Chapter 8 Salt and Nutrient Monitoring Plan

8.1 Introduction

Groundwater quality monitoring is a key component of a proactive strategy to meeting water quality objectives within the basin. Groundwater quality is currently monitored in the Santa Rosa Plain to meet regulatory requirements, including drinking water regulations enforced by the CDPH and regulations of the North Coast Regional Water Quality Control Board, as well as for special studies such as the GAMA program, and reclamation system well monitoring.

This monitoring plan expands upon the *Santa Rosa Subregional Reclamation System Soils and Groundwater Monitoring Program Operations Manual* (CH2M HILL 1991). The 1991 Operations Manual included a detailed monitoring plan for assessing the impact of recycled water use on shallow groundwater. The expanded monitoring program presented below includes a greater geographic scope and the addition of monitoring of deeper aquifer zones and shallow domestic wells.

The monitoring goals are to obtain sufficient data to track spatial and temporal changes in salt and nutrient concentrations in the drinking water aquifer and in shallow groundwater. Monitoring in the drinking water aquifer is necessary to understand how concentrations are changing over time and if the region is continuing to meet Basin Plan objectives. Monitoring in the shallow aquifer is necessary as shallow groundwater is impacted sooner than the deeper aquifer and can provide information on future loading to the aquifer, as well as early information on the impacts of surface activities on the groundwater system.

8.2 Monitoring Locations

The following is a conceptual plan for developing monitoring to support this Salt and Nutrient Management Plan. Details on implementation are provided in Chapter 10.

As discussed in stakeholder workshops, public supply wells and shallow monitoring wells are recommended elements of the monitoring program. Additional shallow wells, beyond the Subregional and SCWA monitoring wells, are recommended to be included in the monitoring program to address areas without shallow monitoring data, to provide more detail on aquifer depths typically utilized by private domestic wells, and to provide more detail on the variability of groundwater quality with depth. The number and type of monitoring locations are selected based on three primary criteria:

- Maintain existing monitoring locations, particularly for those that were installed by public entities and have reasonably long periods of record (i.e., public supply wells).
- Provide coverage of areas of special interest, including monitoring of areas utilizing recycled water and monitoring of areas near surface water courses (i.e., monitoring wells) to better understand surface water/groundwater interaction.
- Provide coverage of shallow zones utilized by private domestic wells in rural areas.

Based on these criteria, the following monitoring location types are available:

- Public Supply Wells – 74 locations available
- Subregional Monitoring Wells – 12 locations available
- SCWA Shallow Monitoring Wells – 8 locations available
- Additional Shallow Monitoring Wells – locations not yet identified.

The City, as monitoring coordinator, will work with the Santa Rosa Plain Groundwater Management Program to identify areas of shallow groundwater that can be monitored for multiple purposes.

Installation of up to an additional five shallow monitoring wells across basin is recommended, and specifics regarding new monitoring wells will be detailed in a Well Installation Plan. The number of monitoring locations may be updated in the future based on results from initial monitoring. Domestic wells voluntarily made available by the well owner for long-term sampling may also be used to meet shallow groundwater monitoring needs, either instead of the new wells or in addition to the new wells.

Table 8-1: Monitoring Locations Available

Agency/Owner	Number of Wells
Public Supply Wells	
Windsor [a]	3
Cal-Am	4
SCWA	3
Santa Rosa [b]	6
Rohnert Park	37
Cotati	3
Sebastopol	18
Subtotal	74
Monitoring Wells	
Santa Rosa Subregional	12
SCWA [c]	8
Subtotal	20
Proposed Shallow Wells to Install	maximum of 5
Total Monitoring Locations [d]	up to 99

a. Wells are emergency supply wells.
b. Two wells are active, three wells are emergency stand-by wells, and one well is a shallow well used solely for irrigation purposes.
c. Wells are utilized currently for groundwater level monitoring only. Wells may require additional development prior to water quality sampling. Includes wells SRP15-19 and SRP 21-23, some wells are nested with multiple screened intervals.
d. Not all wells may be available or suitable for monitoring and final number of wells monitored may be less than 99.

8.3 Parameters and Frequency

The analyses to be completed as part of this monitoring effort and their proposed monitoring frequency are listed in Table 8-2.

Table 8-2: Parameters

Parameters	Units	Analysis	Analytical Method	Frequency
EC	µmohs/cm	Field	Not applicable	Annually
pH	units	Field	Not applicable	Annually
Temperature	°C	Field	Not applicable	Annually
TDS	mg/L	Laboratory	SM 2540C or EPA Method 160.1	Annually
Nitrate-N	mg/L	Laboratory	EPA Method 300.0 or 300.1	Annually

8.4 Methods

The static depth to water from the designated measuring point should be determined prior to any pumping or other disturbances of the well. Static depth to water should be determined to the nearest 0.1 foot, using an electric groundwater sounder. After obtaining the measurement, the portion of the sounder that was immersed in the well water should be decontaminated by rinsing with distilled water from a spray bottle. The depth to water should be entered on a copy of the field form (see Table 8-3). The depth of the well should be entered in Line C of the field form. From this information, the length of the water column can be calculated. The water column length is the depth of well minus the static depth to water or Lines C minus B on the field form. The well purge volume (Line E) is approximately three times the volume of water contained in the well and can be computed from the length of the water column. For a purge volume in gallons, a water column length in feet, and a 4-inch well casing (for example), the purge volume will be approximately two times the length of the water column (2 times Line D).

Once the purge volume is calculated, the pump can be started and a purge rate can be determined by allowing the pump discharge to flow into a bucket of known volume. Dividing the bucket volume in gallons by the field time in minutes gives the purge rate in gallons per minute or GPM (Line F). The purge rate should be adjusted so that it is not greater than 5 GPM. Once a stable purge rate is achieved, the necessary purge time can be calculated as the purge volume divided by the purge rate (Line G). Purging should continue for at least this period of time. The actual purge time should be entered in Line H of the field form.

After purging is complete, the flow rate should be reduced to less than the estimated well yield. The lowest reasonable flow rate for the pump will provide the best sample. This rate may vary depending on the type of pump selected. The well should be pumped steadily at the selected sampling rate until the water runs clear. Sample collection can then begin. The analyses to be completed and their frequency are listed on Table 8-2.

Groundwater temperature must be determined in the field and can be measured using a thermometer calibrated in degrees centigrade. Electrical conductivity (EC) and pH should also be measured on fresh samples in the field using properly calibrated/standardized instruments. Only if absolutely necessary, these measurements can be made in the laboratory. The samples for the analyses can be collected in a 1-liter plastic bottle. Specially cleaned bottles and bottles with added preservative are typically supplied by the laboratory that is to perform the analyses. The filled sample bottles should be placed on ice in a cooler that would also typically be supplied by the analytical laboratory. Samples should be shipped or delivered to the laboratory as soon as possible after sampling, with care taken to meet holding time requirements, specifically for nitrate which is typically 48 hours.

Table 8-3: Santa Rosa Groundwater Monitoring Field Form

Santa Rosa Groundwater Monitoring Field Form		
Date:		
Time:	Sampler Name:	
Parameters	**Entry**	**Units**
A. Well Number		
B. Static Depth to Water		ft
C. Depth of Well		ft (refer to table 8-1)
D. Length of Water Column (C-B)		ft
E. Well Purge Volume (2xD)		gallons
F. Purge Rate:		gallons/minute
G. Calculated Purge Time (E/F)		minutes
H. Actual Purge Time:		minutes
I. Sampling Rate:		gallons/minute
J. Groundwater Temperature		°C
K. Groundwater pH		units
L. Groundwater Electrical Conductivity		µmohs/cm

Low-flow or no-purge techniques may be utilized instead of purging the well. Under the low-flow technique, each well is tested to determine the appropriate pumping rate (typically less than 1 liter/minute) to obtain stabilization of field indicator parameters with minimal drawdown in the shortest amount of time. The mid-point of the water depth is used as the location of the pump intake. Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Stabilization is considered to be achieved when three consecutive readings, taken at a minimum of five minute intervals, are within the following limits:

- Specific conductance: +/- 3%
- Temperature: +/- 3°
- pH: +/- 0.1 pH unit

All measurements must be obtained using field equipment that has been calibrated at the beginning of each sampling day.

Achievement of stable drawdowns of less than 0.3 feet, while desirable, is not mandatory. Sample collection may still take place provided the remaining criteria in this procedure are met. More complete details on this technique are available in Santa Rosa Subregional Reclamation System's 2012 document *Low Flow Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells, Revision 2.*

8.5 Quality Assurance/Quality Control and Reporting

All laboratory results should be reviewed and evaluated by an experienced groundwater scientist to determine if significant changes have occurred. If changes are suspected to be anomalous, the well will be resampled as soon as feasible to confirm the result. Lab results will be compiled into a single database or spreadsheet to facilitate analysis.

The data will be reported by the monitoring coordinator, the City of Santa Rosa, to the North Coast Regional Water Quality Control Board at least every three years. This reporting will not be limited to the monitoring conducted explicitly as part of the Salt and Nutrient Monitoring Plan, but will also include other monitoring activities at the identified wells.

8.6 Updates to Monitoring Plan

The basin monitoring plan will be reviewed to determine the need for updates every five years. More frequent updates may occur if justifiable by basin conditions and data.

8.7 Other Monitoring

The results of the monitoring outlined in this Plan are intended to work together with other monitoring activities in the Study Area, including groundwater quality monitoring from wells not included in this plan as well as the following monitoring:

- Surface Water Quality Monitoring
- Storm Water Monitoring
- Wastewater Discharge Monitoring
- Recycled Water Quality Monitoring
- Groundwater well sampling from the Conditional Waiver of Waste Discharge Requirements for Existing Cow Dairies No. R1-2012-0003 Monitoring and Reporting Program
- Salt and Nutrient Source Loading Monitoring
- Other Constituents of Concern
- Water Balance Monitoring
    - Climatological Monitoring

- Surface Water Flow Monitoring
- Groundwater Production Monitoring

The reporting for this plan will provide information on these other sampling activities in the Study Area, as available, providing references for reports and data.