Wyandotte Creek Subbasin Update on Proposed Monitoring Network Enhancements

Prepared by

The LWA Team in coordination with the Wyandotte Creek GSA Funding provided by the California Department of Water Resources November 2024









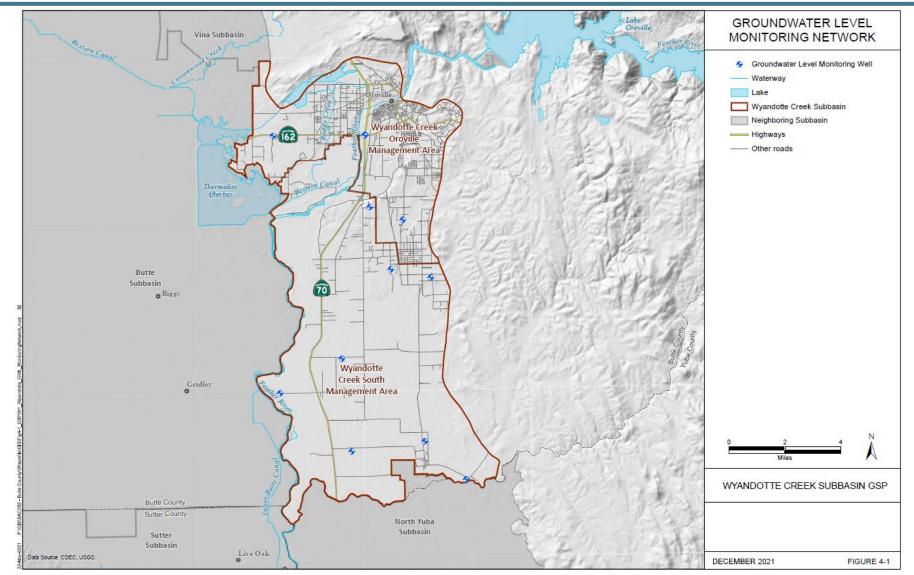
Outline

- Project Objectives
- Overview Existing Groundwater Level Monitoring Network
- Monitoring Network Development Steps
- Proposed Enhancements
- Next Steps

Objectives

- Address data gaps identified in the Wyandotte Creek GSP & comments in DWR's Determination Letter
- Monitor all beneficial uses and users of groundwater including:
 - ✓ Interconnected surface waters (ISWs),
 - Groundwater dependent ecosystems (GDEs),
 - Domestic well owners, and
 - Agricultural users
- Available funding to drill/install a minimum of fifteen (15) shallow wells, three (3) multi-completion wells, and five (5) stream gages

Existing Groundwater Level Monitoring Network



Monitoring Network Development

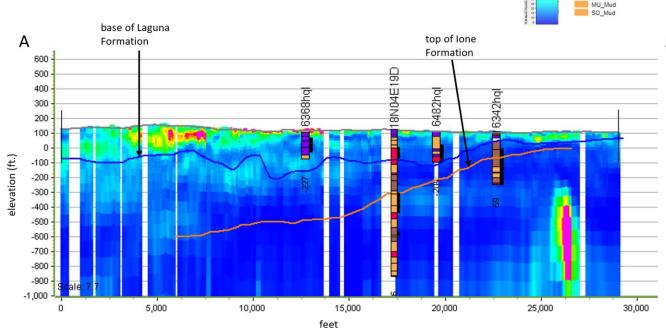
 Identified existing shallow and deep wells using DWR AEM Surveys

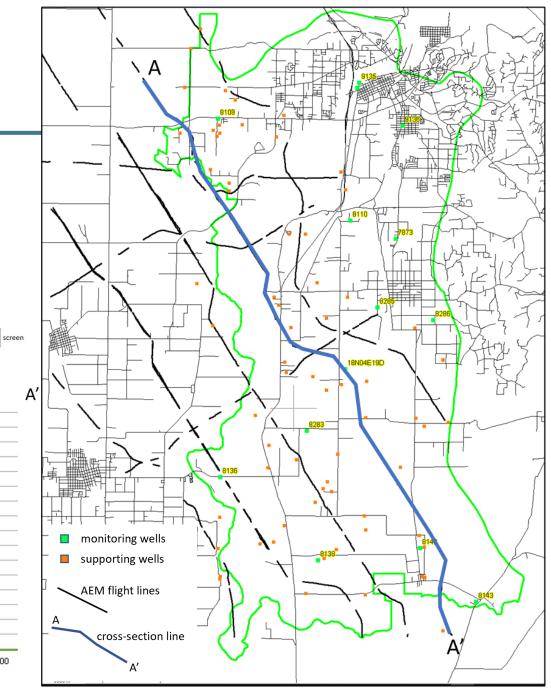
AEM Resistivity (ohm-m)

Unknown GR_Gravel HP Hardpar

> SH_Shale S_Sand

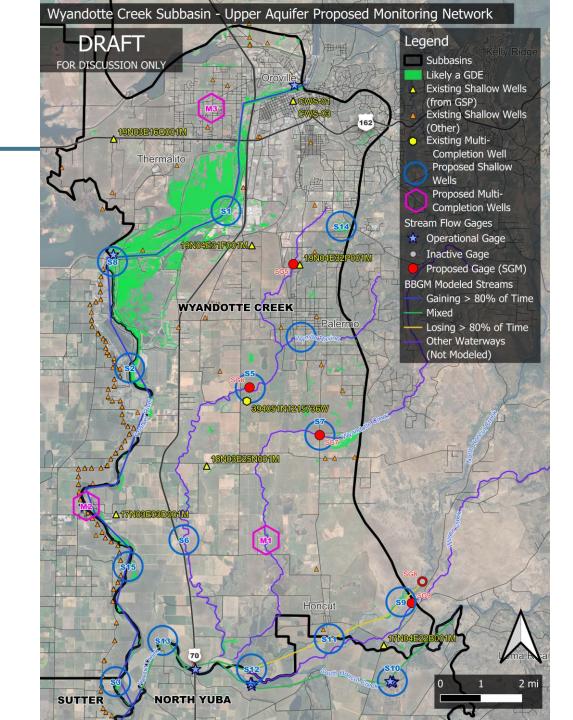
- Laguna Formation = Shallow Layer
- Ione Formation = Deep Layer





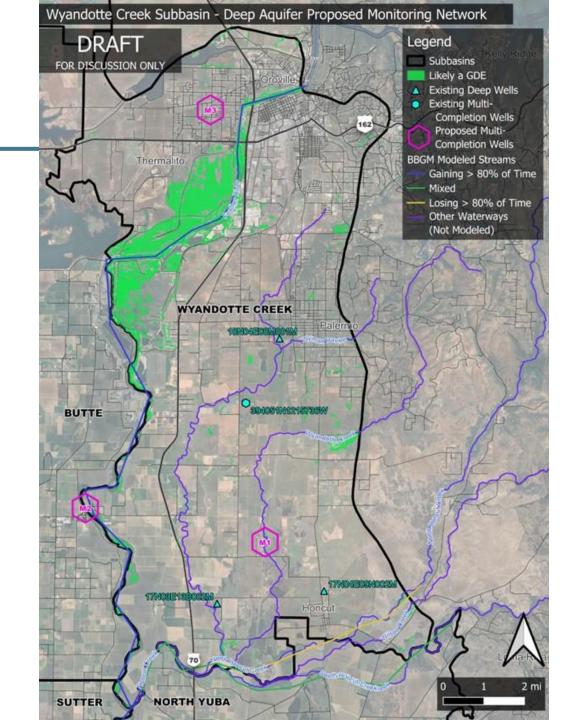
Proposed Shallow Monitoring Network

- Eight (8) existing shallow wells
- One (1) existing multi-completion well
- Enhancements include:
 - ✓ fifteen (15) shallow wells
 - ✓ three (3) multi-completion wells
 - ✓ five (5) stream gages



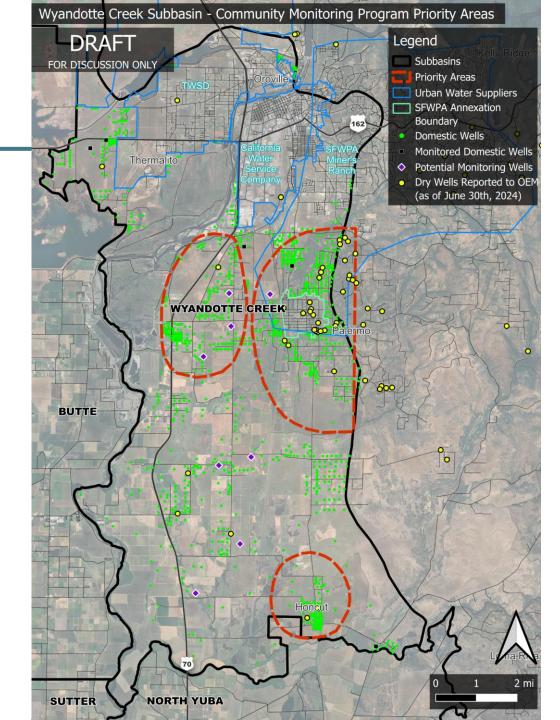
Proposed Deep Monitoring Network

- Three (3) existing deep wells
- One (1) existing multi-completion well
- Enhancements include:
 - ✓ three (3) multi-completion wells



Domestic Well Survey & Monitoring Plan

- Roughly 1,340 domestic wells in the subbasin
- Five (5) existing domestic wells monitored periodically by DWR
- Eight (8) additional domestic wells available for monitoring
- Budget to equip ten (10) domestic wells with continuous monitoring equipment



Real-Time Monitoring

- Groundwater Level Monitoring Sites
 - > Installation Cost: \$6,500 \$11,000 per site
 - > Annual on-going O&M Cost: \$1,000 \$2,500 per site

- Stream Flow Gages
 - > Installation Cost: up to \$35,000 per site
 - > Annual on-going O&M Cost: \$4,000 \$8,000 per site

Figure 1. Groundwater level monitoring site with ENO Scientific sensor.



Figure 2. In-Situ pressure transducer for measuring groundwater levels and stream stage.

Real-Time Monitoring (continued)

Table 1. Installation and Annual O&M Cost for Real-TimeMonitoring.

Locations	Number of Sites	Installation Cost	Average Annual O&M Cost
Domestic Wells	10	\$70,000	\$15,000
Shallow Wells	15	\$105,000	\$22,500
Multi-Completion	3	\$33,000	\$6,000
Stream Gages	5	\$175,000	\$30,000
Total:	33	\$383,000	\$73,500

Assumptions:

1.) Domestic and Shallow Well Installation Cost = \$7,000 per site; O&M Cost = \$1,500 per site.

2.) Multi-Completion Well Installation Cost = \$11,000 per site; O&M Cost = \$2,000 per site.

3.) Stream Gage Installation Cost = \$35,000 per site; O&M Cost = \$6,000 per site.

4.) Sites will be maintained indefinitely (e.g., replace sensors, dataloggers, etc. as needed). Routine site maintenance (e.g., clean solar panel, replace desiccant, etc.) completed by lower cost employee (e.g., intern).

5.) Stream gages calibrated annually to ensure accuracy of stage-discharge relationship.

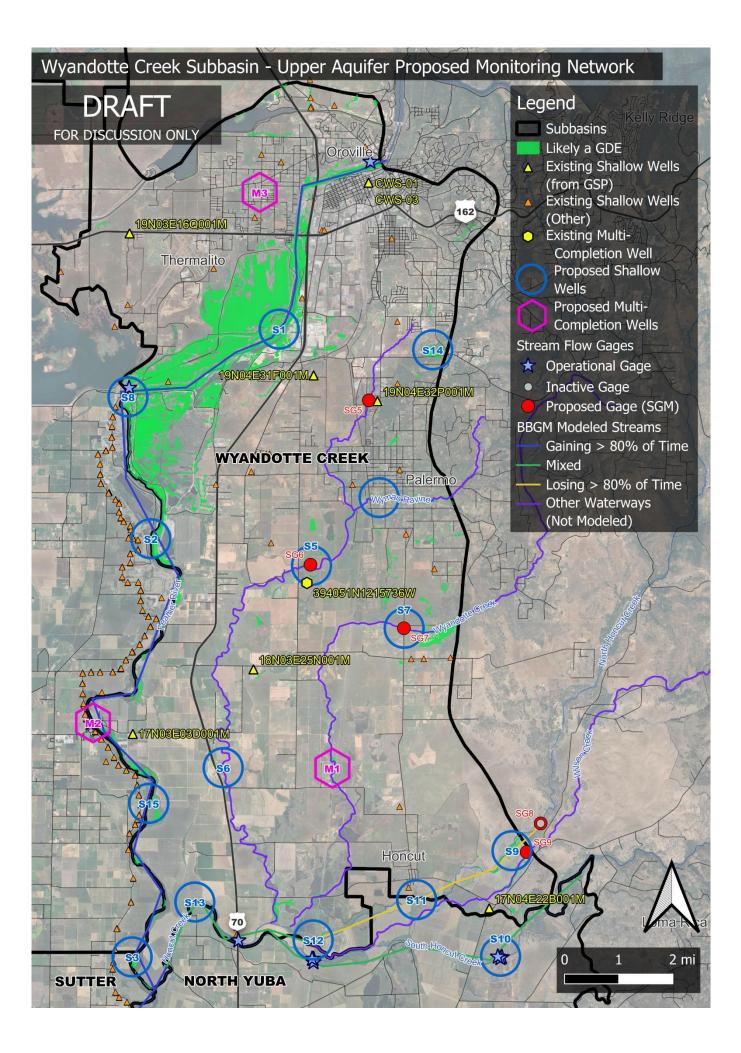
6.) Real-time monitoring planned only at new monitoring locations; additional installations on existing monitoring sites may be considered as grant funding allows.

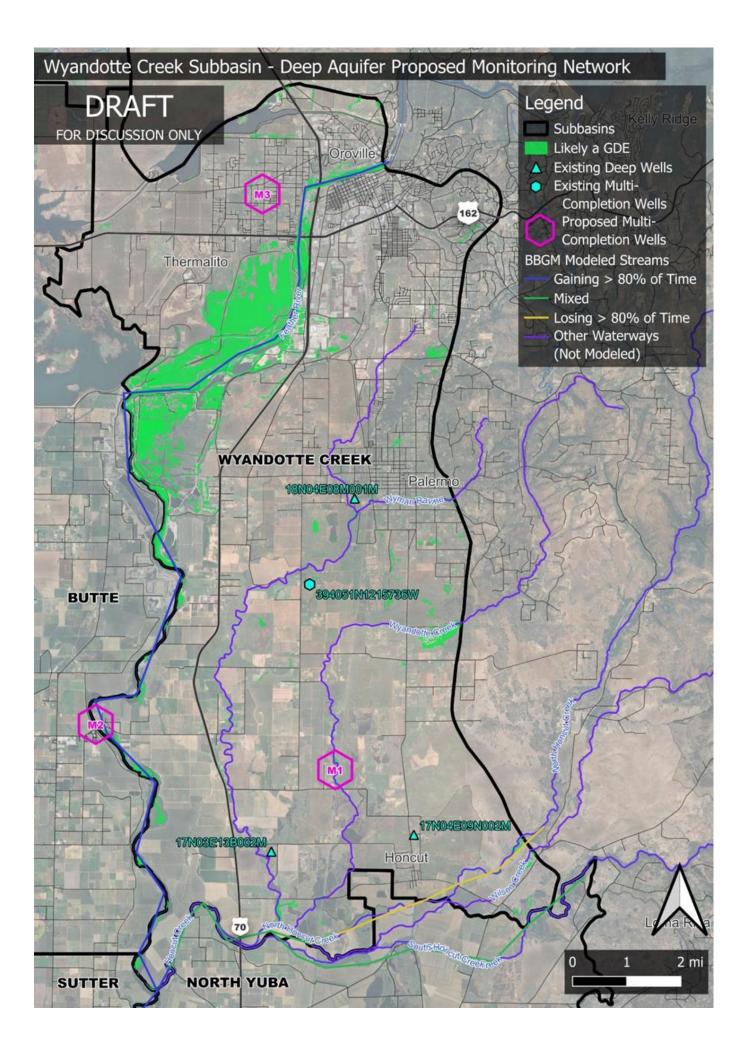
7.) SGM grant pays for installation costs; GSA is responsible for ongoing site maintenance.

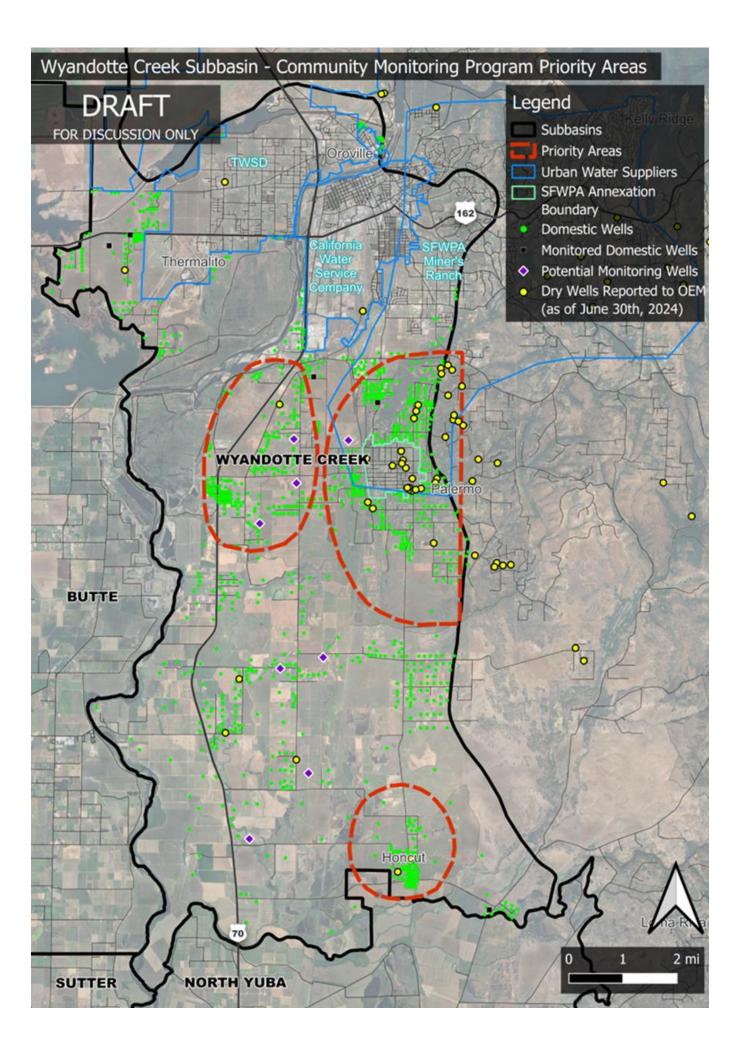
Next Steps

- Access agreements, final designs, & bid documents complete January 2025
- Well contractors notice to proceed by February 2025
- New wells installed by June 2025
- Stream gage installations start December 2024

Questions?







TECHNICAL MEMORANDUM

Date:	November 7, 2024	
To:	Wyandotte Creek Groundwater Sustainability Agency (GSA)	
From:	Larry Walker Associates	
Subject:	Groundwater Monitoring Network Enhancements	

1. BACKGROUND

The Wyandotte Creek Groundwater Sustainability Agency (GSA) groundwater level monitoring network is critical for understanding conditions for all beneficial users and uses of groundwater including interconnected surface waters (ISWs), groundwater dependent ecosystems (GDEs), domestic well users, and agricultural users. The GSA was awarded funding through DWR's Sustainable Groundwater Management (SGM) Grant Program to fund monitoring network enhancements as identified in the Wyandotte Creek Groundwater Sustainability Plan (GSP) and DWR's Determination Letter.¹ The scope of this grant includes (1) a thorough review of the existing monitoring network; (2) the design and installation of a minimum of fifteen new shallow wells, three new multi-completion wells, and five new stream gages; and (3) continuous monitoring of ten domestic wells.

2. METHODS AND PROCEDURES

The Wyandotte Creek GSP, Section 4.2, identifies thirteen (13) existing wells within the Wyandotte Creek Subbasin groundwater level monitoring network (Figure 1). This network of monitoring wells was used for observing groundwater levels and calculating flow directions and hydraulic gradients in the principal aquifer during GSP development and annual reporting. The actual aquifer layers these wells represented based on screen intervals / well depths were not identified in the GSP. After meeting with the Butte County Technical Advisory Committee and neighboring subbasins, it was recommended to develop a separate monitoring network for the upper groundwater aquifer layer, to monitor ISWs and GDEs, and the lower aquifer layer, to monitor impacts from pumping. The two-layer approach allows for assessing the vertical connectivity between aquifer zones.

The GSA partnered with Dr. Todd Greene with CSU Chico to provide stratigraphic context for the screened intervals in the Wyandotte Creek Subbasin monitoring wells. This information was then used to help guide the location and screen intervals for future monitoring well sites for the upper and lower aquifer layers. A thorough breakdown of the data, methodology, and results of this investigation are detailed in a technical memorandum developed by Sub-Terra Heritage Resource Investigations (Greene, 2024).

¹ GSP and Determination Letter available here: <u>https://sgma.water.ca.gov/portal/gsp/preview/99</u>

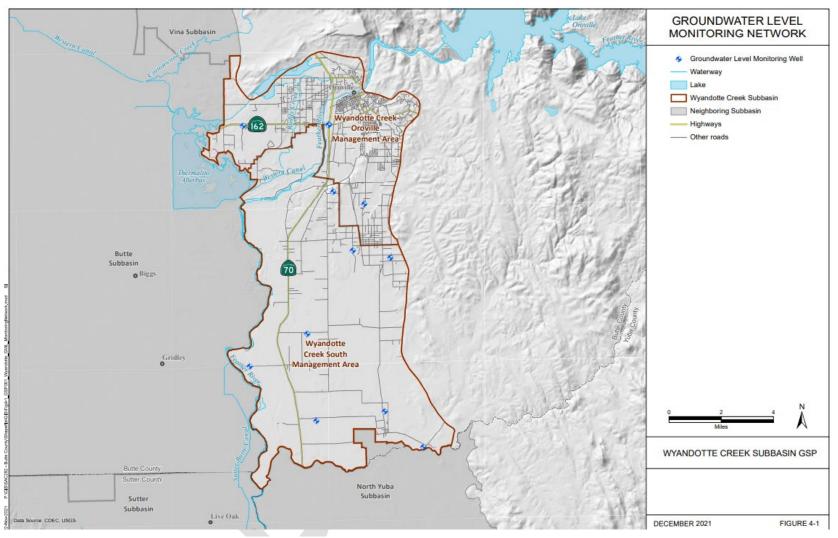


Figure 1. Map of existing groundwater level monitoring network (Wyandotte Creek Groundwater Subbasin GSP, Figure 4-1, page 138).

2.1. Monitoring Network Enhancements

To refine the site selection process for new wells and stream gages in the groundwater monitoring network, LWA in coordination with GSA staff have established the following site selection criteria:

- Data Gaps Prioritize locations that will help address data gaps identified in the GSP and DWR's Determination Letter which includes ISWs and GDEs. The Butte Basin Groundwater Model was used to identify potential ISWs. Potential GDEs were identified using the Natural Communities Commonly Associated with Groundwater dataset developed by DWR, the California Department of Fish and Wildlife (CDFW), and The Nature Conservancy (TNC).
- 2. Land Access The GSA will locate new sites along County and City easements when feasible or establish landowner agreements as needed.
- Existing Infrastructure Prioritize utilizing existing infrastructure to avoid unnecessary drilling and well construction expenses, when possible. For stream gages, locating and reactivating inactive sites will generally be more cost-effective than establishing new gaging sites.
- 4. **SGMA Projects** Prioritize sites that could benefit other SGMA projects. For example, the dedicated recharge basin opportunities spurred on by the Regional Conjunctive Use Project will require shallow wells to help quantify recharge. Installing shallow wells in the vicinity of possible basin locations could help analyze benefits provided by such a project in the short term, while also serving as long-term monitoring sites for ISWs/GDEs.
- 5. Water Quality To the extent possible, new wells will support Subbasin groundwater quality monitoring efforts and fill gaps in the water quality monitoring network.

2.2. Domestic Well Survey

A desktop survey was performed to locate parcels with domestic wells using the County Assessor's Office parcel use codes. The goal of this survey was to refine the GSA's existing domestic well dataset and to identify areas with a high density of domestic wells at risk of going dry (deemed "Priority Areas"). In the desktop survey, parcels within Cal Water, Thermalito Water and Sewer District (TWSD), and South Feather Water and Power Agency (SFWPA) service areas were excluded from the analysis due to being served by a public water supply system. Parcels zoned for agriculture were only included if they had a building with a known address.

The GSA will hold outreach events to solicit interest from community members in Priority Areas in preparation for the launch of the Community Monitoring Program to monitor domestic wells throughout the Subbasin.

3. RESULTS

3.1. Monitoring Network Enhancements

Of the Thirteen (13) existing wells included in the groundwater level monitoring network (see GSP Section 4.2), Dr. Todd Greene's analysis identified eight (8) as shallow and three (3) as

deep. Maps of the proposed shallow and deep monitoring networks are shown in Figures 2 and 3, respectively. These sites are summarized in Table 1 with hydrographs provided in Appendix A.

Table 1. Existing representative monitoring wells measuring groundwater levels in the shallow and deep aquifer layers. All wells are monitored on a quarterly basis. Shallow wells can effectively observe the upper aquifer, deep wells can effectively observe the lower aquifer, and multi-completion wells can observe both.

Map Label	Well Depth	Well Type	Management Area
17N04E22B001M	Shallow	Residential	Wyandotte Creek - South
17N03E13B002M	Deep	Irrigation	Wyandotte Creek - South
17N04E09N002M	Deep	Irrigation	Wyandotte Creek - South
17N03E03D001M	Shallow	Irrigation	Wyandotte Creek - South
18N03E25N001M	Shallow	Irrigation	Wyandotte Creek - South
18N04E19D001M	Multi-completion	Observation	Wyandotte Creek - South
18N04E08M001M	Deep	Irrigation	Wyandotte Creek - South
19N04E32P001M	Shallow	Residential	Wyandotte Creek - Oroville
19N04E31F001M	Shallow	Residential	Wyandotte Creek - South
19N03E16Q001M	Shallow	Residential	Wyandotte Creek - Oroville
CWS-01	Shallow	Municipal	Wyandotte Creek - Oroville
CWS-03	Shallow	Municipal	Wyandotte Creek - Oroville

As illustrated in Figure 2, the long-term goal for the shallow monitoring network is to install wells near streams and potential GDEs in areas delineated with blue circles. Monitoring sites are located along the Feather River, Wyman Ravine, Wyandotte Creek, and Honcut Creek. Shallow wells will be installed at these fifteen (15) locations under the SGM Grant pending review of other existing shallow monitoring wells in the area (e.g., observation wells along the Feather River levee) that may be used instead of drilling a new well.

Multi-completion wells are proposed at the sites labeled M1, M2, and M3 as shown on Figures 2 and 3. The multi-completion wells will fill data gaps in both the upper and lower aquifer monitoring networks. M1 is located along Wyandotte Creek near agricultural fields in the southern, central portion of the Subbasin. M2 is located along the Feather River and will be used to characterize vertical and horizontal movement of groundwater on the Subbasin boundary. M3 is located in the Oroville Management Area, where there are currently no other deep wells to characterize the lower aquifer.

It is recommended to install five stream gages across the Subbasin: two along Wyman Ravine (SG5 and SG6), one along Wyandotte Creek near Palermo Honcut Highway (SG7), and two near the eastern boundary of the Subbasin on North Honcut Creek (SG8) and Wilson Creek (SG9). The stream gages will be used to estimate stream depletions due to groundwater pumping and to support the planning and implementation of groundwater recharge projects.

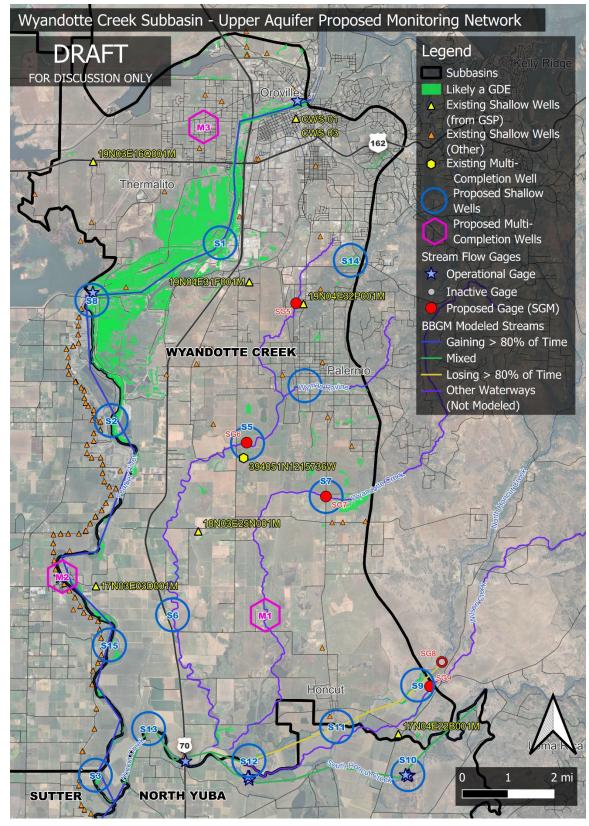


Figure 2. Map depicting all shallow and multi-completion wells, both existing and proposed, to be included in the Upper Aquifer monitoring network.

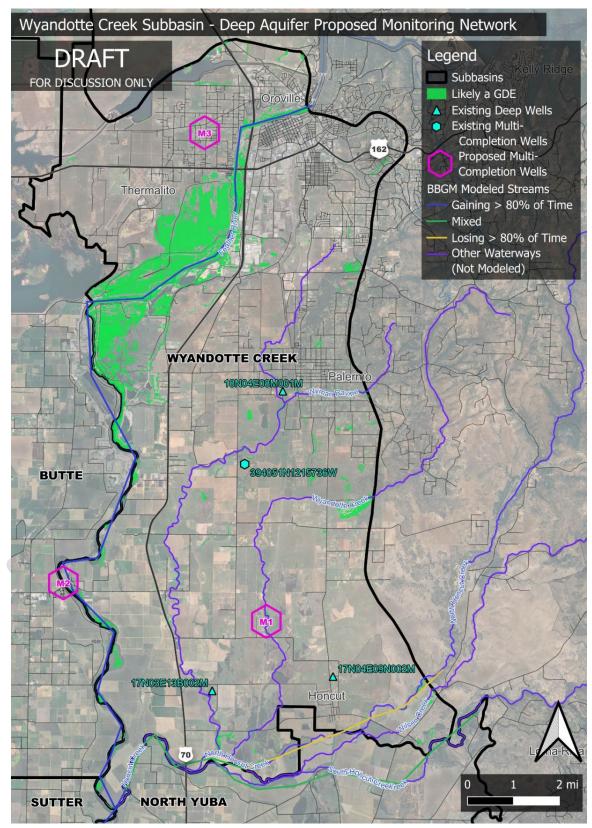


Figure 3. Map depicting all deep and multi-completion wells, both existing and proposed, to be included in the Lower Aquifer monitoring network.

3.3. Domestic Well Survey Preliminary Results

The domestic well survey based on parcel information identified 1,342 domestic wells within the Wyandotte Creek Subbasin. A map of the domestic well survey results with delineated Priority Areas are shown in Figure 3. For comparison, DWR estimates approximately 627 domestic wells within the Subbasin based on the number of well completion reports (WCRs) received since 1977.² The parcel-based approach may be over-estimating the number of domestic wells due to data gaps in the parcel coverage. It is recommended to coordinate further with Cal Water, TWSD, and SFWPA to identify parcels with potable water service.

Eight well owners have volunteered their domestic wells to be monitored under the Community Monitoring Program (see purple points on Figure 3). These wells will be further evaluated to assess the suitability to participate and be monitored through the Program. The GSA has funding to install monitoring equipment on ten domestic wells.

² California's Groundwater Live website link: https://sgma.water.ca.gov/CalGWLive/#wells

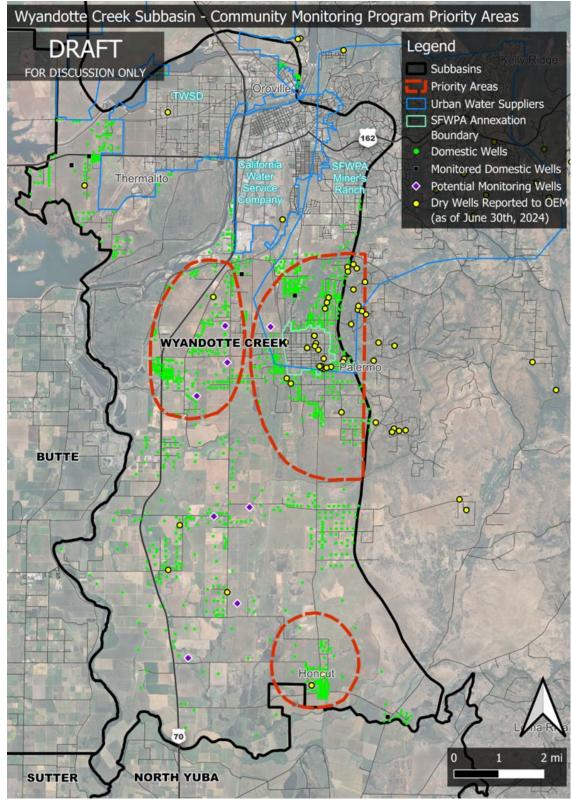


Figure 4. Map depicting results of the domestic well survey. Priority areas were delineated from the domestic well survey results and the dry wells reported to Butte County OEM through June 30, 2024.

4. NEXT STEPS

The LWA Team in coordination with GSA staff are actively soliciting input on the proposed enhanced monitoring network from local stakeholders. To date, we have engaged the following groups for input:

- Members of Butte County Technical Advisory Committee,
- Agricultural Groundwater Users of Butte County,
- Water Well Advisory Group,
- Yuba Water Agency, and
- Other GSA/County technical consultants.

The schedule to request input from the Wyandotte Creek GSA Advisory Committee (WAC) and the Board of Directors is summarized in Table 2. Final recommendation and approval from the WAC and Board of Directors is tentatively scheduled for November 7, 2024, and November 21, 2024; respectively.

Table 2. Proposed WAC and Board of Directors input process schedule.

Group	Meeting Date	Purpose
WAC	November 7, 2024	Recommendation to Board
Board of Directors	November 21, 2024	Final Board Approval

The LWA Team in coordination with GSA staff will continue to advance activities to ensure installation of the monitoring network remains on schedule. Landowner access agreements (as applicable), final monitoring well designs and specifications, and bid documents will be completed by January 2025. Well contractors will be given notice to proceed by February 2025 with all new wells installed by June 2025. Stream gage and domestic well installations will start in December 2024 once final approval is granted by the Wyandotte Creek GSA Board of Directors.

Table 3 summarizes installation and annual operating and maintenance (O&M) costs for groundwater level monitoring sites and stream gages. Installation costs will be covered by the grant. The GSA will be responsible for funding ongoing O & M of monitoring sites. Costs assume sites will be equipped with telemetry to automatically view data online in near real-time via an online stakeholder portal. Monitoring equipment will be installed once wells are drilled, and domestic wells and stream gage locations are selected for monitoring.

Site Type	Installation Costs (\$/site)	Annual O&M Cost (\$/site)
Groundwater Level ¹	\$6,500 - \$11,000	\$1,000 - \$2,500
Stream Gage ²	Up to \$35,000	\$4,000 to \$8,000

Table 3. Installation and O&M costs for groundwater level monitoring sites and stream gages.

Notes:

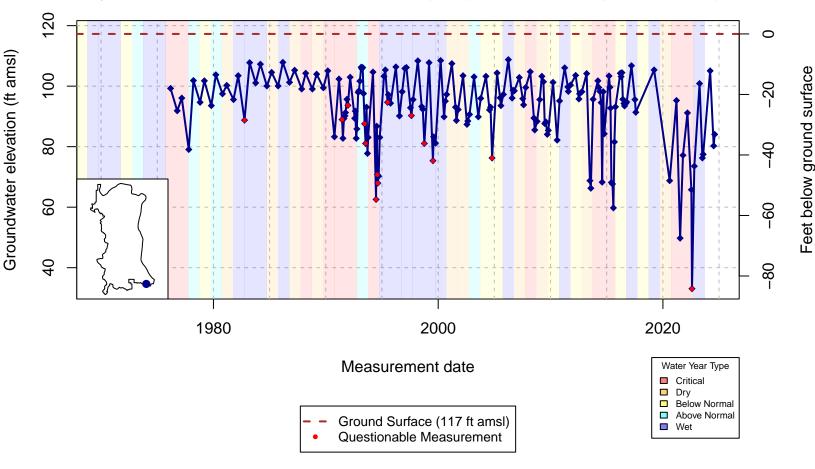
1.) Costs vary based on the following factors: type of sensor (e.g., sonar vs submersible), number of well completions, well casing diameter, and depth to groundwater.

2.) Costs vary based on site flow conditions and ease of access. Assumes a minimum of three stream measurements at low, medium, and high flow are conducted to develop stage – discharge curve and at least one measurement is taken every year to validate stage-discharge curve.

APPENDIX A

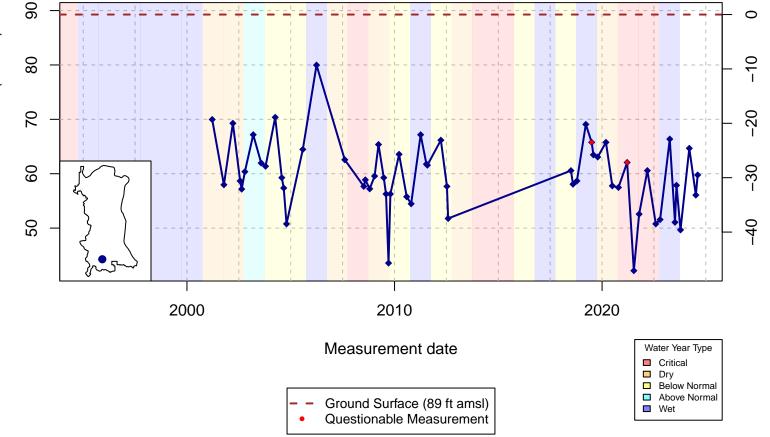
Wyandotte Creek Subbasin Groundwater Hydrographs for Existing Shallow and Deep Wells

(Identified Through Dr. Todd Greene's Analysis)



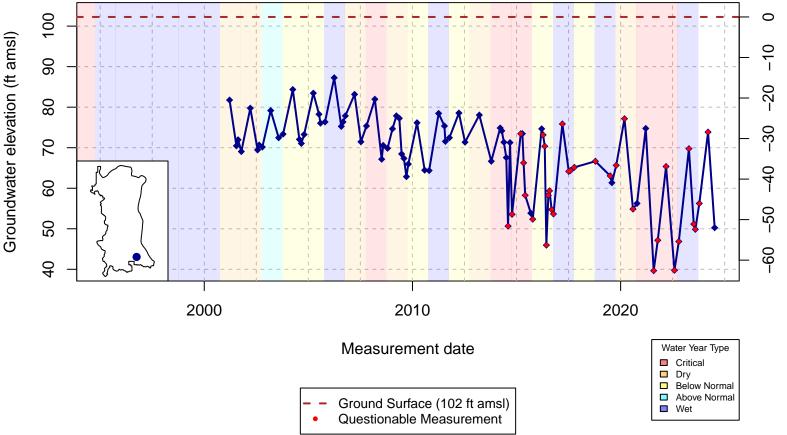
Wyandotte Creek Subbasin – State Well Number (SWN): 17N04E22B001M (Shallow Aquifer)

Wyandotte Creek Subbasin – State Well Number (SWN): 17N03E13B002M (Deep Aquifer)

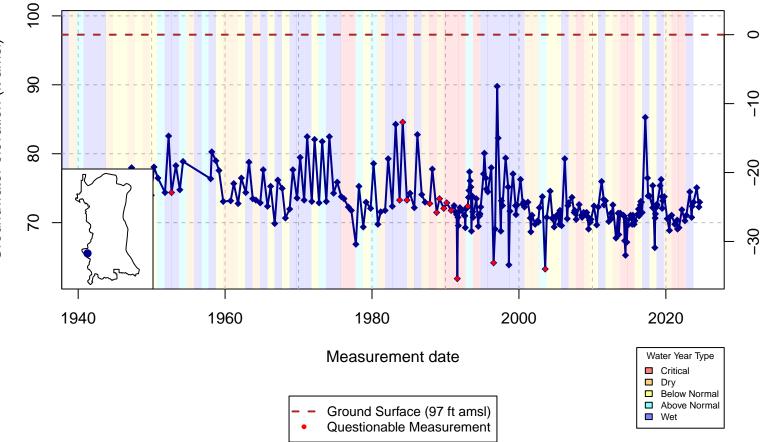


Feet below ground surface

Wyandotte Creek Subbasin – State Well Number (SWN): 17N04E09N002M (Deep Aquifer)



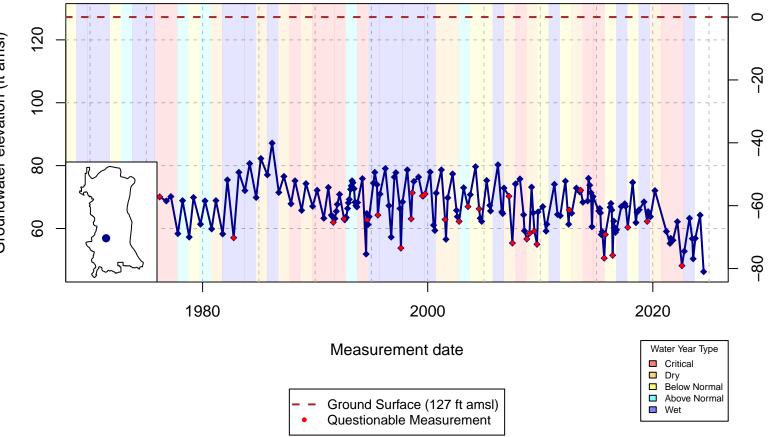
Feet below ground surface



Feet below ground surface

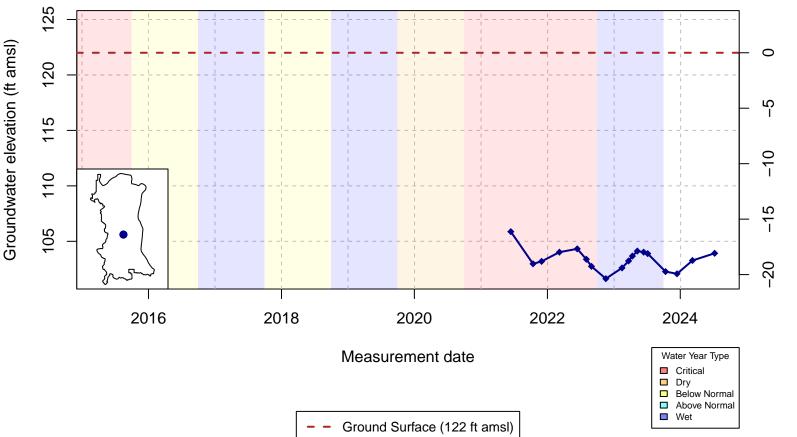
Wyandotte Creek Subbasin – State Well Number (SWN): 17N03E03D001M (Shallow Aquifer)

Wyandotte Creek Subbasin – State Well Number (SWN): 18N03E25N001M (Shallow Aquifer)

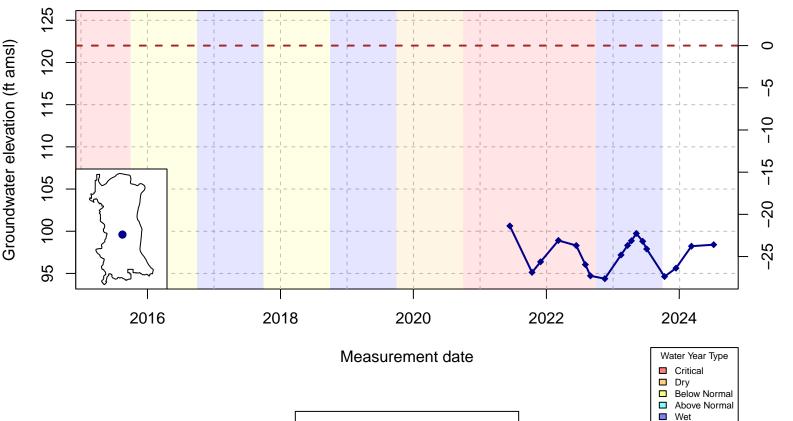


Feet below ground surface

Groundwater elevation (ft amsl)



Wyandotte Creek Subbasin – State Well Number (SWN): 18N04E19D001M (Deep Aquifer)

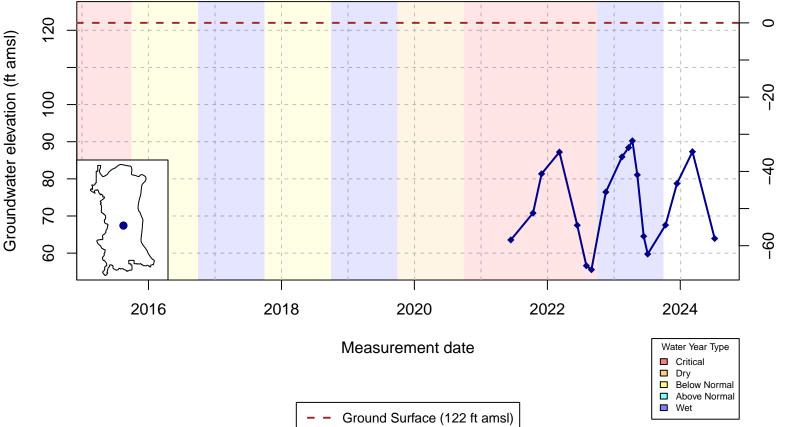


Wyandotte Creek Subbasin – State Well Number (SWN): 18N04E19D002M (Deep Aquifer)

- Ground Surface (122 ft amsl)

Feet below ground surface

Wyandotte Creek Subbasin – State Well Number (SWN): 18N04E19D003M (Shallow Aquifer)



Feet below ground surface

200 0 Groundwater elevation (ft amsl) -20 180 40 160 -60 140 -80 120 -100 100 1940 1960 2000 2020 1980 Measurement date Water Year Type

Ground Surface (203 ft amsl)

Questionable Measurement



Feet below ground surface

Critical Dry

Wet

Below Normal Above Normal

0 140 Groundwater elevation (ft amsl) -20 120 4 100 -60 80 -80 60 -100 1960 1980 2000 2020

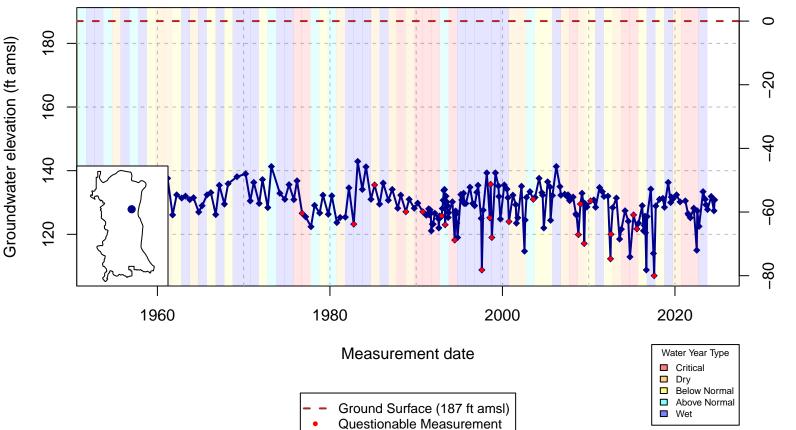
Measurement date

Ground Surface (147 ft amsl)

Questionable Measurement

Wyandotte Creek Subbasin – State Well Number (SWN): 18N04E08M001M (Deep Aquifer)

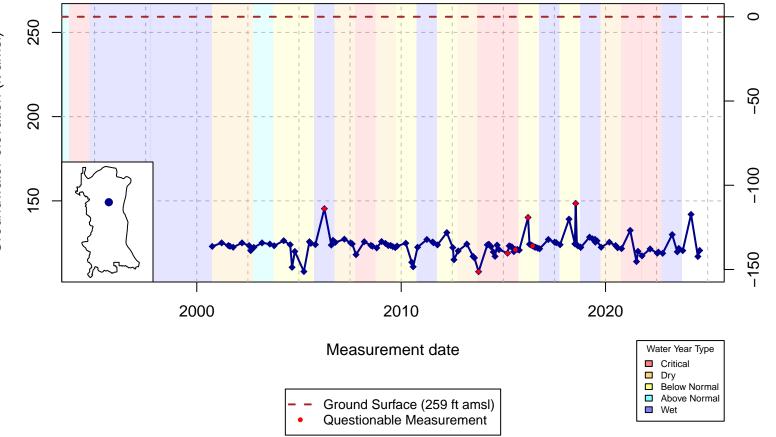




Wyandotte Creek Subbasin – State Well Number (SWN): 19N04E32P001M (Shallow Aquifer)

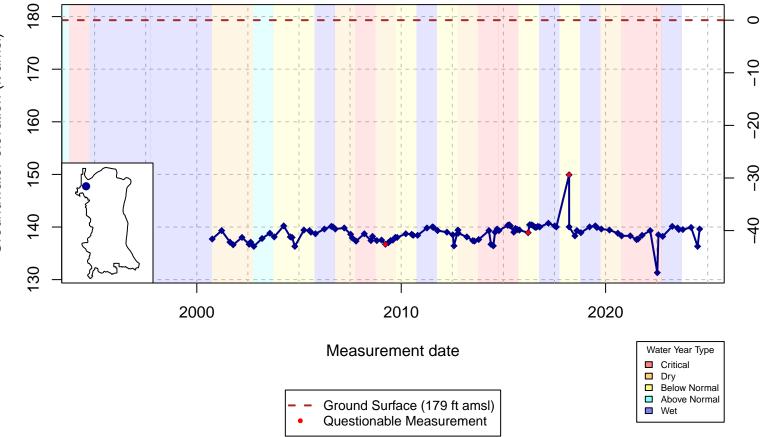
Feet below ground surface

Wyandotte Creek Subbasin – State Well Number (SWN): 19N04E31F001M (Shallow Aquifer)



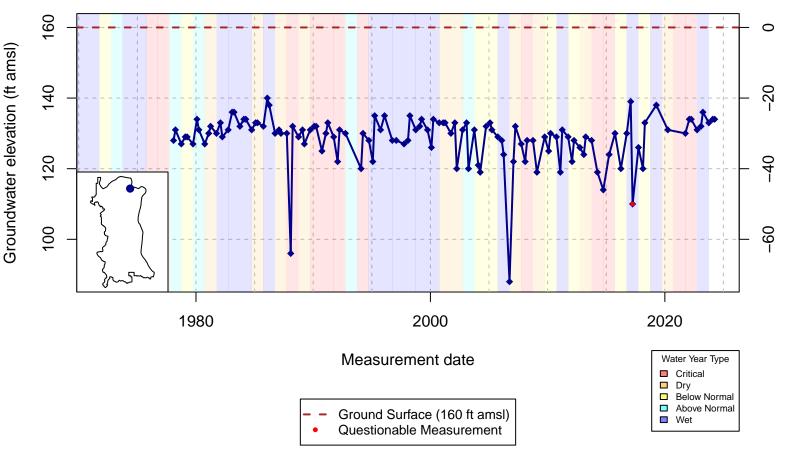
Feet below ground surface

Wyandotte Creek Subbasin – State Well Number (SWN): 19N03E16Q001M (Shallow Aquifer)

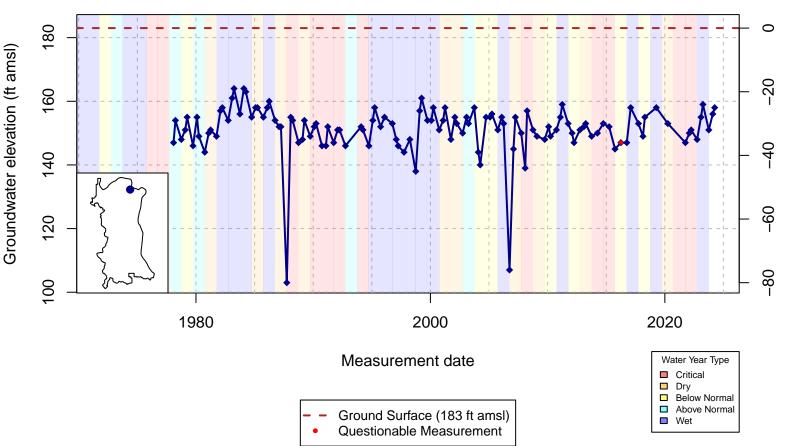


Feet below ground surface

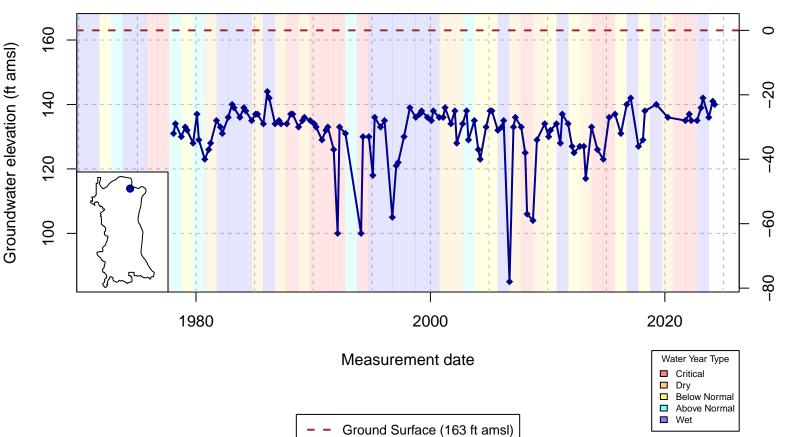
Groundwater elevation (ft amsl)



Wyandotte Creek Subbasin – State Well Number (SWN): CWS-03 (Shallow Aquifer)



Wyandotte Creek Subbasin – State Well Number (SWN): CWS-02 (Both Layers)



Wyandotte Creek Subbasin – State Well Number (SWN): CWS-01 (Shallow Aquifer)