

Spadra Basin Groundwater Sustainability Plan

Technical Memorandum 3 Sustainable Management Criteria (TM 3)

Groundwater Sustainability Plan
Advisory Committee Meeting

August 3, 2020



Phase I - Develop Hydrogeologic Conceptual Model and Groundwater Model for the Spadra Basin

Jun 2019 - Jun 2020

Construct New Monitoring Well



Phase II - Develop Sustainable Management Criteria for the Spadra Basin

Jun - Aug, 2020

Phase III - Evaluate the Sustainability of Future Baseline Conditions

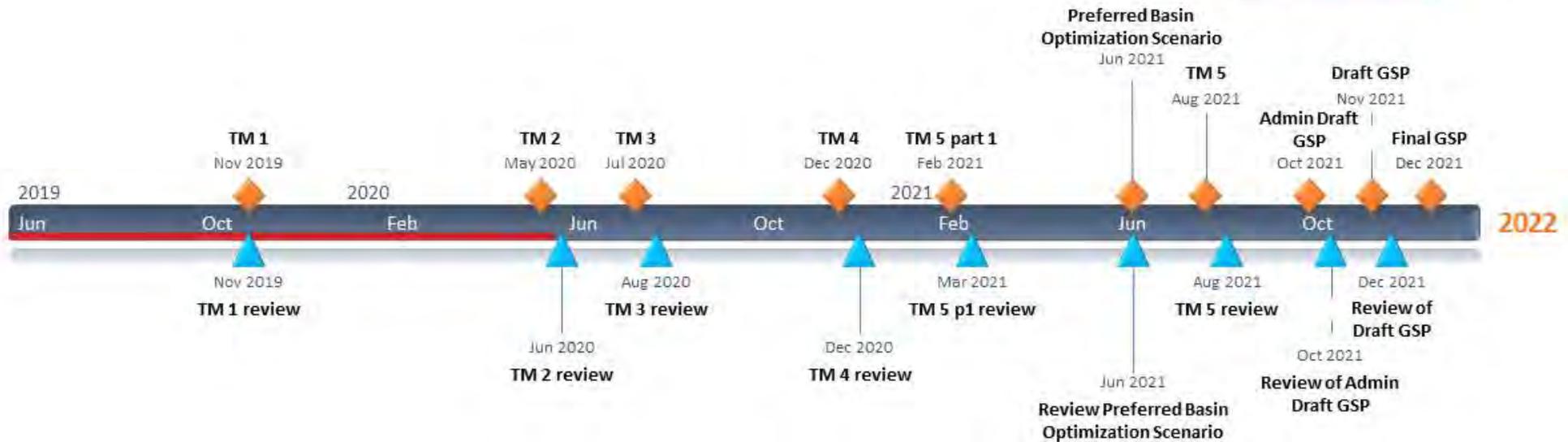
Jun - Dec, 2020

Phase IV - Evaluate Basin Optimization Scenarios to Achieve Sustainability

Dec 2020 - Aug 2021

Phase V - Develop Groundwater Sustainability Plan (GSP)

Aug - Dec, 2021



Groundwater Sustainability Plan – Sustainable Management Criteria

TM 3 describes: The Sustainable Management Criteria of the Spadra Basin pursuant to the DWR’s GSP Regulations for the “Sustainable Management Criteria” section of the GSP ([California Code of Regulations, Title 23, Division 2, Chapter 1.5, Subchapter 2, Article 5, Subarticle 3](#))

GSP Contents:

Executive Summary

Section 1: Introduction, GSA Description, Purpose, Sustainability Goal

Section 2: Plan Area and Basin Setting (TM 1 and TM 2)

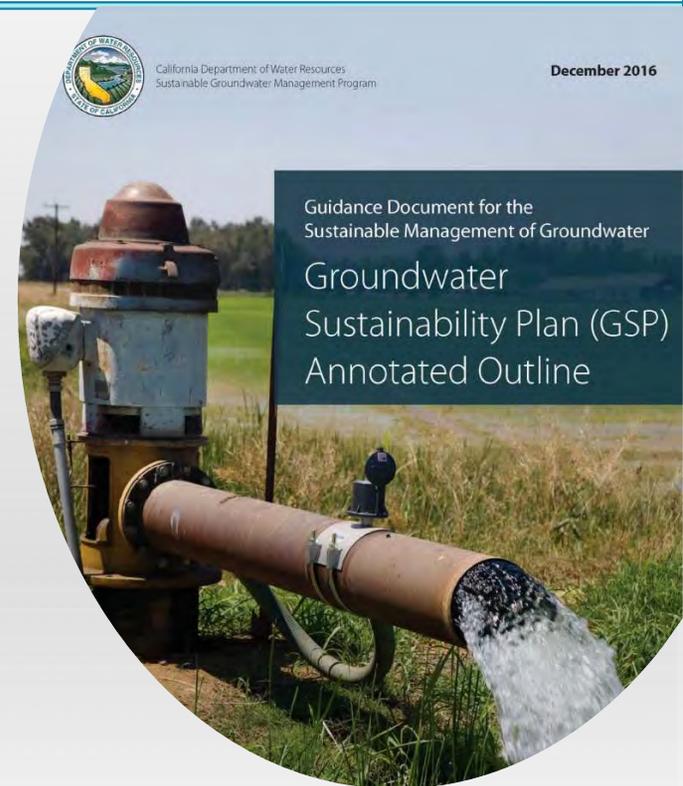
Section 3: Sustainable Management Criteria (TM 3)

Section 4: Projects and Management Actions (TM 4 and TM 5)

Section 5: Plan Implementation

Section 6: References

Appendix A: Comments and Responses-to-Comments for Final GSP



SGMA Definitions of Sustainable Management Criteria

The SGMA defines sustainable groundwater management as the management and utilization of groundwater in a manner that can be maintained over a 50-year planning horizon without causing “Undesirable Results.” The avoidance of Undesirable Results is key to the success of a GSP.

To achieve and demonstrate sustainable groundwater management, the GSP Regulations require establishing “Sustainable Management Criteria” for the groundwater basin. These criteria include:

- **Sustainability Goal**
- **Undesirable Results**
- **Minimum Thresholds**
- **Measurable Objectives**



SGMA Definitions of Sustainable Management Criteria

A Sustainability Goal. The "Sustainability Goal" is the characterization of the sustainable conditions for the basin, and the specific implementation measures that the GSA will implement to ensure the basin is operated within its Sustainable Yield by 2040.

“Sustainable Yield” is the maximum annual quantity of groundwater, calculated over a base period representative of long-term conditions in the basin, that can be withdrawn without causing an Undesirable Result.



SGMA Definitions of Sustainable Management Criteria

Undesirable Results. An Undesirable Result is one or more of the following adverse effects caused by groundwater conditions occurring throughout the basin:

- **Chronic lowering of groundwater levels** indicating a significant and unreasonable depletion of supply if continued over the planning horizon.
- Significant and unreasonable **reduction of groundwater storage.**
- Significant and unreasonable **seawater intrusion.**
- Significant and unreasonable **degraded water quality**, including the migration of contaminant plumes that impair water supplies.
- Significant and unreasonable **land subsidence** that substantially interferes with land uses.
- Depletions of **interconnected surface water** that have significant and unreasonable adverse impacts on beneficial uses of the surface water.



SGMA Definitions of Sustainable Management Criteria

Since avoidance of **Undesirable Results** is a key indicator of sustainable groundwater management, the DWR define each of the below as a “Sustainability Indicator”

- **Chronic lowering of groundwater levels**
- **Reduction of groundwater storage**
- **Seawater intrusion**
- **Degraded water quality**
- **Land subsidence**
- **Interconnected surface water**

When these
"Sustainability
Indicators" become

"Significant or
Unreasonable"

"Undesirable Result"



SGMA Definitions of Sustainable Management Criteria

Minimum Thresholds. A quantitative value that represents the groundwater conditions at a representative monitoring site that, when exceeded individually or in combination with Minimum Thresholds at other monitoring sites, may cause an Undesirable Result in the basin.

GSAAs are required to define Minimum Thresholds at representative monitoring sites for each applicable Sustainability Indicator after considering the interests of beneficial uses and users of groundwater, land uses, and property interests in the basin.

Minimum Thresholds should be set at levels that do not impede the ability to meet Minimum Thresholds or Sustainability Goals defined for adjacent basins.



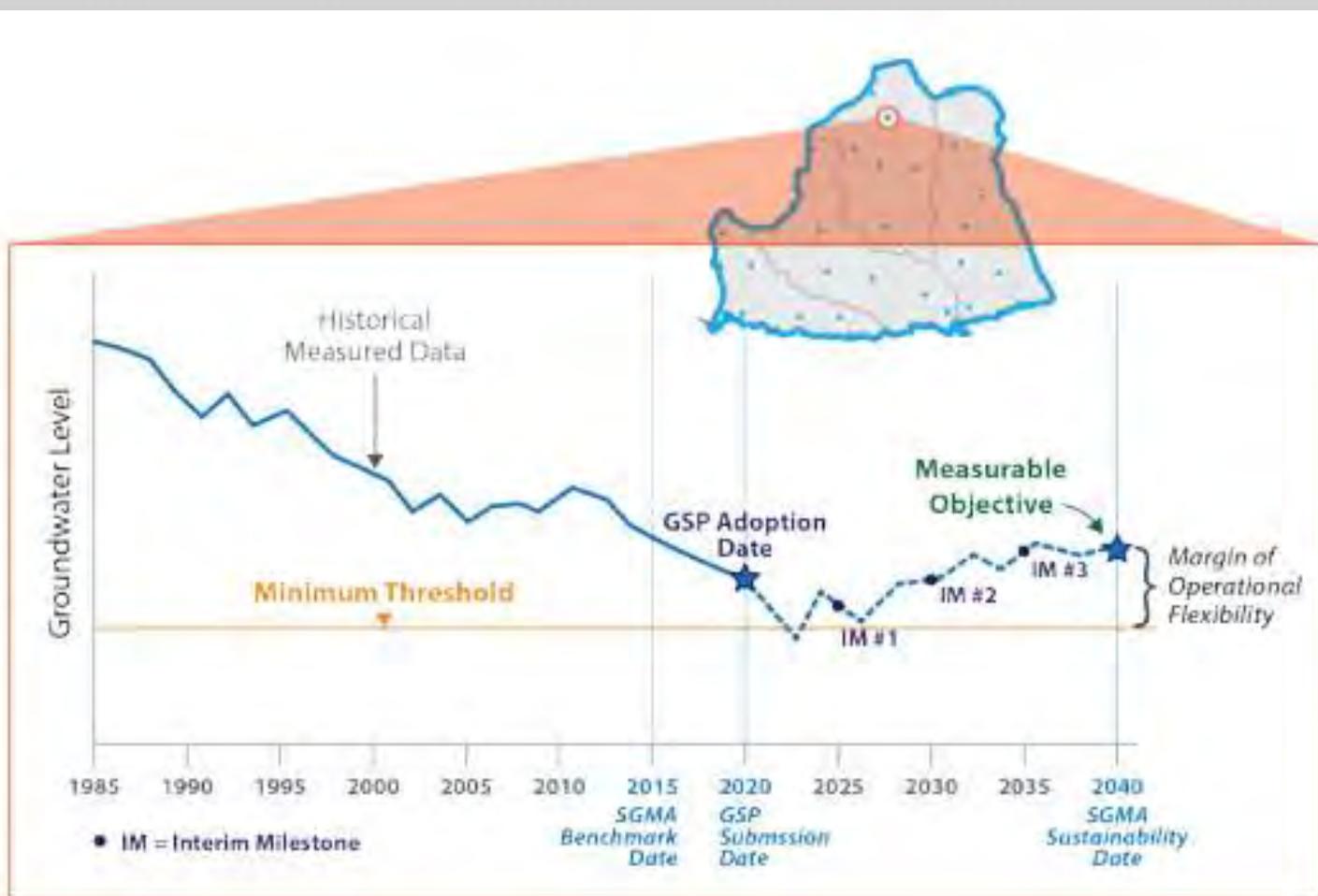
SGMA Definitions of Sustainable Management Criteria

Measurable Objectives. Specific quantitative goals for the maintenance or improvement of specified groundwater conditions to achieve and maintain sustainable groundwater management.

Measurable Objectives are defined for each Sustainability Indicator at the same representative monitoring sites and using the same metrics as Minimum Thresholds.



SGMA Definitions of Sustainable Management Criteria



(DWR, 2017)

Measurable Objectives:

- Should be set such that there is a reasonable margin of operational flexibility between the Minimum Threshold and Measurable Objective that will accommodate droughts, climate change, conjunctive use operations, or other groundwater management activities.

- Bounding condition of an operating band of sustainable groundwater conditions.



Sustainable Management Criteria of **Undesirable Results, Minimum Thresholds,** and **Measurable Objectives** are described for each Sustainability Indicator:

- 1) Chronic lowering of groundwater levels
- 2) Reduction of groundwater storage
- 3) Degraded water quality
- 4) Land Subsidence

- ~~5) Seawater intrusion~~
- ~~6) Surface water depletion~~

Undesirable Results

- Causes
- Primary effect that constitutes an Undesirable Result in the basin



Minimum Thresholds – threshold that when exceeded will cause the Undesirable Result

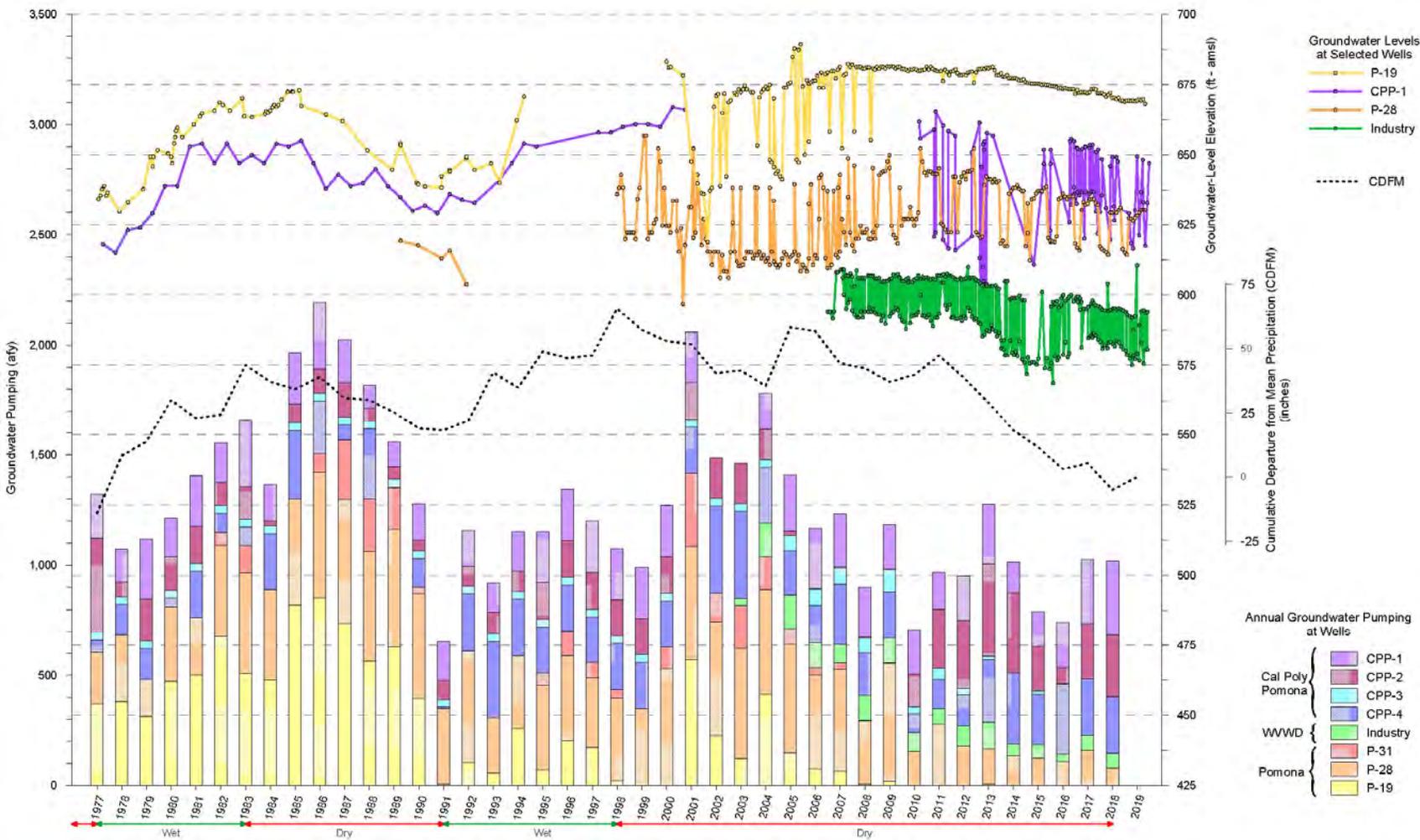
Measurable Objectives - bounding condition of the operating band for sustainable management.



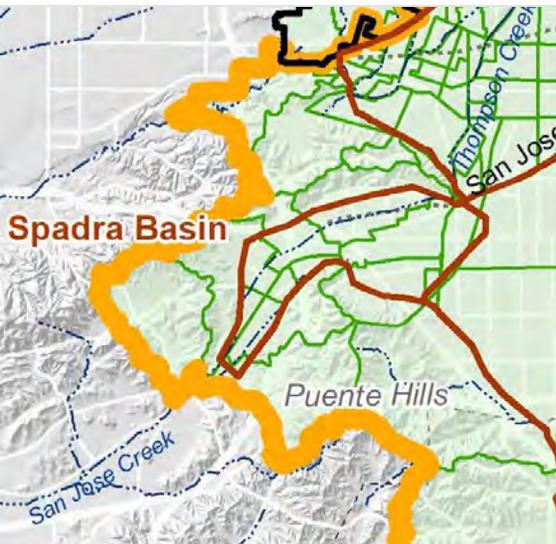
Sustainable Management Criteria



Chronic Lowering of Groundwater Levels



- An important indicator of sustainability → Can be used as a “proxy” for other indicators
- Levels have fluctuated over a range of elevation
- All wells seem to respond to the same stresses of pumping and recharge
- Pumping ranged from 700 - 2,200 afy and averaged 1,280 afy



Causes of Undesirable Results

Chronic lowering of groundwater levels could occur from: (i) over pumping; (ii) a prolonged dry period; (iii) reductions in water applied to overlying outdoor land uses; and/or (iv) declining groundwater levels in the adjacent groundwater basins.

**Table 2-2
Water Budget for the Spadra Basin -- Fiscal Year 1978-2018**

Fiscal Year	Recharge			Discharge			Change in Storage (Recharge - Discharge)		Annual Developed Yield	
	DIPAW ¹	Subsurface Inflow from San Jose and Puente Hills	Total Recharge	Pumping	Outflow to Puente Basin	Outflow to Chino Basin	Total Discharge	Annual		Cumulative
				<i>a</i>				<i>b</i>		
1978	2,961	1,504	4,465	1,402	1,336	950	3,689	777	777	2,179
1979	3,076	1,527	4,604	937	1,769	446	3,151	1,452	2,229	2,389
1980	3,161	1,636	4,797	1,188	1,819	293	3,300	1,497	3,726	2,685
1981	3,114	1,665	4,779	1,544	1,786	384	3,714	1,066	4,792	2,610
1982	3,107	1,657	4,764	1,344	1,871	434	3,649	1,115	5,907	2,460
1983	3,430	1,621	5,051	1,752	2,019	482	4,253	798	6,706	2,550
1984	3,353	1,545	4,898	1,189	2,000	529	3,718	1,179	7,885	2,369
1985	2,984	1,367	4,351	1,805	1,899	648	4,352	0	7,884	1,804

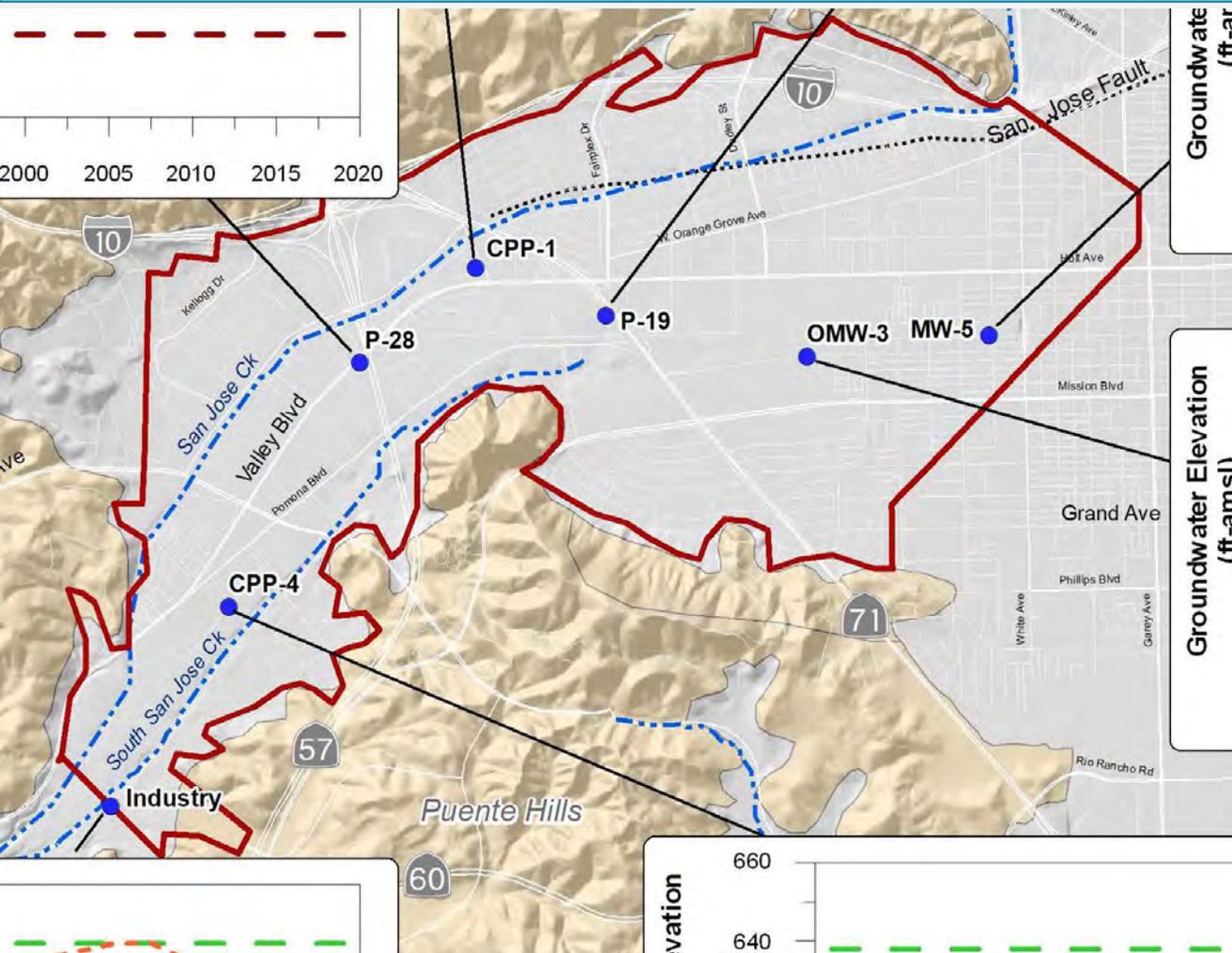
Chronic Lowering of Groundwater Levels

Undesirable Result: If groundwater levels decline to an elevation such that the **well owners could no longer pump their wells at the desired rates**, this would represent a significant and unreasonable depletion of water supply and is an Undesirable Result.

Minimum Threshold - defined as the elevation below which an Undesirable Result will occur at a representative monitoring site.

- ✓ Initial Minimum Thresholds are set as the lowest historical elevations
- ✓ No known history of well owners reporting or describing adverse impacts
- ✓ Reasonable to assume that the range of groundwater levels over the historical period are protective against an Undesirable Result

Chronic Lowering of Groundwater Levels – Representative Monitoring Sites



● Wells with Sustainable Management Criteria for Groundwater Levels

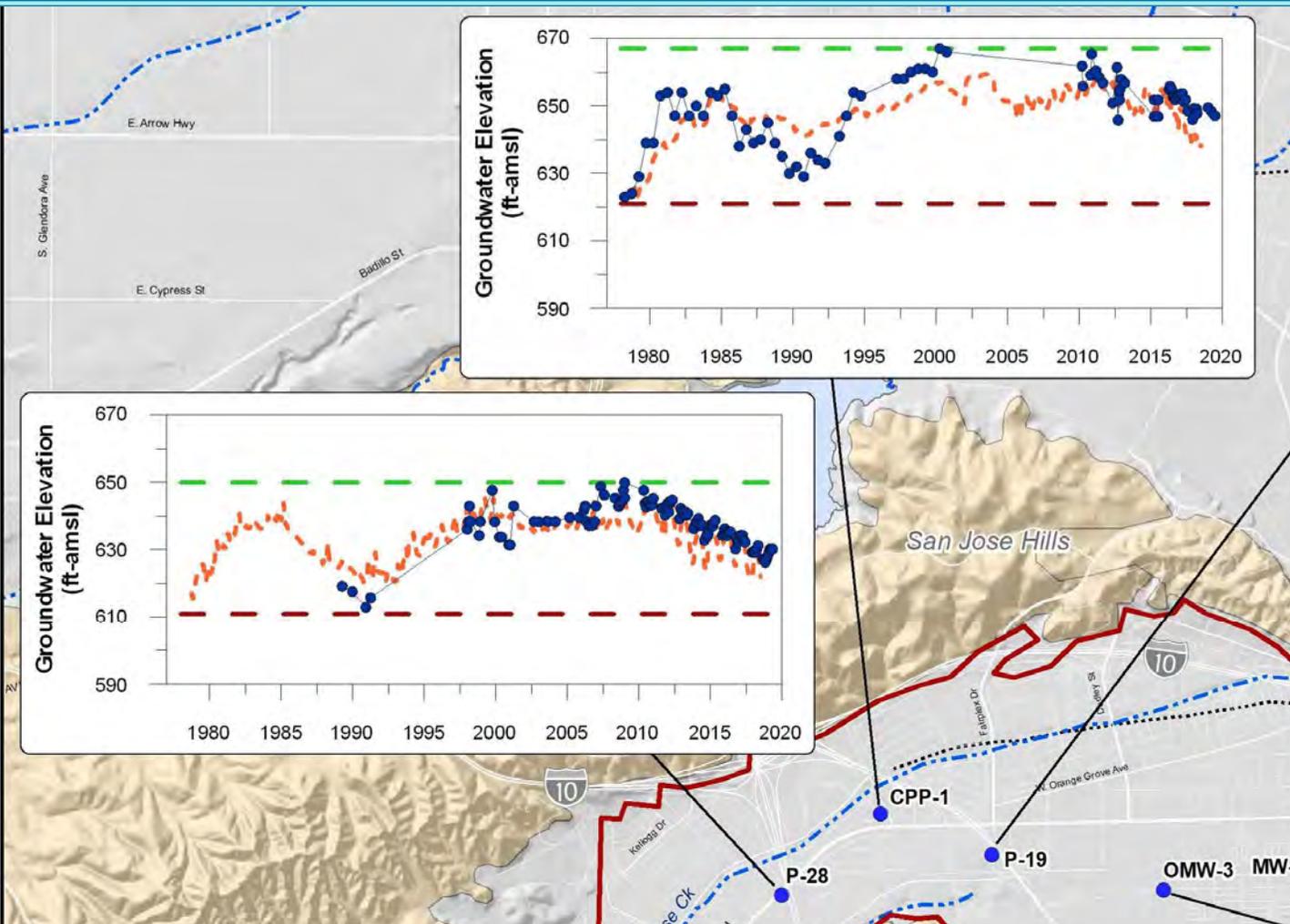
Minimum Threshold established at seven representative monitoring sites.

- Aligned along the central axis of the basin
- One well on each basin boundary



Chronic Lowering of Groundwater Levels

Minimum Thresholds and Measurable Objectives

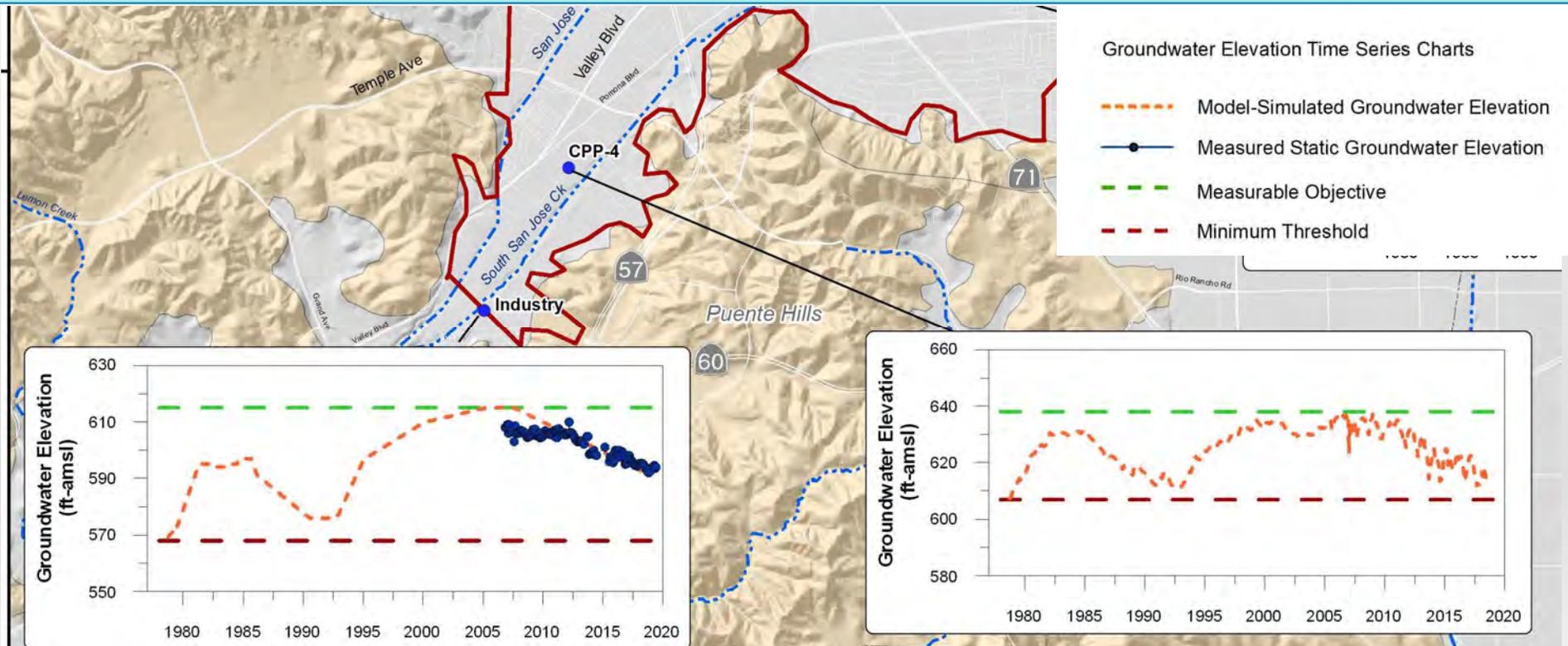


Minimum Threshold –
 Defined as the lowest groundwater elevations across the Spadra Basin over the period of 1978-2018.

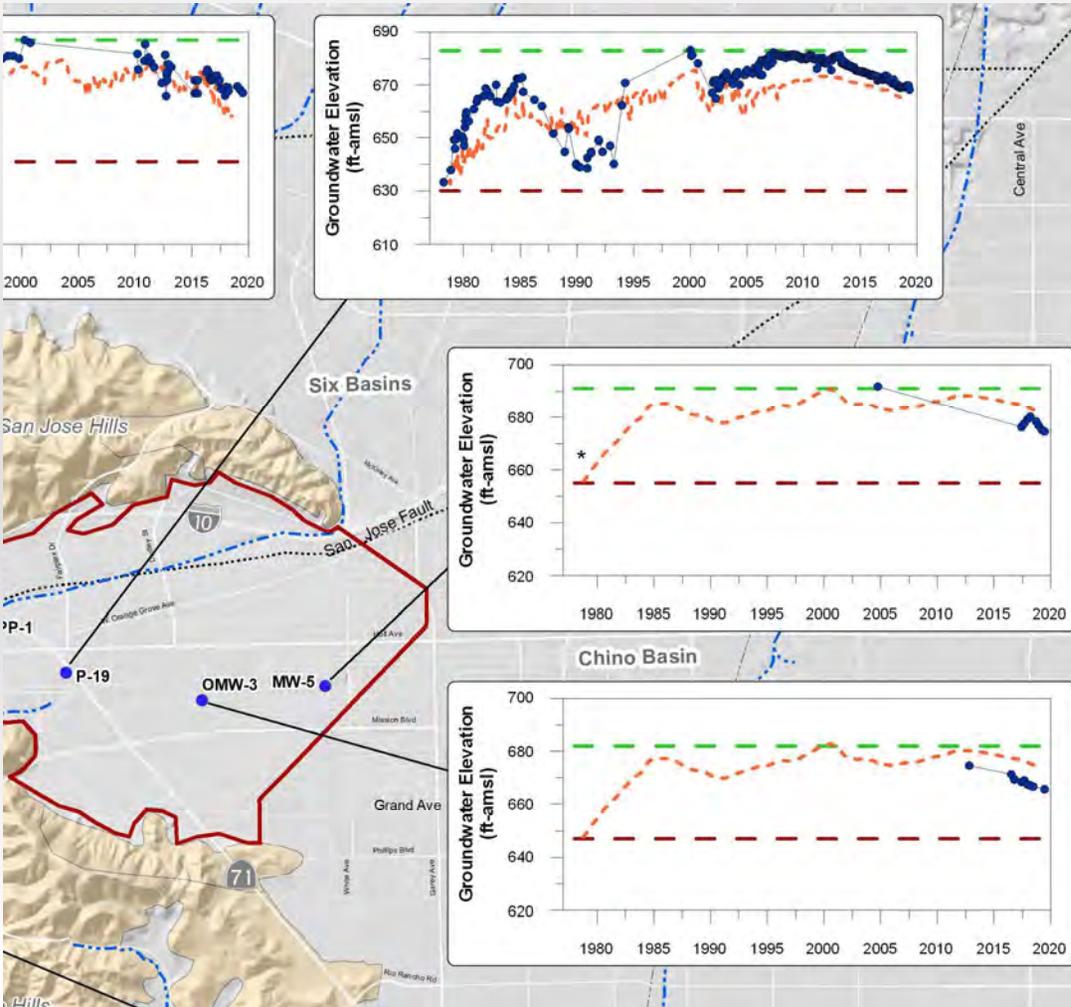
Measurable Objective –
 Defined as the highest historical groundwater elevations.



Chronic Lowering of Groundwater Levels Minimum Thresholds and Measurable Objectives



Chronic Lowering of Groundwater Levels Minimum Thresholds and Measurable Objectives



Groundwater Elevation Time Series Charts

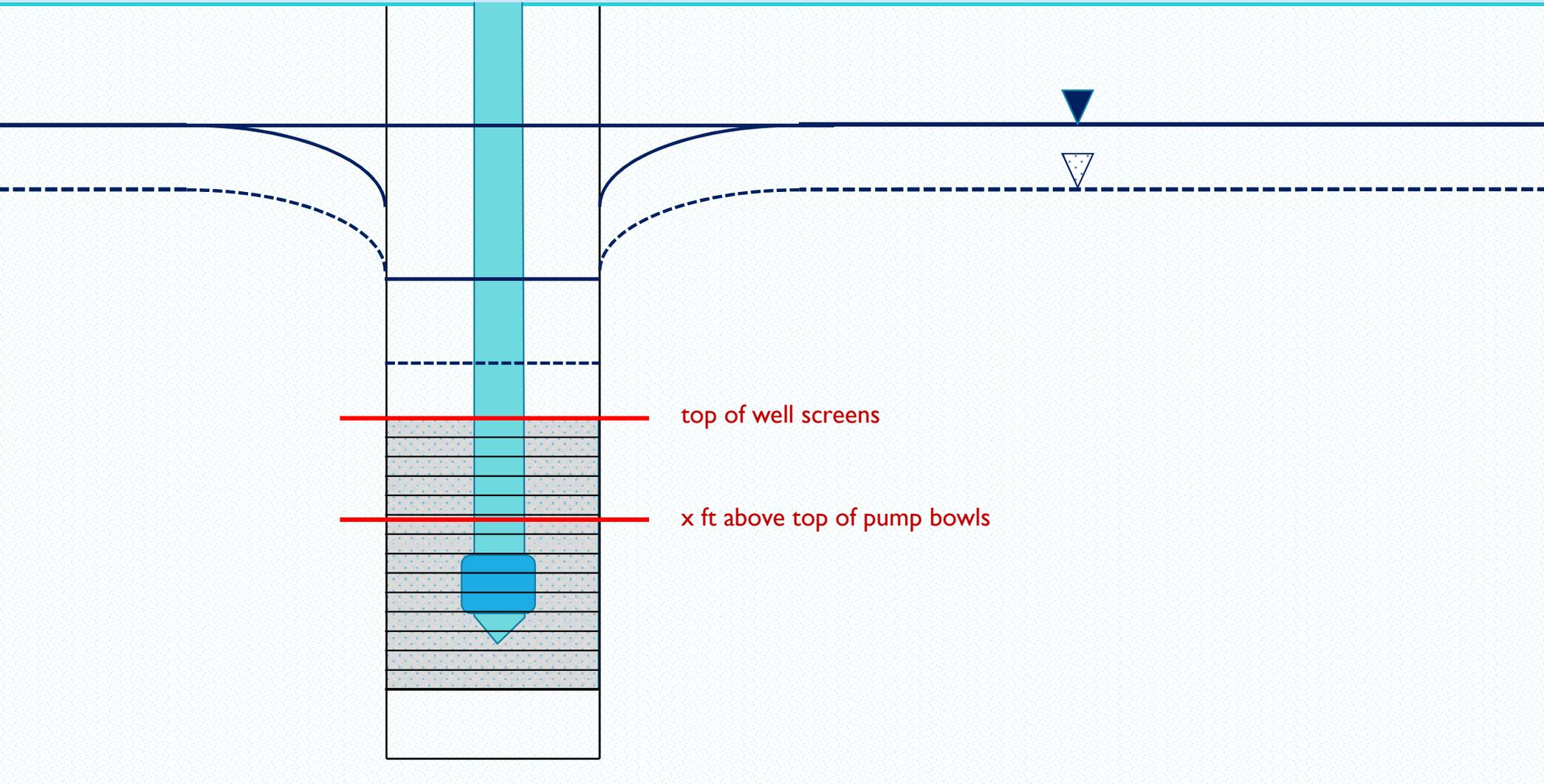
- Model-Simulated Groundwater Elevation
- Measured Static Groundwater Elevation
- Measurable Objective
- Minimum Threshold

The Minimum Thresholds for groundwater levels are a proposal based on the historical records (1978 – 2018) and the belief that there were no Undesirable Results.

To justify the proposed Minimum Thresholds for the entire basin, the GSA will collect information on depth of pump bowls and sustainability metrics for every well in Spadra Basin.



Various choices for pumping sustainability metrics



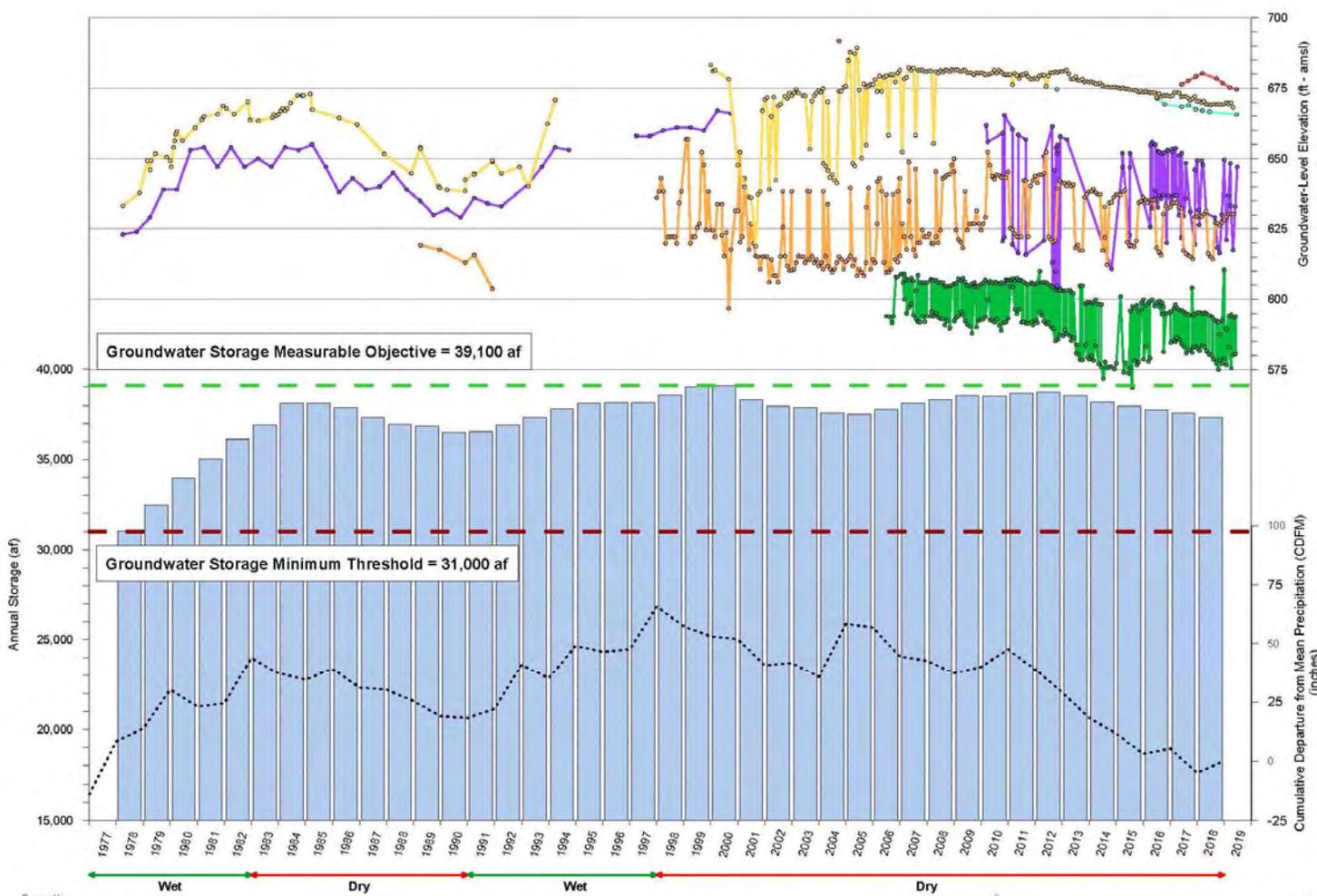
Reduction of Groundwater Storage

Undesirable Result: If groundwater storage were to decline to a volume such that **well owners could no longer pump their wells at the desired rates**, this would represent a significant and unreasonable depletion of water supply in the Spadra Basin and is an Undesirable Result.

Minimum Threshold - defined as the volume of groundwater in storage below which an Undesirable Result will occur.

- ✓ Initial Minimum Threshold is set as the lowest historical volume
- ✓ There are no known records of well owners reporting or describing adverse impacts
- ✓ Reasonable to assume that the range of groundwater levels over the historical period are protective against an Undesirable Result

Reduction of Groundwater Storage Minimum Thresholds and Measurable Objectives



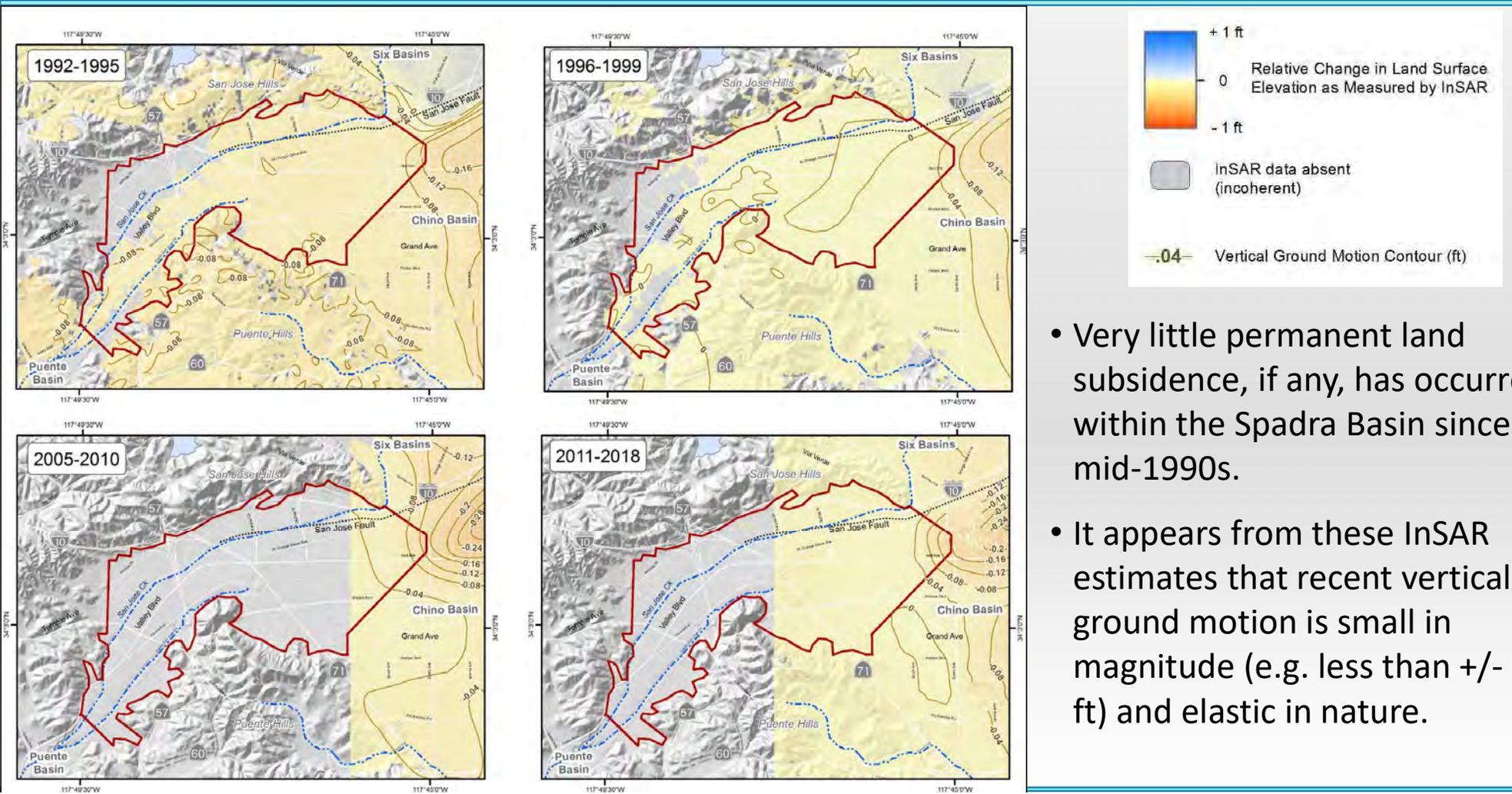
Minimum Threshold

Defined as the lowest volume of groundwater in storage in the Spadra Basin over the period of 1978-2018.

Measurable Objective

Defined as the highest historical volume of groundwater in storage

Land Subsidence



- Very little permanent land subsidence, if any, has occurred within the Spadra Basin since the mid-1990s.
- It appears from these InSAR estimates that recent vertical ground motion is small in magnitude (e.g. less than +/- 0.1 ft) and elastic in nature.

Land Subsidence

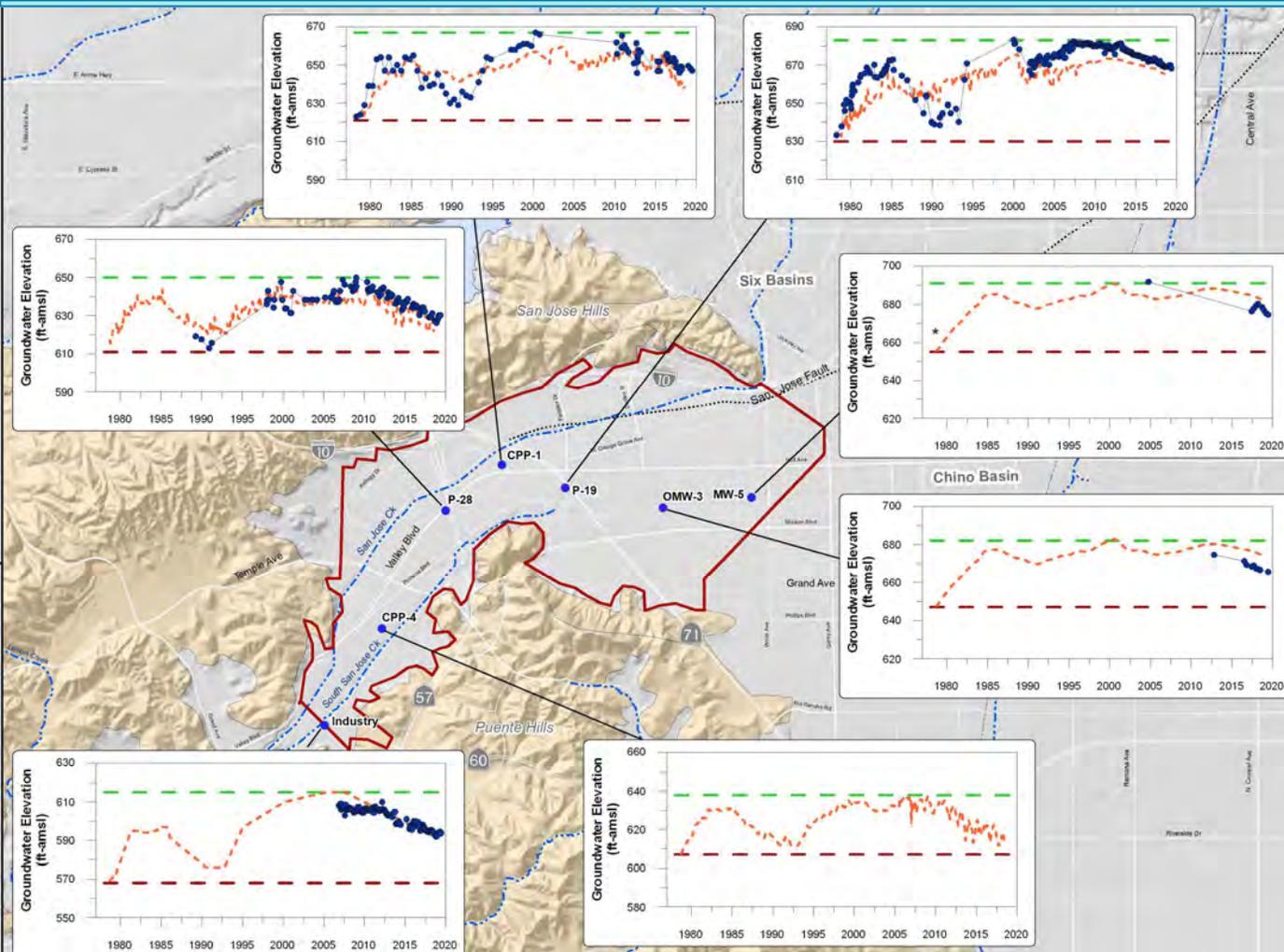
Undesirable Result: Permanent land subsidence can lead to deformation of the ground surface and ground fissuring that can damage the overlying infrastructure. The most conservative position for the GSA is to deem **any occurrence of permanent land subsidence caused by groundwater basin management is significant and unreasonable, and thereby, an Undesirable Result.**

Minimum Threshold - Zero permanent land subsidence across the entire Spadra Basin

Use Minimum Thresholds for chronic lowering of groundwater levels **by proxy:**

- ✓ the lack of observed permanent land subsidence indicates the current groundwater levels are above the *preconsolidation stress*.
- ✓ The *preconsolidation stress* can be estimated as the deepest historical groundwater level to which the sedimentary structure had previously equilibrated.

Land Subsidence – Minimum Thresholds and Measurable Objectives



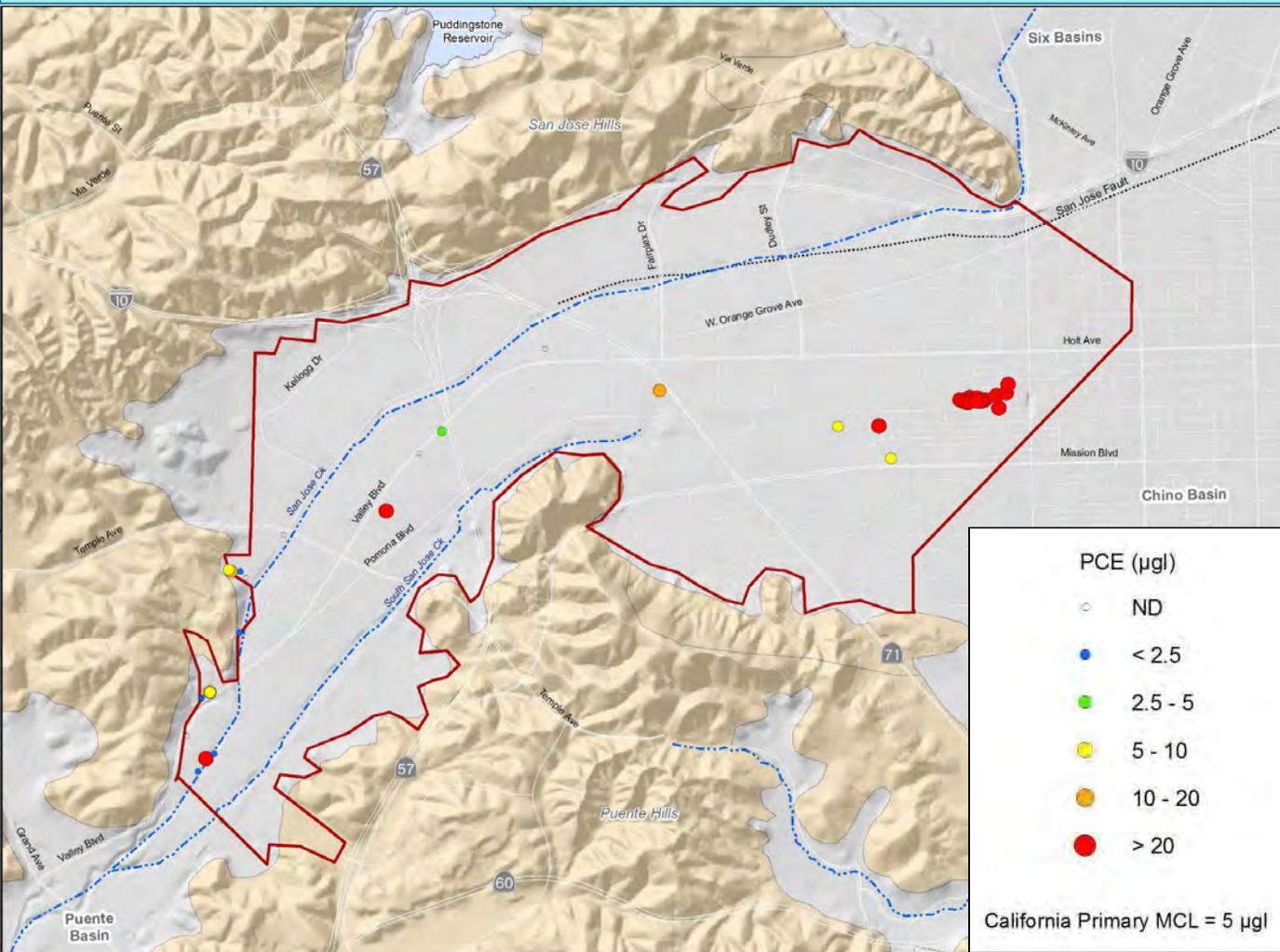
Groundwater Elevation Time Series Charts

- - - Model-Simulated Groundwater Elevation
- Measured Static Groundwater Elevation
- - - Measurable Objective
- - - Minimum Threshold

By proxy, the same Measurable Objectives for Groundwater Levels – highest observed historical elevations

Monitoring of land subsidence will be conducted by the GSA via InSAR and/or differential leveling surveys to verify that permanent land subsidence is not occurring. If permanent land subsidence is detected within the Spadra Basin, this may constitute an Undesirable Result, and cause the GSA to adjust the Minimum Threshold(s).

Degraded Water Quality



- Generally poor groundwater quality, mostly used for non-potable sources or for potable uses after treatment or blending
- Various point-source contaminant sites
- Some supply wells have similar contaminants as the point sources.

Six Contaminants of Concern:

1. TDS
2. Nitrate
3. TCE
4. PCE
5. 1,1-DCE
6. Perchlorate

Degraded Water Quality

The six contaminants of concern can be grouped in two types:

1. **Inorganic contaminants** - TDS, nitrate, and perchlorate
2. **Organic contaminants** - TCE, PCE, and 1,1-DCE



The sources and causes are different:

- **Inorganic contaminants** – non-point source origins that can enter groundwater as a result of human activity on the overlying lands.
- **Organic contaminants** - are man-made chemicals used in industrial solvents that can enter groundwater from the unregulated release or spills at a point source.

* Because the sources and causes of these two types of contaminants in groundwater are different, the conditions that are considered an Undesirable Result are also different.



Degraded Water Quality

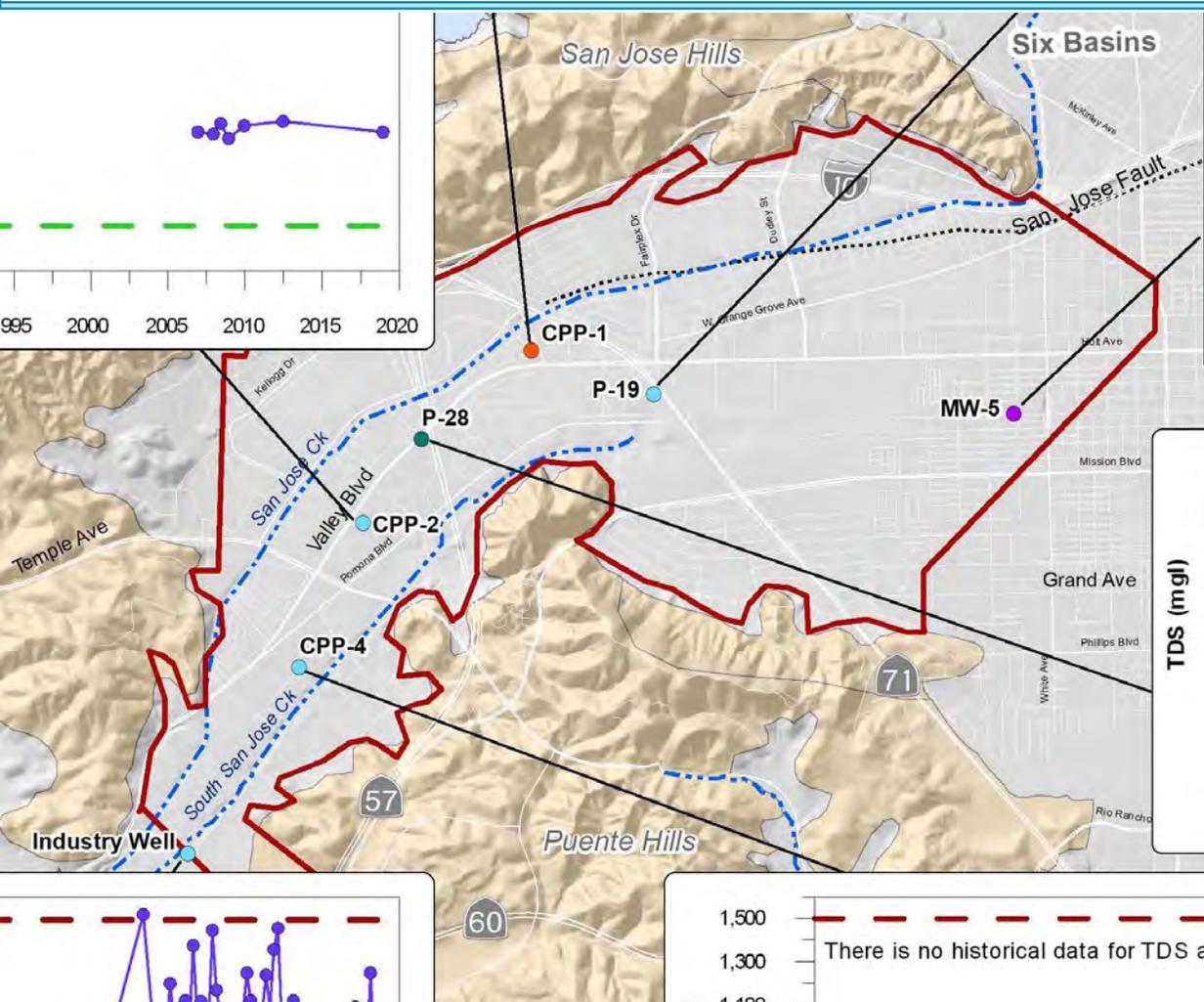
Undesirable Result: The degraded groundwater quality conditions that are considered an Undesirable Result are different depending on the contaminant type:

- If the concentrations of the inorganic contaminants from non-point sources increase at a well to concentrations that **would impact the current beneficial uses** of groundwater from that well and the inability to use a well for its current use, this would represent a significant and unreasonable degradation of water quality and an Undesirable Result.
- If the concentrations of the organic contaminants from point-sources **are above the Primary MCL at a well**, this represents a significant and unreasonable degradation of water quality with an Undesirable Result of preventing all potential beneficial uses in the basin.

Minimum Thresholds: set to avoid these Undesirable Results.



Degraded Water Quality



Wells with Sustainable Management Criteria for Water Quality

- Potable Supply Well
- Non-Potable Supply Well
- Potable Supply Well – Non-Potable Source with Treatment
- Point-Source Contaminant Site Monitoring Well

Minimum Threshold for degraded water quality is the contaminant concentration above which an Undesirable Result will occur at a representative monitoring site.

Minimum Thresholds established at seven representative monitoring sites for the six contaminants of concern

Degraded Water Quality – Minimum Thresholds

Minimum Threshold - contaminant concentration above which an Undesirable Result will occur at a representative monitoring site.

- For the **inorganic contaminants** (TDS, nitrate, and perchlorate), the Minimum Thresholds are set to be **protective of the current beneficial uses** of groundwater at each well.
 - Non-potable wells, and the well that is non-potable and treated for potable supply, the Minimum Threshold is defined as the highest historical concentration of the contaminant historically at all of these representative monitoring wells in the basin.
 - Potable well, the Minimum Threshold for TDS which has a Secondary MCL, is defined as the highest historical concentration at that well, and the Minimum Thresholds for nitrate and perchlorate which have Primary MCLs is defined as the MCL.
- For the **organic contaminants** (TCE, PCE, and 1,1-DCE), the Minimum Thresholds are set **so that point-source discharge of contaminants do not impair all potential beneficial uses** of groundwater. Hence, the Minimum Thresholds are defined as the Primary MCL.



Degraded Water Quality – Measurable Objectives

Measurable Objectives - contaminant concentration that is representative of the lower boundary of the operating band for groundwater quality conditions, to achieve and maintain sustainable groundwater management.

- For the **inorganic contaminants** (TDS, nitrate, and perchlorate), the Measurable Objectives are defined as the lowest historical detected concentration below the MCL at that all representative monitoring sites in the basin, or better. **Set to promote improving quality and reducing need for treatment.**
- For the **organic contaminants** (TCE, PCE, and 1,1-DCE), the Measurable Objectives are defined as:
 - the 2015 concentration, or better, for wells where the current concentration is above the Primary MCL, and;
 - non-detect concentration at the wells where the current concentration is below the Primary MCL.

Set to uphold that point sources should not impair all potential beneficial uses.



Degraded Water Quality - Nitrate

Groundwater Quality Time-Series Charts

- Total Dissolved Solids (TDS) Concentration
- Minimum Threshold
- Measurable Objective

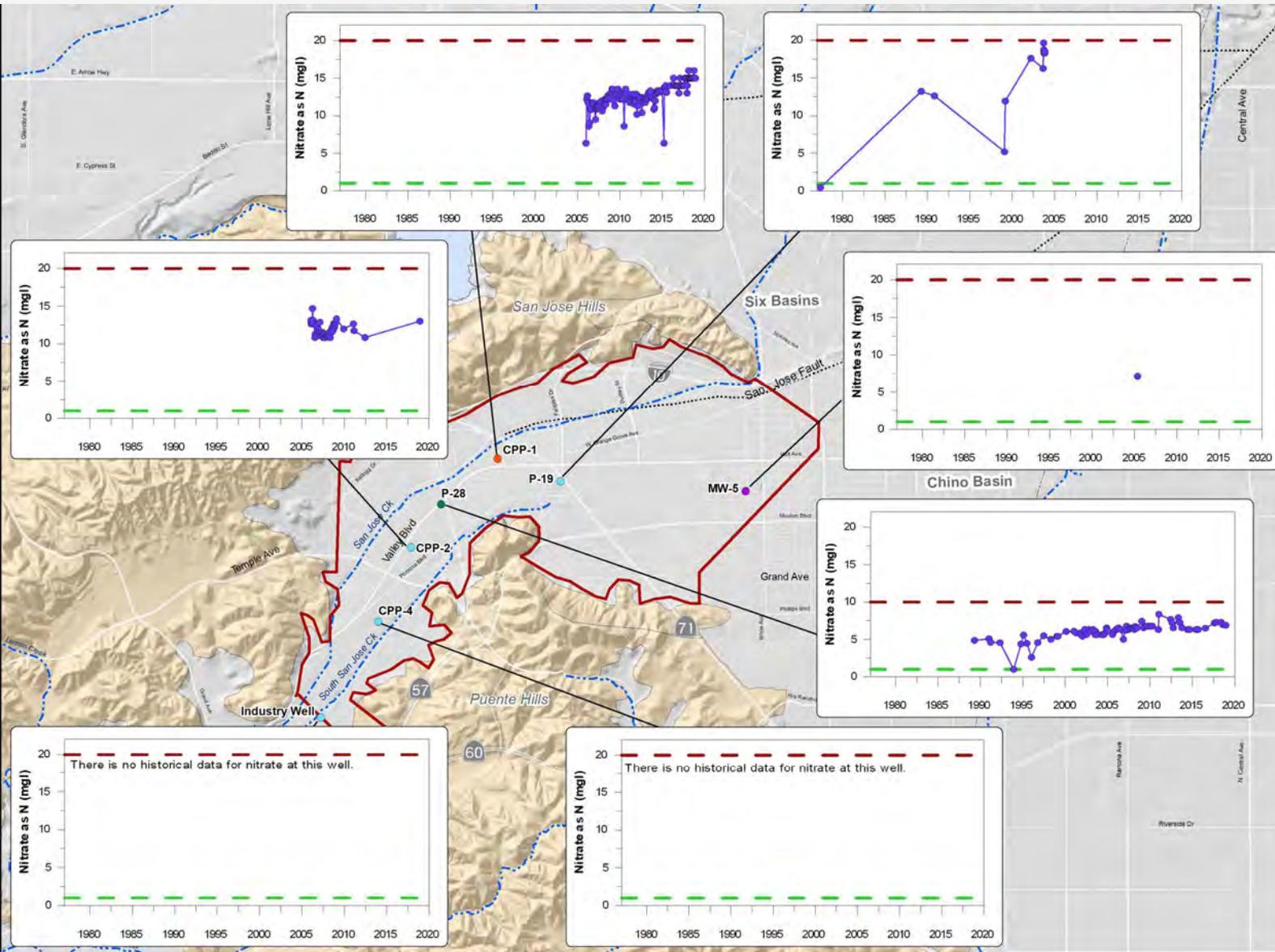
Wells with Sustainable Management Criteria for Water Quality

- Potable Supply Well
- Non-Potable Supply Well
- Potable Supply Well – Non-Potable Source with Treatment
- Point-Source Contaminant Site Monitoring Well

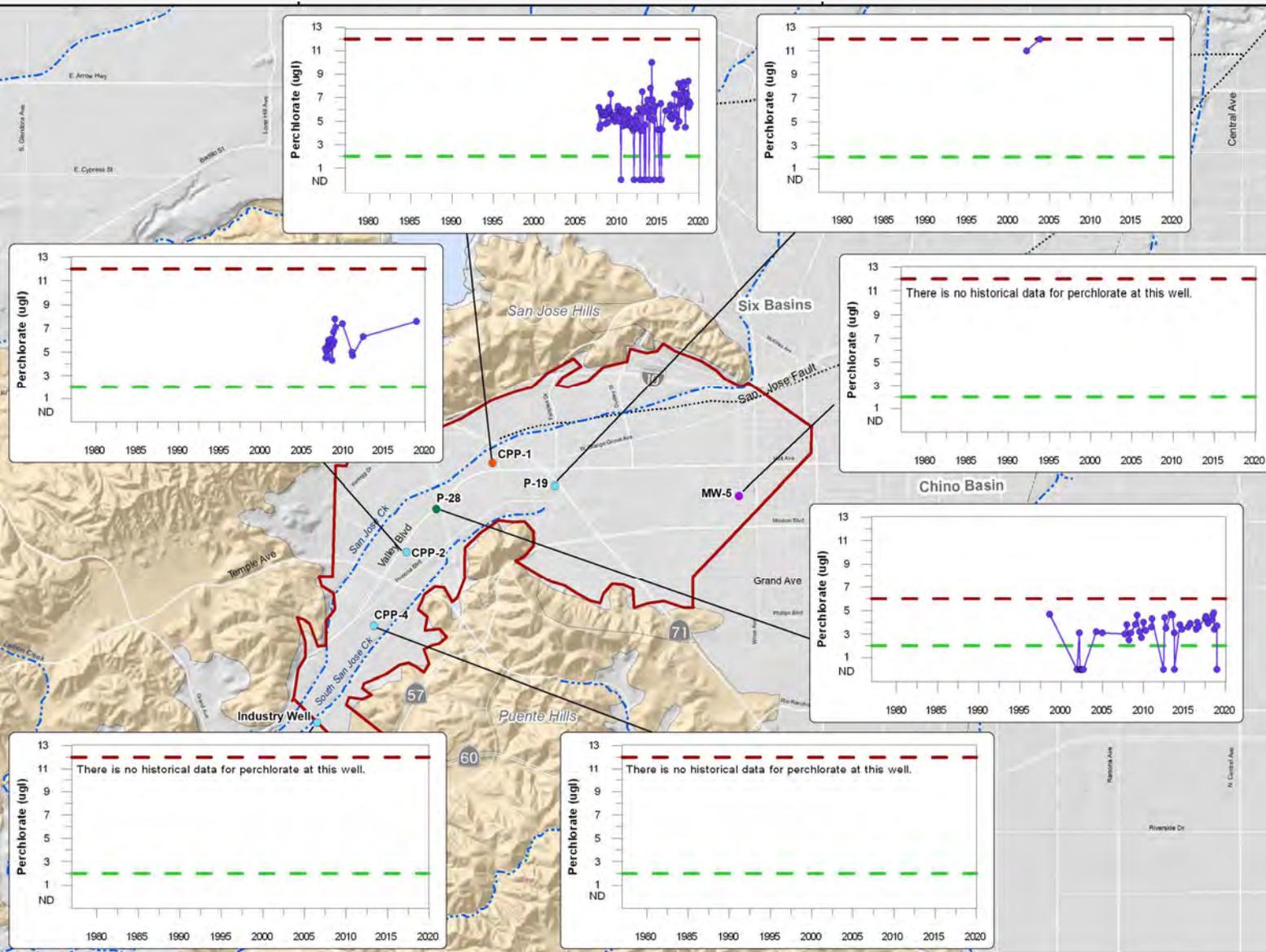
Minimum Thresholds for the inorganic contaminants are different depending on the beneficial use of the well.

- non-potable – highest historical concentrations
- potable = MCL

Measurable Objectives set as the lowest historical concentration.



Degraded Water Quality - Perchlorate



Minimum Thresholds for the inorganic contaminants are different depending on the beneficial use of the well.

- non-potable – highest historical concentrations
- potable = MCL

Measurable Objectives set as the lowest historical concentration.

Degraded Water Quality - TDS

Groundwater Quality Time-Series Charts

- Total Dissolved Solids (TDS) Concentration
- Minimum Threshold
- Measurable Objective

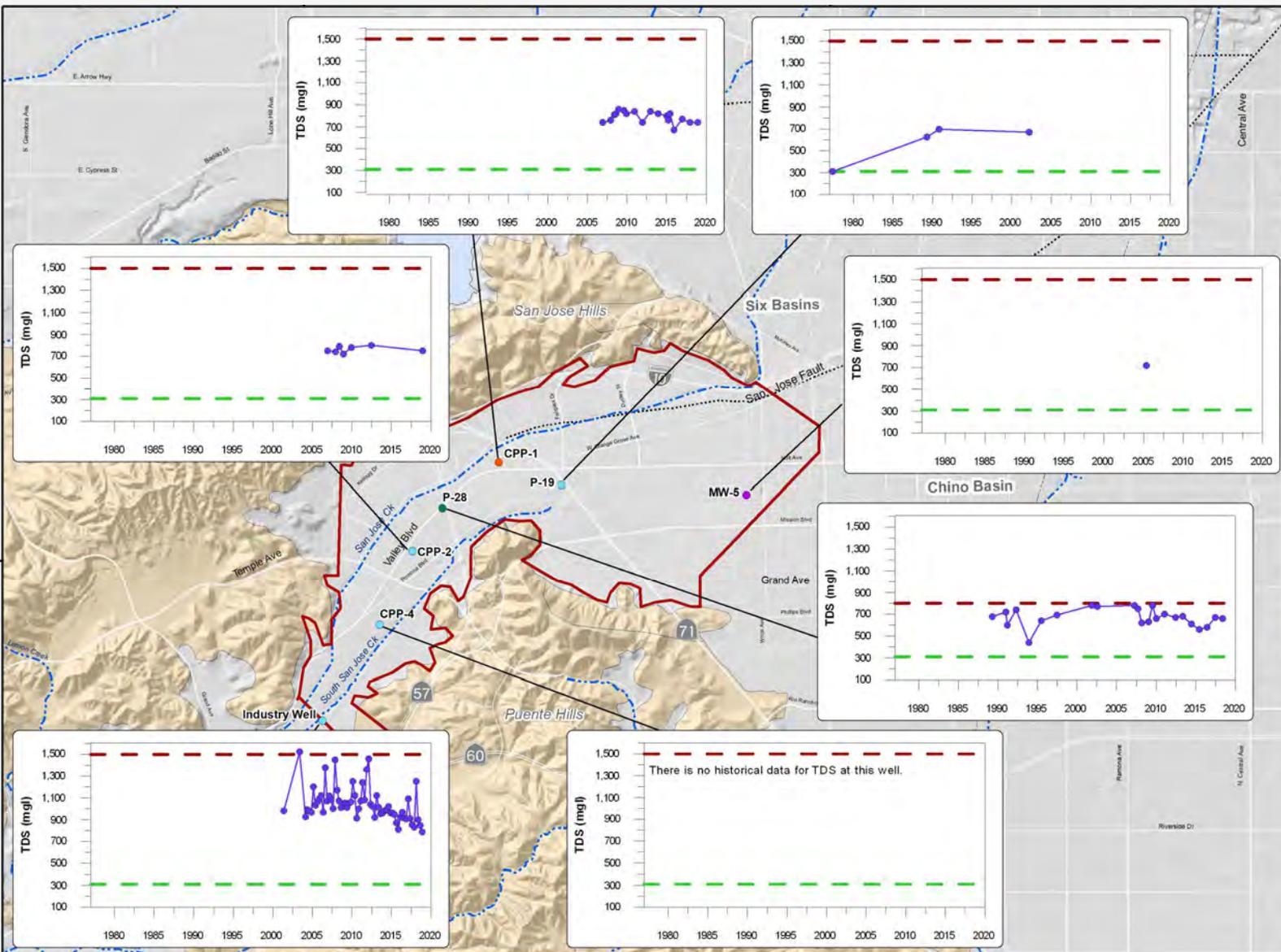
Wells with Sustainable Management Criteria for Water Quality

- Potable Supply Well
- Non-Potable Supply Well
- Potable Supply Well - Non-Potable Source with Treatment
- Point-Source Contaminant Site Monitoring Well

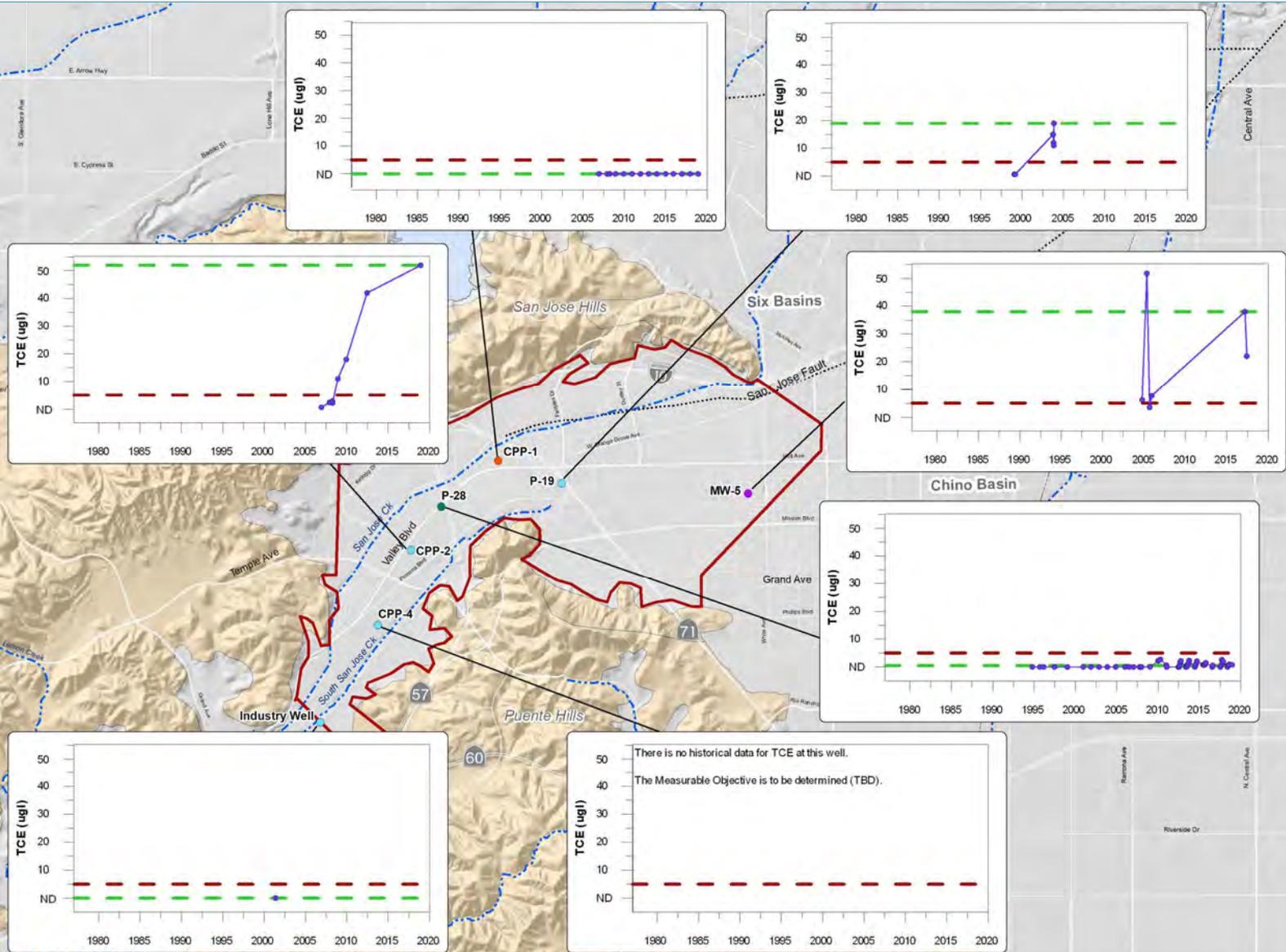
Minimum Thresholds for the inorganic contaminants are different depending on the beneficial use of the well.

- non-potable – highest historical concentrations
- potable = MCL

Measurable Objectives set as the lowest historical concentration.



Degraded Water Quality - TCE



Minimum Thresholds for the organic contaminants are equal to the MCL.

Measurable Objectives set dependent on current (2015) concentration:

- Above MCL = current concentration
- Below MCL = Non-detect

Existing Undesirable Results prior to 2015

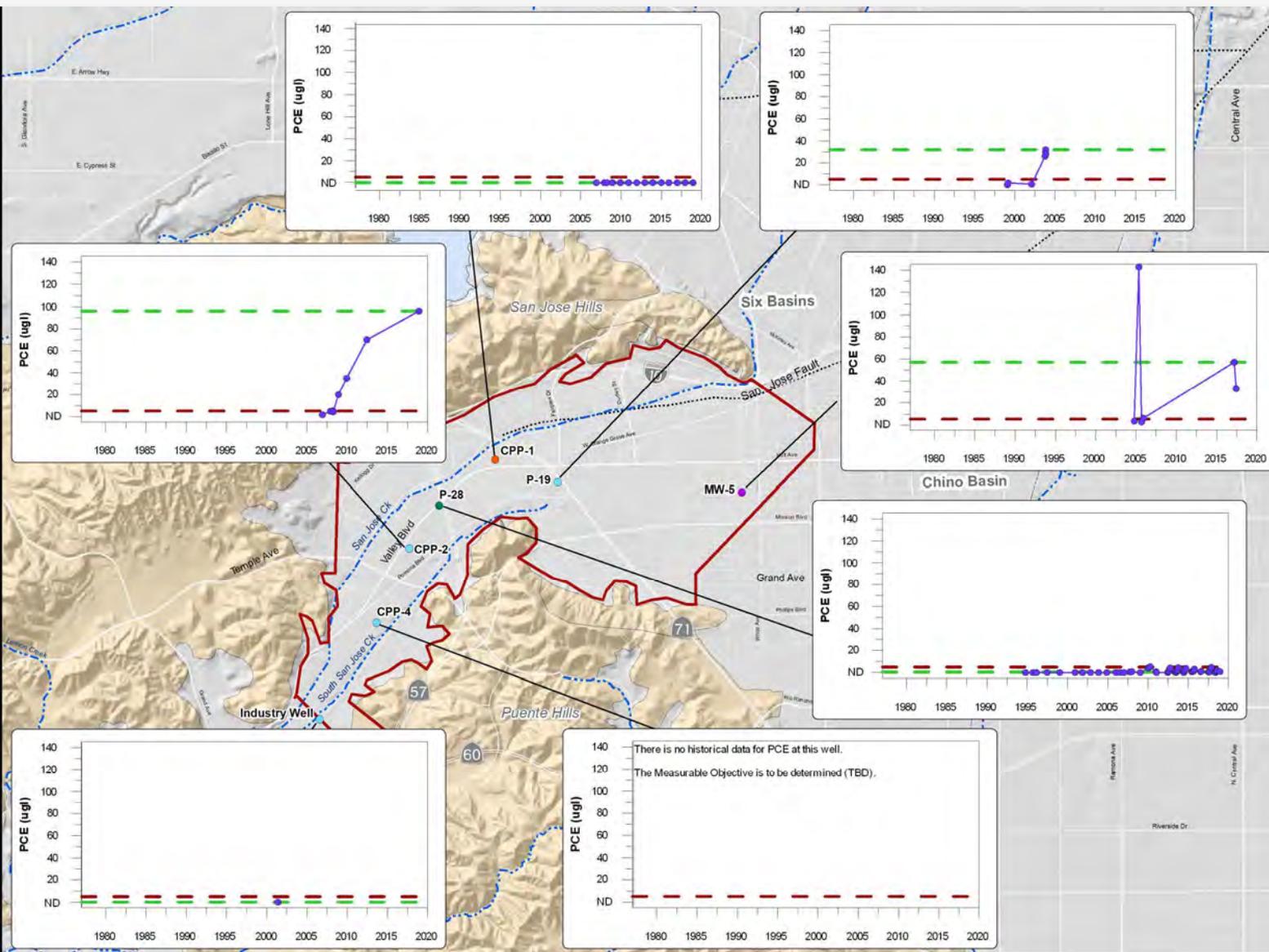
The SGMA Regulations (California Water Code §10727.2[b][4]) indicate:

- that a GSP *“may, but is not required to, address undesirable results that occurred before, and have not been corrected by January 1, 2015”*
- and a GSA *“has discretion as to whether to set Measurable Objectives and the timeframes for achieving any objectives for Undesirable Results that occurred before, and have not been corrected by January 1, 2015.”*

The DWR's BMP guidance document - if an Undesirable Result occurred prior to January 1, 2015, the GSA should set Measurable Objectives to either maintain or improve upon the conditions that were occurring in 2015.



Degraded Water Quality - PCE



Groundwater Quality Time-Series Charts

- Total Dissolved Solids (TDS) Concentration
- Minimum Threshold
- Measurable Objective

Wells with Sustainable Management Criteria for Water Quality

- Potable Supply Well
- Non-Potable Supply Well
- Potable Supply Well - Non-Potable Source with Treatment
- Point-Source Contaminant Site Monitoring Well

Minimum Thresholds for the organic contaminants are equal to the MCL.

Measurable Objectives set dependent on current (2015) concentration:

- Above MCL = current concentration, or better
- Below MCL = Non-detect

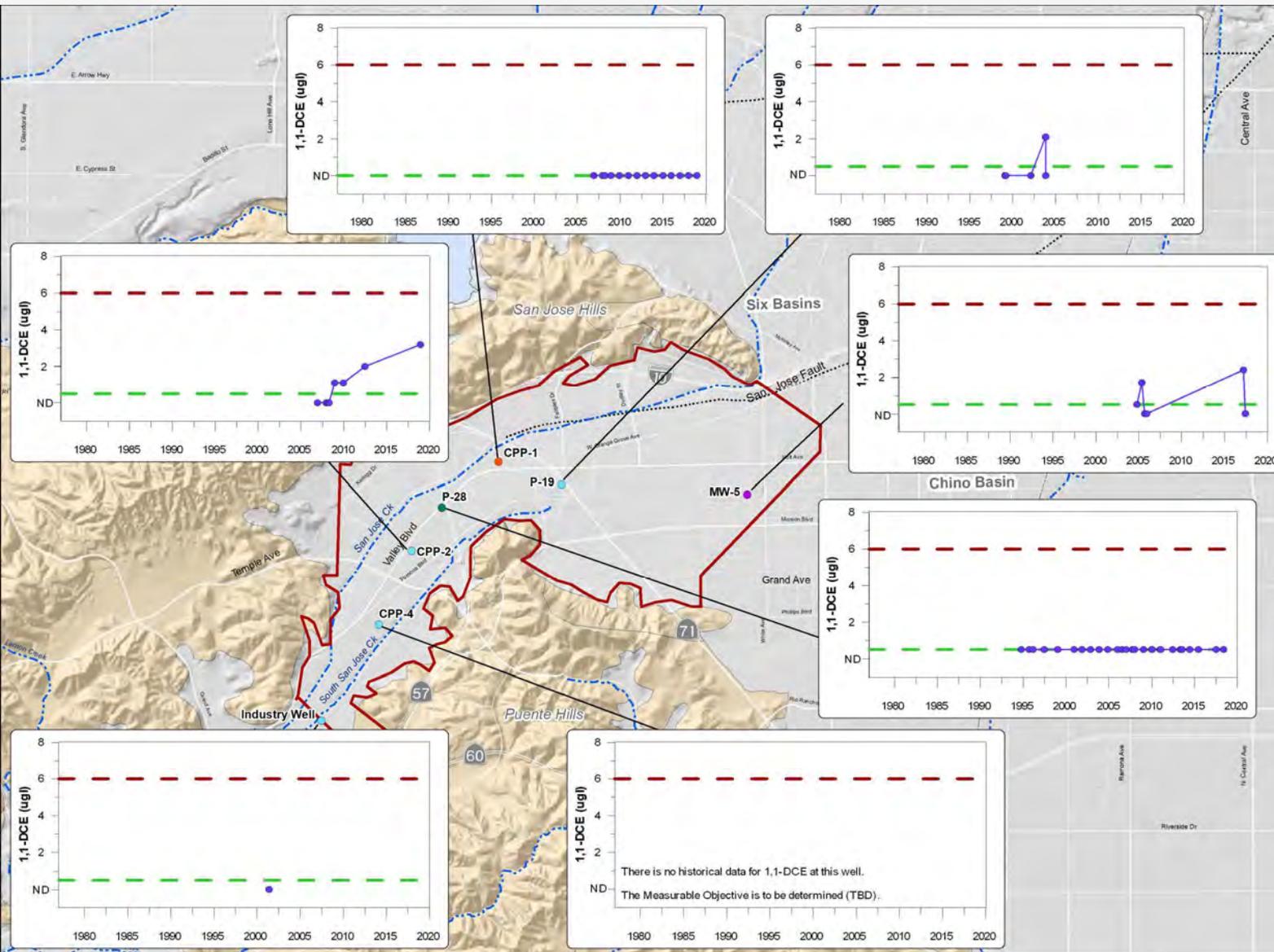
Degraded Water Quality - 1,1-DCE

Groundwater Quality Time-Series Charts

- Total Dissolved Solids (TDS) Concentration
- Minimum Threshold
- Measurable Objective

Wells with Sustainable Management Criteria for Water Quality

- Potable Supply Well
- Non-Potable Supply Well
- Potable Supply Well - Non-Potable Source with Treatment
- Point-Source Contaminant Site Monitoring Well



Minimum Thresholds for the organic contaminants are equal to the MCL.

Measurable Objectives set dependent on current (2015) concentration:

- Above MCL = current concentration, or better
- Below MCL = Non-detect

Sustainability Goal

Sustainability Goal - states the GSA's objectives and desired conditions for the entire basin, how the basin will get to that desired condition, and why the planned measures will lead to success. Includes:

- Description of the goal – GSA's objective or mission statement
- Discussion of measures – projects and management actions
- How the goal will be achieved in 20 years – how the implemented projects and management actions will achieve or maintain sustainability.

The description of the Sustainability Goal will be included with the final GSP.



Conclusions

- Sustainable management criteria are critical and required elements of a GSP that define sustainability in the basin.
- The Sustainable Management Criteria presented TM 3 are draft and rely on GSA and stakeholder feedback. This includes:
 - Depth of the pump bowls metrics specific to each well.
 - Confirming Minimum Thresholds for the inorganic contaminants of TDS, nitrate, and perchlorate to protect current beneficial uses.
- Defining the Sustainable Management Criteria for a basin can be an iterative process. Initial criteria may need to be adjusted. GSPs are evaluated every five years. These adjustments can likely occur during future updates of the GSP deemed necessary during the five-year evaluations.



Next Steps

Phase I - Develop Hydrogeologic Conceptual Model and Groundwater Model for the Spadra Basin

Jun 2019 - Jun 2020

Construct New Monitoring Well

Phase II - Develop Sustainable Management Criteria for the Spadra Basin

Jun - Aug, 2020

Phase III - Evaluate the Sustainability of Future Baseline Conditions

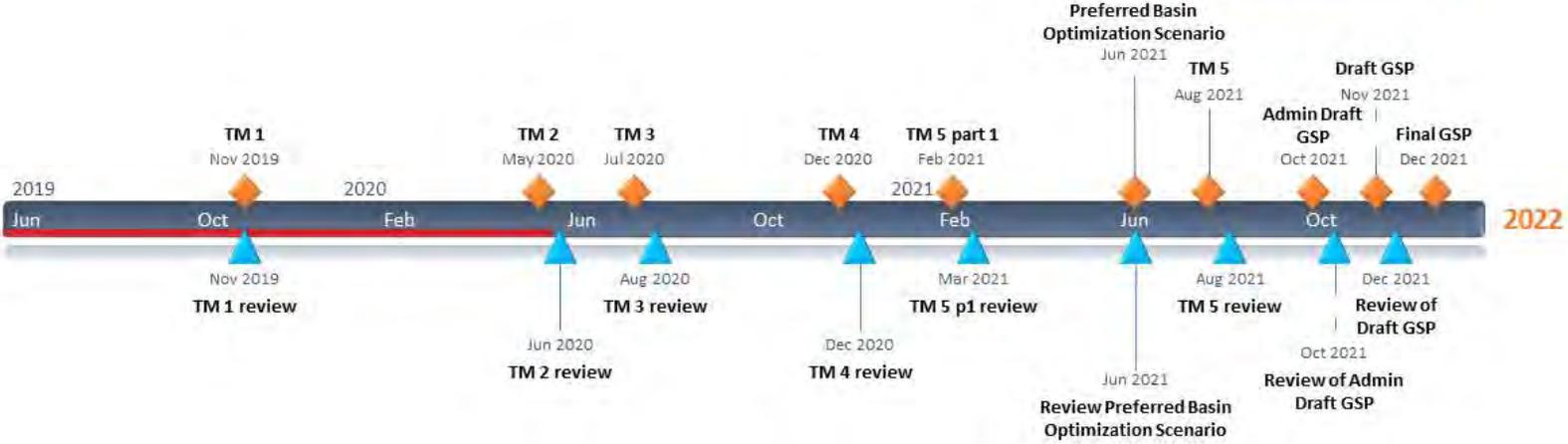
Jun - Dec, 2020

Phase IV - Evaluate Basin Optimization Scenarios to Achieve Sustainability

Dec 2020 - Aug 2021

Phase V - Develop Groundwater Sustainability Plan (GSP)

Aug - Dec, 2021



Next Steps TM 3 – Sustainable Management Criteria

- **September 3, 2020** – GSA/stakeholders submit comments and suggested revisions
 - Submit to vweamer@weewater.com and amalone@weewater.com
- **September 2020** – Prepare Appendix A: GSA/stakeholder comments and response to comments and Final TM 3 [posted at www.spadrabasin.com]



Next Steps TM 4 – Sustainability of Future Baseline Conditions (Phase III)

- **August 2020** – Continue to develop and document the Baseline Scenario
 - Collect current and future water supply plans, land use changes, and pumping
 - Document the Baseline Scenario and review with water supply agencies
- **September to October 2020** – Conduct model simulation of Baseline Scenario and document in TM 4.
- **November 2020** – Draft *TM 4 – Sustainability of Baseline Management Plan*
- **December 7, 2020** – Advisory Committee meeting to review TM 4



Questions

