8 SUSTAINABLE MANAGEMENT CRITERIA

8.4 Chronic Lowering of Groundwater Levels Sustainable Management Criteria

This section is organized to first present the general concepts of the sustainable management criteria as developed in 2019. Responsive to the DWR Corrective Actions, this is supplemented by additional description of the undesirable results and additional explanation of the sustainability criteria with evaluation of the effects of the criteria on beneficial uses and users of groundwater.

8.4.1 Information and Methodology Used to Establish Measurable Objectives and Minimum Thresholds

The information used for establishing the chronic lowering of groundwater levels measurable objectives and minimum thresholds includes:

- Information about the public definition of significant and unreasonable conditions and preferred current and future groundwater elevations, gathered from the Sustainable Management Criteria survey and public outreach meetings.
- Historical groundwater elevation data from wells monitored by the County of San Luis Obispo
- Depths and locations from existing well records
- Maps of current and historical groundwater elevation data
- Results of modeling of various scenarios of future groundwater level conditions

Information and methods used to initially establish sustainable management criteria were supplemented using:

- The identified deficiencies and Corrective Actions defined by DWR in its June 3, 2021 letter reviewing the Paso Robles Area Subbasin – 2020 Groundwater Sustainability Plan and the January 21, 2022 "Incomplete" Determination of the 2020 Paso Robles Area Subbasin Groundwater Sustainability Plan (Appendix O)

- Evaluation of existing well records with information on construction and locations (as of 2021) relative to the Representative Monitoring Site (RMS) wells

- Evaluation of the effects of the sustainability criteria on beneficial uses and users of groundwater, especially existing domestic well records

8.4.2 Locally Defined Significant and Unreasonable Conditions

This section provides the descriptions, definitions, and evaluation that are the basis for establishing sustainability criteria in the next section.

- Description of significant and unreasonable conditions
- Potential causes of significant and unreasonable conditions
- Definition of significant and unreasonable conditions

8.4.2.1 Description of Significant and Unreasonable Conditions

As groundwater levels decline in a well, a sequence of increasingly severe conditions will occur. These include an increase in pumping costs and a decrease in pump output (in gallons per minute). With further declines, the pump may break suction, which means that the water level in the well has dropped to the level of the pump intake. This can be remedied by lowering the pump inside the well, which can cost thousands of dollars. Chronically declining water levels will eventually drop below the top of the well screen. This exposes the screen to air, which can produce two adverse effects. In the first, water entering the well at the top of the screen will cascade down the inside of the well, entraining air; this air entrainment can result in cavitation damage to pump. The other potential adverse effect is accelerated corrosion of the well screen. Corrosion can reduce the efficiency and capacity of a well and eventually creates a risk of well screen collapse, which would likely render the well unusable. If water levels decline below the well screen, water might not be able to flow into the well at the desired rate regardless of the capacity or depth setting of the pump. This might occur more frequently where the thickness of basin fill materials is relatively thin. While describing a progression of potential adverse effects, at some point the well no longer fulfills its water supply purpose and is deemed to have "gone dry." For the purposes of this discussion, a well going dry means that the entire well (to the reported total depth of the well) is unsaturated.

For purposes of setting the Measurable Objective and Minimum Threshold, significant and unreasonable conditions are defined in terms of an increased percentage of wells unable to sufficiently produce water. The rationale is based on four general assumptions summarized below, with more explanation in the following sections:

1. Accurate information on the location, elevation, use, status, and construction of most local supply wells is not readily available for detailed evaluation of the range of adverse effects. Analysis was initiated with the simple concept of the entire well depth

as "going dry" and then applied to the set of existing wells that have available information on location and construction.

2. Responsibility for wells in a SGMA managed groundwater basin is shared between GSAs that manage groundwater levels to protect against significant and unreasonable conditions and well owners who have responsibility for their respective wells.

3. During the recent drought, many wells within the Subbasin were reported to have been unable to sufficiently produce water. The California Department of Water Resources (DWR) *Household Water Supply Shortage Reporting System* (DWR 2021)[1] lists a total of 141 private household wells (i.e., domestic wells) that no longer sufficiently produce water as of the end of 2017, as shown on Figure 8-1.

4. Wells that are unable to sufficiently produce water prior to 2017 are assumed to have either been replaced by deeper wells or an alternative water supply source. 2017 is used as the end of this analysis period to be consistent with the water level measurable objectives defined below.

8.4.2.2 Potential Causes of Significant and Unreasonable Conditions

With respect to chronic groundwater level declines, the primary cause of significant and unreasonable conditions is a water budget imbalance with pumping in excess of recharge. At any given time and place, this could involve multiple factors including local hydrogeologic conditions, cumulative pumping, reduced natural recharge due to drought, or reduction of surface water supplies used in lieu of groundwater and associated reduction in groundwater recharge from return flows.

The groundwater level declines in turn cause adverse conditions (i.e., loss of yield) that not only vary across the Subbasin and through time, but also differ in magnitude from well to well depending on its location, construction, operation, and conditions. Accurate information on the location, elevation, status, and construction of most local supply wells is not readily available and therefore, detailed evaluation of the range of adverse effects is not possible.

Moreover, the significant and unreasonable conditions of a well losing yield, experiencing damage, or the inability to sufficiently produce water represent a complex interplay of causes and shared responsibility. Some of the potential causes are within the responsibility of the GSAs. Most notably, a GSA is responsible for groundwater basin management without causing significant and unreasonable conditions such as chronic groundwater level declines. SGMA also requires that a GSA address significant and unreasonable effects caused by groundwater conditions *throughout the basin.* This indicates that a GSA is not solely

[1] https://mydrywell.water.ca.gov/report/

responsible for local or well-specific problems and furthermore that responsibility is shared with a well owner. A reasonable expectation exists that a well owner would construct, maintain, and operate the well to provide its expected yield over the well's life span, including droughts, and with some anticipation that neighbors also might construct wells (consistent with land use and well permitting policies).

8.4.2.3 Definition of Significant and Unreasonable Conditions

As context, the Sustainability Goal for the Paso Robles Subbasin is to sustainably manage groundwater resources for the long-term community, financial, and environmental benefit of users while maintaining the unique cultural, community, and business aspects of the Subbasin. Significant and unreasonable groundwater levels were initially defined in 2019 as those that:

- Impact the ability of existing domestic wells of average depth to produce adequate water for domestic purposes.
- Cause significant financial burden to those who rely on the groundwater basin
- Interfere with other SGMA sustainability indicators.

These have been modified. First, the limitation of existing domestic wells to those of average depth has been modified to conceptually include all existing well records, with a focus on domestic well records. This focus recognizes the importance of domestic wells as a source of potable supply (often the sole source to one or more households) and assumes that these are more likely to be shallow and thus susceptible to undesirable results from groundwater level declines. Data limitations in identifying domestic wells and evaluating impacts are acknowledged throughout this section. Second, financial burdens are not evaluated as a groundwater sustainability issue but are more appropriately addressed as part of the analysis of projects and management actions and implementation plan. Third, the effects on other SGMA sustainability indicators are addressed in Section 8.4.5.5.

For purposes of this supplementary analysis in response to DWR Corrective Actions and to support the sustainability criteria in this GSP, significant and unreasonable groundwater levels are defined as follows.

1. A significant number of wells throughout the Subbasin unable to sufficiently produce water with the following considerations:
    - As noted above, "going dry" means that the entire well length (to the bottom of the well) is unsaturated.
    - It is acknowledged that groundwater level declines involve a continuum of potential impacts that are specific to a well.

- These include effects not noticed by the well owner and those that are noticed and reasonably handled by the well owner.
- This significance criteria relates to wells that unable to sufficiently produce water prior to 2017.
- The GSAs define a significant number of wells throughout the Subbasin as ten percent of all wells, as represented by wells with known location and construction information.

2. Chronic groundwater level declines that interfere with other SGMA sustainability indicators.

In that light, the definition of significant and unreasonable conditions would be the chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply equivalent to more than five percent of wells unable to sufficiently produce water. This is defined by groundwater conditions occurring throughout the Subbasin. Additional temporal and spatial components defining undesirable results are presented in Section 8.4.6.

8.4.3 Measurable Objectives

The measurable objectives for chronic lowering of groundwater levels represent target groundwater elevations that are established to achieve the sustainability goal by at least 2040. Measurable objectives are groundwater levels established at each RMS. Measurable objective groundwater levels are higher than minimum threshold groundwater levels. Measurable objectives provide operational flexibility above minimum threshold levels to ensure that the Subbasin can be managed sustainably over a reasonable range of climate and hydrologic variability. Measurable objectives may change after GSP adoption as new information and hydrologic data become available.

8.4.3.1 Methodology for Setting Measurable Objectives

Initial measurable objectives were established based on historical groundwater level data along with input and preferences on future groundwater levels from domestic groundwater users, agricultural interests, environmental interests, and other Subbasin stakeholders. The input and preferences were used to formulate a range of conceptual measurable objective scenarios. These scenarios were evaluated using the GSP model to project the effect on future Subbasin operation and to select measurable objectives for the GSP.

8.4.3.2 Paso Robles Formation Aquifer Measurable Objectives

Initial measurable objectives for each groundwater level RMS in the Paso Robles Formation Aquifer were set at the approximate 2017 average groundwater levels. The measurable objectives are depicted on hydrographs in Appendix H.

8.4.3.3 Alluvial Aquifer Measurable Objectives

Only one RMS could be established for the Alluvial Aquifer. This RMS is associated with a new monitoring well (well name 18MW-0191) installed by the City of Paso Robles in June 2018. A measurable objective was not established for this RMS because it does not have sufficient historical groundwater level data. Additional measurable objectives will be established for the Alluvial Aquifer early after GSP adoption when the RMS network is expanded by either locating new candidate monitoring wells, modifying confidentiality agreements at known wells so that groundwater level data can be used, or by installing new monitoring wells.

8.4.4 Minimum Thresholds

Section §354.28(c)(1) of the SGMA regulations states that *"The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results."*

The Sustainable Management Criteria survey (Appendix G) provided general information on stakeholders' preferences for future groundwater levels. Initial minimum thresholds were developed based on the survey and public outreach results, hydrogeologic information including contours of 2017 groundwater levels and evaluation of historical groundwater level variability at the RMS, and information about well construction.

Average 2017 non-pumping groundwater levels have been selected as measurable objectives, and minimum thresholds are set below those levels. As stated in the Executive Summary section ES-7, a groundwater elevation minimum threshold for each monitoring well was set to an elevation 30 feet below the measurable objective. Analysis of historical groundwater elevation data suggested that 30 feet allows for reasonable operational flexibility that accounts for seasonal and anticipated climatic variations on groundwater elevation. Specific conditions such as well depths at each RMS were considered when establishing the groundwater level for the initial minimum threshold. Protecting a sustainable groundwater supply for existing wells was a guiding consideration. Minimum thresholds were selected to allow sufficient time for the GSAs to develop a broader and publicly accessible dataset that will give clear guidance to establish a reasonable justification for any potential management actions that would be triggered by exceedances of minimum thresholds.

As noted above, only one RMS could be established for the Alluvial Aquifer. This RMS is associated with a new monitoring well (well name 18MW-0191) installed by the City of Paso Robles in June 2018. A measurable objective was not established for this well; therefore, a minimum threshold is not established. A minimum threshold will be established after additional groundwater level data are available for the well. Additional minimum thresholds

will be established for the Alluvial Aquifer early after GSP adoption when an expanded RMS network is developed.

8.4.5 Evaluation of Effect on Existing Wells of Sustainability Criteria

This section focuses on the sustainability criteria for the Paso Robles Formation Aquifer. As noted in Sections 8.4.3.3 and 8.4.4, only one well was identified in 2019 to represent the Alluvial Aquifer and no sustainability criteria were defined. This 2021 evaluation includes:

- identification of existing well records with construction information relative to RMS wells
- presentation of measurable objectives at RMS and analysis of effects on existing well records
- presentation of minimum thresholds at RMS and analysis of effects on existing well records

8.4.5.1 Evaluation of Existing Wells with Construction Information

Figure 8-2 shows the locations of the Representative Monitoring Site (RMS) wells along with locations of existing supply well records in their vicinity. Each of the existing well records (shown on the map as a colored dot) has an assigned location and documented construction details from available sources.

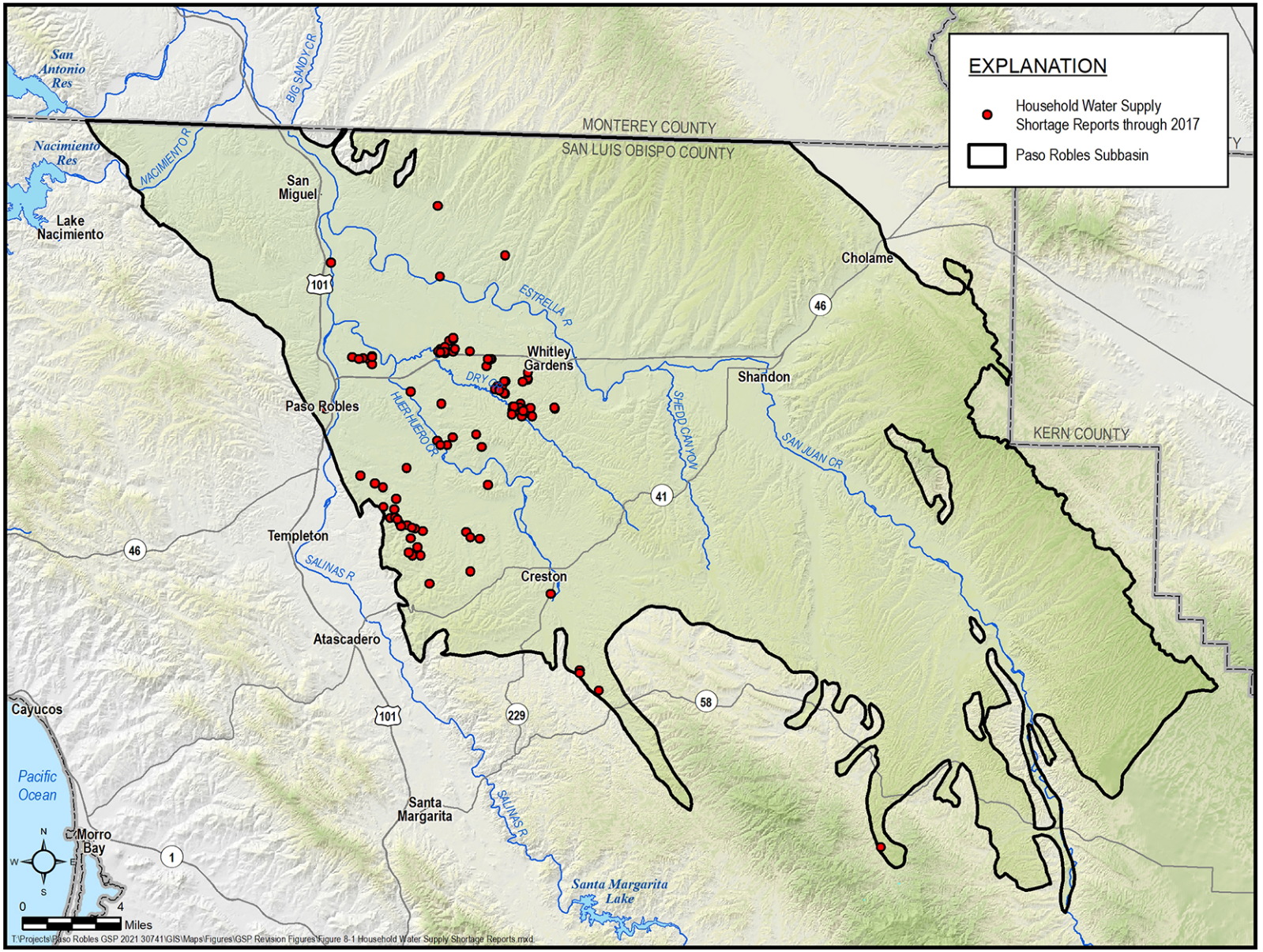

Figure 8-1. Household Water Supply Shortage Reports through 2017

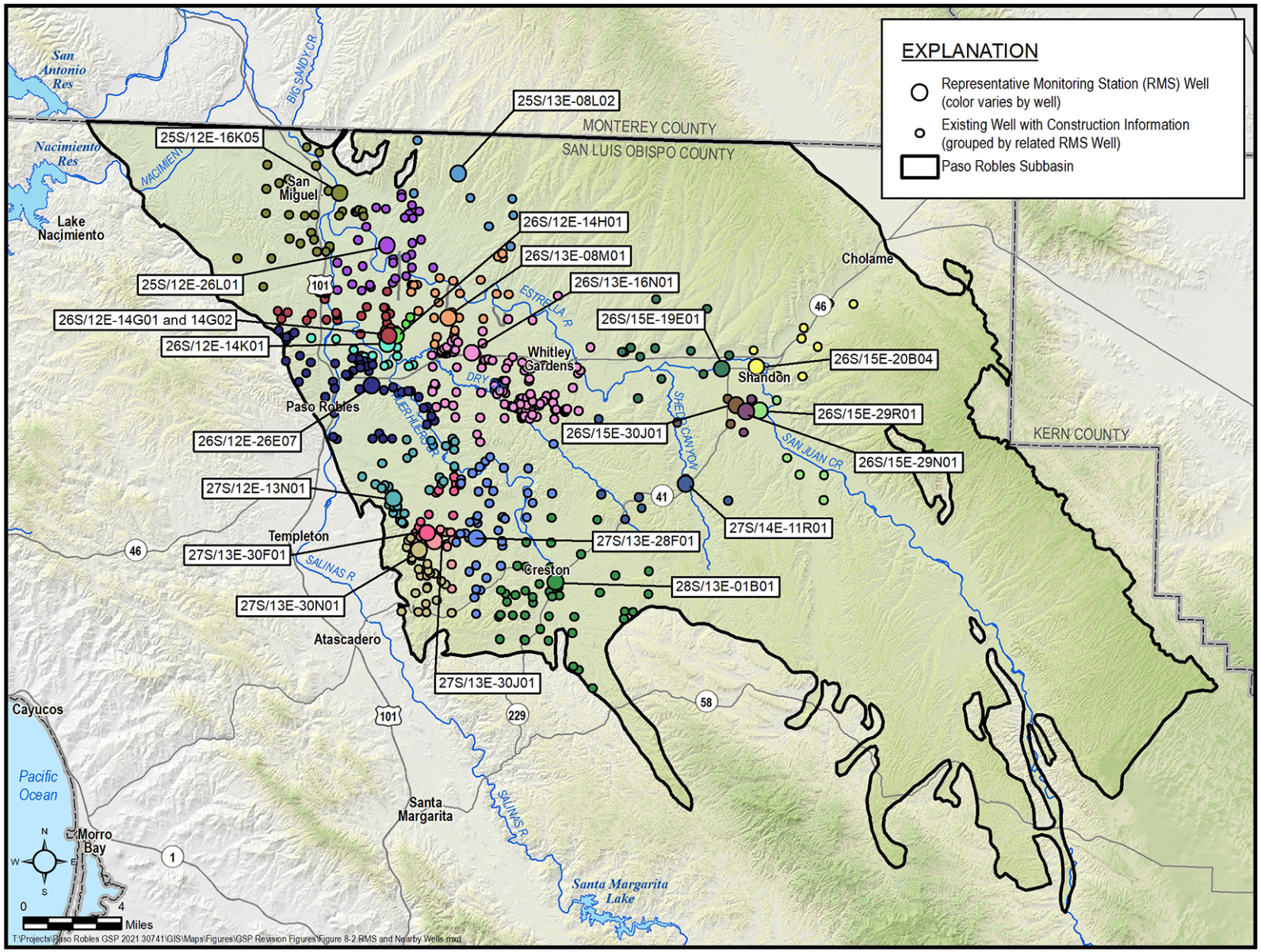

Figure 8-2. Representative Monitoring System (RMS) Wells and Existing Wells with Construction Information

Well locations and total depth information for existing wells in the Subbasin have been collected from three sources:

1. Records digitized as part of the Paso Robles Subbasin Data Management System (DMS)

2. Information from model development (GSSI 2016)

3. Records from DWR's Online System of Well Completion Reports (OSWCR, DWR 2021)

A total of 1,593 wells with total depth information was identified within these three datasets: 71 from the DMS, 193 from model development, and 1,329 from OSWCR. While these datasets include significant well location and construction information, they also have limitations. Specifically:

- These datasets are solely records of well construction. None of the three indicate which wells have been replaced or destroyed, which still exist, or which are actively used for water supply.

- None of these records include information on pumping equipment, so assessment of the effects of water level changes on pumping costs is not possible.

- Very few of these records include complete screen interval information, and total well depth is the most commonly available information relating to well construction. Accordingly, assessment of water levels in comparison to saturated screen length is not possible, but comparison to total well depth is.

- The wells in these datasets represent a long history of well construction and groundwater conditions in the Subbasin. Older wells were typically shallower, corresponding to higher water levels and the drilling technology and practices at the time. Older wells have not been removed from these datasets, even though old shallow wells are likely no longer viable.

- While OSWCR includes the most wells by far, accurate locations for most of the wells in the OSWCR dataset are unknown. Only 4.5 percent of the OSWCR sourced wells with total depth information in the Subbasin are located by address. The remaining wells from this data source have been given Public Land Survey System (PLSS) section centers as their location. This location inaccuracy limits how these data can be used:

- Groundwater surface elevation from subbasin-wide contours or numerical model simulations interpolated at the mapped locations will be incorrect because the elevations would be different at the actual well location(s).

- The hydrogeologic conditions and aquifer in which these wells are completed cannot be accurately assessed because the conditions may be different at the actual well location(s).

- Assessment of the impacts of historical or future groundwater conditions on these wells is limited by the inaccurate locations and should be assumed to be representative in the aggregate and not on an individual-well basis.

The data from these three sources were combined into a single geographically-enabled dataset for evaluation in comparison to water levels in the RMS wells. These existing well recorded locations were mapped and the RMS well closest to each existing well record was identified. The existing well records were then grouped according to the nearest RMS well.

For each of the 22 groupings of wells around the RMS wells, the total depth of the wells was then compiled for comparison to depth to groundwater measurement in the respective RMS well. This allows the enumeration of how many wells theoretically would have been unable to sufficiently produce water in historical and future periods.

Table 8-1 presents summary information for the 1,593 existing well records grouped by the nearest RMS well. As shown in Table 8-1, there is variability in the number and depths of existing wells nearest each RMS well. The number of nearby wells ranges from zero for RMS Well 26S/12E-14G02 (PASO-0017) to 310 for RMS Well 26S/13E-16N01 (PASO-0282). The shallowest well in this dataset is only 6 feet deep (nearest to RMS Well 26S/12E-26E07 (PASO-0124), while the deepest is 1,250 feet deep (nearest RMS Well 26S/13E-08M01 (PASO-0164). While there is a great deal of variability in the total depth of existing well records, the important observations from Table 8-1 are that:

1. The average depth of existing well records is over 400 feet, as shown by the weighted average at the bottom of the last column in the table.

2. The depth of the shallowest wells in the Subbasin varies widely with geography, as shown by the wide range of shallowest well total depths. However, the average depth of the shallowest wells in the Subbasin is only 76 feet, as indicated by the weighted average for the column showing the total depth of the shallowest wells.

These two statistics show that while most well records are for relatively deep wells, there have historically been shallow wells located in the Subbasin.

Table 8-1. RMS Wells and Nearby Existing Wells

RMS Well ID (alt ID)	Number of Nearby Wells	Total Depth of Shallowest Nearby Existing Well (feet)	Total Depth of Deepest Nearby Existing Well (feet)	Average Nearby Well Total Depth (feet)
25S/12E-16K05 (PASO-0345)	40	39	800	431
25S/12E-26L01 (PASO-0205)	92	70	890	377
25S/13E-08L02 (PASO-0195)	8	270	1,180	644
26S/12E-14G01 (PASO-0048)	99	30	870	362
26S/12E-14G02 (PASO-0017)	0	---	---	---
26S/12E-14H01 (PASO-0184)	11	100	1,090	585
26S/12E-14K01 (PASO-0238)	53	32	1,075	379
26S/12E-26E07 (PASO-0124)	174	6	1,004	347
26S/13E-08M01 (PASO-0164)	49	97	1,250	623
26S/13E-16N01 (PASO-0282)	310	120	1,220	610
26S/15E-19E01 (PASO-0073)	16	55	1,060	591
26S/15E-20B04 (PASO-0401)	36	39	475	304
26S/15E-29N01 (PASO-0226)	2	400	640	520
26S/15E-29R01 (PASO-0406)	23	210	867	419
26S/15E-30J01 (PASO-0393)	7	290	800	565
27S/12E-13N01 (PASO-0223)	62	92	980	442
27S/13E-28F01 (PASO-0243)	188	55	800	379
27S/13E-30F01 (PASO-0355)	55	104	810	398
27S/13E-30J01 (PASO-0423)	51	65	740	413
27S/13E-30N01 (PASO-0086)	111	100	660	348
27S/14E-11R01 (PASO-0392)	8	500	940	689
28S/13E-01B01 (PASO-0066)	198	62	750	381
Minimum:	**0**	**6**	**475**	**304**
Maximum:	**310**	**500**	**1,250**	**689**
Range:	**310**	**494**	**775**	**385**
Total / Weighted Average:	**1,593**	**76**	**927**	**437**

8.4.5.2 Effect of Paso Robles Formation Aquifer Measurable Objectives

Measurable objectives for groundwater level RMS wells in the Paso Robles Formation Aquifer are summarized in Table 8-22. Initial measurable objectives were set at the approximate 2017 average groundwater levels.

Assessment of the measurable objectives for the Paso Robles Formation Aquifer involved evaluation of the number of existing recorded wells that would have been unable to sufficiently produce water in 2017 when the measurable objective last occurred. The total depths of existing wells (with construction information) near the RMS wells were reviewed to identify which wells would be unable to sufficiently produce water in average 2017 conditions, as represented by the nearest RMS well. The number and percentage of wells near each RMS well that would have been unable to sufficiently produce water are indicated on Table 8-2. As shown, a total of 225 wells within the available well information dataset would have been unable to sufficiently produce water in average 2017 groundwater level conditions, equivalent to 14.1 percent of the wells with construction information. This is more than the 141 wells that were reported to have been unable to sufficiently produce water in the *Household Water Supply Shortage Reporting System* (DWR 2021). This likely reflects three characteristics or limitations of the available information. First, the dataset includes well construction records for very old wells that have either been destroyed or are no longer in use and thus would not be reported to DWR. Second, not all of the existing wells for which construction information is available are household water supply sources, and thus this analysis likely includes wells for other purposes (e.g., irrigation). Finally, not all wells that are unable to sufficiently produce water may have been reported to DWR.

Table 8-2. Chronic Lowering of Groundwater Levels Measurable Objectives for Paso Robles Formation Aquifer

RMS Well ID (alt ID)	Measurable Objective (feet NAVD88)	Number of Nearby Wells Dry at Measurable Objective	Percent of Nearby Wells Dry at Measurable Objective
25S/12E-16K05 (PASO-0345)	521	3	7.5%
25S/12E-26L01 (PASO-0205)	490	35	38.0%
25S/13E-08L02 (PASO-0195)	916	0	0.0%
26S/12E-14G01 (PASO-0048)	495	32	32.3%
26S/12E-14G02 (PASO-0017)	498	0	---
26S/12E-14H01 (PASO-0184)	505	2	18.2%
26S/12E-14K01 (PASO-0238)	483	17	32.1%
26S/12E-26E07 (PASO-0124)	648	38	21.8%
26S/13E-08M01 (PASO-0164)	613	4	8.2%
26S/13E-16N01 (PASO-0282)	588	4	1.3%
26S/15E-19E01 (PASO-0073)	929	1	6.3%
26S/15E-20B04 (PASO-0401)	967	1	2.8%
26S/15E-29N01 (PASO-0226)	993	0	0.0%
26S/15E-29R01 (PASO-0406)	986	0	0.0%
26S/15E-30J01 (PASO-0393)	959	0	0.0%
27S/12E-13N01 (PASO-0223)	716	10	16.1%
27S/13E-28F01 (PASO-0243)	894	19	10.1%
27S/13E-30F01 (PASO-0355)	766	16	29.1%
27S/13E-30J01 (PASO-0423)	806	12	23.5%
27S/13E-30N01 (PASO-0086)	810	31	27.9%
27S/14E-11R01 (PASO-0392)	1,028	0	0.0%
28S/13E-01B01 (PASO-0066)	1,040	0	0.0%
	Total:	225	14.1%

8.4.5.3 Effect of Paso Robles Formation Aquifer Minimum Thresholds

Minimum thresholds for groundwater level RMS wells in the Paso Robles Formation Aquifer are summarized on Table 8-33. Hydrographs for RMS wells with minimum thresholds are included in Appendix H. These minimum thresholds were selected to avoid the locally defined significant and unreasonable conditions.

As with the measurable objectives, the number of existing wells that would be unable to sufficiently produce water at the minimum threshold was assessed. In this case, the assessment only included well records that would not have gone dry at the measurable objective. It is assumed that wells that would have been unable to sufficiently produce water in average 2017 groundwater conditions were either no longer active or were replaced with a deeper well or alternative water supply source. The number and percentage of additional wells near each RMS well that would be unable to sufficiently produce water at the minimum threshold are indicated

on Table 8-3. A total of 62 additional wells, or 3.9 percent within the available well information dataset, would be unable to sufficiently produce water at the minimum threshold. This is less than the number of wells that were reported to have been unable to sufficiently produce water in the Household Water Supply Shortage Reporting System. The Household Water Supply Shortage Reporting System indicates that at least 95 wells, or 6 percent of wells, have been unable to sufficiently produce water since 2017. Some of these well issues have been resolved by lowering the pump or deepening the well. The number of wells unable to sufficiently produce water is expected to increase due to continued declining groundwater levels. Furthermore, current groundwater levels are above the minimum threshold except for one well, which will be the subject of further investigation. Therefore, the available data indicate that the minimum thresholds are protective of undesirable results as they relate to shallow domestic wells, defined as 10 percent of wells unable to sufficiently produce water after 2017.

Table 8-3: Chronic Lowering of Groundwater Levels Minimum Thresholds for Paso Robles Formation Aquifer

RMS Well ID (alt ID)	Minimum Threshold (feet NAVD88)	Number of Nearby Wells Dry at Minimum Threshold Not Dry at Measurable Objective	Percent of Nearby Wells Dry at Minimum Threshold Not Dry at Measurable Objective
25S/12E-16K05 (PASO-0345)	491	2	5.0%
25S/12E-26L01 (PASO-0205)	460	7	7.6%
25S/13E-08L02 (PASO-0195)	886	0	0.0%
26S/12E-14G01 (PASO-0048)	465	11	11.1%
26S/12E-14G02 (PASO-0017)	468	0	---
26S/12E-14H01 (PASO-0184)	475	0	0.0%
26S/12E-14K01 (PASO-0238)	453	3	5.7%
26S/12E-26E07 (PASO-0124)	618	4	2.3%
26S/13E-08M01 (PASO-0164)	583	0	0.0%
26S/13E-16N01 (PASO-0282)	558	1	0.3%
26S/15E-19E01 (PASO-0073)	899	0	0.0%
26S/15E-20B04 (PASO-0401)	937	0	0.0%
26S/15E-29N01 (PASO-0226)	963	0	0.0%
26S/15E-29R01 (PASO-0406)	956	0	0.0%
26S/15E-30J01 (PASO-0393)	929	0	0.0%
27S/12E-13N01 (PASO-0223)	686	3	4.8%
27S/13E-28F01 (PASO-0243)	864	4	2.1%
27S/13E-30F01 (PASO-0355)	736	4	7.3%
27S/13E-30J01 (PASO-0423)	776	4	7.8%
27S/13E-30N01 (PASO-0086)	780	15	13.5%
27S/14E-11R01 (PASO-0392)	998	0	0.0%
28S/13E-01B01 (PASO-0066)	1,010	4	2.0%
	Total:	62	3.9%

8.4.5.4 Minimum Thresholds Impact on Domestic Wells

The potential impacts of the minimum thresholds on domestic wells are included in the assessment presented above, while acknowledging that the available well information datasets do not necessarily differentiate which wells are domestic. The analysis indicates that no more than 3.9 percent of all wells in the Subbasin are susceptible to being unable to sufficiently produce water in the event that the minimum threshold is reached in all RMS wells simultaneously. However, the Household Water Supply Shortage Reporting System indicates that at least 95 wells, or 6 percent of wells, have been unable to sufficiently produce water since 2017. The methodologies used for the analysis, and methodologies used for forecasting occurrences of wells unable to sufficiently produce water, will be further refined during GSP implementation. As not all wells used in the analysis are for domestic supply, this indicates that a smaller number of domestic wells are susceptible to being unable to sufficiently produce water at the minimum threshold.

8.4.5.5 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

Section 354.28 of the SGMA regulations requires that the description of all minimum thresholds include a discussion about the relationship between the minimum thresholds for each sustainability indicator. In the SMC BMP (DWR, 2017), DWR has clarified this requirement. First, the GSP must describe the relationship between each sustainability indicator's minimum threshold; in other words, describe why or how a water level minimum threshold set at a particular RMS is similar to or different to water level thresholds in nearby RMS. Second, the GSP must describe the relationship between the selected minimum threshold and minimum thresholds for other sustainability indicators; in other words, describe how a water level minimum threshold would not trigger an undesirable result for land subsidence, for example.

Groundwater elevation minimum thresholds are derived from the measurable objectives, which are average 2017 groundwater elevations. Because the measurable objectives represent a historical and realistic groundwater elevation map, the minimum thresholds derived from these objectives (i.e., 30 feet lower) likely do not conflict with each other.

Groundwater elevation minimum thresholds can influence other sustainability indicators.

- **Change in groundwater storage**. Changes in groundwater elevations reflect changes in the amount of groundwater in storage. Pumping at or less than the sustainable yield will maintain or raise average groundwater elevations in the Subbasin. The groundwater elevation minimum thresholds are set to maintain a constant elevation over an extended period of time, consistent with the practice of pumping at or less than the sustainable yield. Therefore, the groundwater elevation minimum thresholds will not result in long term significant or unreasonable change in groundwater storage.

- **Seawater intrusion**. This sustainability indicator is not applicable to this Subbasin.
- **Degraded water quality**. Protecting groundwater quality is critically important to all who depend upon the groundwater resource, particularly for drinking water and agricultural uses. Maintaining groundwater levels protects against degradation of water quality or exceeding regulatory limits for constituents of concern in supply wells due to actions proposed in the GSP. Water quality could be affected through two processes:
    1. Low groundwater elevations in an area could cause deeper, poor-quality groundwater to flow upward into existing supply wells. Groundwater elevation minimum thresholds are set below current levels, meaning upward flow of deep, poor-quality groundwater could occur in the future. Should groundwater quality degrade due to lower groundwater elevations, the groundwater elevation minimum thresholds will be raised to avoid this degradation.
    2. Changes in groundwater elevation due to actions implemented to achieve sustainability could change groundwater gradients, which could cause poor quality groundwater to flow towards supply wells that would not have otherwise been impacted. These groundwater gradients, however, are only dependent on differences between groundwater elevations, not on the groundwater elevations themselves. Therefore, the minimum threshold groundwater elevations do not directly lead to a significant and unreasonable degradation of groundwater quality in production wells.
- **Subsidence**. A significant and unreasonable condition for subsidence is permanent pumping induced subsidence that substantially interferes with surface land use. Subsidence is caused by dewatering and compaction of clay-rich sediments in response to lowering groundwater levels. Very small amounts of land surface elevation fluctuations have been reported across the Basin. The groundwater elevation minimum thresholds are set below existing groundwater elevations, which could induce additional subsidence that has not already started. Should new subsidence be observed due to lower groundwater elevations, the groundwater elevation minimum thresholds will be raised to avoid this subsidence.
- **Depletion of interconnected surface water**. The set of monitoring wells used to evaluate interconnected surface water includes some overlap with the set of RMS wells used for the groundwater level minimum threshold. Depending on the local relationship between Alluvial Aquifer water levels and Paso Robles Formation Aquifer water levels, the minimum threshold for interconnected surface water could be more constraining than the minimum threshold for groundwater elevations. The interconnected surface water minimum threshold (no more than 10 feet below the spring 2017 water level) is higher than the groundwater elevation minimum threshold (30 feet below the average 2017 water level), but the former applies only to Alluvial Aquifer wells. At locations along stream segments with riparian vegetation where the difference between Alluvial Aquifer

and Paso Robles Formation Aquifer water levels is less than 20 feet, the interconnected surface water minimum threshold would likely constrain water levels. The only locations where existing data indicates a potential connection between the surface water system and the underlying Paso Robles Formation Aquifer include the middle reach of the Estrella River (from Shedd Canyon to Martingale Circle) and along San Juan Creek upstream of Spring Creek. At these locations the connection between surface waters and the underlying Paso Robles Formation Aquifer is unknown but sufficient evidence exists that there could potentially be a connection, and therefore further investigation in these areas is recommended.

8.4.5.6 Effect of Minimum Thresholds on Neighboring Basins

One neighboring groundwater basin is required to develop a GSP: the Upper Valley Subbasin of the Salinas Valley Basin. Additionally, the adjoining Atascadero Subbasin is currently developing a GSP under SGMA. The anticipated effect of the groundwater elevation minimum thresholds on each of the two subbasins is addressed below.

Upper Valley Subbasin of the Salinas Valley Basin. The Upper Valley Subbasin is required to develop a GSP by 2022. The Upper Valley Subbasin is hydrogeologically downgradient of the Paso Robles Subbasin: groundwater generally flows from the Paso Robles Subbasin into the Upper Valley Subbasin. Lower groundwater levels in the Paso Robles Subbasin as a result of GSP actions could reduce the amount of groundwater flowing into the Upper Valley Subbasin, affecting that Subbasin's ability to achieve sustainability. The groundwater elevation minimum thresholds are set at constant levels that are below current elevations; therefore, they could reduce groundwater flow into the adjacent Upper Valley Subbasin. If reduced groundwater flow is observed that impacts sustainability in the Upper Valley Subbasin of the Salinas Valley Basin, then minimum thresholds would be adjusted to avoid this impact.

The Paso Robles Subbasin GSAs have developed a cooperative working relationship with the Salinas Valley Basin GSA who will be developing the GSP for the Upper Valley Subbasin. The two GSAs will monitor and work together to ensure that minimum thresholds do not significantly affect each Subbasin's ability to achieve sustainability.

Atascadero Subbasin. The Paso Robles Subbasin is hydrogeologically separated from the Atascadero Subbasin by the Rinconada Fault. The fault acts as a barrier to groundwater flow in the Paso Robles Formation Aquifer as presented in Chapter 4. While minimum thresholds are set at levels below current groundwater levels, these lower levels are not expected to impact sustainability in the Atascadero Subbasin due to the limited groundwater flow between the two Subbasins. The Paso Robles Subbasin GSAs have a cooperative working relationship with the Agencies managing the Atascadero Subbasin and will continue to work together to ensure that minimum thresholds do not significantly affect each Subbasin's ability to achieve sustainability.

8.4.5.7 Effects on Beneficial Users and Land Uses

The groundwater elevation minimum thresholds may have several effects on beneficial users and land uses in the Subbasin.

Agricultural land uses and users. The groundwater elevation minimum thresholds limit lowering of groundwater levels in the Subbasin. In the absence of other mitigating measures this has the effect of potentially limiting the amount of groundwater pumping in the Subbasin. Limiting the amount of groundwater pumping will limit the amount and type of crops that can be grown in the Subbasin, which could result in a proportional reduction in the economic viability of some properties. The groundwater elevation minimum thresholds could therefore limit expansion of the Subbasin's agricultural economy. This could have various effects on beneficial users and land uses:

- There will be an economic impact to employees and suppliers of production products and materials. Many parts of the local economy rely on a vibrant agricultural industry, and they too will be hurt proportional to the losses imparted to agricultural businesses.
- Growth of city, county and state tax rolls could be slowed or reduced due to the limitations imposed on agricultural growth.

Urban land uses and users. The groundwater elevation minimum thresholds effectively limit the amount of groundwater pumping in the Subbasin. This may limit urban growth or result in urban areas obtaining alternative sources of water. This may result in higher water costs for municipal water users.

Domestic land uses and users. The groundwater elevation minimum thresholds protect most domestic wells. Therefore, the minimum thresholds will likely have an overall beneficial effect on existing domestic land uses by protecting the ability to pump from domestic wells. However, limited water in some of the shallowest domestic wells may require owners to drill deeper wells. Additionally, the groundwater elevation minimum thresholds may limit the increase of non-*de minimis* groundwater use in order to limit future declines in groundwater levels caused by more non *de minimis* domestic pumping. Policies allowing offsets of existing use to allow new construction or bringing in new sources of water can mitigate against this effect.

Ecological land uses and users. Historical reductions in the extent and density of riparian vegetation in certain stretches of rivers and creeks may have been associated with declines in groundwater levels. The additional 30 feet of water-level decline allowed by the water-level minimum threshold could cause further reduction in riparian vegetation in areas where the Alluvial Aquifer is in contact with the Paso Robles Formation Aquifer. Groundwater elevation minimum thresholds effectively protect the groundwater resource including those existing ecological habitats that rely upon it because they are set to avoid long term declines in

groundwater levels in a short amount of time. The sustainability criteria for interconnected surface water (see Section 8.8) include minimum thresholds defined as groundwater levels that are in some locations higher than the groundwater elevation minimum thresholds.

8.4.5.8 Relevant Federal, State, or Local Standards

No Federal, State, or local standards exist for chronic lowering of groundwater elevations.

8.4.5.9 Method for Quantitative Measurement of Minimum Thresholds

Groundwater elevation minimum thresholds will be directly measured from existing or new monitoring wells. The groundwater level monitoring will be conducted in accordance with the monitoring plan outlined in Chapter 7. Furthermore, the groundwater level monitoring will meet the requirements of the technical and reporting standards included in the SGMA regulations.

As noted in Chapter 7, the current groundwater monitoring network in the Paso Robles Formation Aquifer currently only includes 24 wells. For the Alluvial Aquifer, only one RMS was established. The GSAs will expand the monitoring network in both aquifers during GSP implementation.

8.4.5.10 Interim Milestones

Initial interim milestones were developed for the 24 RMS established for the Paso Robles Formation Aquifer based on the results of modeling conducted to evaluate management actions and select measurable objectives (Chapter 9). Because measurable objectives have not been established at RMS for the Alluvial Aquifer, interim milestones cannot be developed. Interim milestones will be developed in the future (after GSP adoption) when the RMS network is expanded in the Alluvial Aquifer.

Conceptually, the following actions and groundwater conditions are expected to occur during implementation.

- Monitoring of Subbasin conditions using an expanded monitoring network and continuous monitoring devices will provide additional information to refine interim milestones

- Pumping cutbacks in some areas of the Subbasin will begin about five years after adoption of the GSP. During this five-year period, current groundwater levels trends would continue to be tracked by the RMS.

- After about 5 years, groundwater levels will begin trending toward measurable objectives as a result of management actions and possibly pumping cutbacks in some area of the Subbasin.

Error! Reference source not found. summarizes the interim milestones for the RMS in the Paso Robles Formation Aquifer.

Table 8-4: Chronic Lowering of Groundwater Levels Interim Milestones for Paso Robles Formation Aquifer

Well ID (alt ID)	Interim Milestones (feet NAVD88)		
	2025	2030	2035
25S/12E-16K05 (PASO-0345)	521	521	520
25S/12E-26L01 (PASO-0205)	499	496	492
25S/13E-08L02 (PASO-0195)	911	905	901
26S/12E-14G01 (PASO-0048)	526	532	534
26S/12E-14G02 (PASO-0017)	523	531	533
26S/12E-14H01 (PASO-0184)	513	521	524
26S/12E-14K01 (PASO-0238)	527	533	535
26S/12E-26E07 (PASO-0124)	644	644	645
26S/13E-08M01 (PASO-0164)	620	619	617
26S/13E-16N01 (PASO-0282)	595	594	593
26S/15E-19E01 (PASO-0073)	935	937	938
26S/15E-20B04 (PASO-0401)	972	976	978
26S/15E-29N01 (PASO-0226)	1,009	1,012	1,014
26S/15E-29R01 (PASO-0406)	997	1,001	1,003
26S/15E-30J01 (PASO-0393)	972	976	978
27S/12E-13N01 (PASO-0223)	711	710	709
27S/13E-28F01 (PASO-0243)	896	899	900
27S/13E-30F01 (PASO-0355)	770	768	765
27S/13E-30J01 (PASO-0423)	817	815	812
27S/13E-30N01 (PASO-0086)	804	799	794
27S/14E-11R01 (PASO-0392)	1,029	1,030	1,030
28S/13E-01B01 (PASO-0066)	1,052	1,055	1,055

Interim milestones may be revised during implementation as new data and understanding of the hydrogeologic conditions in the Subbasin become available.

8.4.6 Undesirable Results

8.4.6.1 Criteria for Defining Undesirable Results

The chronic lowering of groundwater elevation undesirable result is a quantitative combination of groundwater elevation minimum threshold exceedances. For chronic lowering of groundwater elevations, an exceedance is defined by the annual average (e.g., spring and fall) water level

below the well's defined minimum threshold. For the Paso Robles Subbasin, the groundwater elevation undesirable result is:

Over the course of two years, no more than two exceedances for the groundwater elevation minimum thresholds within a 5-mile radius or within a defined area of the Basin for any single aquifer. A single monitoring well in exceedance for two consecutive years also represents an undesirable result for the area of the Basin represented by the monitoring well. Geographically isolated exceedances will require investigation to determine if local or Basin wide actions are required in response.

This compound definition of undesirable results provides flexibility in defining sustainability. Increasing the number of allowed minimum threshold exceedances provides more flexibility but may lead to significant and unreasonable conditions for a number of beneficial users. Reducing the number of allowed minimum threshold exceedances ensures strict adherence to minimum thresholds but reduces flexibility due to unanticipated hydrogeologic conditions. The undesirable result was set to balance the interests of beneficial users with the practical aspects of groundwater management under uncertainty.

Use of this definition of undesirable results in combination with the minimum threshold for groundwater elevation will avoid the significant and unreasonable conditions discussed above. Specifically, it will be impossible to cause a significant percentage of the wells in the Subbasin to be unable to sufficiently produce water because the undesirable result includes geographic and temporal components that prevent the entire Subbasin from reaching the minimum thresholds in the RMS wells simultaneously.

As the monitoring system is expanded, the number of exceedances allowed may be adjusted. One additional exceedance will be allowed for approximately every seven new monitoring wells. This was considered a reasonable number of exceedances given the hydrogeologic uncertainty of the Subbasin. Close monitoring of groundwater data over the following years will allow actual numbers to be refined based on observable data. Management of the Subbasin will adapt to specific conditions and to a growing understanding of basin conditions and processes to adopt appropriate responses. When additional data and a better understanding of hydrogeologic conditions are available in the future, the GSAs may adjust measurable objectives and minimum thresholds and adaptively manage sustainability actions to avoid undesirable results.

8.4.6.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result include the following:

- Localized pumping clusters. Even if regional pumping is maintained within the sustainable yield, clusters of high-capacity wells may cause excessive localized drawdowns that lead to undesirable results in specific areas.

- Expansion of *de-minimis* pumping. Individual *de-minimis* pumpers, individually, do not have a significant impact on Subbasin-wide groundwater elevations. However, many *de-minimis* pumpers are often clustered in specific residential areas. Pumping by these *de-minimis* users is not currently regulated under this GSP. Adding additional domestic *de-minimis* pumpers in specific areas may result in excessive localized drawdowns and undesirable results.
- Extensive drought and climate change. Minimum thresholds were established based on historical groundwater elevations and reasonable estimates of future groundwater elevations. Extensive droughts may lead to excessively low groundwater elevations and undesirable results.

8.4.6.3 Effects on Beneficial Users and Land Uses

The primary detrimental effect on beneficial users from allowing multiple exceedances occurs if more than one exceedance occurs in a small geographic area. Exceedances of the minimum thresholds for groundwater elevation are reasonable as long as the exceedances are spread out across the Subbasin. If the exceedances are clustered in a small area, it will indicate that significant and unreasonable effects are being born by a localized group of landowners.