Northern Cities Management Area
2017 Annual Monitoring Report

Prepared for

The Northern Cities Management Area Technical Group

City of Arroyo Grande
City of Grover Beach
Oceano Community Services District
City of Pismo Beach

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Prepared by

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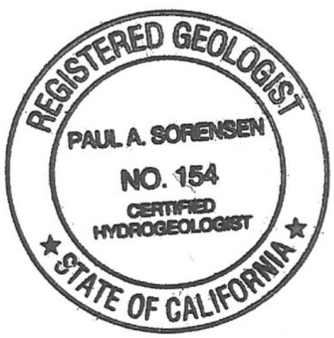
Northern Cities Management Area
2017 Annual Monitoring Report

This report was prepared by the staff of GSI Water Solutions, Inc., in collaboration with GEI Consultants, Inc., under the supervision of professionals whose signatures appear below. The findings or professional opinion were prepared in accordance with generally accepted professional engineering and geologic practice.



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Executive Summary

The 2017 Annual Monitoring Report for the Northern Cities Management Area (NCMA; Annual Report) is prepared pursuant to the requirements of the Stipulation and Judgment After Trial (Judgment) for the Santa Maria Groundwater Basin Adjudication. The Annual Report provides an assessment of hydrologic conditions for the NCMA based on data collected during the calendar year of record. As specified in the Judgment, the NCMA agencies, consisting of the City of Arroyo Grande, City of Grover Beach, City of Pismo Beach, and Oceano Community Services District (OCSD), regularly monitor groundwater in the NCMA and analyze other data pertinent to water supply and demand, including:

- Land and water uses in the basin
- Sources of supply to meet water demand
- Groundwater conditions (including water levels and water quality)
- Amount and disposition of NCMA water supplies that are not groundwater

Results of the data compilation and analysis for calendar year 2017 are documented and discussed in this Annual Report.

Groundwater Conditions

During 2017, water elevations throughout the area exhibited an overall increase in response to a relatively wet rainfall year and a continuation of ongoing efforts by all NCMA agencies to minimize groundwater extraction and maximize surface water supply sources while maintaining strict water conservation requirements.

Groundwater Levels

The best indicator of whether the NCMA portion of the basin can prevent seawater intrusion is the water elevation in the NCMA “sentry wells” near the coastline. The average water elevations of three of the key sentry wells make up the “Deep Well Index.” That index was developed by the NCMA in 2007 to gauge the health of the basin. A Deep Well Index value above 7.5 feet generally indicates that sufficient freshwater flow occurs from the east to the coastline to prevent seawater intrusion. History has shown that a prolonged period with the Deep Well Index level below 7.5 feet develops groundwater conditions at risk of seawater intrusion.

- *Spring 2017*. In the mostly urbanized areas north of Arroyo Grande Creek, groundwater contours in the spring of 2017 generally showed a westerly to southwesterly groundwater flow. These positive groundwater gradients have been developed and maintained primarily because the NCMA agencies have collaborated on water management and conservation efforts. Those efforts have been in response to changes in the Deep Well Index to ensure that flow to the ocean continues to prevent seawater intrusion. Because of a limited number of wells and water level data in the southernmost portion of the area dominated by sensitive-species dunes and State Parks land, the groundwater gradient and flow are generally inferred on the basis of historical records and trends, and water level data from the NMMA farther east.

In the central portion of the NCMA, the Cienega Valley south of Arroyo Grande Creek, agricultural groundwater production resulted in a broad pumping trough. The water elevations in the Cienega Valley are in the range of 7 to 15 feet NAVD88. The Spring 2017 water elevations in the Cienega Valley are significantly improved compared to Spring 2016, when water elevations were in the range of -2.5 (negative 2.5) to -14.5 (negative 14.5) feet NAVD88, that is, below sea level. These data show an increase in water elevations of 8.5 to almost 30 feet from Spring 2016 to Spring 2017, in apparent response to the heavy rainfall in the winter of 2016-17 as well as from continued management of the resource by NCMA agencies. For the past several years, the pumping trough exhibited in the Cienega Valley usually manifested itself as a closed depression, with groundwater elevations generally below “sea level” (NAVD88) in the center of the depression, but the rise in water elevations this past year mitigated the formation of the depression in the Spring. Also in recent years, a second pumping depression often appeared north of Arroyo Grande Creek in the area of concentrated municipal pumping. That historical pumping depression did not form in 2017 due to municipal conservation, increased municipal use of surface water supplies, and increased precipitation. Water levels in the main production zone along the coast ranged from 7.3 to almost 11 feet NAVD88.

- *Fall 2017*. Groundwater conditions in in the Fall of 2017 returned to the persistent pumping depression in the Cienega Valley, with groundwater elevations as deep as -13 (negative thirteen) feet NAVD88. The groundwater elevation in the pumping depression in October 2017 was more than 7 feet higher than was present in October 2016. Although groundwater elevations showed a normal (for this time of year) decline of 4 to 8 feet from April 2017 to October 2017, the Fall 2017 groundwater elevations were generally 2 to 5 feet higher than the October 2016. Groundwater elevations in the main production zone along the coast ranged from 5.5 to 8.5 feet NAVD88.
- *Deep Wells*. For a very brief period between August 18 and August 29, 2017, when the agencies were forced to increase groundwater pumping to maintain service to municipal customers during a shutdown of the Lopez Lake water supply, the Deep Well Index dropped below the 7.5-foot threshold. Otherwise, the index remained above the 7.5-foot threshold value throughout 2017. The Deep Well Index reached its high point of the year in March, with an index value of almost 12 feet NAVD88. Except for the previously mentioned period from August 18 to 29, the lowest index value was reached in October, when the index value was slightly above 7.5 feet NAVD88. The index value finished 2017 at about 9 feet NAVD88.
- *NCMA/NMMA Boundary*. The water elevation in the San Luis Obispo County monitoring well installed to monitor basin conditions along the NCMA/NMMA boundary typically exhibits regular seasonal fluctuations. Despite the fluctuations, the water elevation in the well remained above sea level throughout all of 2017, in contrast with the previous 4 years when the water level typically dropped below sea level in August and remained at a low elevation until early October.

Change in Groundwater in Storage

The change in groundwater in storage in the NCMA portion of the basin between April 2016 and April 2017 was estimated on the basis of a comparison of water level contour maps created for these periods. Comparison of the April water levels was chosen to comply with the California Department of Water Resources reporting requirements under the Sustainable Groundwater Management Act (SGMA).

During the period of April 2016 to April 2017, the NCMA portion of the basin experienced a net gain in groundwater in storage. An increase in groundwater in storage is a reflection of higher water levels across the basin. The net rise in groundwater levels represented a net increase of groundwater in storage from April 2016 to April 2017 of approximately 1,500 acre feet (AF), that is, there was approximately 1,500 AF more groundwater stored in the aquifer in April 2017 than in April 2016, due to continued emphasis by the municipal agencies on conservation efforts, increased municipal use of surface water supplies, and increased precipitation (recharge).

Groundwater Quality

Analytical results of key water quality data (chloride, TDS, and sodium) in 2017 were generally consistent with historical concentrations and observed ranges of constituent concentrations. In general, no water quality results were observed that are a cause of concern.

None of the water quality results from monitoring wells throughout 2017 indicate an incipient episode or immediate threat of seawater intrusion. Since the decline of TDS, sodium, and chloride concentrations following the 2009-2010 seasons, it is also clear that the location and inland extent of the seawater-fresh water interface is not known, except for the apparent indication that it was detected in 2009 in well 30N02, 30N03, and MW-Blue, all of which are screened in the Paso Robles Formation. No indications of seawater intrusion have been observed in wells screened in the underlying Careaga sandstone.

Water Supply and Production/Deliveries

- Total water use in the NCMA in 2017, including urban use by the NCMA agencies as well as agricultural irrigation and private pumping by rural water users, was 8,519 acre feet (AF), which, except for the 2016 water use, is the lowest estimated total water use in the past 30 years or more. Of this amount, Lopez Lake deliveries were 4,553 AF, State Water Project deliveries totaled 451 AF, and groundwater pumping from the NCMA portion of the Santa Maria Groundwater Basin (SMGB) accounted for approximately 3,456 AF (which is the lowest production volume from the SMGB in more than 20 years). Groundwater pumping from the Pismo Formation, outside the SMGB, accounted for 59 AF. The breakdown is shown in the following table (following page).

- Urban water use in 2017 among the NCMA agencies was 5,860 AF. That is the second lowest urban water use in the past 20 years (second only to 2016, at 5,477 AF). Urban water use has ranged from 5,477 AF (2016) to 8,982 AF (2007). Water use since 2007 has steadily declined, with only slight increases in the trend in 2012 and 2013, and then again in 2016. The decline in pumpage since 2013 was in direct response to a statewide order by the governor to reduce the amount of water used in urban areas by 25%, which was achieved locally by conservation activities implemented by the NCMA agencies.

- Agricultural acreage has remained fairly constant. Thus, the annual applied water requirement for agricultural irrigation has been relatively stable though it varies with weather conditions. Acknowledging the variability resulting from weather conditions, agricultural applied water is not expected to change significantly given the relative stability of applied irrigation acreage and cropping patterns in the NCMA. Changes in rural domestic pumping have not been significant.

Urban Area	Lopez Lake (AF)	State Water Project (AF)	SMGB Groundwater (AF)	Other Supplies (AF)	Total (AF)
Arroyo Grande	2,060	0	75	59	2,194
Grover Beach	752	0	496	0	1,248
Pismo Beach	1,044	451	205	0	1,700
Oceano CSD	697	0	21	0	718
Urban Water Use Total	**4,553**	**451**	**797**	**59**	**5,860**
Agricultural Water Supply Requirement	0	0	2,536	0	2,536
Rural Water Users	0	0	80	0	80
Nonpotable Irrigation by Arroyo Grande	0	0	43	0	43
Total	**4,553**	**451**	**3,456**	**59**	**8,519**

Threats to Water Supply

- Total groundwater pumping from the SMGB in the NCMA (urban, agriculture, and rural domestic) was 3,456 AF in 2017, which is 36 percent of the calculated 9,500 acre feet per year (AFY) long-term basin yield of the NCMA portion of the SMGB.
- When pumping is less than the yield of an aquifer, groundwater in storage increases as shown by rising water levels. With several consecutive years of groundwater pumping at 30 to 40 percent of the safe yield, groundwater elevations throughout the NCMA portion of the basin should rise significantly. Although groundwater levels increased some during 2017 as a result of the relatively wet rainfall year, the data show that the basin is in a tenuous position. Water elevations at just a few feet above sea level, coupled with the formation of a pumping depression in the Cienega Valley just west of the NCMA/NMMA boundary, indicates that the basin has very little ability to withstand droughts, any increase in regional pumping, or any other changes that reduces recharge, either directly or through subsurface inflow from the east (Nipomo Mesa).
- During 2017, there were no indications of seawater intrusion.

1. Introduction

The 2017 Annual Monitoring Report (Annual Report) summarizes hydrologic conditions for calendar year 2017 in the Northern Cities Management Area (NCMA) of the Santa Maria River Valley Groundwater Basin (SMGB) in San Luis Obispo County (County), California. This report was prepared on behalf of four public agencies collectively referred to as the Northern Cities, which includes the City of Arroyo Grande (Arroyo Grande), City of Grover Beach (Grover Beach), City of Pismo Beach (Pismo Beach) and the Oceano Community Services District (OCSD; Oceano CSD) (NCMA agencies). These agencies, along with local landowners, the County, and the San Luis Obispo County Flood Control & Water Conservation District (FCWCD) have managed local surface water and groundwater resources in the area since the late 1970s to preserve the long-term integrity of water supplies.

The rights to pump groundwater from the SMGB has been in litigation (adjudication) since the late 1990s. The physical solution set forth in the 2005 Stipulation and the 2008 final order established requirements and goals for the management of the entire Santa Maria Basin. The Court established three separate management areas, including the NCMA, the Nipomo Mesa Management Area (NMMA), and the Santa Maria Valley Management Area (SMVMA). The Court mandated that each management area form a technical group to monitor the groundwater conditions of its area, to continuously assess the hydrologic conditions of each area, and to prepare an Annual Report each year to provide the Court with a summary of the previous year's conditions, actions, and threats.

The requirements of the annual report, as directed by the Court in the Stipulation (June 30, 2005 Version, paragraph IV.D.3), stated that:

> Within one hundred and twenty days after each Year end, the Management Area Engineers will file an Annual Report with the Court. The Annual Report will summarize the results of the Monitoring Program, changes in groundwater supplies, and any threats to Groundwater supplies. The Annual Report shall also include a tabulation of Management Area water use, including Imported Water availability and use, Return Flow entitlement and use, other Developed Water availability and use, and Groundwater use. Any Stipulating Party may object to the Monitoring Program, the reported results, or the Annual Report by motion.

This 2017 Annual Report, satisfies the requirements of the Court. The Annual Report for each calendar year (January 1 to December 31) is submitted to the Court by April 30 of the following calendar year, pursuant to the Stipulation. As a result of legislation passed by the State of California related to the Sustainable Groundwater Management Act (SGMA) that requires submittal of annual reporting and attendant supporting information for each adjudicated groundwater basin by April 1 of each year, the NCMA Annual Report is also published to the California Department of Water Resources (DWR) adjudicated basin reporting website.

The collaborative water supply management approach of the NCMA agencies was recognized by the Court in the 2001 Groundwater Management Agreement (which was based on the 1983 "Gentlemen's Agreement"), formalized in the 2002 Settlement Agreement between the NCMA agencies, Northern Landowners, and Other Parties (2002 Settlement Agreement), and incorporated in the 2005 Stipulation for the Santa Maria Groundwater Basin Adjudication (Stipulation). On June 30, 2005, the Stipulation was agreed upon by numerous parties, including the NCMA agencies. The Stipulation included the 2002 Settlement Agreement. The approach then was adopted by the Superior Court of California, County of Santa Clara, in its Judgment After Trial, entered January 25, 2008 (Judgment). Although appeals to that decision were filed, a subsequent decision by the Sixth Appellate District (filed November 21, 2012) upheld the Judgment. On February 13, 2013, the Supreme Court of California denied a petition to review the decision.

Pursuant to the Court's continuing jurisdiction, Arroyo Grande, Pismo Beach, and Grover Beach filed a motion on September 29, 2015, requesting that the Court impose moratoriums on certain water extraction and use by stipulating parties within the NMMA. Judge Kirwan denied the motion without prejudice. He did, however, order the parties to meet and confer to address the issues raised in the motion by the NCMA agencies. The meet and confer process continued throughout 2016 and 2017. The order by the Court precipitated a series of meetings and collaborative actions between the NCMA and NMMA management areas.

The Judgment orders the stipulating parties to comply with all terms of the Stipulation. As specified in the Judgment and as outlined in the *Monitoring Program for the Northern Cities Management Area* (Todd Groundwater, Inc. [Todd], 2008; *NCMA Monitoring Program*), the NCMA agencies are to conduct groundwater monitoring of wells in the NCMA. In accordance with requirements of the Judgment, the agencies comprising the NCMA group collect and analyze data pertinent to water supply and demand, including:

- Land and water uses in the basin
- Sources of supply to meet those uses
- Groundwater conditions (including water levels and water quality)
- Amount and disposition of other sources of water supply in the NCMA

The Monitoring Program requires that the NCMA gather and compile pertinent information on a calendar year basis; this is accomplished through data collected by NCMA agencies (including necessary field work), the FCWCD, and requests to other public agencies. Periodic reports, such as Urban Water Management Plans (UWMP) prepared by Arroyo Grande, Grover Beach, and Pismo Beach, provide information about demand, supply, and water supply facilities. Annual data are added to the comprehensive NCMA database and analyzed. Results of the data compilation and analysis for 2017 are documented and discussed in this Annual Report.

As shown in Figure 1, the NCMA represents the northernmost portion of the SMGB, as defined in the adjudication and by DWR (DWR, 1958) as the Santa Maria River Valley groundwater basin (Basin 3-12). Adjoining the NCMA to the south and east is the NMMA; the SMVMA encompasses the remainder of the groundwater basin. Figure 2 shows the locations of the four NCMA agencies within the NCMA.

1.1 Description of the NCMA Technical Group

Pursuant to a requirement within the Stipulation, the NCMA Technical Group (TG) was formed (Paragraph IV.C and Paragraph VII). The TG is composed of representatives of each of the NCMA agencies (Table 1).

Table 1. NCMA TG Representatives

Agency	Representative
Arroyo Grande	Bill Robeson Public Works Director
	Shane Taylor Utilities Manager
Grover Beach	Gregory A. Ray, PE Director of Public Works/City Engineer
	R.J. (Jim) Garing, PE Consulting City Engineer for Water and Sewer
Pismo Beach	Benjamin A. Fine, PE Director of Public Works/City Engineer
Oceano CSD	Paavo Ogren General Manager
	Tony Marracino Utility Systems Supervisor

Arroyo Grande, Pismo Beach, and Grover Beach contract with Water Systems Consulting, Inc. (WSC) to serve as staff extension to assist the TG in its roles and responsibilities in managing the water supply resources. The full TG contracts with GSI Water Solutions, Inc. and its sub-consulting partner, GEI Consultants, Inc., to conduct the quarterly groundwater monitoring and sampling tasks, evaluate water demand and available supply, identify threats to water supply, and assist the TG in preparation of the Annual Report.

1.2 Coordination with Management Areas

Since 1983, management of the NCMA was based on cooperative efforts of the four NCMA agencies in continuing collaboration with the County, FCWCD, and other local and state agencies. Specifically, the NCMA agencies have limited their pumping and, in cooperation with the FCWCD, invested in surface water supplies so as to not exceed the accepted safe yield of the NCMA portion of the SMGB. In addition to the efforts discussed in this 2017 Annual Report, cooperative management occurs through many means including communication by the NCMA agencies in their respective public meetings, participation in the FCWCD Zone 3 Advisory Committee and TG (related to the management and operation of Lopez Lake), and participation in the Water Resources Advisory Council (the County-wide advisory panel on water issues). The NCMA agencies participated in preparation and adoption of the 2007 San Luis Obispo County Integrated Regional Water Management Plan (2007 County IRWMP) as well as the 2014 update of the County IRWMP, and are active participants in current and ongoing IRWM efforts. The IRWMP promotes integrated regional water management to ensure sustainable water uses, reliable water supplies, better water quality, environmental stewardship, efficient urban development, protection of agriculture, and a strong economy.

Since the 2008 Judgment, the NCMA TG has taken the lead in cooperative management of its management area. The NCMA TG has met monthly for many years and continued to do so throughout 2017. The TG also participated in the Santa Maria Groundwater Basin Management Area (SMGBMA) technical subcommittee, which formed in 2009. The purpose of the SMGBMA technical subcommittee is to coordinate efforts among the three management areas (NCMA, NMMA, SMVMA) such as sharing data throughout the year and during preparation of the Annual Report, reviewing and commenting on technical work efforts of other management areas, standardization of monitoring protocols, consideration of projects and grant opportunities of joint interest and benefit, and sharing of information and data among the managers of the three management areas.

The outcomes of the motion that Arroyo Grande, Pismo Beach, and Grover Beach filed on September 29, 2015 include increased discussion and collaboration between the NCMA and NMMA. One of the initiatives was the formation of an NCMA-NMMA Management Coordination Committee that met four times in 2017 to discuss items of mutual concern and develop strategies for addressing the concerns. Another area of increased mutual collaboration between the NCMA and NMMA was the formation in 2016 of a technical team to collaboratively develop a single data set of water level data points to prepare a consistent set of semiannual water level contour maps for the NCMA and NMMA. That allows the maps from each management area to present a mutually agreed upon condition at the NCMA/NMMA boundary. Those efforts continued into and throughout 2017 and resulted in the development of consistent water level contouring (and enhanced understanding of groundwater conditions) throughout the NMMA and NCMA.

An NCMA Strategic Plan was developed in 2014 to provide the NCMA TG with a mission statement to guide future initiatives, providing a framework for identifying and communicating water resource planning goals and objectives, and formalizing a 10-year work plan for implementation of those efforts. Several key objectives were identified that are related to enhancing water supply reliability, improving water resource management, and increasing effective public outreach. Implementation of some of these efforts continued throughout 2017 and are described in detail in Section 7.1.

2. Area Description

2.1 Setting

The SMGB as defined in the adjudication has three jurisdictional or management areas. As shown in Figure 1, the NCMA represents the northernmost portion of the SMGB. Adjoining the NCMA to the south and east is the NMMA, and the SMVMA encompasses the remainder of the groundwater basin within the Santa Maria Valley.

The northern portion of the NCMA is dominantly urban (residential/commercial). The Cienega Valley, a low-lying coastal stream and valley regime, is the area south of Arroyo Grande Creek in the central part of the area and is predominantly agricultural. The southern and southwestern portions of the area are composed of beach dunes and small lakes. That area is primarily managed by California Department of Parks and Recreation as a recreational area and a sensitive species habitat.

2.2 Precipitation

Each year, climatological and hydrologic (stream flow) data for the NCMA are added to the NCMA database. Annual precipitation from 1950 to 2017 is presented in Figure 3.

Historical rainfall data are compiled on a monthly basis for the following three stations:

- Desert Research Institute (DRI): Western Regional Climate Center Pismo Station (Coop ID: 046943) for 1950 to present
- DWR California Irrigation Management Information System (CIMIS) Nipomo Station (No. 202) for 2006 to present
- San Luis Obispo County-operated rain gauge (No. SLO 759) in Oceano for 2000 to present

The locations of the three stations are shown in Figure 4. In recent years, it was noted that the CIMIS Nipomo station may have been recording irrigation overspray as precipitation and the precipitation data from the station may not be reliable (the evapotranspiration data, however is still considered to be reliable). For this reason, only the DRI and County gauges were used in this 2017 Annual Report for precipitation data. Note that precipitation values are averaged for station readings only for months when data are available. Average values are not weighted on the basis of station location versus the study area. Figure 3 is a composite graph combining data from the two stations and illustrating annual rainfall totals from available data from 1950 through 2017 (on a calendar year basis). Annual average rainfall for the NCMA is approximately 15.6 inches.

Monthly rainfall and evapotranspiration (ET) for 2017 as well as average monthly historical rainfall and ET are presented in Figure 5. During 2017, below-average rainfall occurred in 8 months. Above-average rainfall occurred in January and February, in May, then again in August. The total for the year was 18.9 inches, a little more than 3 inches greater than the average annual rainfall for the area. The average rainfall total for 2017 is only the third time since 2001 that the area has experienced rainfall equal to or more than the long-term average.

Figure 3 illustrates annual rainfall and exhibits several multi-year drought cycles (e.g., 6 years, 1984-1990) followed by cycles of above-average rainfall (e.g., 7 years, 1991-1998). With the exception of 2010, the period 2007 through 2015 (8 years) experienced below-average annual rainfall indicating a “dry” hydrologic period. This pattern continued into late-2016, when the hydrologic pattern appeared to have broken the serious drought that the area (and state) experienced for the previous 5 years. The rainfall year of 2017 continued to bring hope that the drought cycle had transitioned to a relatively wet period, although as Figure 5 illustrates, the last 7 months of 2017, and continuing into early 2018, were remarkably dry.

Typically, most regional rainfall occurs from November through April. The year 2017 was marked by higher than average rainfall in early winter (January and February), but significantly dryer months throughout the remaining portion of 2017

2.3 Evapotranspiration

CIMIS maintains weather stations in locations throughout the state to provide real time wind speed, humidity, and evapotranspiration data. The nearest CIMIS station to the NCMA is the Nipomo station (see Figure 4). The Nipomo station has gathered data since 2006. While this station may have been subject to irrigation overspray in recent years (noted in the precipitation section above), the apparent irrigation overspray does not have a significant impact on the measurements used for calculating ET. The monthly ET data for the Nipomo station is shown in Figure 5 for 2017 and average (10 years) conditions. ET rate affects recharge potential of rainfall and the amount of outdoor water use (irrigation).

3. Groundwater Conditions

3.1 Geology and Hydrogeology

The current understanding of the geologic framework and hydrogeologic setting is based on numerous previous investigations, particularly Woodring and Bramlette (1950), Worts (1951), DWR (1979, 2002), and Fugro (2015).

The NCMA overlies the northwest portion of the SMGB. Groundwater pumped from the sedimentary deposits comprising the main production aquifer underlying the NCMA is derived principally from the Paso Robles Formation, although the underlying Careaga Sandstone also is an important producing aquifer. Quaternary-age alluvial sediments fill the alluvial valleys.

Several faults either cross or form the boundary of the NCMA, as identified by DWR (2002), Pacific Gas & Electric (PG&E; PG&E, 2014), and others. The Oceano Fault (USGS, 2006) trends northwest-southeast across the central portion of NCMA and has been extensively studied by PG&E (2014). Offshore, the Oceano Fault connects with the Hosgri and Shoreline fault systems several miles west of the coast. Onshore, the Oceano Fault consists of two mapped fault splays, including the main trace of the Oceano Fault as well as the Santa Maria River Fault, which diverges northward of the Oceano Fault through the Cienega Valley before trending into and across the Nipomo Mesa.

The extent that the Oceano and Santa Maria River faults impede groundwater flow within the aquifer materials is unknown, but movement on the faults as mapped by PG&E (2014) may suggest a possible impediment to flow with the Careaga Formation and, possibly, the Paso Robles Formation. PG&E (2014) suggests that the existence of the Santa Maria River Fault is "uncertain," but the water elevation contour maps of the NCMA (Figures 8 and 9, discussed in more detail in Section 3.3.1), may suggest that the Santa Maria River Fault plays a potential, but unknown, role in groundwater flow across the NCMA.

The Wilmar Avenue Fault generally forms the northern boundary of the NCMA, apparently acting as a barrier to groundwater flow from the older consolidated materials north of the fault, southward into the SMGB. There is no evidence, however, that the Wilmar Avenue Fault impedes alluvial flow in the Pismo Creek, Meadow Creek, or Arroyo Grande Creek alluvial valleys.

3.2 Groundwater Flow

The groundwater system of the NCMA has several sources of recharge: precipitation, agricultural return flow, seepage from stream flow, and subsurface inflow from adjacent areas. In addition, some return flows occur from imported surface supply sources including Lopez Lake and the State Water Project (SWP). Discharge in the region is dominated by groundwater production from pumping wells, but minor discharge certainly occurs through phreatophyte consumption and surface water outflow. Historically, groundwater elevations in wells throughout the NCMA and resulting hydraulic gradients show that subsurface outflow discharge occurs westward from the groundwater basin to the ocean, which is an important control to limit the potential of seawater intrusion. This westward gradient and direction of groundwater flow still is prevalent throughout the northern portion of NCMA, although there is some evidence recently that the westward gradient may have reversed in the area of Cienega Valley.

The following descriptions of the boundary conditions of the NCMA are derived primarily from Todd (2007). The eastern boundary is coincident with the FCWCD Zone 3 management boundary and with the northwestern boundary of the NMMA. Aquifer materials of similar formation, provenance, and characteristics are present across the majority of this boundary, which allows subsurface flow to occur between the NCMA and NMMA.

The northern and northwestern boundary is coincident with the Wilmar Avenue Fault, which is located approximately along Highway 101 from Pismo Creek to the southeastern edge of the Arroyo Grande Valley and was established by the Court during the adjudication procedures. There is likely insignificant subsurface flow from the consolidated materials (primarily Pismo Formation) north of the Wilmar Avenue Fault across the boundary into the SMGB; however, basin inflow occurs within the underflow associated with alluvial valleys of Arroyo Grande and Pismo creeks.

The southern boundary of the NCMA is an east-west line, roughly along the trend of Black Lake Canyon and perpendicular to the coastline. Historically, and typically, it appears that groundwater flow is roughly parallel to the boundary, suggesting that little to no subsurface inflow occurs across this boundary.

The western boundary of the NCMA follows the coastline from Pismo Creek in the north to Black Lake Canyon. Given the generally westward groundwater gradient in the area, this boundary is the site of subsurface outflow, and is an important impediment to seawater intrusion. The boundary is, however, susceptible to seawater intrusion if groundwater elevations onshore decline, such as may be imminently occurring in the central portion of NCMA along the Cienega Valley.

3.3 Groundwater Monitoring Network

The NCMA Monitoring Program includes: (1) compilation of groundwater elevation data from the County, (2) water quality and groundwater elevation monitoring data from the network of sentry and monitoring wells in the NCMA, (3) water quality data from the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW), and (4) groundwater elevation data from municipal pumping wells. Analysis of these data is summarized below in accordance with the *Monitoring Program for the Northern Cities Management Area* (Todd, 2008) and as modified over the years as additional well data and data sources have become available.

Approximately 150 wells within the NCMA were monitored by the County at some time during the past few decades. The County currently monitors 75 wells on a semiannual basis (April and October) within the NCMA. Included within the County monitoring program are four “sentry well” clusters (piezometers) along the coast, a four-well cluster in Oceano, and the County Monitoring Well No. 3 (12N/35W-32C03) located on the eastern NCMA boundary between the NCMA and NMMA (Figure 6). The County monitors more than 125 additional wells in the SMGB within the County. Beginning in 2009, the NCMA agencies initiated a quarterly sentry well monitoring program to supplement the County’s semiannual schedule.

To monitor overall changes in groundwater conditions, representative wells within the NCMA were selected for preparation of hydrographs and evaluation of water level changes. Wells were selected based on the following criteria:

- The wells must be part of the County's current monitoring program, or part of a public agency's regular monitoring program.
- Detailed location information must be available.
- Construction details of the wells must be available.
- The locations of the wells should have a wide geographic distribution.
- The historical record of water level data must be long and relatively complete.

Many of the wells that have been used in the program are production wells that were not designed for monitoring purposes and may be screened in various producing zones. Moreover, many of the wells are active production wells or located near active wells and, therefore, potentially subject to localized pumping effects that result in measurements that are lower than the regionally representative water level. These effects are not always apparent at the time of measurement. As a result, data cannot easily be identified as representing static groundwater levels in specific zones (e.g., unconfined or deep confined to semi-confined). Hence, data should be considered as a whole in developing a general representation of groundwater conditions.

The "sentry" wells (32S/12E-24Bxx, 32S/13E-30Fxx, 32S/13E-30Nxx, and 12N/36W-36Lxx) are a critical element of the groundwater monitoring network and are designed to provide an early warning system to identify potential seawater intrusion in the basin (Figure 6). Each sentry well consists of a cluster of multiple wells allowing for the measurement of groundwater elevation and quality from discrete depths. Also shown in Figure 6 is the OCSD observation well cluster, a dedicated monitoring well cluster located just seaward of OCSD production wells 7 and 8, and County Monitoring Well #3 (12N/35W-32C03). Figure 7 shows the depth and well names of the sentry well clusters, the OCSD observation well cluster, and County Monitoring Well #3.

Traditionally, the wells were divided into three basic depth categories: shallow, intermediate, and deep, which describes the relative depths of each monitoring well within the cluster and does not necessarily describe the geologic unit and relative depth of the unit that the screened portion of the well monitors. More recently, however, it is becoming apparent that it is important to recognize and identify the geologic unit that each well monitors; the water level responses and water quality changes are quite different between the shallow alluvial unit (24B01, 30F01, and 30N01), the Paso Robles Formation (24B02, 30F02, 30N02, 30N03, 36L01, Oceano Green, Oceano Blue, and 32C03), and the deeper Careaga Sandstone (24B03, 30F03, 36L02, Oceano Silver, and Oceano Yellow). The significance of this level of differentiation, and the impact of the value of the Deep Well Index, will be studied more extensively in the future.

Since beginning the sentry well monitoring program in 2009, 37 quarterly events have been conducted with one each in May, August, and October 2009, and winter, spring, summer and fall 2010 through 2017, and January and April 2018 (the 2018 data will be included in the 2018 Annual Report). These monitoring events include collection of synoptic groundwater elevation data and water quality samples for laboratory analysis.

3.4 Groundwater Levels

Groundwater elevation data are gathered from the network of wells throughout the NCMA. Water level measurements in these wells are used to monitor effects of groundwater use, groundwater recharge, and as an indicator of risk of seawater intrusion. Analysis of these groundwater elevation data has included development of groundwater surface contour maps, hydrographs, and an index of key sentry well water elevations over time.

3.4.1 Groundwater Level Contour Maps

Contoured groundwater elevations for the spring (April 2017) and fall (October 2017) monitoring events, including data from the County monitoring program, are shown in Figures 8 and 9, respectively.

Groundwater level contours for April 2017 are presented in Figure 8. North of the Santa Maria River Fault, groundwater contours in April show a westerly to southwesterly groundwater flow. Because of a limited number of wells and water level data in the southernmost portion of the area dominated by sensitive-species dunes and State Parks land, the groundwater gradient and flow are generally inferred on the basis of historical records and trends, and water level data from the NMMA farther east.

In the central portion of the NCMA, in Cienega Valley south of Arroyo Grande Creek, agricultural groundwater production resulted in a broad, but subdued, pumping trough. As shown on Figure 8, the water elevations in the Cienega Valley are in the range of 7 to 15 feet NAVD88. However, the Spring 2017 water elevations in the Cienega Valley are considerably and dramatically improved compared to Spring 2016, when water elevations were in the range of (-)2.5 to (-)14.5. These data show an increase in water elevations of 8.5 to almost 30 feet from Spring 2016 to Spring 2017, in apparent response to the relatively heavy rainfall in the winter of 2016-17. For the past several years, the subdued pumping trough exhibited in the Cienega Valley usually manifested itself as a closed depression, with groundwater elevations generally below “sea level” (NAVD88) in the center of the depression.

In recent years, in part in response to the drought, a second pumping depression often appeared north of Arroyo Grande Creek in the area of concentrated municipal pumping, but that historical pumping depression did not form in 2017. Water levels in the main production zone along the coast ranged from 7.3 to almost 11 feet NAVD88.

Groundwater level contours for October 2017 are presented in Figure 9. The groundwater conditions in October 2017 exhibited a return to the previously prevalent pumping depression in the Cienega Valley, with groundwater elevations as deep as (-)13 feet NAVD88. The groundwater elevation in the pumping depression in October 2017 was, however, more than 7 feet higher than was present in October 2016.

Although groundwater elevations showed an unsurprising decline of 4 to 8 feet from April 2017 to October 2017, the Fall 2017 groundwater elevations are generally 2 to 5 feet higher than one year previously (October 2016) and 3 to 8 feet higher than groundwater elevations during this time period throughout the previous drought years. Groundwater elevations in the main production zone along the coast ranged from 5.5 to 8.5 feet NAVD88.

3.4.2 Historical Water Level Trends

Hydrographs of several water wells in the NCMA that have been a part of the County well monitoring program since at least 1995 are presented in Figure 10.

The hydrographs for wells 32D03 and 32D11 (Figure 10) are paired hydrographs for wells in the vicinity of the municipal wellfields. Depending on duration of pumping of the municipal wells, water levels in these wells historically have been below levels in other areas of the basin for prolonged periods of time. The hydrographs show that, historically, groundwater elevations in these wells generally have been above mean sea level. However, an area of lower groundwater elevations (“trough”) beneath the active wellfield appeared during the period of reduced rainfall in 2007 to 2009, when groundwater pumping was the greatest it has been in the past 30 years and which led up to the apparent seawater intrusion event in the coastal wells in 2009.

As illustrated in Figure 10, the water elevations of all the wells, including the paired wells 32D03 and 32D11, exhibited a steady decline from 2011 to 2016 (during which time rainfall was below normal every year). During this time, groundwater elevations declined to near sea level or, in the case of 33K03, to below sea level. The groundwater elevations in these wells were, by October 2016, generally below the levels observed in 2009-10, before water quality degradation was observed in the coastal wells.

However, beginning in 2016 and throughout 2017, all of the wells exhibited an overall increase in water levels (except for the normal, seasonal decline during the summer). The water level in well 33K03 (located near the NCMA/NMMA boundary) is now several feet above sea level (NAVD88).

3.4.3 Sentry Wells

Regular monitoring of water elevations in clustered sentry wells located along the coast are an essential tool for tracking critical groundwater elevation changes at the coast. Groundwater elevations in these wells are monitored quarterly as part of the sentry well monitoring program. As shown by the hydrographs for the five sentry well clusters (Figure 11), the sentry wells provide a long history of groundwater elevations.

Inspection of the recent data shown in Figure 11 compared to the historical record illustrates some noteworthy trends:

- From 2013 until near the end of 2016, the water level signature of 30N02, one of the wells that experienced elevated total dissolved solids (TDS) and chloride levels in 2009-2010, looked quite similar to the water level signature of the well in 2007-2010, immediately before and during the period of water quality degradation. This trend was noteworthy and alarming. However, since the end of 2016 and throughout 2017, the water level reversed the downward trend and now has water elevations seasonally fluctuating around 10 feet NAVD88.
- The decline in water levels since 2005-06 to 2016 in the Oceano Dunes wells (36L01 and 36L02) was also notable and potentially significant, particularly in 36L01 which is screened across the Paso Robles Formation. In 2016, both wells reached historic low water elevations. However, since late 2016, both wells have started recovering to less-alarming levels.

The deepest wells in the clusters (24B03, 30F03, and 30N02) previously were identified as key wells to monitor for potential seawater intrusion, and were suggested to reflect the net effect of changing groundwater recharge and discharge conditions in the primary production aquifer. One of the thresholds to track the status and apparent health of the basin is to average the groundwater elevations from these three deep sentry wells to generate a single, representative index, called the Deep Well Index. Previous studies suggested a Deep Well Index value of 7.5 feet NAVD88 as a minimum threshold, below which the basin is at risk for eastward migration of seawater and a subsequent threat of encroaching seawater intrusion. Historical variation of this index is represented by the average deep sentry well elevations in Figure 12.

Inspection of the Deep Well Index in 2008-09, prior to the period of water quality degradation in 30N02 and 30N03, the Deep Well Index dropped below the 7.5-foot threshold and remained below that level for almost 2 years. It appears that prolonged levels below the threshold may be the key; since the start of the recent drought in 2012, the Deep Well Index dropped several times below the threshold, but usually for only a few months at a time.

What was notable about 2016 was that the Deep Well Index started the year above the trigger value, with an index value of 9.18 in January 2016. By April, the index value dropped to 8.53 (1.03 feet above the trigger value). The index value continued to decline and on June 8, 2016 dropped below the 7.5-foot threshold. For more than 6 months, the Deep Well Index remained below the index trigger value, reaching an index value of 5.39 feet in October. In late October, the Deep Well Index began to rise and on November 28, 2016, it rose above the threshold value (Figure 12).

Except for a very brief period between August 18 and August 29, 2017, when the agencies were forced to increase groundwater pumping due to a maintenance shutdown of the Lopez Lake water supply, the Deep Well Index remained above the 7.5-foot threshold value the entire year.

Key wells (24B03, 30F03, 30N02, 36L01, 36L02, and 32C03) are instrumented with pressure transducers equipped with conductivity probes that periodically record water level, water temperature, and conductivity (Figures 13 through 18). (Note that transducer malfunctions in early to mid-2015 resulted in variable conductivity data in some of the wells; all transducers were replaced and are working properly). Wells 24B03, 30F03, and 30N02 comprise the wells used to calculate the Deep Well Index. Wells 36L01 and 36L02 are adjacent the coast. Well 32C03 is the easternmost well and adjacent to the boundary between the NCMA and NMMA. The following discusses 2017 water levels for these key wells:

- *Deep Well Index Wells*: The Deep Well Index wells exhibited a pattern throughout 2017 consistent with previous years, that is, water levels in wells 30N02 and 30F03 generally declined starting in April or May 2017 and continued declining into October when they began to rise. The water elevation in well 24B03 remained relatively stable throughout 2017, with a slight rise in water levels in late 2017.

  Also consistent with patterns seen in previous years is the variability of aquifer response among the three wells. Well 24B03, the northernmost well located in the North Beach Campground, maintains a relatively stable and moderated water level throughout the year, and consistently sustains groundwater elevations higher than the Deep Well Index value. The water level in 24B03 mitigates the water levels in 30N02, which typically maintain levels consistently deeper than the Deep Well Index. Well 30F03 generally closely follows the Deep Well Index value.

- *Coastal Wells*: The water level in well 36L01, which is screened within the Paso Robles Formation, remained 5 to 10 feet above sea level (NAVD88) throughout 2017, and remained stable within a relatively narrow historical range. The water level in well 36L02, which is screened within the Careaga Sandstone, illustrates a much greater seasonal fluctuation than is observed in 36L01. The water elevation in 36L02 remained above sea level throughout 2017, in comparison with 2015 and 2016 when the water elevation in the well dropped below sea level in late September and remained below sea level into mid-October.
- *NCMA/NMMA Boundary*: Well 32C03, which shows regular seasonal fluctuations, remained above sea level throughout all of 2017, in contrast with the previous 4 years when the water level dropped below sea level in August and remained at a low elevation until early October.

3.5 Change in Groundwater in Storage

The relative change of groundwater levels and associated change in groundwater in storage in the NCMA portion of the SMGB between April 2016 and April 2017 were estimated on the basis of a comparison of water level contour maps created for these periods. Comparison of the April water levels was chosen to comply with the DWR reporting requirements and SGMA.

The groundwater contour lines from each period were compared and the volumetric difference between the two was calculated. The results are presented in Figure 19, which shows contours of equal difference between water elevations of April 2016 and April 2017. Figure 19 shows that the entire NCMA portion of the basin experienced a net gain in groundwater in storage.

From the change of water levels, a volumetric change in groundwater storage was estimated, based on aquifer properties (storage coefficient of 0.02) representative of the Paso Robles Formation in the area as documented in the SMGB Characterization Project (Fugro, 2015). The net rise in groundwater levels represented a net increase of groundwater in storage from April 2016 to April 2017 of approximately 1,500 acre feet (AF).

3.6 Water Quality

Water is used in several ways in the NCMA, each use requiring a certain minimum water quality. Because contaminants from seawater intrusion or from anthropogenic sources potentially can impact the quality of water in the basin, water quality is monitored at each of the sentry well locations in the NCMA and County Well No. 3 (32C03).

3.6.1 Quarterly Groundwater Monitoring

Quarterly groundwater monitoring events occurred in January, April, July, and October 2017. During each event, depths to groundwater were measured, and wells were sampled using procedures, sampling equipment, and in-field sample preservation protocol pursuant to ASTM International Standard D4448-01. The water quality data from these events and historical data from these wells are provided in Appendix A. Graphs of historical chloride and TDS concentrations over time are presented in Figures 20 and 21, respectively, to monitor for trends that may aid in the detection of impending seawater intrusion.

The historical water quality data show that concentration levels of TDS and chlorides (and other constituents, as well) remain relatively stable within a very narrow historical range. There have been a few notable abnormal occurrences, however (see Figures 20 and 21). The *NCMA 2009 Annual Monitoring Report* (Todd, 2010) suggested that the observed historical variation in water quality data could be caused by several reasons, such as variable permeability of geologic materials, potential mixing with seawater, ion exchange in clay-rich units, and variability in surface recharge sources such as Arroyo Grande and Meadow Creeks (Todd, 2010). Improved management of municipal groundwater use (overall reduction in pumping) since 2009 likely has contributed to groundwater quality becoming relatively stable in the past few years.

3.6.2 Analytical Results Summary

Analytical results of key water quality data (chloride, TDS, and sodium) were generally consistent with historical concentrations and observed ranges of constituent concentrations during 2017. In general, no water quality results were observed that are a cause of concern.

As discussed in the *Third Quarter 2017 Sentry Well Monitoring Report* (GSI, 2017), several wells exhibited elevated TDS concentrations outside of the historical range, as shown on Figure 21 and Appendix A. Notably, based on the normal TDS laboratory test methods, 9 of the 13 wells sampled exhibited elevated TDS concentrations compared to the previous quarter and year. Of these 9 wells, concentrations in all but one well were at historic high values.

To evaluate whether the observed elevated TDS concentrations represented a new trend or abnormal occurrence, the purge logs were inspected and the laboratory was contacted. Although the purge logs documenting the sample collection indicated that the water quality parameters measured in the field were similar to those of previous sampling events, the laboratory data indicated that the relationship between the specific conductance and TDS were outside of the normal range for natural waters for these samples. Based on the ratio between specific conductivity and TDS, the laboratory reanalyzed several of the samples by “fixed total dissolved solids” methods. These results were more consistent with historic ranges. Whatever the cause of the abnormal readings in July 2017, all the water quality results exhibited “normal” concentrations in October 2017 (Q4 monitoring event).

Figure 22 is a Piper diagram, one of several means of graphically representing water quality. Of interest is that there appear to be three separate water quality types found in the monitoring wells:

1. The Pier Avenue deep well (30N02, screened in the Paso Robles Formation from 175 to 255 feet) and Oceano Dunes intermediate well (36L01, screened in the Paso Robles Formation from 227 to 237 feet) are, despite their different nomenclature as “deep” vs. “intermediate” wells, screened in the same production zone in the Paso Robles Formation. These two wells are high in sulfates relative to the other wells in the area, and represent calcium-magnesium-sulfate rich water. Interestingly, both wells are relatively low in chloride, which is significant because this zone, and well 30N02 in particular, was the site of the apparent seawater intrusion event in 2009-2010.

2. The County Monitoring Well #3 (32C03) has an apparent water quality that is different than any of the other wells in the area. It is relatively high in sodium, chloride, and potassium. Its location in the right quadrant of the diamond-shaped part of the diagram commonly characterizes a sodium-chloride-rich groundwater representative of marine or deep ancient groundwater, even though it is a relatively shallow well and screened within the Paso Robles Formation, which is a Plio-Pleistocene age alluvial deposit. Although its overall water quality signature is quite different than seawater, it is more closely representative of seawater than any of the other wells in the area. Well 32C03 is screened from 90 to 170 feet, in the Paso Robles Formation.
3. All of the other wells in the monitoring network fall into the third category of groundwater. These wells are all generally a calcium-bicarbonate groundwater that is commonly associated with shallow groundwater. Of interest is that this grouping of water quality represents groundwater from wells that are screened in both the Paso Robles Formation and the Careaga sandstone (wells 24B03, 30F03, and 36L02 are screened in the Careaga sandstone; the others are screened in the Paso Robles Formation).

None of the water quality results from monitoring wells throughout 2017 indicate an incipient episode or immediate threat of seawater intrusion. Since the decline of TDS, sodium, and chloride concentrations following the 2009-2010 seasons, it is also clear that the location and inland extent of the seawater-fresh water interface is not known, except for the apparent indication that it was detected in well 30N02, 30N03, and MW-Blue, all of which are screened in the Paso Robles Formation. No indications of seawater intrusion have been observed in wells screened in the underlying Careaga sandstone. At this time, without additional offshore data, the location of the interface or mixing zone is not known and will not be known unless and until it intercepts a monitoring well.

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4. Water Supply and Production/Delivery

4.1 Water Supply

The NCMA water supply consists of three major sources: Lopez Lake, the SWP, and groundwater. Each source of supply has a defined delivery volume that varies from year to year.

4.1.1 Lopez Lake

Lopez Lake and Water Treatment Plant (Lopez Lake, which also is referred to as Lopez Reservoir) is operated by FCWCD Zone 3, which provides water to the NCMA agencies and releases water to Arroyo Grande Creek for habitat conservation and agricultural use. The operational safe yield of Lopez Lake is 8,730 acre feet per year (AFY), which reflects the amount of sustainable water supply during a drought of defined severity. Of this yield, 4,530 AFY have been apportioned by agreements to contractors including each of the NCMA agencies plus County Service Area (CSA) 12 (in the Avila Beach area). Of the 8,730 AFY safe yield, 4,200 AFY are reserved for downstream releases to maintain flows in Arroyo Grande Creek and provide groundwater recharge. The 2017 FCWCD Zone 3 allocations are shown in Table 2.

Table 2. Lopez Lake (FCWCD Zone 3 Contractors) 2017 Water Allocation (AFY)

Contractor	Normal Water Allocation, (AFY)
Arroyo Grande	2,290
Grover Beach	800
Pismo Beach	892
Oceano CSD	303
CSA 12 (not in NCMA)	245
Total	**4,530**
Downstream Releases	*4,200*
Safe Yield of Lopez Lake	*8,730*

Notes:
AFY = acre-feet per year, CSA = County Service Area, CSD = Community Services District, FCWCD = Flood Control & Water Conservation District, LRRP = Low Reservoir Response Plan, NCMA = Northern Cities Management Area

In December 2014, FCWCD Zone 3 adopted the Low Reservoir Response Plan (LRRP). The LRRP establishes actions that FCWCD Zone 3 can take when the amount of water in storage in the reservoir drops below 20,000 AF, provided that the FCWCD Board of Supervisors declares a drought emergency. The purpose of the LRRP is to limit downstream releases and municipal diversions from Lopez Reservoir to preserve water within the reservoir, above the minimum pool, for a minimum of 3 to 4 years under drought conditions.

The reduction strategies for the LRRP are tied to the amount of water in the reservoir. As the amount of water in the reservoir drops below the triggers (20,000; 15,000; 10,000; 5,000; and 4,000 AF), the hydrologic conditions are reviewed and adaptive management used to meet the LRRP objectives. The municipal diversions are to be reduced according to the strategies shown in Table 3.

Table 3. Lopez Lake Municipal Diversion Reduction Strategy Low Reservoir Response Plan

Amount of Water in Storage (AF)	Municipal Diversion Reduction	Municipal Diversion (AFY)
20,000	0%	4,530
15,000	10%	4,077
10,000	20%	3,624
5,000	35%	2,941
4,000	100%	0

Notes:
AF= acre-feet, AFY = acre-feet per year

The mandatory actions after the LRRP is enacted include: reductions in entitlement water deliveries; reductions in downstream releases; no new allocations of Surplus Water from unreleased downstream releases; and extension of time that agencies can take delivery of existing unused water, throughout the duration that the Drought Emergency is in effect, subject to evaporation losses if the water is not used in the year originally allocated. Included in the LRRP is an adaptive management provision that allows modification of the terms of the LRRP to match the initially prescribed reductions based on actual hydrologic conditions.

The downstream releases are to be reduced according to the strategies described in Table 4. The release strategies represent the maximum amount of water that can be released. The FCWCD controls the timing of the reduced releases to meet the needs of the agricultural stakeholders and to address environmental requirements.

Table 4. Lopez Lake Downstream Release Reduction Strategy Low Reservoir Response Plan

Amount of Water in Storage (AF)	Downstream Release Reduction	Downstream Releases (AFY)
20,000	9.5%	3,800
15,000	9.5%	3,800
10,000	75.6%	1,026
5,000	92.9%	300
4,000	100%	0

Notes:
AF= acre-feet, AFY = acre-feet per year

The LRRP was put into effect on April 1, 2015. Throughout 2015 and all of 2016, Lopez operated pursuant to the 15,000 AF diversion reduction trigger, which required a 10% reduction in municipal diversions. With the agencies enacting mandatory water conservation, utilizing other sources such as SWP, and some minimal rainfall, the 10,000 AF trigger requiring a 20% reduction was avoided.

As a result of the relatively heavy rainfall year of late 2016 and into 2017, Lopez Reservoir recovered from a low of 11,000 AF in storage to a peak of more than 30,000 AF in May 2017, to approximately 25,000 AF at the start of 2018. Although contractually the LRRP is no longer in effect when both triggers rescind (Board of Supervisors declaration of water emergency and reservoir levels drop below 20,000 AF), the Zone 3 agencies resolved to keep the LRRP in effect until there is clear evidence that the drought is over. However, because the reservoir volume was above 20,000 AF, no mandatory reductions in municipal deliveries were required in 2017.

Total discharge from Lopez Lake in 2017 was 7,652 AF, of which 4,553 AF were delivered to NCMA contractors, 88 AF were delivered to CSA 12, and 3,011 AF were released downstream to maintain flow in Arroyo Grande Creek (Table 5).

In the past, when management of releases resulted in a portion of the 4,200 AFY remaining in the reservoir, or the contractors did not use their full entitlement for the year, the water was offered to the contractors as surplus water. Surplus water deliveries to the NCMA agencies in 2017 equaled 451 AF (Table 5).

Table 5. 2017 Lopez Lake Deliveries

Agency	2017 Allocation Usage (AF)	2017 Surplus Usage (AF)	2017 Total Lopez Lake Water Delivery (AF)
Arroyo Grande	2,060	0	2,060
Grover Beach	698	54	752
Pismo Beach	900	144	1,044
Oceano CSD	444	253	697
Total NCMA 2017 Usage	**4,102**	**451**	**4,553**
CSA 12 (not in NCMA)	88	0	88
Downstream Releases	3,011	--	3,011
Total 2017 Lopez Lake Deliveries	**7,201**	**451**	**7,652**

Notes:
AF= acre-feet, AFY = acre-feet per year, CSD = Community Services District, NCMA = Northern Cities Management Area
Source: FCWCD Zone 3 Monthly Operations Report

Throughout 2017, the reservoir was operated under the LRRP at the 20,000 AF trigger, which does not require a reduction in deliveries. The status of the reservoir and management actions related to the LRRP will be monitored throughout 2018 and adjusted accordingly based on winter 2018 rainfall and storage in Lopez Lake.

4.1.2 State Water Project

Pismo Beach and OCSD have contracts with FCWCD to receive water from the SWP. The FCWCD serves as the SWP contractor, providing imported water to local retailers through the Coastal Branch pipeline. Pismo Beach and OCSD have contractual water delivery allocations (commonly referred to as "Table A" water) of 1,100 AFY and 750 AFY, respectively (Table 6). (Pismo Beach contracts for 1,240 AF of SWP, but 140 AF are owned by private parties). In addition to their Table A allocation, Pismo Beach holds 1,240 AFY of additional allocation with FCWCD, and OCSD holds an additional allocation of 750 AFY. The additional allocation held by the agencies (usually referred to as a "drought buffer") is available to augment their SWP water supply when the SWP annual allocation (i.e., percent of SWP water available) is less than 100 percent. The additional allocations also increases each agencies water held in storage. In any given year, however, Pismo Beach's and OCSD's total SWP deliveries cannot exceed 1,240 AF and 750 AF, respectively.

Table 6. 2017 NCMA SWP Deliveries

Agency	Table A Allocation, AFY	Drought Buffer, AFY	2017 Delivery, AFY
Arroyo Grande	--	--	--
Grover Beach	--	--	--
Pismo Beach	1,100	1,240	451
Oceano CSD	750	750	--
Total Allocation/Usage, AFY	**1,850**	**1,990**	**451**

Notes:
Pismo Beach contracts for 1,240 AF of Table A SWP, but 140 AF are owned by private parties
Drought Buffer = Additional supplies when Table A allocation is less than 100%; total SWP deliveries (Table A and drought) cannot exceed 1,240 AFY
AFY= acre-feet per year, CSD = Community Services District, NCMA = Northern Cities Management Area

The SWP annual allocation for contractors for 2017 was set at 60 percent of Table A contractual allocation amounts on January 18, 2017. On April 14, 2017, the 2017 SWP allocation was increased to 85 percent of Table A contractual allocations. Because SWP contractors have the opportunity to store or bank a portion of their allocated water in any one year for delivery during the next year, the volume of delivered SWP water may exceed that year's Table A allocation. Normally, carryover water is water that has been exported during the year from the Delta, but has not been delivered, although storage for carryover water no longer becomes available if it interferes with storage of SWP water for project needs.

For 2018, the initial allocation of the SWP contractors was set at 15 percent of Table A contractual allocation amounts on November 29, 2017. On January 29, 2018, the Table A contractual allocation was increased to 20 percent.

The SWP supply has the potential to be affected by drought and environmental issues, particularly involving the Delta smelt in the Sacramento-San Joaquin Delta. However, OCSD and

Pismo Beach have not been negatively affected to date by reduced SWP supplies because FCWCD allocations to its subcontractors typically are fulfilled, even in dry years. This is a result of FCWCD's maintenance of excess, unused SWP entitlement. Therefore, even when SWP supplies are decreased, the FCWCD's excess SWP entitlement provides a buffer so that contracted volumes to water purveyors, such as OCSD and Pismo Beach, still may be provided in full. During 2017, Pismo Beach took delivery of 451 AF of SWP water, and OCSD did not take any SWP water delivery.

4.1.3 Groundwater

Each of the NCMA agencies has the capability to extract groundwater from municipal water supply wells located in the central and northern portions of the NCMA. Groundwater also satisfies agricultural irrigation and rural domestic use throughout the NCMA. Groundwater use in the NCMA is governed by the Judgment and the 2002 Settlement Agreement, which establishes that groundwater will continue to be allotted and independently managed by the "Northern Parties" (NCMA agencies, NCMA overlying owners, and FCWCD).

A calculated, consensus "safe yield" value of 9,500 AFY for the NCMA portion of the SMGB was cited in the 2002 Settlement Agreement (through affirmation of the 2001 Groundwater Management Agreement) among the NCMA agencies with allotments for agricultural irrigation (5,300 AFY), subsurface outflow to the ocean (200 AFY), and urban use (4,000 AFY). The volume of the allotment for urban use was subdivided as follows:

- Arroyo Grande: 1,202 AFY
- Grover Beach: 1,198 AFY
- Pismo Beach: 700 AFY
- OCSD: 900 AFY

The basis of the safe yield was established in 1982 by a Technical Advisory Committee, consisting of representatives from Arroyo Grande, Grover Beach, Pismo Beach, OCSD, Avila Beach Community Water District, Port San Luis Harbor District, the Farm Bureau, and the County to deal with an safe yield allocation strategy and agreement not to exceed the safe yield of the "Arroyo Grande Groundwater Basin." The basis for the committee's analysis was DWR (1979). The Technical Advisory Committee concluded that the safe yield was 9,500 AFY. These findings and the allocation of the safe yield then were incorporated into a voluntary groundwater management plan (1983 "Gentlemen's Agreement") and were further formalized in the 2002 Settlement Agreement and the 2005 Stipulation for the SMGB Adjudication.

According to Todd (2007), the "safe yield" allotment for agricultural irrigation is significantly higher than the actual agricultural irrigation demand, and the calculated amount for subsurface outflow is unreasonably low. Todd (2007) recognized that maintaining sufficient subsurface outflow to the coast and preservation of a westward groundwater gradient are essential to preventing seawater intrusion, and although the minimum subsurface outflow necessary to prevent seawater intrusion is unknown, a regional outflow of 3,000 AFY was estimated as a reasonable approximation.

The 2001 Groundwater Management Agreement provides that groundwater allotments of each of the urban agencies can be increased when land within the corporate boundaries is converted from agricultural use to urban use, referred to as an agricultural conversion credit. Agricultural conversion credits equal to 121 AFY and 209 AFY were developed in 2011 for Arroyo Grande and Grover Beach, respectively. These agricultural credits were unchanged during 2017 (Table 7).

Total groundwater use in the NCMA, including agricultural irrigation and rural uses, is shown in Table 7 (descriptions of agricultural irrigation applied water and rural use estimation are provided in Sections 4.2.1 and 4.2.2, respectively). Total estimated groundwater pumpage in the NCMA in 2017 from the SMGB was 3,456 AF.

Table 7. NCMA Groundwater Pumpage from Santa Maria Groundwater Basin, 2017

Agency	Groundwater Allotment + Ag Conversion Credit (AF)	2017 Groundwater Use from SMGB (AF)	Percent Pumped of Groundwater Allotment
Arroyo Grande	1,202 + 121 = 1,323	75	6%
Grover Beach	1,198 + 209 = 1,407	496	35%
Pismo Beach	700	205	29%
Oceano CSD	900	21	2%
Total Urban Groundwater Allotment / Use	**4,000 + 330 = 4,330**	**797**	**18%**
Agricultural Irrigation Applied Water	5,300 - 330 = 4,970	2,536	51%
Nonpotable Irrigation by Arroyo Grande	--	43	--
Rural Water Users	--	80	--
Estimated Subsurface Outflow to Ocean (2001 Groundwater Management Agreement)	200	--	--
Total NCMA Groundwater Allotment / Use	**9,500**	**3,456**	**36%**

Notes:
AF= acre-feet, SMGB = Santa Maria Groundwater Basin, CSD = Community Services District, NCMA = Northern Cities Management Area

4.1.4 Developed Water

As defined in the Stipulation, “developed water” is “groundwater derived from human intervention” and includes infiltration from the following sources: “Lopez Lake water, return flow, and recharge resulting from storm water percolation ponds.” Return flow results from deep percolation of water used in irrigation that is in excess of the plant’s requirements and from outdoor uses of Lopez Lake and SWP deliveries, and a minor component of return flows from other supplies pumped from outside the NCMA boundaries (see Section 4.1.5). These return flows have not been estimated recently, but would be considered part of the groundwater basin yield.

In 2008, Arroyo Grande, Grover Beach, and Pismo Beach prepared stormwater management plans. To control stormwater runoff, and to increase groundwater recharge, each city now requires that new development construct onsite retention or detention ponds. As these new ponds or basins are constructed, the increase in groundwater recharge could result in recognition of substantial augmentation of basin yield and provision of recharge credits to one or more of the NCMA agencies (Todd, 2007). Thus a re-evaluation of estimated stormwater recharge is warranted as new recharge facilities are installed and as additional information on flow rates, pond size, infiltration rates, and tributary watershed area becomes available. Pursuant to the 2001 Groundwater Management Agreement, recharge credits would be based on a mutually accepted methodology to evaluate the amount of recharge that would involve quantification of factors such as Lopez Lake and SWP recharge, stormwater runoff amounts, determination of effective recharge under various conditions, and methods to document actual recharge to developed aquifers.

4.1.5 Total Water Supply Availability

The baseline (full allocation) water supply available to the NCMA agencies is summarized in Table 8. The baseline water supplies include 100 percent Lopez Lake allocation, SMGB groundwater allotments, agricultural credits, and 100 percent delivery of SWP allocations. This baseline water supply does not include Lopez Lake surplus or SWP carryover because these supplies vary from year to year and are not always available. The category “Other Supplies” includes groundwater pumped from outside the NCMA boundaries (outside the SMGB). The baseline supply for the NCMA agencies totals 10,625 AFY.

Table 8. Baseline (Full Allotment) Available Urban Water Supplies (AFY)

Urban Area	Lopez Lake	SWP Allocation (at 100%)	Groundwater Allotment	Ag Credit	Other Supplies	Total
Arroyo Grande	2,290	0	1,202	121	160	**3,773**
Grover Beach	800	0	1,198	209	0	**2,207**
Pismo Beach	892	1,100	700	0	0	**2,692**
Oceano CSD	303	750	900	0	0	**1,953**
Total	**4,285**	**1,850**	**4,000**	**330**	**160**	**10,625**

Notes:
AFY= acre-feet per year, CSD = Community Services District, SWP = State Water Project

Table 9 summarizes the available water supply to the NCMA agencies in 2017, including Lopez Lake, Lopez Lake carryover (surplus) water, the 2017 SWP 85 percent Table A delivery schedule, and the available SWP carryover water. The total available water supply is a compilation of all components of each agency’s portfolio.

Table 9. 2017 Available Urban Water Supply, (AF)

Urban Area	Lopez Lake Allocation	Lopez Lake Surplus	2017 SWP Allocation (at 85% Delivery)	2017 SWP Drought Buffer	2017 SWP Carryover	Ground-water Allotment	Ag Credit	Other Supplies	Total (2017)
Arroyo Grande	2,290	937	0	0	0	1,202	121	160	**4,710**
Grover Beach	800	308	0	0	0	1,198	209	0	**2,515**
Pismo Beach	892	1,228	935	0[1]	511	700	0	0	**4,266[1]**
Oceano CSD	303	713	638	112[1]	0	900	0	0	**2,666[1]**
Total	**4,285**	**3,186**	**1,573**	**112**	**511**	**4,000**	**330**	**160**	**14,157**

Notes:
[1]In any given year, Pismo Beach's total SWP deliveries cannot exceed 1,240 AF and OCSD's deliveries cannot exceed 750 AF. In years when the Table A SWP allocation, plus drought buffer, plus carryover exceed 1,240 AF for Pismo Beach and 750 AF for OCSD, the total available SWP supply is capped at 1,240 AF or 750 AF for Pismo Beach and OCSD, respectively.
AF = acre-feet, CSD = Community Services District, SWP = State Water Project

4.2 Water Use

Water use refers to the total amount of water used to satisfy the needs of all water user groups. In the NCMA, water use predominantly serves urban production and agricultural applied water, and a relatively small component of rural domestic use (including small community water systems), and domestic, recreational, and agriculture-related businesses.

4.2.1 Agricultural Water Supply Requirements

For this 2017 NCMA Annual Monitoring Report, the irrigation applied water estimations were updated using the 2015 Integrated Water Flow Model (IWFM) Demand Calculator (IDC). The IDC is a stand-alone program that simulates land surface and root zone flow processes, and, importantly for this report, the agricultural water supply requirements for each crop type. IDC applies user specified soil, weather, and land-use data to estimate and track the soil moisture balances. More specifically, available water within the root zone is tracked for each of the crops to and simulate when irrigation events take place based on crop requirements and cultural irrigation practices.

Data Used in the IDC:

- *Land-use*. The San Luis Obispo County Agricultural Commissioner's Office (ACO) annually compiles an estimate of irrigated acres in the County. A view displaying the irrigated agricultural lands within NCMA for 2017 is shown in Figure 23. The 2017 survey indicates a total of 1,447 acres of irrigated agriculture in the NCMA consisting predominantly of rotational crops. Table 10 lists the crop types and acreages found in the NCMA that were used in the IDC program.

- *Climate Data*. 2017 weather data from the FCWCD rain gauge in Oceano and the CIMIS Nipomo Station (202) were used for precipitation and data related to reference ET values, respectively. The data needed to calculate reference ET include solar radiation, humidity, air temperature, and wind speed. Both weather stations are shown in Figure 4 along with another rain gauge located in Pismo Beach.
- *ET Values by Crop Category*. The DWR Consumptive Use Program (CUP) was used to estimate potential ET values based on specific annual climate data and crop type. The CUP used monthly climate data from the closest CIMIS station (202, Nipomo) and includes crop coefficients to calculate ET values for the irrigated crop categories.
- Assumptions used in the analysis include:
    - Since the NCMA is located near the coast, agricultural practices are influenced significantly by the marine layer. As seen in Figure 4, the Nipomo CIMIS station used for climatological data in both the CUP and IDC is located farther inland than the easternmost boundary of NCMA and the recorded weather data do not fully account for the cooling and moisture effects of the marine layer.
    - Use of an unadjusted calculated ET results in a higher value than that actually taking place in the NCMA. Studies have identified that ET values within the marine layer can be as much as 20 to 25 percent lower than that of the same crop located just outside of the marine layer influence. Irrigation Training and Research Center <http://www.itrc.org/etdata/etmain.htm> provides typical year (1997 Hydrology) ET values using various irrigation methods for Zone 3 (coastal outside marine layer) and Zone 1 (marine layer). The computed percent reduction in ET to Zone 3 values range from 11% for rotational crops (small vegetables) to 19% for strawberries. The distance the marine layer extends inland can vary from less than ½ mile to as much as 4 to 5 miles, depending on land topography. Low-lying areas have a higher frequency of marine layer coverage, and for longer periods throughout the day.
    - The NCMA is considered to be a low-lying area with boundaries extending between 2 and 5 miles inland. Recognizing that not all the crops would be affected by the marine layer, but also accounting for the cooling influence over some of the area, monthly ET values calculated on the basis of the CIMIS Nipomo Station data were adjusted lower by 12 percent and are shown in Table 10.
- *Soil Data.* The Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) was used to collect soil parameters in the NCMA for use in the IDC. The soil properties used include saturated hydraulic conductivity, porosity, and the runoff curve numbers. The field capacity and wilting points were developed on the basis of the described soil textures (i.e., sand, loam, sandy clay, etc.) and industry standards. The IDC

relies on soil properties for estimating water storage, deep percolation, and runoff; all of which lead to a refined estimation of applied water.

Table 10. 2017 NCMA Crop Acreages and Calculated Evapotranspiration

Crop Type	Acreage	2017 Potential ET[1] (AF per acre)
Rotational Crops	1,256	1.9[2]
Strawberry	168	0.8
Nursery Plants	12	1.9
Potatoes	11	1.2

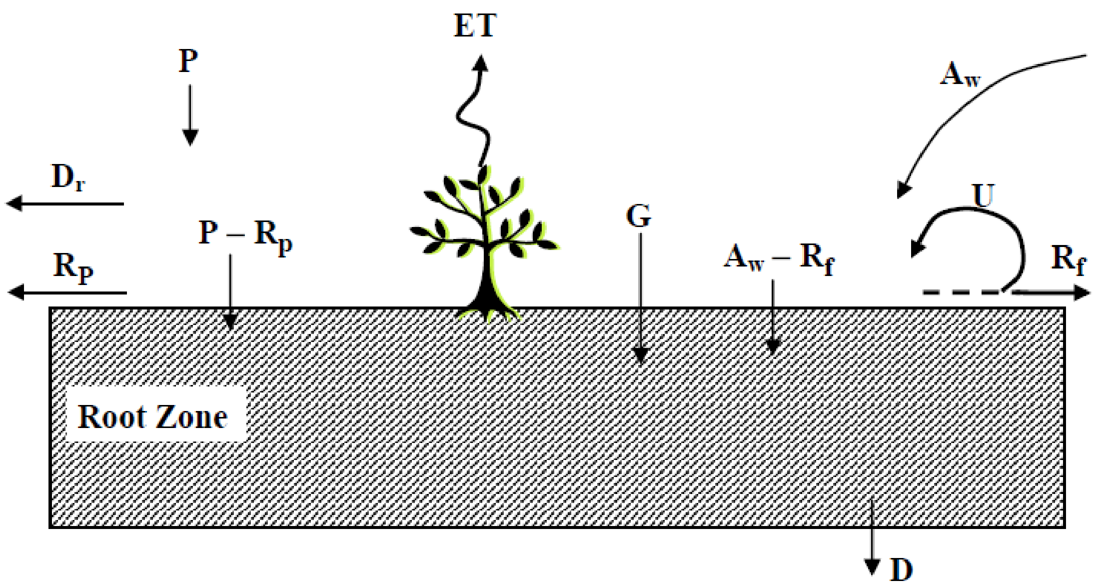
Notes:
[1]See "ET Values by Crop Category," in text section above.
[2]Rotational crops ET is based on a two- to three-crop rotation.
ET = evapotranspiration, AF = acre-feet

Model Development and Computations

The IDC is written in FORTRAN 2003 using an object-oriented programming approach. The program consists of three main components: (1) input data files, (2) output data files, and (3) the numerical engine that reads data from input files, computes applied water demands, routes water through the root zone, and prints out the results to the output files. The flow terms used in the root zone routing are defined in the table below and shown in the graphic on the following page. Drainage from ponded areas (D_r) was not applicable because there are no ponded crops in the NCMA; and data related to generic soil moisture (G) were not available.

P	Precipitation	*User Specified*
ET	Evapotranspiration	*IDC Output*
G	Generic source of moisture (i.e., fog, dew)	*Data Not Available*
A_w	Applied water	*IDC Output*
D_r	Outflow resulting from drainage of ponded areas (rice, refuges, etc.)	*Not Applicable*
R_P	Direct runoff	*IDC Output*
R_f	Return flow	*User Specified (fraction of applied water)*
U	Re-used portion of return flow	*User Specified (fraction of return flow)*
D	Deep percolation	*IDC Output*

Notes:
Integrated Water Flow Model (IWFM) Demand Calculator (IDC)



Source: California DWR (2016).

All extracted geospatial information was applied to a computational grid within the IDC framework to simulate the root zone moisture for 2017 in NCMA agricultural areas. The IDC provides the total water supply requirement for each crop category met through rainfall and applied irrigation water in agricultural areas based on user-defined parameters for crop evaporation and transpiration requirements, climate conditions, soil properties, and agricultural management practices. Sources for data related to crop demands (i.e., potential ET), climate conditions, and soil properties are discussed above. The computations for actual crop ET (versus potential ET), applied water, and deep percolation are described below.

The potential ET is the amount of water a given crop will consume through evaporation and/or transpiration under ideal conditions (i.e., fully irrigated 100 percent of the time). Fully irrigated conditions mean that the water required to meet all crop demands is available. Water is available to the crops when the soil moisture content within the root zone is between the field capacity and the wilting point. When the soil moisture is above the field capacity, some water will go to runoff and/or deep percolation; when the soil moisture is below the wilting point, it is contained in the smallest pore spaces within the root zone and considered unavailable to the crops.

The difference between the field capacity and the wilting point is the total available water (TAW). In IDC, when the soil moisture is above one-half of the TAW, the crop ET will be equal to the potential ET. However, if the soil moisture is below one-half of the TAW, the plants will experience water stress and ET decreases linearly until it reaches zero at the wilting point. This method of simulating water stress is similar to the method described in Allen et al. (1998) to compute non-standard crop ET under water stress conditions.

The IDC monitors the moisture content within the root zone and applies water by triggering an irrigation event when the calculated soil moisture is below a user-specified minimum allowable soil moisture requirement. For this application of the IDC, the minimum soil moisture requirement was set to trigger an irrigation event when the soil moisture fell below one-half the TAW to limit water stress in the crops. During an irrigation event, the soil moisture content in the root zone reaches field capacity. If precipitation occurs, soil moisture may increase above field capacity, generating deep percolation, and potentially runoff, both depending on the quantity and temporal distribution of rainfall.

Deep percolation is the vertical movement of water through the soil column flowing out of the root zone resulting in the potential for groundwater recharge. The IDC applies the van Genuchten-Mualem equation (Mualem, 1976; van Genuchten, 1985) to compute deep percolation using the user-defined saturated hydraulic conductivity and pore size distribution.

Results

The total agricultural water supply requirements for 2017 was estimated to be 2,536 AF, and the effective precipitation (i.e., rainwater used by the crop) was 450 AF. Figure 24 illustrates the estimated crop water requirement in the NCMA as calculated by the IDC, and displays the four identified crop types and their estimated monthly applied water. The rotational crops have the highest water supply requirement because they cover the greatest area (see Figure 23) and have the greatest annual ET (Table 11).

The estimated agricultural water supply requirement of 2,536 AF in 2017 compares with estimated 2,551 AF in 2016, 3,008 AF in 2015, and 2,955 AF in 2014. In 2014, the methodology of estimating agricultural water requirements was modified from an estimated applied rate based on hydrologic conditions to the IWFM IDC methodology described here.

Table 11. 2017 IDC Model Results of Monthly Applied Water

	Monthly Applied Water (AF)												Annual Total (AF)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Rotational Crops (AF)	-	-	-	214	329	274	374	341	312	253	277	-	2,373
Strawberry (AF)	-	-	-	-	-	19	26	38	31	-27	-	-	141
Potatoes (AF)	-	-	-	-	1	3	5	3	-	-	-	-	12
Flowering and Nursery (AF)	-	-	-	-	-	-	1	3	3	2	2	-	11
Total	**-**	**-**	**-**	**214**	**330**	**295**	**406**	**385**	**345**	**281**	**279**	**-**	**2,536**
	Monthly Precipitation (inches)												**Annual Total (inches)**
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	
Precipitation (inches)	8.90	5.99	1.26	0.83	0.35	-	-	-	0.20	0.08	0.15	-	**17.76**
	Monthly Unit Water Demand (AF/Acre)												**Annual Total (AF/Acre)**
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	
Rotational Crops (AF/Acre)	-	-	-	0.17	0.26	0.22	0.30	0.27	0.25	0.20	0.22	-	1.89
Strawberry (AF/Acre)	-	-	-	-	-	0.11	0.16	0.23	0.18	0.16	-	-	0.84
Potatoes (AF/Acre)	-	-	-	-	0.8	0.21	0.43	0.26	-	-	-	-	0.98
Flowering and Nursery (AF/Acre)	-	-	-	-	-	-	0.05	0.31	0.24	0.15	0.19	0.03	0.96
Area Weighted Average	**-**	**-**	**-**	**0.15**	**0.23**	**0.20**	**0.28**	**0.27**	**0.24**	**0.19**	**0.19**	0.00	**1.75**

Notes:
AF = acre-feet, AF/Acre = acre-feet per acre

4.2.2 Rural Use

In the NCMA, rural water use refers to groundwater pumping not designated as urban use or agricultural irrigation applied water and includes small community water systems, individual domestic water systems, recreational uses, and agriculture-related business systems. Small community water systems using groundwater in the NCMA were identified initially through a review of a list of water purveyors compiled in the 2007 County IRWMP. These include the Halcyon Water System, Ken Mar Gardens, and Pacific Dunes RV Resort. The Halcyon Water System serves 35 homes in the community of Halcyon, while Ken Mar Gardens provides water supply to 48 mobile homes on South Halcyon Road. The Pacific Dunes RV Resort, with 215 RV sites, provides water supply to a largely transitory population and a nearby riding stable. In addition, about 25 homes and businesses have been identified as served by private wells through inspection of aerial photographs of rural areas within NCMA. Two mobile home communities, Grande Mobile and Halcyon Estates, are served by OCSD through the distribution system of Arroyo Grande; thus the production summary of OCSD includes these two communities. Based on prior reports, it is assumed that the number of private wells is negligible within the service areas of the NCMA agencies.

The Pismo Beach Golf Course (Le Sage Riviera Campground) uses an onsite water well for turf irrigation. The pumped water is not metered, and total water use is not known by the golf course operators. An estimate of water demand for the golf course is based on the irrigated acreage, sandy soils, near-ocean climate, and water duty factors from the U.S. Golf Association, Alliance for Water Efficiency, U.S. Golf Courses Organization of America, and several other sources. The estimated rural water demand is provided in Table 12.

Table 12. Estimated Rural Water Production

Groundwater User	No. of Units	Estimated Water Production, AFY per Unit	Estimated Annual Water Production, AFY	Notes
Halcyon Water System	35	0.40	14	*1*
Ken Mar Gardens	48	--	5	*2*
Pacific Dunes RV Resort	215	0.03	6	*3*
Pismo Beach Golf Course	--	--	45	*4*
Rural Users	25	0.40	10	*1*
Current Estimated Rural Use			**80**	

Notes:
[1] Water use/unit based on 2000 and 2005 Grover Beach water use per connection, 2005 UWMP.
[2] Demand based on metered water usage.
[3] Water use/unit assumes 50 percent annual occupancy and 0.06 AFY per occupied site.
[4] Estimated golf course demand, based on estimated water duty factor, annual ET, and irrigated acreage.
AFY = acre-feet per year
UWMP = Urban Water Management Plan
ET = evapotranspiration

4.2.3 Urban Production

Urban water production is presented in Table 13 for each of the NCMA agencies from 2005 through 2017. These values reflect Lopez Lake deliveries, SWP deliveries, and groundwater production data, and represent all water used within the service areas of the four NCMA agencies (including the portions of Arroyo Grande and Pismo Beach that extend outside the NCMA), and system losses. In general, urban water production has ranged from 5,476 AF (2016) to 8,982 AF (2007). There has been an overall decline in urban production since 2009, although there were slight increases in 2012 and 2013, and again this past year in 2017. The long-term declining trend in production is likely attributed to the relatively slower economy from 2009 through 2012 and, since then, because of conservation activities implemented by the NCMA agencies in response to the historic drought. Since 2013, when urban production was 7,939 AF, urban production declined dramatically to 2016 to the lowest level in at least the past 12 years. The urban production in 2017 is up slightly from 2016, at 5,690 AF.

Table 13. Urban Water Production (Groundwater and Surface Water, AF)

Year	Arroyo Grande	Grover Beach	Pismo Beach	OCSD	Total Urban
2005	3,460	2,082	2,142	931	**8,615**
2006	3,425	2,025	2,121	882	**8,453**
2007	3,690	2,087	2,261	944	**8,982**
2008	3,579	2,051	2,208	933	**8,771**
2009	3,315	1,941	2,039	885	**8,180**
2010	2,956	1,787	1,944	855	**7,542**
2011	2,922	1,787	1,912	852	**7,473**
2012	3,022	1,757	2,029	838	**7,646**
2013	3,111	1,792	2,148	888	**7,939**
2014	2,752	1,347	1,949	807	**6,856**
2015	2,239	1,265	1,736	703	**5,943**
2016	1,948	1,210	1,646	672	**5,476**
2017	2,194	1,248	1,700	718	**5,860**

Notes:
AF = acre-feet, CSD = Community Services District

4.2.4 2017 Groundwater Pumpage

Total SMGB groundwater use in the NCMA, including urban production, applied agricultural water requirements, and rural pumping, is shown in Table 14 (replication of Table 7). Total estimated SMGB groundwater pumpage in the NCMA in 2017 was 3,456 AF, which represents a slight increase over 2016 (3,284 AF), which was the lowest volume of groundwater production from the NCMA portion of the basin in at least the past 20 years.

Table 14. NCMA Groundwater Pumpage from Santa Maria Groundwater Basin, 2017 (AF)

Agency	Groundwater Allotment + Ag Conversion Credit (AF)	2017 Groundwater Use (AF)	Percent Pumped of Groundwater Allotment
Arroyo Grande	1,202 + 121 = 1,323	75	6%
Grover Beach	1,198 + 209 = 1,407	496	35%
Pismo Beach	700	205	29%
Oceano CSD	900	21	2%
Total Urban Groundwater Allotment / Use	**4,000 + 330 = 4,330**	**797**	**18%**
Agricultural Irrigation Applied Water	5,300 - 330 = 4,970	2,536	51
Nonpotable Irrigation by Arroyo Grande	--	43	--
Rural Water Users	--	80	--
Estimated Subsurface Outflow to Ocean (2001 Groundwater Management Agreement)	200	--	--
Total NCMA Groundwater Allotment / Use	**9,500**	**3,456**	**36%**

Notes:
AF = acre-feet, CSD = Community Services District, NCMA = Northern Cities Management Area

The estimated groundwater pumpage of 3,456 in 2017 represents about 36 percent of the calculated yield of 9,500 AFY for the NCMA portion of the Santa Maria Basin.

A graphical depiction of water use by supply source for each NCMA agency since 1999 is presented as Figure 25. The graphs depict changes in water supply availability and use over time, including the increased use of SWP water during the early years of the period when SWP Table A deliveries were greater. The increased dependence in 2017 on Lopez Reservoir is illustrated in this graphic. Although all four agencies pumped groundwater as part of their supply portfolio in 2017, groundwater pumped from the SMGB constituted a minor part of the overall water supply (797 AF, or 14 percent of overall urban use).

As shown in Figure 26, groundwater pumpage reached a peak in 2007, and then declined in 2008, 2009, and 2010. From 2010 through 2013, pumpage increased slightly every year, but even so, overall groundwater use remained significantly lower than historical annual pumpage rates. From 2013 through 2016, pumpage steadily declined. In 2017, urban groundwater use declined to 797 AF, which is 18 percent of the 4,330 AF of combined urban groundwater allotment and agricultural conversion credit.

4.2.5 Changes in Water Production

The historical water use for urban uses, agricultural irrigation, and rural uses are shown in Table 15.

Table 15. Total Water Use (Groundwater and Surface Water, AF)

Year	Arroyo Grande	Grover Beach	Pismo Beach	OCSD	Total Urban	Agricultural Irrigation[1]	Rural Water	Total Use
2005	3,460	2,082	2,142	931	8,615	2,056	36	**10,707**
2006	3,425	2,025	2,121	882	8,453	2,056	36	**10,545**
2007	3,690	2,087	2,261	944	8,982	2,742	36	**11,760**
2008	3,579	2,051	2,208	933	8,771	2,742	36	**11,549**
2009	3,315	1,941	2,039	885	8,180	2,742	36	**10,958**
2010	2,956	1,787	1,944	855	7,542	2,056	38	**9,636**
2011	2,922	1,787	1,912	852	7,473	2,742	38	**10,253**
2012	3,022	1,757	2,029	838	7,646	2,742	41	**10,429**
2013	3,111	1,792	2,148	888	7,939	2,742	42	**10,722**
2014	2,752	1,347	1,949	807	6,855	2,955	38	**9,848**
2015	2,239	1,266	1,736	703	5,943	3,008	38	**8,990**
2016	1,948	1,210	1,646	672	5,476	2,551	81	**8,108**
2017	2,194	1,248	1,700	718	5,860	2,579	80	**8,519**

Notes:
[1]Irrigation applied water includes agricultural irrigation plus SMGB non-potable irrigation by Arroyo Grande.
AF = acre-feet, CSD = Community Services District

In general, urban water production has ranged from 5,476 AF (2016) to 8,982 AF (2007; Table 15). Water use since 2007 shows an overall decline each year with a slight increase in 2012 and 2013; this overall decline in water use may be attributed to the relatively slower economy and, particularly in recent years, conservation activities implemented by the NCMA agencies in response to the drought.

In the agricultural irrigation category, agricultural acreage has remained fairly constant. Thus, annual applied water for agricultural irrigation varies mostly with weather conditions. Acknowledging the variability caused by weather conditions, agricultural irrigation applied water is not expected to change significantly given the relative stability of applied irrigation acreage and cropping patterns in the NCMA south of Arroyo Grande Creek.

Changes in rural domestic pumping have not been significant.

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5. Comparison of Water Supply v. Water Production

The Baseline Available Urban Water Supplies for each of the NCMA agencies is 10,625 AFY (assuming 100 percent delivery of SWP allocation and assuming no Lopez Lake surplus water or SWP carryover; refer to Table 8). In 2017, because of the availability of Lopez Lake surplus water and SWP carryover water and a relatively robust SWP delivery, the total available urban water supply was 14,157 AF (Table 9).

As described in the 2001 Groundwater Management Agreement and affirmed in the 2002 Settlement Agreement, the calculated historical "safe yield" from the NCMA portion of the groundwater basin is 9,500 AFY. Because all of the agricultural irrigation water use is supplied by groundwater, the total available agricultural irrigation supply is a portion of the estimated safe yield; this portion was allocated as 5,300 AFY for agricultural and rural use. The agricultural conversion of 330 AFY reduces this allocation to 4,970 AFY. Of the estimated safe yield of 9,500 AFY, other than what is allocated for agricultural irrigation and rural use, the remaining 4,330 AFY is allocated for urban water use (4,330 AFY, including 4,000 AFY groundwater allocation plus 330 AFY in agricultural conversion credit) and an estimated 200 AFY for subsurface outflow to the ocean.

In 2017, the total estimated NCMA water production was 8,519 AF (Table 16). The 2017 water production, by source, of each city and agency is shown in Table 16. Note that the production volumes described here are gross production (if pumped groundwater) and gross deliveries (if surface water deliveries) and equals net consumptive demand plus losses and return water.

Table 16. 2017 Water Production by Source (AF)

Urban Area	Lopez Lake	State Water Project	SMGB Groundwater	Other Supplies	Total
Arroyo Grande	2,060	0	75	59	2,194
Grover Beach	752	0	496	0	1,248
Pismo Beach	1,044	451	205	0	1,700
Oceano CSD	697	0	21	0	718
Urban Water Use Total	**4,553**	**451**	**797**	**59**	**5,860**
Agricultural Irrigation Applied Water	0	0	2,536	0	2,536
Rural Water Users	0	0	80	0	80
Non-potable Irrigation by Arroyo Grande	0	0	43	0	43
Total	**4,553**	**451**	**3,456**	**59**	**8,519**

Notes:
AF = acre-feet, SMGB = Santa Maria Groundwater Basin, CSD = Community Services District

As shown in Table 16, urban water use in 2017 to the NCMA was supplied from 4,553 AF of Lopez Lake water, 451 AF of SWP water, and 797 AF of groundwater. The 59 AF of "Other Supplies" delivered to Arroyo Grande consists of groundwater pumped from the Pismo Formation, which is located outside of the shared groundwater basin.

Based on the calculated yield of the NCMA portion of the basin, the baseline (full allocation) total available supply for all uses is 15,595 AFY, which is the sum of 10,625 AFY for urban use plus the allocation for agricultural irrigation and rural area of 4,970 AFY. In 2017, factoring in the SWP delivery schedule and availability of SWP carryover water and Lopez Lake surplus, the total available supply for all uses (in 2017) was 14,157 AF (Table 9), compared to actual 2017 NCMA water use of 8,519 AF (Table 15). It must be noted, however, that this comparative review of available 2017 supply versus production must be viewed with caution because of the potential threats to the groundwater supply (see Section 6.1, below). As described earlier, the NCMA agencies pumped only 18 percent of their "available" groundwater allotment. Such minimal utilization of the groundwater resource, coupled with the relatively wet rainfall year, resulted in a positive increase in groundwater in storage in the basin and a slight rise in overall water level elevations. It is clear, however, that the NCMA agencies could not have used their entire groundwater allotment in 2017 without significantly lowering water elevations below current conditions and potentially seriously exacerbating the threat of seawater intrusion.

6. Threats to Water Supply

Because the NCMA agencies depend on both local and imported water supplies, changes in either state-wide or local conditions can threaten the NCMA water supply. Water supply imported from other areas of the state may be threatened by state-wide drought, effects of climate change in the SWP source area, management and environmental protection issues in the Sacramento-San Joaquin Delta that affect the amount and reliability of SWP deliveries, and risk of seismic damage to the SWP delivery system. Local threats to the NCMA water supply similarly include extended drought and climate change that may affect the yield from Lopez Lake and reduced recharge to the NCMA. In addition, the NCMA is not hydrologically isolated from the NMMA and the rest of the SMGB, and water supply threats in the NMMA are a potential threat to the water supply sustainability of the NCMA.

There is a potential impact from seawater intrusion if the groundwater system as a whole, including the entire SMGB, is not adequately monitored and managed. In particular, the management of the basin may need to account for sea level rise and the relative change in groundwater gradient along the shore line.

6.1 Threats to Local Groundwater Supply

6.1.1 Declining Water Levels

Water levels continue to exhibit an overall declining trend in the NCMA. Important factors to maintaining water levels are managing inflow and outflow.

- Inflow: An important inflow component to the NCMA area is subsurface inflow into the aquifers that supply water wells serving the NCMA. Historically, subsurface inflow to the NCMA from the Nipomo Mesa along the southeast boundary of the NCMA is an important component of groundwater recharge. This inflow is reduced from historical levels, as recognized in 2008-2009, to “something approaching no subsurface flow” because of lower groundwater levels in the NMMA (*NMMA 2nd Annual Report CY 2009*, page 43). This condition continues to worsen, as described in all subsequent NMMA Annual Reports (NMMA, 2011, 2012, 2013, 2014, 2015, 2016, and 2017).
- Outflow: A major outflow component is groundwater pumpage. Total SMGB groundwater pumping in the NCMA (urban, agriculture, and rural domestic) was 3,456 AF in 2017, which is 36 percent of the court-accepted 9,500 AFY safe yield of the NCMA portion of the basin. Such minimal utilization of the groundwater resource, coupled with the relatively wet rainfall year, resulted in a positive increase in groundwater in storage in the basin and a slight rise in overall water level elevations. It is clear, however, that the NCMA agencies could not have used their entire groundwater allotment in 2017 without significantly lowering water elevations below current conditions and potentially seriously exacerbating the threat of seawater intrusion.

The current condition, with groundwater pumping at 36 percent of the safe yield and a moderate increase in groundwater in storage for the first time in several years, illustrates the impacts of the drought that essentially started in 2002, with the only years since then of higher than normal rainfall in 2010 and 2017, that manifested itself in significantly reduced recharge. But it also illustrates the impacts of reduced subsurface inflow recharge from the east (Nipomo Mesa). This condition of declining water levels in the NCMA, even though total pumping is currently 36 percent of the basin safe yield, will be exacerbated if the NCMA agencies are required to increase groundwater withdrawals because of a reduction or total loss in local surface water supplies or SWP deliveries.

6.1.2 Seawater Intrusion

The NCMA is underlain by an accumulation of alluvial materials that slope gently offshore and extend for many miles under the ocean (DWR 1970, 1975). Coarser materials within the alluvial materials comprise aquifer zones that receive freshwater recharge in areas above sea level. If sufficient outflow from the aquifer occurs, the dynamic interface between seawater and fresh water will be prevented from moving onshore. Sufficient differential pressure to maintain a net outflow is indicated by onshore groundwater elevations that are above mean sea level and establish a seaward gradient to maintain that outflow.

The 2008 NCMA Annual Report documented that a portion of the NCMA groundwater basin exhibited water surface elevations below sea level (*NCMA 2008 Annual Monitoring Report (Todd, 2009)*). Hydrographs for NCMA sentry wells (Figures 11 and 12) show coastal groundwater elevations that were at relatively low levels for as long as 2 years. Such sustained low levels had not occurred previously in the historical record and reflected the impact of drought on groundwater levels. The low coastal groundwater levels indicated a potential for seawater intrusion.

Elevated concentrations of TDS, chloride, and sodium were observed in wells 30N03 and 30N02 beginning in May 2009, indicating potential seawater intrusion (Figures 27 and 28). (MW-Blue well also showed elevated concentrations of TDS and chlorides, but a concomitant decline in sodium.) Concentrations declined to historical levels in well 30N03 by July 2010, and declined in well 30N02 (one of the sentry wells comprising the Deep Well Index) to historical levels by October 2009. Comparing well 30N02 to the other deep index wells, the other deep index wells showed no elevated concentrations during the same time period. However, comparing well 30N02 to wells with similar screen elevations (Figure 7), wells 36L01 (approximately 11,950 feet south of well 30N02) and the MW-Blue well (approximately 3,300 feet east-southeast of well 30N02) suggested that seawater intrusion perhaps progressed eastward as far as the MW-Blue well, but not as far south as well 36L01 (Figure 28). While the TDS and chloride concentrations were elevated from August 2009 to July 2011 in the MW-Blue well, the sodium concentrations remained within historical levels. During the same time period, TDS, chloride, and sodium concentrations remained within historical levels in well 36L01. The well cluster at 32S/13E 30N may be relatively prone to seawater intrusion because of the location near the more permeable sediments deposited by the ancestral Arroyo Creek (NCMA 2009 Annual Monitoring Report) and the lower groundwater elevations typical to the east (Figures 8 and 9).

During 2017, there were no indications of seawater intrusion.

6.1.3 Measures to Avoid Seawater Intrusion

In recognition of the risk of seawater intrusion, the NCMA agencies have developed and implemented a water quality monitoring program for the sentry wells and OCSD observation wells. The NCMA agencies, FCWCD, and the State of California also have worked cooperatively toward the protection of the sentry wells as long-term monitoring sites. Several measures are employed by the NCMA agencies to reduce the potential for seawater intrusion. Specifically, the NCMA agencies have voluntarily reduced coastal groundwater pumping, decreased overall water use via conservation, and initiated plans, studies, and institutional arrangements to secure additional surface water supplies. As a result, each of the four major municipal water users reduced groundwater use between 25 and 95 percent during the past several years. In 2017, municipal groundwater use was 797 AF, which constitutes 18 percent of the urban user's groundwater allotment (including agricultural conversion credits) of the basin safe yield (Table 7).

Central Coast Blue is a regional recycled water project that includes advanced treatment of water from Pismo Beach's and South San Luis Obispo County's (SSLOCSD) wastewater treatment plants and injection into the SMGB to reduce the risk of seawater intrusion and improve water supply sustainability for the region. Tasks related to the development of the project that were performed prior to and throughout 2017 include plant design and upgrade, pilot plant development and testing, funding appropriation, and groundwater modeling.

Reduced groundwater recharge, whether it is from drought or reduction of subsurface inflow from the north and east, reduces subsurface outflow to the ocean and increases the potential threat of seawater intrusion.

6.2 Threats to State Water Project Supply

Both extended drought and long-term reduction in snowpack from climate change can affect SWP deliveries. Despite the predictions of a strong El Niňo hydrologic year in 2016, the rainfall patterns in the central coast of California did not result in the "drought-buster" that was hoped to pull California from the impacts of the recent 5-year severe drought. However, rainfall in March/April, and again in November/December of 2016 in the SWP source area resulted in storage capacity levels of the state's two largest reservoirs, Lake Shasta and Lake Oroville, at 73 and 56 percent capacity, respectively, as of the start of 2017.

Leading into 2018, rainfall during the last 8 months of 2017 resulted in 0.62 inches of rain. The initial allocation announcement by DWR, announced on November 29, 2017, informed SWP contractors that their 2018 allocation would be 15 percent of requests for deliveries. The Table A allocation was subsequently increased on January 29, 2018 to 20 percent. As the winter rainfall season progresses, the allocations often increase by March or April. The last 100 percent allocation—difficult to achieve even in wet years largely because of Delta pumping restrictions to protect threatened and endangered fish species—was in 2006.

The immediate threat of allocation reductions to Pismo Beach and OCSD (the only SWP contractors in the NCMA) has not significantly materialized during the past several years, as the FCWCD's excess SWP entitlement provides a buffer, in addition to the agency's drought buffer, so that contracted volumes to water purveyors, such as the OCSD and Pismo Beach, still may be provided in full. However, the SWP supply has the potential to be affected by drought as well as environmental issues, particularly involving the Delta smelt in the Sacramento-San Joaquin Delta.

6.3 Threats to Lopez Lake Water Supply

Extended drought conditions in recent years have contributed to record low water levels in Lopez Lake and impacts of climate change may affect future precipitation amounts in the Lopez Creek watershed. As discussed in Section 4.1.1, the Zone 3 agencies developed and implemented the LRRP in response to reduced water in storage in the lake. The LRRP is intended to reduce municipal diversions and downstream releases as water levels drop in order to preserve water within the reservoir for an extended drought. The relatively heavy rainfall of late 2016 and early 2017 created hope that the drought of 2012 to 2016 had ended; however, the rainfall year of 2016-17 started out as the driest year in record. A relatively wet March, 2018 increased the 2017-18 rainfall totals to the area to approximately 60 percent of normal, which would still constitute a continuation of the long-term drought. If drought conditions continue, even with reduced diversions and releases, water from Lopez Lake may be unavailable, or at least significantly reduced, to the Zone 3 agencies. Without access to water from Lopez Lake, the NCMA agencies and local agriculture stakeholders may be forced to rely more heavily on their groundwater supplies and increase pumping during extended drought conditions, which could result in lowering water levels in the aquifer and an increased threat from seawater intrusion. Moreover, a reduction in downstream releases from the reservoir, as mandated by the LRRP, likely will lead to reduced recharge to the NCMA portion of the SMGB and further contribute to declining groundwater levels.

7. Management Activities

The NCMA and overlying private well users have actively managed surface water and groundwater resources in the NCMA agencies area for more than 30 years. Management objectives and responsibilities were first established in the 1983 "Gentlemen's Agreement," recognized in the 2001 Groundwater Management Agreement, and affirmed in the 2002 Settlement Agreement. The responsibility and authority of the Northern Parties for NCMA groundwater management was formally established through the 2002 Settlement Agreement, Stipulation, and Judgment After Trial. Throughout the long history of collaborative management, which was formalized through the Agreement, Stipulation, and Judgment, the overall management goal for the NCMA agencies is to preserve the long-term integrity of water supplies in the NCMA portion of the SMGB.

7.1 Management Objectives

Eight basic Water Management Objectives have been established for ongoing NCMA groundwater management:

1. Share Groundwater Resources and Manage Pumping
2. Enhance Management of NCMA Groundwater
3. Monitor Supply and Demand and Share Information
4. Manage Groundwater Levels and Prevent Seawater Intrusion
5. Protect Groundwater Quality
6. Manage Cooperatively
7. Encourage Water Conservation
8. Evaluate Alternative Sources of Supply

Each of these objectives is discussed in the following sections. Under each objective, the NCMA TG has identified strategies to meet the objectives. These strategies are listed and then discussed under each of the eight objectives listed below. Other potential objectives are outlined in the final section.

A major management undertaking of the NCMA TG was the development in 2014 of a Strategic Plan (WSC, 2014) to provide the NCMA with:

1. A mission statement to guide ongoing and future initiatives as well as capture the requirements outlined in the Gentlemen's Agreement, the Settlement Agreement, and the Stipulation. The mission statement said:

    Preserve and enhance the *sustainability* of water supplies *for* the Northern Cities Area by:

    - **Enhancing supply *reliability***
    - **Protecting water *quality***
    - **Maintaining *cost-effective* water supplies**
    - **Advancing the legacy of *cooperative* water resources management**

2. A framework for communicating water resource goals
3. A formalized Work Plan for the next 10 years

Through the strategic planning process, the NCMA TG identified several key strategic objectives to guide its efforts. These efforts include:

A. Enhance Water Supply Reliability
    - Prepare the NCMA agencies for prolonged drought conditions.
    - Develop a coordinated response plan for seawater intrusion and other supply emergencies.
    - Analyze impacts of pumping on the groundwater basin.
    - Better protect against threats to groundwater sustainability.

B. Improve Water Resource Management
    - Update the 2001 Groundwater Management Agreement.
    - Develop more formalized structure/governance for the NCMA TG.

C. Increase Effective Outreach
    - Engage agriculture stakeholders.
    - Improve coordination with FCWCD and other regional efforts.
    - Increase communication with various City Councils and Boards of Directors.

The Strategic Plan formalized many of the water resource management projects, programs, and planning efforts that the NCMA agencies, both individually and jointly, have been engaged in that address water supply and demand issues, particularly with respect to efforts to ensure a long-term sustainable supply. The following section discusses the major management activities that the NCMA agencies have pursued during 2017 that incorporate the planning objectives outlined in the 2014 Strategic Plan.

In January 2015, the NCMA agencies developed a Water Supply, Production and Delivery Plan (WSPDP) that applies the strategic objectives to the various supplies available to the area. The NCMA area receives supplies from Lopez Lake, the SWP, and the underlying groundwater basin.

> *The purpose of the FY 2014/15 Water Supply, Production and Delivery Plan is to provide the NCMA agencies with a delivery plan that optimizes use of existing infrastructure and minimizes groundwater pumping from the SMGB. The plan includes the development of a water supply and delivery modeling tool for the NCMA agencies, evaluation of three delivery scenarios, and development of recommendations for water delivery for FY 2014/15.*

The WSPDP made recommendations that were implemented or subject to further study. These recommendations are summarized in subsequent sections, and include:

- Continue ongoing water conservation efforts to limit demand and make additional supply available for potentially future dry years.
- Immediately implement the strategies identified in Scenario 1 Baseline Delivery to minimize SMGB groundwater pumping in the near term.

These recommendations reinforce the ongoing management efforts by the NCMA and provide potential projects to improve water supply reliability and protect water quality during the ongoing drought. Ongoing work to implement the recommendations includes evaluation of additional delivery facilities to add operational flexibility to ensure optimum use of all supplies.

Implementing the WSPDP has allowed the NCMA to minimize the use of groundwater thereby protecting against seawater intrusion while meeting the needs of its customers and other water users in the basin.

The NCMA agencies, in conjunction with the other Zone 3 agencies and the FCWCD, continue efforts to evaluate and implement potential drought emergency options. This initiative includes identification, evaluation, and ranking of potential options available to Zone 3 to improve the reliability of its water supplies. This evaluation of options was completed by the Zone 3 Technical Advisory Committee and presented to the Zone 3 Advisory Committee and the County Board of Supervisors (BOS). As a result of these efforts, the Zone 3 agencies and the County have pledged to work collaboratively together to continue to evaluate and implement emergency water supply reliability options as required in conditions of extended drought. Potential options that the Zone 3 agencies have evaluated in the past few years include:

Zone 3 Extended Drought Emergency Options:

- **Cloud Seeding**. Investigate opportunities to use cloud seeding to enhance rainfall in the Lopez Watershed. This could involve a cooperative agreement with the County.
- **State Water Project**. Maximize importation of FCWCD SWP supplies, including subcontractor and "Excess Entitlement" supplies.
    - Evaluate delivery of SWP water to non-SWP subcontractors under emergency provisions (e.g., Arroyo Grande, Grover Beach, etc.).
- **Unsubscribed Nacimiento Water Project (NWP) Water**. Investigate transfer/exchange opportunities to obtain unsubscribed NWP water for the Zone 3 agencies (i.e., exchange agreements with the City of San Luis Obispo and the Chorro Valley pipeline SWP subcontractors).
- **Water Market Purchases**. Investigate opportunities to obtain additional imported water and deliver it to the Zone 3 agencies through the SWP infrastructure (e.g., exchange agreements with San Joaquin/Sacramento Valley farmers, water broker consultation, groundwater banking exchange agreements, etc.).
- **Morro Bay Desalination Plant Exchanges**. Investigate opportunities to obtain SWP water from Morro Bay by providing incentives for Morro Bay to fully utilize its desalination plant capacity.
- **Land Fallowing.** Evaluate potential agreements with local agriculture representatives to offer financial incentives to fallow land within the Arroyo Grande and Cienega Valleys and make that water available for municipal use.
- **Enhanced Conservation**. Evaluate opportunities for enhanced water conservation by the Zone 3 agencies beyond the Governor's Mandatory Water Conservation Order (e.g., water

rationing, no outdoor watering, agriculture water restrictions, etc.) to preserve additional water.

- **Nacimiento/California Men's Colony Intertie**. Complete design of a pipeline that would connect the NWP pipeline to the California Men's Colony (CMC) Water Treatment Plant. Investigate opportunities for Zone 3 agencies to purchase NWP water and use exchange agreements and existing infrastructure to deliver additional water to Zone 3 through the Coastal Branch pipeline.

7.1.1 Share Groundwater Resources and Manage Pumping

Strategies:

- Continued reduction of groundwater pumping, maintain below safe yield.
- Coordinated delivery of Lopez Lake water to the maximum amount available, pursuant to the Lopez Lake LRRP.
- Continue to import SWP supplies to OCSD and Pismo Beach.
- Maintain surface water delivery infrastructure to maximize capacity.
- Utilize Lopez Lake to store additional SWP water within San Luis Obispo County

Discussion:

A longstanding objective of water users in the NCMA has been to cooperatively share and manage groundwater resources. In 1983, the Northern Parties (including water users in the NCMA area) mutually agreed on an initial safe yield estimate and an allotment of pumping between the urban users and agricultural irrigation users of 57 percent and 43 percent, respectively. In this agreement, the NCMA agencies also established pumping allotments among themselves. Subsequently, the 2001 Groundwater Management Agreement included provisions to account for changes such as agricultural land conversions. The agreements provide that any change in the accepted safe yield based on ongoing assessments would be shared on a pro rata basis. Pursuant to the stipulation, the NCMA agencies conducted a water balance study to update the safe yield estimate (Todd, 2007). As a result, the NCMA agencies agreed to maintain the existing pumping allotment among the urban users and established a consistent methodology to address agricultural land use conversion.

In addition to cooperatively sharing and managing groundwater resources, the NCMA agencies have coordinated delivery of water from Lopez Lake. At the same time, Pismo Beach and OCSD have continued to import SWP water. Both actions maximize use of available surface water supplies. In 2016, in response to the ongoing drought at that time and the threat of diminishing water supplies, Arroyo Grande approved a measure authorizing the City to purchase SWP water from the FCWCD's excess allotment on a temporary basis and only during a declared local water emergency; that condition was not reached in 2017 and Arroyo Grande did not purchase SWP water.

The WSPDP now provides a framework for the NCMA, as a whole, to actively and effectively manage the groundwater resource, particularly in years of below normal rainfall and below "normal" SWP delivery schedules. The WSPDP outlined a strategy to provide sufficient supplies to NCMA water users in instances of reduced SWP delivery. Specifically, in 2017, municipal groundwater pumpage at 797 AF was less than any year during the 19-year period from 1999 through 2017 (inclusive).

Many aspects of the NCMA's water management strategy that shifted direction in 2014 as a result of the severity of the 2012-16 drought continued into 2017. Adoption of the LRRP by FCWCD resulted in the implementation of the first stage of LRRP reduction triggers, which protect the Lopez Lake from running dry in any single year while providing flows for habitat protection in Arroyo Grande Creek. Although the drought emergency was lifted, the Zone 3 agencies continued operating under the LRRP throughout 2017, until there is some assurance that the drought is truly relieved. In addition, the NCMA agencies have increased conservation efforts even more than in previous years to adequately and safely manage the water resource (additional discussion in Section 7.1.7).

Seawater intrusion is the most important potential adverse impact for the NCMA agencies to consider in their efforts to effectively manage the basin. Seawater intrusion, a concern since the 1960s, would degrade the quality of water in the aquifer and potentially render portions of the basin unsuitable for groundwater production (DWR, 1970). A Deep Well Index of the three primary deep sentry wells of 7.5 feet (NAVD 88) has been recognized as the index, above which it is thought that there is sufficient fresh water (groundwater) outflow to prevent seawater intrusion. From late 2009 to April 2013, the NCMA agencies' management of groundwater levels and groundwater pumpage maintained the sentry well index above the 7.5-foot level. However, for several weeks in April and May 2013, from early July through mid-December 2013, and from mid-April 2014 through mid-December 2014, the index value dropped below the target. In 2015, the index value was above the Deep Well Index threshold from January through February; however, the index remained below the target level from March through December 2015, generally between 4 and 7 feet below the 7.5-foot target.

Similarly, in 2016, the Deep Well Index started the year above the threshold value, with an index value of 9.18 in January. By mid-May the index value dropped below the 7.5-foot index level. Between mid-May and October 2016, the Deep Well Index remained below the index threshold value, reaching an index value of 5.64 feet in October. In late October 2016, the Deep Well Index began to rise and in mid-December 2016, the index value has been above the threshold value.

Except for a very brief period between August 18 and August 29, 2017, when the agencies were forced to increase groundwater pumping due to a maintenance shutdown of the Lopez Lake water supply, the Deep Well Index remained above the 7.5-foot threshold value throughout the entirety of 2017.

Another potential adverse impact of localized pumping includes reduction of flow in local streams, notably Arroyo Grande Creek (Todd, 2007). The NCMA agencies (as Zone 3 contractors) have participated with FCWCD in preparation of the Arroyo Grande Creek Habitat Conservation Plan (HCP) that addresses reservoir releases to maintain both groundwater levels and habitat diversity in the creek. The FCWCD contracted with ECORP Consulting in 2015 to conduct the additional hydraulic studies to finalize the HCP. The work continued throughout 2017; the scheduled completion of the HCP is not certain.

7.1.2 Enhance Management of NCMA Groundwater

Strategies:

- Develop a groundwater model for the NCMA/NMMA or the entire SMGB.
- Coordinate with the County and NMMA to develop new monitoring well(s) in key locations within the SMGB.
- Develop a Salt and Nutrient Management Plan (SNMP) for the NCMA/NMMA.
- Develop and implement a framework for groundwater storage/conjunctive use, including return flows.
- Update the 2001 Agreement Regarding Management of the Arroyo Groundwater Basin, approved in 2002.

Discussion:

The NCMA agencies participated in the oversight of the performance of the SMGB characterization study (Fugro, 2015), which was finalized with the distribution of the complete datasets in March 2016. The project was conducted as part of the County IRWMP 2014 updated, in part to prepare for and to provide the foundational data for development of a numerical groundwater flow model and preparation of a basin-wide SNMP. To date, the SNMP has not been initiated, but significant progress was made in 2017 toward development of a numerical groundwater flow model, associated with a recycled water project referred to as Central Coast Blue (formerly referred to as the Regional Groundwater Sustainability Project). The intent of Central Coast Blue is to enable Pismo Beach and the South San Luis Obispo County Sanitation District (SSLOCSD) to construct an Advanced Treatment Facility (ATF) to produce Advanced Purified Water (APW) to augment its water supply through injection to recharge the groundwater basin and provide a new, drought-proof, source of water supply for the area. As part of Central Coast Blue planning and technical studies, a localized groundwater flow model (the Phase 1A model) was developed for the northern portion of the NCMA that evaluated the concept of injecting APW into the SMGB to increase the recharge to the basin, improve water supply reliability and help prevent future occurrences of seawater intrusion.

Based on the results of the Phase 1A model and through funding by SSLOCSD Supplemental Environmental Program (SEP), work was initiated in 2017 for development of the Phase 1B groundwater flow model. The model domain of the Phase 1B model covers the entire NCMA, NMMA, and the portion of the SMVMA north of the Santa Maria River. The purpose of the model is to evaluate groundwater injection and extraction scenarios to support Central Coast Blue. It will be utilized to identify the locations of the proposed injection wells, quantify the amount of water that can be injected, evaluate strategies for preventing seawater intrusion, and develop estimates of the overall yield that the Central Coast Blue stakeholders will be able to receive from the project. This modeling work is expected to be completed in mid-2018.

As part of the FCWCD's SMGB characterization study (Fugro, 2015), continuous monitoring transducers were installed in 2015 in coastal sentry wells 36L01 and 36L02 (which are part of the

NCMA monitoring program) and in wells 11N/36W-12C01 and 11N/36W-12C02. As a result, continuous water level and field-parameter water quality data were collected from these wells throughout 2017.

The monthly NCMA TG meetings provide for collaborative development of joint budget proposals for studies and plans, and shared water resources. In addition, the monthly meetings provide a forum for discussing the data collected as part of the quarterly monitoring reports.

7.1.3 Monitor Supply and Demand and Share Information

Strategies:

- Develop coordinated Urban Water Management Plans (UWMPs) for the NCMA agencies.
- Develop a coordinated Water Shortage Contingency Plan to respond to a severe water shortage condition in the NCMA.
- Share groundwater pumping data at monthly NCMA TG meetings.
- Evaluate future water demands through comparison to UWMP projections:
    - Arroyo Grande 2015 UWMP (revised and updated, January 2017)
    - Pismo Beach 2015 UWMP (June 2016)
    - Grover Beach 2010 UWMP
    - OCSD is not required to prepare an UWMP because the community population does not meet the minimum requirement threshold.

Discussion:

Pismo Beach and Arroyo Grande prepared updated UWMPs in 2016 and 2017, respectively. OCSD is not required to prepare an UWMP because the community population does not meet the minimum requirement threshold; however, many of the aspects of a UWMP are addressed through participation in the NCMA planning process.

Regular monitoring of activities that affect the groundwater basin, and sharing that information, have occurred for many years. The monitoring efforts include gathering data on hydrologic conditions, water supply and demand, and groundwater pumping, levels, and quality. The current monitoring program is managed by the NCMA agencies in accordance with the Stipulation and the Judgment, guided by the July 2008 Monitoring Program for the NCMA. The monitoring data and a summary of groundwater management activities are summarized in the Annual Reports. Arroyo Grande, Grover Beach, and Pismo Beach each have evaluated their future water demands as part of their respective 2010 UWMPs and 2015 UWMP updates. The NCMA shares information with the two other management areas (NMMA and SMVMA) through data exchange and regular meetings throughout the Annual Report preparation cycle.

Management activities have become more closely coordinated among the NCMA agencies as a result of the 2012-16 drought. In particular, the NCMA agencies implemented the LRRP to limit municipal diversions and downstream releases from Lopez Reservoir to ensure that water is available for future potentially dry years. In addition, the Zone 3 agencies (which include the

NCMA TG) initiated a long-term drought planning effort. The planning effort is intended to plan water supplies for periods of extended drought conditions.

7.1.4 Manage Groundwater Levels and Prevent Seawater Intrusion

Strategies:

- Use stormwater ponds to capture stormwater runoff and recharge the groundwater basin.
- Install transducers in key monitoring wells to provide continuous groundwater elevation data; the following wells have transducers:
  - 24B03
  - 30F03
  - 30N02
  - 36L01
  - 36L02
  - 32C03 (County Monitoring Well No. 3)
- Collect and evaluate daily municipal pumping data to determine the impact on local groundwater elevation levels.

Discussion:

Prevention of seawater intrusion through the management of groundwater levels is essential to protect the shared resource. The NCMA agencies increase groundwater recharge with stormwater infiltration and closely monitoring groundwater levels and water quality in sentry wells along the coast.

Arroyo Grande and Grover Beach each maintain stormwater retention ponds within their jurisdiction; the FCWCD maintains the stormwater system, including retention ponds, in OCSD. These ponds collect stormwater runoff, allowing it to recharge the underlying aquifers. There are approximately 140 acres of detention ponds in Arroyo Grande and 48 acres of detention ponds in Grover Beach. The stormwater detention pond in OCSD is approximately one-half acre. Grover Beach modified its stormwater system in 2012 to direct additional flow into one of its recharge basins.

Although closely related to the objectives to manage pumping, monitor supply and demand, and share information, this objective also specifically recognizes the proximity of production wells to the coast and the threat of seawater intrusion. The NCMA agencies and FCWCD have long cooperated in the monitoring of groundwater levels, including quarterly measurement by the NCMA of groundwater levels in sentry wells at the coast. Upon assuming responsibility for the coastal monitoring wells, the NCMA became aware of the need to upgrade their condition. In July 2010 the wellheads (surface completions) at four sentry monitoring well clusters in the NCMA were renovated:

- 24B01, -B02, and-B03
- 30F01, -F02, and -F03

- 30N01, -N02, and -N03
- 36L01 and -L02

The renovations included raising the elevations of the top of each individual well casing by 2 to 3 feet and resurveying relative to the NAVD88 standard in late September 2010 (Wallace Group, 2010). The individual well casings are now above the ground surface and protective locking steel risers enclose each cluster. As a result of this work, the sentry wells in the NCMA now are protected from surface contamination and tampering.

Quarterly measurement of groundwater levels aids in assessing the risk of seawater intrusion along the coast. To enhance the data collection and assessment efforts, the NCMA installed transducers in five of the key sentry monitoring wells to provide continuous groundwater levels at key locations. By combining this with the collection and evaluation of daily municipal pumping data, the NCMA is better able to determine the response of local groundwater levels to extractions and, therefore, better manage the basin.

To gain insight into water level fluctuation and water quality variation in the area between the NCMA and NMMA, a continuous monitor was installed in well 32C03 (County Well No. 3), which was constructed and is owned by the County as part of the County-wide groundwater monitoring network. Water level monitoring was initiated in April 2012, when sensors were installed to document water level, temperature, and specific conductivity.

In 2015, continuous monitoring sensors were installed in coastal monitoring wells 36L01 and 36L02 located in the Oceano Dunes. Data from the transducers in these wells now are collected on a quarterly basis along with the other sentry wells.

Additional studies to enhance basin management efforts that have been discussed by the NCMA TG include:

- Consider implementation of a monthly water level elevation data analysis of the sentry wells during periods when the Deep Well Index value is below the index target of 7.5 feet NAVD88 for an extended period of time. Given that the index generally has remained steady because of reduced groundwater pumping, the NCMA has deferred the issue of monthly analysis.
- Consider implementation of a monthly analysis of electrical conductivity data from the wells with downhole transducers during periods when the Deep Well Index value is below the index target of 7.5 feet to track potential water quality degradation (an enhanced monitoring schedule of County Well No. 3 is not necessary because background water quality does not change or fluctuate significantly). If electrical conductivity data suggest water quality degradation, implement a monthly sampling and monitoring program. Given that the index generally has remained steady because of reductions in groundwater pumping, the NCMA has deferred the issue of monthly analysis.
- Assess the potential impacts on sentry well water level elevations from extended periods of increased groundwater pumping by conducting analytical modeling analyses to predict water level responses given certain pumping scenarios. These analyses may prove fruitful as scenarios unfold regarding decreased SWP deliveries or short-term emergency cuts to

Lopez Lake deliveries. Utilization of the Phase 1B model, in preparation in 2017 in support of Central Coast Blue, may be used for the purpose in 2018 and beyond.

- The 2005 Stipulation requires Nipomo Community Services District (NCSD) and the other NMMA parties to develop a Nipomo Supplemental Water Project (NSWP) to import a minimum of 2,500 AFY to mitigate overpumping that may impact groundwater inflow to the NCMA, and thus may facilitate seawater intrusion in both NCMA and NMMA. On July 2, 2015, the NCSD began taking deliveries of SWP from the City of Santa Maria. The NSWP is designed to deliver 3,000 AFY, however current deliveries are about 800 AFY. The additional stages of the NSWP and funding sources to implement the project to allow increased water delivery to meet the requirements of the Judgment are being planned; full implementation of the project is apparently planned for 2025-26.

7.1.5 Protect Groundwater Quality

Strategies:

- Perform quarterly water quality monitoring at all sentry wells and County Well No. 3.
- Gather temperature and electrical conductivity data from monitoring wells to continuously track water quality indicators for seawater intrusion.
- Prepare an SNMP pursuant to state policy using the results of the SMGB characterization study (Fugro, 2015).
- Construct a recycled water system in Pismo Beach, pursuant to the results of Pismo Beach's Recycled Water Facilities Planning Study (RWFPS), completed in 2015 (WSC, 2015) and Central Coast Blue.
- Support regional recycled water project planning through performance of a RWFPS by the South San Luis Obispo County Sanitation District. The RWFPS was completed in 2017.

Discussion:

The objective to protect groundwater quality is closely linked with the objective for monitoring and data sharing. To meet this objective all sources of water quality degradation, including the threat of seawater intrusion, need to be recognized. Water quality threats and possible degradation affect the integrity of the groundwater basin, potentially resulting in loss of use or the need for expensive water treatment processes. Sentry wells are monitored quarterly and data from other NCMA production wells are assessed annually. The monitoring program includes evaluation of potential contaminants in addition to those that might indicate seawater intrusion. Temperature and electrical conductivity probes have been installed in five monitoring wells to provide continuous water quality tracking for early indication of seawater intrusion. A sixth sentry well cluster (36L) in the Oceano Dunes was instrumented in April 2015 as part of the SMGB characterization study (Fugro, 2015). The results of the SMGB characterization study provide the foundation for preparation of an SNMP.

Investigations continued throughout 2017 for work associated with Pismo Beach's Central Coast Blue project. These efforts followed up on Pismo Beach's RWFPS to investigate alternatives for constructing a recycled water system that will enable the NCMA agencies to beneficially use recycled water to augment their groundwater supply and provide a new, drought-proof source of water supply for the area. Engineering was performed throughout 2017, and the environmental review process was initiated along with development of the groundwater flow model.

7.1.6 Manage Cooperatively

Strategies:

- Improve agriculture outreach by enhancing coordination with local growers.
- Coordinate groundwater monitoring data sharing and annual report preparation with the NCMA, NMMA, and the SMVMA.
- Improve interagency coordination among the NCMA agencies and include the County.

Discussion:

Since 1983, NCMA management has been based on cooperative efforts of the affected parties, including the NCMA agencies, private agricultural groundwater users, the County, the FCWCD, and other local and state agencies. Specifically, the NCMA agencies have limited their pumping and, in cooperation with FCWCD, invested in surface water supplies so as to not exceed the safe yield of the NCMA portion of the SMGB. Other organizations participate, as appropriate. In addition to the efforts discussed in this 2017 Annual Report, cooperative management occurs through many other venues and forums, including communication by the NCMA agencies in their respective public meetings and participation in the Water Resources Advisory Council (the County-wide advisory panel on water issues).

The NCMA agencies participated in preparation and adoption of the 2014 update of the County IRWMP. The IRWMP promotes integrated regional water management to ensure sustainable water uses, reliable water supplies, better water quality, environmental stewardship, efficient urban development, protection of agriculture, and a strong economy. The IRWMP integrates all of the programs, plans, and projects within the region into water supply, water quality, ecosystem preservation and restoration, groundwater monitoring and management, and flood management programs.

Since the Judgment, the NCMA has taken the lead in cooperative management of its management area. The NCMA TG met monthly throughout 2017 and has been a willing and active participant in the SMGBMA technical subcommittee, which first met in 2009 (the SMGBMA technical subcommittee did not meet in 2017). The purpose of the SMGBMA technical subcommittee is to coordinate efforts among the management areas, such as enhanced monitoring of groundwater levels and improved sharing of data. With the current threats to water supply in all management areas, greater communication, analytical collaboration, and data sharing, especially between NCMA and NMMA, are encouraged.

An outcome of actions initiated by NCMA in early 2016 resulted in several activities of increased discussion and collaboration between the NCMA and NMMA throughout 2017. The NCMA-NMMA Management Coordination Committee met four times in 2017 to discuss items of mutual concern and develop strategies for addressing the concerns.

Another area of increased mutual collaboration between the NCMA and NMMA was the formation of a technical team, consisting of representatives from the NCMA and NMMA, to collaboratively develop a single data set of water level data points to prepare a consistent set of semiannual water level contour maps for the NCMA and NMMA, so that the maps from each management area would represent a mutually agreed upon condition at the NCMA/NMMA boundary. This collaboration continued throughout 2017.

A third initiative was to create a Modeling Subcommittee, composed of a select set of representatives from the NCMA and NMMA, to discuss the feasibility and possible work scope for the development of a numerical groundwater flow model of the SMGB, or at least that portion of the basin north of the Santa Maria River. When the Phase 1B groundwater flow model project was initiated in 2017, representatives from this subcommittee formed a technical review and advisory committee to provide input to the modeling consultant and monitor progress.

7.1.7 Encourage Water Conservation

Strategies:

- Share updated water conservation information.
- Implement UWMPs.

Discussion:

Water conservation, or water use efficiency, is linked to the monitoring of supply and demand and the management of pumping. Water conservation reduces overall demand on all sources, including groundwater, and supports management objectives to manage groundwater levels and prevent seawater intrusion. In addition, water conservation is consistent with state policies seeking to achieve a 20 percent reduction in water use by the year 2020. Water conservation activities in the NCMA are summarized in various documents produced by the NCMA agencies, including the 2015 Urban Water Management Plans (UWMP) of Arroyo Grande and Pismo Beach and the 2010 UWMP of Grover Beach. OCSD is not required to prepare an UWMP.

In addition to ongoing water conservation efforts, the drought conditions that extended throughout 2016 led the NCMA agencies to increase their effort to reduce water use. The statewide mandatory water conservation requirements, signed into law on April 1, 2015, by the governor (Executive Order B-29-15), which enacted mandatory water conservation requirements because of the ongoing drought conditions and the historic low Sierra snowpack measurements, were continued throughout 2016 and into early 2017. On April 7, 2017, the State of California took action to lift the drought emergency and State mandated water use restrictions throughout the state.

The water conservation measures instituted by each NCMA agency are summarized below.

Arroyo Grande

On April 7, 2017, the State of California took action to lift the drought emergency and State mandated water use restrictions throughout the state. The action also eliminated the State's mandate for Arroyo Grande to save 28 percent of its water use. In response, the Arroyo Grande City Council approved and adopted a resolution in May 2017 rescinding the Stage 1 Water Shortage Emergency in the City, which removes temporary water use limitations that established individualized water budgets for all residential customers. During the State-mandated Stage 1 restrictions, Arroyo Grande water use reduction was on average 42% compared to 2013, thereby meeting and exceeding the State mandates.

The City Council's action was based on a determination that there is no immediate or imminent threat to the City's ability to meet the community's water supply needs. However, all established mandatory water use restrictions remained in effect, including limitations on outdoor irrigation and continued adherence to four-day outdoor irrigation based on the property address.

Mandatory water conservation measures include:

- Use of water that results in excessive gutter runoff is prohibited.
- No water will be used for cleaning driveways, patios, parking lots, sidewalks, streets, or other such use except where necessary to protect the public health and safety.
- Outdoor water use for washing vehicles will be attended and have hand-controlled water devices.
- Outdoor irrigation is prohibited between 10 a.m. and 4 p.m.
- Irrigation of private and public landscaping, turf areas, and gardens is permitted at even-numbered addresses only on Mondays and Thursdays, and at odd-numbered addresses only on Tuesdays and Fridays.
- No irrigation of private and public landscaping, turf areas, and gardens is permitted on Wednesdays. Irrigation is permitted at all addresses on Saturdays and Sundays.
- In all cases, customers are directed to use no more water than necessary to maintain landscaping.
- Emptying and refilling swimming pools and commercial spas are prohibited except to prevent structural damage and/or to provide for the public health and safety.
- New swimming pools may be constructed, however, they will have a cover that conforms to the size and shape of the pool and acts as an effective barrier to evaporation. The cover must be in place during periods when use of the pool is not reasonably expected to occur.
- Use of potable water for soil compaction or dust control purposes in construction activities is prohibited.
- Hotel, motel, or other commercial lodging establishments will offer their patrons the option to forego the daily laundering of towels, sheets, and other linens.
- Restaurants or other commercial food service establishments will not serve water except upon the request of a patron.
- The City may impose fines for violation of mandatory conservation measures. Customers who received a financial penalty may have their penalty waived if they attend a 2-hour water conservation class.

In addition to the mandatory water conservation measures outlined above, the Water Shortage Emergency resolution included a tiered billing system, whereby residential customers were assigned a baseline amount of water, based on the amount of water used during the billing period of 2013. Residential customers in Tier 1 then were required to reduce consumption by 10 percent, customers in Tier 2 were required to reduce consumption by 20 percent, and customers in Tier 3 were required to reduce consumption by 30 percent.

To help manage the use of water, the City offers several water conservation incentive programs designed to decrease overall water use, particularly outside (irrigation) use in the summer. The conservation and incentive programs include:

- **Plumbing Retrofit Program.** This program includes installation or adjustment of showerheads, toilets, faucet aerators, and pressure regulators for single-family and multi-family residential units constructed before 1992. This program has been in place since 2004 at an expense to the City of more than $1.55 million.
- **Cash for Grass.** Because of its popularity and limited funding, this program was suspended.
- **StormRewards Program.** This rebate program (administered by Coastal San Luis Resource Conservation District) provides an incentive for landowners to install rain gardens, rain barrels, dry wells, and porous pavement, and to remove impervious pavement.
- **Sustainable Landscape Seminar Series.** This program offers monthly seminars on sustainable landscaping practices. DVDs of the seminars are available at the County library located at 800 West Branch Street in Arroyo Grande.
- **Smart Irrigation Controller and Sensor Program.** This program offers Smart Irrigation Controllers and Sensors at no charge to customers to encourage residents to upgrade their old irrigation controllers with new weather-based sensor technology.
- **Washing Machine Rebate.** This program pays water customers a one-time rebate for the installation of a certified energy efficient Tier 3 washing machine.
- **Mandatory Plumbing Retrofit.** Upon change of ownership of any residential property, the seller must retrofit the property’s plumbing fixtures to meet defined low-water use criteria.

Pismo Beach

In 2014, Pismo Beach introduced the first-in-the-state waterless urinal mandate and a 0.5-gallon per minute (gpm) restroom aerator retrofit requirement. The components of this program includes:

- **Waterless urinal retrofits.** All existing urinals in the City will be retrofitted to waterless urinals before February 14, 2016. Exemptions to this section may be granted at the discretion of the City Engineer under certain conditions.
- **Faucet aerators.** Residential restroom construction will be fitted with aerators that emit no more than 0.5 gpm. Exemptions may be granted at the discretion of the City Engineer in cases to protect public health and safety. Restroom faucets in all publicly accessible restrooms, including those in hotel rooms, lobbies and restrooms, restaurants, schools, commercial and retail buildings, public buildings, and similar publicly accessible restrooms were retrofitted to install aerators that emit no more than 0.5 gpm.
- **Sub-meters in new construction.** All new multi-unit buildings, regardless of proposed use, will be required to have a separate sub-meter capable of measuring the water use of every usable unit, separate common space, and landscaping that is expected to use at least 25 gallons of water per day on average for the course of a year, regardless of the

overall size of the building. Buildings that have a separate water meter for each unit are exempt.

Also in 2014, Pismo Beach adopted several Water Conservation Incentive Programs to help reduce water consumption and ensure reliable future water supply. The programs include:

- **Cash for Grass.** This program reimburses residents for each square foot of lawn removed (minimum 300 square feet) and replaced with drought-tolerant landscaping, which is required to have drip or micro-spray irrigation and be on an automatic timer.
- **Free Catch Bucket Program.** This program gives residents one free shower catch bucket for capturing unused shower water and re-purposing it for irrigation or utility purposes.
- **Rain Barrel Rebate Program.** This program reimburses residents up to $100 ($50 per rain barrel) when up to two rain barrels are purchased and installed to use rain water, conserve potable water, and reduce stormwater runoff.
- **Washing Machine Rebate.** This program pays a one-time amount for the purchase and installation of a certified energy-efficient Tier 3 washing machine.
- **Smart Irrigation Controller Program.** This program pays a one-time amount toward the cost of a new irrigation controller and associated sensors.
- **Irrigation Retrofit Program.** This program provides a one-time rebate for conversion of a manually operated irrigation system to automatic irrigation.
- **Waterless Urinal Rebate Program.** This program provides a one-time rebate for each conventional flushing urinal that is replaced with a flushless urinal.
- **High Efficiency Toilet Rebate Program.** This program provides a one-time rebate for each 3.5-gallon per flush or higher toilet replaced with a 1.28-gallon per flush or lower toilet.

In January, 2017, Pismo Beach adopted an updated schedule of development impact fees to include new recycled water fees for all new development, redevelopment, and additions to existing buildings that create additional dwelling units or additional non-residential floor area, to help fund the cost of Central Coast Blue.

In June, 2017, in response to the State of California action to lift the drought emergency and State mandated water use restrictions throughout the state, Pismo Beach declared a “Normal Water Supply” and adopted an Urgency Ordinance O-2017-003, revising the restrictions associated with each water supply status to conform to State mandates. The restrictions for a Normal Water Supply include:

- Use of water which causes runoff onto adjacent properties, non-irrigated areas, private and public walkways, roadways, gutters, parking lots or structures is prohibited.
- Outdoor water use for washing vehicles, boats, paved surfaces, buildings, and similar uses shall be attended and have hand-controlled water devices, which shut off the water immediately when not in use.

- No water will be used for cleaning driveways, patios, parking lots, sidewalks, streets, or other such uses except as found necessary by the city to protect the public health or safety.
- Outdoor Irrigation.
  - Outdoor irrigation is prohibited between 10 a.m. and 4 p.m.
  - Applying water to outdoor landscapes during and within 48 hours following measurable precipitation is prohibited.
- Restaurants will serve drinking water only in response to a specific request by a customer.
- Using water in a fountain or other decorative water feature, except where the water is part of a recirculating system, is prohibited.

Grover Beach

In June 2014, Grover Beach declared a Stage III Water Shortage that required all water customers to reduce their water usage by 10 percent. Many of the prohibitions that had previously been voluntary since declaration of the Stage II Water Shortage Declaration became mandatory with the Stage III declaration. The declaration also provided the City with the authority to impose penalties for failure to comply with the water reduction or use prohibitions. The Stage III Water Shortage declaration, with associated prohibitions, continued throughout 2017. These prohibitions include:

- Washing of sidewalks, driveways, or roadways where air-blowers or sweeping provides a reasonable alternative.
- Refilling of private pools except to maintain water levels.
- Planting of turf and other new landscaping, unless it consists of drought-tolerant plants.
- Washing vehicles, boats, etc. without a quick-acting shut-off nozzle on the hose.
- Washing any exterior surfaces unless using a quick-acting shut-off nozzle on the hose.
- Restaurant water service, unless requested.
- Use of potable water for construction purposes, unless no other source of water or method can be used.
- Operation of ornamental fountain or car wash unless water is re-circulated.

Grover Beach has implemented demand management rebate programs including:

- Cash for Grass Rebate Program
- Smart Irrigation Controller and Sensor Rebate Program
- Toilet Fixtures, Showerheads, and Aerators Retrofit Rebate Program
- Washing Machine Rebate Program

Oceano CSD

Given the population of its service area, OCSD is not required to prepare an UWMP or reduce water consumption as mandated by the Governor for Urban Water Suppliers. Outdoor water use restrictions have been adopted, as required. In April 2015, OCSD adopted a rate increase that included tiered rates to promote water conservation; the conditions continued throughout 2017.

OCSD has essentially eliminated groundwater pumping (OCSD pumped 0.5 percent of its groundwater allotment), and is maintaining its annual allocation of Lopez Lake water in storage as allowed pursuant to the LRRP. Meanwhile, OCSD's conservation efforts continue to exceed the Governor's drought-mandated goal (since rescinded) of 25 percent. Overall consumption has declined to approximately 85 gallons per capita daily (gpcd) after the implementation of drought conservation rates, illustrating that as a disadvantaged community, it is responding effectively to conservation rates.

OCSD's demand is less than its annual allocation of SWP water, preserving local supplies if needed in subsequent years, depending on SWP deliveries. In the event that SWP deliveries are decreased to a level that is insufficient to meet OCSD demand, then mandatory conservation efforts will be implemented to match the available supply. If the supply is less than 55 gpcd needed to meet health and safety needs, then the supply shortfall will be supplemented from Lopez Lake supplies. Current SWP reliability analyses prepared by the DWR illustrate a low probability that SWP water will not be able to meet OCSD demands in any two consecutive years.

Additional strategies exist in the event of temporary non-delivery of SWP and Lopez Lake water and other unforeseen circumstances. Post-drought strategies include resumption of groundwater pumping, resumption of Lopez Lake deliveries, and storage of SWP water as provided in SWP contracts.

7.1.8 Evaluate Alternative Sources of Supply

Strategies:

- Evaluate expanded use of recycled water, including development and implementation of Central Coast Blue.
- Analyze capacity of the Lopez Lake and Coastal Branch pipelines to maximize deliveries of surface water. The following analyses have been completed:
    - Lopez Lake Pipeline Capacity Evaluation
    - Lopez Lake Pipeline Capacity Re-Evaluation
    - Coastal Branch Capacity Assessment
    - Lopez Bypass and State Water Delivery Evaluation
- Optimize existing surface water supplies, including surface water storage through the development of a framework for interagency exchanges and transfers, including SWP and Lopez Lake supplies.
- Maximize Lopez Lake pipeline capacity.

Discussion:

The NCMA agencies continue to evaluate alternative sources of water supply that could provide a more reliable and sustainable water supply for the NCMA. An expanded portfolio of water supply sources will support sustainable management of the groundwater resource and help to reduce the risk of water shortages. These alternative sources include:

- **State Water Project**. OCSD and Pismo Beach are currently SWP customers. Both agencies increased their SWP allocations by securing “drought buffers” to increase the availability of supply during periods of SWP shortfalls. Grover Beach and Arroyo Grande are not SWP customers; however, Arroyo Grande approved a measure in 2016 authorizing the City to purchase SWP water from the FCWCD’s excess allotment on a temporary basis and only during a declared local water emergency. To date, Arroyo Grande has not declared such an emergency and has not purchased SWP water.
- **Water Recycling**. As discussed in Section 7.1.5, Pismo Beach and the SSLOCSD both prepared RWFPSs to evaluate alternatives for a recycled water program that could provide a supplemental water supply source and improve the water supply reliability for the Pismo Beach and the SSLOCSD member agencies (Arroyo Grande, Grover Beach, and OCSD).

  Section 7.1.5 also describes ongoing efforts for Central Coast Blue that will enable the NCMA agencies to produce recycled water to augment their water supplies. Construction of the new facility will allow for the use of recycled water to recharge the groundwater basin and provide a new, drought-proof source of water supply for the area. As conceived, the project includes construction of a distribution system that will inject advanced purified water into the SMGB and will allow the NCMA agencies to increase recharge to the basin, improve water supply reliability, and help to prevent future occurrences of seawater intrusion.

  Lopez Lake Expansion. In 2008, the County sponsored a preliminary assessment of the concept of installing an inflatable rubber dam at the Lopez Dam spillway. Subsequently, the FCWCD Service Area 12 and Arroyo Grande, Grover Beach, and Pismo Beach funded a study to further analyze the feasibility of increasing the yield of Lopez Lake by raising the spillway height with an inflatable dam or permanent extension. The study was finalized in 2013 and identified the potential to increase the annual yield from Lopez Lake by 500 AFY with a spillway height increase by 6 feet (Stetson, 2013). The NCMA agencies are continuing to evaluate other aspects of the project, including pipeline capacity and impacts on the HCP process.
- **Desalination**. In 2006, Arroyo Grande, Grover Beach, and OCSD used Prop 50 funds to complete a feasibility study on desalination as an additional water supply option for the NCMA. This alternative supply is not considered to be a viable option at this time.

  Previous efforts by the FCWCD to (1) evaluate the potential to expand the existing desalination facility at the PG&E Diablo Canyon Power Plant and (2) connect it to the Lopez Lake pipeline to provide a supplemental water supply for the Zone 3 agencies have been terminated since PG&E announced plans to close the power plant.

- **Nacimiento Pipeline Extension**. In 2006, Arroyo Grande, Grover Beach, and OCSD completed a Nacimiento pipeline extension evaluation to determine the feasibility of delivery of water from the Nacimiento reservoir to the NCMA. This alternative supply is not considered to be a viable option at this time.

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FIGURES

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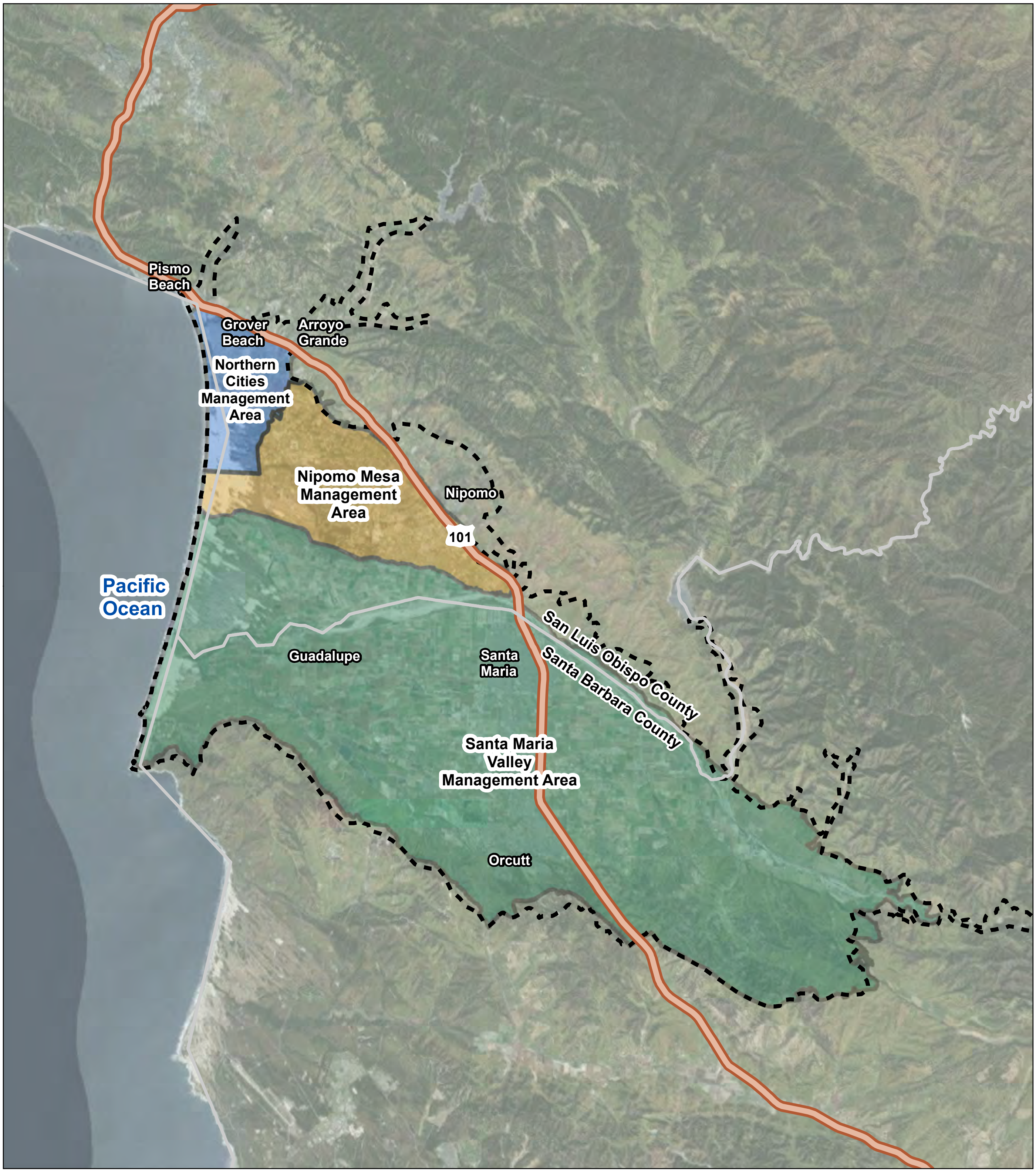

LEGEND

- Northern Cities Management Area
- Nipomo Mesa Management Area
- Santa Maria Valley Management Area
- Santa Maria Groundwater Basin (DWR 2016)
- County Borders

N

0 1 2 3 4 5
Miles

FIGURE 1

Santa Maria Groundwater Basin

Northern Cities Management Area
San Luis Obispo County, California

Date: December 23, 2016
Data Sources:

GSI Water Solutions, Inc.

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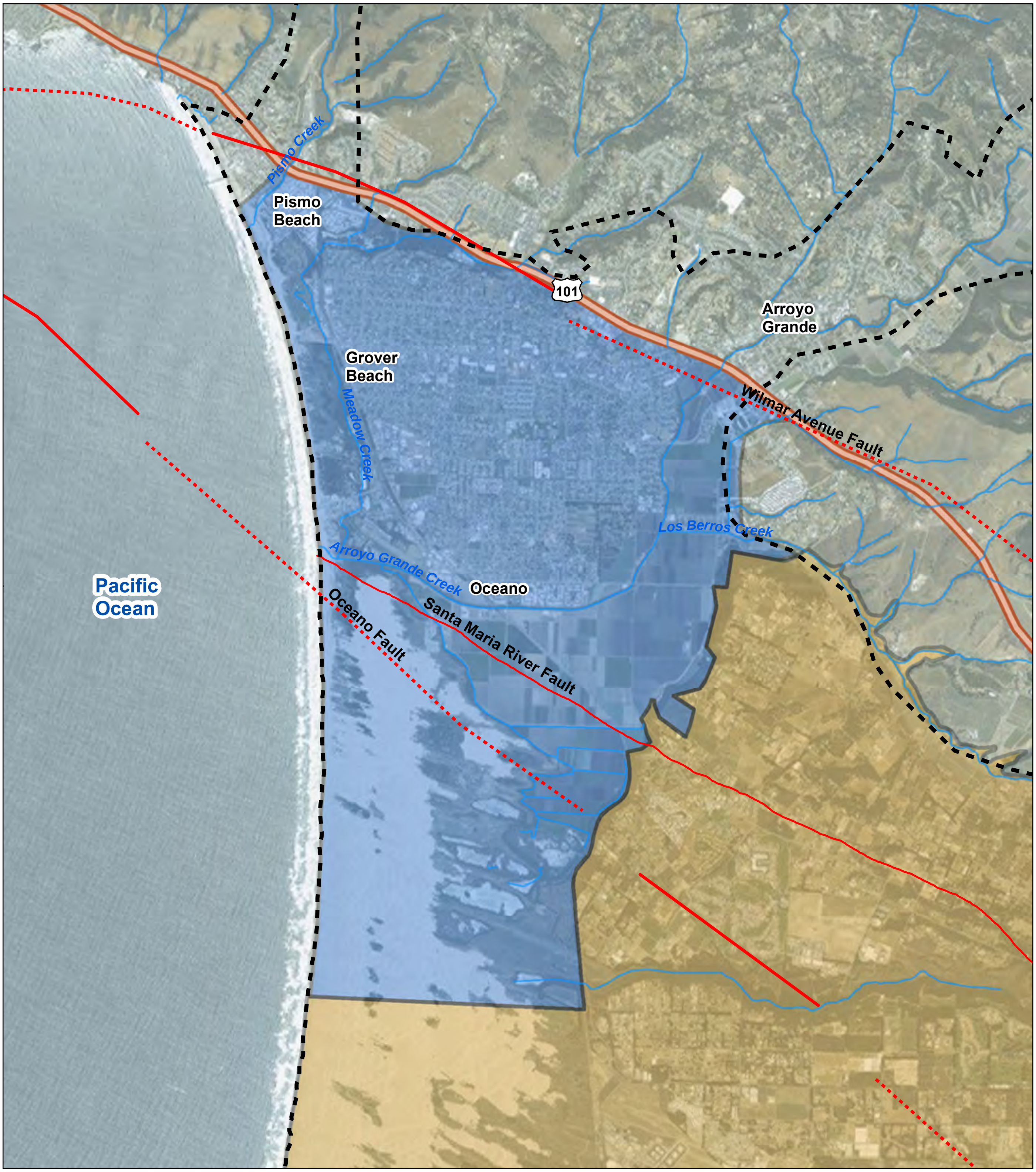

LEGEND

- Northern Cities Management Area
- Nipomo Mesa Management Area
- Santa Maria Groundwater Basin (DWR 2016)
- Faults
- Streams

N

0 — 1 Miles

FIGURE 2

Northern Cities Management Area

San Luis Obispo County, California

GSI Water Solutions, Inc.

Date: December 23, 2016
Data Sources:

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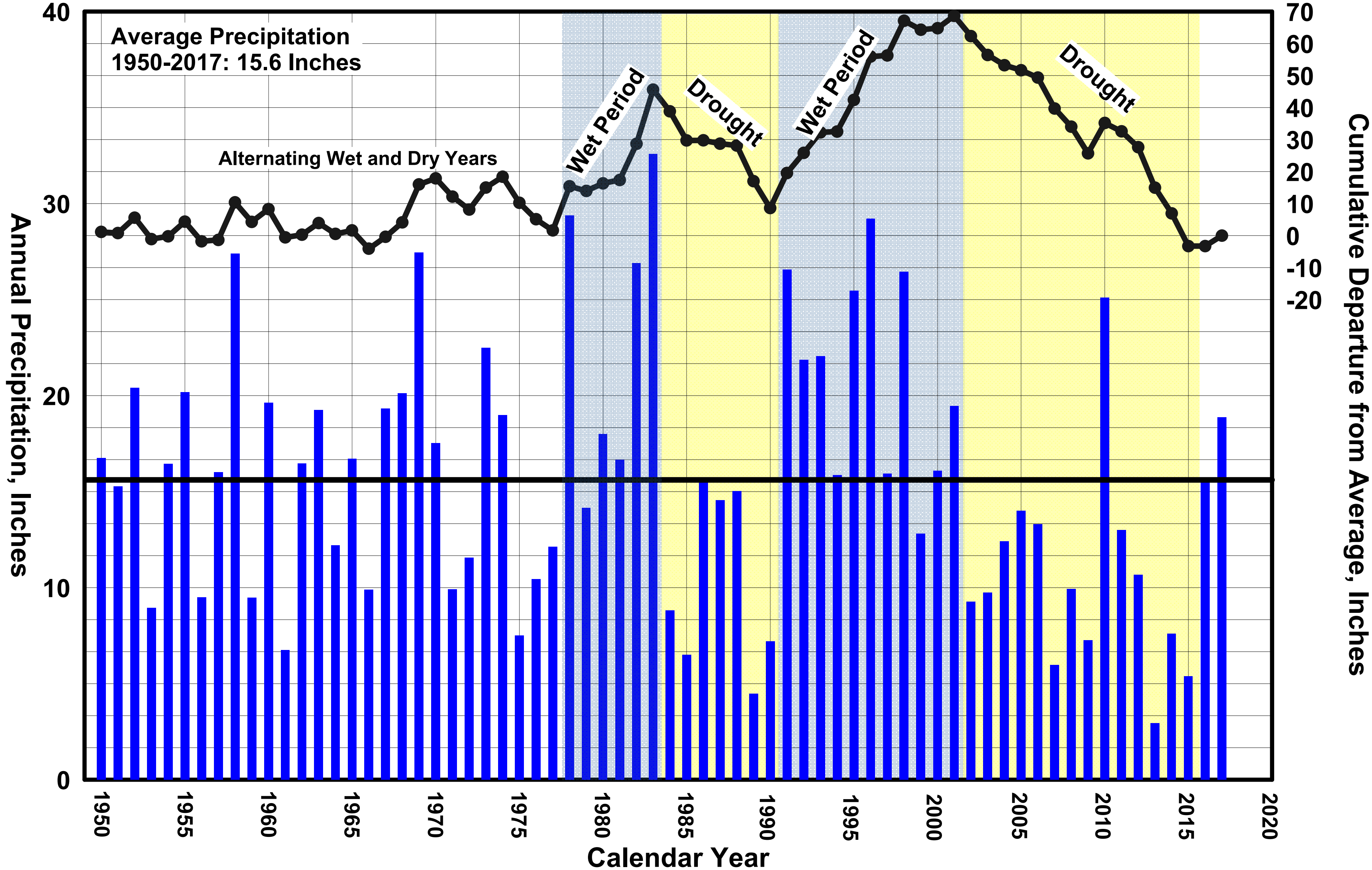

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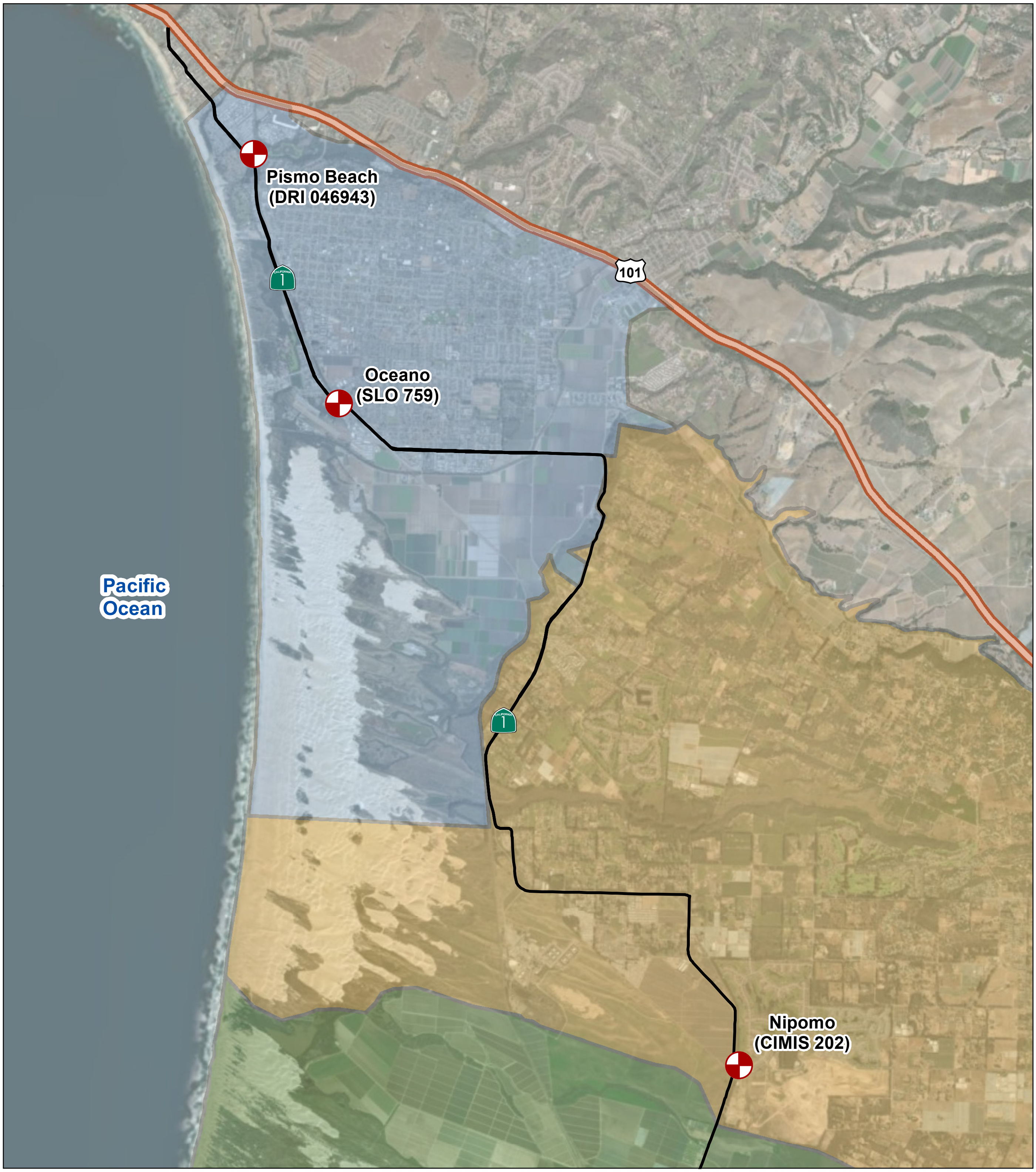
FIGURE 3

ANNUAL PRECIPITATION 1950 TO 2017
Northern Cities Management Area
San Luis Obispo County, California

GSI Water Solutions, Inc.



LEGEND

Weather Station

Nipomo Mesa Management Area

Northern Cities Management Area

Santa Maria Valley Management Area

N

0 1

Miles

Date: January 22, 2018

FIGURE 4

Location of Precipitation Stations

Northern Cities Management Area
San Luis Obispo County, California

GSI Water Solutions, Inc.

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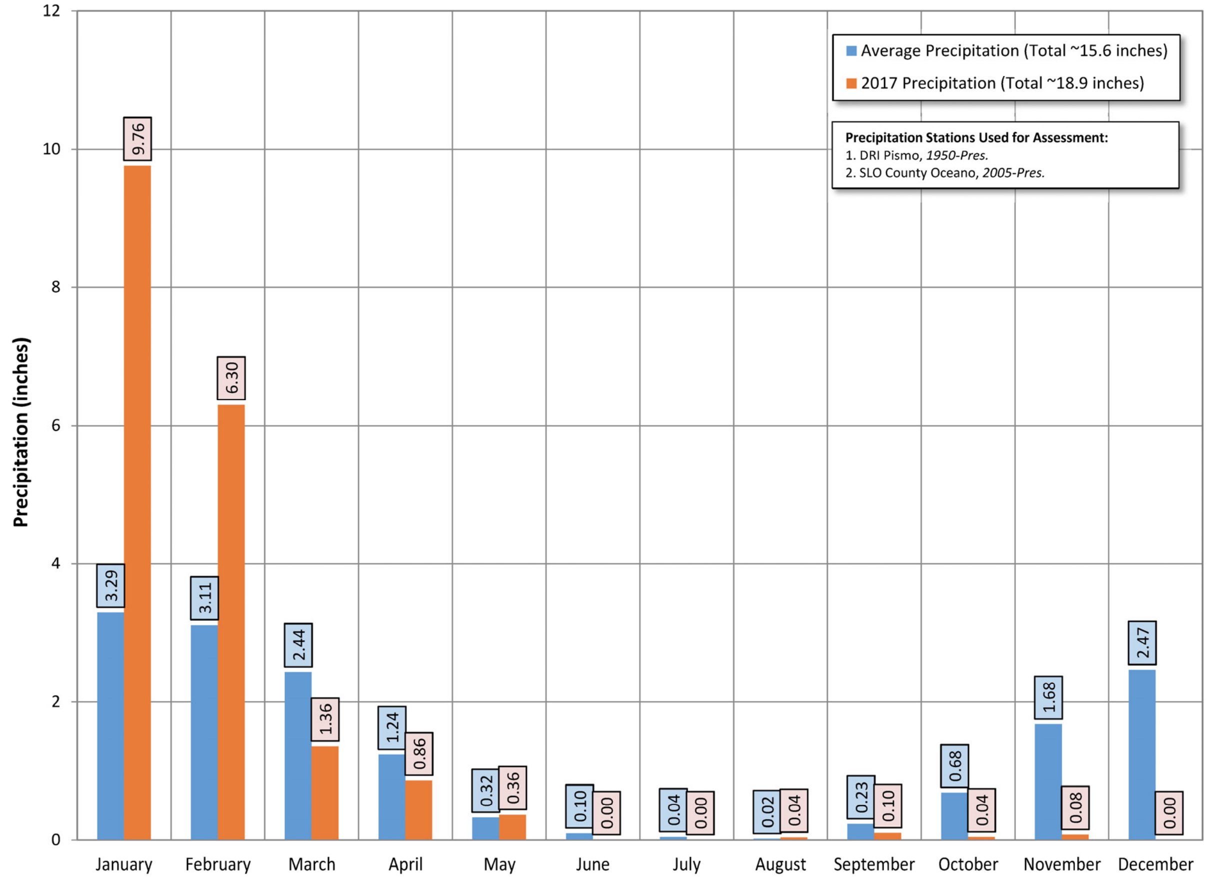

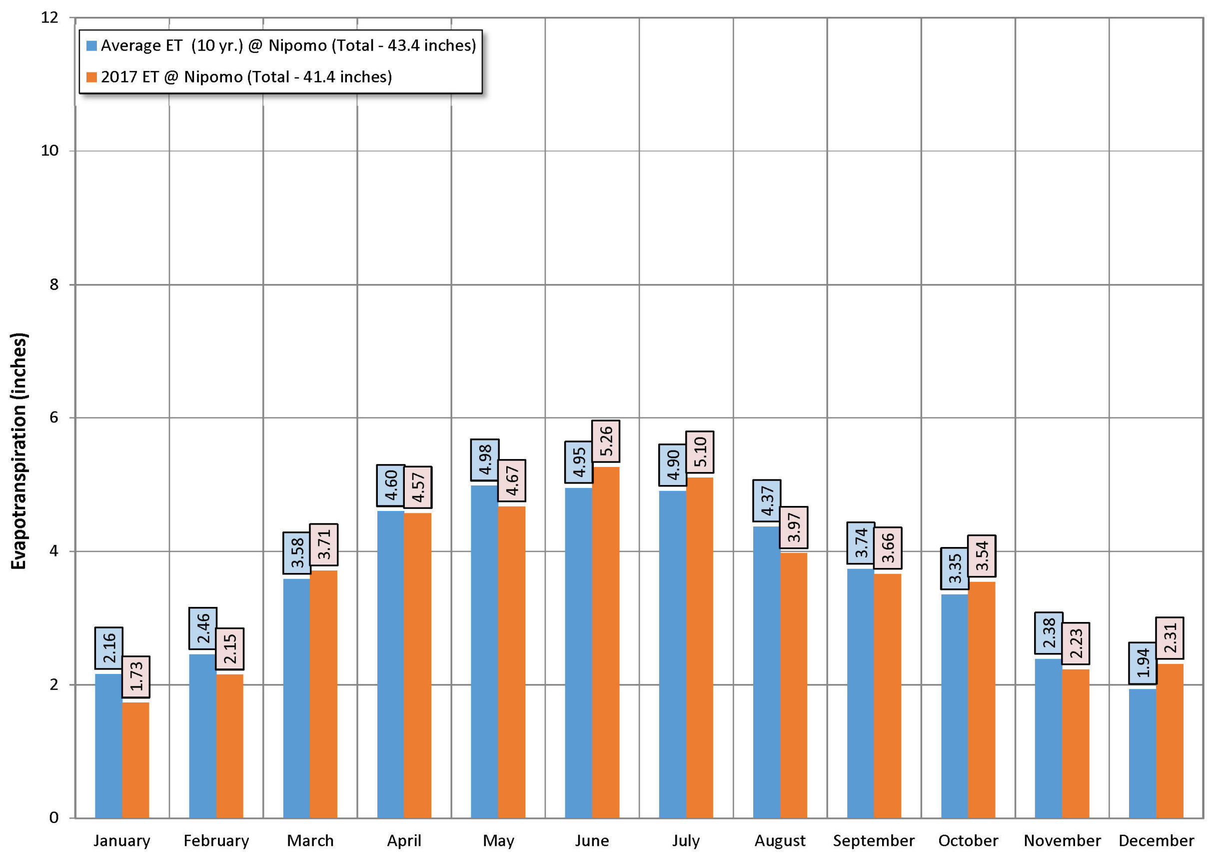

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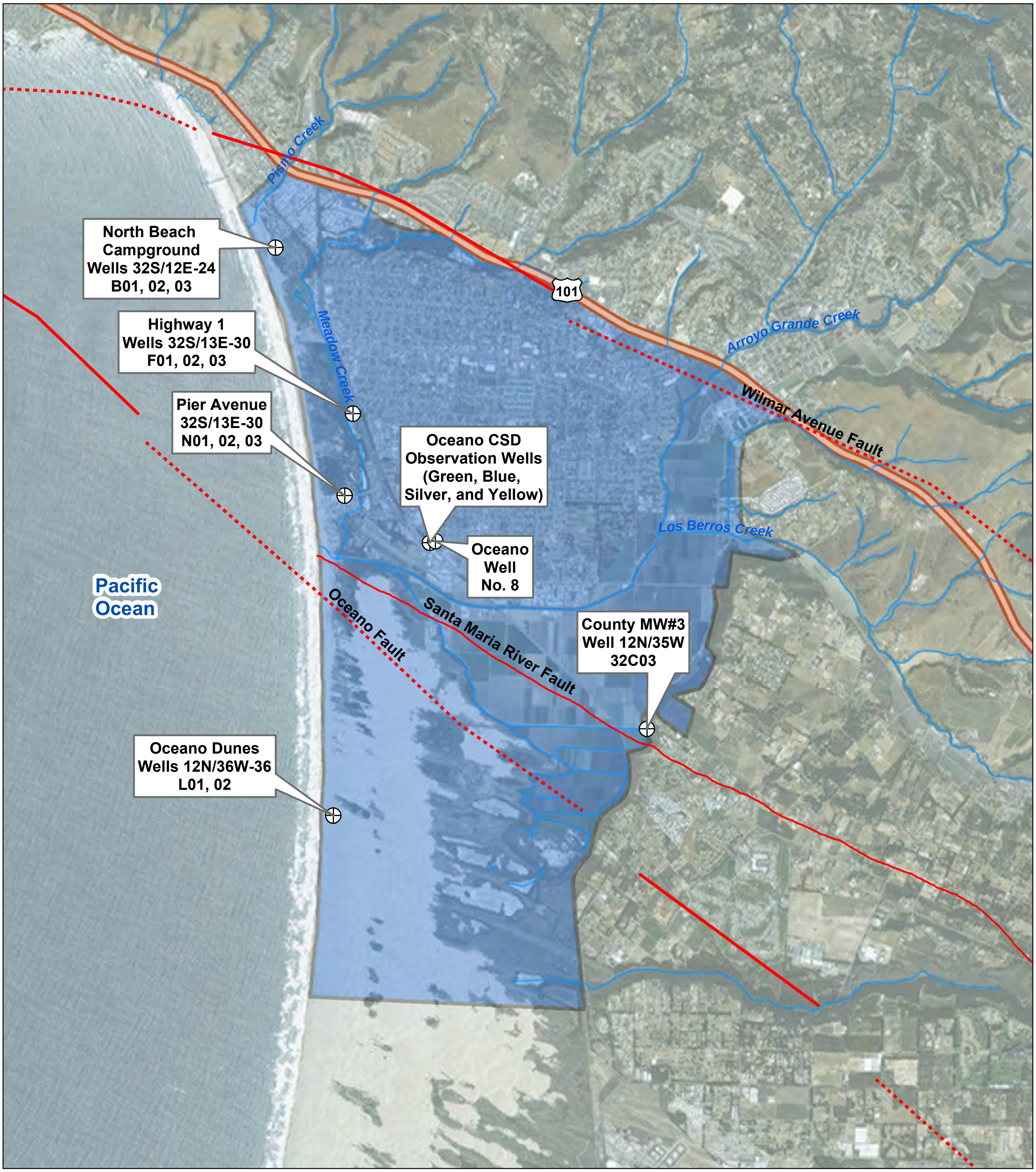
GSI Water Solutions, Inc.

MONTHLY 2017 AND AVERAGE PRECIPITATION AND EVAPOTRANSPIRATION
Northern Cities Management Area
San Luis Obispo County, California

FIGURE 5



LEGEND

- NCMA Monitoring Wells
- Northern Cities Management Area
- Faults
- Streams

FIGURE 6

Locations of Monitoring Wells

Northern Cities Management Area
San Luis Obispo County, California

N

0 1
Miles

Date: December 23, 2016
Data Sources:

GSI Water Solutions, Inc.

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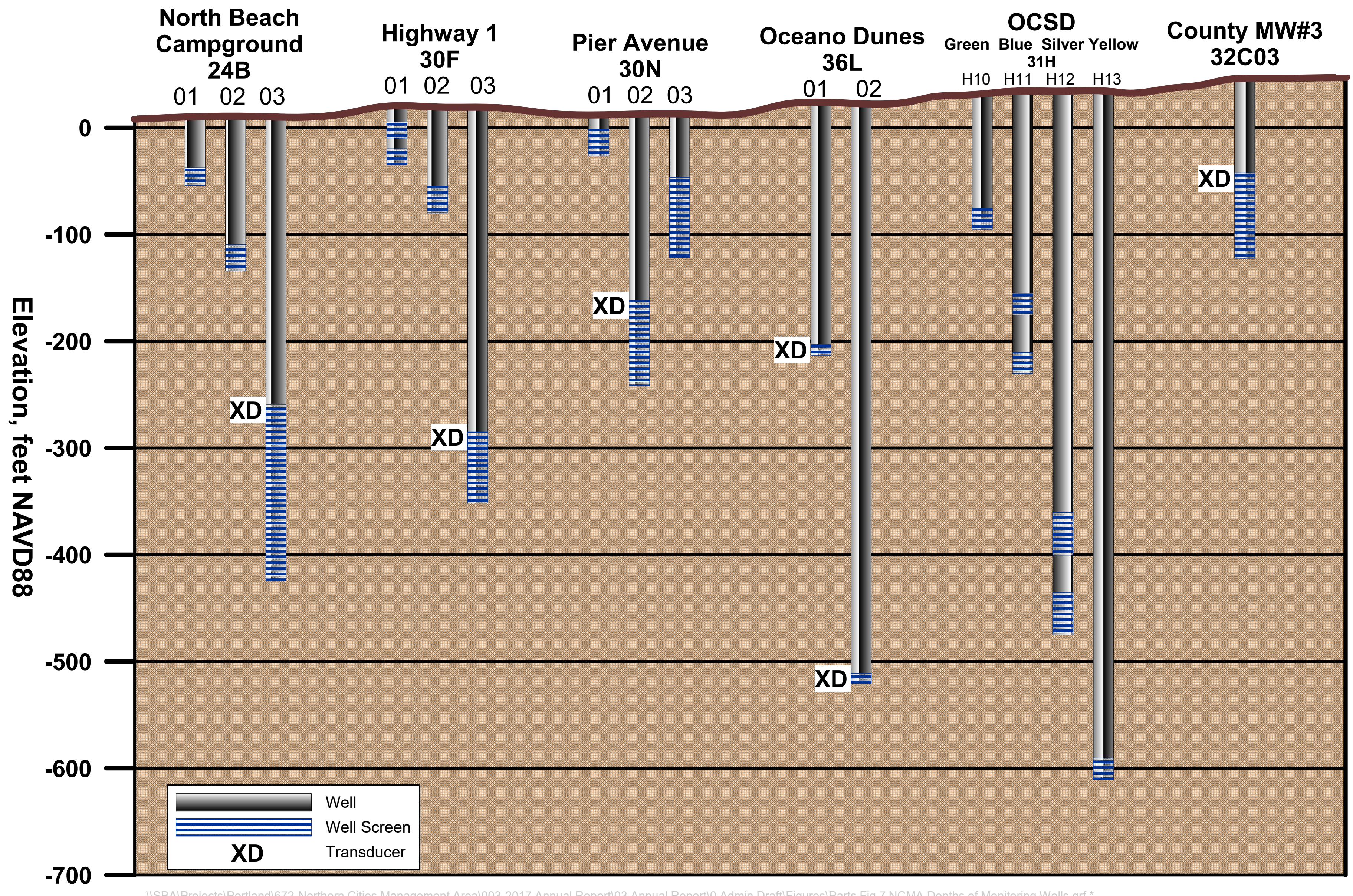
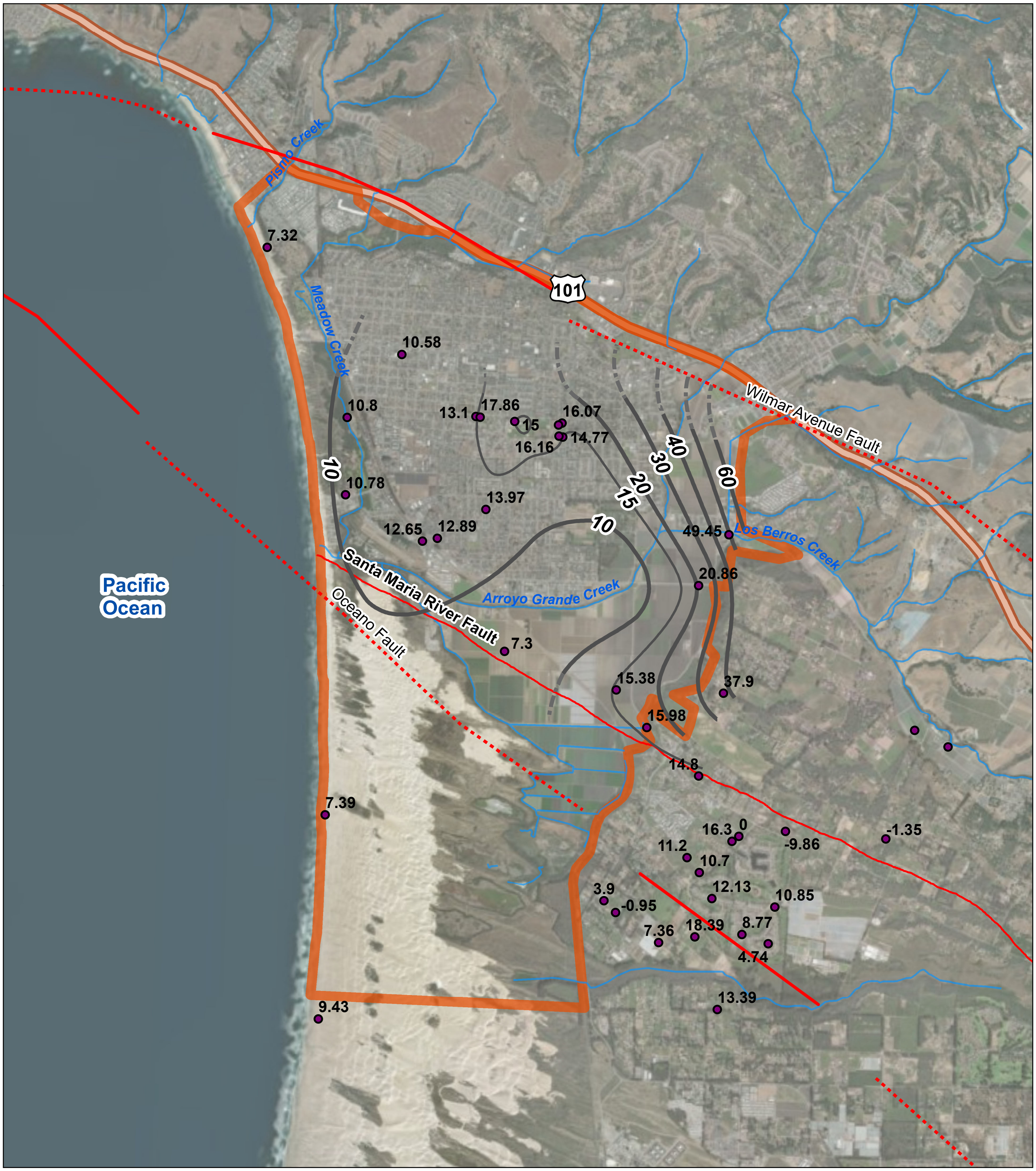


FIGURE 7

DEPTHS OF MONITORING WELLS
Northern Cities Management Area
San Luis Obispo County, California



LEGEND

- Wells Used in Groundwater Contouring
- Groundwater Contour (feet, NAVD88)
- Minor Groundwater Contour
- Northern Cities Management Area
- Streams
- Faults

N

0 1 Miles

FIGURE 8

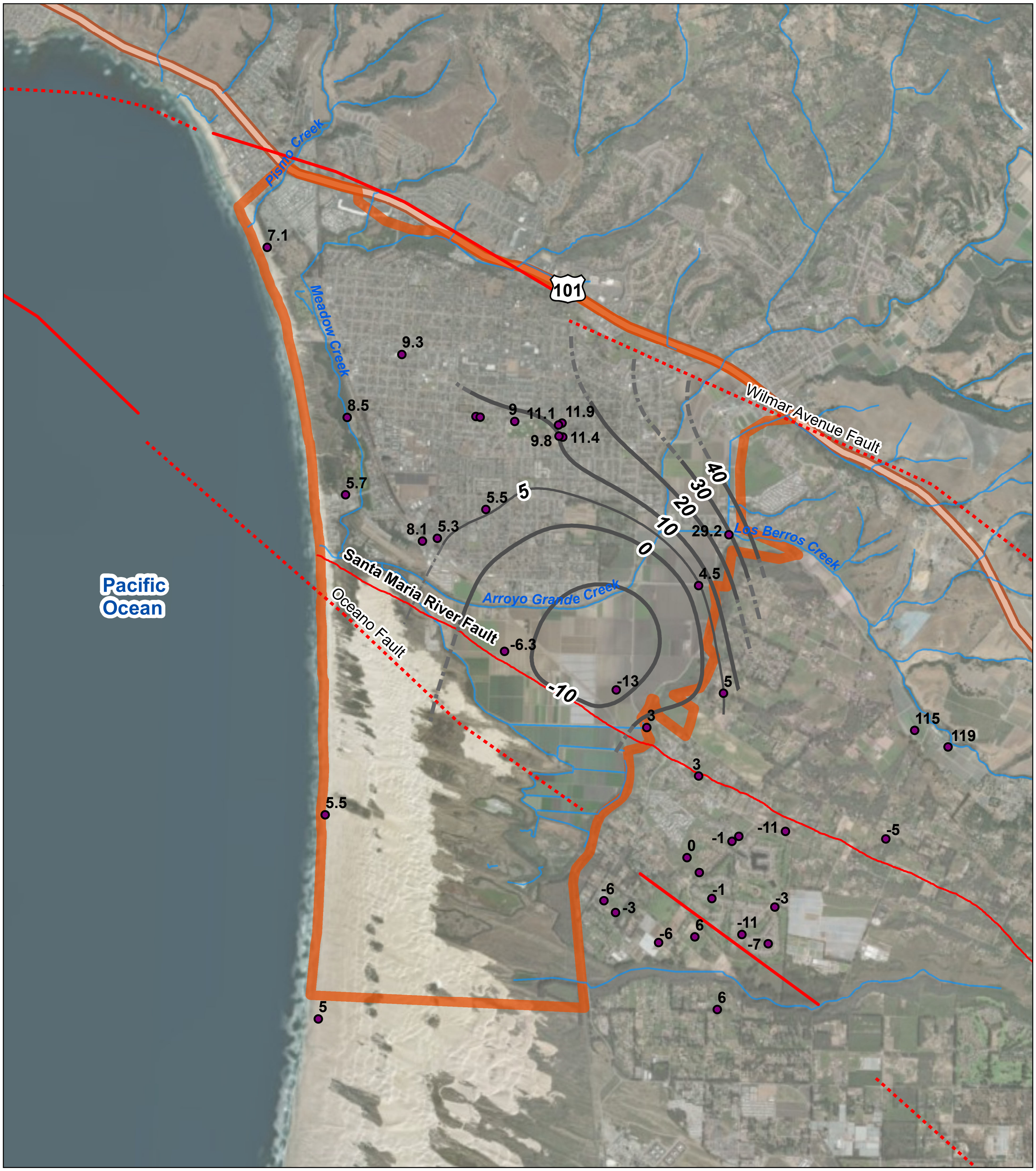
Groundwater Level Contours Spring 2017

Northern Cities Management Area
San Luis Obispo County, California

GSI Water Solutions, Inc.

Date: March 19, 2018
Data Sources: SLO County, NCMA and NMMA Agencies

Document Path: P:\Portland\672-Northern Cities Management Area\003-2017 Annual Report\Project_GIS\Project_mxds\Annual_Report\Figure_8_NCMA_Water_Level_Contours_April_2017.mxd



LEGEND

- Wells Used in Groundwater Contouring
- Groundwater Contour (feet, NAVD88)
- Minor Groundwater Contour
- Northern Cities Management Area
- Streams
- Faults

N

0 1 Miles

FIGURE 9

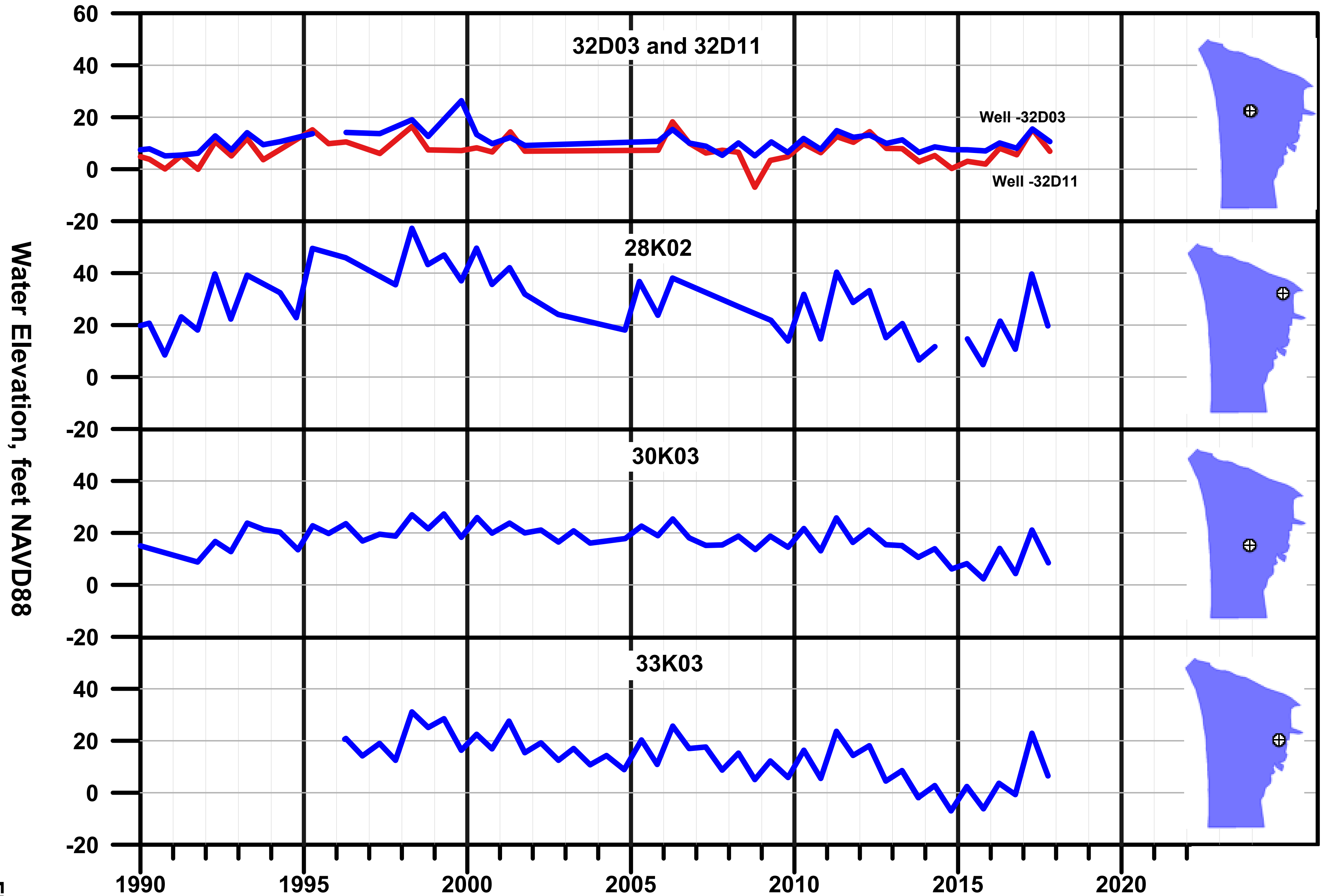
Groundwater Level Contours Fall 2017

Northern Cities Management Area
San Luis Obispo County, California

Date: March 19, 2018
Data Sources: SLO County, NCMA and NMMA Agencies

GSI Water Solutions, Inc.

Document Path: P:\Portland\672-Northern Cities Management Area\003-2017 Annual Report\Project_GIS\Project_mxds\Annual_Report\Figure_9_NCMA_Water_Level_Contours_Oct_2017.mxd



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SELECTED HYDROGRAPHS
Northern Cities Management Area
San Luis Obispo County, California

FIGURE 10

GSI Water Solutions, Inc.

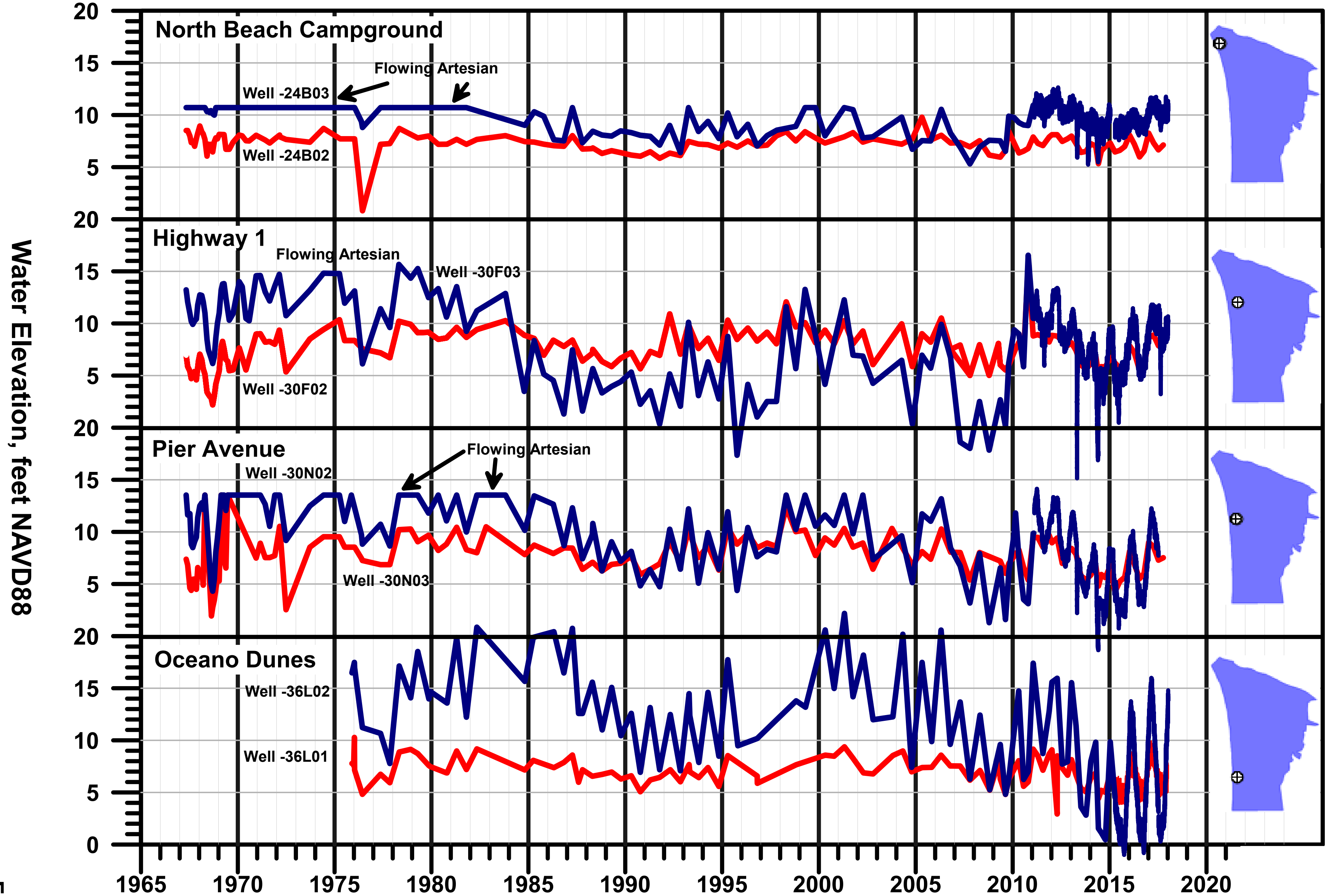

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FIGURE 11

SENTRY WELL HYDROGRAPHS
Northern Cities Management Area
San Luis Obispo County, California

GSI Water Solutions, Inc.

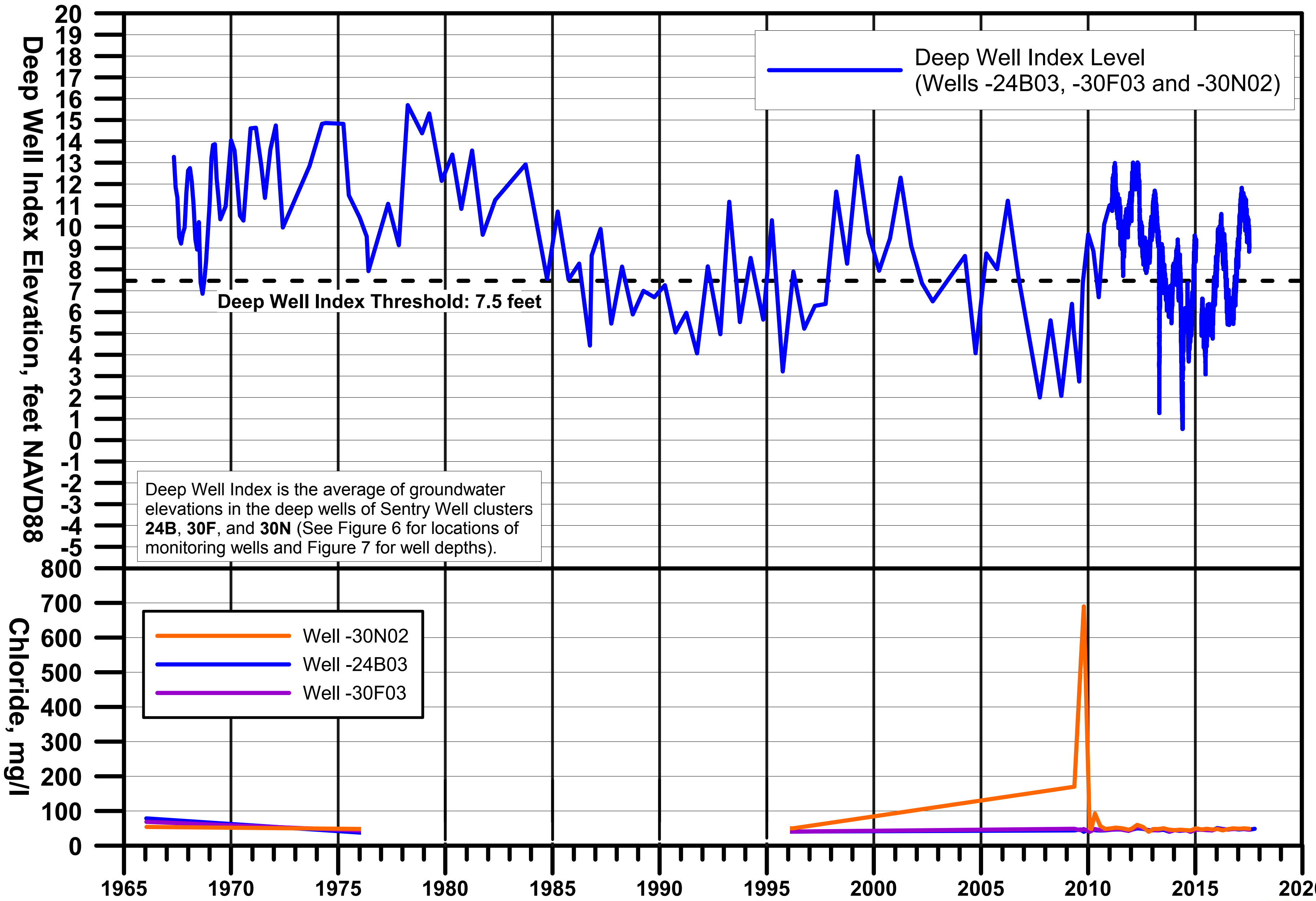


FIGURE 12

HYDROGRAPH OF DEEP WELL INDEX LEVEL
Northern Cities Management Area
San Luis Obispo County, California

GSI Water Solutions, Inc.

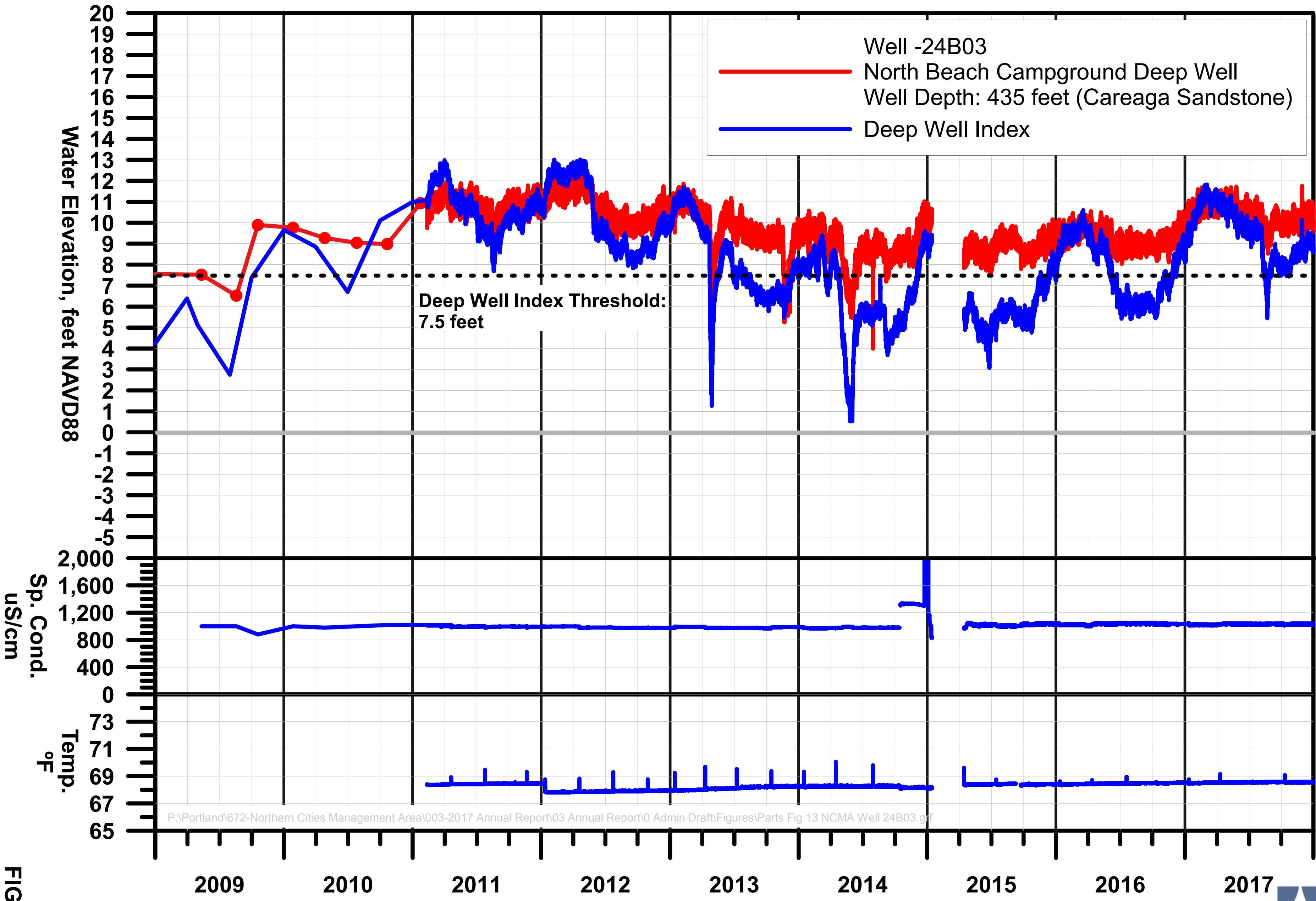


FIGURE 13

WATER ELEVATION, CONDUCTIVITY, AND TEMPERATURE, WELL 24B03

Northern Cities Management Area

San Luis Obispo County, California

GSI Water Solutions, Inc.

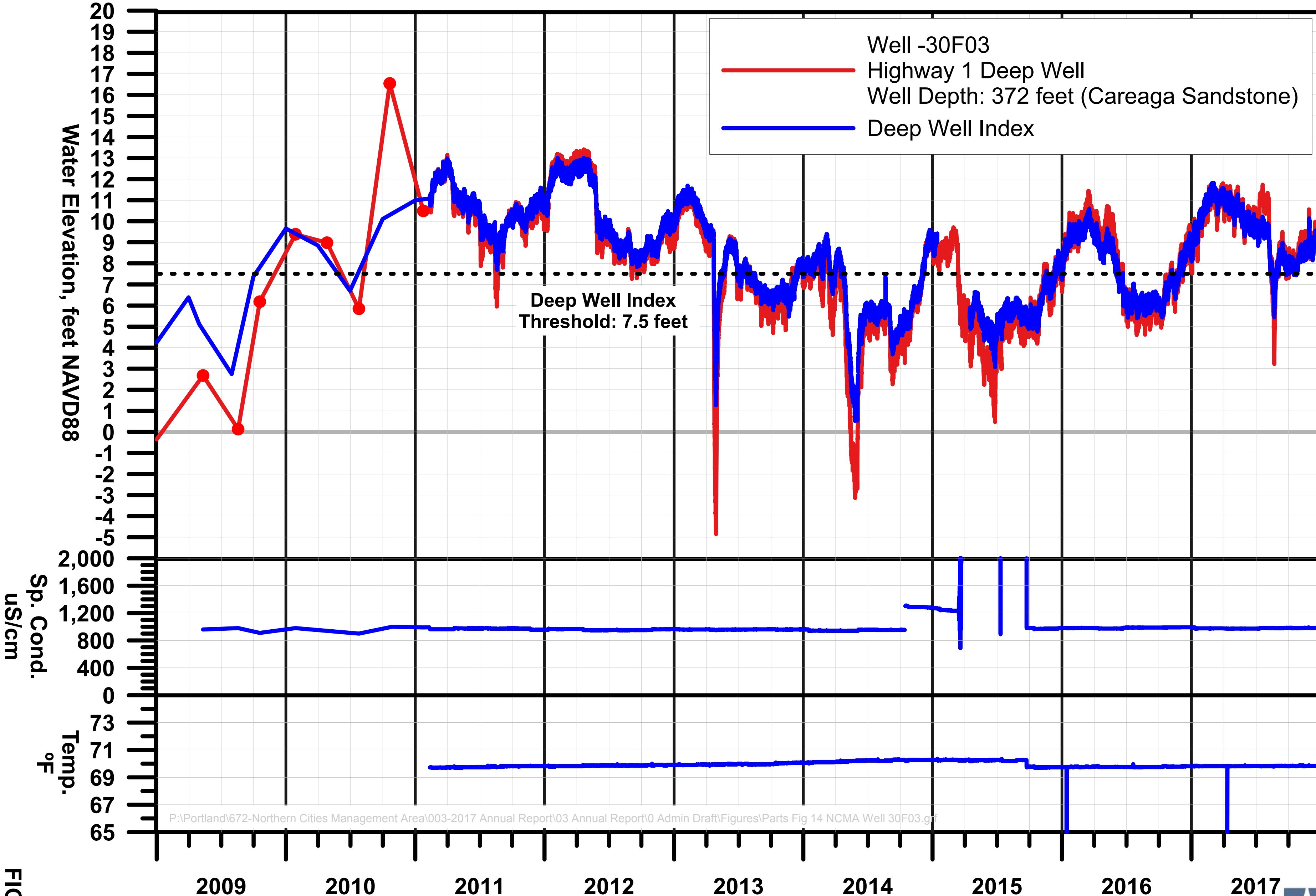


FIGURE 14

WATER ELEVATION, CONDUCTIVITY, AND TEMPERATURE, WELL 30F03
Northern Cities Management Area
San Luis Obispo County, California

GSI Water Solutions, Inc.

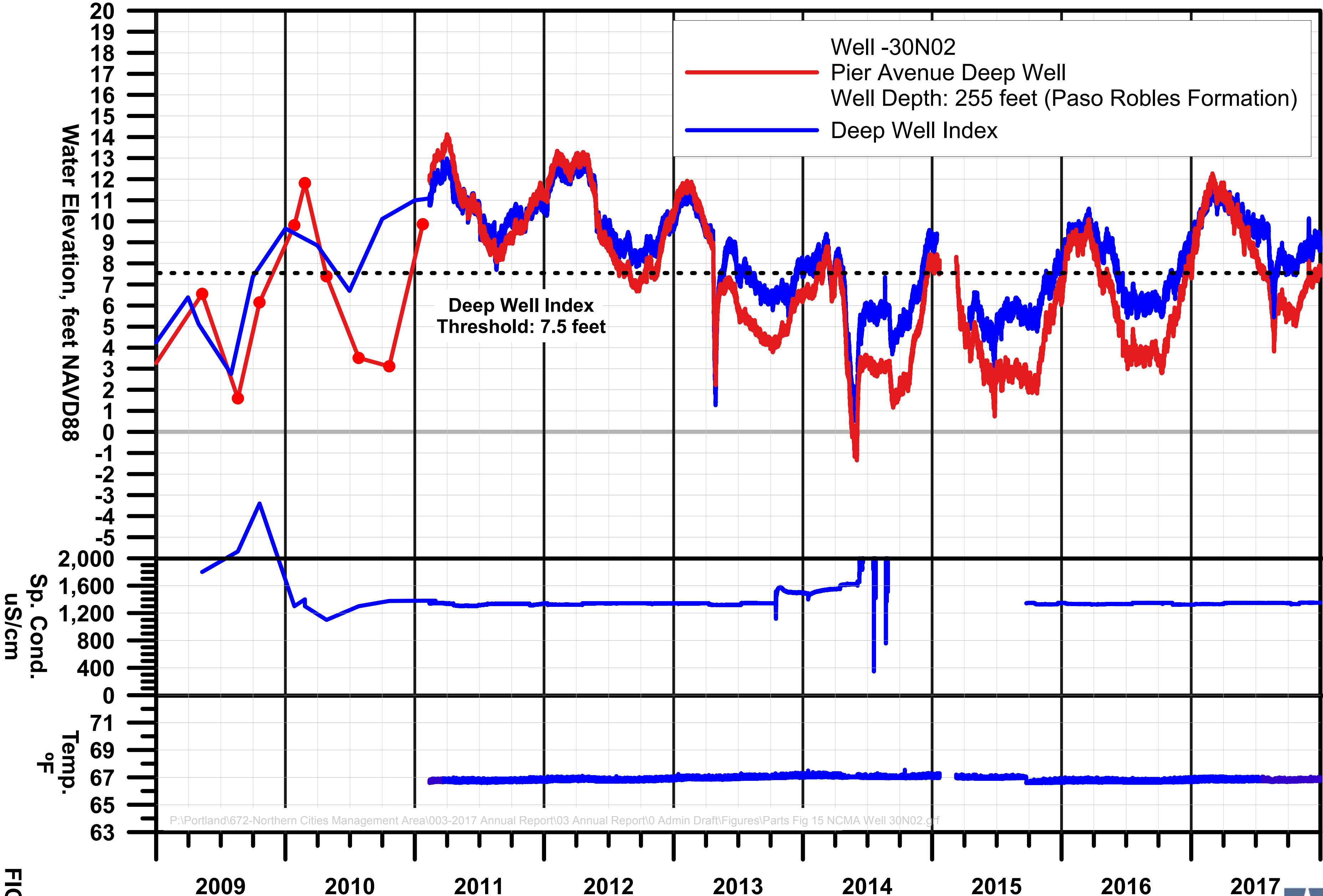
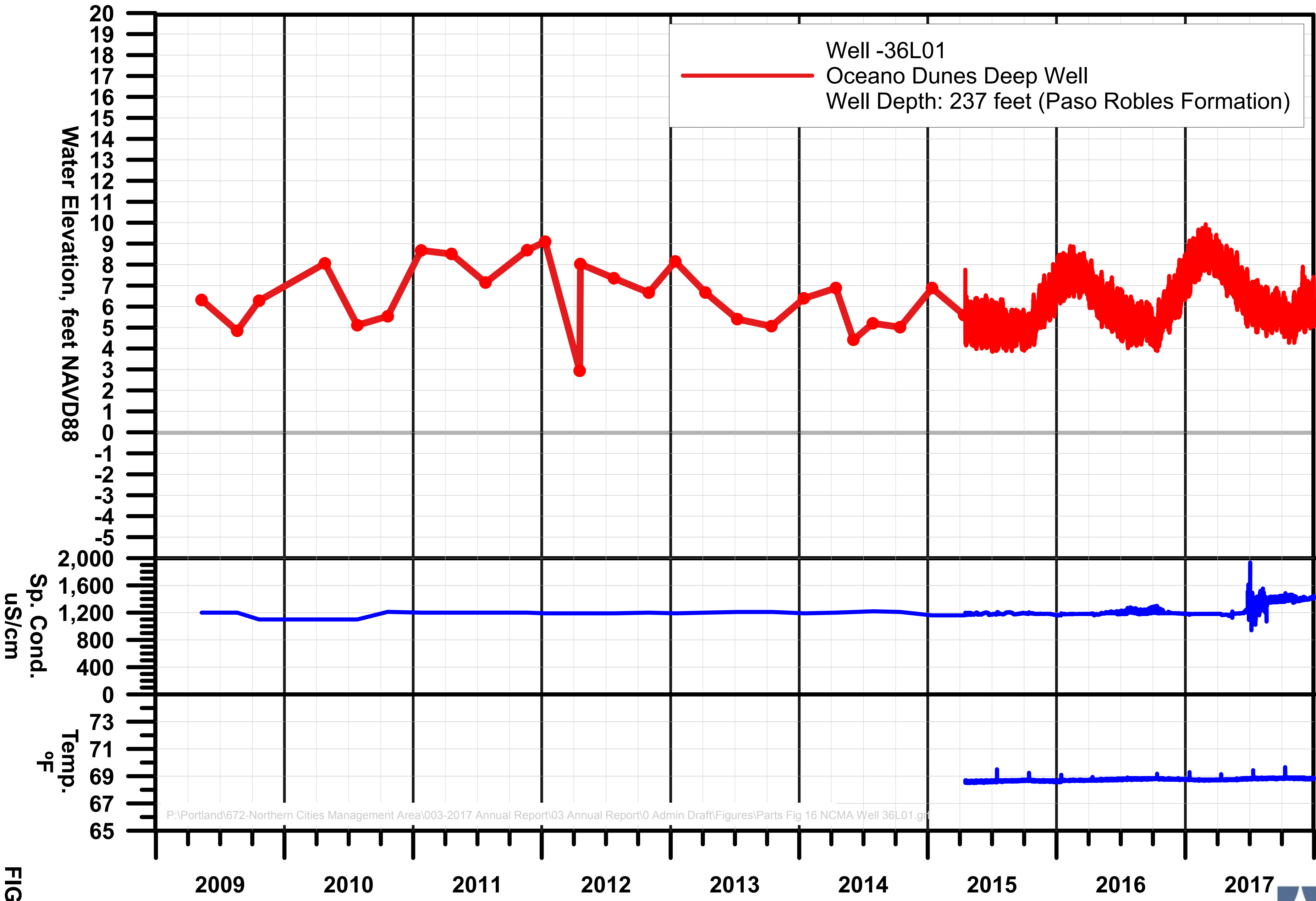


FIGURE 15

WATER ELEVATION, CONDUCTIVITY, AND TEMPERATURE, WELL 30N02
Northern Cities Management Area
San Luis Obispo County, California

GSI Water Solutions, Inc.



WATER ELEVATION, CONDUCTIVITY, AND TEMPERATURE, WELL 36L01
Northern Cities Management Area
San Luis Obispo County, California

GSI Water Solutions, Inc.

FIGURE 16

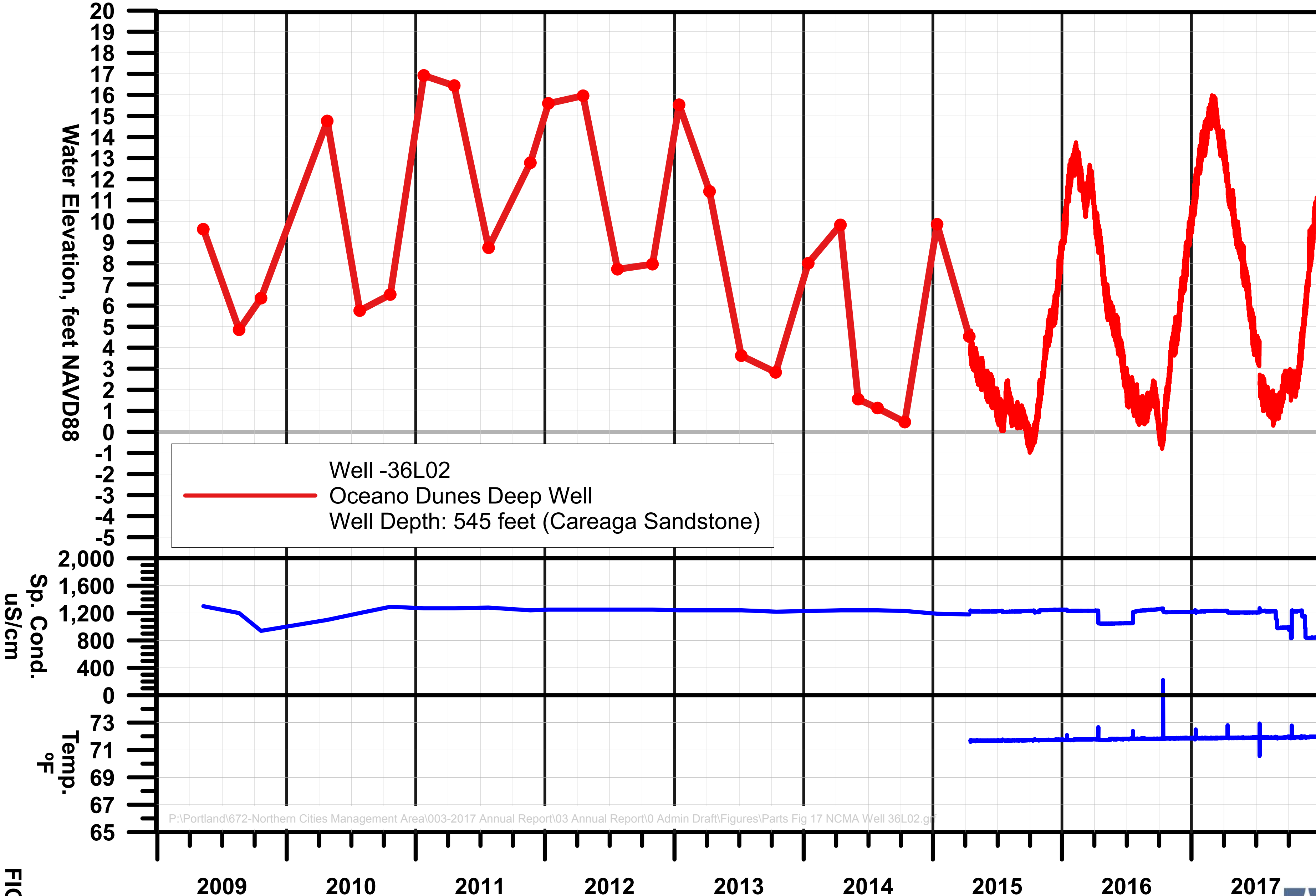


FIGURE 17

WATER ELEVATION, CONDUCTIVITY, AND TEMPERATURE, WELL 36L02

Northern Cities Management Area

San Luis Obispo County, California

GSI Water Solutions, Inc.

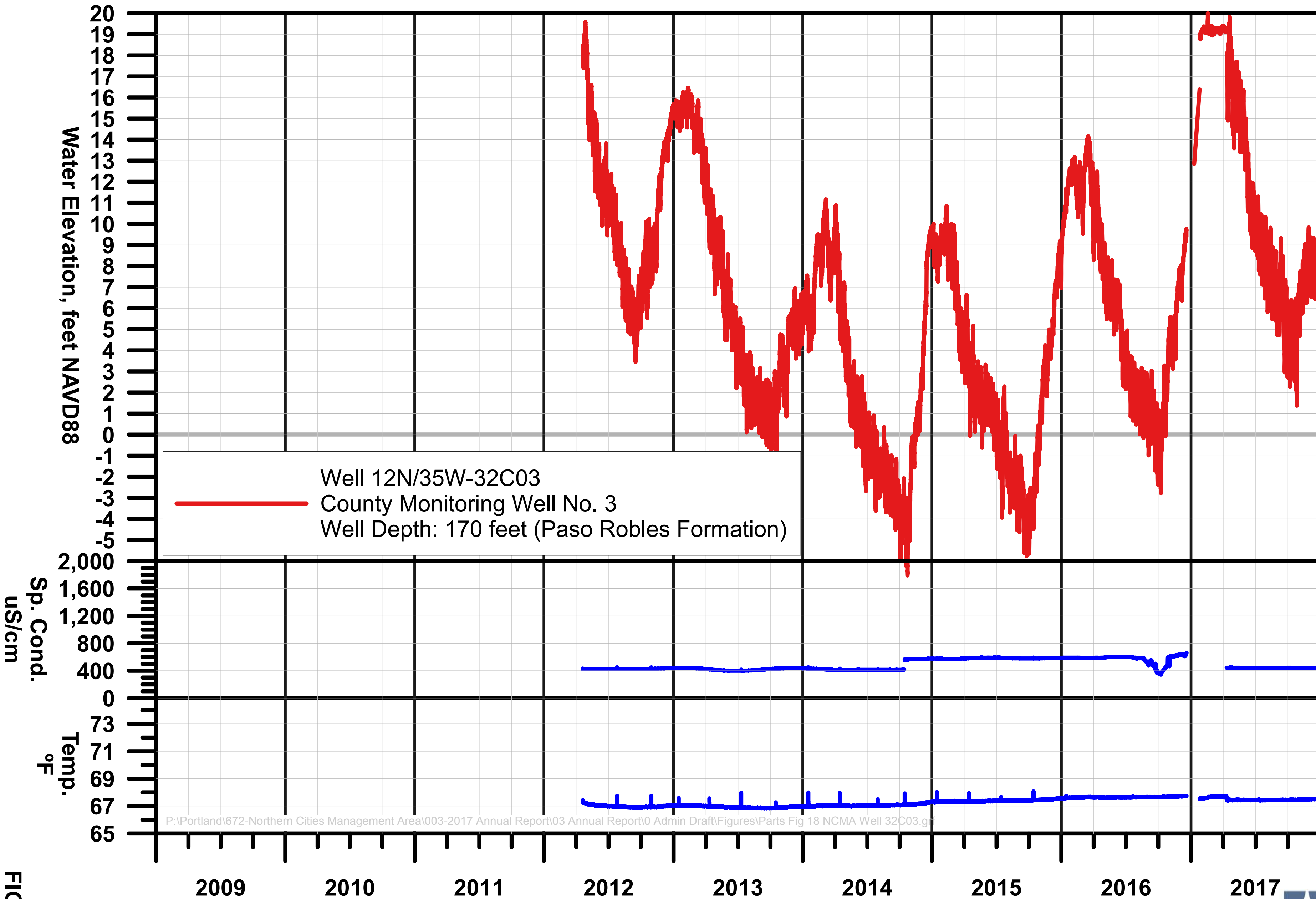
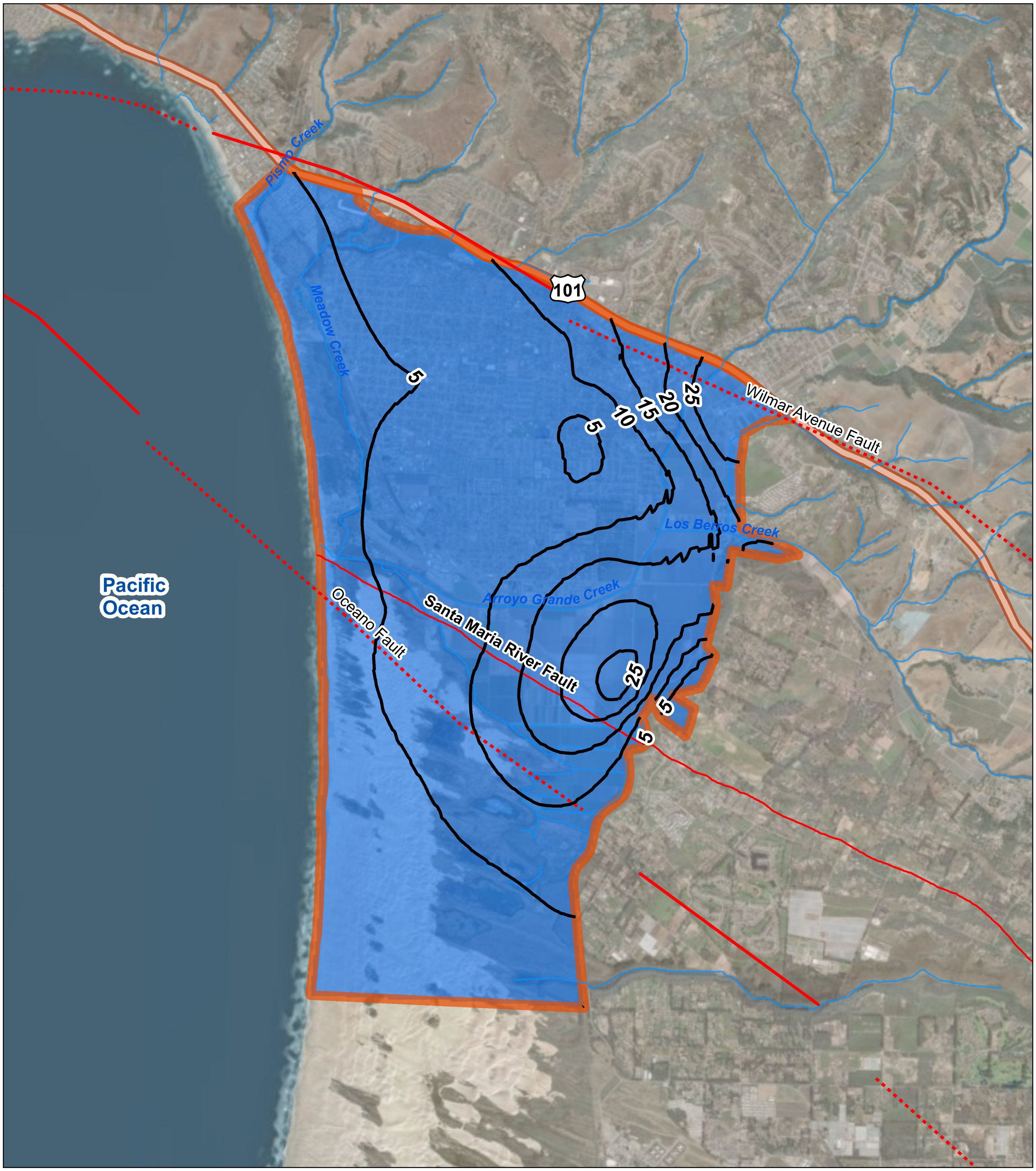


FIGURE 18

WATER ELEVATION, CONDUCTIVITY, AND TEMPERATURE, WELL 32C03
Northern Cities Management Area
San Luis Obispo County, California

GSI Water Solutions, Inc.



LEGEND

- Contours of Equal Difference in Water Level, feet
- Area of Net Rise
- Area of Net Decline
- Northern Cities Management Area
- Streams
- Faults

FIGURE 19

Change in Groundwater Levels, April 2016 to April 2017

Northern Cities Management Area
San Luis Obispo County, California

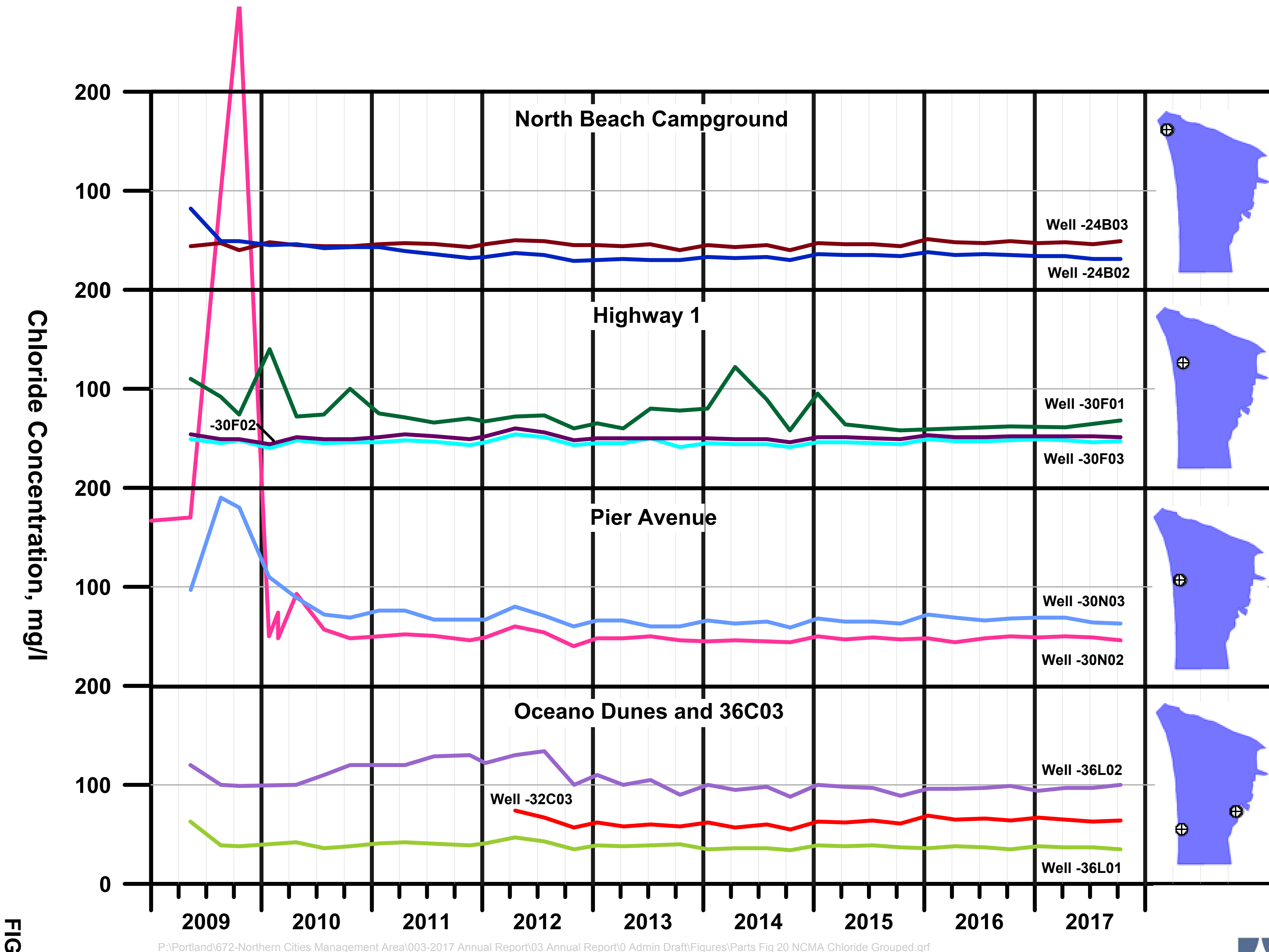
N

0 1
Miles

GSI Water Solutions, Inc.

Date: March 19, 2018
Data Sources: SLO County, NCMA and NMMA Agencies

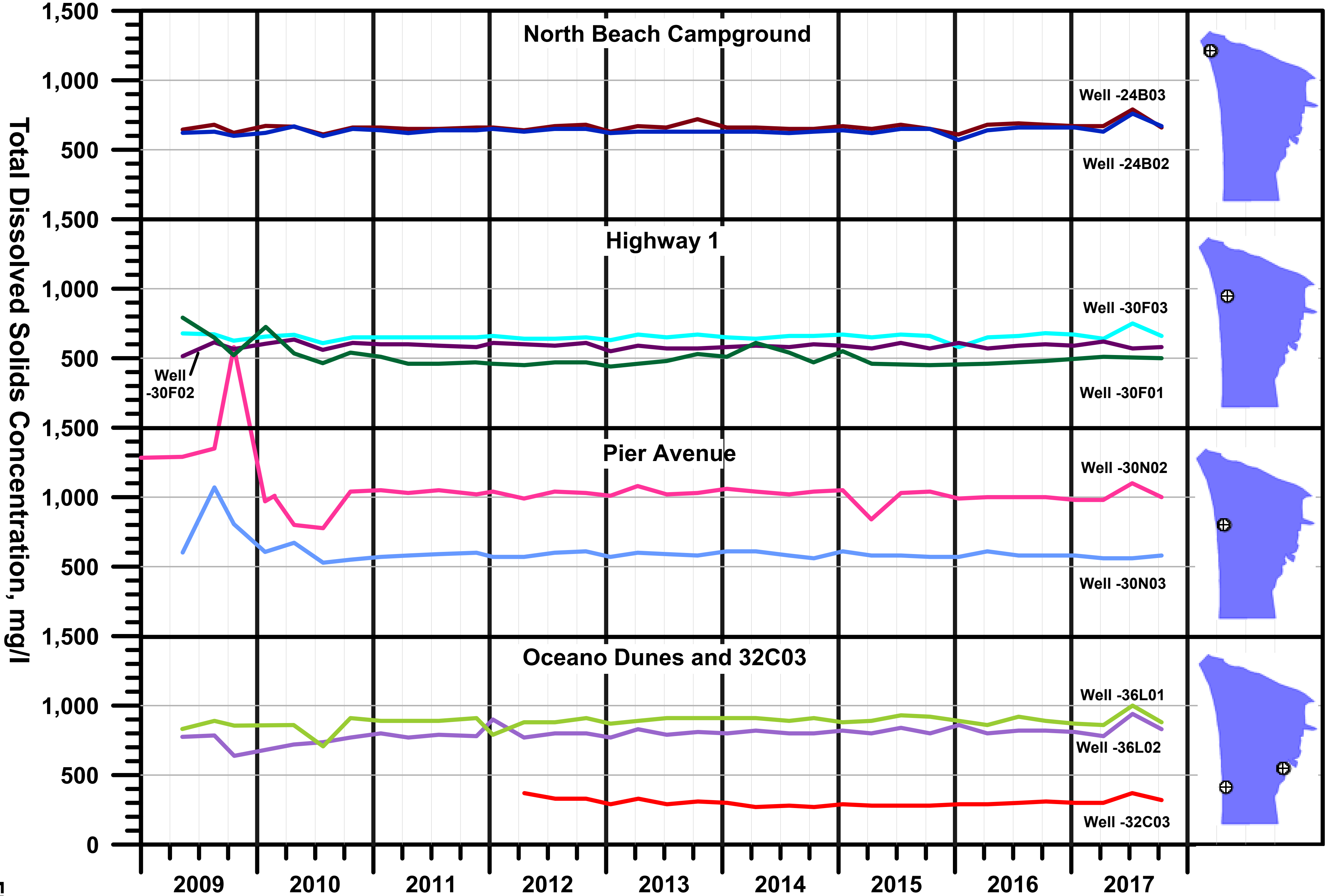
Document Path: P:\Portland\672-Northern Cities Management Area\003-2017 Annual Report\Project_GIS\Project_mxds\Annual_Report\Figure_19_Water Level Change_April_2016 to 2017.mxd



CHLORIDE CONCENTRATIONS IN MONITORING WELLS
Northern Cities Management Area
San Luis Obispo County, California

GSI Water Solutions, Inc.

FIGURE 20



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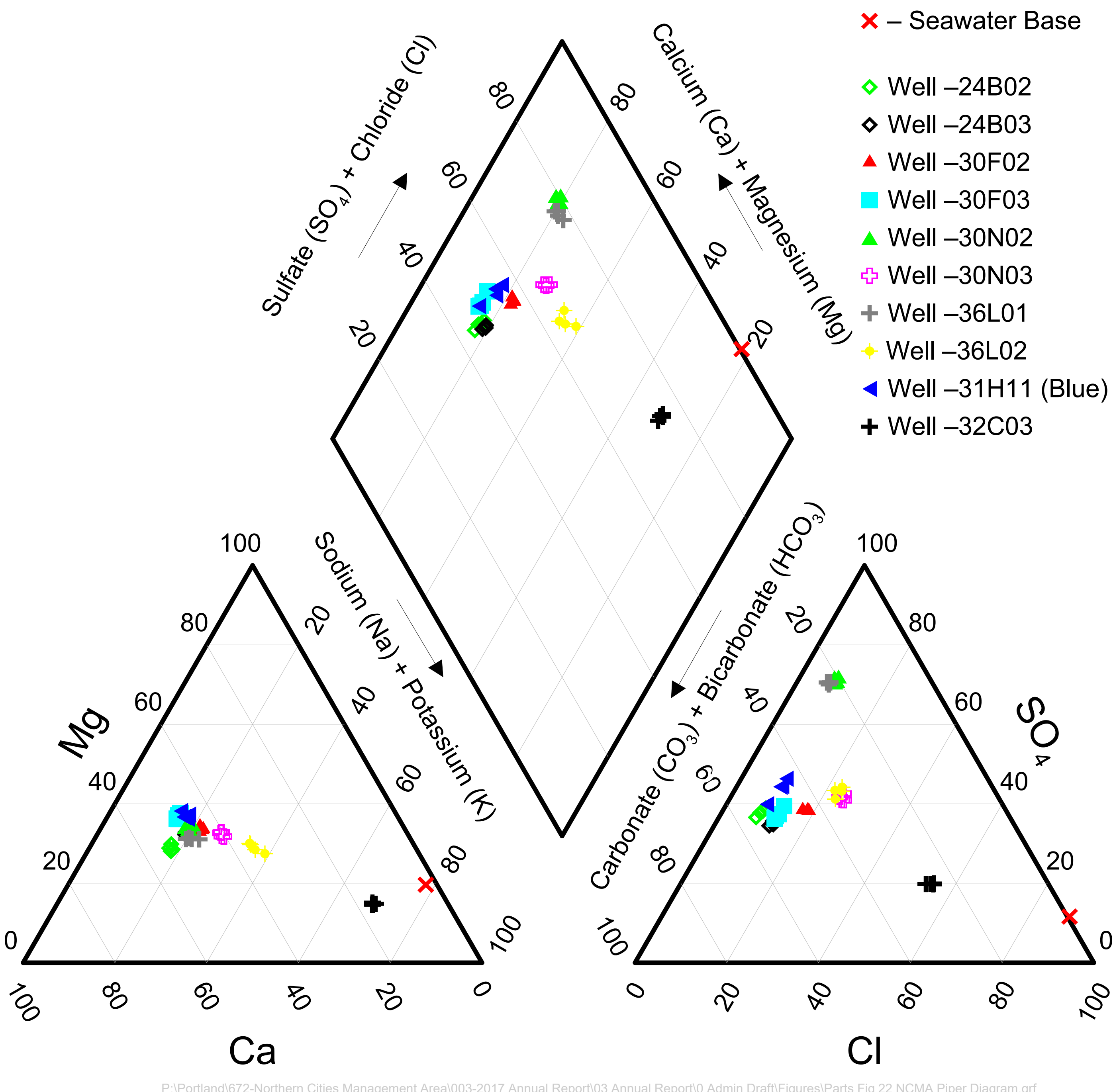
TOTAL DISSOLVED SOLIDS CONCENTRATIONS IN MONITORING WELLS
Northern Cities Management Area
San Luis Obispo County, California

GSI Water Solutions, Inc.

FIGURE 21

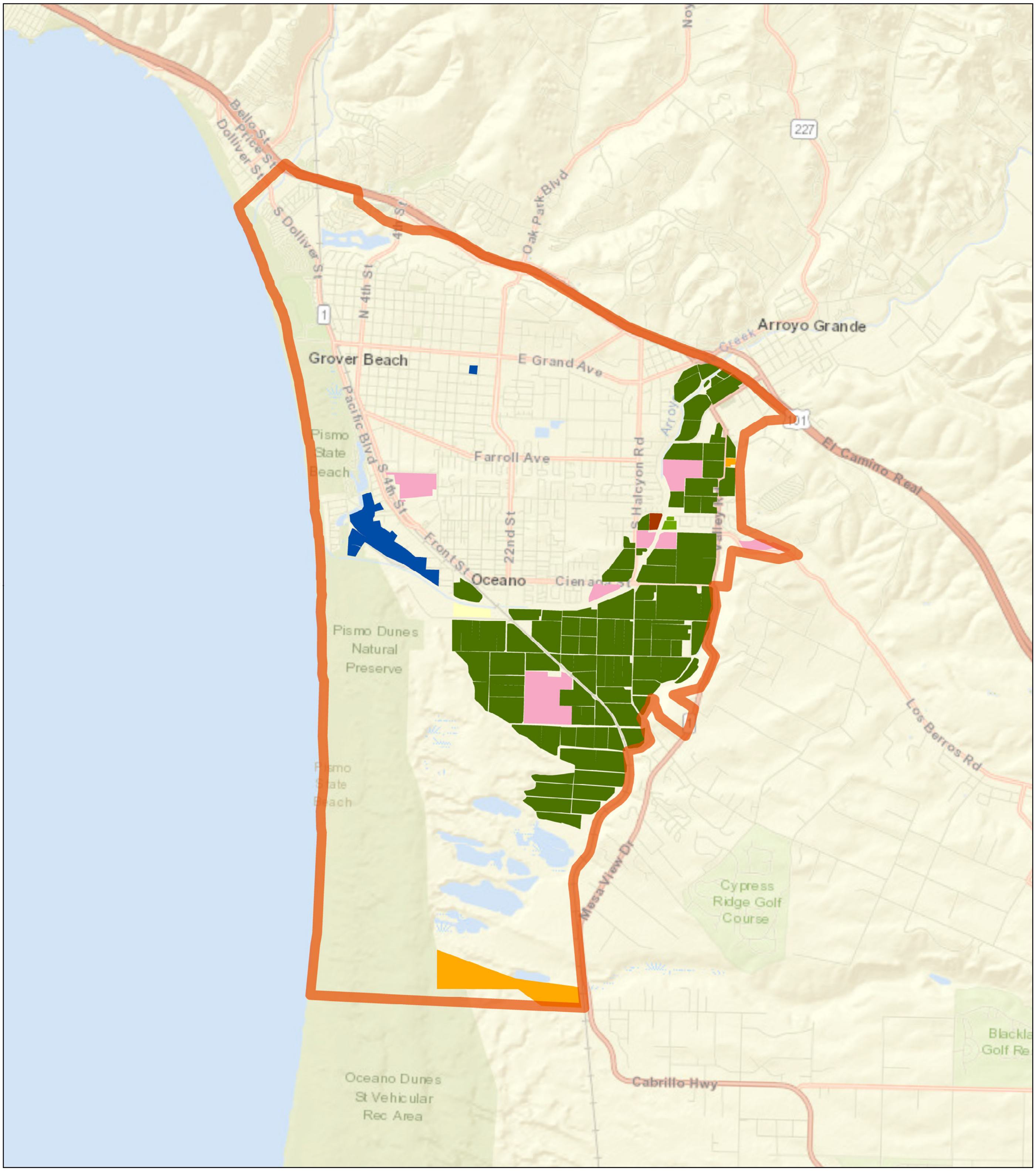


Note: Data include "middle" and "deep" wells from 2017 quarterly sampling events.

GSI Water Solutions, Inc.

PIPER DIAGRAM OF WATER QUALITY IN SELECT MONITORING WELLS
Northern Cities Management Area
San Luis Obispo County, California

FIGURE 22



LEGEND

Northern Cities Management Area
Landscape Main
Garden Transplant Plants
Outdoor Transplant Plants
Potato
Rotational Crops
Strawberry
Uncultivated Land

N

0 1
Miles

FIGURE 23

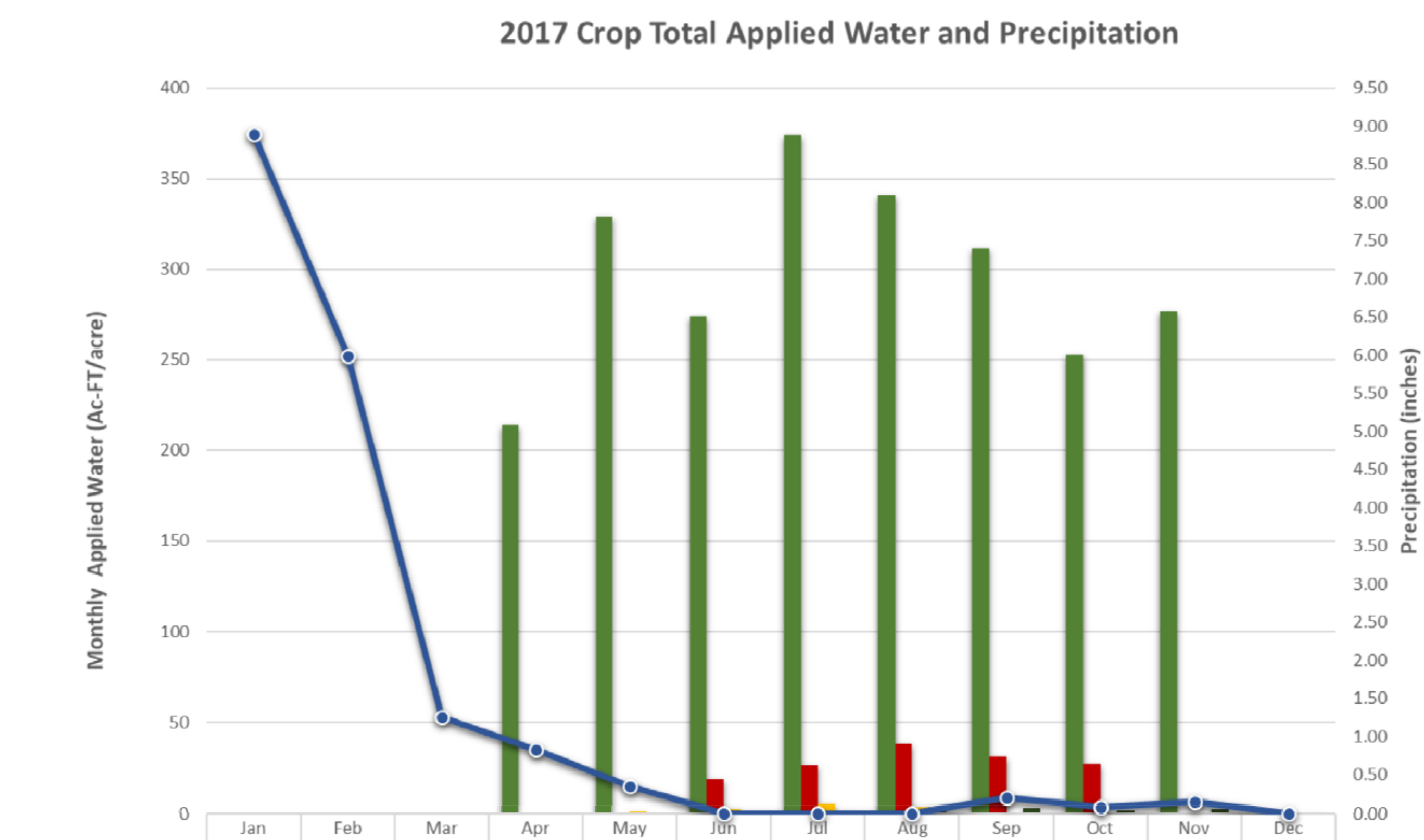
NCMA Agricultural Land 2017

Northern Cities Management Area
San Luis Obispo County, California

GSI Water Solutions, Inc.

Date: January 26, 2018
Data Sources:

Document Path: P:\Portland\672-Northern Cities Management Area\003-2017 Annual Report\Project_GIS\Project_mxds\Annual_Report\Figure_23_NCMA Agricultural Land_2017.mxd



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rotational Crops	0	0	0	214	329	274	374	341	312	253	277	0
Strawberries	0	0	0	0	0	19	26	38	31	27	0	0
Potatoes	0	0	0	0	1	3	5	3	0	0	0	0
Nursery Plants	0	0	0	0	0	0	1	3	3	2	2	0
Precipitation (in)	8.90	5.99	1.26	0.83	0.35	0.00	0.00	0.00	0.20	0.08	0.15	0.00

FIGURE 24

2017 ESTIMATED AGRICULTURAL WATER DEMAND AND MONTHLY PRECIPITATION AT THE CIMIS NIPOMO STATION

Northern Cities Management Area

San Luis Obispo County, California

GSI Water Solutions, Inc.

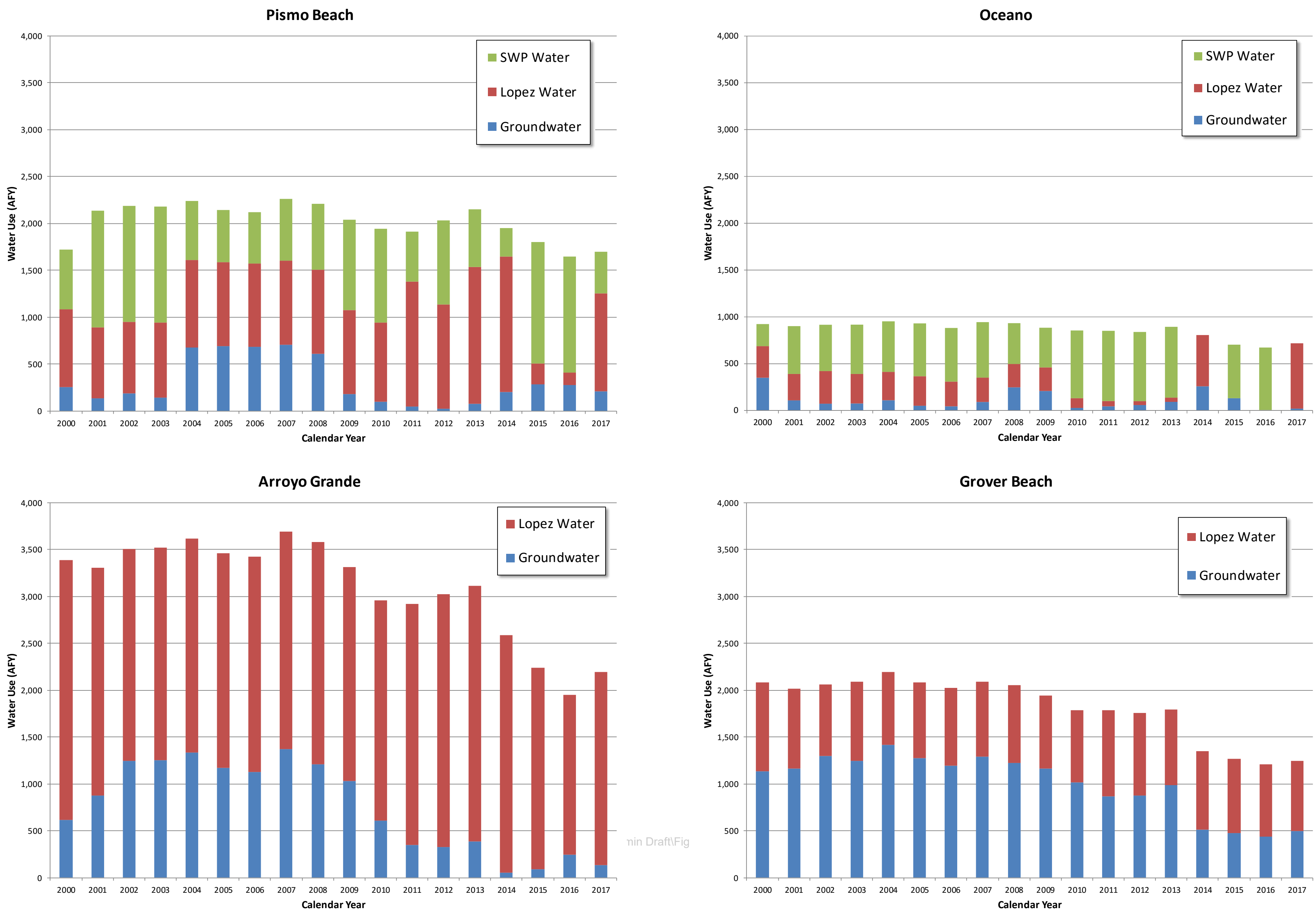


FIGURE 25

MUNICIPAL WATER USE BY SOURCE
Northern Cities Management Area
San Luis Obispo County, California

GSI Water Solutions, Inc.

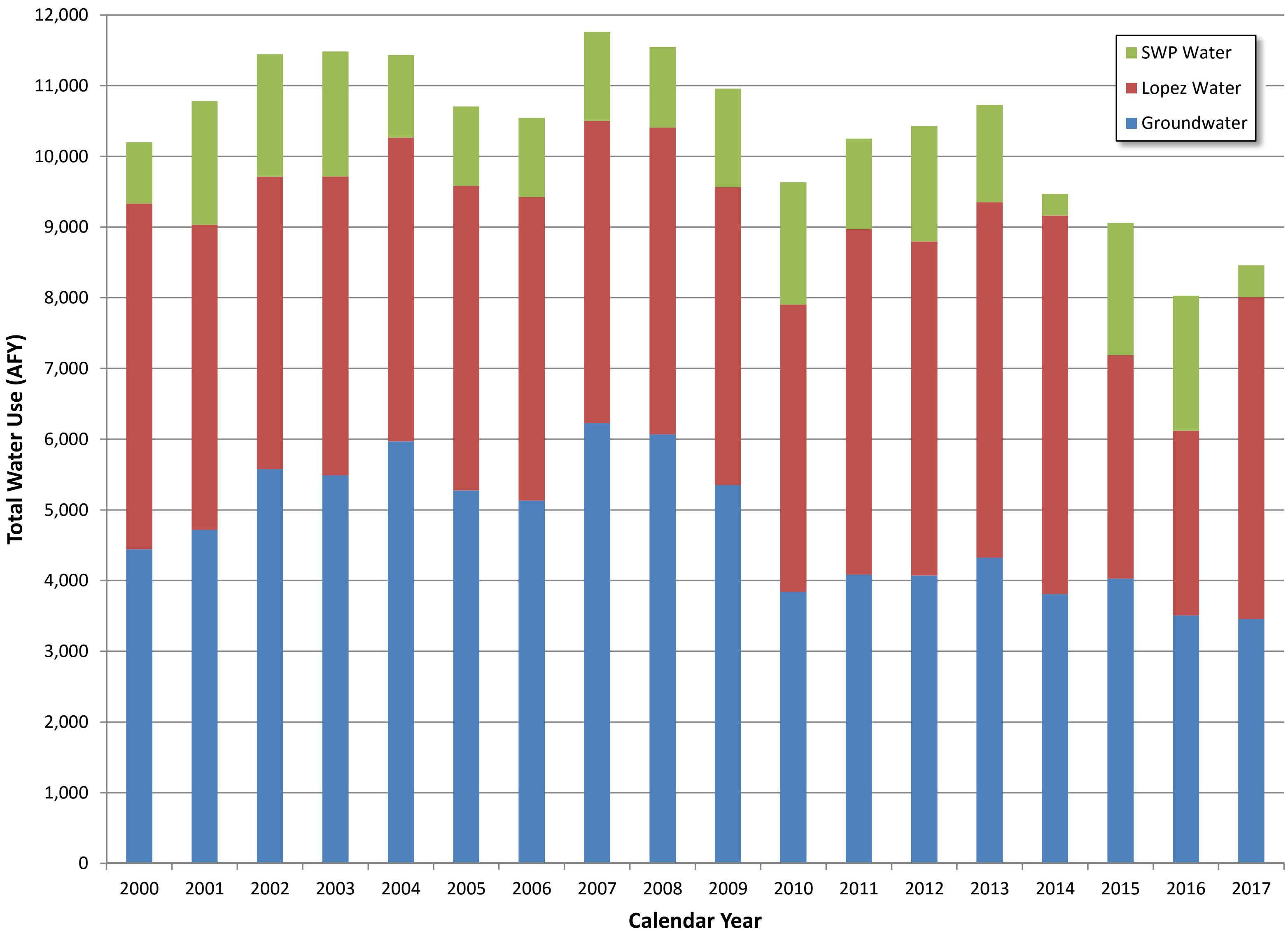


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FIGURE 26

TOTAL WATER USE (URBAN, RURAL, AG) BY SOURCE
Northern Cities Management Area
San Luis Obispo County, California

GSI Water Solutions, Inc.

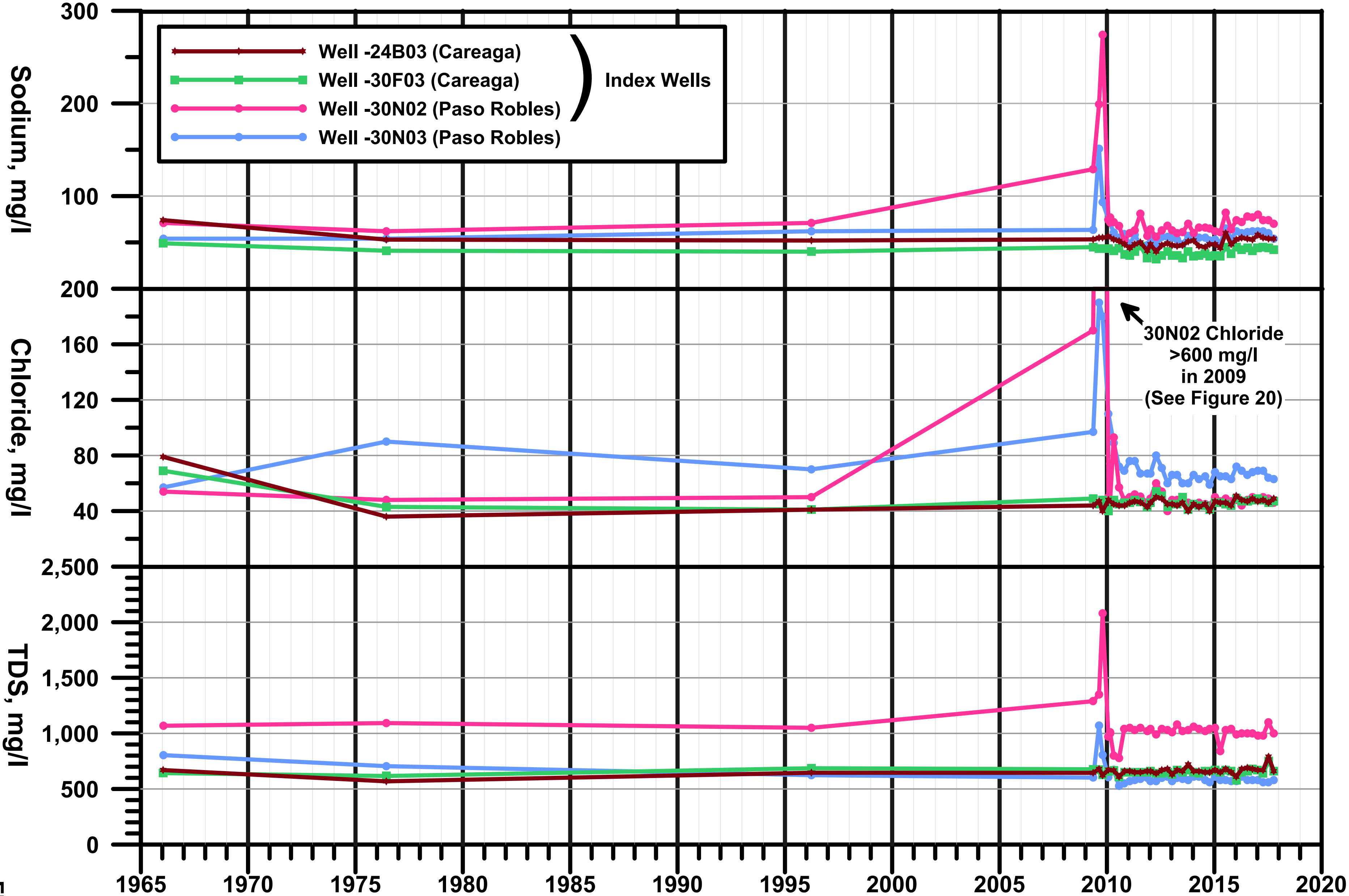

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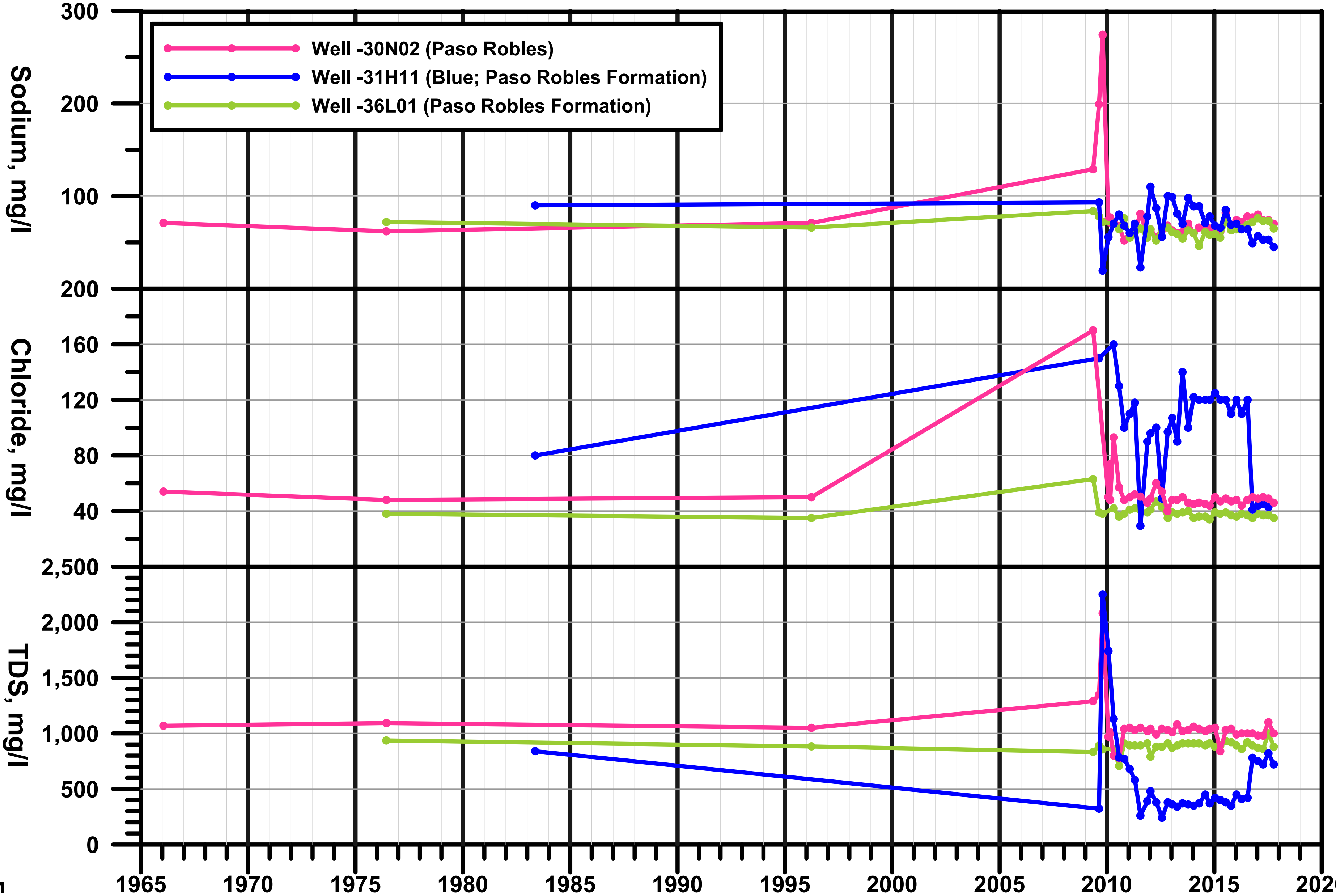
FIGURE 27

HISTORICAL TDS, CHLORIDE AND SODIUM, INDEX WELLS AND 30N03
Northern Cities Management Area
San Luis Obispo County, California

GSI Water Solutions, Inc.



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HISTORICAL TDS, CHLORIDE AND SODIUM, WELLS 30N02, MW-BLUE AND 36L01

Northern Cities Management Area

San Luis Obispo County, California

GSI Water Solutions, Inc.

FIGURE 28

APPENDIX A

NCMA Monitoring Well Water Level and Water Quality Data

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Appendix A: NCMA Sentry Wells Water Level Data

Well	Common Name	Aquifer	Date	Depth to Water (feet)	Surface Completion	RP Description	RP Elev, feet NAVD88	Groundwater Elevation (feet VD88)
32S/12E-24B01	North Beach Shallow	Alluvium	10/10/2017	6.12	Stove Pipe	Top of Steel	13.58	7.46
32S/12E-24B01	North Beach Shallow	Alluvium	7/11/2017	6.74	Stove Pipe	Top of Steel	13.58	6.84
32S/12E-24B01	North Beach Shallow	Alluvium	4/11/2017	6.30	Stove Pipe	Top of Steel	13.58	7.28
32S/12E-24B01	North Beach Shallow	Alluvium	1/10/2017	5.54	Stove Pipe	Top of Steel	13.58	8.04
32S/12E-24B01	North Beach Shallow	Alluvium	10/12/2016	6.54	Stove Pipe	Top of Steel	13.58	7.04
32S/12E-24B01	North Beach Shallow	Alluvium	7/19/2016	6.78	Stove Pipe	Top of Steel	13.58	6.80
32S/12E-24B01	North Beach Shallow	Alluvium	4/12/2016	6.35	Stove Pipe	Top of Steel	13.58	7.23
32S/12E-24B01	North Beach Shallow	Alluvium	1/12/2016	5.17	Stove Pipe	Top of Steel	13.58	8.41
32S/12E-24B01	North Beach Shallow	Alluvium	10/13/2015	5.73	Stove Pipe	Top of Steel	13.58	7.85
32S/12E-24B01	North Beach Shallow	Alluvium	7/14/2015	6.06	Stove Pipe	Top of Steel	13.58	7.52
32S/12E-24B01	North Beach Shallow	Alluvium	4/14/2015	6.22	Stove Pipe	Top of Steel	13.58	7.36
32S/12E-24B01	North Beach Shallow	Alluvium	1/13/2015	5.83	Stove Pipe	Top of Steel	13.58	7.75
32S/12E-24B01	North Beach Shallow	Alluvium	10/14/2014	5.76	Stove Pipe	Top of Steel	13.58	7.82
32S/12E-24B01	North Beach Shallow	Alluvium	7/29/2014	5.99	Stove Pipe	Top of Steel	13.58	7.59
32S/12E-24B01	North Beach Shallow	Alluvium	6/4/2014	6.52	Stove Pipe	Top of Steel	13.58	7.06
32S/12E-24B01	North Beach Shallow	Alluvium	4/15/2014	5.95	Stove Pipe	Top of Steel	13.58	7.63
32S/12E-24B01	North Beach Shallow	Alluvium	1/14/2014	5.75	Stove Pipe	Top of Steel	13.58	7.83
32S/12E-24B01	North Beach Shallow	Alluvium	10/14/2013	6.07	Stove Pipe	Top of Steel	13.58	7.51
32S/12E-24B01	North Beach Shallow	Alluvium	7/9/2013	6.09	Stove Pipe	Top of Steel	13.58	7.49
32S/12E-24B01	North Beach Shallow	Alluvium	4/10/2013	7.00	Stove Pipe	Top of Steel	13.58	6.58
32S/12E-24B01	North Beach Shallow	Alluvium	1/14/2013	5.72	Stove Pipe	Top of Steel	13.58	7.86
32S/12E-24B01	North Beach Shallow	Alluvium	10/29/2012	5.92	Stove Pipe	Top of Steel	13.58	7.66
32S/12E-24B01	North Beach Shallow	Alluvium	7/23/2012	5.79	Stove Pipe	Top of Steel	13.58	7.79
32S/12E-24B01	North Beach Shallow	Alluvium	4/18/2012	5.58	Stove Pipe	Top of Steel	13.58	8.00
32S/12E-24B01	North Beach Shallow	Alluvium	1/11/2012	5.72	Stove Pipe	Top of Steel	13.58	7.86
32S/12E-24B01	North Beach Shallow	Alluvium	11/21/2011	5.80	Stove Pipe	Top of Steel	13.58	7.78
32S/12E-24B01	North Beach Shallow	Alluvium	7/26/2011	6.38	Stove Pipe	Top of Steel	13.58	7.20
32S/12E-24B01	North Beach Shallow	Alluvium	4/20/2011	6.40	Stove Pipe	Top of Steel	13.58	7.18
32S/12E-24B01	North Beach Shallow	Alluvium	1/24/2011	5.78	Stove Pipe	Top of Steel	13.58	7.80
32S/12E-24B01	North Beach Shallow	Alluvium	10/21/2010	6.37	Stove Pipe	Top of Steel	13.58	7.21
32S/12E-24B01	North Beach Shallow	Alluvium	7/27/2010	6.48	Stove Pipe	Top of Steel	13.58	7.1
32S/12E-24B01	North Beach Shallow	Alluvium	4/27/2010	3.84	Flush	Top Flush Mount	10.70	6.86
32S/12E-24B01	North Beach Shallow	Alluvium	1/27/2010	3.13	Flush	Top Flush Mount	10.70	7.57
32S/12E-24B01	North Beach Shallow	Alluvium	10/19/2009	2.28	Flush	Top Flush Mount	10.70	8.42
32S/12E-24B01	North Beach Shallow	Alluvium	8/20/2009	3.25	Flush	Top Flush Mount	10.70	7.45
32S/12E-24B01	North Beach Shallow	Alluvium	5/12/2009	3.58	Flush	Top Flush Mount	10.70	7.12
32S/12E-24B01	North Beach Shallow	Alluvium	4/7/2009	1.61	Flush	Top Flush Mount	11.70	10.09
32S/12E-24B01	North Beach Shallow	Alluvium	10/15/2008	4.72	Flush	Top Flush Mount	12.70	7.98
32S/12E-24B01	North Beach Shallow	Alluvium	4/15/2008	2.65	Flush	Top Flush Mount	13.70	11.05
32S/12E-24B02	North Beach Middle	Paso Robles	10/10/2017	6.46	Stove Pipe	Top of Steel	13.58	7.12
32S/12E-24B02	North Beach Middle	Paso Robles	7/11/2017	6.93	Stove Pipe	Top of Steel	13.58	6.65

Appendix A: NCMA Sentry Wells Water Level Data

Well	Common Name	Aquifer	Date	Depth to Water (feet)	Surface Completion	RP Description	RP Elev, feet NAVD88	Groundwater Elevation (feet VD88)
32S/12E-24B02	North Beach Middle	Paso Robles	4/11/2017	6.26	Stove Pipe	Top of Steel	13.58	7.32
32S/12E-24B02	North Beach Middle	Paso Robles	1/10/2017	5.33	Stove Pipe	Top of Steel	13.58	8.25
32S/12E-24B02	North Beach Middle	Paso Robles	10/12/2016	7.05	Stove Pipe	Top of Steel	13.58	6.53
32S/12E-24B02	North Beach Middle	Paso Robles	7/19/2016	7.61	Stove Pipe	Top of Steel	13.58	5.97
32S/12E-24B02	North Beach Middle	Paso Robles	4/12/2016	6.37	Stove Pipe	Top of Steel	13.58	7.21
32S/12E-24B02	North Beach Middle	Paso Robles	1/12/2016	5.51	Stove Pipe	Top of Steel	13.58	8.07
32S/12E-24B02	North Beach Middle	Paso Robles	10/13/2015	6.61	Stove Pipe	Top of Steel	13.58	6.97
32S/12E-24B02	North Beach Middle	Paso Robles	7/14/2015	6.97	Stove Pipe	Top of Steel	13.58	6.61
32S/12E-24B02	North Beach Middle	Paso Robles	4/14/2015	7.13	Stove Pipe	Top of Steel	13.58	6.45
32S/12E-24B02	North Beach Middle	Paso Robles	1/13/2015	6.28	Stove Pipe	Top of Steel	13.58	7.30
32S/12E-24B02	North Beach Middle	Paso Robles	10/14/2014	6.61	Stove Pipe	Top of Steel	13.58	6.97
32S/12E-24B02	North Beach Middle	Paso Robles	7/29/2014	7.05	Stove Pipe	Top of Steel	13.58	6.53
32S/12E-24B02	North Beach Middle	Paso Robles	6/4/2014	8.25	Stove Pipe	Top of Steel	13.58	5.33
32S/12E-24B02	North Beach Middle	Paso Robles	4/15/2014	6.55	Stove Pipe	Top of Steel	13.58	7.03
32S/12E-24B02	North Beach Middle	Paso Robles	1/14/2014	6.34	Stove Pipe	Top of Steel	13.58	7.24
32S/12E-24B02	North Beach Middle	Paso Robles	10/14/2013	7.08	Stove Pipe	Top of Steel	13.58	6.50
32S/12E-24B02	North Beach Middle	Paso Robles	7/9/2013	7.17	Stove Pipe	Top of Steel	13.58	6.41
32S/12E-24B02	North Beach Middle	Paso Robles	4/10/2013	6.33	Stove Pipe	Top of Steel	13.58	7.25
32S/12E-24B02	North Beach Middle	Paso Robles	1/14/2013	5.61	Stove Pipe	Top of Steel	13.58	7.97
32S/12E-24B02	North Beach Middle	Paso Robles	10/29/2012	5.88	Stove Pipe	Top of Steel	13.58	7.7
32S/12E-24B02	North Beach Middle	Paso Robles	7/23/2012	6.12	Stove Pipe	Top of Steel	13.58	7.46
32S/12E-24B02	North Beach Middle	Paso Robles	4/18/2012	5.48	Stove Pipe	Top of Steel	13.58	8.1
32S/12E-24B02	North Beach Middle	Paso Robles	1/11/2012	5.47	Stove Pipe	Top of Steel	13.58	8.11
32S/12E-24B02	North Beach Middle	Paso Robles	11/21/2011	5.69	Stove Pipe	Top of Steel	13.58	7.89
32S/12E-24B02	North Beach Middle	Paso Robles	7/26/2011	6.51	Stove Pipe	Top of Steel	13.58	7.07
32S/12E-24B02	North Beach Middle	Paso Robles	4/20/2011	6.30	Stove Pipe	Top of Steel	13.58	7.28
32S/12E-24B02	North Beach Middle	Paso Robles	1/24/2011	5.69	Stove Pipe	Top of Steel	13.58	7.89
32S/12E-24B02	North Beach Middle	Paso Robles	10/21/2010	6.79	Stove Pipe	Top of Steel	13.58	6.79
32S/12E-24B02	North Beach Middle	Paso Robles	7/27/2010	7.05	Stove Pipe	Top of Steel	13.58	6.53
32S/12E-24B02	North Beach Middle	Paso Robles	4/27/2010	4.34	Flush	Top Flush Mount	10.70	6.36
32S/12E-24B02	North Beach Middle	Paso Robles	1/27/2010	3.38	Flush	Top Flush Mount	10.70	7.32
32S/12E-24B02	North Beach Middle	Paso Robles	10/19/2009	2.26	Flush	Top Flush Mount	10.70	8.44
32S/12E-24B02	North Beach Middle	Paso Robles	8/20/2009	4.09	Flush	Top Flush Mount	10.70	6.61
32S/12E-24B02	North Beach Middle	Paso Robles	5/12/2009	4.74	Flush	Top Flush Mount	10.70	5.96
32S/12E-24B02	North Beach Middle	Paso Robles	10/15/2008	4.54	Flush	Top Flush Mount	10.70	6.16
32S/12E-24B02	North Beach Middle	Paso Robles	4/15/2008	3.17	Flush	Top Flush Mount	10.70	7.53

Well	Common Name	Aquifer	Date	Depth to Water (feet)	Surface Completion	RP Description	RP Elev, feet NAVD88	Groundwater Elevation (feet VD88)
32S/12E-24B03	North Beach Deep	Careaga	10/10/2017	3.60	Stove Pipe	Top of Steel	13.58	9.98
32S/12E-24B03	North Beach Deep	Careaga	7/11/2017	3.75	Stove Pipe	Top of Steel	13.58	9.83
32S/12E-24B03	North Beach Deep	Careaga	4/11/2017	2.90	Stove Pipe	Top of Steel	13.58	10.68
32S/12E-24B03	North Beach Deep	Careaga	1/10/2017	2.59	Stove Pipe	Top of Steel	13.58	10.99
32S/12E-24B03	North Beach Deep	Careaga	10/12/2016	4.70	Stove Pipe	Top of Steel	13.58	8.88
32S/12E-24B03	North Beach Deep	Careaga	7/19/2016	5.10	Stove Pipe	Top of Steel	13.58	8.48
32S/12E-24B03	North Beach Deep	Careaga	4/12/2016	3.81	Stove Pipe	Top of Steel	13.58	9.77
32S/12E-24B03	North Beach Deep	Careaga	1/12/2016	3.01	Stove Pipe	Top of Steel	13.58	10.57
32S/12E-24B03	North Beach Deep	Careaga	10/13/2015	4.62	Stove Pipe	Top of Steel	13.58	8.96
32S/12E-24B03	North Beach Deep	Careaga	7/14/2015	4.76	Stove Pipe	Top of Steel	13.58	8.82
32S/12E-24B03	North Beach Deep	Careaga	4/14/2015	4.86	Stove Pipe	Top of Steel	13.58	8.72
32S/12E-24B03	North Beach Deep	Careaga	1/13/2015	3.59	Stove Pipe	Top of Steel	13.58	9.99
32S/12E-24B03	North Beach Deep	Careaga	10/14/2014	4.60	Stove Pipe	Top of Steel	13.58	8.98
32S/12E-24B03	North Beach Deep	Careaga	7/29/2014	4.78	Stove Pipe	Top of Steel	13.58	8.80
32S/12E-24B03	North Beach Deep	Careaga	6/4/2014	7.33	Stove Pipe	Top of Steel	13.58	6.25
32S/12E-24B03	North Beach Deep	Careaga	5/5/2014	5.36	Stove Pipe	Top of Steel	13.58	8.22
32S/12E-24B03	North Beach Deep	Careaga	4/15/2014	3.94	Stove Pipe	Top of Steel	13.58	9.64
32S/12E-24B03	North Beach Deep	Careaga	1/14/2014	3.81	Stove Pipe	Top of Steel	13.58	9.77
32S/12E-24B03	North Beach Deep	Careaga	10/14/2013	4.50	Stove Pipe	Top of Steel	13.58	9.08
32S/12E-24B03	North Beach Deep	Careaga	7/9/2013	4.48	Stove Pipe	Top of Steel	13.58	9.1
32S/12E-24B03	North Beach Deep	Careaga	4/10/2013	3.41	Stove Pipe	Top of Steel	13.58	10.17
32S/12E-24B03	North Beach Deep	Careaga	1/14/2013	2.48	Stove Pipe	Top of Steel	13.58	11.1
32S/12E-24B03	North Beach Deep	Careaga	10/29/2012	3.01	Stove Pipe	Top of Steel	13.58	10.57
32S/12E-24B03	North Beach Deep	Careaga	7/23/2012	2.98	Stove Pipe	Top of Steel	13.58	10.6
32S/12E-24B03	North Beach Deep	Careaga	4/18/2012	1.93	Stove Pipe	Top of Steel	13.58	11.65
32S/12E-24B03	North Beach Deep	Careaga	1/12/2012	2.15	Stove Pipe	Top of Steel	13.58	11.43
32S/12E-24B03	North Beach Deep	Careaga	11/21/2011	2.93	Stove Pipe	Top of Steel	13.58	10.65
32S/12E-24B03	North Beach Deep	Careaga	7/26/2011	3.17	Stove Pipe	Top of Steel	13.58	10.41
32S/12E-24B03	North Beach Deep	Careaga	4/20/2011	3.25	Stove Pipe	Top of Steel	13.58	10.33
32S/12E-24B03	North Beach Deep	Careaga	1/24/2011	2.65	Stove Pipe	Top of Steel	13.58	10.93
32S/12E-24B03	North Beach Deep	Careaga	10/21/2010	4.60	Stove Pipe	Top of Steel	13.58	8.98
32S/12E-24B03	North Beach Deep	Careaga	7/27/2010	4.54	Stove Pipe	Top of Steel	13.58	9.04
32S/12E-24B03	North Beach Deep	Careaga	4/27/2010	1.43	Flush	Top Flush Mount	10.70	9.27
32S/12E-24B03	North Beach Deep	Careaga	1/27/2010	0.94	Flush	Top Flush Mount	10.70	9.76
32S/12E-24B03	North Beach Deep	Careaga	10/19/2009	0.81	Flush	Top Flush Mount	10.70	9.89
32S/12E-24B03	North Beach Deep	Careaga	8/19/2009	4.18	Flush	Top Flush Mount	10.70	6.52
32S/12E-24B03	North Beach Deep	Careaga	5/12/2009	3.18	Flush	Top Flush Mount	10.70	7.52
32S/12E-24B03	North Beach Deep	Careaga	10/15/2008	3.13	Flush	Top Flush Mount	10.70	7.57
32S/12E-24B03	North Beach Deep	Careaga	4/15/2008	3.80	Flush	Top Flush Mount	10.70	6.90
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	10/10/2017	14.65	Stove Pipe	Top of Steel	23.16	8.51
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	7/11/2017	13.73	Stove Pipe	Top of Steel	23.16	9.43

Appendix A: NCMA Sentry Wells Water Level Data

Well	Common Name	Aquifer	Date	Depth to Water (feet)	Surface Completion	RP Description	RP Elev, feet NAVD88	Groundwater Elevation (feet VD88)
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	4/11/2017	13.25	Stove Pipe	Top of Steel	23.16	9.91
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	1/10/2017	13.99	Stove Pipe	Top of Steel	23.16	9.17
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	10/12/2016	17.08	Stove Pipe	Top of Steel	23.16	6.08
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	7/19/2016	16.42	Stove Pipe	Top of Steel	23.16	6.74
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	4/12/2016	14.83	Stove Pipe	Top of Steel	23.16	8.33
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	1/12/2016	15.00	Stove Pipe	Top of Steel	23.16	8.16
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	10/13/2015	17.11	Stove Pipe	Top of Steel	23.16	6.05
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	7/14/2015	16.93	Stove Pipe	Top of Steel	23.16	6.23
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	4/14/2015	16.01	Stove Pipe	Top of Steel	23.16	7.15
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	1/13/2015	15.41	Stove Pipe	Top of Steel	23.16	7.75
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	10/14/2014	17.05	Stove Pipe	Top of Steel	23.16	6.11
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	7/29/2014	17.11	Stove Pipe	Top of Steel	23.16	6.05
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	6/4/2014	16.82	Stove Pipe	Top of Steel	23.16	6.34
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	4/15/2014	15.56	Stove Pipe	Top of Steel	23.16	7.60
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	1/14/2014	16.58	Stove Pipe	Top of Steel	23.16	6.58
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	10/14/2013	17.07	Stove Pipe	Top of Steel	23.16	6.09
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	7/9/2013	16.17	Stove Pipe	Top of Steel	23.16	6.99
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	4/10/2013	14.58	Stove Pipe	Top of Steel	23.16	8.58
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	1/14/2013	14.36	Stove Pipe	Top of Steel	23.16	8.8
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	10/30/2012	14.95	Stove Pipe	Top of Steel	23.16	8.21
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	7/24/2012	14.00	Stove Pipe	Top of Steel	23.16	9.16
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	4/18/2012	13.42	Stove Pipe	Top of Steel	23.16	9.74
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	1/10/2012	13.80	Stove Pipe	Top of Steel	23.16	9.36
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	11/21/2011	13.78	Stove Pipe	Top of Steel	23.16	9.38
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	7/26/2011	13.50	Stove Pipe	Top of Steel	23.16	9.66
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	4/20/2011	12.82	Stove Pipe	Top of Steel	23.16	10.34
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	1/24/2011	13.33	Stove Pipe	Top of Steel	23.16	9.83
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	10/21/2010	16.55	Stove Pipe	Top of Steel	23.16	6.61
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	7/26/2010	15.68	Stove Pipe	Top of Steel	23.16	7.48
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	4/27/2010	11.02	Stove Pipe	Top of Steel	23.16	12.14
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	1/28/2010	12.73	Stove Pipe	Top of Steel	23.16	10.43
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	10/19/2009	14.33	Stove Pipe	Top of Steel	23.16	8.83
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	8/19/2009	14.34	Stove Pipe	Top of Steel	23.16	8.82
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	5/12/2009	12.38	Stove Pipe	Top of Steel	23.16	10.78
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	4/7/2009	11.67	Stove Pipe	Top of Steel	24.16	12.49
32S/13E-30F01	Highway 1 Shallow	Alluvium / Paso Robles	10/15/2008	15.53	Stove Pipe	Top of Steel	25.16	9.63

Well	Common Name	Aquifer	Date	Depth to Water (feet)	Surface Completion	RP Description	RP Elev, feet NAVD88	Groundwater Elevation (feet VD88)
32S/13E-30F02	Highway 1 Middle	Paso Robles	10/10/2017	15.45	Stove Pipe	Top of Steel	23.16	7.71
32S/13E-30F02	Highway 1 Middle	Paso Robles	7/11/2017	15.30	Stove Pipe	Top of Steel	23.16	7.86
32S/13E-30F02	Highway 1 Middle	Paso Robles	4/11/2017	14.27	Stove Pipe	Top of Steel	23.16	8.89
32S/13E-30F02	Highway 1 Middle	Paso Robles	1/10/2017	14.53	Stove Pipe	Top of Steel	23.16	8.63
32S/13E-30F02	Highway 1 Middle	Paso Robles	10/12/2016	17.35	Stove Pipe	Top of Steel	23.16	5.81
32S/13E-30F02	Highway 1 Middle	Paso Robles	7/19/2016	17.63	Stove Pipe	Top of Steel	23.16	5.53
32S/13E-30F02	Highway 1 Middle	Paso Robles	4/12/2016	15.98	Stove Pipe	Top of Steel	23.16	7.18
32S/13E-30F02	Highway 1 Middle	Paso Robles	1/12/2016	15.29	Stove Pipe	Top of Steel	23.16	7.87
32S/13E-30F02	Highway 1 Middle	Paso Robles	10/13/2015	17.29	Stove Pipe	Top of Steel	23.16	5.87
32S/13E-30F02	Highway 1 Middle	Paso Robles	7/14/2015	17.44	Stove Pipe	Top of Steel	23.16	5.72
32S/13E-30F02	Highway 1 Middle	Paso Robles	4/14/2015	16.94	Stove Pipe	Top of Steel	23.16	6.22
32S/13E-30F02	Highway 1 Middle	Paso Robles	1/13/2015	16.41	Stove Pipe	Top of Steel	23.16	6.75
32S/13E-30F02	Highway 1 Middle	Paso Robles	10/14/2014	17.33	Stove Pipe	Top of Steel	23.16	5.83
32S/13E-30F02	Highway 1 Middle	Paso Robles	7/29/2014	17.31	Stove Pipe	Top of Steel	23.16	5.85
32S/13E-30F02	Highway 1 Middle	Paso Robles	6/4/2014	18.00	Stove Pipe	Top of Steel	23.16	5.16
32S/13E-30F02	Highway 1 Middle	Paso Robles	4/15/2014	16.27	Stove Pipe	Top of Steel	23.16	6.89
32S/13E-30F02	Highway 1 Middle	Paso Robles	1/14/2014	17.01	Stove Pipe	Top of Steel	23.16	6.15
32S/13E-30F02	Highway 1 Middle	Paso Robles	10/14/2013	17.52	Stove Pipe	Top of Steel	23.16	5.64
32S/13E-30F02	Highway 1 Middle	Paso Robles	7/9/2013	17.15	Stove Pipe	Top of Steel	23.16	6.01
32S/13E-30F02	Highway 1 Middle	Paso Robles	4/10/2013	15.76	Stove Pipe	Top of Steel	23.16	7.4
32S/13E-30F02	Highway 1 Middle	Paso Robles	1/14/2013	15.01	Stove Pipe	Top of Steel	23.16	8.15
32S/13E-30F02	Highway 1 Middle	Paso Robles	10/30/2012	15.27	Stove Pipe	Top of Steel	23.16	7.89
32S/13E-30F02	Highway 1 Middle	Paso Robles	7/24/2012	14.82	Stove Pipe	Top of Steel	23.16	8.34
32S/13E-30F02	Highway 1 Middle	Paso Robles	4/18/2012	14.38	Stove Pipe	Top of Steel	23.16	8.78
32S/13E-30F02	Highway 1 Middle	Paso Robles	1/12/2012	14.31	Stove Pipe	Top of Steel	23.16	8.85
32S/13E-30F02	Highway 1 Middle	Paso Robles	11/21/2011	14.94	Stove Pipe	Top of Steel	23.16	8.22
32S/13E-30F02	Highway 1 Middle	Paso Robles	7/26/2011	14.46	Stove Pipe	Top of Steel	23.16	8.7
32S/13E-30F02	Highway 1 Middle	Paso Robles	4/20/2011	14.23	Stove Pipe	Top of Steel	23.16	8.93
32S/13E-30F02	Highway 1 Middle	Paso Robles	1/24/2011	14.36	Stove Pipe	Top of Steel	23.16	8.80
32S/13E-30F02	Highway 1 Middle	Paso Robles	10/21/2010	7.39	Stove Pipe	Top of Steel	23.16	15.77
32S/13E-30F02	Highway 1 Middle	Paso Robles	7/26/2010	16.21	Stove Pipe	Top of Steel	23.16	6.95
32S/13E-30F02	Highway 1 Middle	Paso Robles	4/27/2010	12.14	Flush	Top Flush Mount	20.36	8.22
32S/13E-30F02	Highway 1 Middle	Paso Robles	1/28/2010	13.09	Flush	Top Flush Mount	20.36	7.27
32S/13E-30F02	Highway 1 Middle	Paso Robles	10/19/2009	14.36	Flush	Top Flush Mount	20.36	6.00
32S/13E-30F02	Highway 1 Middle	Paso Robles	8/19/2009	14.81	Flush	Top Flush Mount	20.36	5.55
32S/13E-30F02	Highway 1 Middle	Paso Robles	5/12/2009	14.34	Flush	Top Flush Mount	20.36	6.02
32S/13E-30F02	Highway 1 Middle	Paso Robles	4/7/2009	12.28	Flush	Top Flush Mount	20.36	8.08
32S/13E-30F02	Highway 1 Middle	Paso Robles	10/15/2008	15.34	Flush	Top Flush Mount	20.36	5.02
32S/13E-30F02	Highway 1 Middle	Paso Robles	4/15/2008	12.40	Flush	Top Flush Mount	20.36	7.96
32S/13E-30F03	Highway 1 Deep	Careaga	10/10/2017	14.70	Stove Pipe	Top of Steel	23.16	8.46
32S/13E-30F03	Highway 1 Deep	Careaga	7/11/2017	13.64	Stove Pipe	Top of Steel	23.16	9.52

Well	Common Name	Aquifer	Date	Depth to Water (feet)	Surface Completion	RP Description	RP Elev, feet NAVD88	Groundwater Elevation (feet VD88)
32S/13E-30F03	Highway 1 Deep	Careaga	4/11/2017	12.36	Stove Pipe	Top of Steel	23.16	10.80
32S/13E-30F03	Highway 1 Deep	Careaga	1/10/2017	14.25	Stove Pipe	Top of Steel	23.16	8.91
32S/13E-30F03	Highway 1 Deep	Careaga	10/12/2016	17.82	Stove Pipe	Top of Steel	23.16	5.34
32S/13E-30F03	Highway 1 Deep	Careaga	7/19/2016	17.22	Stove Pipe	Top of Steel	23.16	5.94
32S/13E-30F03	Highway 1 Deep	Careaga	4/12/2016	14.90	Stove Pipe	Top of Steel	23.16	8.26
32S/13E-30F03	Highway 1 Deep	Careaga	1/12/2016	14.84	Stove Pipe	Top of Steel	23.16	8.32
32S/13E-30F03	Highway 1 Deep	Careaga	10/13/2015	18.87	Stove Pipe	Top of Steel	23.16	4.29
32S/13E-30F03	Highway 1 Deep	Careaga	7/14/2015	18.87	Stove Pipe	Top of Steel	23.16	4.29
32S/13E-30F03	Highway 1 Deep	Careaga	4/14/2015	17.92	Stove Pipe	Top of Steel	23.16	5.24
32S/13E-30F03	Highway 1 Deep	Careaga	1/13/2015	14.13	Stove Pipe	Top of Steel	23.16	9.03
32S/13E-30F03	Highway 1 Deep	Careaga	10/14/2014	18.98	Stove Pipe	Top of Steel	23.16	4.18
32S/13E-30F03	Highway 1 Deep	Careaga	7/29/2014	18.62	Stove Pipe	Top of Steel	23.16	4.54
32S/13E-30F03	Highway 1 Deep	Careaga	6/4/2014	22.27	Stove Pipe	Top of Steel	23.16	0.89
32S/13E-30F03	Highway 1 Deep	Careaga	5/5/2014	21.34	Stove Pipe	Top of Steel	23.16	1.82
32S/13E-30F03	Highway 1 Deep	Careaga	4/15/2014	16.14	Stove Pipe	Top of Steel	23.16	7.02
32S/13E-30F03	Highway 1 Deep	Careaga	1/14/2014	15.35	Stove Pipe	Top of Steel	23.16	7.81
32S/13E-30F03	Highway 1 Deep	Careaga	10/14/2013	17.30	Stove Pipe	Top of Steel	23.16	5.86
32S/13E-30F03	Highway 1 Deep	Careaga	7/9/2013	16.61	Stove Pipe	Top of Steel	23.16	6.55
32S/13E-30F03	Highway 1 Deep	Careaga	4/10/2013	14.69	Stove Pipe	Top of Steel	23.16	8.47
32S/13E-30F03	Highway 1 Deep	Careaga	1/14/2013	12.62	Stove Pipe	Top of Steel	23.16	10.54
32S/13E-30F03	Highway 1 Deep	Careaga	10/30/2012	14.61	Stove Pipe	Top of Steel	23.16	8.55
32S/13E-30F03	Highway 1 Deep	Careaga	7/24/2012	14.50	Stove Pipe	Top of Steel	23.16	8.66
32S/13E-30F03	Highway 1 Deep	Careaga	4/18/2012	10.43	Stove Pipe	Top of Steel	23.16	12.73
32S/13E-30F03	Highway 1 Deep	Careaga	1/12/2012	12.37	Stove Pipe	Top of Steel	23.16	10.79
32S/13E-30F03	Highway 1 Deep	Careaga	11/21/2011	13.24	Stove Pipe	Top of Steel	23.16	9.92
32S/13E-30F03	Highway 1 Deep	Careaga	7/26/2011	14.22	Stove Pipe	Top of Steel	23.16	8.94
32S/13E-30F03	Highway 1 Deep	Careaga	4/20/2011	12.51	Stove Pipe	Top of Steel	23.16	10.65
32S/13E-30F03	Highway 1 Deep	Careaga	1/24/2011	12.67	Stove Pipe	Top of Steel	23.16	10.49
32S/13E-30F03	Highway 1 Deep	Careaga	10/21/2010	6.62	Stove Pipe	Top of Steel	23.16	16.54
32S/13E-30F03	Highway 1 Deep	Careaga	7/26/2010	17.32	Stove Pipe	Top of Steel	23.16	5.84
32S/13E-30F03	Highway 1 Deep	Careaga	4/27/2010	11.38	Flush	Top Flush Mount	20.36	8.98
32S/13E-30F03	Highway 1 Deep	Careaga	1/28/2010	10.98	Flush	Top Flush Mount	20.36	9.38
32S/13E-30F03	Highway 1 Deep	Careaga	10/19/2009	14.18	Flush	Top Flush Mount	20.36	6.18
32S/13E-30F03	Highway 1 Deep	Careaga	8/19/2009	20.23	Flush	Top Flush Mount	20.36	0.13
32S/13E-30F03	Highway 1 Deep	Careaga	5/12/2009	17.68	Flush	Top Flush Mount	20.36	2.68
32S/13E-30F03	Highway 1 Deep	Careaga	10/15/2008	22.52	Flush	Top Flush Mount	20.36	-2.16
32S/13E-30F03	Highway 1 Deep	Careaga	4/15/2008	17.86	Flush	Top Flush Mount	20.36	2.50
32S/13E-30N01	Pier Ave Shallow	Alluvium	10/10/2017	9.35	Stove Pipe	Top of Steel	16.13	6.78
32S/13E-30N01	Pier Ave Shallow	Alluvium	7/11/2017	9.00	Stove Pipe	Top of Steel	16.13	7.13
32S/13E-30N01	Pier Ave Shallow	Alluvium	4/11/2017	8.70	Stove Pipe	Top of Steel	16.13	7.43
32S/13E-30N01	Pier Ave Shallow	Alluvium	1/10/2017	7.89	Stove Pipe	Top of Steel	16.13	8.24

Appendix A: NCMA Sentry Wells Water Level Data

Well	Common Name	Aquifer	Date	Depth to Water (feet)	Surface Completion	RP Description	RP Elev, feet NAVD88	Groundwater Elevation (feet VD88)
32S/13E-30N01	Pier Ave Shallow	Alluvium	10/12/2016	10.21	Stove Pipe	Top of Steel	16.13	5.92
32S/13E-30N01	Pier Ave Shallow	Alluvium	7/19/2016	9.91	Stove Pipe	Top of Steel	16.13	6.22
32S/13E-30N01	Pier Ave Shallow	Alluvium	4/12/2016	8.93	Stove Pipe	Top of Steel	16.13	7.20
32S/13E-30N01	Pier Ave Shallow	Alluvium	1/12/2016	8.73	Stove Pipe	Top of Steel	16.13	7.40
32S/13E-30N01	Pier Ave Shallow	Alluvium	10/13/2015	10.11	Stove Pipe	Top of Steel	16.13	6.02
32S/13E-30N01	Pier Ave Shallow	Alluvium	7/14/2015	9.91	Stove Pipe	Top of Steel	16.13	6.22
32S/13E-30N01	Pier Ave Shallow	Alluvium	4/14/2015	9.51	Stove Pipe	Top of Steel	16.13	6.62
32S/13E-30N01	Pier Ave Shallow	Alluvium	1/13/2015	9.03	Stove Pipe	Top of Steel	16.13	7.10
32S/13E-30N01	Pier Ave Shallow	Alluvium	10/14/2014	9.95	Stove Pipe	Top of Steel	16.13	6.18
32S/13E-30N01	Pier Ave Shallow	Alluvium	7/29/2014	9.88	Stove Pipe	Top of Steel	16.13	6.25
32S/13E-30N01	Pier Ave Shallow	Alluvium	6/4/2014	9.54	Stove Pipe	Top of Steel	16.13	6.59
32S/13E-30N01	Pier Ave Shallow	Alluvium	4/15/2014	9.17	Stove Pipe	Top of Steel	16.13	6.96
32S/13E-30N01	Pier Ave Shallow	Alluvium	1/14/2014	9.61	Stove Pipe	Top of Steel	16.13	6.52
32S/13E-30N01	Pier Ave Shallow	Alluvium	10/14/2013	9.86	Stove Pipe	Top of Steel	16.13	6.27
32S/13E-30N01	Pier Ave Shallow	Alluvium	7/9/2013	9.40	Stove Pipe	Top of Steel	16.13	6.73
32S/13E-30N01	Pier Ave Shallow	Alluvium	4/10/2013	8.98	Stove Pipe	Top of Steel	16.13	7.15
32S/13E-30N01	Pier Ave Shallow	Alluvium	1/14/2013	8.60	Stove Pipe	Top of Steel	16.13	7.53
32S/13E-30N01	Pier Ave Shallow	Alluvium	10/29/2012	8.96	Stove Pipe	Top of Steel	16.13	7.17
32S/13E-30N01	Pier Ave Shallow	Alluvium	7/23/2012	8.54	Stove Pipe	Top of Steel	16.13	7.59
32S/13E-30N01	Pier Ave Shallow	Alluvium	4/18/2012	8.53	Stove Pipe	Top of Steel	16.13	7.60
32S/13E-30N01	Pier Ave Shallow	Alluvium	1/9/2012	8.74	Stove Pipe	Top of Steel	16.13	7.39
32S/13E-30N01	Pier Ave Shallow	Alluvium	11/21/2011	8.78	Stove Pipe	Top of Steel	16.13	7.35
32S/13E-30N01	Pier Ave Shallow	Alluvium	7/26/2011	9.01	Stove Pipe	Top of Steel	16.13	7.12
32S/13E-30N01	Pier Ave Shallow	Alluvium	4/20/2011	8.59	Stove Pipe	Top of Steel	16.13	7.54
32S/13E-30N01	Pier Ave Shallow	Alluvium	1/24/2011	8.18	Stove Pipe	Top of Steel	16.13	7.95
32S/13E-30N01	Pier Ave Shallow	Alluvium	10/21/2010	9.99	Stove Pipe	Top of Steel	16.13	6.14
32S/13E-30N01	Pier Ave Shallow	Alluvium	7/27/2010	8.97	Stove Pipe	Top of Steel	16.13	7.16
32S/13E-30N01	Pier Ave Shallow	Alluvium	4/27/2010	6.14	Flush	Top Flush Mount	13.53	7.39
32S/13E-30N01	Pier Ave Shallow	Alluvium	1/26/2010	4.90	Flush	Top Flush Mount	13.53	8.63
32S/13E-30N01	Pier Ave Shallow	Alluvium	10/20/2009	6.53	Flush	Top Flush Mount	13.53	7.00
32S/13E-30N01	Pier Ave Shallow	Alluvium	8/20/2009	6.71	Flush	Top Flush Mount	13.53	6.82
32S/13E-30N01	Pier Ave Shallow	Alluvium	5/11/2009	6.03	Flush	Top Flush Mount	13.53	7.50
32S/13E-30N01	Pier Ave Shallow	Alluvium	4/7/2009	5.83	Flush	Top Flush Mount	13.53	7.70
32S/13E-30N01	Pier Ave Shallow	Alluvium	10/15/2008	7.19	Flush	Top Flush Mount	13.53	6.34
32S/13E-30N01	Pier Ave Shallow	Alluvium	4/15/2008	6.20	Flush	Top Flush Mount	13.53	7.33

Appendix A: NCMA Sentry Wells Water Level Data

Well	Common Name	Aquifer	Date	Depth to Water (feet)	Surface Completion	RP Description	RP Elev, feet NAVD88	Groundwater Elevation (feet VD88)
32S/13E-30N03	Pier Ave Middle	Paso Robles	10/10/2017	8.61	Stove Pipe	Top of Steel	16.13	7.52
32S/13E-30N03	Pier Ave Middle	Paso Robles	7/11/2017	8.84	Stove Pipe	Top of Steel	16.13	7.29
32S/13E-30N03	Pier Ave Middle	Paso Robles	4/11/2017	7.55	Stove Pipe	Top of Steel	16.13	8.58
32S/13E-30N03	Pier Ave Middle	Paso Robles	1/10/2017	7.11	Stove Pipe	Top of Steel	16.13	9.02
32S/13E-30N03	Pier Ave Middle	Paso Robles	10/12/2016	10.13	Stove Pipe	Top of Steel	16.13	6.00
32S/13E-30N03	Pier Ave Middle	Paso Robles	7/19/2016	10.62	Stove Pipe	Top of Steel	16.13	5.51
32S/13E-30N03	Pier Ave Middle	Paso Robles	4/12/2016	9.21	Stove Pipe	Top of Steel	16.13	6.92
32S/13E-30N03	Pier Ave Middle	Paso Robles	1/12/2016	7.98	Stove Pipe	Top of Steel	16.13	8.15
32S/13E-30N03	Pier Ave Middle	Paso Robles	10/13/2015	10.48	Stove Pipe	Top of Steel	16.13	5.65
32S/13E-30N03	Pier Ave Middle	Paso Robles	7/14/2015	10.88	Stove Pipe	Top of Steel	16.13	5.25
32S/13E-30N03	Pier Ave Middle	Paso Robles	4/14/2015	11.88	Stove Pipe	Top of Steel	16.13	4.25
32S/13E-30N03	Pier Ave Middle	Paso Robles	1/13/2015	9.40	Stove Pipe	Top of Steel	16.13	6.73
32S/13E-30N03	Pier Ave Middle	Paso Robles	10/14/2014	10.52	Stove Pipe	Top of Steel	16.13	5.61
32S/13E-30N03	Pier Ave Middle	Paso Robles	7/29/2014	10.22	Stove Pipe	Top of Steel	16.13	5.91
32S/13E-30N03	Pier Ave Middle	Paso Robles	6/4/2014	11.33	Stove Pipe	Top of Steel	16.13	4.80
32S/13E-30N03	Pier Ave Middle	Paso Robles	4/15/2014	9.31	Stove Pipe	Top of Steel	16.13	6.82
32S/13E-30N03	Pier Ave Middle	Paso Robles	1/14/2014	10.26	Stove Pipe	Top of Steel	16.13	5.87
32S/13E-30N03	Pier Ave Middle	Paso Robles	10/14/2013	10.72	Stove Pipe	Top of Steel	16.13	5.41
32S/13E-30N03	Pier Ave Middle	Paso Robles	7/9/2013	10.36	Stove Pipe	Top of Steel	16.13	5.77
32S/13E-30N03	Pier Ave Middle	Paso Robles	4/10/2013	8.26	Stove Pipe	Top of Steel	16.13	7.87
32S/13E-30N03	Pier Ave Middle	Paso Robles	1/14/2013	7.71	Stove Pipe	Top of Steel	16.13	8.42
32S/13E-30N03	Pier Ave Middle	Paso Robles	10/29/2012	8.01	Stove Pipe	Top of Steel	16.13	8.12
32S/13E-30N03	Pier Ave Middle	Paso Robles	7/23/2012	9.15	Stove Pipe	Top of Steel	16.13	6.98
32S/13E-30N03	Pier Ave Middle	Paso Robles	4/18/2012	6.72	Stove Pipe	Top of Steel	16.13	9.41
32S/13E-30N03	Pier Ave Middle	Paso Robles	1/11/2012	7.17	Stove Pipe	Top of Steel	16.13	8.96
32S/13E-30N03	Pier Ave Middle	Paso Robles	11/21/2011	6.45	Stove Pipe	Top of Steel	16.13	9.68
32S/13E-30N03	Pier Ave Middle	Paso Robles	7/26/2011	7.59	Stove Pipe	Top of Steel	16.13	8.54
32S/13E-30N03	Pier Ave Middle	Paso Robles	4/20/2011	6.65	Stove Pipe	Top of Steel	16.13	9.48
32S/13E-30N03	Pier Ave Middle	Paso Robles	1/24/2011	6.68	Stove Pipe	Top of Steel	16.13	9.45
32S/13E-30N03	Pier Ave Middle	Paso Robles	10/21/2010	10.76	Stove Pipe	Top of Steel	16.13	5.37
32S/13E-30N03	Pier Ave Middle	Paso Robles	7/27/2010	9.53	Stove Pipe	Top of Steel	16.13	6.60
32S/13E-30N03	Pier Ave Middle	Paso Robles	4/27/2010	5.26	Flush	Top Flush Mount	13.53	8.27
32S/13E-30N03	Pier Ave Middle	Paso Robles	1/26/2010	5.88	Flush	Top Flush Mount	13.53	7.65
32S/13E-30N03	Pier Ave Middle	Paso Robles	10/20/2009	6.56	Flush	Top Flush Mount	13.53	6.97
32S/13E-30N03	Pier Ave Middle	Paso Robles	8/20/2009	7.50	Flush	Top Flush Mount	13.53	6.03
32S/13E-30N03	Pier Ave Middle	Paso Robles	5/12/2009	6.33	Flush	Top Flush Mount	13.53	7.20
32S/13E-30N03	Pier Ave Middle	Paso Robles	4/15/2008	5.50	Flush	Top Flush Mount	13.53	8.03

Well	Common Name	Aquifer	Date	Depth to Water (feet)	Surface Completion	RP Description	RP Elev, feet NAVD88	Groundwater Elevation (feet VD88)
32S/13E-30N02	Pier Ave Deep	Paso Robles	10/10/2017	10.40	Stove Pipe	Top of Steel	16.13	5.73
32S/13E-30N02	Pier Ave Deep	Paso Robles	7/11/2017	8.38	Stove Pipe	Top of Steel	16.13	7.75
32S/13E-30N02	Pier Ave Deep	Paso Robles	4/11/2017	5.35	Stove Pipe	Top of Steel	16.13	10.78
32S/13E-30N02	Pier Ave Deep	Paso Robles	1/10/2017	7.34	Stove Pipe	Top of Steel	16.13	8.79
32S/13E-30N02	Pier Ave Deep	Paso Robles	10/12/2016	13.44	Stove Pipe	Top of Steel	16.13	2.69
32S/13E-30N02	Pier Ave Deep	Paso Robles	7/19/2016	12.40	Stove Pipe	Top of Steel	16.13	3.73
32S/13E-30N02	Pier Ave Deep	Paso Robles	4/12/2016	8.57	Stove Pipe	Top of Steel	16.13	7.56
32S/13E-30N02	Pier Ave Deep	Paso Robles	1/12/2016	7.48	Stove Pipe	Top of Steel	16.13	8.65
32S/13E-30N02	Pier Ave Deep	Paso Robles	10/13/2015	14.14	Stove Pipe	Top of Steel	16.13	1.99
32S/13E-30N02	Pier Ave Deep	Paso Robles	7/14/2015	13.55	Stove Pipe	Top of Steel	16.13	2.58
32S/13E-30N02	Pier Ave Deep	Paso Robles	4/14/2015	10.02	Stove Pipe	Top of Steel	16.13	6.11
32S/13E-30N02	Pier Ave Deep	Paso Robles	1/13/2015	7.85	Stove Pipe	Top of Steel	16.13	8.28
32S/13E-30N02	Pier Ave Deep	Paso Robles	10/14/2014	13.69	Stove Pipe	Top of Steel	16.13	2.44
32S/13E-30N02	Pier Ave Deep	Paso Robles	7/29/2014	13.27	Stove Pipe	Top of Steel	16.13	2.86
32S/13E-30N02	Pier Ave Deep	Paso Robles	6/4/2014	15.20	Stove Pipe	Top of Steel	16.13	0.93
32S/13E-30N02	Pier Ave Deep	Paso Robles	5/5/2014	13.19	Stove Pipe	Top of Steel	16.13	2.94
32S/13E-30N02	Pier Ave Deep	Paso Robles	4/15/2014	8.57	Stove Pipe	Top of Steel	16.13	7.56
32S/13E-30N02	Pier Ave Deep	Paso Robles	1/14/2014	9.30	Stove Pipe	Top of Steel	16.13	6.83
32S/13E-30N02	Pier Ave Deep	Paso Robles	10/14/2013	12.13	Stove Pipe	Top of Steel	16.13	4.00
32S/13E-30N02	Pier Ave Deep	Paso Robles	7/9/2013	11.05	Stove Pipe	Top of Steel	16.13	5.08
32S/13E-30N02	Pier Ave Deep	Paso Robles	4/10/2013	7.06	Stove Pipe	Top of Steel	16.13	9.07
32S/13E-30N02	Pier Ave Deep	Paso Robles	1/14/2013	4.98	Stove Pipe	Top of Steel	16.13	11.15
32S/13E-30N02	Pier Ave Deep	Paso Robles	10/29/2012	8.52	Stove Pipe	Top of Steel	16.13	7.61
32S/13E-30N02	Pier Ave Deep	Paso Robles	7/23/2012	8.31	Stove Pipe	Top of Steel	16.13	7.82
32S/13E-30N02	Pier Ave Deep	Paso Robles	4/18/2012	3.45	Stove Pipe	Top of Steel	16.13	12.68
32S/13E-30N02	Pier Ave Deep	Paso Robles	1/11/2012	4.88	Stove Pipe	Top of Steel	16.13	11.25
32S/13E-30N02	Pier Ave Deep	Paso Robles	11/21/2011	5.35	Stove Pipe	Top of Steel	16.13	10.78
32S/13E-30N02	Pier Ave Deep	Paso Robles	7/26/2011	7.25	Stove Pipe	Top of Steel	16.13	8.88
32S/13E-30N02	Pier Ave Deep	Paso Robles	4/20/2011	3.53	Flush	Top Flush Mount	13.53	10.00
32S/13E-30N02	Pier Ave Deep	Paso Robles	1/24/2011	3.67	Flush	Top Flush Mount	13.53	9.86
32S/13E-30N02	Pier Ave Deep	Paso Robles	10/21/2010	10.42	Flush	Top Flush Mount	13.53	3.11
32S/13E-30N02	Pier Ave Deep	Paso Robles	7/27/2010	10.02	Flush	Top Flush Mount	13.53	3.51
32S/13E-30N02	Pier Ave Deep	Paso Robles	4/27/2010	6.14	Flush	Top Flush Mount	13.53	7.39
32S/13E-30N02	Pier Ave Deep	Paso Robles	2/25/2010	1.72	Flush	Top Flush Mount	13.53	11.81
32S/13E-30N02	Pier Ave Deep	Paso Robles	2/25/2010	1.72	Flush	Top Flush Mount	13.53	11.81
32S/13E-30N02	Pier Ave Deep	Paso Robles	1/26/2010	3.72	Flush	Top Flush Mount	13.53	9.81
32S/13E-30N02	Pier Ave Deep	Paso Robles	10/20/2009	7.38	Flush	Top Flush Mount	13.53	6.15
32S/13E-30N02	Pier Ave Deep	Paso Robles	8/20/2009	11.94	Flush	Top Flush Mount	13.53	1.59
32S/13E-30N02	Pier Ave Deep	Paso Robles	5/11/2009	6.98	Flush	Top Flush Mount	13.53	6.55
32S/13E-30N02	Pier Ave Deep	Paso Robles	10/15/2008	12.23	Flush	Top Flush Mount	13.53	1.30
32S/13E-30N02	Pier Ave Deep	Paso Robles	4/15/2008	5.60	Flush	Top Flush Mount	13.53	7.93

Appendix A: NCMA Sentry Wells Water Level Data

Well	Common Name	Aquifer	Date	Depth to Water (feet)	Surface Completion	RP Description	RP Elev, feet NAVD88	Groundwater Elevation (feet VD88)
32S/13E-31H10	Oceano Green	Paso Robles	10/10/2017	26.53	Manhole	Top Flush Mount	34.63	8.10
32S/13E-31H10	Oceano Green	Paso Robles	7/11/2017	25.11	Manhole	Top Flush Mount	34.63	9.52
32S/13E-31H10	Oceano Green	Paso Robles	4/11/2017	21.98	Manhole	Top Flush Mount	34.63	12.65
32S/13E-31H10	Oceano Green	Paso Robles	1/10/2017	24.50	Manhole	Top Flush Mount	34.63	10.13
32S/13E-31H10	Oceano Green	Paso Robles	10/12/2016	30.74	Manhole	Top Flush Mount	34.63	3.89
32S/13E-31H10	Oceano Green	Paso Robles	7/19/2016	29.77	Manhole	Top Flush Mount	34.63	4.86
32S/13E-31H10	Oceano Green	Paso Robles	4/12/2016	25.64	Manhole	Top Flush Mount	34.63	8.99
32S/13E-31H10	Oceano Green	Paso Robles	1/12/2016	20.83	Manhole	Top of Casing	30.49	9.66
32S/13E-31H10	Oceano Green	Paso Robles	10/13/2015	31.88	Manhole	Top Flush Mount	34.63	2.75
32S/13E-31H10	Oceano Green	Paso Robles	7/14/2015	31.61	Manhole	Top Flush Mount	34.63	3.02
32S/13E-31H10	Oceano Green	Paso Robles	4/14/2015	28.81	Manhole	Top Flush Mount	34.63	5.82
32S/13E-31H10	Oceano Green	Paso Robles	1/13/2015	26.11	Manhole	Top Flush Mount	34.63	8.52
32S/13E-31H10	Oceano Green	Paso Robles	10/14/2014	31.64	Manhole	Top Flush Mount	34.63	2.99
32S/13E-31H10	Oceano Green	Paso Robles	7/29/2014	32.30	Manhole	Top Flush Mount	34.63	2.33
32S/13E-31H10	Oceano Green	Paso Robles	6/4/2014	32.82	Manhole	Top Flush Mount	34.63	1.81
32S/13E-31H10	Oceano Green	Paso Robles	4/15/2014	27.98	Manhole	Top Flush Mount	34.63	6.65
32S/13E-31H10	Oceano Green	Paso Robles	1/14/2014	28.55	Manhole	Top Flush Mount	34.63	6.08
32S/13E-31H10	Oceano Green	Paso Robles	10/14/2013	30.31	Manhole	Top Flush Mount	34.63	4.32
32S/13E-31H10	Oceano Green	Paso Robles	7/9/2013	29.98	Manhole	Top Flush Mount	34.63	4.65
32S/13E-31H10	Oceano Green	Paso Robles	4/10/2013	23.30	Manhole	Top Flush Mount	34.63	11.33
32S/13E-31H10	Oceano Green	Paso Robles	1/14/2013	23.59	Manhole	Top Flush Mount	34.63	11.04
32S/13E-31H10	Oceano Green	Paso Robles	10/30/2012	27.31	Manhole	Top Flush Mount	34.63	7.32
32S/13E-31H10	Oceano Green	Paso Robles	7/25/2012	27.15	Manhole	Top Flush Mount	34.63	7.48
32S/13E-31H10	Oceano Green	Paso Robles	4/18/2012	21.65	Manhole	Top Flush Mount	34.63	12.98
32S/13E-31H10	Oceano Green	Paso Robles	1/12/2012	23.29	Manhole	Top Flush Mount	34.63	11.34
32S/13E-31H10	Oceano Green	Paso Robles	11/21/2011	22.46	Manhole	Top Flush Mount	34.63	12.17
32S/13E-31H10	Oceano Green	Paso Robles	7/26/2011	25.51	Manhole	Top Flush Mount	34.63	9.12
32S/13E-31H10	Oceano Green	Paso Robles	4/20/2011	114.79	Manhole	Top Flush Mount	34.63	-80.16
32S/13E-31H10	Oceano Green	Paso Robles	1/24/2011	106.59	Manhole	Top Flush Mount	34.63	-71.96
32S/13E-31H10	Oceano Green	Paso Robles	10/21/2010	112.71	Manhole	Top of Casing	30.49	-82.22
32S/13E-31H10	Oceano Green	Paso Robles	7/26/2010	95.61	Manhole	Top of Casing	30.49	-65.12
32S/13E-31H10	Oceano Green	Paso Robles	4/26/2010	63.90	Manhole	Top of Casing	30.49	-33.41
32S/13E-31H10	Oceano Green	Paso Robles	1/27/2010	43.71	Manhole	Top of Casing	30.49	-13.22
32S/13E-31H10	Oceano Green	Paso Robles	10/20/2009	29.20	Manhole	Top of Casing	30.49	1.29
32S/13E-31H10	Oceano Green	Paso Robles	8/19/2009	24.55	Manhole	Top of Casing	30.49	5.94
32S/13E-31H10	Oceano Green	Paso Robles	4/7/2009	28.12	Manhole	Top of Casing	30.49	2.37
32S/13E-31H10	Oceano Green	Paso Robles	10/15/2008	27.84	Manhole	Top of Casing	30.49	2.65
32S/13E-31H10	Oceano Green	Paso Robles	4/16/2008	26.82	Manhole	Top of Casing	30.49	3.67

Well	Common Name	Aquifer	Date	Depth to Water (feet)	Surface Completion	RP Description	RP Elev, feet NAVD88	Groundwater Elevation (feet VD88)
32S/13E-31H11	Oceano Blue	Paso Robles	10/10/2017	28.03	Manhole	Top Flush Mount	34.63	6.6
32S/13E-31H11	Oceano Blue	Paso Robles	7/11/2017	26.18	Manhole	Top Flush Mount	34.63	8.45
32S/13E-31H11	Oceano Blue	Paso Robles	4/11/2017	21.90	Manhole	Top Flush Mount	34.63	12.73
32S/13E-31H11	Oceano Blue	Paso Robles	1/10/2017	25.00	Manhole	Top Flush Mount	34.63	9.63
32S/13E-31H11	Oceano Blue	Paso Robles	10/12/2016	30.74	Manhole	Top Flush Mount	34.63	3.89
32S/13E-31H11	Oceano Blue	Paso Robles	7/19/2016	29.62	Manhole	Top Flush Mount	34.63	5.01
32S/13E-31H11	Oceano Blue	Paso Robles	4/12/2016	25.13	Manhole	Top Flush Mount	34.63	9.50
32S/13E-31H11	Oceano Blue	Paso Robles	1/12/2016	22.00	Manhole	Top of Casing	30.54	8.54
32S/13E-31H11	Oceano Blue	Paso Robles	10/13/2015	32.70	Manhole	Top Flush Mount	34.63	1.93
32S/13E-31H11	Oceano Blue	Paso Robles	7/14/2015	32.21	Manhole	Top Flush Mount	34.63	2.42
32S/13E-31H11	Oceano Blue	Paso Robles	4/14/2015	28.41	Manhole	Top Flush Mount	34.63	6.22
32S/13E-31H11	Oceano Blue	Paso Robles	1/13/2015	25.98	Manhole	Top Flush Mount	34.63	8.65
32S/13E-31H11	Oceano Blue	Paso Robles	10/14/2014	32.70	Manhole	Top Flush Mount	34.63	1.93
32S/13E-31H11	Oceano Blue	Paso Robles	7/29/2014	32.69	Manhole	Top Flush Mount	34.63	1.94
32S/13E-31H11	Oceano Blue	Paso Robles	6/4/2014	34.02	Manhole	Top Flush Mount	34.63	0.61
32S/13E-31H11	Oceano Blue	Paso Robles	4/15/2014	27.07	Manhole	Top Flush Mount	34.63	7.56
32S/13E-31H11	Oceano Blue	Paso Robles	1/14/2014	27.86	Manhole	Top Flush Mount	34.63	6.77
32S/13E-31H11	Oceano Blue	Paso Robles	10/14/2013	30.98	Manhole	Top Flush Mount	34.63	3.65
32S/13E-31H11	Oceano Blue	Paso Robles	7/9/2013	29.36	Manhole	Top Flush Mount	34.63	5.27
32S/13E-31H11	Oceano Blue	Paso Robles	4/10/2013	24.45	Manhole	Top Flush Mount	34.63	10.18
32S/13E-31H11	Oceano Blue	Paso Robles	1/14/2013	23.14	Manhole	Top Flush Mount	34.63	11.49
32S/13E-31H11	Oceano Blue	Paso Robles	10/30/2012	27.68	Manhole	Top Flush Mount	34.63	6.95
32S/13E-31H11	Oceano Blue	Paso Robles	7/25/2012	27.18	Manhole	Top Flush Mount	34.63	7.45
32S/13E-31H11	Oceano Blue	Paso Robles	4/18/2012	20.10	Manhole	Top Flush Mount	34.63	14.53
32S/13E-31H11	Oceano Blue	Paso Robles	1/12/2012	22.26	Manhole	Top Flush Mount	34.63	12.37
32S/13E-31H11	Oceano Blue	Paso Robles	11/21/2011	22.73	Manhole	Top Flush Mount	34.63	11.90
32S/13E-31H11	Oceano Blue	Paso Robles	7/26/2011	25.29	Manhole	Top Flush Mount	34.63	9.34
32S/13E-31H11	Oceano Blue	Paso Robles	4/20/2011	22.59	Manhole	Top Flush Mount	34.63	12.04
32S/13E-31H11	Oceano Blue	Paso Robles	1/24/2011	24.87	Manhole	Top Flush Mount	34.63	9.76
32S/13E-31H11	Oceano Blue	Paso Robles	10/21/2010	30.11	Manhole	Top of Casing	30.54	0.43
32S/13E-31H11	Oceano Blue	Paso Robles	7/26/2010	24.74	Manhole	Top of Casing	30.54	5.80
32S/13E-31H11	Oceano Blue	Paso Robles	4/26/2010	18.52	Manhole	Top of Casing	30.54	12.02
32S/13E-31H11	Oceano Blue	Paso Robles	1/27/2010	22.06	Manhole	Top of Casing	30.54	8.48
32S/13E-31H11	Oceano Blue	Paso Robles	10/20/2009	27.50	Manhole	Top of Casing	30.54	3.04
32S/13E-31H11	Oceano Blue	Paso Robles	8/19/2009	24.65	Manhole	Top of Casing	30.54	5.89
32S/13E-31H11	Oceano Blue	Paso Robles	4/7/2009	27.65	Manhole	Top of Casing	30.54	2.89
32S/13E-31H11	Oceano Blue	Paso Robles	10/15/2008	29.29	Manhole	Top of Casing	30.54	1.25
32S/13E-31H11	Oceano Blue	Paso Robles	4/16/2008	26.98	Manhole	Top of Casing	30.54	3.56

Well	Common Name	Aquifer	Date	Depth to Water (feet)	Surface Completion	RP Description	RP Elev, feet NAVD88	Groundwater Elevation (feet VD88)
32S/13E-31H12	Oceano Silver	Careaga	10/10/2017	28.06	Manhole	Top Flush Mount	34.63	6.57
32S/13E-31H12	Oceano Silver	Careaga	7/11/2017	24.09	Manhole	Top Flush Mount	34.63	10.54
32S/13E-31H12	Oceano Silver	Careaga	4/11/2017	21.14	Manhole	Top Flush Mount	34.63	13.49
32S/13E-31H12	Oceano Silver	Careaga	1/10/2017	24.80	Manhole	Top Flush Mount	34.63	9.83
32S/13E-31H12	Oceano Silver	Careaga	10/12/2016	31.00	Manhole	Top Flush Mount	34.63	3.63
32S/13E-31H12	Oceano Silver	Careaga	7/19/2016	26.95	Manhole	Top of Casing	30.48	3.53
32S/13E-31H12	Oceano Silver	Careaga	4/12/2016	25.32	Manhole	Top Flush Mount	34.63	9.31
32S/13E-31H12	Oceano Silver	Careaga	1/12/2016	21.44	Manhole	Top of Casing	30.48	9.04
32S/13E-31H12	Oceano Silver	Careaga	10/13/2015	32.30	Manhole	Top Flush Mount	34.63	2.33
32S/13E-31H12	Oceano Silver	Careaga	7/14/2015	32.58	Manhole	Top Flush Mount	34.63	2.05
32S/13E-31H12	Oceano Silver	Careaga	4/14/2015	30.38	Manhole	Top Flush Mount	34.63	4.25
32S/13E-31H12	Oceano Silver	Careaga	1/13/2015	26.19	Manhole	Top Flush Mount	34.63	8.44
32S/13E-31H12	Oceano Silver	Careaga	10/14/2014	43.01	Manhole	Top Flush Mount	34.63	-8.38
32S/13E-31H12	Oceano Silver	Careaga	7/29/2014	33.65	Manhole	Top Flush Mount	34.63	0.98
32S/13E-31H12	Oceano Silver	Careaga	6/4/2014	36.33	Manhole	Top Flush Mount	34.63	-1.70
32S/13E-31H12	Oceano Silver	Careaga	4/15/2014	42.20	Manhole	Top Flush Mount	34.63	-7.57
32S/13E-31H12	Oceano Silver	Careaga	1/14/2014	27.78	Manhole	Top Flush Mount	34.63	6.85
32S/13E-31H12	Oceano Silver	Careaga	10/14/2013	30.92	Manhole	Top Flush Mount	34.63	3.71
32S/13E-31H12	Oceano Silver	Careaga	7/9/2013	30.91	Manhole	Top Flush Mount	34.63	3.72
32S/13E-31H12	Oceano Silver	Careaga	4/10/2013	26.08	Manhole	Top Flush Mount	34.63	8.55
32S/13E-31H12	Oceano Silver	Careaga	1/14/2013	23.12	Manhole	Top Flush Mount	34.63	11.51
32S/13E-31H12	Oceano Silver	Careaga	10/30/2012	27.14	Manhole	Top Flush Mount	34.63	7.49
32S/13E-31H12	Oceano Silver	Careaga	7/25/2012	27.68	Manhole	Top Flush Mount	34.63	6.95
32S/13E-31H12	Oceano Silver	Careaga	4/18/2012	20.13	Manhole	Top Flush Mount	34.63	14.5
32S/13E-31H12	Oceano Silver	Careaga	1/11/2012	23.00	Manhole	Top Flush Mount	34.63	11.63
32S/13E-31H12	Oceano Silver	Careaga	11/21/2011	22.85	Manhole	Top Flush Mount	34.63	11.78
32S/13E-31H12	Oceano Silver	Careaga	7/26/2011	25.23	Manhole	Top Flush Mount	34.63	9.4
32S/13E-31H12	Oceano Silver	Careaga	4/20/2011	21.27	Manhole	Top Flush Mount	34.63	13.36
32S/13E-31H12	Oceano Silver	Careaga	1/24/2011	22.02	Manhole	Top Flush Mount	34.63	12.61
32S/13E-31H12	Oceano Silver	Careaga	10/21/2010	29.11	Manhole	Top Flush Mount	34.63	5.52
32S/13E-31H12	Oceano Silver	Careaga	7/26/2010	24.24	Manhole	Well Casing	30.48	6.24
32S/13E-31H12	Oceano Silver	Careaga	4/26/2010	19.04	Manhole	Well Casing	30.48	11.44
32S/13E-31H12	Oceano Silver	Careaga	1/27/2010	21.05	Manhole	Well Casing	30.48	9.43
32S/13E-31H12	Oceano Silver	Careaga	10/20/2009	27.52	Manhole	Well Casing	30.48	2.96
32S/13E-31H12	Oceano Silver	Careaga	8/19/2009	29.34	Manhole	Well Casing	30.48	1.14
32S/13E-31H12	Oceano Silver	Careaga	4/7/2009	31.32	Manhole	Well Casing	30.48	-0.84
32S/13E-31H12	Oceano Silver	Careaga	10/15/2008	41.62	Manhole	Well Casing	30.48	-11.14
32S/13E-31H12	Oceano Silver	Careaga	4/16/2008	29.70	Manhole	Well Casing	30.48	0.78

Appendix A: NCMA Sentry Wells Water Level Data

Well	Common Name	Aquifer	Date	Depth to Water (feet)	Surface Completion	RP Description	RP Elev, feet NAVD88	Groundwater Elevation (feet VD88)
32S/13E-31H13	Oceano Yellow	Careaga	10/10/2017	27.96	Manhole	Top Flush Mount	34.63	6.67
32S/13E-31H13	Oceano Yellow	Careaga	7/11/2017	23.68	Manhole	Top Flush Mount	34.63	10.95
32S/13E-31H13	Oceano Yellow	Careaga	4/11/2017	21.18	Manhole	Top Flush Mount	34.63	13.45
32S/13E-31H13	Oceano Yellow	Careaga	1/10/2017	24.79	Manhole	Top Flush Mount	34.63	9.84
32S/13E-31H13	Oceano Yellow	Careaga	10/12/2016	30.91	Manhole	Top Flush Mount	34.63	3.72
32S/13E-31H13	Oceano Yellow	Careaga	7/19/2016	29.58	Manhole	Top Flush Mount	34.63	5.05
32S/13E-31H13	Oceano Yellow	Careaga	4/12/2016	25.25	Manhole	Top Flush Mount	34.63	9.38
32S/13E-31H13	Oceano Yellow	Careaga	1/12/2016	21.66	Manhole	Top of Casing	30.52	8.86
32S/13E-31H13	Oceano Yellow	Careaga	10/13/2015	32.28	Manhole	Top Flush Mount	34.63	2.35
32S/13E-31H13	Oceano Yellow	Careaga	7/14/2015	32.60	Manhole	Top Flush Mount	34.63	2.03
32S/13E-31H13	Oceano Yellow	Careaga	4/14/2015	30.42	Manhole	Top Flush Mount	34.63	4.21
32S/13E-31H13	Oceano Yellow	Careaga	1/13/2015	26.32	Manhole	Top Flush Mount	34.63	8.31
32S/13E-31H13	Oceano Yellow	Careaga	10/14/2014	41.12	Manhole	Top Flush Mount	34.63	-6.49
32S/13E-31H13	Oceano Yellow	Careaga	7/29/2014	33.72	Manhole	Top Flush Mount	34.63	0.91
32S/13E-31H13	Oceano Yellow	Careaga	6/4/2014	36.55	Manhole	Top Flush Mount	34.63	-1.92
32S/13E-31H13	Oceano Yellow	Careaga	4/15/2014	39.06	Manhole	Top Flush Mount	34.63	-4.43
32S/13E-31H13	Oceano Yellow	Careaga	1/14/2014	27.80	Manhole	Top Flush Mount	34.63	6.83
32S/13E-31H13	Oceano Yellow	Careaga	10/14/2013	30.83	Manhole	Top Flush Mount	34.63	3.80
32S/13E-31H13	Oceano Yellow	Careaga	7/9/2013	30.41	Manhole	Top Flush Mount	34.63	4.22
32S/13E-31H13	Oceano Yellow	Careaga	4/10/2013	26.09	Manhole	Top Flush Mount	34.63	8.54
32S/13E-31H13	Oceano Yellow	Careaga	1/14/2013	23.25	Manhole	Top Flush Mount	34.63	11.38
32S/13E-31H13	Oceano Yellow	Careaga	10/30/2012	27.23	Manhole	Top Flush Mount	34.63	7.40
32S/13E-31H13	Oceano Yellow	Careaga	7/25/2012	27.69	Manhole	Top Flush Mount	34.63	6.94
32S/13E-31H13	Oceano Yellow	Careaga	4/18/2012	20.05	Manhole	Top Flush Mount	34.63	14.58
32S/13E-31H13	Oceano Yellow	Careaga	1/12/2012	23.08	Manhole	Top Flush Mount	34.63	11.55
32S/13E-31H13	Oceano Yellow	Careaga	11/21/2011	22.98	Manhole	Top Flush Mount	34.63	11.65
32S/13E-31H13	Oceano Yellow	Careaga	7/26/2011	26.73	Manhole	Top Flush Mount	34.63	7.90
32S/13E-31H13	Oceano Yellow	Careaga	4/20/2011	21.30	Manhole	Top Flush Mount	34.63	13.33
32S/13E-31H13	Oceano Yellow	Careaga	1/24/2011	22.01	Manhole	Top Flush Mount	34.63	12.62
32S/13E-31H13	Oceano Yellow	Careaga	10/21/2010	28.22	Manhole	Well Casing	30.52	2.30
32S/13E-31H13	Oceano Yellow	Careaga	7/26/2010	25.50	Manhole	Well Casing	30.52	5.02
32S/13E-31H13	Oceano Yellow	Careaga	4/26/2010	19.17	Manhole	Well Casing	30.52	11.35
32S/13E-31H13	Oceano Yellow	Careaga	1/27/2010	20.58	Manhole	Well Casing	30.52	9.94
32S/13E-31H13	Oceano Yellow	Careaga	10/20/2009	25.80	Manhole	Well Casing	30.52	4.72
32S/13E-31H13	Oceano Yellow	Careaga	8/19/2009	31.04	Manhole	Well Casing	30.52	-0.52
32S/13E-31H13	Oceano Yellow	Careaga	4/7/2009	34.78	Manhole	Well Casing	30.52	-4.26
32S/13E-31H13	Oceano Yellow	Careaga	10/15/2008	37.72	Manhole	Well Casing	30.52	-7.20
32S/13E-31H13	Oceano Yellow	Careaga	4/16/2008	29.80	Manhole	Well Casing	30.52	0.72

Appendix A: NCMA Sentry Wells Water Level Data

Well	Common Name	Aquifer	Date	Depth to Water (feet)	Surface Completion	RP Description	RP Elev, feet NAVD88	Groundwater Elevation (feet VD88)
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	10/10/2017	21.23	Stove Pipe	Top of Steel	26.77	5.54
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	7/11/2017	21.59	Stove Pipe	Top of Steel	26.77	5.18
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	4/11/2017	19.38	Stove Pipe	Top of Steel	26.77	7.39
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	1/10/2017	19.70	Stove Pipe	Top of Steel	26.77	7.07
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	10/12/2016	21.86	Stove Pipe	Top of Steel	26.77	4.91
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	7/19/2016	22.21	Stove Pipe	Top of Steel	26.77	4.56
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	4/12/2016	20.56	Stove Pipe	Top of Steel	26.77	6.21
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	1/12/2016	18.76	Stove Pipe	Top of Steel	26.77	8.01
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	10/13/2015	22.14	Stove Pipe	Top of Steel	26.77	4.63
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	7/14/2015	21.84	Stove Pipe	Top of Steel	26.77	4.93
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	4/14/2015	21.18	Stove Pipe	Top of Steel	26.77	5.59
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	1/13/2015	19.89	Stove Pipe	Top of Steel	26.77	6.88
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	10/14/2014	21.75	Stove Pipe	Top of Steel	26.77	5.02
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	7/29/2014	21.57	Stove Pipe	Top of Steel	26.77	5.20
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	6/4/2014	22.36	Stove Pipe	Top of Steel	26.77	4.41
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	4/15/2014	19.89	Stove Pipe	Top of Steel	26.77	6.88
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	1/14/2014	20.38	Stove Pipe	Top of Steel	26.77	6.39
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	10/14/2013	21.71	Stove Pipe	Top of Steel	26.77	5.06
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	7/9/2013	21.37	Stove Pipe	Top of Steel	26.77	5.4
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	4/10/2013	20.10	Stove Pipe	Top of Steel	26.77	6.67
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	1/14/2013	18.62	Stove Pipe	Top of Steel	26.77	8.15
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	10/31/2012	20.11	Stove Pipe	Top of Steel	26.77	6.66
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	7/24/2012	19.42	Stove Pipe	Top of Steel	26.77	7.35
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	4/20/2012	18.26	Stove Pipe	Top of Steel	26.77	8.51
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	4/18/2012	23.83	Stove Pipe	Top of Steel	26.77	2.94
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	1/11/2012	17.68	Stove Pipe	Top of Steel	26.77	9.09
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	11/21/2011	18.08	Stove Pipe	Top of Steel	26.77	8.69
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	7/26/2011	19.63	Stove Pipe	Top of Steel	26.77	7.14
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	4/20/2011	18.26	Stove Pipe	Top of Steel	26.77	8.51
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	1/24/2011	17.61	Stove Pipe	Top of Steel	26.77	9.16
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	10/21/2010	20.75	Stove Pipe	Top of Steel	26.77	6.02
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	7/27/2010	21.18	Stove Pipe	Top of Steel	26.77	5.59
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	4/26/2010	15.94	Flush	Top Flush Mount	23.98	8.04
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	10/21/2009	17.72	Flush	Top Flush Mount	23.98	6.26
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	8/20/2009	19.16	Flush	Top Flush Mount	23.98	4.82
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	5/11/2009	17.68	Flush	Top Flush Mount	23.98	6.30
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	4/18/2009	15.95	Flush	Top Flush Mount	23.98	8.03
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	10/23/2008	18.75	Flush	Top Flush Mount	23.98	5.23
12N/36W-36L01	Oceano Dunes Middle	Paso Robles	4/23/2008	16.87	Flush	Top Flush Mount	23.98	7.11

Well	Common Name	Aquifer	Date	Depth to Water (feet)	Surface Completion	RP Description	RP Elev, feet NAVD88	Groundwater Elevation (feet VD88)
12N/36W-36L02	Oceano Dunes Deep	Careaga	10/10/2017	24.70	Stove Pipe	Top of Steel	26.77	2.07
12N/36W-36L02	Oceano Dunes Deep	Careaga	7/11/2017	23.65	Stove Pipe	Top of Steel	26.77	3.12
12N/36W-36L02	Oceano Dunes Deep	Careaga	4/10/2017	15.00	Stove Pipe	Top of Steel	26.77	11.77
12N/36W-36L02	Oceano Dunes Deep	Careaga	1/10/2017	16.15	Stove Pipe	Top of Steel	26.77	10.62
12N/36W-36L02	Oceano Dunes Deep	Careaga	10/12/2016	27.86	Stove Pipe	Top of Steel	26.77	-1.09
12N/36W-36L02	Oceano Dunes Deep	Careaga	7/19/2016	25.76	Stove Pipe	Top of Steel	26.77	1.01
12N/36W-36L02	Oceano Dunes Deep	Careaga	4/12/2016	18.43	Stove Pipe	Top of Steel	26.77	8.34
12N/36W-36L02	Oceano Dunes Deep	Careaga	1/12/2016	16.27	Stove Pipe	Top of Steel	26.77	10.50
12N/36W-36L02	Oceano Dunes Deep	Careaga	10/13/2015	27.17	Stove Pipe	Top of Steel	26.77	-0.40
12N/36W-36L02	Oceano Dunes Deep	Careaga	7/14/2015	26.11	Stove Pipe	Top of Steel	26.77	0.66
12N/36W-36L02	Oceano Dunes Deep	Careaga	4/14/2015	22.24	Stove Pipe	Top of Steel	26.77	4.53
12N/36W-36L02	Oceano Dunes Deep	Careaga	1/13/2015	16.91	Stove Pipe	Top of Steel	26.77	9.86
12N/36W-36L02	Oceano Dunes Deep	Careaga	10/14/2014	26.30	Stove Pipe	Top of Steel	26.77	0.47
12N/36W-36L02	Oceano Dunes Deep	Careaga	7/29/2014	25.64	Stove Pipe	Top of Steel	26.77	1.13
12N/36W-36L02	Oceano Dunes Deep	Careaga	6/4/2014	25.22	Stove Pipe	Top of Steel	26.77	1.55
12N/36W-36L02	Oceano Dunes Deep	Careaga	4/15/2014	16.94	Stove Pipe	Top of Steel	26.77	9.83
12N/36W-36L02	Oceano Dunes Deep	Careaga	1/14/2014	18.76	Stove Pipe	Top of Steel	26.77	8.01
12N/36W-36L02	Oceano Dunes Deep	Careaga	10/14/2013	23.94	Stove Pipe	Top of Steel	26.77	2.83
12N/36W-36L02	Oceano Dunes Deep	Careaga	7/9/2013	23.15	Stove Pipe	Top of Steel	26.77	3.62
12N/36W-36L02	Oceano Dunes Deep	Careaga	4/10/2013	15.35	Stove Pipe	Top of Steel	26.77	11.42
12N/36W-36L02	Oceano Dunes Deep	Careaga	1/14/2013	11.24	Stove Pipe	Top of Steel	26.77	15.53
12N/36W-36L02	Oceano Dunes Deep	Careaga	10/31/2012	18.81	Stove Pipe	Top of Steel	26.77	7.96
12N/36W-36L02	Oceano Dunes Deep	Careaga	7/24/2012	19.05	Stove Pipe	Top of Steel	26.77	7.72
12N/36W-36L02	Oceano Dunes Deep	Careaga	4/18/2012	10.81	Stove Pipe	Top of Steel	26.77	15.96
12N/36W-36L02	Oceano Dunes Deep	Careaga	1/11/2012	11.18	Stove Pipe	Top of Steel	26.77	15.59
12N/36W-36L02	Oceano Dunes Deep	Careaga	11/21/2011	13.99	Stove Pipe	Top of Steel	26.77	12.78
12N/36W-36L02	Oceano Dunes Deep	Careaga	7/26/2011	18.03	Stove Pipe	Top of Steel	26.77	8.74
12N/36W-36L02	Oceano Dunes Deep	Careaga	1/24/2011	9.37	Stove Pipe	Top of Steel	26.77	17.40
12N/36W-36L02	Oceano Dunes Deep	Careaga	10/21/2010	19.77	Stove Pipe	Top of Steel	26.77	7.00
12N/36W-36L02	Oceano Dunes Deep	Careaga	7/27/2010	20.53	Stove Pipe	Top of Steel	26.77	6.24
12N/36W-36L02	Oceano Dunes Deep	Careaga	4/26/2010	9.24	Flush	Top Flush Mount	23.98	14.74
12N/36W-36L02	Oceano Dunes Deep	Careaga	10/21/2009	17.65	Flush	Top Flush Mount	23.98	6.33
12N/36W-36L02	Oceano Dunes Deep	Careaga	8/20/2009	19.15	Flush	Top Flush Mount	23.98	4.83
12N/36W-36L02	Oceano Dunes Deep	Careaga	5/11/2009	14.38	Flush	Top Flush Mount	23.98	9.60
12N/36W-36L02	Oceano Dunes Deep	Careaga	10/23/2008	18.73	Flush	Top Flush Mount	23.98	5.25
12N/36W-36L02	Oceano Dunes Deep	Careaga	4/23/2008	11.55	Flush	Top Flush Mount	23.98	12.43

Appendix A: NCMA Sentry Wells Water Level Data

Well	Common Name	Aquifer	Date	Depth to Water (feet)	Surface Completion	RP Description	RP Elev, feet NAVD88	Groundwater Elevation (feet VD88)
12N/35W-32C03	County MW-3	Paso Robles	10/10/2017	42.05	Flush	Top Flush Mount	47.70	5.65
12N/35W-32C03	County MW-3	Paso Robles	7/11/2017	38.34	Flush	Top Flush Mount	47.70	9.36
12N/35W-32C03	County MW-3	Paso Robles	4/11/2017	28.44	Flush	Top Flush Mount	47.70	19.26
12N/35W-32C03	County MW-3	Paso Robles	1/10/2017	34.85	Flush	Top Flush Mount	47.70	12.85
12N/35W-32C03	County MW-3	Paso Robles	10/12/2016	47.49	Flush	Top Flush Mount	47.70	0.21
12N/35W-32C03	County MW-3	Paso Robles	7/19/2016	44.51	Flush	Top Flush Mount	47.70	3.19
12N/35W-32C03	County MW-3	Paso Robles	4/12/2016	36.41	Flush	Top Flush Mount	47.70	11.29
12N/35W-32C03	County MW-3	Paso Robles	1/12/2016	36.48	Flush	Top Flush Mount	47.70	11.22
12N/35W-32C03	County MW-3	Paso Robles	10/13/2015	51.21	Flush	Top Flush Mount	47.70	-3.51
12N/35W-32C03	County MW-3	Paso Robles	7/14/2015	49.07	Flush	Top Flush Mount	47.70	-1.37
12N/35W-32C03	County MW-3	Paso Robles	4/14/2015	44.00	Flush	Top Flush Mount	47.70	3.70
12N/35W-32C03	County MW-3	Paso Robles	1/13/2015	38.90	Flush	Top Flush Mount	47.70	8.80
12N/35W-32C03	County MW-3	Paso Robles	10/14/2014	50.50	Flush	Top Flush Mount	47.70	-2.80
12N/35W-32C03	County MW-3	Paso Robles	7/29/2014	44.02	Flush	Top Flush Mount	47.70	3.68
12N/35W-32C03	County MW-3	Paso Robles	6/4/2014	45.46	Flush	Top Flush Mount	47.70	2.24
12N/35W-32C03	County MW-3	Paso Robles	4/15/2014	41.51	Flush	Top Flush Mount	47.70	6.19
12N/35W-32C03	County MW-3	Paso Robles	1/14/2014	41.00	Flush	Top Flush Mount	47.70	6.70
12N/35W-32C03	County MW-3	Paso Robles	10/14/2013	45.26	Flush	Top Flush Mount	47.70	2.44
12N/35W-32C03	County MW-3	Paso Robles	7/9/2013	43.83	Flush	Top Flush Mount	47.70	3.87
12N/35W-32C03	County MW-3	Paso Robles	4/10/2013	37.89	Flush	Top Flush Mount	47.70	9.81
12N/35W-32C03	County MW-3	Paso Robles	1/14/2013	32.26	Flush	Top Flush Mount	47.70	15.44
12N/35W-32C03	County MW-3	Paso Robles	10/30/2012	40.05	Flush	Top Flush Mount	47.70	7.65
12N/35W-32C03	County MW-3	Paso Robles	7/25/2012	38.62	Flush	Top Flush Mount	47.70	9.08
12N/35W-32C03	County MW-3	Paso Robles	4/19/2012	23.02	Flush	Top Flush Mount	47.70	24.68

Appendix A: NCMA Sentry Wells Water Quality Data

Well	Date	TDS	Chloride	Sodium	Potassium	Calcium	Magnesium	Bicarbonate as CaCO3	Sulfate	Nitrate (as N)	Total Kjeldahl Nitrogen	Boron	Fluoride	Iodide	Manganese	Bromide	Total Alkalinity as CaCO3	Carbonate as CaCO3	Hydroxide as CaCO3	Specific Conductivity	Iron	Bromide / Chloride Ratio	Chloride / Bromide Ratio
32S/12E-24B01	10/11/2017	3100	1400	590	36	180	190	430	190	ND	2.3	0.17	0.13	0.11	1.4	0.64	430	ND	ND	5180	1.7	0.0005	2188
32S/12E-24B01	4/11/2017	3,400	1,400	680	41	190	210	420	190	ND	2.4	0.16	0.17	0.11	1.6	4.7	420	ND	ND	5,020	1.8	0.0034	298
32S/12E-24B01	10/11/2016	3,100	1,400	700	44	210	220	450	190	0.26	2.1	0.18	ND	0.12	1.6	4.1	450	ND	ND	5,020	1.3	0.0029	341
32S/12E-24B01	4/12/2016	2,800	1,400	640	37	170	180	420	190	<0.48	2.2	0.16	<0.055	0.081	1.3	4.8	420	<8.2	<8.2	5,000	0.73	0.0034	292
32S/12E-24B01	10/15/2015	3,230	230	560	34	160	170	413	42	<0.05	2.2	0.14	<0.10	0.091	1.1	0.68	413	<10	<10	4,880	0.54	0.0030	338
32S/12E-24B01	4/15/2015	3,010	1,300	510	30	150	160	410	220	<0.05	2.9	0.15	<0.5	0.023	1.0	3.4	410	<10	<10	4,760	0.72	0.0026	382
32S/12E-24B01	1/14/2015	2,980	1,300	520	30	150	170	400	210	<0.25	2.2	0.14	<0.5	<0.021	1.0	2.9	400	<10	<10	4,640	0.52	0.0022	448
32S/12E-24B01	10/14/2014	3,160	1,100	530	32	150	170	390	180	0.32	2.2	0.16	<0.5	<0.01	1.1	<0.5	390	<10	<10	4,780	0.67	NA	NA
32S/12E-24B01	7/30/2014	2,950	1,300	520	29	140	170	440	190	<0.25	1.9	0.11	<0.5	0.03	1.1	2.6	440	<10	<10	4,830	0.62	0.0020	500
32S/12E-24B01	4/16/2014	2,880	1,200	560	29	140	140	390	190	<0.05	2.2	0.130	<0.5	0.03	0.92	2.9	390	<10	<10	4,790	0.72	0.0024	414
32S/12E-24B01	1/15/2014	2,870	1,300	540	30	140	160	380	214	<0.25	2.4	0.17	<0.5	<0.01	1.0	3.0	380	<10	<10	4,800	0.71	0.0023	433
32S/12E-24B01	10/15/2013	2,860	1,200	560	31	150	160	380	200	<0.25	2.2	0.13	<0.5	<0.01	1.0	3.0	380	<10	<10	4,810	0.75	0.0025	400
32S/12E-24B01	7/9/2013	2,960	1,300	560	32	150	160	395	215	<0.25	2.4	0.16	<0.5	<0.01	1.1	2.0	395	<10	<10	4,850	0.81	0.0015	650
32S/12E-24B01	4/10/2013	2,920	1,300	540	30	140	150	410	220	<0.25	1.9	0.16	<0.1	<0.01	1.00	3.5	410	<10	<10	4,830	0.67	0.0027	371
32S/12E-24B01	1/14/2013	2,630	1,300	540	30	140	140	410	220	<0.05	2.7	0.15	<0.1	<0.01	0.96	2.8	410	<10	<10	4,790	0.72	0.0022	464
32S/12E-24B01	10/29/2012	2,950	1,200	590	34	150	160	360	200	<0.25	2.4	0.18	<0.5	<0.01	1.1	11	360	<10	<10	4,750	0.78	0.0092	109
32S/12E-24B01	7/23/2012	3,010	1,400	530	30	120	130	397	210	<0.05	2.1	0.15	<0.1	0.041	0.86	3	397	<10	<10	4,720	1.4	0.0021	467
32S/12E-24B01	4/18/2012	3,000	1,500	450	27	120	120	400	230	<0.1	2	0.13	0.13	<0.01	0.89	3.12	400	<10	<10	4,660	0.6	0.0021	481
32S/12E-24B01	1/11/2012	2,750	1,200	520	30	140	140	400	170	<0.1	4	0.18	0.1	0.033	0.94	3.2	400	<10	<10	4,560	0.55	0.0027	375
32S/12E-24B01	11/21/2011	2,740	1,200	410	25	130	120	380	200	<0.3	2.3	0.13	<0.6	0.053	0.9	2.73	380	<10	<10	4,470	0.7	0.0023	440
32S/12E-24B01	7/25/2011	3,690	1,200	530	33	140	150	380	200.2	<0.05	1.8	0.14	<0.1	0.053	0.91	3.281	380	<5	<5	4,900	0.73	0.0027	366
32S/12E-24B01	4/20/2011	2,810	1,214	500	27	140	130	400	216	<0.05	1.7	0.24	0.18	0.067	0.95	3.3	400	<2.0	<2.0	4,430	NA	0.0027	368
32S/12E-24B01	1/24/2011	2,380	1,100	370	24	110	120	380	180	<0.15	1.8	0.16	<0.3	0.63	0.68	2.8	380	<2.0	<2.0	4,020	0.89	0.0025	393
32S/12E-24B01	10/28/2010	2,330	960	390	25	140	140	350	160	<0.1	3.9	0.15	<0.1	NA	0.75	2.6	350	<10	<10	3,860	1.3	0.0027	369
32S/12E-24B01	7/27/2010	616	43	52.5	6.21	115	44.7	341	160	< 0.10	2.9	0.063	< 0.10	0.11	0.274	0.18	341	< 1.0	< 1.0	1,000	9.34	0.0042	239
32S/12E-24B01	4/27/2010	676	47	54.7	4.60	107	43.6	327	140	< 0.10	0.98	0.0714	< 0.10	< 0.10	0.0458	0.18	327	< 1.0	< 1.0	990	4.06	0.0038	261
32S/12E-24B01	1/27/2010	694	55	56.2	6.80	123	43.2	340	150	0.40	1.7	0.12	< 0.10	0.33	0.875	0.19	340	< 1.0	< 1.0	1,000	16.6	0.0035	289
32S/12E-24B01	10/19/2009	766	140	121	16.7	111	52.4	303	150	0.25	2.8	0.0959	0.11	< 0.10	0.208	0.47	303	< 1.0	< 1.0	1,200	7.79	0.0034	298
32S/12E-24B01	8/20/2009	705	94	86.8	11.7	116	35.6	286	150	0.21	2.7	NA	< 0.10	0.12	0.248	0.38	286	< 1.0	< 1.0	1,000	7.15	0.0040	247
32S/12E-24B01	5/12/2009	695	100	82.1	13.2	108	45	288	150	NA	NA	NA	0.11	NA	0.66	0.29	288	< 1.0	< 1.0	1,100	23.9	0.0029	345
32S/12E-24B01	3/26/1996	1,870	773	380	24.0	125	95	427	154	0.2	NA	0.27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
32S/12E-24B01	6/9/1976	1,706	667	400	16.2	94	95	474	159	0.4	NA	0.12	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
32S/12E-24B01	1/17/1966	1,700	652	406	20.0	95	83	440	175	1	NA	0.07	0.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Appendix A: NCMA Sentry Wells Water Quality Data

Well	Date	TDS	Chloride	Sodium	Potassium	Calcium	Magnesium	Bicarbonate as CaCO3	Sulfate	Nitrate (as N)	Total Kjeldahl Nitrogen	Boron	Fluoride	Iodide	Manganese	Bromide	Total Alkalinity as CaCO3	Carbonate as CaCO3	Hydroxide as CaCO3	Specific Conductivity	Iron	Bromide / Chloride Ratio	Chloride / Bromide Ratio
32S/12E-24B02	10/11/2017	670	31	45	3.7	120	38	330	160	ND	0.41	0.077	0.045	0.014	0.18	0.1	330	ND	ND	962	0.74	0.0032	310
32S/12E-24B02	7/12/2017	760	31	48	4	130	39	310	160	ND	0.18	0.072	0.04	0.015	0.2	0.12	310	ND	ND	948	0.93	0.0039	258
32S/12E-24B02	4/11/2017	630	34	46	3.7	120	35	310	170	ND	0.31	0.062	0.09.	0.017	0.17	0.12	310	ND	ND	933	0.59	0.0035	283
32S/12E-24B02	1/12/2017	660	34	47	3.7	120	36	320	170	ND	0.26	0.069	0.031	0.023	0.2	0.097	320	ND	ND	938	0.79	0.0029	351
32S/12E-24B02	10/11/2016	660	35	48	4	120	39	320	170	ND	0.26	0.069	0.038	0.023	0.18	0.12	320	ND	ND	953	0.75	0.0034	292
32S/12E-24B02	7/19/2016	660	36	50	3.9	120	38	320	160	<0.096	0.15	0.07	0.036	0.016	0.17	0.15	320	<4.1	<4.1	947	0.67	0.0042	240
32S/12E-24B02	4/12/2016	640	35	48	3.8	110	37	300	160	<0.096	0.38	0.064	0.045	0.011	0.17	0.13	300	<4.1	<4.1	939	0.53	0.0037	269
32S/12E-24B02	1/12/2016	570	38	48	3.8	110	36	290	170	<0.022	0.27	0.044	0.11	0.015	0.16	0.15	290	<4.1	<4.1	951	0.48	0.0039	253
32S/12E-24B02	10/15/2015	650	34	41	3.8	100	33	306	160	<0.05	<1	0.054	<0.10	0.014	0.18	<0.10	306	<10	<10	950	0.72	NA	NA
32S/12E-24B02	7/15/2015	650	35	50	3.0	120	36	295	160	<0.05	<1	0.069	<0.1	0.01	0.16	<0.1	295	<10	<10	950	0.69	NA	NA
32S/12E-24B02	4/15/2015	620	35	40	3.4	100	31	300	170	<0.05	<1	0.066	<0.1	0.01	0.14	<0.1	300	<10	<10	900	0.45	NA	NA
32S/12E-24B02	1/14/2015	640	36	41	3.3	110	32	290	170	<0.05	<1	0.062	<0.1	<0.01	0.14	<0.1	290	<10	<10	900	0.48	NA	NA
32S/12E-24B02	10/14/2014	630	30	41	3.9	100	32	290	140	<0.05	<1	0.065	<0.1	<0.01	0.15	<0.1	290	<10	<10	940	0.44	NA	NA
32S/12E-24B02	7/29/2014	620	33	42	3.5	100	33	300	150	<0.05	<1	<0.1	<0.1	<0.01	0.14	<0.1	300	<10	<10	940	0.37	NA	NA
32S/12E-24B02	4/16/2014	630	32	43	4.3	88	28	300	150	<0.05	<1	0.067	<0.1	<0.01	0.12	<0.1	300	<10	<10	940	0.32	NA	NA
32S/12E-24B02	1/15/2014	630	33	46	3.9	100	34	290	165	<0.05	<1	<0.05	<0.1	<0.01	0.14	<0.1	290	<10	<10	940	0.37	NA	NA
32S/12E-24B02	10/15/2013	630	30	44	3.8	98	32	290	170	<0.05	<1	<0.05	<0.1	<0.01	0.13	<0.1	290	<10	<10	920	0.39	NA	NA
32S/12E-24B02	7/9/2013	630	30	43	3.9	110	33	295	170	<0.05	<1	0.076	<0.1	<0.01	0.14	<0.1	295	<10	<10	940	0.6	NA	NA
32S/12E-24B02	4/10/2013	630	31	44	4	100	32	310	160	<0.05	<1	0.08	<0.1	<0.01	0.13	<0.1	310	<10	<10	940	0.41	NA	NA
32S/12E-24B02	1/14/2013	620	30	43	4	97	31	305	170	<0.05	<1	0.079	<0.1	<0.01	0.12	<0.1	305	<10	<10	950	0.72	NA	NA
32S/12E-24B02	10/29/2012	650	29	45	4.2	100	32	280	160	<0.05	<1	0.074	0.14	<0.01	0.13	<0.1	280	<10	<10	950	0.56	NA	NA
32S/12E-24B02	7/23/2012	650	35	45	4.3	87	27	297	170	<0.05	<1	<0.1	<0.1	<0.01	0.12	<0.1	297	<10	<10	950	0.43	NA	NA
32S/12E-24B02	4/18/2012	630	37	39	3.7	88	28	310	171	<0.1	<1	<0.1	0.16	<0.01	0.099	<0.2	310	<10	<10	950	0.26	NA	NA
32S/12E-24B02	1/11/2012	650	33	46	4.6	110	32	300	150	<0.1	1.3	<0.1	0.21	<0.02	0.13	0.03	300	<10	<10	950	1.7	0.0010	971
32S/12E-24B02	11/21/2011	640	32	39	3.9	93	29	290	150	<0.05	<1	0.064	<0.1	<0.01	0.096	<0.1	290	<10	<10	930	0.32	NA	NA
32S/12E-24B02	7/25/2011	640	36	48	4.2	97	31	290	165.3	<0.05	<1	<0.1	<0.1	<0.01	0.096	<0.1	290	<5	<5	950	0.88	NA	NA
32S/12E-24B02	4/20/2011	620	39	46	7.4	90	36	320	174	<0.05	<1	0.17	0.14	0.014	<0.005	<0.1	320	<2.0	<2.0	950	NA	NA	NA
32S/12E-24B02	1/24/2011	640	43	44	5.9	87	28	270	170	<0.05	<1.0	0.11	<0.1	0.14	0.085	<0.1	270	<2.0	<2.0	940	1.3	NA	NA
32S/12E-24B02	10/28/2010	650	43	50	4.5	110	35	270	160	<0.1	<1.0	0.12	<0.1	NA	0.085	<0.3	270	<10	<10	970	0.63	NA	NA
32S/12E-24B02	7/27/2010	598	42	48.9	4.29	111	40.5	318	160	< 0.10	1.3	0.0609	< 0.10	0.11	0.106	0.15	318	< 1.0	< 1.0	980	2.84	0.0036	280
32S/12E-24B02	4/27/2010	668	46	52.7	4.73	111	43.2	349	150	< 0.10	1.3	0.0666	< 0.10	0.14	0.101	0.16	349	< 1.0	< 1.0	980	6.66	0.0035	288
32S/12E-24B02	1/27/2010	622	45	58.0	5.39	115	32.2	270	160	0.18	0.84	0.117	< 0.10	0.14	0.209	0.16	270	< 1.0	< 1.0	920	3.49	0.0036	281
32S/12E-24B02	10/19/2009	600	49	59.1	5.12	112	30.1	281	160	< 0.10	0.98	0.0776	0.14	< 0.10	0.163	0.19	281	< 1.0	< 1.0	870	1.14	0.0039	258
32S/12E-24B02	8/20/2009	630	49	63.5	5.85	128	30.1	288	150	< 0.10	0.98	NA	< 0.10	< 0.10	0.203	0.20	288	< 1.0	< 1.0	920	3.22	0.0041	245
32S/12E-24B02	5/12/2009	622	82	67.5	6.33	114	34.5	282	150	NA	NA	NA	0.11	NA	0.252	0.24	282	< 1.0	< 1.0	990	6.76	0.0029	342
32S/12E-24B02	3/26/1996	652	54	46	5	107	24	344	169	0.2	NA	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
32S/12E-24B02	6/9/1976	565	34	52	4	104	27	337	153	0.6	NA	0.02	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
32S/12E-24B02	1/17/1966	651	62	79	5	101	32	380	147	0	NA	0.05	0.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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Well	Date	TDS	Chloride	Sodium	Potassium	Calcium	Magnesium	Bicarbonate as CaCO3	Sulfate	Nitrate (as N)	Total Kjeldahl Nitrogen	Boron	Fluoride	Iodide	Manganese	Bromide	Total Alkalinity as CaCO3	Carbonate as CaCO3	Hydroxide as CaCO3	Specific Conductivity	Iron	Bromide / Chloride Ratio	Chloride / Bromide Ratio
32S/12E-24B03	10/11/2017	660	49	54	4	120	45	330	160	ND	0.16	0.069	0.022	0.02	0.011	0.19	330	ND	ND	1020	0.2	0.0039	258
32S/12E-24B03	7/12/2017	790	46	54	4	120	45	320	160	ND	ND	0.062	0.015	0.02	0.011	0.18	320	ND	ND	1,010	0.19	0.0039	256
32S/12E-24B03	4/11/2017	670	48	55	4.1	120	45	330	160	ND	0.17	0.058	ND	0.019	0.012	0.21	330	ND	ND	988	0.23	0.0044	229
32S/12E-24B03	1/12/2017	670	47	58	4.3	130	50	340	160	ND	ND	0.068	0.012	0.024	0.014	0.18	340	ND	ND	1,000	0.27	0.0038	261
32S/12E-24B03	10/11/2016	680	49	53	4	110	47	340	160	ND	ND	0.06	0.015	0.025	0.013	0.17	340	ND	ND	1020	0.22	0.0035	288
32S/12E-24B03	7/19/2016	690	47	54	4.1	110	46	340	160	<0.096	0.32	0.063	0.017	0.016	0.013	0.20	340	<8.2	<8.2	1,010	0.32	0.0043	235
32S/12E-24B03	4/12/2016	680	48	55	4.1	110	45	320	160	<0.096	0.21	0.056	0.019	0.018	0.012	0.17	320	<8.2	<8.2	1,010	0.28	0.0035	282
32S/12E-24B03	1/12/2016	610	51	53	4.0	110	46	320	170	<0.022	0.11	0.037	0.038	<0.10	0.015	0.19	320	<8.2	<8.2	1,050	0.27	0.0037	268
32S/12E-24B03	10/15/2015	650	44	48	4.4	100	42	325	160	<0.05	<1	<0.05	<0.10	0.016	0.010	<0.10	325	<10	<10	1,020	0.21	NA	NA
32S/12E-24B03	7/15/2015	680	46	60	40.0	120	47	333	160	<0.05	<1	0.064	<0.1	0.01	0.010	<0.1	333	<10	<10	1,020	0.20	NA	NA
32S/12E-24B03	4/15/2015	650	46	44	3.5	96	38	330	170	<0.05	<1	0.061	<0.1	0.012	0.0080	<0.1	330	<10	<10	980	0.17	NA	NA
32S/12E-24B03	1/14/2015	670	47	48	3.6	110	43	330	170	<0.05	<1	0.052	<0.10	0.01	0.090	<0.1	330	<10	<10	970	0.17	NA	NA
32S/12E-24B03	10/14/2014	650	40	48	4.1	100	41	330	142	<0.05	<1	0.061	<0.1	<0.01	0.010	<0.1	330	<10	<10	1,010	0.19	NA	NA
32S/12E-24B03	7/30/2014	650	45	45	3.1	94	40	390	150	<0.05	<1	<0.1	<0.1	<0.01	<0.005	<0.1	390	<10	<10	1,020	0.19	NA	NA
32S/12E-24B03	4/16/2014	660	43	46	4.3	90	35	330	150	0.23	<1	0.056	<0.1	<0.01	<0.005	0.11	330	<10	<10	1,010	0.16	0.0026	391
32S/12E-24B03	1/15/2014	660	45	52	4.0	100	41	320	165	<0.05	<1	<0.05	<0.1	<0.01	0.0090	<0.1	320	<10	<10	1,010	0.17	NA	NA
32S/12E-24B03	10/15/2013	720	40	51	4.0	100	40	310	170	<0.05	<1	<0.05	<0.1	<0.01	0.0090	<0.1	310	<10	<10	1,010	0.2	NA	NA
32S/12E-24B03	7/9/2013	660	46	47	3.9	110	41	310	170	<0.05	<1	0.066	<0.1	<0.01	0.0100	<0.1	310	<10	<10	1,010	0.27	NA	NA
32S/12E-24B03	4/10/2013	670	44	46	3.8	96	38	320	160	<0.05	<1	0.071	<0.1	<0.01	0.0080	<0.1	320	<10	<10	1,010	0.19	NA	NA
32S/12E-24B03	1/14/2013	630	45	47	3.9	96	37	320	170	<0.05	<1	0.065	<0.1	<0.01	0.0080	<0.1	320	<10	<10	1,010	0.26	NA	NA
32S/12E-24B03	10/29/2012	680	45	49	4.1	100	39	305	158	<0.05	<1	0.069	0.1	<0.01	0.0090	<0.1	305	<10	<10	1,010	0.22	NA	NA
32S/12E-24B03	7/23/2012	670	49	47	4.1	86	35	318	170	<0.05	<1	<0.1	<0.1	<0.01	0.0150	<0.1	318	<10	<10	1,010	0.24	NA	NA
32S/12E-24B03	4/18/2012	640	50	40	3.4	84	33	320	160	<0.1	<1	<0.1	<0.2	<0.01	0.0070	<0.2	320	<10	<10	1,010	0.23	NA	NA
32S/12E-24B03	1/12/2012	660	46	48	3.2	92	36	300	150	<0.1	<1	<0.1	0.35	<0.02	0.0080	<0.2	300	<10	<10	1,000	0.15	NA	NA
32S/12E-24B03	11/21/2011	660	43	41	3.7	91	34	310	150	<0.05	1.6	0.046	<0.1	0.014	0.0090	<0.1	310	<10	<10	970	0.12	NA	NA
32S/12E-24B03	7/25/2011	650	46	50	6.0	98	38	310	159.6	<0.05	<1	<0.1	<0.1	0.011	0.0100	<0.1	310	<5	<5	1,010	0.21	NA	NA
32S/12E-24B03	4/20/2011	650	47	48	4.6	95	31	310	168	<0.05	<1	0.11	0.08	0.015	0.0080	<0.1	310	<2.0	<2.0	1,020	NA	NA	NA
32S/12E-24B03	1/24/2011	660	46	44	5.6	87	33	320	160	<0.05	<1.0	NA	<0.1	0.15	0.0096	<0.1	320	<2.0	<2.0	1,020	0.22	NA	NA
32S/12E-24B03	10/28/2010	660	44	48	3.8	110	39	315	50	<0.1	<1.0	0.089	<0.1	NA	0.0120	<0.3	315	<10	<10	1,020	0.55	NA	NA
32S/12E-24B03	7/27/2010	610	44	51.4	8.34	112	41.6	328	160	< 0.10	1.8	0.0533	< 0.10	0.17	0.0602	0.16	328	< 1.0	< 1.0	1,000	6.7	0.0036	275
32S/12E-24B03	4/27/2010	666	45	53.2	4.84	118	44	357	150	< 0.10	1.5	0.0636	< 0.10	0.1	0.0519	0.17	357	< 1.0	< 1.0	980	9.71	0.0038	265
32S/12E-24B03	1/27/2010	672	48	56.4	5.40	119	43.4	336	150	< 0.10	1.4	0.101	< 0.10	0.15	0.140	0.15	336	< 1.0	< 1.0	1,000	5.18	0.0031	320
32S/12E-24B03	10/19/2009	622	40	55.1	3.93	110	42.6	342	160	< 0.10	< 0.50	0.0613	< 0.10	0.13	0.0181	0.14	342	< 1.0	< 1.0	880	0.343	0.0035	286
32S/12E-24B03	8/19/2009	680	47	54.9	5.21	128	43.4	337	150	< 0.10	2.2	NA	< 0.10	0.66	0.182	0.15	337	< 1.0	< 1.0	1,000	14.3	0.0032	313
32S/12E-24B03	5/12/2009	645	44	53.2	4.53	108	41.8	332	140	NA	NA	NA	< 0.10	NA	0.124	0.16	332	< 1.0	< 1.0	1,000	5.9	0.0036	275
32S/12E-24B03	3/26/1996	646	41	52	4.3	104	42	412	164	0.2	NA	0.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
32S/12E-24B03	6/9/1976	569	36	53	3.7	85	39	330	165	0	NA	0.06	0.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
32S/12E-24B03	1/17/1966	670	79	74	5	103	36	345	158	1	NA	0	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Appendix A: NCMA Sentry Wells Water Quality Data

Well	Date	TDS	Chloride	Sodium	Potassium	Calcium	Magnesium	Bicarbonate as CaCO3	Sulfate	Nitrate (as N)	Total Kjeldahl Nitrogen	Boron	Fluoride	Iodide	Manganese	Bromide	Total Alkalinity as CaCO3	Carbonate as CaCO3	Hydroxide as CaCO3	Specific Conductivity	Iron	Bromide / Chloride Ratio	Chloride / Bromide Ratio
32S/13E-30F01	10/11/2017	500	68	67	2.2	46	23	97	120	13	0.18	0.093	0.045	ND	0.018	0.28	97	ND	ND	752	0.061	0.0041	243
32S/13E-30F01	4/12/2017	510	61	65	2.1	42	20	85	120	13	0.12	0.074	0.062	ND	ND	0.28	85	ND	ND	682	0.045	0.0046	218
32S/13E-30F01	10/11/2016	480	62	72	2.3	46	23	91	120	12	0.13	0.09	0.046	ND	ND	0.32	91	ND	ND	702	ND	0.0052	194
32S/13E-30F01	4/13/2016	460	60	70	2.3	43	21	90	120	52	0.2	0.086	0.054	<0.01	<.0040	0.30	90	<4.1	<4.1	696	<0.030	0.0050	200
32S/13E-30F01	10/14/2015	450	58	61	2.1	39	19	87	120	13	<1	0.084	<0.10	<0.01	<0.005	0.18	87	<10	<10	700	<0.05	0.0031	322
32S/13E-30F01	4/15/2015	460	64	60	2.0	40	19	90	130	12	<1	0.081	<0.1	<0.01	<0.005	0.202	90	<10	<10	700	<0.05	0.0032	317
32S/13E-30F01	1/14/2015	550	95	69	2	50	24	98	140	12.50	<1	0.085	<0.1	<0.01	<0.005	0.2	98	<10	<10	820	<0.05	0.0018	562
32S/13E-30F01	10/14/2014	470	58	64	2	42	19	84	120	10.00	<1	0.081	<0.1	<0.01	<0.005	0.2	84	<10	<10	730	<0.05	0.0030	337
32S/13E-30F01	7/30/2014	540	89	71	2	46	24	94	130	13.6	<1	<0.1	<0.1	<0.01	<0.005	0.101	94	<10	<10	860	<0.05	0.0011	881
32S/13E-30F01	4/16/2014	610	122	78	3.3	47	22	100	140	12	<1	0.100	<0.1	<0.01	<0.005	0.17	100	<10	<10	970	<0.05	0.0014	718
32S/13E-30F01	1/15/2014	510	80	69	2.3	45	22	94	136	12.6	13.00	<0.1	<0.1	<0.01	<0.005	0.19	94	<10	<10	810	<0.05	0.0024	421
32S/13E-30F01	10/15/2013	530	78	73	2.3	47	22	86	140	12	<1	0.072	<0.1	<0.01	<.005	0.17	86	<10	<10	830	<0.05	0.0022	459
32S/13E-30F01	7/10/2013	480	80	64	2.2	49	22	85	140	12.2	<1	0.089	<0.1	<0.01	<0.005	<0.1	85	<10	<10	770	<0.05	NA	NA
32S/13E-30F01	4/11/2013	460	60	60	2.20	38	18	78	120	12	<1	0.091	<0.1	<0.01	<0.005	0.2	78	<10	<10	710	<0.05	0.0033	300
32S/13E-30F01	1/15/2013	440	65	64	2.40	40	19	95	130	12	<1	0.090	<0.1	<0.01	<0.005	0.11	95	<10	<10	720	0.05	0.0017	591
32S/13E-30F01	10/30/2012	470	60	66	2.50	43	20	75	123	12	<1	0.087	<0.1	<0.01	<0.005	0.13	75	<10	<10	720	<0.05	0.0022	462
32S/13E-30F01	7/24/2012	470	73	66	2.70	36	18	86	120	13	<1	<0.1	<0.1	<0.01	0.019	0.11	86	<10	<10	720	<0.05	0.0015	664
32S/13E-30F01	4/19/2012	450	72	52	1.90	32	15	81	130	13	<1	<0.1	<0.2	<0.01	<0.005	<0.2	81	<10	<10	700	<0.1	NA	NA
32S/13E-30F01	1/10/2012	460	67	61	2.00	35	17	81	120	11	<1	<0.1	0.12	<0.01	<0.005	<0.1	81	<10	<10	720	<0.1	NA	NA
32S/13E-30F01	11/17/2011	470	70	82	2.40	40	19	78	120	12	<1	<0.1	<0.1	<0.01	<0.005	0.16	78	<10	<10	720	<0.1	0.0023	438
32S/13E-30F01	7/25/2011	460	66	68	4.40	37	19	78	117.4	12.17	<1	0.100	0.101	<0.01	0.014	0.178	78	<5	<5	720	0.11	0.0027	370
32S/13E-30F01	4/20/2011	460	71	69	2.60	36	14	87	124	12	<1	0.180	0.11	<0.01	<0.005	0.17	87	<2.0	<2.0	730	NA	0.0024	418
32S/13E-30F01	1/24/2011	510	75	64	4.00	34	18	83	140	11	<1.0	0.170	0.11	<0.10	<0.005	<0.1	83	<2.0	<2.0	780	<0.1	NA	NA
32S/13E-30F01	10/21/2010	540	100	73	2.00	43	21	88	120	13	<1.0	0.067	<0.1	NA	<0.005	<0.3	88	<10	<10	894	<.1	NA	NA
32S/13E-30F01	7/26/2010	464	74	82.2	2.16	47.9	25.1	88.0	120	12	< 0.50	0.098	< 0.10	< 0.10	0.0817	0.37	88.0	< 1.0	< 1.0	710	0.79	0.0050	200
32S/13E-30F01	4/27/2010	534	72	77.1	2.59	45.8	23.6	100	140	9.8	0.56	0.129	< 0.10	< 0.10	0.112	0.29	100	< 1.0	< 1.0	780	1.02	0.0040	248
32S/13E-30F01	1/28/2010	725	140	99.9	2.70	76.4	35.8	214	170	1.6	0.84	0.120	< 0.10	< 0.10	0.112	0.56	214	< 1.0	< 1.0	1,200	0.640	0.0040	250
32S/13E-30F01	10/19/2009	522	74	85.6	2.35	52.8	26.3	102	150	13	0.70	0.136	0.13	< 0.10	0.123	0.32	102	< 1.0	< 1.0	770	1.30	0.0043	231
32S/13E-30F01	8/19/2009	648	92	98.9	3.84	63.1	31.9	113	190	10	0.56	NA	< 0.10	0.12	1.03	0.32	113	< 1.0	< 1.0	970	4.52	0.0035	288
32S/13E-30F01	5/12/2009	792	110	108	2.89	80.2	39.9	136	280	NA	NA	NA	< 0.10	NA	0.0353	0.39	136	< 1.0	< 1.0	1,200	0.281	0.0035	282

Well	Date	TDS	Chloride	Sodium	Potassium	Calcium	Magnesium	Bicarbonate as CaCO3	Sulfate	Nitrate (as N)	Total Kjeldahl Nitrogen	Boron	Fluoride	Iodide	Manganese	Bromide	Total Alkalinity as CaCO3	Carbonate as CaCO3	Hydroxide as CaCO3	Specific Conductivity	Iron	Bromide / Chloride Ratio	Chloride / Bromide Ratio
32S/13E-30F02	10/11/2017	580	51	46	2.6	80	34	200	130	14	0.16	0.094	0.083	ND	0.037	0.65	200	ND	ND	877	0.037	0.0127	78
32S/13E-30F02	7/12/2017	570	52	49	2.9	89	39	200	130	13	ND	0.094	0.096	ND	0.15	0.66	200	ND	ND	861	ND	0.0127	79
32S/13E-30F02	4/12/2017	620	52	51	2.9	88	38	200	130	13	ND	0.088	0.063	ND	0.022	0.67	200	ND	ND	856	0.041	0.0129	78
32S/13E-30F02	1/10/2017	590	52	50	2.8	90	37	220	140	13	ND	0.09	0.08	ND	1.1	0.6	220	ND	ND	884	0.15	0.0115	87
32S/13E-30F02	10/11/2016	600	52	50	2.9	89	40	220	140	13	0.089	0.09	0.074	ND	0.025	0.6	220	ND	ND	886	ND	0.0115	87
32S/13E-30F02	7/20/2016	590	51	51	3.0	88	38	220	130	58	0.14	0.091	0.072	<0.010	0.170	0.57	220	<4.1	<4.1	880	0.033	0.0112	89
32S/13E-30F02	4/13/2016	570	51	51	2.9	89	40	200	130	58	0.08	0.1	0.086	<0.010	0.014	0.60	200	<4.1	<4.1	876	<0.030	0.0118	85
32S/13E-30F02	1/13/2016	610	53	51	2.9	89	38	210	140	13	0.14	0.091	0.15	<0.010	0.035	0.47	210	<4.1	<4.1	858	<0.030	0.0089	113
32S/13E-30F02	10/14/2015	570	49	45	2.8	80	35	212	130	13	<1	0.085	<0.10	<0.01	0.20	0.39	212	<10	<10	890	0.078	0.0080	126
32S/13E-30F02	7/15/2015	610	50	51	2.0	88	38	204	140	13	<1	0.091	<0.1	<0.01	0.048	0.30	204	<10	<10	890	<0.05	0.0060	167
32S/13E-30F02	4/15/2015	570	51	43	2.7	78	34	200	140	13.5	<1	0.085	<0.1	<0.01	0.087	0.42	200	<10	<10	850	<0.05	0.0082	121
32S/13E-30F02	1/14/2015	590	51	42	2.4	80	34	210	140	13	<1	0.08	<0.1	<0.01	0.014	0.324	210	<10	<10	860	<0.05	0.0064	157
32S/13E-30F02	10/14/2014	600	46	42	2.6	76	32	310	120	12	<1	0.08	<0.1	<0.01	0.22	0.37	310	<10	<10	890	<0.05	0.0080	124
32S/13E-30F02	7/30/2014	580	49	46	2.6	80	35	210	130	13	<1	<0.1	<0.1	<0.01	0.02	0.27	210	<10	<10	890	<0.05	0.0055	181
32S/13E-30F02	4/16/2014	590	49	45	3.3	68	30	200	130	12	<1	0.089	<0.1	<0.01	0.011	0.44	200	<10	<10	890	<0.05	0.0090	111
32S/13E-30F02	1/15/2014	580	50	45	2.7	76	31	190	136	13.1	13.4	<0.1	<0.1	<0.01	0.054	0.4	190	<10	<10	890	<0.05	0.0080	125
32S/13E-30F02	10/15/2013	570	50	45	2.7	75	33	190	140	12	<1	0.69	0.19	<0.01	0.099	0.38	190	<10	<10	890	<0.05	0.0076	132
32S/13E-30F02	7/10/2013	570	50	38	2.6	78	32	190	180	<0.05	<1	0.08	0.13	<0.01	0.14	<0.1	190	<10	<10	880	<0.05	NA	NA
32S/13E-30F02	4/11/2013	590	50	41	2.6	70	30	190	140	14	<1	0.09	0.1	<0.01	0.082	0.43	190	<10	<10	880	<0.05	0.0086	116
32S/13E-30F02	1/15/2013	550	50	44	2.9	72	31	200	140	13	<1	0.09	0.1	<0.01	0.011	0.32	200	<10	<10	880	0.12	0.0064	156
32S/13E-30F02	10/30/2012	610	48	45	3.0	79	34	188	135	13	<1	0.09	<0.1	<0.01	0.06	0.31	188	<10	<10	890	0.011	0.0065	155
32S/13E-30F02	7/24/2012	590	56	46	3.2	69	30	194	140	14	<1	<0.1	0.11	<0.01	0.038	0.27	194	<10	<10	880	<0.05	0.0048	207
32S/13E-30F02	4/19/2012	600	60	40	2.7	68	30	200	140	14	<1	<0.1	<0.2	<0.01	0.19	0.3	200	<10	<10	890	0.11	0.0050	200
32S/13E-30F02	1/12/2012	610	52	45	3.0	73	32	200	130	12	<1	<0.1	0.25	<0.02	0.29	0.33	200	<10	<10	890	<0.1	0.0063	158
32S/13E-30F02	11/21/2011	580	49	38	2.7	73	30	190	120	13	<1	0.07	<0.1	<0.01	0.022	0.34	190	<10	<10	870	<0.1	0.0069	144
32S/13E-30F02	7/25/2011	590	52	46	5.1	73	31	190	134.3	13.19	<1	<0.1	0.127	<0.1	0.025	0.387	190	<5	<5	900	<0.1	0.0074	135
32S/13E-30F02	4/20/2011	600	54	57	4.2	74	29	200	141	13	<1	0.18	0.17	<0.01	0.025	0.38	200	<2.0	<2.0	920	NA	0.0070	142
32S/13E-30F02	1/24/2011	600	51	43	4.9	71	31	210	140	12	<1.0	0.15	0.12	0.27	0.041	0.3	210	<2.0	<2.0	920	<0.1	0.0059	170
32S/13E-30F02	10/28/2010	610	49	38	2.3	70	30	210	130	11	<1.0	0.10	<0.1	NA	0.0094	<0.3	210	<10	<10	920	<0.1	NA	NA
32S/13E-30F02	7/26/2010	560	49	45.8	2.95	85.4	36.8	223	130	11	2.5	0.0928	< 0.10	0.13	0.0646	0.59	223	< 1.0	< 1.0	890	< 0.100	0.0120	83
32S/13E-30F02	4/27/2010	634	51	50.3	3.12	87.9	38.6	225	130	10	0.8	0.112	< 0.10	< 0.10	0.615	0.51	225	< 1.0	< 1.0	880	3.28	0.0100	100
32S/13E-30F02	1/28/2010	604	44	52.2	4.47	92.1	38.5	230	150	11	1.4	0.127	< 0.10	< 0.10	0.913	0.48	230	< 1.0	< 1.0	920	4.55	0.0109	92
32S/13E-30F02	10/19/2009	566	49	49.5	2.80	88.3	37.6	240	140	11	1.0	0.0942	0.17	< 0.10	0.924	0.51	240	< 1.0	< 1.0	850	2.15	0.0104	96
32S/13E-30F02	8/19/2009	614	49	51.8	3.19	87.3	36.8	225	130	11	2.00	NA	0.10	< 0.10	2.24	0.54	225	< 1.0	< 1.0	920	19.4	0.0110	91
32S/13E-30F02	5/12/2009	514	54	48.7	3.26	81.1	34.9	206	120	NA	NA	NA	0.11	NA	1.87	0.53	206	< 1.0	< 1.0	890	3.23	0.0098	102
32S/13E-30F02	3/27/1996	678	49	52	3.8	98	42	305	166	49	NA	0.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
32S/13E-30F02	6/9/1976	637	48	55	2.8	98	43	343	172	17.6	NA	0.1	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
32S/13E-30F02	1/20/1966	580	68	47	2	94	38	280	152	27	NA	0.08	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Appendix A: NCMA Sentry Wells Water Quality Data

GSI Water Solutions, Inc.

Well	Date	TDS	Chloride	Sodium	Potassium	Calcium	Magnesium	Bicarbonate as CaCO3	Sulfate	Nitrate (as N)	Total Kjeldahl Nitrogen	Boron	Fluoride	Iodide	Manganese	Bromide	Total Alkalinity as CaCO3	Carbonate as CaCO3	Hydroxide as CaCO3	Specific Conductivity	Iron	Bromide / Chloride Ratio	Chloride / Bromide Ratio
32S/13E-30F03	10/11/2017	660	47	42	2.6	110	50	320	170	ND	0.13	0.067	0.13	0.037	0.021	0.2	320	ND	ND	996	0.056	0.0043	235
32S/13E-30F03	7/12/2017	750	46	44	3	120	53	280	170	ND	ND	0.064	0.14	0.035	0.023	0.2	280	ND	ND	980	0.046	0.0043	230
32S/13E-30F03	4/12/2017	640	48	45	2.9	120	51	310	170	ND	ND	0.076	0.16	0.035	0.022	0.22	310	ND	ND	972	0.065	0.0046	218
32S/13E-30F03	1/10/2017	670	49	44	2.7	120	51	330	170	ND	ND	0.064	0.13	0.045	0.023	0.31	330	ND	ND	993	0.14	0.0063	158
32S/13E-30F03	10/11/2016	680	48	41	2.6	110	49	320	170	ND	0.11	0.056	0.13	0.042	0.02	0.22	320	ND	ND	992	ND	0.0046	218
32S/13E-30F03	7/20/2016	660	47	44	2.9	110	51	320	170	<0.096	<0.080	0.062	0.12	0.032	0.023	0.20	320	<4.1	<4.1	992	0.04	0.0043	235
32S/13E-30F03	4/13/2016	650	47	42	2.7	110	51	310	170	<0.096	0.2	0.072	0.13	0.028	0.021	0.22	310	<4.1	<4.1	981	0.03	0.0047	214
32S/13E-30F03	1/14/2016	580	49	45	2.8	120	52	310	180	0.05	0.1	0.061	0.2	<0.010	0.025	0.21	310	<4.1	<4.1	947	0.054	0.0043	233
32S/13E-30F03	10/14/2015	660	44	38	2.8	100	44	306	160	<0.05	<1	<0.05	0.13	0.028	0.021	0.10	306	<10	<10	990	<0.05	0.0023	440
32S/13E-30F03	7/15/2015	670	45	45	1.9	120	51	305	170	<0.05	<1	0.060	0.11	0.03	0.019	<0.1	305	<10	<10	990	<0.05	NA	NA
32S/13E-30F03	4/15/2015	650	46	35	2.3	99	44	300	170	<0.05	<1	0.056	0.126	0.02	0.015	0.1	300	<10	<10	950	<0.05	NA	NA
32S/13E-30F03	1/14/2015	670	46	36	2.2	100	45	310	180	<0.05	<1	0.05	0.121	0.02	0.016	<0.1	310	<10	<10	950	0.01	NA	NA
32S/13E-30F03	10/14/2014	660	41	35	3.0	99	42	310	150	<0.05	<1	<0.05	<0.1	0.011	0.017	<0.1	310	<10	<10	990	<0.05	NA	NA
32S/13E-30F03	7/30/2014	660	44	38	2.6	96	46	300	160	<0.05	<1	0.28	0.12	0.02	0.015	<0.1	300	<10	<10	990	<0.05	NA	NA
32S/13E-30F03	4/16/2014	640	44	36	3.3	55	38	310	169	<0.05	<1	0.062	0.12	0.02	0.011	0.11	310	<10	<10	990	<0.05	0.0025	400
32S/13E-30F03	1/15/2014	650	45	35	2.5	90	41	300	173	<0.05	<1	<0.05	0.13	0.01	0.015	0.12	300	<10	<10	990	<0.05	0.0027	375
32S/13E-30F03	10/15/2013	670	41	40	2.7	100	44	280	179	<0.05	<1	<0.05	0.14	0.02	0.016	<0.1	280	<10	<10	990	<0.05	NA	NA
32S/13E-30F03	7/10/2013	650	50	33	2.4	100	43	290	140	13.5	<1	0.055	<0.1	0.02	0.017	0.23	290	<10	<10	990	<0.05	0.0046	217
32S/13E-30F03	4/11/2013	670	45	36	2.7	94	42	300	170	<0.05	<1	0.06	0.13	0.02	0.016	0.12	300	<10	<10	990	<0.05	0.0027	375
32S/13E-30F03	1/15/2013	630	45	36	2.3	92	41	295	180	<0.05	<1	0.06	0.11	<0.01	0.015	<0.1	295	<10	<10	980	<0.05	NA	NA
32S/13E-30F03	10/30/2012	650	43	40	3.1	100	46	280	170	<0.05	<1	0.06	<0.1	0.03	0.016	<0.1	280	<10	<10	990	0.02	NA	NA
32S/13E-30F03	7/24/2012	640	51	36	2.7	81	37	296	180	<0.05	<1	<0.1	0.17	<0.01	0.016	0.2	296	<10	<10	990	<0.05	0.0039	255
32S/13E-30F03	4/19/2012	640	54	32	2.3	84	36	290	180	<0.1	<1	<0.1	<0.2	0.01	0.014	<0.2	290	<10	<10	990	<0.1	NA	NA
32S/13E-30F03	1/12/2012	660	46	39	2.1	94	42	280	160	<0.1	<1	<0.1	0.2	0.025	0.016	<0.2	280	<10	<10	990	<0.1	NA	NA
32S/13E-30F03	11/21/2011	650	43	33	2.6	93	39	290	160	<0.05	<1	0.04	0.15	0.028	0.016	<0.1	290	<10	<10	960	<0.1	NA	NA
32S/13E-30F03	7/25/2011	650	47	46	5.1	73	31	190	170.5	<0.05	<1	<0.1	0.155	0.02	0.025	<0.1	190	<5	<5	900	<0.1	NA	NA
32S/13E-30F03	4/21/2011	650	48	40	3.8	91	34	280	179	<0.05	<1	0.1	0.2	0.029	0.015	0.11	280	<2.0	<2.0	1,000	NA	0.0023	436
32S/13E-30F03	1/24/2011	650	46	36	4.7	87	38	300	170	<0.05	<1.0	0.11	0.17	0.24	0.016	<0.1	300	<2.0	<2.0	990	<0.1	NA	NA
32S/13E-30F03	10/28/2010	650	46	37	2.7	100	43	280	160	<0.1	<1.0	0.10	<0.1	NA	0.032	<0.3	280	<10	<10	1,000	0.53	NA	NA
32S/13E-30F03	7/26/2010	608	45	43.8	2.94	107	46.8	294	160	1.3	0.84	0.0479	< 0.10	0.10	0.129	0.24	294	< 1.0	< 1.0	900	7.55	0.0053	188
32S/13E-30F03	4/27/2010	668	48	40.8	2.91	101	44.7	304	160	0.21	0.84	0.0733	0.14	0.11	0.0694	0.23	304	< 1.0	< 1.0	940	2.62	0.0048	209
32S/13E-30F03	1/28/2010	656	40	43.1	3.91	112	47.2	310	180	< 0.20	2.8	0.0833	0.13	< 0.10	0.287	0.21	310	< 1.0	< 1.0	980	4.80	0.0053	190
32S/13E-30F03	10/19/2009	626	48	43.3	3.14	108	46.2	308	170	< 0.10	1.8	0.0646	0.22	< 0.10	0.255	0.17	308	< 1.0	< 1.0	910	2.09	0.0035	282
32S/13E-30F03	8/19/2009	672	45	43.1	3.15	111	44.3	290	170	< 0.10	2.5	NA	0.14	< 0.10	0.468	0.19	290	< 1.0	< 1.0	980	18.5	0.0042	237
32S/13E-30F03	5/12/2009	678	49	44.8	3.32	109	42.9	276	180	NA	NA	NA	0.17	NA	0.146	0.18	276	< 1.0	< 1.0	960	1.16	0.0037	272
32S/13E-30F03	3/27/1996	686	41	40	3.4	109	48	379	197	0.2	NA	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
32S/13E-30F03	6/7/1976	616	43	41	2.6	96	49	333	190	0.4	NA	0.05	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
32S/13E-30F03	1/19/1966	642	69	49	4	109	40	321	182	1	NA	0.05	0.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Well	Date	TDS	Chloride	Sodium	Potassium	Calcium	Magnesium	Bicarbonate as CaCO3	Sulfate	Nitrate (as N)	Total Kjeldahl Nitrogen	Boron	Fluoride	Iodide	Manganese	Bromide	Total Alkalinity as CaCO3	Carbonate as CaCO3	Hydroxide as CaCO3	Specific Conductivity	Iron	Bromide / Chloride Ratio	Chloride / Bromide Ratio
32S/13E-30N01	10/11/2017	870	150	120	31	78	57	320	170	ND	0.68	0.24	0.38	0.019	0.12	1.5	320	ND	ND	1350	3	0.0100	100
32S/13E-30N01	4/11/2017	960	260	160	35	92	73	350	150	ND	0.84	0.23	0.42	0.015	0.14	1.5	350	ND	ND	1,690	3.9	0.0058	173
32S/13E-30N01	10/12/2016	900	180	130	32	77	61	290	180	ND	0.53	0.19	0.34	0.021	0.11	1.7	290	ND	ND	1420	2.7	0.0094	106
32S/13E-30N01	4/12/2016	790	110	110	27	55	46	230	190	0.21	0.5	0.18	0.42	0.013	0.1	1.7	230	<8.2	<8.2	1,190	1.7	0.0155	65
32S/13E-30N01	10/15/2015	740	120	100	27	52	41	250	190	<0.05	<1	0.18	0.43	0.032	0.072	1.3	250	<10	<10	1,220	1.8	0.0108	92
32S/13E-30N01	4/14/2015	930	190	130	28	69	54	360	170	<0.05	1.4	0.23	0.334	0.01	0.087	1.2	360	<10	<10	1,500	2.5	0.0063	158
32S/13E-30N01	1/14/2015	845	170	110	29.0	71	54	320	180	<0.05	<1	0.21	0.332	0.01	0.087	1.2	320	<10	<10	1,360	2.3	0.0071	140
32S/13E-30N01	10/15/2014	790	140	110	30.0	62	53	300	160	0.68	<1	0.21	0.29	<0.01	0.084	1.2	300	<10	<10	1,350	2.5	0.0086	117
32S/13E-30N01	7/30/2014	800	150	110	27.0	61	52	310	160	<0.05	<1	0.81	0.33	0.01	0.081	1.1	310	<10	<10	1,360	2.4	0.0073	136
32S/13E-30N01	4/16/2014	850	160	112	26.0	55	43	310	170	<0.05	<1	0.20	0.33	0.01	0.077	1.3	310	<10	<10	1,410	2.4	0.0081	123
32S/13E-30N01	1/15/2014	790	154	110	26.0	56	45	260	190	<0.05	<1	0.19	0.41	<0.01	0.077	1.4	260	<10	<10	1,340	2.5	0.0091	110
32S/13E-30N01	10/15/2013	950	200	140	32.0	74	60	330	180	<0.05	<1	0.21	0.33	0.01	0.095	1.3	330	<10	<10	1,570	2.8	0.0065	154
32S/13E-30N01	7/10/2013	830	175	120	29.0	71	54	310	185	<0.05	<1	0.22	0.32	0.01	0.087	0.84	310	<10	<10	1,430	2.3	0.0048	208
32S/13E-30N01	4/10/2013	860	180	120	29.0	67	54	320	180	<0.05	1.1	0.21	0.31	0.01	0.087	1.2	320	<10	<10	1,470	2.5	0.0067	150
32S/13E-30N01	1/14/2013	800	170	120	32.0	66	53	280	200	<0.05	1.1	0.22	0.26	<0.01	0.09	1.2	280	<10	<10	1,380	2.5	0.0071	142
32S/13E-30N01	10/29/2012	900	180	120	34.0	77	60	300	190	<0.05	<1	0.21	0.40	0.011	0.098	1.2	300	<10	<10	1,500	2.8	0.0067	150
32S/13E-30N01	7/23/2012	840	190	120	31.0	56	45	266	200	<0.05	<1	0.22	0.43	<0.01	0.096	1.2	266	<10	<10	1,370	2.3	0.0063	158
32S/13E-30N01	4/18/2012	1,050	280	140	31.0	59	47	330	210	<0.1	1.4	0.2	0.50	<0.01	0.078	1.3	330	<10	<10	1,680	2.4	0.0046	215
32S/13E-30N01	1/9/2012	1,050	260	170	34.0	68	52	307	200	<0.05	2.7	0.21	0.41	<0.01	0.088	1.9	307	<10	<10	1,760	2.9	0.0073	137
32S/13E-30N01	11/17/2011	1,300	360	320	40	90	69	390	220	<0.1	<1	0.23	0.38	0.017	0.11	2.5	390	<10	<10	2,210	3.4	0.0069	144
32S/13E-30N01	7/25/2011	1,680	445	230	42	99	81	380	255.5	<0.05	1.2	0.21	<0.1	<0.01	0.12	3.016	380	<5	<5	2,480	4.2	0.0068	148
32S/13E-30N01	4/20/2011	890	210	130	26	68	46	180	215	<0.05	<1	0.24	0.39	0.013	0.086	4.57	180	<2.0	<2.0	1,550	NA	0.0218	46
32S/13E-30N01	1/24/2011	870	180	100	28	84	46	240	210	<0.05	<1.0	<0.1	0.34	0.12	0.24	3.63	240	<2.0	<2.0	1,430	18	0.0202	50
32S/13E-30N01	10/21/2010	890	190	120	26	58	45	246	200	<0.1	<1.0	<0.1	0.37	NA	0.078	2.3	246	<10	<10	1,498	<0.1	0.0121	83
32S/13E-30N01	7/27/2010	917	200	130	30.0	75.0	56.2	241	220	< 0.10	< 0.50	0.165	0.29	0.23	0.101	2.8	241	< 1.0	< 1.0	1,400	2.61	0.0140	71
32S/13E-30N01	4/27/2010	808	150	130	29	136	55.6	286	210	0.76	1.7	0.171	0.37	0.19	0.276	2.6	286	< 1.0	< 1.0	1,300	20.4	0.0173	58
32S/13E-30N01	1/26/2010	902	210	155	33.5	156	66.4	307	230	< 0.10	1.7	0.317	0.30	0.12	0.333	3.2	307	< 1.0	< 1.0	1,500	27.3	0.0152	66
32S/13E-30N01	10/20/2009	828	200	159	34.3	118	59.8	238	230	< 0.10	1.3	0.241	0.38	< 0.10	0.157	3.2	238	< 1.0	< 1.0	1,300	5.33	0.0160	63
32S/13E-30N01	8/20/2009	835	160	150	27.8	121	49.4	235	220	< 0.10	1.3	NA	0.37	0.12	0.228	2.9	235	< 1.0	< 1.0	1,400	15.9	0.0181	55
32S/13E-30N01	5/11/2009	960	180	175	33.5	86.7	46.2	274	220	NA	NA	NA	0.36	NA	0.113	3.2	274	< 1.0	< 1.0	1,500	2.26	0.0178	56

Appendix A: NCMA Sentry Wells Water Quality Data

Well	Date	TDS	Chloride	Sodium	Potassium	Calcium	Magnesium	Bicarbonate as CaCO3	Sulfate	Nitrate (as N)	Total Kjeldahl Nitrogen	Boron	Fluoride	Iodide	Manganese	Bromide	Total Alkalinity as CaCO3	Carbonate as CaCO3	Hydroxide as CaCO3	Specific Conductivity	Iron	Bromide / Chloride Ratio	Chloride / Bromide Ratio
32S/13E-30N03	10/11/2017	580	63	54	3.2	73	33	150	130	15	0.24	0.1	0.16	ND	0.86	0.64	150	ND	ND	836	0.59	0.0102	98
32S/13E-30N03	7/11/2017	560	64	60	3.2	77	34	150	140	14	0.1	0.089	0.14	ND	0.54	0.66	150	ND	ND	871	0.18	0.0103	97
32S/13E-30N03	4/11/2017	560	69	62	3.6	82	36	160	140	14	0.12	0.08	0.15	ND	0.62	0.69	160	ND	ND	866	0.43	0.0100	100
32S/13E-30N03	1/12/2017	580	69	62	3.6	83	38	170	150	14	0.13	0.088	0.13	ND	3.3	0.74	170	ND	ND	878	1.5	0.0107	93
32S/13E-30N03	10/12/2016	580	68	62	3.5	80	37	170	140	15	ND	0.088	0.16	ND	0.56	0.76	170	ND	ND	879	0.17	0.0112	89
32S/13E-30N03	7/19/2016	580	66	61	3.6	75	36	160	130	65	0.20	0.084	0.16	<0.010	0.030	0.76	160	<4.1	<4.1	864	<0.030	0.0115	87
32S/13E-30N03	4/12/2016	610	69	60	3.4	75	36	160	130	64	0.16	0.078	0.18	<0.010	0.0095	0.78	160	<4.1	<4.1	895	<0.05	0.0113	88
32S/13E-30N03	1/13/2016	570	72	62	3.4	77	35	160	140	15	0.15	0.083	0.22	<0.010	0.0089	0.66	160	<4.1	<4.1	867	0.079	0.0092	109
32S/13E-30N03	10/15/2015	570	63	54	3.3	69	32	162	130	15	<1	0.0161	0.23	<0.01	0.015	0.56	162	<10	<10	860	<0.05	0.0089	113
32S/13E-30N03	7/16/2015	580	65	65	3.0	81	35	160	140	15	15.3	0.079	0.14	0.45	0.011	0.46	160	<10	<10	880	<0.05	0.0071	141
32S/13E-30N03	4/14/2015	580	65	49	2.9	65	31	160	140	15.2	<1	0.078	<0.1	<0.01	<0.005	0.47	160	<10	<10	860	<0.05	0.0072	138
32S/13E-30N03	1/14/2015	610	68	53	3.0	73	34	170	150	15	<1	0.074	0.151	<0.01	0.0540	0.43	170	<10	<10	870	0.49	0.0063	158
32S/13E-30N03	10/15/2014	560	59	52	3.5	67	32	160	130	14	0.54	0.066	0.14	<0.01	<0.005	0.452	160	<10	<10	890	<0.05	0.0077	131
32S/13E-30N03	7/30/2014	580	65	55	3.2	69	32	170	130	15	<1	<0.1	0.16	<0.01	<0.005	0.34	170	<10	<10	910	<0.05	0.0052	191
32S/13E-30N03	4/16/2014	610	63	55	4.3	65	29	170	140	13.00	<1	0.08	0.15	<0.01	0.058	0.38	170	<10	<10	910	<0.05	0.0060	166
32S/13E-30N03	1/15/2014	610	66	54	3.2	67	31	170	149	14.8	15	<0.1	0.16	<0.01	0.065	0.46	170	<10	<10	910	0.27	0.0070	143
32S/13E-30N03	10/15/2013	580	60	57	3.3	71	32	170	150	14	<1	0.057	0.16	<0.01	0.370	0.41	170	<10	<10	910	0.1	0.0068	146
32S/13E-30N03	7/10/2013	590	60	48	3.1	71	31	160	150	15.1	<1	0.074	0.18	<0.01	1.3	0.17	160	<10	<10	900	0.43	0.0028	353
32S/13E-30N03	4/10/2013	600	66	53	3.3	69	31	160	150	15	<1	0.11	0.2	<0.01	0.064	0.35	160	<10	<10	910	<0.05	0.0053	189
32S/13E-30N03	1/14/2013	570	66	55	3.4	68	30	165	150	15	<1	0.093	0.2	<0.01	0.028	0.27	165	<10	<10	900	0.084	0.0041	244
32S/13E-30N03	10/29/2012	610	60	56	3.7	74	33	155	148	14	<1	0.081	0.2	<0.01	0.027	0.3	155	<10	<10	900	0.04	0.0050	200
32S/13E-30N03	7/23/2012	600	71	56	3.5	61	28	152	200	<0.05	<1	0.1	<0.1	<.002	0.120	0.3	152	<10	<10	890	0.44	0.0042	237
32S/13E-30N03	4/18/2012	570	80	47	3.0	57	25	150	150	16	<1	0.1	0.3	<0.01	<0.005	0.28	150	<10	<10	880	<0.1	0.0035	286
32S/13E-30N03	1/11/2012	570	67	55	3.9	68	30	140	130	14	<1	0.1	0.2	<0.02	0.0510	0.39	140	<10	<10	870	0.17	0.0058	172
32S/13E-30N03	11/21/2011	600	67	47	3.2	64	28	140	130	15	1.2	0.088	0.2	<0.01	<0.005	0.62	140	<10	<10	850	<0.1	0.0093	108
32S/13E-30N03	7/25/2011	590	67	47	5.0	54	24	290	139.8	15	<1	<0.1	0.2	<0.01	0.0520	0.79	290	<5	<5	890	0.14	0.0118	85
32S/13E-30N03	4/20/2011	580	76	58	4.2	62	23	140	142	16	<1	0.12	0.2	<0.1	0.0510	0.92	140	<2.0	<2.0	890	NA	0.0121	83
32S/13E-30N03	1/24/2011	570	76	48	4.8	55	25	130	130	16	<1.0	0.12	0.2	<0.10	0.0088	1.7	130	<2.0	<2.0	900	<0.1	0.0224	45
32S/13E-30N03	10/21/2010	550	69	59	3.3	65	31	133	130	15	<1.0	<0.1	0.1	NA	<0.005	1.1	133	<10	<10	886	<0.1	0.0159	63
32S/13E-30N03	7/27/2010	528	72	55.1	3.41	68.7	31.0	139	130	15.0	< 0.50	0.0672	0.14	0.11	< 0.00500	1.3	139	< 1.0	< 1.0	860	< 0.100	0.0181	55
32S/13E-30N03	4/27/2010	672	89	60.6	3.65	70.6	32.5	134	130	14.0	< 0.50	0.0779	0.18	0.11	< 0.00500	1.2	134	< 1.0	< 1.0	870	< 0.100	0.0135	74
32S/13E-30N03	1/26/2010	606	110	75.0	4.51	77.8	34.3	126	130	14	1.4	0.0654	0.15	< 0.10	0.0130	1.3	126	< 1.0	< 1.0	990	0.653	0.0118	85
32S/13E-30N03	10/20/2009	806	180	93.3	25.5	92.3	41.5	162	150	9.7	2.2	0.107	0.26	< 0.10	0.245	1.4	162	< 1.0	< 1.0	1,200	0.344	0.0078	129
32S/13E-30N03	8/20/2009	1,070	190	151	61.6	112	44.2	130	130	16	3.4	NA	0.20	< 0.10	0.151	1.6	130	< 1.0	< 1.0	1,700	1.93	0.0084	119
32S/13E-30N03	5/12/2009	602	97	63.4	3.96	72.9	32.2	122	120	NA	NA	NA	0.22	NA	24	1.2	122	< 1.0	< 1.0	900	2.24	0.0124	81
32S/13E-30N03	3/27/1996	624	70	62	4	78	35	150	161	106.8	NA	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
32S/13E-30N03	6/7/1976	705	90	54	2.9	99	43	189	168	112.5	NA	0.08	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
32S/13E-30N03	1/21/1966	804	57	54	3	132	59	410	250	1	NA	0.08	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Well	Date	TDS	Chloride	Sodium	Potassium	Calcium	Magnesium	Bicarbonate as CaCO3	Sulfate	Nitrate (as N)	Total Kjeldahl Nitrogen	Boron	Fluoride	Iodide	Manganese	Bromide	Total Alkalinity as CaCO3	Carbonate as CaCO3	Hydroxide as CaCO3	Specific Conductivity	Iron	Bromide / Chloride Ratio	Chloride / Bromide Ratio
32S/13E-30N02	10/11/2017	1000	46	70	4.8	160	65	200	510	0.19	0.19	0.17	0.11	ND	0.005	0.27	200	ND	ND	1340	0.28	0.0059	170
32S/13E-30N02	7/11/2017	1,100	49	74	4.8	150	64	190	480	0.2	0.13	0.15	0.08	ND	0.023	0.16	190	ND	ND	1,360	2.0	0.0033	306
32S/13E-30N02	4/11/2017	980	50	74	4.8	160	64	190	510	0.2	0.12	0.14	0.14	ND	ND	0.18	190	ND	ND	1,320	0.2	0.0036	278
32S/13E-30N02	1/13/2017	980	49	80	5.1	170	69	200	490	0.19	0.12	0.16	0.078	ND	0.011	0.16	200	ND	ND	1,340	0.63	0.0033	306
32S/13E-30N02	10/12/2016	1,000	50	77	5	160	69	200	500	0.18	ND	0.15	0.11	ND	ND	0.27	200	ND	ND	1370	ND	0.0054	185
32S/13E-30N02	7/19/2016	1,000	48	78	5	160	68	200	500	0.97	0.17	0.15	0.11	<0.010	<0.0040	0.2	200	<8.2	<8.2	1,350	<0.030	0.0042	240
32S/13E-30N02	4/12/2016	1,000	44	72	4.8	150	67	190	470	1.0	<0.080	0.14	0.096	<0.010	<0.0040	0.21	190	<8.2	<8.2	1,390	<0.030	0.0048	210
32S/13E-30N02	1/13/2016	990	48	74	4.9	150	64	190	520	0.27	0.12	0.14	0.22	<0.010	<0.0040	<0.046	190	<8.2	<8.2	1,300	0.041	NA	NA
32S/13E-30N02	10/15/2015	1,040	47	64	4.6	140	60	192	480	0.72	<1	0.13	0.18	<0.01	<0.005	<0.10	192	<10	<10	1,350	<0.05	NA	NA
32S/13E-30N02	7/16/2015	1,030	49	82	4.4	170	70	190	480	1.4	1.52	0.15	<0.1	<0.01	<0.005	0.11	190	<10	<10	1,360	<0.05	0.0022	445
32S/13E-30N02	4/14/2015	840	47	61	4.3	130	58	190	500	0.576	<1	0.14	<0.3	<0.01	<0.005	<0.3	190	<10	<10	1,330	<0.05	NA	NA
32S/13E-30N02	1/14/2015	1,050	50	62	4.2	140	59	190	520	0.40	<1	0.13	0.115	<0.01	<0.005	<0.1	190	<10	<10	1,320	<0.05	NA	NA
32S/13E-30N02	10/15/2014	1,040	44	65	5.0	140	58	200	440	0.77	<1	0.13	<0.1	<0.01	<0.005	<0.1	200	<10	<10	1,370	<0.05	NA	NA
32S/13E-30N02	7/30/2014	1,020	45	66	4.6	140	60	220	470	0.51	<1	0.10	0.13	<0.01	<0.005	<0.4	220	<10	<10	1,340	<0.05	NA	NA
32S/13E-30N02	4/16/2014	1,040	46	66	5.0	120	50	190	520	0.47	<1	0.14	0.1	<0.01	<0.005	<0.1	190	<10	<10	1,350	<0.05	NA	NA
32S/13E-30N02	1/15/2014	1,060	45	60	4.1	120	49	190	477	0.65	1.1	0.13	0.43	<0.01	<0.005	<0.2	190	<10	<10	1,370	<0.05	NA	NA
32S/13E-30N02	10/15/2013	1,030	46	70	4.9	140	58	190	541	0.46	<1	0.12	0.18	<0.01	<0.005	<0.2	190	<10	<10	1,360	<0.05	NA	NA
32S/13E-30N02	7/10/2013	1,020	50	61	4.5	140	59	185	500	0.63	<1	0.14	0.12	<0.01	<0.005	<0.1	185	<10	<10	1,370	<0.05	NA	NA
32S/13E-30N02	4/10/2013	1,080	48	60	4.3	120	52	185	500	0.50	<1	0.15	<0.2	<0.01	<0.005	<0.2	185	<10	<10	1,360	<0.05	NA	NA
32S/13E-30N02	1/14/2013	1,010	48	63	4.5	120	53	188	530	0.40	<1	0.14	<0.2	<0.01	<0.005	<0.2	188	<10	<10	1,350	0.07	NA	NA
32S/13E-30N02	10/29/2012	1,030	40	68	5.0	140	58	180	500	<0.25	<1	0.14	<0.5	<0.01	<0.005	<0.5	180	<10	<10	1,360	<0.05	NA	NA
32S/13E-30N02	7/23/2012	1,040	54	63	4.5	110	48	188	510	0.13	<1	0.15	0.15	<0.01	0.01	<0.1	188	<10	<10	1,360	<0.05	NA	NA
32S/13E-30N02	4/18/2012	990	60	56	4.2	110	47	190	560	0.14	<1	0.12	0.21	<0.01	<0.005	0.28	190	<10	<10	1,360	<0.1	0.0047	214
32S/13E-30N02	1/11/2012	1,040	49	64	4.9	130	54	180	460	1.30	<1	0.17	0.16	<0.02	<0.005	<0.2	180	<10	<10	1,360	<0.1	NA	NA
32S/13E-30N02	11/21/2011	1,020	46	57	4.5	130	54	180	450	0.15	<1	0.15	<0.2	<0.01	<0.005	<0.2	180	<10	<10	1,360	<0.1	NA	NA
32S/13E-30N02	7/25/2011	1,050	50	81	7.7	150	62	180	479.1	0.15	<1	0.16	0.144	<0.01	0.006	<0.1	180	<5	<5	1,370	0.49	NA	NA
32S/13E-30N02	4/20/2011	1,030	52	63	5.4	130	44	180	508	0.17	<1	0.19	0.2	<0.01	<0.005	<0.1	180	<2.0	<2.0	1,380	NA	NA	NA
32S/13E-30N02	1/24/2011	1,050	50	60	6.4	120	49	190	490	0.24	<1.0	0.17	0.17	<0.10	0.064	<0.1	190	<2.0	<2.0	1,380	0.12	NA	NA
32S/13E-30N02	10/21/2010	1,040	48	52	3.5	100	45	181	460	0.15	<1.0	<0.1	<0.1	NA	<0.005	<0.3	181	<10	<10	1,377	<0.1	NA	NA
32S/13E-30N02	7/27/2010	777	57	67.6	7.31	141	58.5	190	470	0.3	3.5	0.138	< 0.10	0.11	0.102	0.28	190	< 1.0	< 1.0	1,300	3.43	0.0049	204
32S/13E-30N02	4/27/2010	800	93	71.9	12.50	108	46.3	159	300	7.0	3.2	0.123	0.13	0.11	0.0776	0.7	159	< 1.0	< 1.0	1,100	3.27	0.0075	133
32S/13E-30N02	2/25/2010	1,000	48	71.4	4.70	141	58.1	195	490	0.16	< 0.50	0.15	0.15	< 0.10	0.0393	0.16	195	< 1.0	< 1.0	1,300	3.30	0.0033	300
32S/13E-30N02	2/25/2010	1,010	74	76.9	10.2	138	55.8	195	440	0.13	2.4	0.142	0.16	< 0.10	0.0579	0.24	195	< 1.0	< 1.0	1,400	1.69	0.0032	308
32S/13E-30N02	1/26/2010	970	50	74.2	4.77	152	62.2	195	510	0.14	< 0.50	0.129	0.11	< 0.10	< 0.00500	0.16	195	< 1.0	< 1.0	1,300	< 0.100	0.0032	313
32S/13E-30N02	10/20/2009	2,080	690	274	151	239	101.0	220	400	< 0.10	7.0	0.201	0.16	0.87	0.398	2.0	220	< 1.0	< 1.0	2,800	5.50	0.0029	345
32S/13E-30N02	8/20/2009	1,350	500	199	82.2	123	49.0	199	220	6.4	6.3	NA	0.23	0.14	0.339	2.8	199	< 1.0	< 1.0	2,100	4.91	0.0056	179
32S/13E-30N02	5/11/2009	1,290	170	129	52	137	66.9	176	470	NA	NA	NA	0.18	NA	0.128	0.56	176	< 1.0	< 1.0	1,800	5.24	0.0033	304
32S/13E-30N02	3/27/1996	1,050	50	71	5.5	145	60	243	516	0.9	NA	0.23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
32S/13E-30N02	6/7/1976	1,093	48	62	4.7	150	60	248	484	0	NA	0.13	0.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
32S/13E-30N02	1/21/1966	1,069	54	71	5	148	63	232	483	0	NA	0.12	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Appendix A: NCMA Sentry Wells Water Quality Data

Well	Date	TDS	Chloride	Sodium	Potassium	Calcium	Magnesium	Bicarbonate as CaCO3	Sulfate	Nitrate (as N)	Total Kjeldahl Nitrogen	Boron	Fluoride	Iodide	Manganese	Bromide	Total Alkalinity as CaCO3	Carbonate as CaCO3	Hydroxide as CaCO3	Specific Conductivity	Iron	Bromide / Chloride Ratio	Chloride / Bromide Ratio
32S/13E-31H10	10/11/2017	640	33	41	3.1	120	57	360	160	ND	0.38	0.083	0.18	ND	0.21	0.13	450	89	ND	1070	4.3	0.0039	254
32S/13E-31H10	7/11/2017	720	36	48	3.8	120	60	350	170	ND	0.17	0.09	0.15	0.011	0.17	0.13	350	ND	ND	1,020	4.7	0.0036	277
32S/13E-31H10	4/12/2017	600	39	47	3.4	120	62	340	190	ND	ND	0.09	0.19	0.013	0.19	0.22	340	ND	ND	1,020	5.2	0.0056	177
32S/13E-31H10	1/13/2017	670	34	45	3.4	130	60	370	180	ND	0.16	0.076	0.17	0.014	0.22	0.1	370	ND	ND	1,020	7.8	0.0029	340
32S/13E-31H10	10/12/2016	700	33	40	3.2	120	59	380	170	ND	0.22	0.062	0.18	0.012	0.15	0.12	380	ND	ND	1040	5.3	0.0036	275
32S/13E-31H10	7/20/2016	630	33	42	4.4	99	57	370	150	<0.096	0.3	0.068	0.14	<0.01	0.19	0.14	370	<8.2	<8.2	991	8.9	0.0042	236
32S/13E-31H10	4/13/2016	670	37	46	3.4	120	57	350	180	<0.096	0.21	0.078	0.19	0.011	0.23	0.14	350	<8.2	<8.2	1,030	6.7	0.0038	264
32S/13E-31H10	1/13/2016	380	37	49	9.9	6.8	46	170	54	<0.022	0.43	0.044	0.088	0.014	0.084	0.19	210	34	<4.1	603	2.2	0.0051	195
32S/13E-31H10	10/14/2015	320	32	33	2.7	17	48	216	68	<0.05	<1	0.089	0.12	0.016	0.098	<0.10	227	11	<10	600	1.4	NA	NA
32S/13E-31H10	7/15/2015	330	34	44	3.4	15	54	195	81	<0.05	<1	0.082	<0.1	<0.01	0.081	<0.1	213	18	<10	610	0.98	NA	NA
32S/13E-31H10	4/16/2015	660	35	33	2.7	99	48	360	170	<0.05	<1	0.083	0.163	<0.01	0.17	<0.1	360	<10	<10	1,000	4.6	NA	NA
32S/13E-31H10	1/14/2015	760	55	56	3.0	110	50	300	250	<0.05	<1	0.11	0.159	0.021	0.17	<0.1	300	<10	<10	1,070	4.2	NA	NA
32S/13E-31H10	10/16/2014	720	41	46	3.7	110	53	330	200	<0.05	<1	0.10	<0.1	<0.01	0.17	<0.1	330	<10	<10	1,090	6.5	NA	NA
32S/13E-31H10	7/30/2014	660	34	35	2.4	95	49	420	160	<0.05	<1	<0.1	0.16	<0.01	0.17	<0.1	420	<10	<10	1,040	6.5	NA	NA
32S/13E-31H10	4/17/2014	890	55	70	5.4	100	45	250	380	<0.05	<1	0.15	0.12	0.01	0.31	0.13	250	<10	<10	1,260	4.9	0.0024	423
32S/13E-31H10	1/16/2014	900	57	66	4.60	110	50	240	360	<0.05	<1	0.180	0.2	0.02	0.32	<0.1	240	<10	<10	1,260	6.0	NA	NA
32S/13E-31H10	10/16/2013	690	30	40	3.40	100	49	340	190	<0.05	<1	0.091	0.14	<0.01	0.23	<0.1	340	<10	<10	1,050	7.4	NA	NA
32S/13E-31H10	7/11/2013	860	60	50	4.40	110	47	240	340	<0.05	<1	0.18	0.15	0.02	0.28	<0.1	240	<10	<10	1,230	4.9	NA	NA
32S/13E-31H10	4/11/2013	900	60	69	4.60	110	47	250	350	0.82	<1	0.2	0.12	0.03	0.28	<0.2	250	<10	<10	1,250	5.7	NA	NA
32S/13E-31H10	1/16/2013	820	66	76	5.00	100	47	260	320	<0.1	<1	0.21	0.13	<0.01	0.31	<0.2	260	<10	<10	1,230	4.2	NA	NA
32S/13E-31H10	10/30/2012	780	65	75	4.70	100	46	255	280	<0.05	<1	0.19	0.14	0.04	0.23	<0.1	255	<10	<10	1,190	4	NA	NA
32S/13E-31H10	7/25/2012	830	76	80	5.30	96	45	250	310	<0.05	<1	0.22	0.15	0.04	0.24	<0.1	250	<10	<10	1,220	6.7	NA	NA
32S/13E-31H10	4/19/2012	790	87	69	4.50	52	37	250	270	<0.1	<1	0.19	0.21	0.05	0.17	<0.2	250	<10	<10	1,180	4	NA	NA
32S/13E-31H10	1/12/2012	760	76	85	4.00	79	40	270	190	<0.1	<1	0.23	0.21	0.069	0.23	<0.2	270	<10	<10	1,150	4.8	NA	NA
32S/13E-31H10	11/21/2011	720	39	38	3.40	96	43	320	180	<0.05	3.5	0.079	0.19	0.013	0.17	<0.1	320	<10	<10	1,050	4.8	NA	NA
32S/13E-31H10	7/25/2011	760	69	66	6.40	80	35	310	208.8	<0.05	<1	0.16	0.17	0.041	0.23	0.199	310	<5	<5	1,170	5.3	0.0029	348
32S/13E-31H10	1/24/2011	310	98	22	8.1	34	9.2	19.0	53	<0.05	<1.0	<0.1	0.2	4.42	0.4	0.63	19.0	<2.0	<2.0	480	10	0.0064	156
32S/13E-31H10	10/28/2010	290	81	26	9.3	64	11	160.0	68	<0.1	<1.0	<0.1	0.2	NA	0.85	0.36	160.0	<10	<10	520	38	0.0044	225
32S/13E-31H10	7/26/2010	438	85	34.3	1.93	61.7	30.4	30.0	210	< 0.10	< 0.50	0.0435	0.58	0.22	1.46	0.32	30.0	< 1.0	< 1.0	690	36	0.0038	266
32S/13E-31H10	4/26/2010	560	83	47.7	5.7	86.1	48.3	62	310	< 0.10	0.84	< 0.02	< 0.1	0.56	2.54	0.31	62.0	< 1.0	< 1.0	880	233	0.0037	268
32S/13E-31H10	1/27/2010	460	130	45.0	25.4	682	124	112	100	0.56	NA	< 0.0200	0.21	0.25	32.4	0.49	112.0	< 1.0	< 1.0	760	4,360	0.0038	265
32S/13E-31H10	10/20/2009	362	92	39.6	2.92	19.2	45.1	76.8	110	< 0.10	< 0.50	0.0697	< 0.10	< 0.10	0.242	0.39	80.0	3.2	< 1.0	590	11.4	0.0042	236
32S/13E-31H10	8/19/2009	420	160	48.4	3.37	49.9	20.4	17.6	54	< 0.10	1.1	NA	< 0.10	0.25	1.76	0.68	17.6	< 1.0	< 1.0	690	242	0.0043	235
32S/13E-31H10	5/16/1983	665	35	40	NA	85	65	360	90	< 4	NA	NA	0.2	NA	0.01	NA	360	ND	ND	950	0.10	NA	NA

Appendix A: NCMA Sentry Wells Water Quality Data

Well	Date	TDS	Chloride	Sodium	Potassium	Calcium	Magnesium	Bicarbonate as CaCO3	Sulfate	Nitrate (as N)	Total Kjeldahl Nitrogen	Boron	Fluoride	Iodide	Manganese	Bromide	Total Alkalinity as CaCO3	Carbonate as CaCO3	Hydroxide as CaCO3	Specific Conductivity	Iron	Bromide / Chloride Ratio	Chloride / Bromide Ratio
32S/13E-31H11	10/11/2017	720	38	45	3.7	120	56	350	200	ND	0.22	0.13	0.18	0.015	0.22	0.14	350	ND	ND	1080	5.6	0.0037	271
32S/13E-31H11	7/11/2017	820	43	53	3.9	130	58	320	230	ND	0.11	0.11	0.13	0.018	0.29	0.19	320	ND	ND	1,100	9.7	0.0044	226
32S/13E-31H11	4/12/2017	720	45	53	3.8	120	56	320	250	ND	ND	0.11	0.17	0.022	0.25	0.18	320	ND	ND	1,100	6.3	0.0040	250
32S/13E-31H11	1/13/2017	750	44	57	4	130	58	340	240	ND	0.11	0.11	0.13	0.024	0.29	0.15	340	ND	ND	1,100	7.20	0.0034	293
32S/13E-31H11	10/12/2016	780	41	49	3.9	120	57	350	220	ND	0.12	0.097	0.16	0.021	0.28	0.16	350	ND	ND	1100	8.10	0.0039	256
32S/13E-31H11	7/20/2016	420	120	64	6.8	4.3	38	60	39	<0.096	0.097	0.12	0.059	0.084	0.084	0.59	89	29	<4.1	617	9.0	0.0049	203
32S/13E-31H11	4/13/2016	410	110	64	604	3.9	40	51	56	<0.096	<0.080	0.11	0.058	0.084	0.053	0.58	92	41	<4.1	628	6.7	0.0053	190
32S/13E-31H11	1/13/2016	450	120	70	7.7	4.5	36	49	65	<0.022	<0.080	0.11	0.095	0.11	0.072	0.76	86	37	<4.1	675	8.6	0.0063	158
32S/13E-31H11	10/14/2015	350	110	69	9.2	3.7	31	42	74	<0.05	<1	0.16	<0.10	0.099	0.036	0.44	75	33	<10	670	5.7	0.0040	250
32S/13E-31H11	7/15/2015	380	120	85	11.0	4.3	35	40	85	<0.05	<1	0.19	<0.1	0.1	0.05	0.409	65	25	<10	690	9.6	0.0034	293
32S/13E-31H11	4/16/2015	400	120	66	7.6	4.9	36	54	100	<0.05	<1	0.17	<0.1	0.088	0.039	0.481	76	22	<10	700	6.6	0.0040	249
32S/13E-31H11	1/14/2015	420	125	68	7.0	6.4	37	45	126	<0.05	<1	0.15	<0.1	0.097	0.038	0.39	65	20	<10	720	3.5	0.0031	325
32S/13E-31H11	10/16/2014	370	120	78	13.0	4.2	29	53	77	<0.05	<1	0.17	<0.1	0.11	0.040	0.35	88	<10	<10	740	4.5	0.0029	343
32S/13E-31H11	7/30/2014	450	120	71	4.4	9.6	43	53	130	0.13	<1	0.15	0.12	0.1	0.078	0.29	73	20	<10	800	8	0.0024	414
32S/13E-31H11	4/17/2014	370	120	89	14.0	2.4	17	76	39	<0.05	<1	0.16	<0.1	0.12	0.03	0.43	121	45	<10	720	3.7	0.0036	279
32S/13E-31H11	1/16/2014	350	122	89	15	2	18	68	42	<0.05	<1	0.17	0.1	0.09	0.026	0.48	125	57.5	<10	710	2.3	0.0039	254
32S/13E-31H11	10/16/2013	360	100	98	20	3.1	15	66	36	<0.05	<1	0.19	<0.1	0.11	0.057	0.38	139	73	<10	710	4.1	0.0038	263
32S/13E-31H11	7/11/2013	370	140	70	6.3	4	23	82	40	0.4	<1	0.2	0.11	0.11	0.043	0.44	117	35	<10	730	3.2	0.0031	318
32S/13E-31H11	4/11/2013	340	90	81	14	2.9	18	78	30	<0.05	<1	0.19	0.12	0.07	0.046	0.3	155	77.5	<10	650	3.2	0.0033	300
32S/13E-31H11	1/16/2013	360	107	99	7.1	3.3	24	110	36	<0.05	<1	0.25	<0.1	<0.01	0.048	0.4	165	55	<10	720	3.7	0.0037	268
32S/13E-31H11	10/30/2012	380	97	100	6.4	4.5	24	130	38	<0.05	<1	0.28	<0.1	0.1	0.09	0.2	168	38	<10	720	6.1	0.0021	485
32S/13E-31H11	7/25/2012	240	49	56	11	5.4	22	99	43	<0.05	<1	0.16	0.19	0.023	0.11	<0.1	132	33	<10	470	6.6	NA	NA
32S/13E-31H11	4/19/2012	380	100	87	5.5	3.5	26	150	79	<0.1	<1	0.27	0.26	0.09	0.033	0.68	180	30	<10	750	1.6	0.0068	147
32S/13E-31H11	1/12/2012	480	96	110	4.9	5.6	33	154	95	<0.1	<1	0.28	<0.2	0.11	0.01	0.306	180	26	<10	850	0.2	0.0032	314
32S/13E-31H11	11/21/2011	390	90	78	4.6	5.2	24	111	86	<0.05	<1	0.19	0.13	0.092	0.014	0.28	128	17	<10	720	0.5	0.0031	321
32S/13E-31H11	7/25/2011	260	29	23	5.3	8.7	20	84	80	<0.05	<1	<0.1	0.199	0.072	0.041	<0.1	89	<5	<5	440	2.7	NA	NA
32S/13E-31H11	4/21/2011	580	118	70	19	49	17	8.8	274	<0.05	<1	<0.1	0.29	0.109	0.091	0.4	11.3	2.5	<2.0	950	NA	0.0034	295
32S/13E-31H11	1/24/2011	680	110	60	17	64	22	5.0	330	<0.05	<1.0	<0.1	0.22	0.96	0.16	0.31	11.2	6.2	<2.0	1,040	10.0	0.0028	355
32S/13E-31H11	10/21/2010	770	100	68	12	88	31	14.0	380	<0.1	<1.0	<0.1	0.28	NA	0.054	<0.3	14.0	<10	<10	1,163	2.2	NA	NA
32S/13E-31H11	7/26/2010	783	130	80.1	8.58	142	42.0	2.8	450	< 0.10	< 0.50	< 0.0200	0.26	0.31	3.97	0.8	2.8	< 1.0	< 1.0	1,200	593	0.0059	169
32S/13E-31H11	4/26/2010	1,130	160	70.2	6.48	208	50.7	8.4	530	< 0.10	0.56	< 0.02	0.23	0.54	3.10	1.0	8.4	< 1.0	< 1.0	1,600	383	0.0061	165
32S/13E-31H11	1/27/2010	1,740	430	55.6	4.98	282	43.0	< 1.0	680	< 0.10	< 0.50	0.0819	0.14	0.41	9.41	2.0	< 1.0	< 1.0	< 1.0	2,300	170	0.0047	215
32S/13E-31H11	10/20/2009	2,250	1,000	19.5	2.40	487	22.5	5.0	410	< 0.10	0.98	0.0532	0.13	< 0.10	13.1	4.5	5.0	< 1.0	< 1.0	3,100	236	0.0045	222
32S/13E-31H11	8/19/2009	322	150	93.2	16.7	23.9	12.1	3.0	4.0	< 0.10	1.3	NA	0.19	0.5	0.7	0.74	23.0	20.0	< 1.0	640	153	0.0049	203
32S/13E-31H11	5/16/1983	840	80	90	NA	100	50	250	160.0	< 4	NA	ND	0.2	NA	0.14	NA	250.0	ND	ND	1,200	0.10	NA	NA

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Well	Date	TDS	Chloride	Sodium	Potassium	Calcium	Magnesium	Bicarbonate as CaCO3	Sulfate	Nitrate (as N)	Total Kjeldahl Nitrogen	Boron	Fluoride	Iodide	Manganese	Bromide	Total Alkalinity as CaCO3	Carbonate as CaCO3	Hydroxide as CaCO3	Specific Conductivity	Iron	Bromide / Chloride Ratio	Chloride / Bromide Ratio
32S/13E-31H12	4/21/2011	410	97	100	7.2	3.5	21	80	134	<0.05	<1	0.23	0.18	0.097	0.065	0.42	100	20	<2.0	770	NA	0.0043	231
32S/13E-31H12	1/24/2011	440	92	90	9.2	3.4	27	90	140	<0.05	<1.0	0.25	0.11	0.94	0.041	0.35	110	20	<2.0	810	2.2	0.0038	263
32S/13E-31H12	10/21/2010	460	90	110	15	6.8	32	94	140	<0.1	<1.0	0.2	0.1	NA	0.1	0.38	124	30	<10	868	3.5	0.0042	237
32S/13E-31H12	7/26/2010	478	83	109	5.94	52.9	30.4	122.0	94	< 0.10	<0.50	0.255	< 0.10	0.41	0.477	0.56	130.0	8.0	< 1.0	730	61.0	0.0067	148
32S/13E-31H12	4/26/2010	452	83	83	7.42	29.3	34.5	72.0	190	< 0.1	0.56	0.134	< 0.10	0.65	0.702	0.4	86.0	14.0	< 1.0	810	71.0	0.0048	208
32S/13E-31H12	1/27/2010	496	71	92.2	10.6	22.9	39.1	13.0	230	<0.10	< 0.50	0.323	< 0.10	0.20	0.604	0.29	51.0	38.0	< 1.0	780	54.4	0.0041	245
32S/13E-31H12	10/20/2009	564	71	80.8	8.63	33.2	49.8	49.6	310	<0.10	< 0.50	0.148	< 0.10	< 0.10	0.337	0.32	64.0	14.4	< 1.0	850	20.0	0.0045	222
32S/13E-31H12	8/19/2009	522	180	148	71.6	95.2	8.42	30.0	3.5	<0.10	1.7	NA	0.24	0.52	2.36	0.76	170	140	< 1.0	1,000	278	0.0042	237
32S/13E-31H12	5/16/1983	630	40	40	NA	90	50	330	80	< 4	NA	NA	0.1	NA	0.02	NA	330	ND	ND	900	0.05	NA	NA

Well	Date	TDS	Chloride	Sodium	Potassium	Calcium	Magnesium	Bicarbonate as CaCO3	Sulfate	Nitrate (as N)	Total Kjeldahl Nitrogen	Boron	Fluoride	Iodide	Manganese	Bromide	Total Alkalinity as CaCO3	Carbonate as CaCO3	Hydroxide as CaCO3	Specific Conductivity	Iron	Bromide / Chloride Ratio	Chloride / Bromide Ratio
32S/13E-31H09	10/11/2017	640	40	47	2.6	120	55	370	160	0.024	0.12	0.079	0.13	0.016	0.046	0.13	370	ND	ND	1020	0.34	0.0033	308
32S/13E-31H09	7/11/2017	750	40	48	2.8	120	56	360	170	ND	ND	0.075	0.11	0.015	0.057	0.15	360	ND	ND	1,050	0.42	0.0038	267
32S/13E-31H09	4/12/2017	620	42	52	3.1	130	60	360	170	0.037	ND	0.082	0.17	0.017	0.05	0.14	360	ND	ND	1,040	0.30	0.0033	300
32S/13E-31H09	1/11/2017	640	61	53	3	100	48	320	150	ND	ND	0.071	0.16	0.02	0.05	0.24	320	ND	ND	976	0.40	0.0039	254
32S/13E-31H09	10/12/2016	720	46	49	2.8	120	56	370	170	0.029	0.18	0.069	0.12	0.021	0.041	0.18	370	ND	ND	1070	0.36	0.0039	256
32S/13E-31H09	7/20/2016	680	45	50	2.9	120	56	370	160	0.18	0.14	0.075	0.15	0.013	0.049	0.16	370	<8.2	<8.2	1,060	0.33	0.0036	281
32S/13E-31H09	4/13/2016	670	43	48	2.9	110	57	350	160	<0.096	0.2	0.062	0.14	0.012	0.056	0.18	350	<8.2	<8.2	1,040	0.46	0.0042	239
32S/13E-31H09	1/12/2016	630	48	48	2.8	110	54	350	180	0.051	0.14	0.042	0.24	0.017	0.047	0.36	350	<8.2	<8.2	1,100	0.46	0.0075	133
32S/13E-31H09	10/14/2015	680	43	44	3.1	100	50	360	160	<0.05	<1	0.089	0.28	0.02	0.033	<0.10	360	<10	<10	1,060	0.18	NA	NA
32S/13E-31H09	7/15/2015	680	43	52	2.4	120	56	360	170	<0.05	<1	0.079	0.11	0.01	0.033	<0.1	360	<10	<10	1,070	0.13	NA	NA
32S/13E-31H09	4/16/2015	680	49	41	2.4	100	47	350	170	<0.05	<1	0.068	0.114	<0.01	0.039	<0.1	350	<10	<10	1,030	0.47	NA	NA
32S/13E-31H09	10/16/2014	670	40	43	2.8	110	50	3500	150	<0.05	<1	0.055	0.103	<0.01	0.03	<0.1	350	<10	<10	1,060	0.064	NA	NA
32S/13E-31H09	7/30/2014	670	43	43	2.2	110	48	360	160	<0.05	<1	<0.1	0.15	<0.01	0.029	<0.1	360	<10	<10	1,070	0.057	NA	NA
32S/13E-31H09	4/15/2014	680	42	43	3.3	87	43	340	170	<0.05	<1	0.09	0.11	<0.01	0.023	<0.1	340	<10	<10	1,070	0.05	NA	NA
32S/13E-31H09	1/16/2014	680	45	42	2.6	100	46	360	171	<0.05	<1	<0.05	0.13	<0.01	0.032	<0.1	360	<10	<10	1,060	0.18	NA	NA
32S/13E-31H09	10/16/2013	670	40	44	2.6	100	47	350	180	0.47	<1	<0.05	0.15	<0.01	0.03	<0.1	350	<10	<10	1,053	0.11	NA	NA
32S/13E-31H09	7/10/2013	670	44	43	2.8	110	52	350	180	<0.05	<1	0.072	0.12	<0.01	0.032	<0.1	350	<10	<10	1,070	0.11	NA	NA
32S/13E-31H09	4/11/2013	720	43	40	2.7	98	46	350	170	<0.05	<1	0.072	0.14	<0.01	0.029	<0.1	350	<10	<10	1,070	0.12	NA	NA
32S/13E-31H09	1/16/2013	660	43	43	2.7	100	47	360	180	<0.05	<1	0.07	0.1	<0.01	0.031	<0.1	360	<10	<10	1,060	0.130	NA	NA
32S/13E-31H09	10/30/2012	660	40	44	2.9	110	49	345	170	<0.05	<1	0.071	0.14	<0.01	0.03	<0.1	345	<10	<10	1,070	0.086	NA	NA
32S/13E-31H09	7/24/2012	700	47	44	2.8	93	45	356	180	<0.05	<1	<0.1	0.17	<0.01	0.029	<0.1	356	<10	<10	1,070	0.660	NA	NA
32S/13E-31H09	4/25/2012	680	48	44	2.7	95	43	350	200	<0.1	<1	<0.1	0.26	<0.01	0.032	<0.2	350	<10	<10	1,070	0.200	NA	NA
32S/13E-31H09	1/10/2012	690	45	44	2.6	100	44	340	160	<0.05	<1	<0.1	0.2	<0.01	0.024	<0.1	340	<10	<10	1,070	0.100	NA	NA
32S/13E-31H09	11/22/2011	690	41	39	2.7	100	46	350	160	<0.1	<1	0.046	<0.2	0.013	0.03	<0.2	350	<10	<10	1,010	0.0	NA	NA
32S/13E-31H09	7/25/2011	690	44	39	4.5	86	40	340	166.9	<0.05	<1	<0.1	0.145	<0.01	0.026	<0.1	340	<5	<5	1,070	<0.1	NA	NA

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Well	Date	TDS	Chloride	Sodium	Potassium	Calcium	Magnesium	Bicarbonate as CaCO3	Sulfate	Nitrate (as N)	Total Kjeldahl Nitrogen	Boron	Fluoride	Iodide	Manganese	Bromide	Total Alkalinity as CaCO3	Carbonate as CaCO3	Hydroxide as CaCO3	Specific Conductivity	Iron	Bromide / Chloride Ratio	Chloride / Bromide Ratio
32S/13E-31H13	10/11/2017	390	77	70	3.7	4.9	38	190	15	ND	0.11	0.16	0.034	0.039	0.079	0.28	220	29	ND	648	1.1	0.0036	275
32S/13E-31H13	7/11/2017	390	76	80	3.9	7.8	45	190	30	ND	ND	0.15	0.033	0.036	0.13	0.28	210	19	ND	680	2.2	0.0037	271
32S/13E-31H13	4/12/2017	430	79	87	4.4	4	44	180	21	ND	0.13	0.17	0.024	0.043	0.77	0.28	220	40	ND	667	4.5	0.0035	282
32S/13E-31H13	1/13/2017	480	81	95	4.7	3.9	41	190	14	ND	ND	0.19	0.037	0.056	0.065	0.31	220	33	ND	652	3.3	0.0038	261
32S/13E-31H13	10/12/2016	410	80	87	4.3	4.2	43	190	22	ND	ND	0.18	0.04	0.055	0.072	0.29	220	33	ND	678	2.3	0.0036	276
32S/13E-31H13	7/20/2016	510	91	99	5.1	2.4	34	170	19	<0.096	<0.080	0.22	0.043	0.054	0.038	0.43	210	44	<4.1	694	1.2	0.0047	212
32S/13E-31H13	4/13/2016	450	94	99	4.6	2.5	33	150	25	<0.096	<0.080	0.22	0.054	0.045	0.035	0.44	200	51	<4.1	701	1.2	0.0047	214
32S/13E-31H13	1/13/2016	460	99	97	4.8	2.6	32	150	30	<0.022	<0.080	0.19	0.084	<0.010	0.038	0.53	190	43	<4.1	717	0.33	0.0054	187
32S/13E-31H13	10/14/2015	370	85	91	4.8	3.1	32	159	45	<0.05	<1	0.23	<0.10	0.060	0.043	0.26	189	30	<10	710	0.30	0.0031	327
32S/13E-31H13	7/15/2015	390	90	99	4.4	2.7	34	145	55	<0.05	<1	0.21	<0.1	0.06	0.034	0.24	185	40	<10	730	0.24	0.0027	375
32S/13E-31H13	4/16/2015	360	89	86	4.8	2.6	31	137	58	<0.05	<1	0.20	<0.1	0.057	0.030	0.266	172	35	<10	680	0.42	0.0030	335
32S/13E-31H13	1/14/2015	390	90	84	4.8	2	31	140	61	<0.05	<1	0.18	<0.1	0.059	0.035	0.24	170	30	<10	670	0.47	0.0026	383
32S/13E-31H13	10/16/2014	370	80	84	5.0	3.2	32	146	59	<0.05	<1	0.19	<0.1	0.055	0.044	0.18	170	24	<10	720	0.61	0.0023	444
32S/13E-31H13	7/30/2014	380	86	81	4.2	3.6	35	158	61	<0.05	<1	0.16	<0.1	0.05	0.047	0.17	175	17	<10	730	0.25	0.0020	506
32S/13E-31H13	4/17/2014	380	84	86	5.2	3	26	120	87	<0.05	<1	0.18	<0.1	0.08	0.032	0.3	143	23	<10	730	0.45	0.0036	280
32S/13E-31H13	1/16/2014	390	89	91	5.0	4.1	34	119	103	<0.05	<1	0.20	<0.1	0.06	0.043	0.34	136	17	<10	740	0.30	0.0038	262
32S/13E-31H13	10/16/2013	410	84	87	4.7	5.3	33	114	130	<0.05	<1	0.17	<0.1	0.08	0.053	0.3	124	10	<10	760	0.28	0.0036	280
32S/13E-31H13	7/11/2013	420	80	70	4.8	4.5	35	116	120	<0.05	<1	0.19	<0.1	0.06	0.047	0.21	136	20	<10	760	0.19	0.0026	381
32S/13E-31H13	4/11/2013	450	77	77	4.7	5.8	38	113	150	<0.05	<1	0.19	<0.1	0.06	0.069	0.2	128	15	<10	780	0.15	0.0026	385
32S/13E-31H13	1/15/2013	420	74	78	4.7	7.0	40	110	180	<0.05	<1	0.18	<0.1	<0.01	0.087	<0.1	125	15	<10	810	0.55	NA	NA
32S/13E-31H13	10/30/2012	380	88	99	5.7	3.3	30	160	63	<0.05	<1	0.25	<0.1	0.08	0.035	0.3	168	7.5	<10	740	0.33	0.0034	293
32S/13E-31H13	7/25/2012	390	108	107	5.5	2.7	29	13	66	<0.05	<1	0.28	<0.1	0.079	0.0037	0.23	168	155	<10	750	0.84	0.0021	470
32S/13E-31H13	4/19/2012	390	110	83	4.3	2.5	26	400	68	<0.1	<1	0.22	0.23	0.09	0.032	0.39	420	20	<10	790	0.24	0.0035	282
32S/13E-31H13	1/12/2012	410	94	95	4.5	3.0	28	300	68	<0.1	<1	0.24	<0.2	0.1	0.032	0.31	320	20	<10	760	0.89	0.0033	303
32S/13E-31H13	11/21/2011	410	94	83	4.6	3.4	30	152	72	<0.05	<1	0.21	<0.1	0.09	0.035	0.3	160	8	<10	730	0.65	0.0032	313
32S/13E-31H13	7/25/2011	420	90	84	7.1	4.4	31	148	91.8	<0.05	<1	0.20	<0.1	0.071	0.046	0.297	150	2.5	<5	760	1.90	0.0033	302
32S/13E-31H13	4/21/2011	380	88	110	6.3	4.0	27	140	101	<0.05	<1	0.41	0.14	0.07	0.13	0.33	140	<2.0	<2.0	750	N/A	0.0038	267
32S/13E-31H13	1/24/2011	430	83	73	6	6.3	31	160	100	<0.05	<1.0	0.22	0.11	0.66	0.078	0.28	160	<2.0	<2.0	780	0.49	0.0034	296
32S/13E-31H13	10/21/2010	410	87	100	3.9	6.0	33	148	100	<0.1	<1.0	0.14	<0.1	NA	0.087	<0.3	148	<10	<10	796	0.66	NA	NA
32S/13E-31H13	7/26/2010	446	94	93.0	8.81	10.2	32.0	38.4	120	< 0.10	< 0.50	0.142	< 0.10	0.32	0.196	0.48	56.0	17.6	< 1.0	700	22.4	0.0051	196
32S/13E-31H13	4/26/2010	416	96	87.6	9.86	14.8	37.1	46.0	150	< 0.1	0.63	0.132	< 0.10	0.39	0.579	0.44	58.0	12.0	< 1.0	780	56.2	0.0046	218
32S/13E-31H13	1/27/2010	498	89	79.6	10.2	15.6	38.0	31.0	180	< 0.10	0.56	0.132	< 0.10	0.19	0.283	0.38	51.0	20.0	< 1.0	810	23.6	0.0043	234
32S/13E-31H13	10/20/2009	446	100	97.1	12.8	16.4	37.9	26.6	180	< 0.10	0.56	0.168	0.2	< 0.10	0.180	0.42	42.6	16.0	< 1.0	760	18.9	0.0042	238
32S/13E-31H13	8/19/2009	426	160	101	18.9	93.2	29.1	64.4	36	< 0.10	0.98	NA	0.2	0.31	5.490	0.60	84.4	20.0	< 1.0	790	682	0.0038	267
32S/13E-31H13	5/16/1983	770	60	70	NA	90	70	330	120	9	NA	NA	0.1	NA	0.02	NA	330	ND	ND	1,100	0.24	NA	NA

Well	Date	TDS	Chloride	Sodium	Potassium	Calcium	Magnesium	Bicarbonate as CaCO3	Sulfate	Nitrate (as N)	Total Kjeldahl Nitrogen	Boron	Fluoride	Iodide	Manganese	Bromide	Total Alkalinity as CaCO3	Carbonate as CaCO3	Hydroxide as CaCO3	Specific Conductivity	Iron	Bromide / Chloride Ratio	Chloride / Bromide Ratio
12N/36W-36L01	10/11/2017	880	35	65	3.7	140	50	190	430	0.43	0.14	0.19	0.048	ND	0.054	ND	190	ND	ND	1210	0.23	NA	NA
12N/36W-36L01	7/12/2017	1,000	37	73	3.9	150	55	180	420	0.36	0.15	0.17	0.034	ND	0.0048	ND	180	ND	ND	1,180	0.23	NA	NA
12N/36W-36L01	4/12/2017	860	37	73	4	130	49	180	420	0.45	0.14	0.17	0.017	ND	0.0087	0.06	180	ND	ND	1,170	0.43	0.0017	597
12N/36W-36L01	1/12/2017	870	38	76	3.8	150	55	190	430	0.46	0.12	0.21	0.036	ND	ND	0.07	190	ND	ND	1,180	0.11	0.0018	543
12N/36W-36L01	10/12/2016	890	35	72	3.8	140	56	190	430	0.42	0.11	0.17	0.036	ND	ND	0.12	190	ND	ND	1220	0.037	0.0034	292
12N/36W-36L01	7/19/2016	920	37	69	3.6	130	50	180	430	1.9	0.25	0.15	0.043	<0.010	<0.0040	0.10	180	<8.2	<8.2	1,200	<0.030	0.0027	370
12N/36W-36L01	4/12/2016	860	38	65	3.5	130	49	180	390	2.0	<0.080	0.16	0.036	<0.010	<0.0040	0.12	180	<8.2	<8.2	1,210	<0.05	0.0032	317
12N/36W-36L01	1/14/2016	890	36	64	3.4	130	49	180	410	0.47	<0.080	0.15	0.062	<0.010	<0.0040	0.10	180	<8.2	<8.2	1,210	0.070	0.0028	360
12N/36W-36L01	10/15/2015	920	37	63	4.2	120	47	180	400	0.68	<1	0.15	<0.20	<0.01	<0.005	<0.20	180	<10	<10	1,210	<0.05	NA	NA
12N/36W-36L01	7/16/2015	930	39	74	2.8	140	50	180	410	1.2	<1	0.15	<0.1	<0.01	<0.005	<0.1	180	<10	<10	1,210	<0.05	NA	NA
12N/36W-36L01	4/14/2015	890	38	55	3.1	110	44	180	440	0.759	1.0	0.16	<0.2	<0.01	<0.005	<0.2	180	<10	<10	1,160	<0.05	NA	NA
12N/36W-36L01	1/13/2015	880	39	59	3.0	120	45	180	440	0.584	<1	0.14	<0.1	<0.01	<0.005	<0.1	180	<10	<10	1,160	<0.05	NA	NA
12N/36W-36L01	10/15/2014	910	34	58	3.7	120	43	180	380	0.950	<1	0.14	<0.2	<0.01	<0.005	<0.2	180	<10	<10	1,210	<0.05	NA	NA
12N/36W-36L01	7/30/2014	890	36	61	3.2	120	47	180	390	0.603	<1	0.12	<0.2	<0.01	<0.005	<0.2	180	<10	<10	1,220	<0.05	NA	NA
12N/36W-36L01	4/16/2014	910	36	46	2.6	76	27	180	440	0.77	<1	0.15	<0.1	<0.01	<0.005	<0.1	180	<10	<10	1,200	<0.05	NA	NA
12N/36W-36L01	1/16/2014	910	35	60	3.1	110	42	180	416	1.00	1.1	0.14	<0.2	<0.01	<0.005	<0.2	180	<10	<10	1,190	<0.05	NA	NA
12N/36W-36L01	10/16/2013	910	40	63	4.5	120	43	170	460	0.76	<1	0.13	<0.2	<0.01	<0.005	<0.2	170	<10	<10	1,210	<0.05	NA	NA
12N/36W-36L01	7/10/2013	910	39	54	3.2	120	42	175	430	0.78	<1	0.14	<0.1	<0.01	<0.005	<0.1	175	<10	<10	1,210	0.18	NA	NA
12N/36W-36L01	4/11/2013	890	38	59	3.6	110	43	180	420	0.82	<1	0.16	<0.2	<0.01	<0.005	<0.2	180	<10	<10	1,200	<0.05	NA	NA
12N/36W-36L01	1/15/2013	870	39	61	3.4	110	41	178	440	0.57	<1	0.15	<0.2	<0.01	<0.005	<0.2	178	<10	<10	1,190	0.13	NA	NA
12N/36W-36L01	10/31/2012	910	35	66	4.0	130	46	165	400	1.60	<1	0.16	0.2	<0.01	<0.005	<0.5	165	<10	<10	1,200	<0.05	NA	NA
12N/36W-36L01	7/24/2012	880	43	65	3.9	110	41	168	420	<0.05	<1	0.16	<0.1	<0.01	0.02	<0.1	168	<10	<10	1,190	0.19	NA	NA
12N/36W-36L01	4/18/2012	880	47	52	3.2	95	36	180	450	0.42	<1	0.12	<0.2	<0.01	<0.005	<0.2	180	<10	<10	1,190	<0.1	NA	NA
12N/36W-36L01	1/11/2012	790	41	64	4.1	120	44	170	380	1.30	<1	0.19	0.18	<0.02	<0.005	<0.2	170	<10	<10	1,190	<0.1	NA	NA
12N/36W-36L01	11/21/2011	910	39	55	3.5	110	40	180	380	0.37	<1	0.16	<0.2	<0.01	<0.005	<0.2	180	<10	<10	1,200	<0.1	NA	NA
12N/36W-36L01	7/25/2011	890	41	65	5.7	110	43	170	408.9	0.39	<1	0.15	<0.1	<0.01	<0.005	<0.1	170	<5	<5	1,200	0.024	NA	NA
12N/36W-36L01	4/21/2011	890	42	61	4.2	100	30	170	415	0.60	<1	0.19	0.07	<0.01	<0.005	<0.1	170	<2.0	<2.0	1,200	NA	NA	NA
12N/36W-36L01	1/24/2011	890	41	55	5.1	98	36	180	400	0.50	<1.0	0.20	0.15	<0.10	<0.005	<0.1	180	<2.0	<2.0	1,200	<0.1	NA	NA
12N/36W-36L01	10/21/2010	910	38	76	3.6	130	47	169	400	0.39	<1.0	0.10	<0.1	NA	<0.005	<0.3	169	<10	<10	1,213	<0.1	NA	NA
12N/36W-36L01	7/27/2010	707	36	64.2	3.70	127	47.4	182	420	0.40	< 0.50	0.158	< 0.10	< 0.10	< 0.00500	0.11	182	< 1.0	< 1.0	1,100	< 0.100	0.0031	327
12N/36W-36L01	4/26/2010	860	42	70.3	4.13	129	48.9	191	400	0.45	0.77	0.223	< 0.1	0.15	0.057	0.14	191	< 1.0	< 1.0	1,100	4.53	0.0033	300
12N/36W-36L01	10/21/2009	856	38	72.0	4.64	131	48.2	192	420	0.49	0.84	0.150	0.12	< 0.10	0.0994	0.13	192	< 1.0	< 1.0	1,100	1.68	0.0034	292
12N/36W-36L01	8/20/2009	890	39	78.0	4.21	138	48.1	184	390	0.49	0.56	NA	< 0.10	< 0.10	0.185	0.14	184	< 1.0	< 1.0	1,200	2.03	0.0036	279
12N/36W-36L01	5/11/2009	832	63	83.8	4.88	111	45.4	204	330	NA	NA	NA	0.12	NA	0.551	0.22	204	< 1.0	< 1.0	1,200	4.02	0.0035	286
12N/36W-36L01	3/26/1996	882	35	66	4.8	124	47	233	408	2	NA	0.24	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12N/36W-36L01	6/8/1976	936	38	72	3.5	130	48	223	423	0.6	NA	0.15	0.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Appendix A: NCMA Sentry Wells Water Quality Data

Well	Date	TDS	Chloride	Sodium	Potassium	Calcium	Magnesium	Bicarbonate as CaCO3	Sulfate	Nitrate (as N)	Total Kjeldahl Nitrogen	Boron	Fluoride	Iodide	Manganese	Bromide	Total Alkalinity as CaCO3	Carbonate as CaCO3	Hydroxide as CaCO3	Specific Conductivity	Iron	Bromide / Chloride Ratio	Chloride / Bromide Ratio
12N/36W-36L02	10/11/2017	830	100	100	5.9	97	44	280	230	ND	1.8	0.36	0.087	0.13	0.16	0.66	280	ND	ND	1220	0.41	0.0066	152
12N/36W-36L02	7/12/2017	940	97	100	6.1	98	45	250	230	ND	2.2	0.32	0.096	0.13	0.16	0.59	250	ND	ND	1,200	0.75	0.0061	164
12N/36W-36L02	4/12/2017	780	97	120	6.7	98	43	250	240	ND	2.2	0.35	0.082	0.14	0.16	0.51	250	ND	ND	1,190	0.77	0.0053	190
12N/36W-36L02	1/12/2017	810	94	120	6.6	110	48	270	240	ND	2	0.36	0.08	0.19	0.19	0.53	270	ND	ND	1,200	1.1	0.0056	177
12N/36W-36L02	10/12/2016	820	99	120	6.6	110	50	270	240	ND	2	0.35	0.084	0.14	0.17	0.58	270	ND	ND	1230	0.1	0.0059	171
12N/36W-36L02	7/19/2016	820	97	110	6.2	95	45	270	240	<0.096	2	0.33	0.081	0.1	0.15	0.65	270	<8.2	<0.82	1,220	0.14	0.0067	149
12N/36W-36L02	4/12/2016	800	96	100	6	94	44	270	230	<0.096	1.8	0.32	0.12	0.12	0.14	0.81	270	<8.2	<0.82	1,240	0.37	0.0084	119
12N/36W-36L02	1/14/2016	860	96	110	6.4	99	47	260	230	<0.018	1.6	0.34	0.10	0.078	0.17	0.65	260	<8.2	<8.2	1,240	1.9	0.0068	148
12N/36W-36L02	10/15/2015	800	89	96	6.0	91	0.15	266	230	<0.05	2.2	0.32	0.22	0.098	0.15	0.37	266	<10	<10	1,220	0.32	0.0042	241
12N/36W-36L02	7/16/2015	840	97	120	5.9	110	46	260	240	<0.05	2.44	0.34	0.11	0.11	0.15	0.59	260	<10	<10	1,230	0.16	0.0061	164
12N/36W-36L02	4/14/2015	800	98	88	5.3	83	39	270	240	<0.05	2.9	0.33	0.104	0.089	0.13	0.380	270	<10	<10	1,180	0.40	0.0039	258
12N/36W-36L02	1/13/2015	820	100	91	5.5	86	39	250	250	<0.05	2.2	0.31	0.105	0.09	0.13	0.322	250	<10	<10	1,190	0.077	0.0032	311
12N/36W-36L02	10/15/2014	800	88	96	6.4	91	40	260	210	<0.05	2.1	0.32	<0.1	0.092	0.14	0.358	260	<10	<10	1,230	0.12	0.0041	246
12N/36W-36L02	7/30/2014	800	98	99	5.8	88	39	280	210	<0.05	2.4	0.28	0.11	0.09	0.14	0.19	280	<10	<10	1,240	0.27	0.0019	516
12N/36W-36L02	4/16/2014	820	95	89	6.3	73	31	280	210	<0.05	2.3	0.31	<0.1	0.09	0.13	0.35	280	<10	<10	1,240	0.22	0.0037	271
12N/36W-36L02	1/16/2014	800	100	87	5	76	33	270	230	<0.05	2.3	0.31	0.23	0.09	0.14	0.44	270	<10	<10	1,230	0.41	0.0044	227
12N/36W-36L02	10/16/2013	810	90	110	6.4	91	40	260	240	<0.05	2.2	0.32	<0.1	0.1	0.15	0.32	260	<10	<10	1,220	0.54	0.0036	281
12N/36W-36L02	7/10/2013	790	105	94	5.8	88	38	260	240	<0.05	2.5	0.34	<0.1	0.08	0.13	0.11	260	<10	<10	1,240	0.31	0.0010	955
12N/36W-36L02	4/11/2013	830	100	99	6.2	83	37	260	220	<0.05	2.2	0.35	<0.1	0.098	0.14	0.45	260	<10	<10	1,240	0.60	0.0045	222
12N/36W-36L02	1/15/2013	770	110	110	6.7	84	38	265	220	<0.05	2.8	0.36	<0.1	0.02	0.14	0.20	265	<10	<10	1,240	0.61	0.0018	550
12N/36W-36L02	10/31/2012	800	100	120	7.3	90	39	265	200	<0.1	2.4	0.4	0.34	0.12	0.14	0.34	265	<10	<10	1,250	0.30	0.0034	294
12N/36W-36L02	7/24/2012	800	134	125	7.4	83	35	277	200	<0.05	2.3	0.42	0.13	0.12	0.14	0.31	277	<10	<10	1,250	0.52	0.0023	432
12N/36W-36L02	4/18/2012	770	130	95	6.2	75	33	270	210	0.42	4	0.35	0.36	0.12	0.13	<0.2	270	<10	<10	1,250	0.77	NA	NA
12N/36W-36L02	1/11/2012	900	122	110	7.2	95	37	290	170	<0.1	4.8	0.48	0.28	<0.02	0.17	0.45	290	<10	<10	1,250	1.80	0.0037	271
12N/36W-36L02	11/21/2011	780	130	95	6.1	77	33	270	160	<0.1	<1	0.4	<0.2	<0.01	0.13	0.45	270	<10	<10	1,240	0.40	0.0035	289
12N/36W-36L02	7/25/2011	790	129	110	9.1	74	33	280	177	<0.05	2.3	0.36	0.12	0.14	0.13	0.51	280	<5	<5	1,280	2.30	0.0040	252
12N/36W-36L02	4/21/2011	770	120	90	5.3	86	26	280	206	<0.05	2.3	0.24	0.26	0.14	0.004	0.57	280	<2.0	<2.0	1,270	NA	0.0048	211
12N/36W-36L02	1/24/2011	800	120	95	7.6	75	30	300	190	<0.05	2.3	0.39	0.16	1.31	0.13	0.53	300	<2.0	<2.0	1,270	1.40	0.0044	226
12N/36W-36L02	10/21/2010	770	120	130	7.6	89	44	275	160	<0.1	3.4	0.48	<0.1	NA	0.15	0.54	275	<10	<10	1,293	0.12	0.0045	222
12N/36W-36L02	7/27/2010	737	110	121	7.81	91.1	38.9	268	190	< 0.10	< 0.50	0.427	0.10	0.77	0.180	0.80	268	< 1.0	< 1.0	1,200	0.845	0.0073	138
12N/36W-36L02	4/26/2010	720	100	116	6.88	85.4	32.4	215	210	1.5	0.77	0.382	0.2	0.28	0.167	0.7	215	< 1.0	< 1.0	1,100	3.870	0.0070	143
12N/36W-36L02	10/21/2009	638	99	113	6.15	81.6	23.0	172	200	< 0.10	3.2	0.268	0.33	57	0.128	0.61	172	< 1.0	< 1.0	940	0.255	0.0062	162
12N/36W-36L02	8/20/2009	785	100	131	6.66	89.8	36.6	290	190	< 0.10	3.8	NA	0.15	0.27	0.307	0.75	290	< 1.0	< 1.0	1,200	0.830	0.0075	133
12N/36W-36L02	5/11/2009	775	120	132	7.24	84	39.7	294	180	NA	NA	NA	0.18	NA	0.426	0.78	294	< 1.0	< 1.0	1,300	0.958	0.0065	154
12N/36W-36L02	3/26/1996	772	127	130	8.7	86	36	390	148	0.2	NA	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12N/36W-36L02	6/8/1976	820	126	118	6.6	94	44	393	184	0	NA	NA	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Well	Date	TDS	Chloride	Sodium	Potassium	Calcium	Magnesium	Bicarbonate as CaCO3	Sulfate	Nitrate (as N)	Total Kjeldahl Nitrogen	Boron	Fluoride	Iodide	Manganese	Bromide	Total Alkalinity as CaCO3	Carbonate as CaCO3	Hydroxide as CaCO3	Specific Conductivity	Iron	Bromide / Chloride Ratio	Chloride / Bromide Ratio
12N/35W-32C03	10/11/2017	320	64	63	2.8	14	6.5	53	28	8.4	0.11	0.11	0.04	ND	0.01	0.17	53	ND	ND	445	0.6	0.0027	376
12N/35W-32C03	7/11/2017	370	63	71	2.9	16	7	55	28	7.9	ND	0.094	0.035	ND	0.0062	0.21	55	ND	ND	450	0.3	0.0033	300
12N/35W-32C03	4/11/2017	300	65	66	2.8	14	6.6	52	28	8	ND	0.082	0.038	ND	ND	0.19	52	ND	ND	442	0.077	0.0029	342
12N/35W-32C03	1/13/2017	300	67	72	3	16	7.1	53	29	8.2	ND	0.093	0.033	ND	ND	0.21	53	ND	ND	449	0.072	0.0031	319
12N/35W-32C03	10/13/2016	310	64	68	2.9	14	6.5	53	25	8.1	0.12	0.088	0.08	ND	ND	0.18	53	ND	ND	433	ND	0.0028	356
12N/35W-32C03	7/20/2016	300	66	65	2.8	13	6.4	57	26	35	<0.08	0.087	0.03	<0.010	<0.0040	0.16	57	<4.1	<4.1	450	0.039	0.0024	413
12N/35W-32C03	4/13/2016	290	65	66	2.8	14	6.5	51	26	36	0.086	0.083	0.039	<0.010	<0.0040	0.22	51	<4.1	<4.1	438	0.08	0.0034	295
12N/35W-32C03	1/14/2016	290	69	68	2.9	14	6.3	50	27	8.6	<0.08	0.094	0.083	<0.010	<0.0040	0.16	50	<4.1	<4.1	430	0.079	0.0023	431
12N/35W-32C03	10/14/2015	280	61	57	2.6	12	5.8	51	28	8.4	<1	0.090	<0.10	<0.01	<0.005	<0.10	51	<10	<10	430	0.33	NA	NA
12N/35W-32C03	7/14/2015	280	64	67	2.7	14	6.2	50	30	8.0	<1	0.10	<0.1	<0.01	<0.005	<0.1	50	<10	<10	440	0.22	NA	NA
12N/35W-32C03	4/15/2015	280	62	52	2.4	12	5.4	51	30	7.8	<1	0.081	<0.1	<0.01	<0.005	0.11	51	<10	<10	420	0.11	0.0018	564
12N/35W-32C03	1/14/2015	290	63	56	2.3	13	5.8	51	30	8.2	<1	0.077	<0.1	<0.01	<0.005	0.1	51	<10	<10	420	0.38	0.0016	630
12N/35W-32C03	10/16/2014	270	55	54	2.7	13	5.7	51	26	7.3	0.3	0.069	<0.1	<0.01	0.005	<0.1	51	<10	<10	430	0.35	NA	NA
12N/35W-32C03	7/30/2014	280	60	58	1.9	14	6.5	60	29	7.3	<1	<0.1	<0.1	<0.01	<0.005	<0.1	60	17	<10	450	0.16	NA	NA
12N/35W-32C03	4/15/2014	270	57	55	2.2	12	5	54	29	7.1	<1	0.096	<0.1	<0.01	<0.005	0.11	54	<10	<10	430	0.21	0.0019	518
12N/35W-32C03	1/16/2014	300	62	57	2.8	14	6.3	54	35	8.1	8.2	<0.1	<0.1	<0.01	0.008	0.12	54	<10	<10	450	0.47	0.0019	517
12N/35W-32C03	10/16/2013	310	58	62	2.9	15	6.4	54	38	7.5	<1	0.06	<0.1	<0.01	0.009	0.1	54	<10	<10	450	0.21	0.0017	580
12N/35W-32C03	7/11/2013	290	60	45	2.4	14	5.9	61	30	7.4	<1	0.071	<0.1	<0.01	0.006	<0.1	61	<10	<10	440	0.17	NA	NA
12N/35W-32C03	4/12/2013	330	58	55	2.9	16	6.6	60	35	7.5	<1	0.091	<0.1	<0.01	0.019	0.1	60	<10	<10	460	0.49	0.0017	580
12N/35W-32C03	1/15/2013	290	62	57	2.8	15	6.3	55	38	8.3	<1	0.089	<0.1	<0.01	0.01	<0.1	55	<10	<10	470	0.23	NA	NA
12N/35W-32C03	10/30/2012	330	57	60	3.3	19	7.5	60	36	7.8	<1	0.09	<0.1	<0.01	0.033	<0.1	60	<10	<10	470	1.9	NA	NA
12N/35W-32C03	7/25/2012	330	67	61	3.3	17	6.4	59	35	8.2	<1	<0.1	<0.1	<0.01	0.068	<0.1	59	<10	<10	460	0.49	NA	NA
12N/35W-32C03	4/19/2012	370	74	52	2.9	30	12	120	58	5	<1	0.17	0.2	<0.01	0.056	<0.2	120	<10	<10	580	1.3	NA	NA