
- Beneath the ground (groundwater) – where we can't see it, but it collects in spaces in the soil. The underground areas that hold water are called aquifers.
- At connection points where groundwater and surface water meet (like springs).

Water comes into Sierra Valley in two main ways:

- As precipitation (snow or rain).
- As water flow (either above or below ground) from other areas.

Water leaves Sierra Valley in a couple of ways:

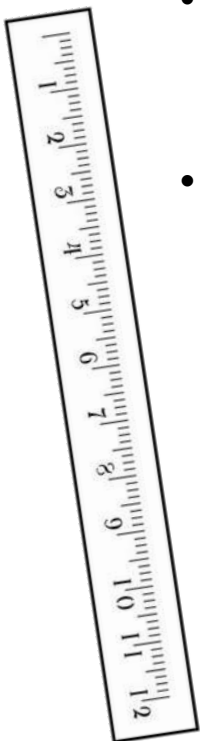
- As evaporation (going back into the atmosphere on hot days).
- Used (consumed) by plants, animals and people.
- It flows to other areas outside of the valley.

How do we measure water? In several ways!

- Precipitation (rain and snow) can be measured with rain gauges.
- Surface water can be measured by:
 - The depth (or amount) of water in a lake or stream.
 - The rate at which water is moving (using gauges).
- Groundwater is measured by:
 - The depth (or amount) of water in the aquifer.
 - The tracking the flow of groundwater by using substances that can be followed along (much like a dye).
- Water use is usually measured by:
 - Meters that measure the amount of water pumped.
 - Calculations that multiply average amounts of use by the number users (for example, amount of water used by the average person x the number of people using water).

Small amounts of water are measured in **gallons**.

Large amounts of water are measured in “**acre-feet**” – or the amount of water needed to cover one acre (about the size of a football field) with 12” of water... or about 325,650 gallons. That's a lot of water!!!! It's about ½ of water in an Olympic sized swimming pool.



Appendix D

Outreach Materials: Well Sounder Flyer

Want to check your well's water level?



If you want to know the groundwater levels in your well, these *easy-to-use sounding meters* make it simple. After set-up, well readings take 5 minutes!

Interested?

Email svgmd@sierravalley.gmd.org, to reserve a device, get step-by-step instructions, and have your questions answered.

Learn more at sierravalleygmd.org.

This community program is made possible through grant funding from the Department of Water Resources to support the Sierra Valley Groundwater Sustainability Plan.





Want to check your well's water level?

The Sierra Valley Groundwater Management District has **groundwater level measuring devices** available to borrow - **at no cost to you!**

Interested?

Sounding meters are simple to use and we'll show you how they work. After set-up, well readings take 5 minutes! Email svgmd@sierravalleygmd.org to reserve a device or ask questions.

This community program is made possible through grant funding from the Department of Water Resources to support the Sierra Valley Groundwater Sustainability Plan.



Appendix E

Outreach Materials: Guide to Measuring Depth to Groundwater

Volunteer Monitoring Program A Guide to Measuring Depth to Groundwater

The Volunteer Monitoring Program (MVP) provides well owners and residents with the opportunity to check the levels of their wells. This can help identify risks of a well going dry and to improve the accuracy of future well impact analysis. The sounder for measuring groundwater levels can be borrowed from the Sierra Valley Groundwater Management District (SVGMD). Contact SVGMD at svgmd@sierravallygmd.org to learn more.

This guide follows along with the quick start guide from Eno Scientific (see last page of this document) with adaptations and figures relevant to domestic and agricultural well owners.



The sounder unit is carried in a black case, with a screen meter stored on the left, the probe on the right, and wires and User Manual in the middle (see above). The tube end of the probe will be inserted into the well opening. The meter is powered by six internal AAA batteries. While the meter and probe are not waterproof, they are resistant to rain. Please cover the equipment during moderate and heavy rain.

Volunteer Monitoring Program
A Guide to Measuring Depth to Groundwater

INSTRUCTIONS

1. **Attach probe to meter.** Make sure that the pins on the probe cable line up with those on the meter. The flat side of the cable should be facing away from the screen of the meter.



Figure 1. Correct orientation of the cable, with the flat side down. Top is the side with screen and buttons.

Volunteer Monitoring Program

A Guide to Measuring Depth to Groundwater

2. **Attach probe to well.** The probe fits into vent holes from $\frac{3}{4}$ " to 1" (*Figure 2* and *Figure 3*). An accurate reading requires a well opening that is completely covered and the waves can "leak" out if there is a gap in the well covering. For well openings larger than 1" Eno Scientific recommends cutting a hole in cardboard or plastic (solid materials) to reduce the size of a well opening. In cases where a solid material cannot be fitted to completely cover a well opening, such as in a tight crowded space, a cloth/rag can be used to cover a well opening (*Figure 3*). A clean piece of cloth or rag with a cut hole in the center can be easily draped over the well opening but must be secured from falling into the well. If the probe is used during pumping, a cloth/rag separating the steel vent hole from the probe helps to reduce vibration of the meter (excessive vibration can prevent it from accurately measuring depth to water).

- a. **Domestic well.** Most domestic wells have a $\frac{3}{4}$ " threaded opening for monitoring and venting that is the perfect size for the probe and needs no adjustment.
- b. **Agricultural well.** Ag wells have more variability in vent holes and openings. Here, a little more creativity may be needed to attach the probe such as the use of a cloth rag to fit an oddly shaped opening or some pipe and couplings to improve the fit.



Figure 2. Example Well Opening that is 0.75 inches wide.

Volunteer Monitoring Program
A Guide to Measuring Depth to Groundwater



Figure 3. Example sensor setups and example use of cloth to cover a 4 inch well opening, leaving a cut hole for the probe (lower right).

Volunteer Monitoring Program A Guide to Measuring Depth to Groundwater

3. **Turn the meter on.** Press the ON button and you should hear a popping sound coming from the probe. If not, make sure the probe connector is firmly seated.
4. **Measuring well depth.** To take a correct measurement, the well diameter and well depth much be entered into the meter.
 - a. Enter the well information into the meter.
 - i. Range Max = The lesser of: the well depth or depth to a dedicated pump in feet
 - ii. Well Diameter = diameter of inner well casing in inches
 - iii. Well Depth = well depth in feetPress the SET button until the three options appear and change the value with the up and down arrows.
 - b. Use the provided paper data sheet to record the time and date of the measurement, the full value of the depth including both decimal places (write 71.84 not just 71), and feel free to add a note about weather conditions or recent well use.
 - c. After recording the depth to water on the paper data sheet, you can share your data with SVGMD if you want to. More data points about groundwater levels creates a better understanding of overall aquifer conditions. You can share the data by taking a photo of the completed sheet and emailing it to the SVGMD: svgmd@sierravalleygmd.org.
5. **Change initial settings (if necessary).** If the well sounder shows an unexpected reading (for example the depth to water reading doesn't change when the pump is turned on or is very different from the historic low and high) then there may be interference from the pump bowl or another obstruction in the well. This can be resolved by changing the maximum and minimum depth to water by pressing the SET button until "Range Min" or "Range Max" appears and then changing the value with the up and down arrows.

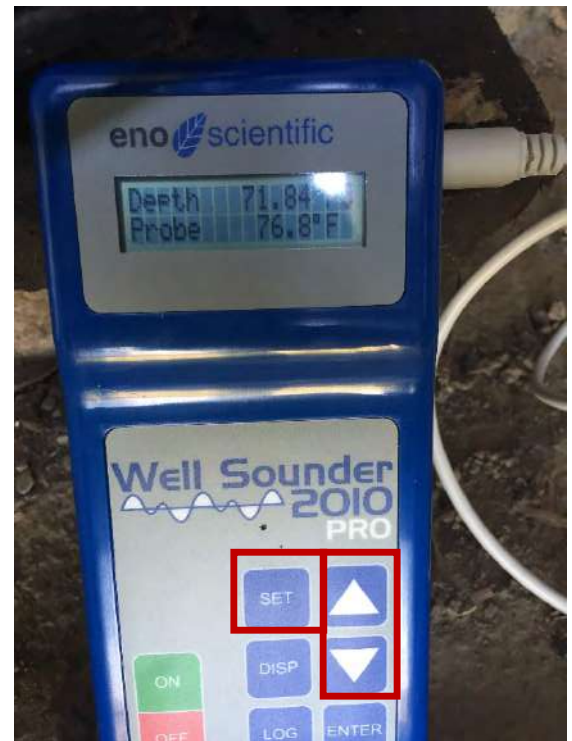


Figure 4. Sensor Display showing referenced buttons in red.

Volunteer Monitoring Program

A Guide to Measuring Depth to Groundwater

- a. To check that the meter is reading depth to water correctly: 1st read depth to water with the well off, 2nd turn on the well with the meter in place, 3rd watch the depth readings as they should increase during pumping, if the readings do not change then proceed to step b.
 - b. For example, if you are taking a measurement and the depth to water reads out as 2 ft (keeping in mind the depth to water is around 10-100ft in the Sierra Valley Basin) then there may be interference due to a change in well diameter or a pipe coupling. If you have well construction information available, then you can check at what depth this and increase “Range Min” to 25 ft. Then check the depth to water reading to make sure it is closer to the expected value. If the well sounder is still not operating as expected please reach out to the SVGMD.
 - c. If the well has a well opening larger than 1” and measurements are unusual, the material covering the well opening may not be appropriate (ie., does not completely cover the opening). Try using alternatives, such as a clean cloth/rag that will completely cover the opening.
- 6. Read other information.** While reading the depth to water the up and down arrows can be used to show more information on the display, but this is not necessary for depth to water measurement.

Meter set up notes:

- Once you have determined where you will consistently measure the depth to water from (top of PVC casing, top of well vent) then you should measure the vertical height from the ground surface to that point accounting for the distance to the tip of the probe (in inches, e.g., a tape measurer to the 1/8” or 1/16”). This will then allow you to calculate depth to water from the ground surface, which can be compared to other water levels nearby).
- The average well water temperature is 54° F on the valley floor, with some wells ranging colder and hotter (51° F near Sierraville and 68° F near Loyaltown). The Eno Scientific meter is set to a well water temperature of 60° F to accommodate the range in temperatures. The error is approximately 0.1%/°F for the total depth to water measured. If you believe that your well has a temperature significantly different than this (>10 °F, resulting in an error of 1 ft) then please reach out to the SVGMD.

Volunteer Monitoring Program

A Guide to Measuring Depth to Groundwater

Online resources:

For an example installation video by Eno Scientific search “Well Sounder 2010 PRO (2013)” on youtube.com.

Monitoring Volunteer Program (MVP)

Who: Any local person who has a water well that they would like to monitor.

Where: In your own backyard, but when grouped together with everyone’s measurements we will see a bigger picture of the entire Sierra Valley Basin’s groundwater conditions and whether domestic wells are at risk for undesirable effects.

Why: To let individual well owners and residents measure depth to groundwater at a given well and know whether the well pump may be getting close to the water surface.

How: By making a sounding unit available for use in Sierra Valley. This guide covers how to use the Eno Scientific Acoustic Water Level Meter that can be borrowed from SVGMD.

When: There is no one best answer for when or how often groundwater levels should be measured. In Sierra Valley, the interest is in monitoring long-term trends in groundwater levels and in seasonal variation of groundwater levels. To get a sense of seasonal variations, it would be very helpful to get quarterly samples to reflect the effect of changing precipitation and weather conditions throughout the year.

Volunteer Monitoring Program

A Guide to Measuring Depth to Groundwater

QUICK START GUIDE

The Well Sounder is nearly ready to go right out of the box. Follow the few steps below to find the depth to water. If depth to the water is all you are interested in, then this is all you need to read. To learn about the more advanced features continue reading the operation section of this manual.

1. **Attach probe to meter.** Insert the probe connector into the mating connector on the side of the Well Sounder. The flat side of the probe connector should face the back of the Well Sounder. Make sure that the metal barrel of the probe connector is fully inserted.
2. **Attach probe to well.** Insert the probe end into the vent hole on the well. If the casing is open, it should be covered with anything solid such as cardboard or plastic with a hole in it for the probe. The cover does not need to be air tight, but the tighter it is, the stronger the signal will be.
3. **Turn meter on.** Press the ON button to turn the meter on. You should hear a popping sound coming from the probe. If not, make sure the probe connector is firmly seated.
4. **Measure well.** Read the measured depth on the display. If the measured distance is not as expected, then proceed to the next step to change the initial settings.
5. **Change initial settings.** Press the SET button repeatedly to show the various settings to be changed. Press the UP or DOWN button to change setting. When set as desired, press SET again to change another setting or press DISP to return to read the measured depth. For best depth results, the **range min**, **range max**, and the **well temperature** should all be set.
6. **Read other information.** While reading the depth display, press the UP or DOWN buttons to read other information. The water in well and recovery rates etc are available but will only be correct if the well parameters (diameter and well depth) are set correctly in the settings.

We encourage you to read the frequently asked questions section. They really are frequently asked. Also, visit our website www.enoscientific.com for the latest manual and installation tips.