

Agenda

Santa Cruz Mid-County Groundwater Sustainability Plan (GSP)

Advisory Committee Meeting #6

Wednesday, April 25, 2018, 6:00 – 9:00 p.m.

Santa Cruz County Sheriff's Office, Conference Room, 5200 Soquel Avenue, Santa Cruz

Meeting Objectives

1. Receive additional background information about basin conditions.
2. Share Advisory Committee input on Minimum Threshold and Undesirable Result Options with Underlying Significant and Unreasonable Conditions for the following Sustainability Indicators:
 - a. Seawater Intrusion
 - b. Subsidence

Agenda

Item No.	Time	Topic	Presenter & Materials
	5:45 p.m.	<i>Arrivals/Committee members collect food for dinner</i>	
1	6:00 p.m.	Welcome, Introductions, Meeting Objectives, and Agenda Review <ul style="list-style-type: none"> • Review project timeline 	<ul style="list-style-type: none"> • Rosemary Menard, City of Santa Cruz • Eric Poncelet, Facilitator (presentation) <i>Materials:</i> 1.1 Agenda 1.2. Updated GSP Process Timeline Graphic 1.3 Iterative Process Graphic
2	6:10 p.m.	Oral communications <ul style="list-style-type: none"> • <i>Members of the public to comment on non-agenda items</i> 	<ul style="list-style-type: none"> • All
3	6:20 p.m.	Share additional background information <ul style="list-style-type: none"> • Trend data 	<ul style="list-style-type: none"> • Georgina King, HydroMetrics <i>Materials:</i> 3.1 Soquel Creek Water District, 1965 – 2017: Groundwater Pumping, Connections, and Rainfall (Handout)
4	6:30 p.m.	Seawater Intrusion – Undesirable Results with Underlying Significant and Unreasonable Conditions	<ul style="list-style-type: none"> • Georgina King, HydroMetrics • All

Item No.	Time	Topic	Presenter & Materials
		<ul style="list-style-type: none"> Background information Discuss staff proposal and select preferred option 	<i>Materials:</i> <i>4.1 Proposal: Seawater Intrusion Minimum Thresholds</i> <i>Refer to PowerPoint Presentation</i>
5	7:40 p.m.	Public comment <ul style="list-style-type: none"> <i>Focus on meeting agenda items and other Advisory Committee work</i> 	Public
6	7:50 p.m.	Break	
7	8:05 p.m.	Subsidence – Undesirable Results with Underlying Significant and Unreasonable Conditions <ul style="list-style-type: none"> Background information Discuss staff proposal and select preferred option 	<ul style="list-style-type: none"> Georgina King, HydroMetrics <i>Materials:</i> <i>7.1 Proposal: Subsidence Minimum Thresholds</i> <i>Refer to PowerPoint Presentation</i>
8	8:40 p.m.	Public Comment <ul style="list-style-type: none"> <i>Focused on topics discussed in this meeting and other Advisory Committee work.</i> 	Public
9	8:50 p.m.	Confirm: <ul style="list-style-type: none"> March 28, 2018 Advisory Committee Meeting Summary 	<ul style="list-style-type: none"> All Eric Poncelet, Facilitator <i>Materials:</i> <i>9.1. Draft Meeting Summary from March 28</i>
10	8:55 p.m.	Recap and Next Steps	<ul style="list-style-type: none"> Eric Poncelet, Facilitator
	9:00 p.m.	Adjourn	

Written Communications and Correspondence (included in the meeting materials packet).

1. Email correspondence from B. Steinbruner, April 9, 2018
2. Email correspondence from B. Steinbruner, April 14, 2018

Santa Cruz Mid-County Groundwater Basin Groundwater Sustainability Plan Process Overview — Phase 2: January–July 2018

2018

PHASE 2: GSP ADVISORY COMMITTEE POLICY DEVELOPMENT

1/18 2/18 3/18 4/18 5/18 6/18 7/18 8/18 9/18 10/18 11/18 12/18

Develop and Evaluate Preliminary Criteria for Sustainability Indicators

Jan 2018

- Initial draft GSP problem statement and policy questions
- Interrelationships between technical GSP sections and Sustainability Indicators,
- Overarching goals of groundwater sustainability in the Basin.

Feb 2018

- Applicability of Groundwater Levels, Groundwater Storage and Seawater Intrusion in the Mid-County Basin
- Significant and Unreasonable Conditions and Undesirable Results for three focal Sustainability Indicators

Mar 2018

- Background on Basin conditions and Groundwater Levels, Groundwater Storage, Seawater Intrusion, and Surface Water.

Apr 2018

- Present Minimum Threshold and Undesirable Result options with underlying Significant and Unreasonable Conditions for: Seawater Intrusion and Land Subsidence.
- Advisory Committee to select preferred option.

May 2018

- Present Minimum Threshold and Undesirable Result options with underlying Significant and Unreasonable Conditions for: Groundwater Levels and Groundwater Storage.
- Advisory Committee to select preferred option.

June 2018

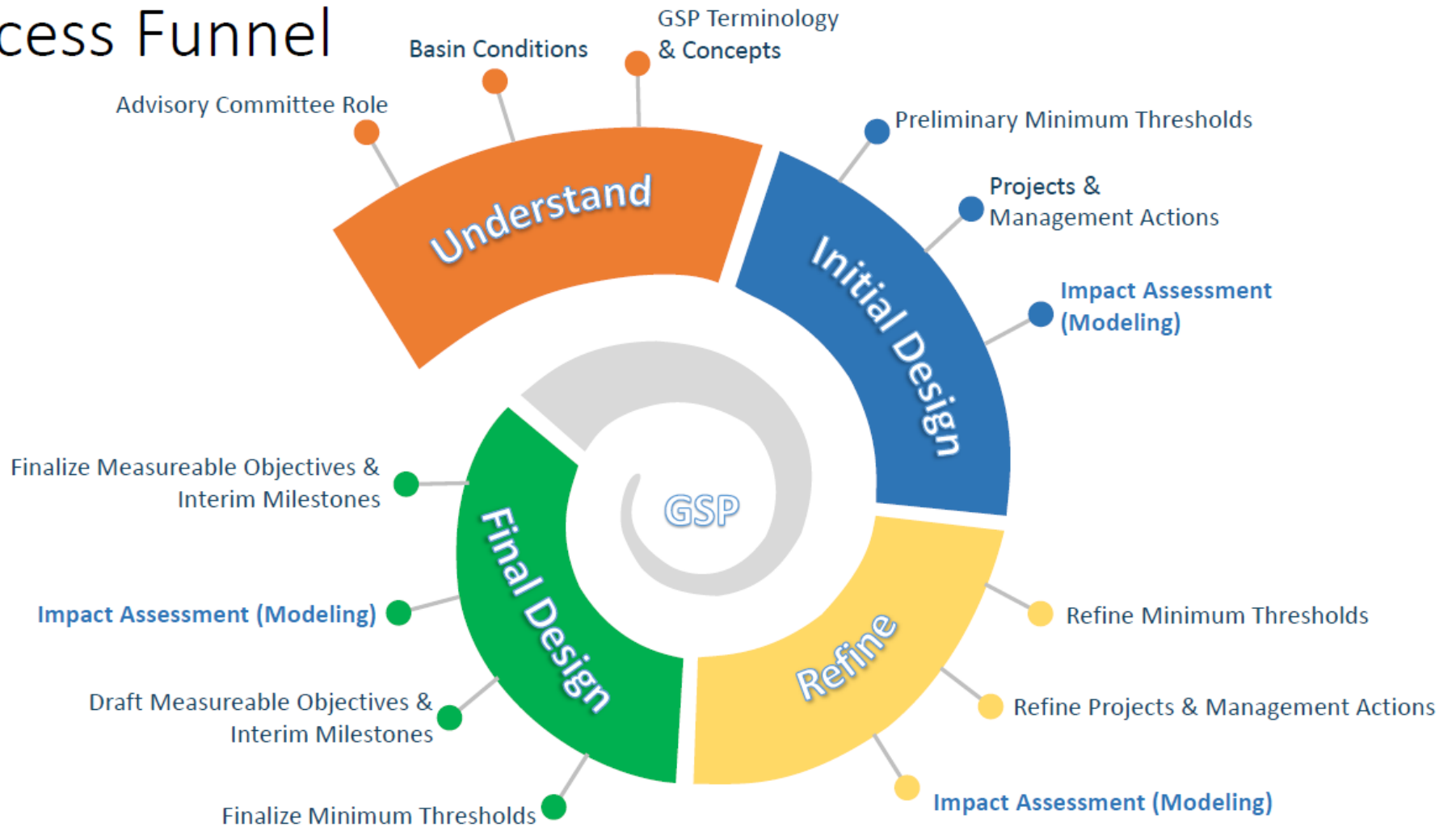
- Present Minimum Threshold and Undesirable Result options with underlying Significant and Unreasonable Conditions for: Surface Water Interactions and Water Quality.

July 2018

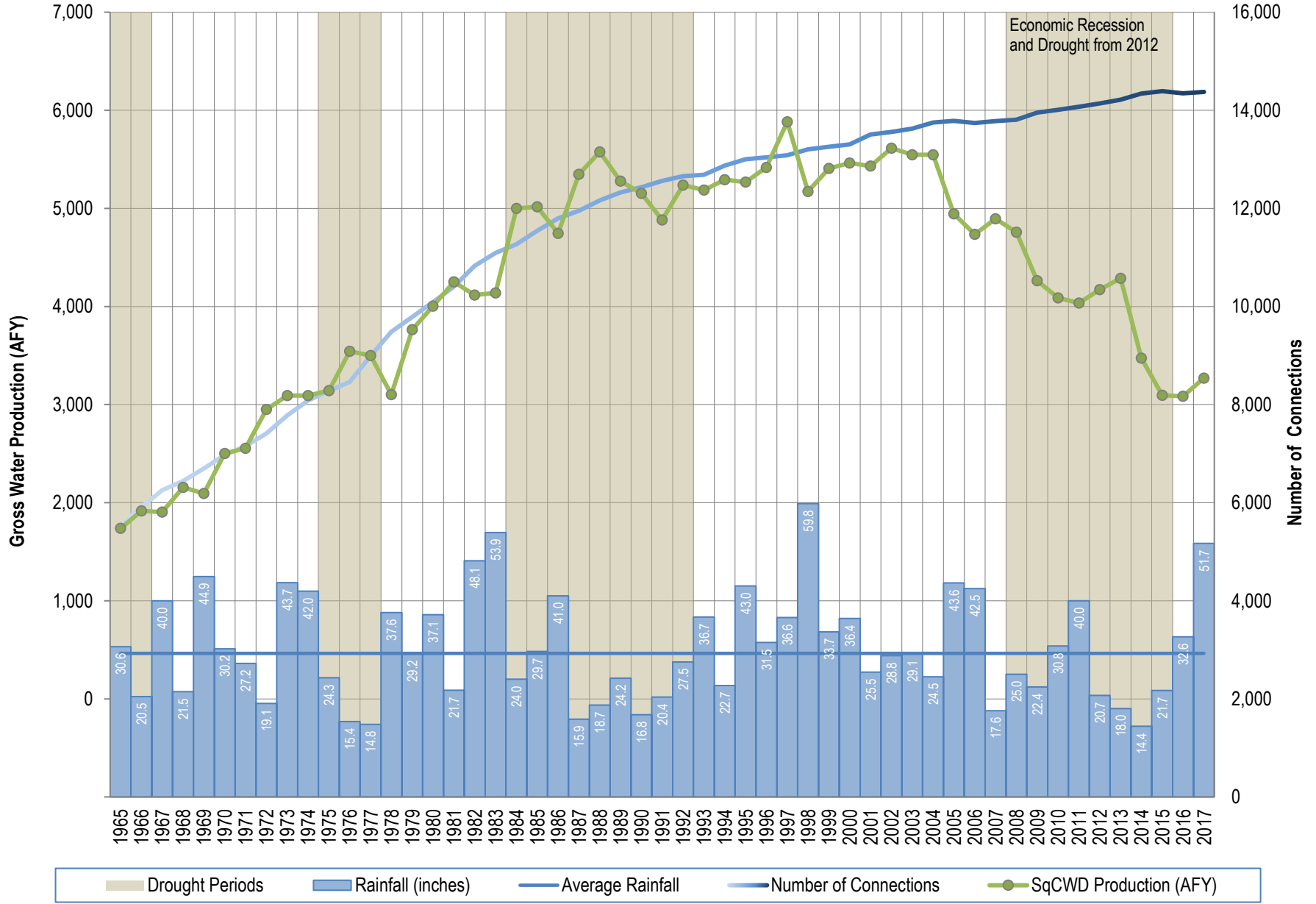
- Discussion of projects and management actions, including which projects to model to assess if they avoid Undesirable Results.
- Review of basin impacts from projects already evaluated.

1/18 2/18 3/18 4/18 5/18 6/18 7/18 8/18 9/18 10/18 11/18 12/18

Process Funnel



Soquel Creek Water District, Water Year 1965 - 2017



Technical Staff Proposal Seawater Intrusion Minimum Thresholds

This document is organized into the following three sections:

1. Background - Current Seawater Intrusion Management. This section describes the current state of seawater intrusion and the policy goals that have been previously established
2. Technical staff proposal for what is considered a Significant and Unreasonable condition (what we want to avoid). This section provides a Significant and Unreasonable statement reflecting the status quo and provides options that are more and less conservative to change what we would want to avoid happening in the basin from seawater intrusion.
3. Technical Staff Proposal - Undesirable Results for:
 - A. Chloride concentrations
 - i) Intruded Coastal Monitoring wells
 - ii) Inland and Unintruded Coastal Monitoring wells
 - B. Protective groundwater elevations

1. BACKGROUND - CURRENT SEAWATER INTRUSION MANAGEMENT

Aromas Area (Aromas Aquifer and Purisima F Unit):

- Seawater has moved inland of SC-A2 and SC-A3 from where it was observed when Coastal monitoring wells were originally installed ~1987.
- Soquel Creek Water District's goal set in 2011 is to maintain seawater interface at current depth at coastal monitoring wells (i.e., below SC-A1A, between SC-A8A and A8B, within SC-A2B and within SC-A3B).

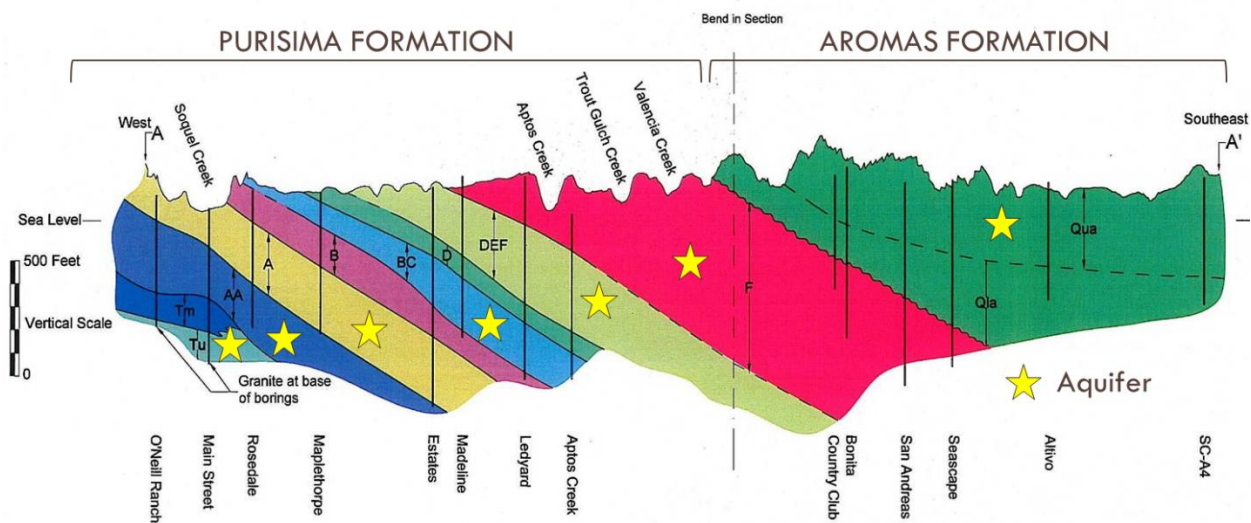
Purisima Area (Purisima Formation Aquifers Deeper than F Unit):

- No seawater intrusion has been detected onshore in Soquel Creek Water District monitoring wells despite low groundwater elevations historically. A recent geophysical survey (SkyTEM) detected salty water at the shoreline in the deeper Purisima aquifers and the underlie Tu unit. This survey indicates seawater intrusion is just offshore and has a high probability of intruding onshore if groundwater levels remain below protective elevations.
- Soquel Creek Water District's goal is to keep seawater intrusion offshore in deepest unit between Coastal monitoring well and coast likely to provide groundwater supply in the area (Purisima A, BC, and DEF moving west to east). Only non-municipal wells would likely be located between the coast and Coastal monitoring wells, and it is not likely they would pump from below the Purisima units

protected by Soquel Creek Water District and there are shallower productive units they would likely pump from.

- By only protecting the deepest productive units (Purisima A, BC, and DEF), it implies onshore intrusion can occur below those units because protective groundwater levels have not been set below the protected Purisima unit (i.e., Purisima AA/Tu units where Purisima A unit overlies). There is need to consider setting protective elevations for deeper units such as Purisima AA and Tu where pumping has been increased and projects could utilize more groundwater.
- The City of Santa Cruz had two monitoring wells impacted by seawater intrusion in the Purisima A unit. However, in the Moran Lake monitoring well chloride concentrations have decreased to levels below 250 mg/L with increased groundwater levels. The Medium level screen of the Soquel Point monitoring well continues to be intruded with seawater.
- The City of Santa Cruz’s implied goal from its Ghyben-Herzberg protective groundwater elevations is to keep seawater intrusion below its Medium screens in the Purisima A unit of its coastal monitoring wells. This implies seawater intrusion can occur in any screens below the Medium screens. The City’s deepest screens are partially in the Purisima AA unit and are at risk from seawater intrusion given the recent SkyTEM geophysical survey which detected salty water at the shoreline in the deepest Purisima aquifer (AA unit) and the Tu unit.

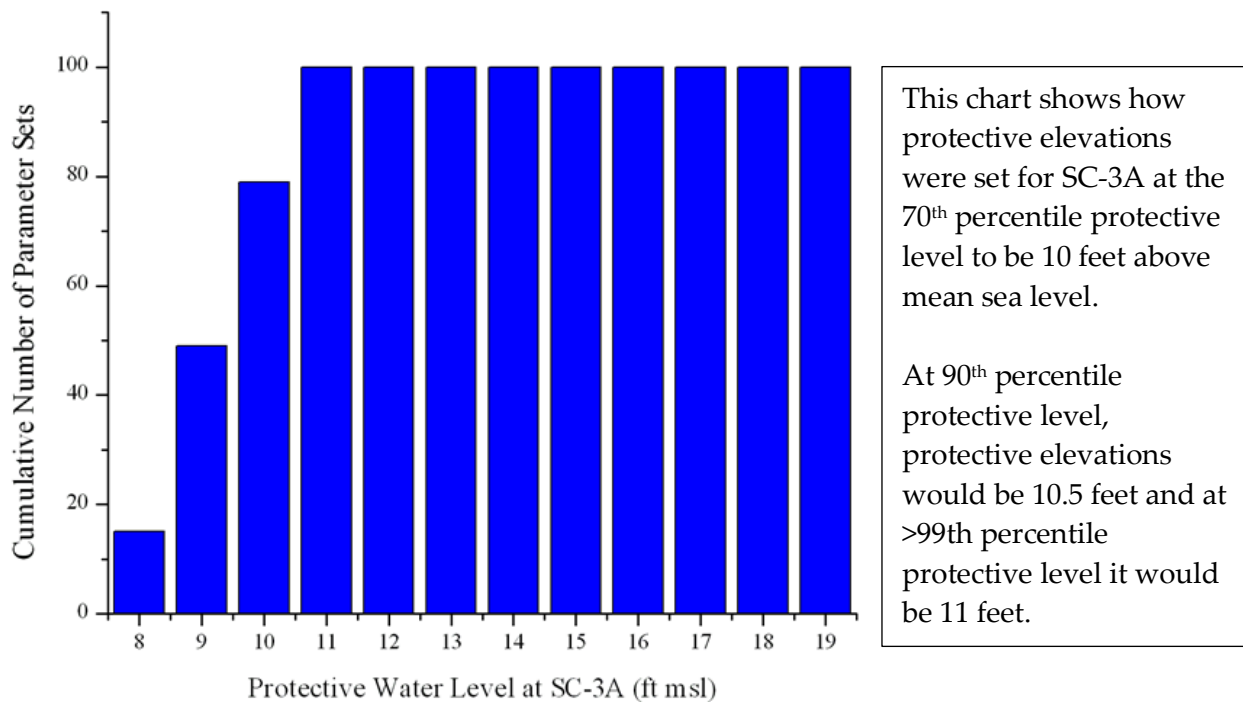
For reference and context, the aquifer cross-section graphic is provided below to allow visualization of where each aquifer is in relation to one another.



Risk Policy

Both Soquel Creek Water District and the City of Santa Cruz have established protective elevations at Coastal monitoring wells. They each used different methods for doing so, with the Soquel Creek Water District making a risk policy decision in their development of protective elevations.

- A risk estimation technique was used to estimate risk of seawater intrusion at different protective elevations. Soquel Creek Water District made a policy decision to use the 70th percentile protective level (or 30% risk).
- The City of Santa Cruz uses the Ghyben-Herzberg calculation for determining protective elevation. This calculation is considered more conservative than the method used by the Soquel Creek Water District.



Cumulative Distribution of Protective Water Levels at SC-3A Resulting from Random Parameter Sets

In the Mid-County Basin, technical staff recommends that both **chloride concentration and protective elevation** conditions need to be met to avoid undesirable results. The use of protective elevations was implemented in managing seawater intrusion because most of the coast is not intruded by seawater. The agencies wanted a proactive way of managing the basin that prevented seawater intrusion instead of waiting to detect it in the Coastal monitoring wells. So far this approach has been successful in controlling seawater intrusion as evident by decreasing chloride concentrations in wells where long-term groundwater elevations are above protective elevations. Even where seawater intrusion is detected onshore (Aromas area and Soquel Point), using protective elevations

as a groundwater level proxy facilitates basin management because groundwater levels are easier to monitor and model than water quality. There is no groundwater quality model for the basin, however, the basin groundwater flow model will be used to evaluate whether various future projects and management actions are able to meet groundwater level related Minimum Thresholds.

2. TECHNICAL STAFF PROPOSAL FOR WHAT IS CONSIDERED A SIGNIFICANT AND UNREASONABLE CONDITION (what we want to avoid)

Advisory Committee Objective: Select a statement that represents what beneficial users of the basin want to avoid happening from seawater intrusion.

Technical staff proposal:

Aromas aquifer – seawater intrusion found at depths shallower to those observed in intruded Coastal monitoring wells (i.e., existing seawater intrusion is ok) and

<p>Rationale: Based on existing seawater intrusion management.</p>
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Purisima aquifer - in currently unintruded areas, seawater intrusion moves inland from the coast (i.e., no onshore seawater intrusion allowed), and seawater intrusion found at depths shallower than those observed in currently intruded Purisima A unit area (Soquel Point (Med))(i.e., existing seawater intrusion is ok)

Some other less protective options:

- Seawater intrusion impacting production wells. Intrusion would be allowed to progress farther inland than it is now, but not farther than the closest private, agricultural, or municipal production well (i.e., more intrusion than current is ok).
- Seawater intrusion impacting Coastal monitoring wells in Purisima area. Intrusion would be allowed to progress farther inland than it is now, but not farther than Coastal monitoring wells, presumed to be between coast and municipal production wells (i.e., more intrusion than current is ok).

A more protective option:

- Seawater intrusion farther inland than the coastline for each aquifer (i.e., any intrusion is not ok).

Like the technical staff proposal, consider allowing intrusion into some aquifers but not others (hybrid of the above options).

3. TECHNICAL STAFF PROPOSAL - UNDESIRABLE RESULTS (what set of conditions would cause significant and unreasonable impacts to occur)

Overarching Advisory Committee Objective: Select a set of A) chloride concentrations and B) protective elevation conditions that if exceeded would cause significant and unreasonable impacts to occur.

Note from DWR: The occurrence of one or more Undesirable Results within the initial 20-year period (by 2040) does not, by itself, necessarily indicate that a basin is not being managed sustainably, or that it will not achieve sustainability within the 20-year period. However, GSPs must clearly define a planned pathway to reach sustainability in the form of interim milestones, and show actual progress in annual reporting.

A. Undesirable Results for Chloride Concentrations

Advisory Committee Objective: Select level of flexibility to avoid undesirable results in

i) Intruded Coastal Monitoring Wells and ii) Unintruded Coastal Monitoring Wells or Representative Inland Monitoring wells

Generic Framing: If any Monitoring well with intrusion has a chloride concentration above <threshold concentration> mg/L in <number of samples> during a <certain period>

The words in < > represent variables that change how easily we can meet the threshold concentration. If we demonstrate that we are able to avoid Undesirable Results within 20 years then the State views the basin as sustainable. Below are examples to show how changing the variables makes it easier or more difficult to avoid Undesirable Results.

Concentration:

- the lower the threshold concentration, the more difficult it might be to remain below that threshold and the more difficult it will be to avoid Undesirable Results (less flexibility)
- the higher the threshold concentration, the easier it will be to meet the threshold but then there is a greater risk of degrading water quality (more flexibility)

Number of samples:

- the fewer the number of samples that can exceed the concentration, the more difficult it will be to avoid Undesirable Results (less flexibility)
- the more samples that can exceed the threshold concentration, the easier it will be to avoid Undesirable Results (more flexibility)

Certain time period:

- the shorter the time period over which we evaluate whether wells exceed the threshold, the fewer samples we have to determine if the threshold concentration is being met, thereby decreasing our confidence that this is a true change in water quality and not just seasonal fluctuations (less flexibility)
- the longer the time period over which we evaluate whether wells exceed the threshold, the more samples we have to determine if the threshold concentration is being met, thereby increasing our confidence that this is a true change in water quality and not just seasonal fluctuations (more flexibility)

i) Intruded Coastal Monitoring Wells

Technical staff’s proposal of Undesirable Results for Intruded Coastal Monitoring wells:

Any Coastal Monitoring well with current intrusion has a chloride concentration above its 2013 – 2017 average chloride concentration. This concentration must be exceeded in more than 75% of the last 8 consecutive samples (quarterly sampled wells).

Rationale:
 5-year average takes into account recent natural concentration fluctuations.
 Number of samples and time period allow for some outliers over a 2-year period.

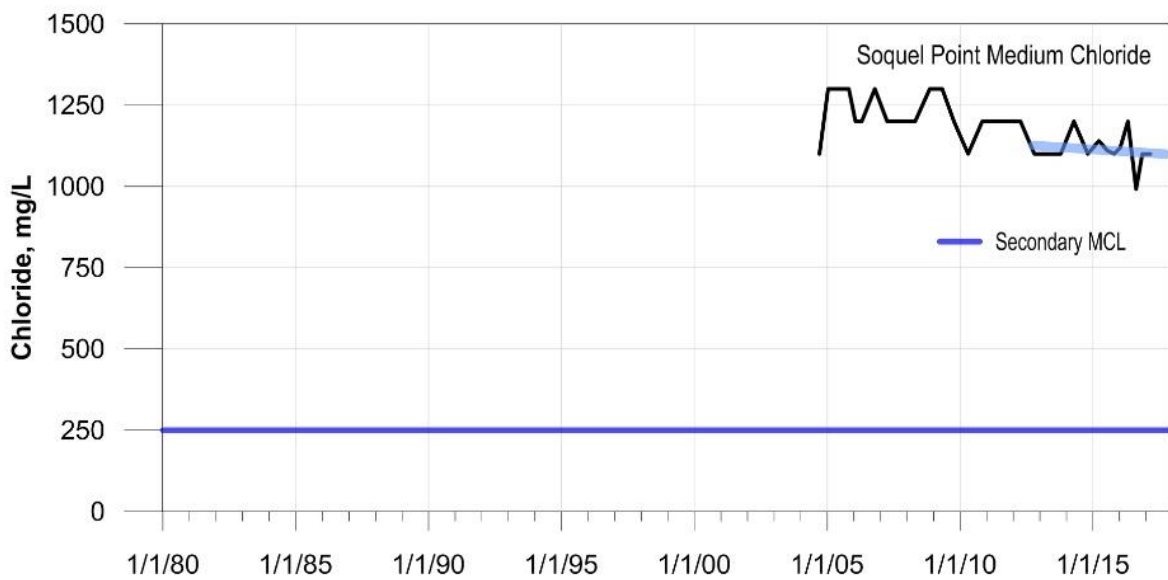
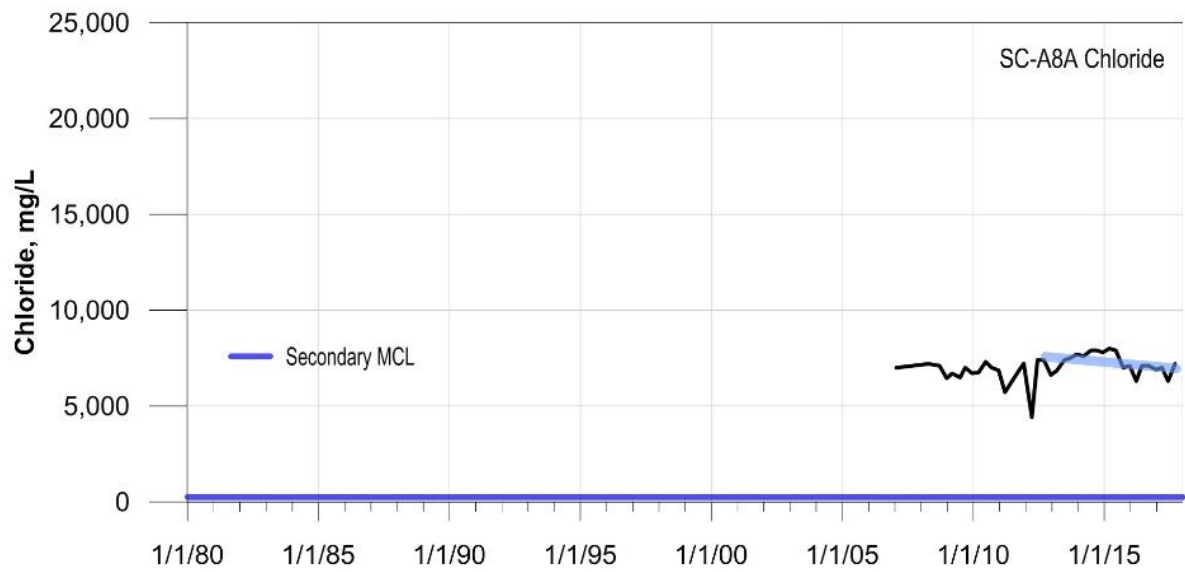
More flexibility in avoiding undesirable results:

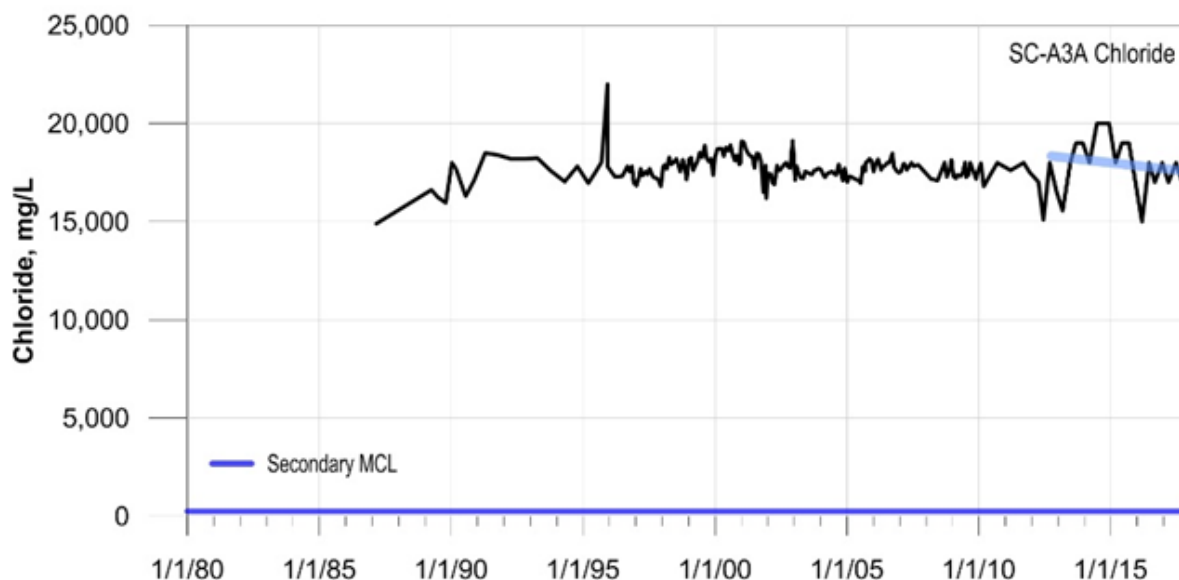
Any Coastal Monitoring well with current intrusion has a chloride increase above its historical maximum chloride concentration. This concentration must be exceeded in 100% of the last 8 consecutive samples (quarterly sampled wells).

Less flexibility in avoiding undesirable results:

Any Coastal Monitoring well with current intrusion has a chloride increase above its 2013 – 2017 average chloride concentration. This concentration must be exceeded in 50% of the last 4 consecutive samples (quarterly sampled wells).

For reference, chemographs (charts showing chloride concentrations over time) for Coastal monitoring wells with seawater intrusion within the basin are provided on the following pages. These charts show how seawater impacted Coastal monitoring wells SC-A2B after it was installed. Monitoring wells Soquel Point (Med) and SC-A8A were already impacted at the time the well was installed, and monitoring well SC-A3 had increasing concentrations until about 1993. Note the seasonal variability in chloride concentrations that need to be considered when looking at how often wells can exceed Minimum Thresholds in order cause Undesirable Results.





ii) *Inland and Unintruded Coastal Monitoring Wells*

Technical staff’s proposal of Undesirable Results for Inland Representative Monitoring or unintruded Coastal Monitoring Wells:

Any Inland Representative Monitoring or unintruded Coastal Monitoring Well has a chloride concentration above 250 mg/L. This concentration must be exceeded in more than 2 (50%) of the last 4 consecutive samples.

Rationale:
 250 mg/L is the basin water quality objective and recommended secondary maximum contaminant level.
 Coastal monitoring wells are sampled quarterly, and inland wells twice a year. Inland wells are evaluated over a 2-year period, and the early warning Coastal wells are evaluated over a one year period. This gives the Coastal wells more importance while still providing some flexibility in avoiding Undesirable Results.

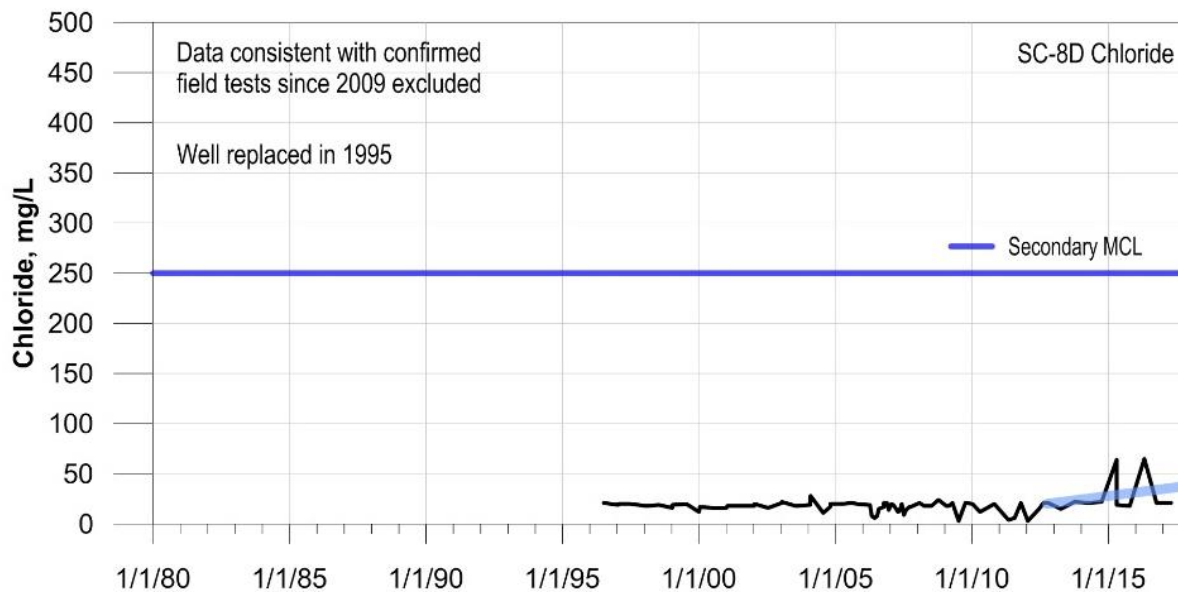
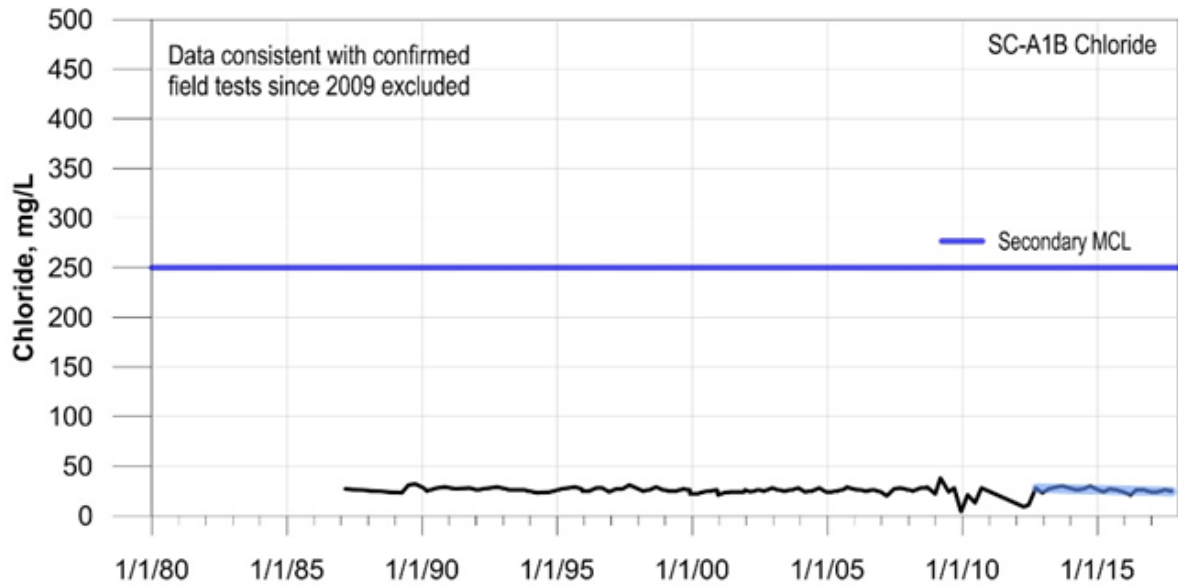
More flexibility in avoiding undesirable results:

Any Inland Representative Monitoring or unintruded Coastal Monitoring Well has a chloride concentration above 500 mg/L (upper range of secondary maximum contaminant level). This concentration must be exceeded in all of (100%) the last 4 consecutive samples.

Less flexibility in avoiding undesirable results:

Any Inland Representative Monitoring or unintruded Coastal Monitoring Well has a chloride concentration above 125 mg/L. This concentration must be exceeded in more than 2 (50%) of the last 4 consecutive samples.

Two examples of chloride concentrations in unintruded wells are shown below to illustrate how concentrations vary over time, even though they are not impacted by seawater.



3B. Technical Staff Proposal - Undesirable Results for Protective Groundwater Elevations

Advisory Committee Objective: Select level of flexibility in meeting protective groundwater elevations to avoid undesirable results

Generic Framing: <Period of time for averaging groundwater elevations> average groundwater elevation below protective groundwater elevations in Coastal Monitoring Wells for <number of wells>

The words in < > represent variables that change how easily we can meet the protective groundwater level. Below are examples to show how changing the variables makes it easier or more difficult to avoid Undesirable Results with respect to protective groundwater elevations.

Period of time for averaging groundwater elevations:

- the longer the time period over which to average groundwater elevations in a well, the easier it will be to be above protective elevations (more flexible), i.e., for wells above the protective elevation already, you can have a few levels below protective elevations and still avoid Undesirable Results
- the shorter the time period over which to average groundwater elevations in a well, the more difficult it will be to be above protective elevations (less flexible), i.e., for wells above the protective elevation already, a few levels below protective elevations may cause Undesirable Results

Number of wells:

- The fewer wells that have levels below protective elevations, the lower the risk seawater intrusion
- The more wells that have levels below protective elevations, the higher the risk of seawater intrusion

Technical staff's proposal of Undesirable Results for Protective Groundwater Elevations in Coastal Monitoring wells:

Five-year average groundwater elevations below protective groundwater elevations in Coastal Monitoring Wells for any well

Rationale:

5-year average groundwater elevation provides some flexibility in avoiding Undesirable Results. The current policy is to have groundwater elevations in all Coastal Monitoring wells above protective elevations.

More flexibility in avoiding undesirable results:

Ten-year average groundwater elevations below protective groundwater elevations in Coastal Monitoring Wells in more than 1 of the 13 wells

Less flexibility in avoiding undesirable results:

Three-year average groundwater elevations below protective groundwater elevations in Coastal Monitoring Wells for any well

Technical Staff Proposal Land Subsidence Minimum Thresholds

This document is organized into the following sections:

1. Background – land subsidence susceptibility in the Mid-County Basin
2. Guidance - Use Groundwater Levels as a Proxy for Land Subsidence Minimum Thresholds
3. Technical staff proposal for what would represent a Significant and Unreasonable condition (what we want to avoid)
4. Technical Staff Proposal - Undesirable Results in Purisima A, BC, and DEF units, using groundwater levels as a proxy for subsidence
5. Technical Staff Proposal - Undesirable Results in Purisima AA/Tu unit, using ground surface elevations as the numeric

1. BACKGROUND - LAND SUBSIDENCE SUSCEPTIBILITY IN THE MID-COUNTY BASIN

Conditions you need for land subsidence to occur:

- Drainage and decomposition of organic soils,
- Underground mining, oil and gas extraction, hydrocompaction, natural compaction, sinkholes, and thawing permafrost, or
- Aquifer-system compaction

There are no known organic soils in the Mid-County Basin. The depositional environments of the sediments comprising the basin's aquifers are not conducive to deposition of organics.

There is no underground mining, oil and gas extraction, hydrocompaction, natural compaction, sinkholes, and thawing permafrost occurring in the basin.

Because there have historically been declines in groundwater levels (greater than 50 feet), the possibility of aquifer-system compaction does exist. Susceptibility to land subsidence from groundwater level declines requires aquitards (fine-grained silts and clays) above- or within-which preconsolidation-stress thresholds are exceeded. There are aquitards in the Mid-County Basin between the aquifer units. However, in areas with pumping, the bottom elevations of aquitards are generally more than 100 feet below sea level, which is deeper than typical groundwater levels. This means that the aquitards do not get dewatered, but may still be subjected to changes in preconsolidation stresses.

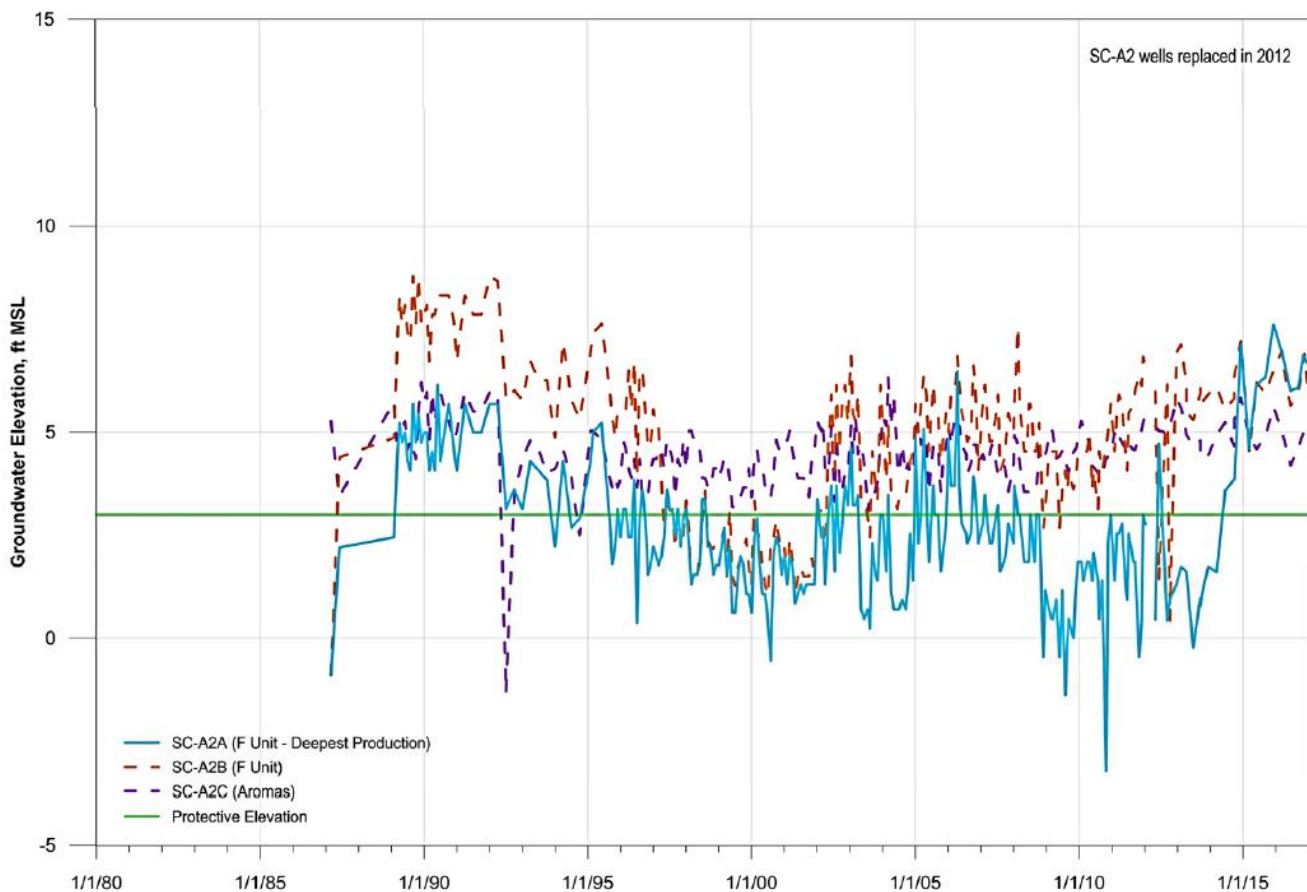
HAS ANY SUBSIDENCE OCCURRED DURING HISTORIC LOW GROUNDWATER LEVELS?

The greatest groundwater level declines since recording levels started in 1984 are in the Purisima BC units where declines in the order of 140 feet historically occurred. The Purisima A and DEF units have also had significant historical declines that led to historic low levels, which have since recovered. The table below summarizes the maximum declines for each aquifer and lists the associated hydrograph.

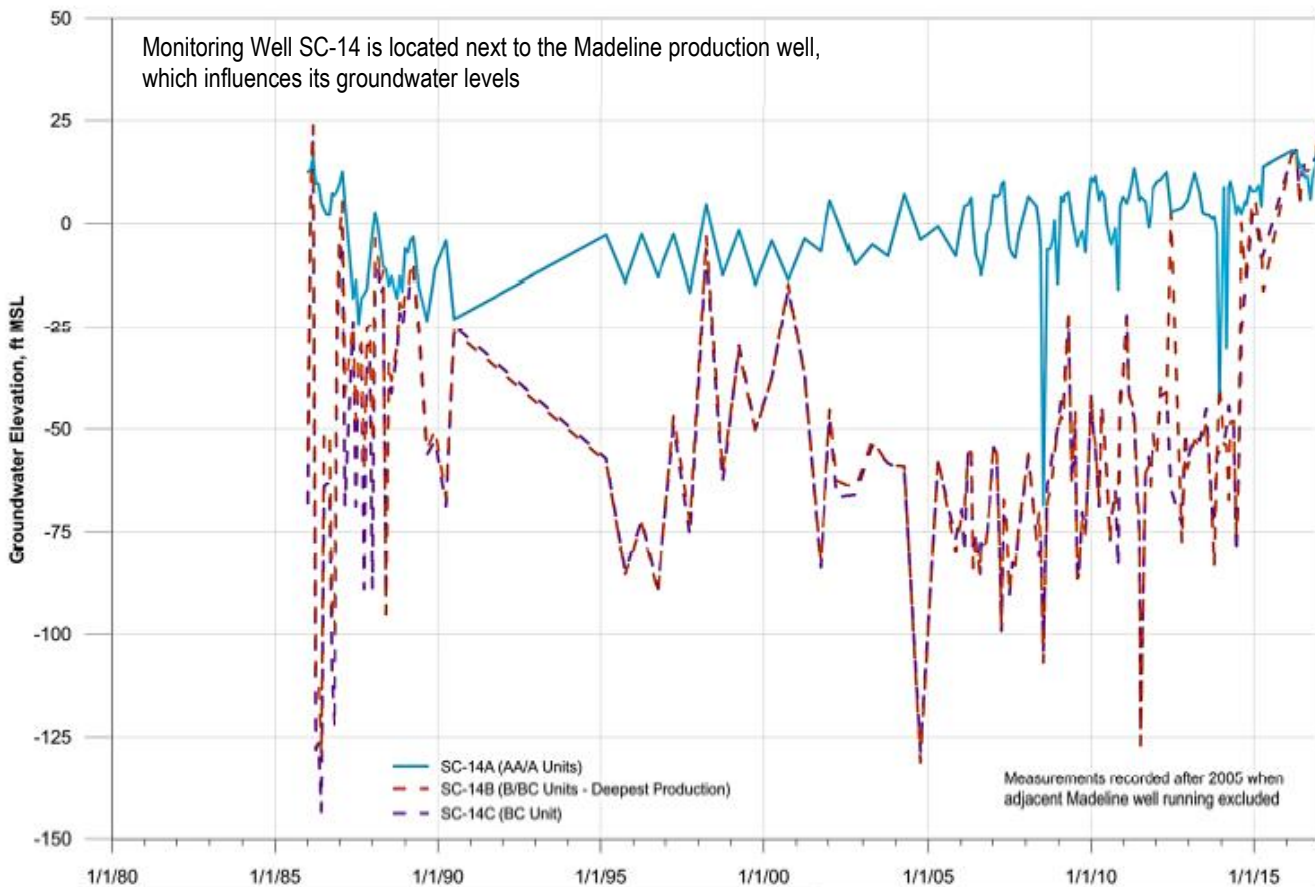
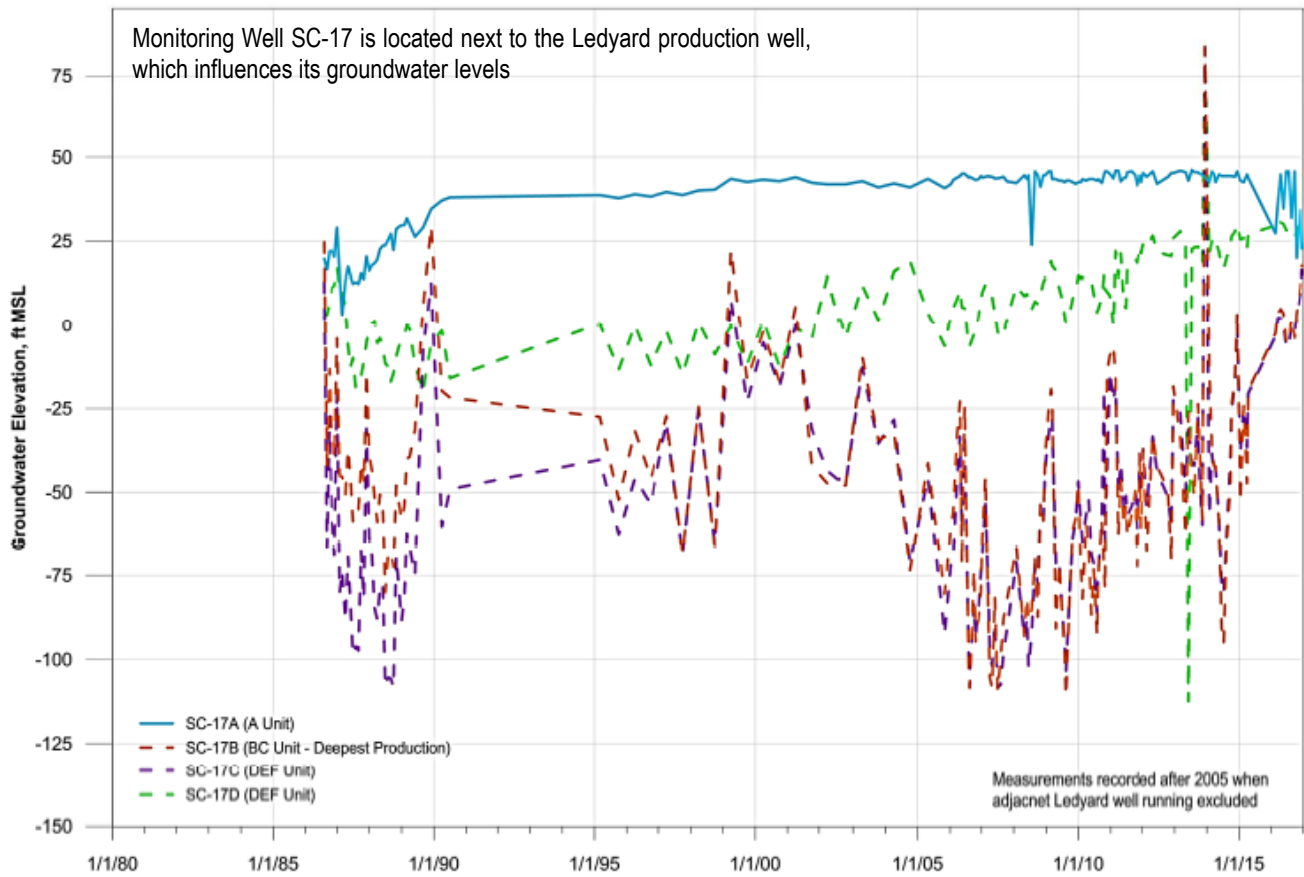
Years of historic low groundwater levels:

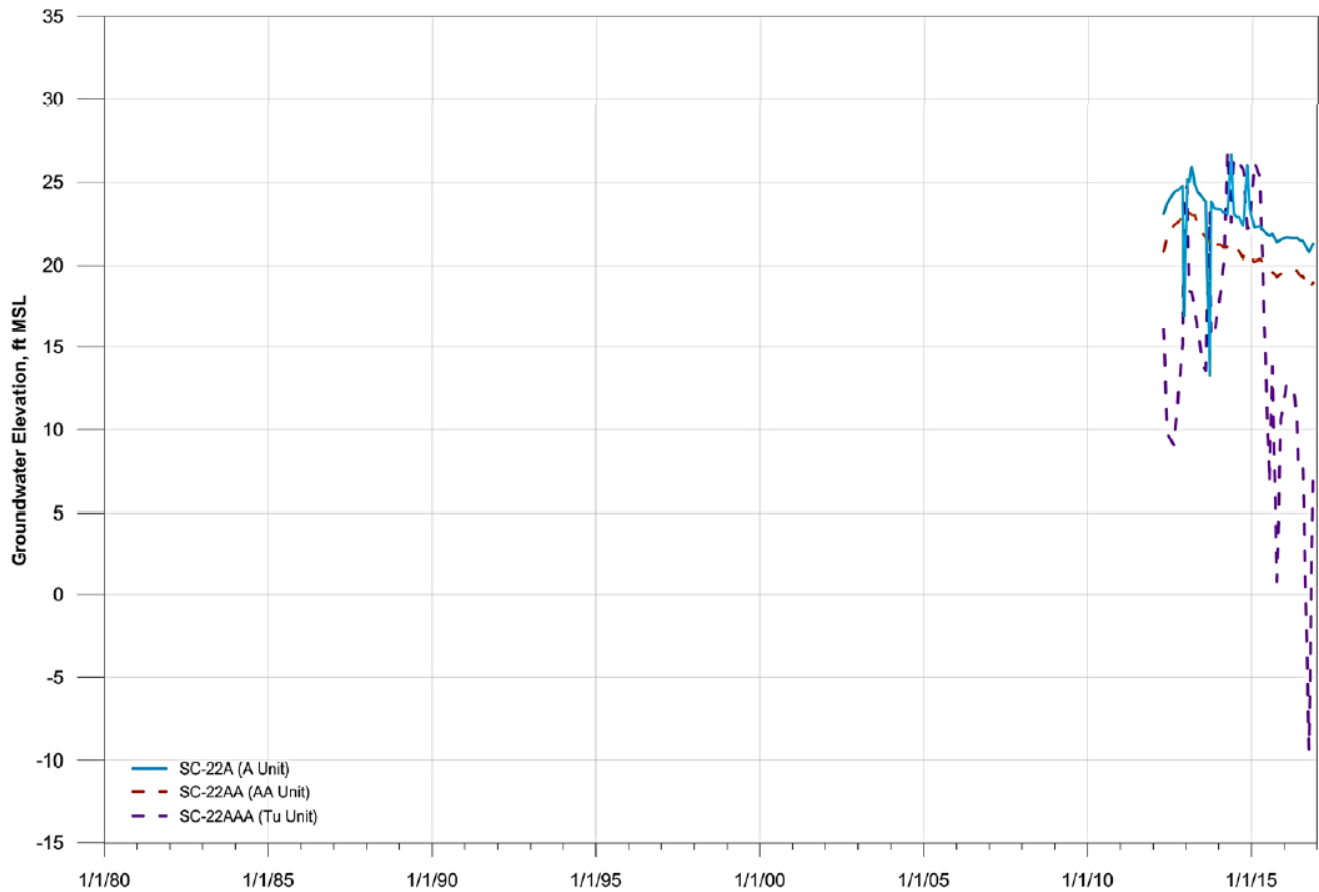
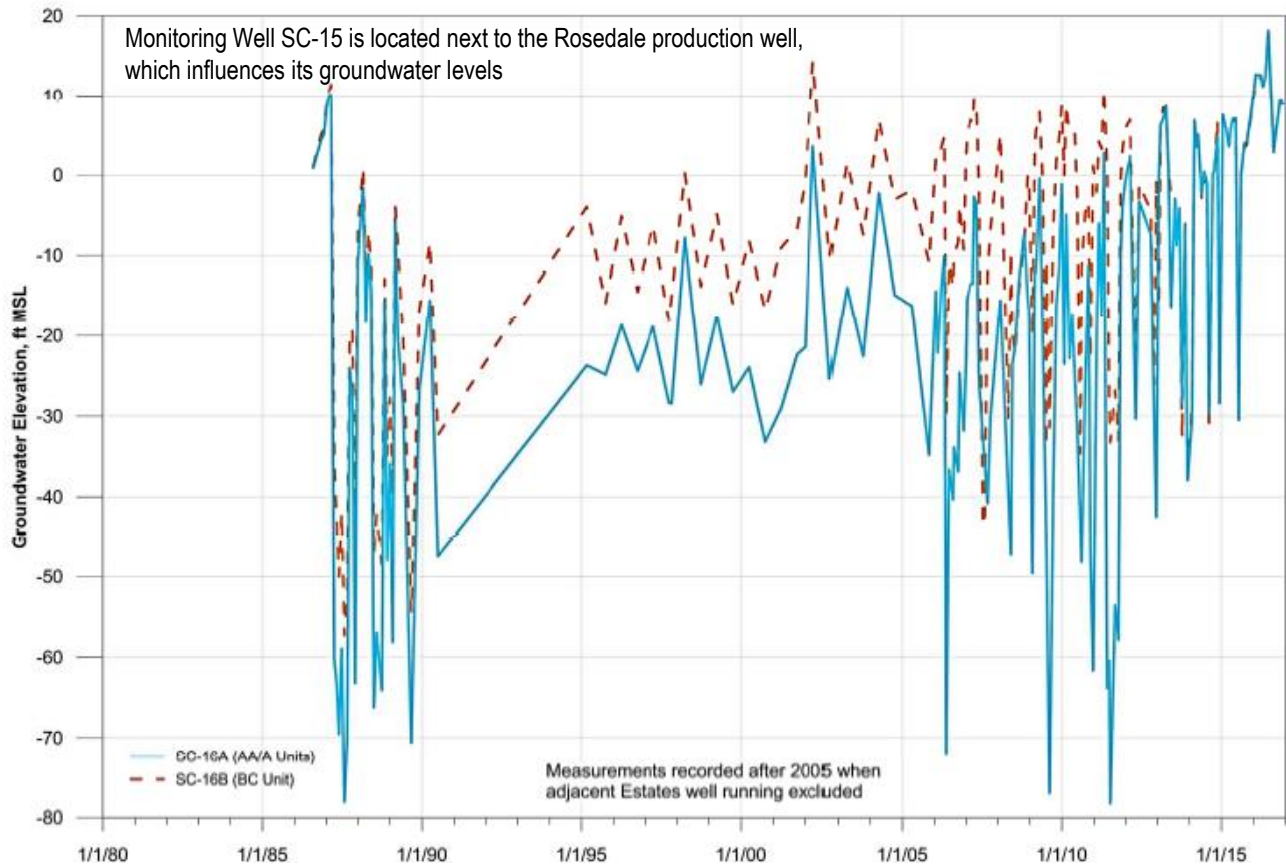
Unit	Maximum Decline, feet	Year of Historic Low
Aromas/Purisima F	5 (SC-A2A)	2000
Purisima DEF	100 (SC-17C)	1988
Purisima BC	140 (SC-14B)	1986
Purisima A	80 (SC-16A)	1988
Purisima AA/Tu	35 (SC-22AAA)	2017

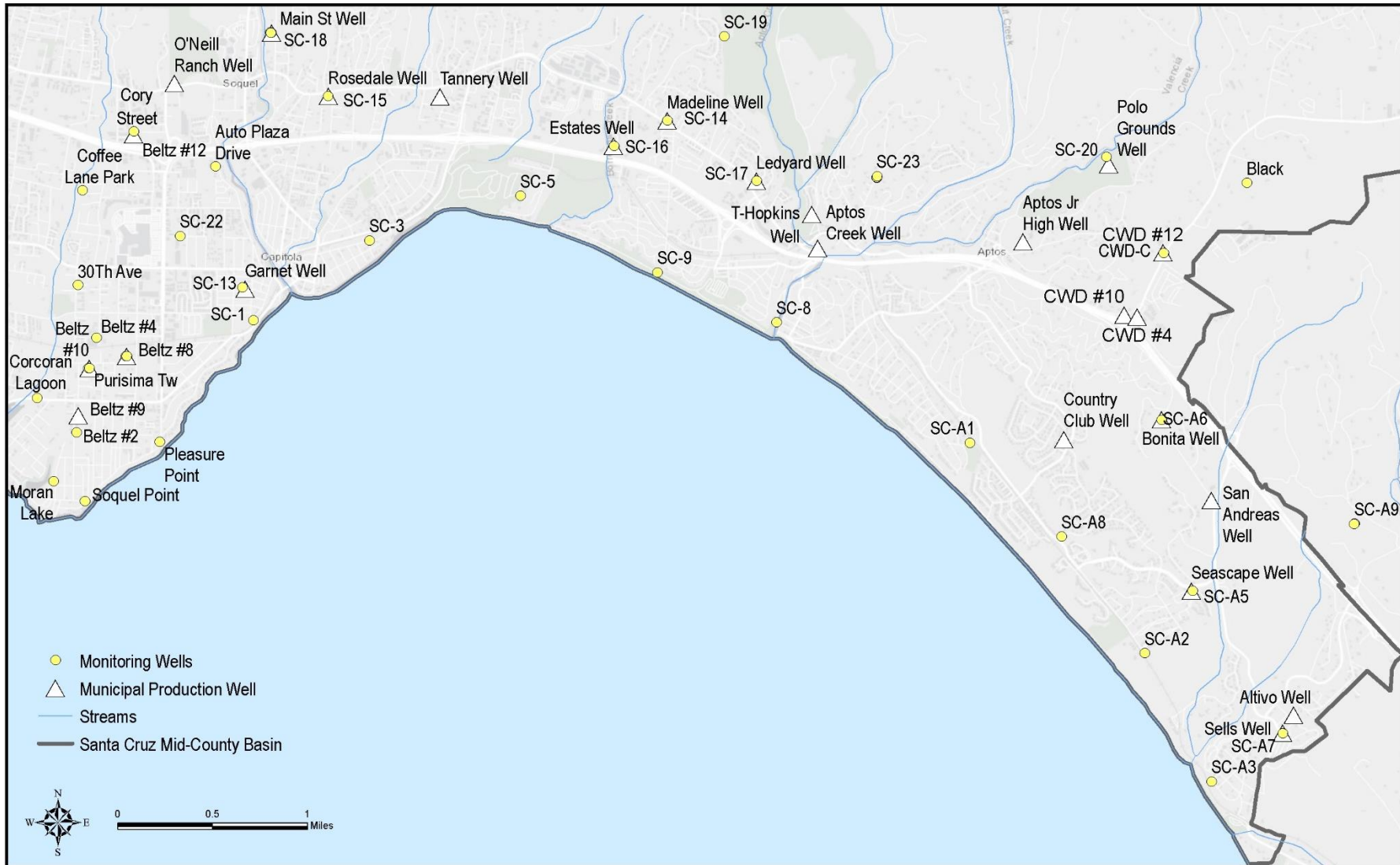
Hydrographs of wells with greatest declines are shown below. A map showing locations of the wells is included after the last hydrograph.



Proposal for Subsidence Minimum Thresholds







For all groundwater elevation declines in the basin there is no reported evidence of the typical manifestations of land subsidence on manmade infrastructure or natural systems (described below) either during or after the documented historic low periods. Groundwater elevation declines in the Purisima AA/Tu unit are too recent to evaluate for any long-term effects, but have shown none of the typical manifestations of land subsidence to date.

Examples of subsidence effects on manmade infrastructures which have not been observed in the Mid-County Basin:

- Changes to gradients of water conveyance structures (e.g., canals, pipelines) causing reductions in designed flow capacity (Central Valley),
- Damage to roads and railways,
- Damage to bridges and buildings, and
- Damage to pipelines and wells.

Example of subsidence effects on natural systems which have not been observed in the Mid-County Basin:

- Permanently decreased capacity to store groundwater in affected parts of a basin,
- If topography of the land changes by varying amounts in different places, the low areas, such as wetlands, will change size and shape, migrate to lower elevations, or even disappear, and
- Rivers changing course or erosion/deposition patterns changing to reach a new equilibrium.

2. GUIDANCE - USE GROUNDWATER LEVELS AS A PROXY FOR LAND SUBSIDENCE MINIMUM THRESHOLDS

DWR will allow groundwater levels to act as a proxy for land subsidence Minimum Thresholds if the following applies: the GSA must establish and document that subsidence has not/will not occur if groundwater levels are maintained above minimum historic levels, then any Minimum Threshold for groundwater levels that is higher than historic low groundwater levels would avoid land subsidence as well.

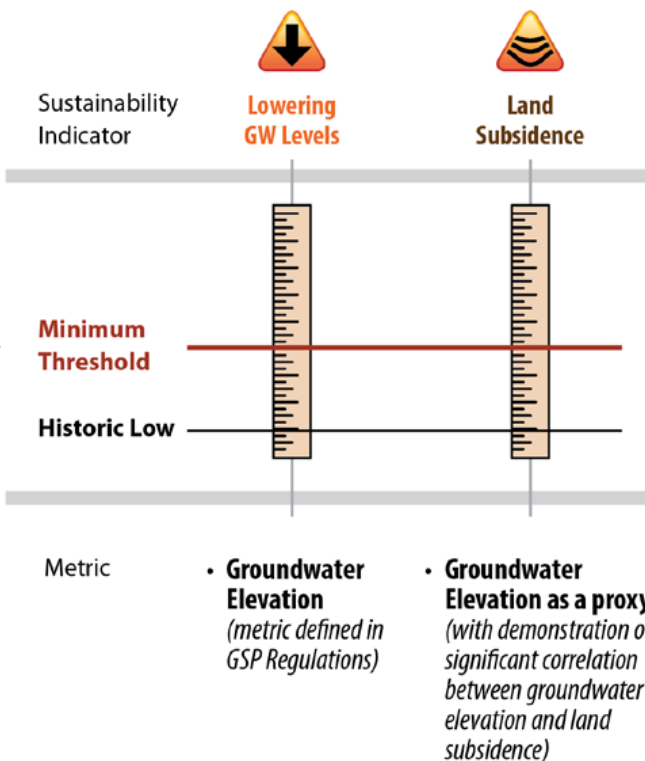
This approach results in applying the same numeric definition (groundwater levels) to two Undesirable Results – chronic lowering of groundwater and land subsidence (see following figure).

EXAMPLE 1

Groundwater elevation as a proxy for land subsidence



- = Groundwater Level Representative Monitoring Site
- = Land Subsidence Representative Monitoring Site
- MA = Management Area



Proposed direction from the technical staff:

Because historic low groundwater levels in the Mid-County Basin will all be lower than the Minimum Thresholds for chronic lowering of groundwater levels, then we recommend groundwater levels as a proxy for land subsidence in all aquifers, except in the Purisima AA/Tu unit. The Purisima AA/Tu unit has too recent of a decline in groundwater levels to determine if historic low levels would be protective against subsidence or not.

Purisima AA/Tu unit Minimum Thresholds will need to be based on measured land surface elevation changes, instead of groundwater levels like the other aquifers.

3. TECHNICAL STAFF PROPOSAL FOR WHAT WOULD REPRESENT A SIGNIFICANT AND UNREASONABLE CONDITION (what we want to avoid)

Advisory Committee Objective: Select or adapt a statement of what represents significant and unreasonable subsidence conditions in the basin.

Rationale:
 There is a very low likelihood that subsidence will occur in the basin, even more so with groundwater being managed. Making sure no subsidence occurs will not be difficult to achieve since historically it has not happened.

**Technical staff’s proposal:
 Any land subsidence occurring**

A less protective option:

- Land subsidence occurring in developed areas only (ok if it occurs in undeveloped areas)

4. TECHNICAL STAFF PROPOSAL - UNDESIRABLE RESULTS IN AROMAS, PURISIMA A, BC, AND DEF UNITS, USING GROUNDWATER LEVELS AS A PROXY FOR SUBSIDENCE (what set of conditions would cause significant and unreasonable subsidence impacts to occur)

Advisory Committee Objective: Select a set of groundwater levels conditions that if exceeded would cause significant and unreasonable impacts to occur.

Generic Framing: <Number of wells > Representative monitoring wells in the Aromas and Purisima A, BC, and DEF units with groundwater levels below their historic lows in <area>

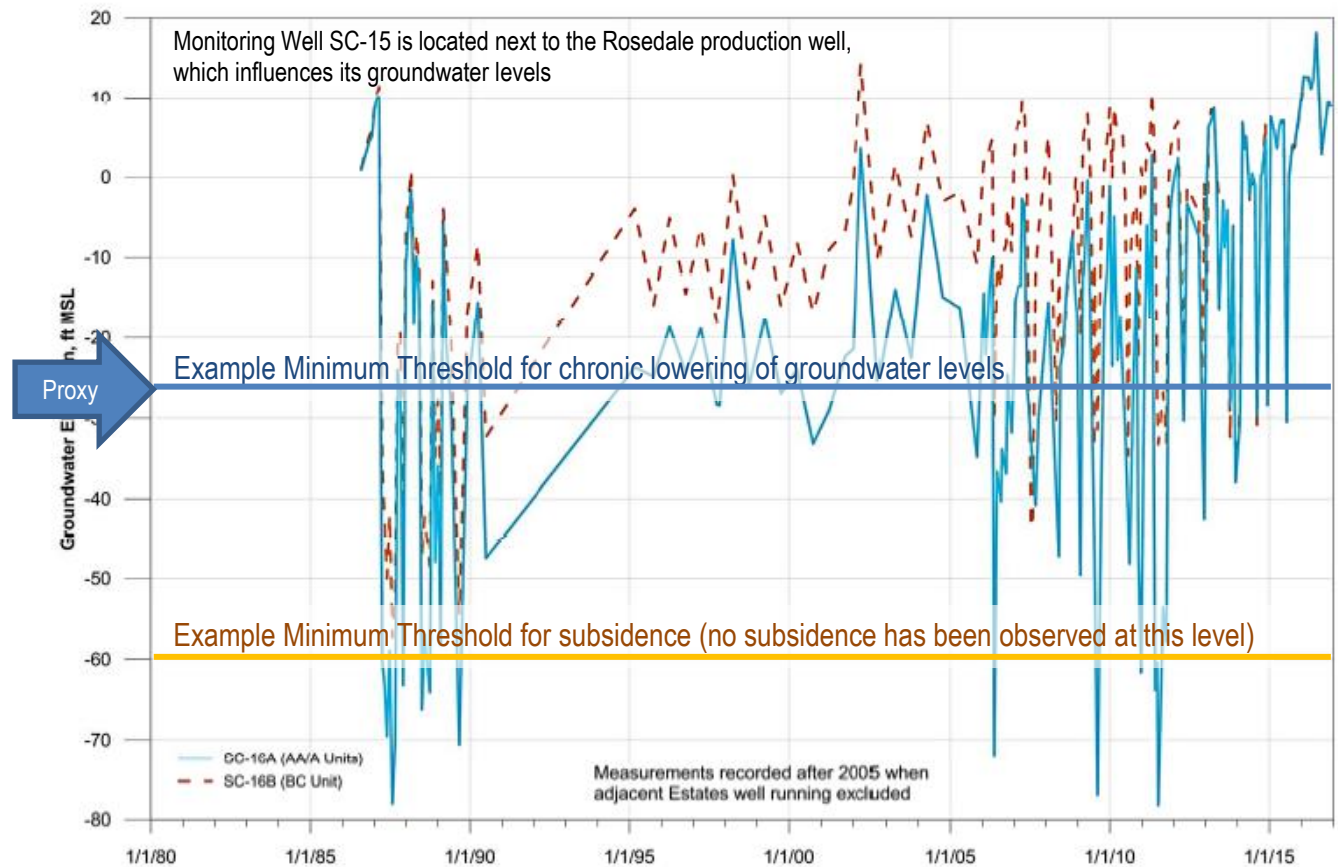
The words in < > represent variables that change how easily we can meet the threshold of historic low groundwater elevations in Representative monitoring wells, if we conservatively assume that land subsidence may occur if groundwater levels fall below their historical lows.

To justify why we can use chronic lowering of groundwater level Minimum Thresholds, a very protective (inflexible) proposal of Undesirable Results for subsidence in the Aromas and Purisima A, BC, and DEF units is provided below.

Technical staff’s proposal of an Undesirable Result in the Aromas and Purisima A, BC, and DEF units:

Any representative monitoring well in the Aromas and Purisima A, BC, and DEF units with groundwater levels below their historic lows in any part of the basin

When we establish Minimum Thresholds for chronic lowering of groundwater levels, these thresholds will be much higher than historic low levels. This allows us to use Minimum Thresholds for chronic lowering of groundwater levels as a proxy for subsidence, because thresholds for chronic lowering of groundwater levels will always be higher than subsidence thresholds that would probably be set just above historical low groundwater levels. This concept is illustrated on the hydrograph below.



5. TECHNICAL STAFF PROPOSAL - UNDESIRABLE RESULTS IN PURISIMA AA/TU UNIT, USING GROUND SURFACE ELEVATIONS AS THE METRIC (what set of conditions would cause significant and unreasonable subsidence impacts to occur from pumping the Purisima AA/Tu unit)

Advisory Committee Objective: Select a combination of subsidence rates and extent that if exceeded would cause significant and unreasonable impacts to occur.

If a groundwater level proxy cannot be used for subsidence, the metrics for subsidence as an indicator of sustainability are rate and extent of subsidence. Note that there is no subsidence monitoring infrastructure or subsidence studies conducted to date in the basin because there have been no reports of subsidence.

This metric can only be set for areas with land surface elevation monitoring to check if the threshold rate of subsidence is being exceeded. In this case, monitoring infrastructure will need to be established in areas where there are large groundwater declines in the Purisima AA/Tu unit.

Generic Framing: <Rate of subsidence, inches per year> occurring in <extent >

The words in < > represent variables that change how easily we can meet the subsidence threshold. If we demonstrate that we are able to avoid Undesirable Results within 20 years then the State views the basin as sustainable. Below are examples to show how changing the variables makes it easier or more difficult to avoid Undesirable Results.

Rate of subsidence:

- the lower the subsidence rate, the more difficult it might be to remain below that threshold if you have known subsidence and the more difficult it will be to avoid Undesirable Results (less flexibility)
- the higher the subsidence rate, the easier it will be to meet the threshold if you have known subsidence and the easier it will be to avoid Undesirable Results (more flexibility) but there is a greater risk of damage if you have inelastic subsidence
- Example of local subsidence: Santa Clara Valley has a tolerable rate of 0.01 feet (0.12 inches) per year to prevent inelastic subsidence

Extent:

- limiting the threshold area to developed areas only and allowing undeveloped areas to subside may make it easier to avoid Undesirable Results in subsidence prone areas (more flexible) if that aligns with what you consider Significant and Unreasonable basin conditions

Technical staff’s proposal of an Undesirable Result in the Purisima AA/Tu unit:

Any land subsidence occurring in the area where the Purisima AA/Tu unit is being pumped or injected into

Rationale:
The absence of known subsidence in the basin and low susceptibility for it occurring in the future.

It is possible to include in the GSP that subsidence monitoring and/or InSAR (using satellites to measure very small changes in surface elevation over time) will be established after the GSP due date (Jan 2020). We can use data collected from this monitoring to determine if very small changes in land surface have occurred historically (even though no reports of subsidence were reported) and to fine-tune the Minimum Thresholds for the Purisima AA/Tu unit subsidence rates.



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Draft Meeting Summary

Santa Cruz Mid-County Groundwater Sustainability Planning (GSP) Advisory Committee Meeting #5 March 28, 2018, 5:30 – 9:00 pm

This meeting was the fifth convening of the Groundwater Sustainability Planning (GSP) Advisory Committee. It took place on March 28, 2018 from 5:30-9:00 p.m. at the Santa Cruz County Sheriff's Office. This document summarizes presentations to the Advisory Committee and discussion focusing on four Sustainability Indicators: Groundwater Levels, Groundwater Storage, Seawater Intrusion and Surface Water interactions. It also captures additional information provided on Basin conditions; presentation of an example proposal covering Seawater Intrusion; key points of discussion between Advisory Committee members, Santa Cruz Mid-County Groundwater Agency (MGA) staff and consultants; action items; and an overview of public comment received. It is not intended to serve as a detailed transcript of the meeting.

Meeting Objectives

The objectives for the meeting were to:

1. Share additional background information about Basin conditions.
2. Build understanding around four related Sustainability Indicators—Groundwater Levels, Groundwater Storage, Seawater Intrusion, and Surface Water Interactions—to inform future Advisory Committee discussions around initial proposals for each indicator in terms of Significant and Unreasonable Conditions, Minimum Thresholds, and Undesirable Results.
3. Discuss Seawater Intrusion example initial proposal to better understand the information that will be included in future options and alternatives to be presented by support staff.

Action Items

Key action items from the meeting include the following:

1) *Compendium of maps*

- a) *Staff* to revise maps as needed to make them more readable. Include additional information, such as:
 - i) Information on wells that are not already represented in the compendium of maps.
 - b) Page numbers.



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- c) *Staff* to post the maps/charts that were not in the meeting packet.
- d) *Advisory Committee members* to review compendium list of maps/charts and provide feedback to staff, particularly for red lined areas.

2) Committee request for historical basin information

- a) *Staff* to prepare trend information that is representative of basin history.

3) Example proposal – Seawater Intrusion

- a) *Staff/technical consultant* to provide multiple options that may be viable for future proposals.
- b) *Technical consultant* to incorporate an explanation of (Seawater Intrusion) risks in discussing options.
- c) *Technical consultant* to review concept of protective elevations.

4) Working group on streamflow depletion and groundwater dependent ecosystems

- a) *John Ricker* to connect with Coastal Watershed Council about joining the working group.
- b) *Kate Anderton* to send John Ricker contact information for Monterey Bay Aquarium Research Institute and The Nature Conservancy who could potentially join the working group (complete).
- c) *Darcy Pruitt* to follow up with Monterey Bay Aquarium Research Institute staff regarding considerations of groundwater dependent ecosystems in Monterey Bay.
- d) *John Ricker* to reach out to Advisory Committee volunteers (below) regarding further details of the working group.
 - i) Kate Anderton
 - ii) Keith Gudger
 - iii) Bruce Jaffe
 - iv) Jonathan Lear
 - v) Allyson Violante (absent, but indicated interest in advance of the meeting)

5) Other:

- a) *Staff* to review Charter to reassess approach to public comment and ensure approach is Brown Act-compliant.
- b) *Staff* to review date options for Joint MGA/Advisory Committee meeting (May 17 or July 19) and report back to Advisory Committee on final date.



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Meeting attendance

Committee members in attendance included:

1. Kate Anderton, Environmental Representative
2. John Bargetto, Agricultural Representative
3. David Baskin, City of Santa Cruz
4. Rich Casale, Small Water System Management
5. Keith Gudger, At-Large Representative
6. Bruce Jaffe, Soquel Creek Water District
7. Jon Kennedy, Private Well Representative
8. Jonathan Lear, At-Large Representative
9. Dana Katofsky McCarthy, Water Utility Rate Payer
10. Marco Romanini, Central Water District
11. Charlie Rous, At-Large Representative
12. Thomas Wyner for Cabrillo College, Institutional Representative

Committee members who were absent included:

1. Douglas P. Ley, Business Representative
2. Allyson Violante, County of Santa Cruz

Meeting Key Outcomes (linked to agenda items)

1. Introduction and Update on Advisory Committee Membership

John Ricker, County of Santa Cruz, opened the meeting and welcomed participants. Mr. Ricker announced that the MGA Board appointed two new Advisory Committee members: Thomas Wyner, Cabrillo College, Institutional Representative; and Keith Gudger, At-Large Representative. Mr. Ricker asked the two new members, MGA Executive Team, staff and consultant support team around the room to introduce themselves. He then addressed members of the public in attendance and asked them for self-introductions.

Eric Poncelet, Facilitator, reviewed the agenda, meeting objectives, and the updated GSP process timeline.

2. Oral Communications (for items *not* on the agenda)

There were no public comments on general topics related to the Advisory Committee's work during this agenda item.

3. Broader Context for and Interrelationships among Four Focal Sustainability Indicators: Groundwater Levels, Groundwater Storage, Seawater Intrusion, and Surface Water Depletion



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Ron Duncan, Soquel Creek Water District, presented to the Advisory Committee a broader context for and interrelationships among four focal Sustainability Indicators: Groundwater Levels, Groundwater Storage, Seawater Intrusion, and Surface Water Depletion.

The group discussed the following key points following Mr. Duncan's presentation and made several requests to staff:

- The amount of groundwater pumped in the Mid-County Basin in 2016 was the lowest in about 40 years. Factors that influenced this trend in reduced pumping include: population growth, tiered water rates, and increased awareness of water use, among others.
- The graphs would be more helpful and digestible if they were accompanied by or reformatted to include more information. Some suggestions for improving the graphs include:
 - Develop a dashboard/table for key indicator data (e.g., rainfall, population, production) measured on a similar scale over a time period (e.g., five years) that shows the history, change in, and total water use over time.
 - Create a breakdown showing historical changes for different types of water uses and finer detail on pumping for each use.
 - Present data showing the impact of management acts on consumption.

4. Additional Background Information on Basin Conditions to Inform Future Advisory Committee Discussions on Initial Proposals regarding Sustainability Indicators.

Darcy Pruitt, Regional Water Management District and Georgina King, HydroMetrics, shared additional background information on basin conditions in the form of a compendium of maps to inform future Advisory Committee discussions on initial proposals regarding Sustainability Indicators. Ms. Pruitt and Ms. King requested that the Advisory Committee review the listing of maps and charts distributed at the meeting for accuracy and completeness.

Advisory Committee members made the following comments on the compendium of maps:

- The readability of the maps would be improved by including the following information:
 - Information on missing wells; this will assist in determining populations impacted by the GSP.
 - Clearer boundary delineations for water formations (e.g., Purisima, Aromas) and water districts.
 - Maps that show levels and historical data overlay of water use.
 - Disconnected points in major streams (e.g., Valencia at 80-90 feet below water table).
 - Clearer refinements of watershed information.
 - Page numbers on each map for better reference.



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5. Review and Discuss an Example Seawater Intrusion Proposal

Ms. King, HydroMetrics, presented a numeric example of a Seawater Intrusion proposal as requested by the Advisory Committee members.

Key discussion points among Committee members, staff, and consultants included the following:

- An Undesirable Result could be assessed on a quarterly basis and should be applied (mg/L) by aquifer.
- When presenting proposing sustainable management criteria for Sustainability Indicators, staff and consultants should consider and include multiple viable options (e.g., different Minimum Thresholds for different locations).
- Options presented to the Advisory Committee should also consider whether the Minimum Threshold levels chosen lead to management actions.
- The concept of protective elevations should be an iterative component of each proposal presented to the Advisory Committee.
- Staff should provide the Advisory Committee with historical data, context, and rationales for all proposals presented.
- It is important for Advisory Committee members to understand the risks associated with Seawater Intrusion and other Sustainability Indicators.
- It is important to understand the impacts of particular proposal options on neighboring basins, and the impacts of those basins on the Mid-County basin..
- Overall, Advisory Committee members appreciated the format of the example proposal as something on which they could provide feedback and advice.

6. Overview of Management Areas

Ms. King provided an overview of Management Areas, including how they are defined and how they may apply to the Mid-County Basin. Key considerations around the use of Management Areas include:

- It is advisable to have fewer designated Management Areas, as each area would require justification for varying monitoring activities.
- Staff and technical consultant will provide recommendations on Management Areas to the Advisory Committee throughout the discussions on Sustainability Indicators. Committee members are also encouraged to share their recommendations for Management Areas with staff and consultants.
- Management Areas could apply differently to certain areas and stakeholders.



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7. Public Comment

No public comments were provide.

8. Working Group to Review Streamflow Depletion and Groundwater Dependent Ecosystems

Mr. Ricker discussed forming a working group to review streamflow depletion and groundwater dependent ecosystems and invited Advisory Committee members to participate.

The following Committee members volunteered for this working group. Next steps for convening this group are captured above under Action Items.

- Kate Anderton
- Keith Gudger
- Bruce Jaffee
- Jonathan Lear
- Allyson Violante (absent, but indicated interest in advance of the meeting)

9. Confirm February 28th Advisory Committee Meeting Summary

The Advisory Committee members did not have any edits or comments on the February 28th Advisory Committee meeting summary. Mr. Poncelet confirmed it for submission to the MGA Board.

10. Confirm Amended Advisory Committee Charter

Mr. Poncelet explained that the Advisory Committee Charter was updated to reflect changes in Advisory Committee membership. One Committee member noted additional minor updates. Others recommended that staff again review the public involvement section of the Charter (Section 4) for compliance with the Brown Act. The Advisory Committee confirmed the changes made.

11. Next Steps

In closing, Mr. Poncelet reviewed the anticipated meeting objectives for the April, May and June Advisory Committee meetings, as well as action items from this meeting. Darcy Pruitt, RWMF, noted that Executive staff members are working on scheduling the joint MGA Board/Advisory Committee for July rather than May. Executive staff members closed the meeting by thanking the attendees for their participation.

From: Darcy Pruitt
Sent: Tuesday, April 17, 2018 2:59 PM
To: 'Becky Steinbruner' <ki6tkb@yahoo.com>
Cc: Rob Marani <rob@meritage-group.com>
Subject: RE: Wondering About GSP Committee Recording for March 28, 2018?

Dear Ms. Steinbruner,

Thank you for your note and I apologize for the delay in responding to it. It took time to find answers to all of your questions. I will include your email in the committee and board packets as requested.

Recording Availability:

The March 15th MGA meeting video was posted on Thursday, April 12th.
<http://www.midcountygroundwater.org/node/106>. The March 28th GSP Meeting audio recording should be posted by the end of this week. When it is posted it will be available here:
<http://www.midcountygroundwater.org/gsp-advisory-committee/committee-meetings>.

We will see what we can do to improve our turn-around time on preparing the recordings and posting them to the MGA website. As you have noted, there are quality issues with the recordings that we try to address while still preserving the integrity of the original recordings for transparency reasons. We try to balance these competing interests and choose to err on the side of transparency, which doesn't always result in ideal sound quality.

Living Planning Documents:

The living concept of planning documents really breaks the process in to two phases: (1) plan development and (2) plan implementation.

- (1) GSP plan development: During plan preparation the GSP Advisory Committee and MGA Board's public process will focus on policy decisions related to setting local sustainability goals for the basin that are carried out into an unknown future. Together the committee and board members will recommend/set policy goals and provide policy guidance on how to achieve those goals. The planning goals established in the GSP will remain the same until some future planning process is undertaken if changes are required. Policy changes to the GSP could be required by future state laws or a change in local conditions. SGMA states that GSP plan preparation and adoption are exempt from CEQA (Cal. Water Code section 10728.6). However, projects to implement the GSP are not exempt.
- (2) GSP plan implementation: MGA staff and member agencies, with ongoing direction from the MGA Board and their own governing bodies, will carry out implementation of the GSP. Staff will be required to address unknown future conditions to attain the goals set in the GSP as time unfolds. Projects that are identified to fulfill GSP planning goals may not be approved, or if approved and built, may not provide the expected benefits because of changes in climate, groundwater recharge, unforeseen water demands (from future unexpected conditions similar to things like Airbnb, increased cannabis production), and other unexpected future events. The projects required to carry out the GSP's goals will be approved separately from the plan itself as required by law (CEQA, California Coastal Act, Endangered Species Act, etc.)

The MGA Board's purpose as a regional agency is to oversee the attainment of groundwater sustainability in our basin. The board will continue to meet in public to deliberate and direct staff to address these future changes as they arise. If the goals laid out in the GSP must change due to future conditions or changed legal requirements, that future planning process will be a public one.

MGA/GSP Public Comment and Member Contacts:

Both MGA and GSP meetings offer ample opportunity for public comments throughout the meetings. MGA staff have made additional changes since February to include even more opportunities for public comment. You may notice these changes when you next attend.

We have been working on providing email addresses for the board and committee as appropriate. In the interim, you are welcome to contact the GSP Advisory Committee and/or MGA Board members by sending mail and email to me. I will forward your communications as requested. You can also continue to submit comments to me for inclusion in the publicly available meeting packets. Sierra Ryan is also available as an MGA contact, but will be on leave from July through October 2018.

Thank you again for your ongoing sustainability interest in the Santa Cruz Mid-County Groundwater Basin. I hope this email answers your questions.

Best,
Darcy

Darcelle Pruitt Senior Planner

Groundwater Sustainability Planning for the Santa Cruz Mid-County Groundwater Agency
REGIONAL WATER MANAGEMENT FOUNDATION
COMMUNITY FOUNDATION SANTA CRUZ COUNTY
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From: Becky Steinbruner [<mailto:ki6tkb@yahoo.com>]

Sent: Monday, April 09, 2018 4:33 PM

To: Darcy Pruitt <DPruitt@cfsc.org>

Cc: Rob Marani <rob@meritage-group.com>; Becky Steinbruner <ki6tkb@yahoo.com>

Subject: Wondering About GSP Committee Recording for March 28, 2018?

Hi, Ms. Pruitt,

I could not attend all of the March 28 MidCounty Groundwater GSP Advisory meeting and wanted to listen to the parts that I missed before the Santa Cruz City / Soquel Creek Water District Study Session tomorrow night at the Santa Cruz City Council meeting. I looked on the MGA website but did not find it. Will it be posted soon? Also, when will the March 15, 2018 SkyTem Presentation Community video recording be available? I was very glad to see it was recorded by Community Television.

I did review the available Agenda Packet and listened to most of the February 28, 2018 GSP meeting recording. It was difficult to hear many of the speakers and the changes in audio volume were sometimes painful. I found myself constantly having to adjust the volume for various speakers and it made it a challenge to concentrate on what was actually being discussed.

While the audio quality is much improved at the Sheriff's Center (vs. Simpkins Center), it is still difficult for me to understand a good deal of what is said because there sometimes is background noise of shuffling papers, coughing that is very loud, and multiple people speaking, some with modulation that drown out others.

I do have a question for the Board and Advisory Committee:

The technical advisors kept informing the GSP Committee members not to worry too much about addressing some technical aspects, such as building in parameters for climate change and effects on seawater intrusion, because the Plan will be a living document and can always be changed in the future. If the Plan needs to be changed in the future, what would be the process for those changes to be made, and by whom? What would be the criteria for a reconsideration to be initiated?

I want to again ask that there be public comment throughout the future Committee meetings to allow the public poignant and appropriate comment as well as possible beneficial information on the topics being discussed by the Committee. I would also like to again ask that there be some method for the public to communicate directly with their respective interest group representative(s) between meetings. I have asked for this many times, but it has not been addressed.

Please include this message in the next Agenda Packet for both the Board and GSP Committee, and for the Public Record.

Thank you.
Sincerely,
Becky Steinbruner

From: Darcy Pruitt
Sent: Monday, April 16, 2018 1:25 PM
To: 'Becky Steinbruner' <ki6tkb@yahoo.com>
Cc: Rob Marani <rob@meritage-group.com>
Subject: RE: Public Comment for MidCounty Groundwater Agency Board and GSP Advisory Committee Agenda Packets

Dear Ms. Steinbruner,

Thank you for your communication to the MGA Board and GSP Advisory Committee. Your correspondence will be included in the meeting packets as requested.

The SkyTEM report went through a technical review process that, among other things, included participation from members of the USGS and Dr. Knight's lab. Bathymetry and thus seawater depth was considered as part of the data analysis for the report (see Section 9.8, p. 20 of 29). Draft 3D images were developed by Ramboll as part of their contract, but were not especially valuable given the purpose of locating the freshwater/saltwater interface.

The draft 3D images were not developed into final documents because of their limited value as compared to the cost of further development. The layered images (figures 21 and 22) and cross sections (figures 9 and 10 and Appendix 2) available in the report do an excellent job identifying the saltwater/freshwater interface along the coast.

Thank you for your continued interest in groundwater sustainability for the Santa Cruz Mid-County Groundwater Basin.

Best,
Darcy

Darcelle Pruitt Senior Planner

Groundwater Sustainability Planning for the Santa Cruz Mid-County Groundwater Agency
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From: Becky Steinbruner [<mailto:ki6tkb@yahoo.com>]
Sent: Saturday, April 14, 2018 12:52 AM
To: Darcy Pruitt <DPruitt@cfsc.org>
Cc: Rob Marani <rob@meritage-group.com>; Becky Steinbruner <ki6tkb@yahoo.com>
Subject: Public Comment for MidCounty Groundwater Agency Board and GSP Advisory Committee Agenda Packets

Dear Ms. Pruitt,
Please include the following letter in the next MidCounty Groundwater Agency Board and GSP Advisory Committee agenda packets.
Thank you.
Sincerely,
Becky Steinbruner

Dear MicCounty Groundwater Agency Board and GSP Committee Members,
I have reviewed the SkyTEM Report and wonder about the influence of the seawater depth on the ultimate findings. The Survey Design states that the effectiveness of the Electro-Resistivity Tomography (ERT) for locating freshwater beneath sea water is limited by a maximum 15-20 meters salt water depth. No seawater depths are reported in the SkyTEM report. Can you please clarify the sea water depth of the survey areas?

Also, the report discusses the influence of the benthic composition on the degree of salt water intrusion and the survey results. The report does not address this issue in the findings. Did the Ramboll scientists determine the clay vs. sand composition in the seabeds where the survey was conducted?

In the course of my communication with Dr. Rosemary Knight, Stanford University researcher using ERT in 2014 along the MidCounty beaches, I learned about the ability of the Stanford research team to transfer ERT data to 3-D video images. I think this makes the massive volumes of SkyTEM data more meaningful and helps summarize the information into a very understandable format.

Here is the link to the Marina SkyTEM work that Dr. Knights recently conducted and transferred to the 3-D video:

(Dr. Knight gave me permission to share this link with others who are interested in this work.)

"You might be interested in our recent SkyTEM work in Marina - a video displaying the results is here"

<https://www.youtube.com/watch?v=xcgRhKbFW7Q&feature=youtu.be>

Rosemary

I wonder if the MidCounty Groundwater Agency would consider paying either the Ramboll group or Dr. Knight's team to transfer the MidCounty SkyTEM report into this 3-D video format? I think it would be helpful for better interpretation of the results and help the GSP Advisory group make better use of the data.

Please respond. Thank you.

Sincerely,
Becky Steinbruner