MEMORANDUM

To:	Nick Kunstek
From:	Matt Naftaly
Subject:	Revisions to the Draft Montecito Groundwater Basin GSP
Date:	December 22, 2022
cc:	Nick Turner, Adam Kanold
Attachment(s):	DRAFT Chapter 2

Mr. Kunstek:

Dudek is providing a revised version of *Chapter 2: Basin Setting* of the Montecito Groundwater Basin (MGB) Groundwater Sustainability Plan (GSP) attached to this letter. Dudek originally provided an initial DRAFT of Chapter 2 to the GSA for review in November 2019, which documented jurisdictional boundaries in the MGB, regulatory and monitoring programs, and historical and current groundwater, surface water, and hydrologic conditions in the MGB. The Montecito Groundwater Sustainability Agency (GSA) provided comments on this initial draft, which Dudek incorporated into the initial draft document.

Since completion of the initial draft, Dudek has worked closely with the GSA to develop the Basin Numerical Model for the MGB, which has included the development of future scenarios; estimate the historical and future sustainable/safe yield of the MGB; further evaluate state-provided datasets documenting potential groundwater dependent ecosystems in the MGB; and implement and describe activities associated with State-funded grant programs. The data and understanding gained from these evaluations have been incorporated into the DRAFT Chapter 2 attached. These data have been incorporated into, and are described in, the following sections of the attached draft:

- Section 2.1.2.5 – Monitoring Network Grant Programs
- Section 2.2.4.7 – Groundwater Dependent Ecosystems
- Section 2.3.5 – Quantification of Historical, Current, and Future Water Budget
- Section 2.3.6. – Discussion of Model Calibration and Uncertainties
- Section 2.3.7 – Quantification of Overdraft
- Section 2.3.8 – Estimate of Sustainable Yield
- Section 2.3.9 – Surface Water Available for Groundwater Recharge or In-Lieu Use

To support the development of these Sections, Dudek has also prepared the following appendices that document data relied upon and discussed in the chapter text:

- Appendix D – Groundwater Level Data

- Appendix E – Groundwater Dependent Ecosystem Inventory and Evaluation
- Appendix F – Water Budget Tables

The sections not listed above are largely the same as the revised initial draft provided to GSA and stakeholder committees in November 2019, with minor edits made to correct language and typos, as necessary.

If you have any questions, please contact Matt Naftaly at mnaftaly@dudek.com.

CHAPTER 2: Table of Contents

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CHAPTER 2
PLAN AREA AND BASIN SETTING

This chapter of the Montecito Groundwater Basin (MGB) Groundwater Sustainability Plan (GSP) is organized into four major parts, as follows: Section 2.1, Description of the Plan Area, covers administrative, statutory, and policy issues, as well as aspects of the built environment related to water supply and demand. Section 2.2, Basin Setting, describes the physical setting and technical data used to develop the hydrogeologic conceptual model for the MGB. This section also describes the current and historical groundwater conditions in the MGB. Section 2.3, Water Budget, covers the groundwater budget including groundwater flux, alternative water supplies, and quantification of historical, current, and future water budget conditions. Finally, Section 2.4, Management Areas, describes the management areas in the MGB. A list of references cited, as well as all figures, are provided at the end of the chapter.

2.1 DESCRIPTION OF THE PLAN AREA

The Plan Area consists of the MGB, which is designated by the California Department of Water Resources (DWR) under California Water Code Section 12924 as one of California's 515 alluvial basins. The MGB (DWR Basin No. 3-049) is a coastal groundwater basin encompassing approximately 9.6 square miles (6,145 acres) in the southeastern part of Santa Barbara County (the County). The MGB underlies the unincorporated communities of Montecito and Summerland, a portion of Toro Canyon, and a 210-acre portion of the eastern edge of the City of Santa Barbara. It is bounded on the north and northeast by coarse-grained Tertiary age consolidated rocks associated with the Santa Ynez Mountains of California's Transverse Ranges, and on the south by the Pacific Ocean. The eastern boundary of the MGB is approximately a quarter-mile to the east of Toro Canyon Creek, and roughly follows the creek corridor. To the southeast, the MGB boundary is coincident with the boundary of the 7,978-acre Carpinteria Groundwater Basin (DWR Basin No. 3-018) as well as the Carpinteria Water District's service area. The MGB's western boundary roughly marks the boundary between the City of Santa Barbara and Montecito, and separates the MGB from the 6,183-acre Santa Barbara Groundwater Basin (DWR Basin No. 3-017). The surface topography of the MGB ranges from near mean sea level along the southern boundary to about 1,100 feet above mean sea level (amsl) at the northernmost reaches (Figure 2-1, Plan Area and Contributing Watersheds).

The service area boundaries of the Montecito Water District (MWD), which is the Groundwater Sustainability Agency (MBGSA) for the MGB, extend beyond the boundaries of the MGB to the northwest, north, and northeast (Figure 2-2, Water Purveyors within and adjacent to the Groundwater Sustainability Agency Boundary). The service area of the City of Santa Barbara extends into the MGB along its western fringes occupying approximately 74.8 acres of the MGB.[1] Although the City of Santa Barbara is not part of the MBGSA, management of this area will be coordinated with the City of Santa Barbara under an existing Memorandum of Understanding, included as Appendix 2A to this GSP. This GSP therefore consists of a "single plan covering the entire basin developed and implemented by one groundwater sustainability agency," per California Water Code Section 10727(b)(1). For the purpose of development and implementation of this GSP, the "Plan Area" is therefore synonymous with the MGB, although this GSP includes descriptions of adjacent areas for reference purposes, e.g., where relevant to discussion of Plan Area boundary conditions, as well as inflows and outflows in the groundwater budget.

DWR originally designated the MGB as a very low priority basin;[2] however, it was reprioritized as a medium priority basin during Phase 2 of DWR's Sustainable Groundwater Management Act (SGMA) basin reprioritization process (DWR 2020a). This reprioritization was based on an increase in the calculated annual acre-feet (AF) of groundwater extracted from the MGB. GSAs in medium or high priority basins "have the responsibility for adopting a Plan that defines the basin setting and establishes criteria that will maintain or achieve sustainable groundwater management" (23 CCR, Section 350.4[e]).

To the east of the MGB, the Carpinteria Groundwater Basin was reprioritized from a low to high priority basin in 2019 based on an increase in the calculated annual acre-feet of groundwater extracted from the basin. MWD, in cooperation with the Carpinteria Valley Water District, applied for a jurisdictional basin boundary modification, which was approved by DWR in 2018 and resulted in a portion of the southeastern boundary between the MGB and the Carpinteria Groundwater Basin being moved west to coincide with the agencies' abutting service areas (Figure 2-2).

To the west of the MGB is the Santa Barbara Groundwater Basin, DWR Basin No. 3-017. During DWR's initial groundwater basin prioritization, DWR characterized the Santa Barbara Groundwater Basin as having a very low priority. The Santa Barbara Groundwater Basin boundary and prioritization remains as initially determined by DWR processes. As noted above there is an existing Memorandum of Understanding between the City of Santa Barbara and the MBGSA,

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[1] The Detachment Area, Coast Village Road Area, and Westmont Area, as labeled on Figure 2-2, are served by MWD, but are located within the land use jurisdiction of the City of Santa Barbara; there are also fringe areas on the western edge of the MGB that are not within MWD's service area, but within the City of Santa Barbara's water service area. The areas outside of MWD's service area but within the MGB total approximately 74.8 acres and contain a single groundwater well (well 4N/27W-13R01S).

[2] Basin prioritization classifies the California's 517 basins and subbasins into priorities based on components identified in the California Water Code. The priority process consists of applying datasets and information in a consistent, statewide manner in accordance to the provisions in California Water Code Section 10933(b). Further information on DWR's basin prioritization process can be found on the following website: https://water.ca.gov/Programs/Groundwater-Management/Basin-Prioritization.

which includes plans to cooperate on a future basin boundary modification to simplify areas of overlap in jurisdiction and groundwater management (Figure 2-2).

Natural recharge to the MGB occurs through subsurface inflow from unconsolidated and consolidated rocks, infiltration of precipitation over the MGB, and stream seepage. The five major contributing watersheds that bisect the MGB include the Montecito Creek watershed, which is approximately 6.2 square miles (3,968 acres); the Oak Creek watershed, which is approximately 2.0 square miles (1,282 acres); the San Ysidro Creek watershed, which is approximately 4.9 square miles (3,144 acres); the Romero Creek watershed, which is approximately 5.0 square miles (3,223 acres); and the Toro Canyon Creek watershed, which is approximately 4.1 square miles (2,601 acres) (Figure 2-1). Together, these watersheds have an area of 22.2 square miles (14,217 acres). The entire watershed area contributing to the MGB, which includes regions that are not contained within any of the five major watersheds but that contribute recharge to the MGB, is 26.2 square miles (16,753 acres) (Figure 2-1). A summary of the groundwater basins, contributing watersheds, and DWR designations is provided in Table 2-1. Both MWD and the Carpinteria Valley Water District have existing groundwater management plans (GWMPs) developed under Assembly Bill (AB) 3030; these are to be superseded with adoption of GSPs.

Table 2-1
Summary of the Montecito Groundwater Basin, Adjacent Basins, and Contributing Watershed Area

Basin/Watershed Name	**Area**			**DWR Designations**		**Previous Groundwater Management Plan**	**GSP Required per SGMA**
	Acres	*Square Miles*	*Basin Number*	*Critically Overdrafted*	*Basin Priority*		
Montecito Groundwater Basin	6,145	9.6	3-049	No	Medium	Yes	Yes
Adjacent Basins							
Santa Barbara Groundwater Basin	6,183	9.7	3-017	No	Very low	No	No
Carpinteria Groundwater Basin	7,978	12.5	3-018	No	High	Yes	Yes
Watersheds Contributing to the Montecito Groundwater Basin							
Montecito Creek, Oak Creek, San Ysidro Creek, Romero Creek, and Toro Canyon Creek Watersheds[a]	14,217	22.2	Not applicable				

Source: DWR 2020b; USGS StreamStats.

Notes: DWR = Department of Water Resources; GSP = Groundwater Sustainability Plan; SGMA = Sustainable Groundwater Management Act.

[a] These watersheds are relevant for recharge to the Montecito Groundwater Basin and the water budget.

2.1.1 Summary of Jurisdictional Areas and Other Features

The Plan Area consists primarily of private land under County jurisdiction and is bordered to the west by the City of Santa Barbara, to the south by the Pacific Ocean, to the north by public land owned by the U.S. Forest Service, and to the east by the unincorporated community of Carpinteria (Figure 2-3, Jurisdictional Boundaries). The following is a description of additional water-related and resource agencies, the jurisdiction or function of which includes the Plan Area.

2.1.1.1 Land Use Jurisdictions within the Plan Area

Land use jurisdictions in the Plan Area primarily consist of unincorporated parts of the County of Santa Barbara (the County), although the eastern edges of the City of Santa Barbara overlaps approximately 210 acres of the western edges of the Plan Area (Figure 2-2). In addition to the County of Santa Barbara and the City of Santa Barbara, the California Coastal Commission (Commission) has permitting and oversight responsibilities over land use within the California Coastal Zone, which occupies an area of approximately 6.6 square miles (4,249 acres), also shown in Figure 2-3. There is no federal land within the MGB; however, parts of the watersheds south of the crest of the Santa Ynez Mountains that contribute runoff to WGB creeks are located within the Los Padres National Forest which is owned by the federal government (Figure 2-3).

Santa Barbara County

The Department of Planning & Development has land use authority in the unincorporated Santa Barbara County parts of the Plan Area. The Department of Planning and Development conducts policy development, planning, permitting, and inspection services through its divisions which includes administration, building and safety division, development review, and long-range planning. Section 2.1.4, Existing Groundwater Regulatory Programs, provides greater detail on land use, population, and general plan land use policies relevant to the GSP.

California Coastal Commission

The Coastal Zone within the MGB extends from 3 miles offshore to a minimum of about 0.5 miles inland at the west end, and a maximum of about 1.5 miles inland at the east end of the Plan Area (Figure 2-3). Various activities within the Coastal Zone are regulated by the Commission, which was established by the California Coastal Act of 1976. In conjunction with local governments, the Commission regulates aspects of development and access to coastal waters within the Coastal Zone. Relevant to the MGB, the Commission regulates the construction of groundwater wells within the Coastal Zone. Section 2.1.4 provides greater detail on land use, population, and general plan land use policies relevant to the GSP.

2.1.1.2 Water Agencies Relevant to the Plan Area

The retail water agency serving the Plan Area is MWD, with the City of Santa Barbara serving an approximately 69-acre area of the western fringe of the Plan Area. The wholesale water agency relevant to the Plan Area consists of the Central Coast Water Authority (CCWA),[3] which delivers MWD's allocation of State Water Project (SWP) water and supplemental water from other sources, if available, to Lake Cachuma. The water stored in Lake Cachuma and imported to the south coast via the Tecolote Tunnel is delivered through the South Coast Conduit from the City of Santa Barbara's William B. Cater Water Treatment Plant (Cater Water Treatment Plant), to the South Coast Water Agencies, by the Cachuma Operations and Maintenance Board. Each water agency relevant to the Plan Area is described below. Water district boundaries and the locations of small private water systems are shown on Figure 2-2, and a larger view of regional water infrastructure is shown on Figure 2-4, Water Infrastructure Map.

Montecito Water District

MWD is an independent special district providing potable water service to a population of approximately 11,370 located within the unincorporated areas of Montecito, Summerland, and western parts of Toro Canyon in Santa Barbara County. MWD is organized pursuant to California Water Code Section 30000 et seq., which grants it water supply and water management responsibilities within its service area overlying the MGB.

MWD was formed as a County Water District in November 1921, in accordance with the California Water Code, with the purpose of furnishing potable water within MWD's service area (MWD 2017). MWD executed the first contract with the U.S. Bureau of Reclamation (Reclamation) in 1949 to receive water from Lake Cachuma (Bradbury Dam). A merger in 1995 with the former Summerland County Water District increased the total acreage of MWD's service area to the current size of 9,909 acres. MWD's service area includes the unincorporated Montecito and Summerland communities, as well as the western part of Toro Canyon and the eastern tip of the City of Santa Barbara (Figure 2-2). Figure 2-2 shows the western boundary of MWDs service area, where it overlaps with the City of Santa Barbara water service area, and the 93 acres of the MGB that is not covered by MWD's service area.

In the past, MWD's primary water supply management tools were the Water Supply Optimization Plan prepared in 2005, and the Future Water Demand and Water Supply Options report prepared in 2007 (MWD 2005, 2007). The Water Supply Optimization Plan analyzed and prioritized the use of MWD's various sources of supply, identified the optimal operation of the Lake Cachuma

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[3] The Santa Barbara County Flood Control and Water Conservation District is the SWP contractor. It was allocated up to 57,700 AFY of water for the region in 1963; however, ballot measures and other efforts to fund the necessary delivery infrastructure failed until 1991, when, after years of severe drought, voters authorized the required infrastructure funding that led to the formation of the CCWA (MWD 2017).

and Jameson Lake reservoirs, addressed the need for storage and banking of water outside of MWD's service area, and evaluated the purchase and use of other alternative dry-year supplies during periods of drought (MWD 2005). Similarly, the Future Water Demand and Water Supply Options report evaluated MWD's future water demand and the reliability of existing supplies, investigated potential water supply options to supplement existing supplies, and provided recommendations for how to avoid future water supply shortages.

Private Water Companies

In addition to MWD, there are multiple small private water companies that also provide water service within the Plan Area, including Wilkinson/Gill Water Company, Hot Springs/Montecito Creek Water Company, Ivydene Water Company, Lingate Lane Mutual Water Company, Miramar Addition and Improvement Company, Riven Rock Mutual Water Company, Toro Canyon Estates Mutual Water Company, Coyote Springs Water Company, Sea Meadows, and Sunshine Water Company (East Montecito Mutual Water Company) (Figure 2-2; MWD 2017). These small private water companies provide a mix of potable and non-potable water service for both domestic and irrigation/landscape purposes. See Section 2.1.4.3 for additional information on the permitting and reporting requirements of water companies.

Central Coast Water Authority

CCWA is a public entity organized under a joint exercise of powers agreement dated August 1, 1991, by the cities and special districts responsible for the creation and maintenance of water resources in portions of the North County, Santa Ynez Valley, and the South Coast areas of Santa Barbara County. Beginning in 1997, CCWA has delivered SWP water to Lake Cachuma, where it is mixed with Cachuma Project water and any other stored water before being delivered through the Tecolote Tunnel to south coast water purveyors including MWD. CCWA owns and operates a water treatment plant and pipeline that delivers water from the SWP to project participants in Santa Barbara and San Luis Obispo Counties. The distribution system consists of an approximate 130-mile-long pipeline (Coastal Branch Pipeline), treated water tanks at the water treatment plant, three interim storage facilities, one energy dissipation facility, nine turnouts, four isolation valve facilities, a chloramines removal and water pumping facility, and the Lake Cachuma inlet monitoring facility. Major reservoirs, pipelines, tunnels, and water treatment plants are shown on Figure 2-4.

Water supply projections for water from the SWP are based on DWR's determination of the long-term annual average delivery of MWD's SWP Table A allocation. MWD's full allocation of SWP water is 3,300 acre-feet per year (AFY), which includes a 300 AFY drought buffer to enhance the reliability of SWP water during shortages. In 2015, MWD received 2,015 AF from the SWP through CCWA (MWD 2017). As of 2020, the CCWA estimated that MWD would have up to

1,189 AF available for the year, much of it (up to 694 AF) consisting of carryover water from previous years, as the actual SWP allocation for 2020 was only 15% of MWD's Table A allocation (up to 495 AF; CCWA 2020). By contrast, in 2019, the allocation amount was 75%, illustrating the substantial difference that the water year type makes (DWR 2019). On average, MWD's annual DWR Table A allocation has been approximately 60%, and in 2014 was a historically low 5% (MWD 2017). MWD expects that in the years to come, it is likely to receive between 59% and 61% of its full allocation (MWD 2017). This estimate is from the 2015 SWP Delivery Capability Report, which provides the best estimate of anticipated deliveries over the planning and implementation horizon under various hydrologic conditions.

Santa Barbara County Water Agency

The Santa Barbara County Water Agency was established by the State Legislature in 1945 to control and conserve storm, flood, and other surface waters for beneficial use and to enter into contracts for water supply. It prepares investigations and reports on the County's water requirements, groundwater conditions, efficient use of water, and other water-supply-related technical studies, and manages a number of County-wide programs, including the Integrated Regional Water Management (IRWM) Program, the Regional Water Efficiency Program, and the winter cloud seeding program. The Santa Barbra County Water Agency also administers the Cachuma Project and the Twitchell Dam Project contracts with Reclamation, holds the SWP water contract with DWR, and participates in some of the County's GSAs.

Cachuma Operations and Maintenance Board

The Cachuma Project is located within the Santa Ynez Valley of Santa Barbara County and is a primary water supply for the County's south coast communities. The Cachuma Reservoir was built by Reclamation beginning in 1950. In addition to serving the communities and agriculture of the lower Santa Ynez River via reservoir releases, water from Cachuma Project is served to the south coast communities through the Santa Ynez Mountains via the Tecolote Tunnel, the South Coast Conduit, and several reservoirs and treatment plants (COMB 2019). The SWP supply to South Coast agencies is delivered to Cachuma for distribution via Cachuma Project facilities (Figure 2-4).

The Cachuma Operations and Maintenance Board is the joint powers authority, formed in 1956, that is responsible for the operation and maintenance of all Cachuma Project facilities with the exception of Bradbury Dam, which is operated by Reclamation. The Cachuma Operations and Maintenance Board's member units include Goleta Water District, the City of Santa Barbara, MWD, and Carpinteria Valley Water District. The master contract for the Cachuma Project water supply, held by the Santa Barbara County Water Agency, expires in 2020 and is currently under renegotiation. The project yield was determined to be 25,714 AFY, of which 2,651 AFY is allocated to MWD (SBCGJ 2016).

Cachuma Conservation and Release Board

Cachuma Conservation and Release Board is a joint powers authority formed in 1973 consisting of Goleta Water District, the City of Santa Barbara, MWD, and Carpinteria Valley Water District (the Carpinteria Water District has since withdrawn from the joint powers authority). The member-funded organization is tasked with protecting the south coast water rights and is involved in the mandated protection of fisheries and steelhead restoration (CCRB 2020).

2.1.2 Existing Monitoring Programs

2.1.2.1 Groundwater Level Monitoring

In response to Senate Bill (SB) X7-6, passed by the State Legislature in 2009, DWR developed the California Statewide Groundwater Elevation Monitoring (CASGEM) Program to encourage collaboration between local monitoring parties and DWR and to collect statewide groundwater elevations for the purpose of tracking seasonal and long-term groundwater elevation trends in groundwater basins statewide. DWR works cooperatively with local agencies, referred to as CASGEM monitoring entities, to collect and maintain groundwater elevation data in a manner that is readily and widely available to the public through the CASGEM online reporting system.

In April 2018, MWD was designated the monitoring entity for the purpose of tracking groundwater elevation trends within the MGB under CASGEM. Under its groundwater monitoring program, MWD has been collecting semi-annual, static groundwater levels for all active and some inactive MWD groundwater production wells since 1983, occurring each spring and fall during high and low season groundwater levels (MWD 2018). MWD has submitted a CASGEM Monitoring Plan to DWR that identifies the 12 groundwater production wells where water levels will be collected and reported, describes the data collection methodology and reporting format, and commits to continuing to submit semi-annual groundwater elevation data to CASGEM by July 1 and by January 1 for each seasonal high and low groundwater elevation. Within the MGB, MWD has been submitting groundwater elevation data for 12 wells to the CASGEM online reporting system since spring 2018 (MWD 2018).

In addition, since 1983 MWD has conducted a survey of about 60 groundwater wells (consisting of both MWD-owned and private wells) within MWD's service boundary twice a year (Figure 2-5, Current Groundwater Monitoring Network; MWD 2017). The collection of data twice a year reflects groundwater conditions following the rainfall/groundwater recharge season (spring) and the groundwater extraction season (fall). The survey consists of measuring the static water elevations in wells and converting this data to a water storage level with reference to mean sea level. Two groundwater wells in the survey are equipped with automated groundwater level sensors and additional sensors will be added as part of the Sustainable Groundwater Management Grant (see Chapter 4, Projects and Management Actions). These data have been collected by MWD to continue monitoring the MGB and to ascertain groundwater storage conditions within the four defined groundwater storage units in the Plan Area. MWD also coordinates with the U.S. Geological Survey (USGS), which monitors one well (well 4N/26W-17J02S or Ennisbrook 5) in the MGB. Groundwater wells that are routinely monitored for groundwater levels are shown on Figure 2-5 and listed in Table 2-2.

Table 2-2
Current Groundwater Monitoring Network

Common Well Name	MWD Well ID	CASGEM Well ID	Latitude	Longitude	Use	Groundwater Monitoring Networks		
						Elevation	*Quality*	*Production*
Storage Unit 1								
Valley Club 2	1-1	51947	34.43428534	−119.6169238	Irrigation	X	—	X
EVR 8	1-3	—	34.43352008	−119.603945	Monitoring	X	—	—
—	1-4	—	34.44786976	−119.6352207	—	X	—	—
—	1-5	—	34.44751774	−119.6398833	—	X	—	—
—	1-6	—	34.44022383	−119.6394658	—	X	—	—
—	1-7	—	34.4378693	−119.6412301	—	X	—	—
—	1-8	—	34.43807662	−119.6416611	—	X	—	—
—	1-10	—	34.43646126	−119.6060257	—	X	—	—
—	1-11	—	34.43700335	−119.6064426	—	X	—	—
—	1-13	—	34.4367037	−119.614938	—	X	—	—
—	1-14	—	34.43690695	−119.6228628	—	X	—	—
Live Oaks	1-15	—	34.43563354	−119.6264154	Monitoring	X	—	—
—	1-16	—	34.439228	−119.6266207	—	X	—	—
Hodges	1-17	—	34.43708048	−119.6304058	Monitoring	X	—	—
—	1-18	—	34.44083974	−119.6310058	—	X	—	—
—	1-18a	—	34.44083974	−119.6310058	—	X	—	—
T. Mosby	1-19	51941	34.43890778	−119.6325848	Domestic	X	X	X
—	1-21	—	34.44063562	−119.6213389	—	X	—	—
—	1-28	—	34.44552264	−119.6063785	—	X	—	—
—	1-29[a]	—	34.4486092	−119.6327239	—	X	—	—
—	1-30	—	34.44646232	−119.6317048	—	X	—	—
—	1-31	—	34.43823117	−119.6463892	—	X	—	—
—	1-32	—	34.45218904	−119.6669693	—	X	—	—
—	1-33	—	34.44356239	−119.6171353	—	X	—	—
—	1-35	—	34.44566107	−119.6609628	—	X	—	—
—	1-36	—	34.44392102	−119.6649438	—	X	—	—
—	1-37	—	34.43923511	−119.6234443	—	X	—	—
—	1-38[a]	—	34.45005922	−119.6697054	—	X	—	—
—	1-40	—	34.44396595	−119.6258503	—	X	—	—
—	1-42	—	34.43976288	−119.6094941	—	X	—	—
—	1-43[b]	—	34.44330678	−119.5788951	—	X	—	—

Table 2-2
Current Groundwater Monitoring Network

Common Well Name	MWD Well ID	CASGEM Well ID	Latitude	Longitude	Use	Groundwater Monitoring Networks		
						Elevation	*Quality*	*Production*
—	1-45	—	34.44277841	−119.6094477	—	X	—	—
—	1-47	—	34.4531118	−119.6567542	—	X	—	—
—	1-48	—	34.44297749	−119.6573498	—	X	—	—
EVR 3	1-49	51950	34.43118494	−119.6067338	Irrigation	X	—	X
EVR 4	1-50	51951	34.43125376	−119.6080552	Irrigation	X	—	X
Seaview 2	1-51	—	34.4356375	−119.6293937	Monitoring	X	—	—
—	1-52	—	34.44671339	−119.6172078	—	X	—	—
Las Fuentes	1-53	51948	34.4360176	−119.605703	Irrigation	X	—	X
EVR 6	1-54	51952	34.43159237	−119.6078519	Irrigation	X	—	X
Storage Unit 2								
—	2-2	—	34.43319798	−119.6516919	—	X	—	—
—	2-3	—	34.43321036	−119.6521918	—	X	—	—
Storage Unit 3								
Las Entradas 2	3-2	51946	34.42383974	−119.613408	Irrigation	X	—	X
—	3-5[a]	—	34.41894272	−119.6557273	—	X	—	—
—	3-7	—	34.41874629	−119.6433174	—	X	—	—
Neal	3-8	—	34.42567611	−119.6386139	Monitoring	X	—	—
—	3-9	—	34.4280764	−119.6308149	—	X	—	—
Paden 2	3-12a	51942	34.42551094	−119.6196748	Domestic	X	X	X
—	3-15	—	34.42339094	−119.616081	—	X	—	—
—	3-16	—	34.42766978	−119.6445449	—	X	—	—
—	3-17	—	34.42959189	−119.6511446	—	X	—	—
—	3-19	—	34.41983172	−119.6410392	—	X	—	—
—	3-20	—	34.41896692	−119.6387953	—	X	—	—
Amapola	3-22	51943	34.42757182	−119.6249585	Domestic	X	X	X
Morgan	3-23	—	34.42382164	−119.6127863	Monitoring	X	—	—
Underwood	3-24	—	34.42186514	−119.6224629	Monitoring	X	—	—
Ennisbrook 2	3-25	51944	34.42562371	−119.6221383	Domestic	X	X	X
Ennisbrook 5	3-26	51945	34.42734473	−119.6203879	Domestic	X	X	X
—	3-27	—	34.41910028	−119.6477425	—	X	—	—
—	3-28	—	34.42028748	−119.626366	—	X	—	—
Toro Canyon Storage Unit								
—	4-4	—	34.43216406	−119.5745258	—	X	—	—
Edgewood	4-6	51949	34.41626413	−119.5773536	Irrigation	X	—	X

Notes: — = not available or not applicable.

[a] Well located immediately outside the Montecito Groundwater Basin boundary.

[b] Well included in Storage Unit 1 monitoring network; however, well is located in the Toro Canyon Storage Unit.

2.1.2.2 Groundwater Extraction Monitoring

MWD collects groundwater extraction information on at least a weekly basis from up to 12 of its municipal supply wells. All of the municipal supply wells are equipped with propeller flow meters that record total production in gallons. On a monthly basis, the total volume in gallons produced by each MWD well is recorded and reported in acre-feet. Groundwater wells that are routinely monitored for groundwater production are shown on Figure 2-5 and in Table 2-2.

2.1.2.3 Groundwater Quality Monitoring

SWRCB's Groundwater Ambient Monitoring and Assessment Program (GAMA) conducts comprehensive monitoring of California's groundwater quality, compiles and standardizes groundwater quality data across several different sources and regulatory programs, and makes that data readily accessible to the public. In addition, GAMA conducts groundwater studies related to groundwater vulnerability, groundwater quality in domestic wells, and groundwater impacts associated with non-point sources of contamination. GAMA also contains a collection of scientific assessment reports that contain results of regionally specific groundwater quality investigations (GAMA 2020). Water quality data from the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) is included in GAMA, including information on cleanup sites with the potential to impair water quality. In addition, the Surface Water Ambient Monitoring Program) and the California Environmental Data Exchange Network (CEDEN) contain water quality data collected by state and regional monitoring programs. The Regional Water Quality Control Boards (RWQCBs) also oversee several regulatory programs that collect and report water quality data, such as the Irrigated Lands Regulatory Program. Some of these data are accessible in GAMA. Groundwater quality data for the MGB is included in both the GAMA and CEDEN programs and was used in the preparation of the GSP (see Section 2.2.4.4, Groundwater Quality).

MWD routinely monitors water quality in its active domestic groundwater production wells (both raw and treated groundwater quality) and submits the data to SWRCB as part of Title 22 compliance. Groundwater wells that are routinely monitored for groundwater quality are shown on Figure 2-5 and in Table 2-2.

2.1.2.4 Precipitation and Streamflow Monitoring

The primary sources of historical and current climate and streamflow data for the MGB include the County of Santa Barbara Public Works Department, National Oceanic and Atmospheric Administration, California Irrigation Management Information System (CIMIS), and USGS. The primary web access portals for climate data are the County's Public Works Department Hydrology Section webpage, the National Oceanic and Atmospheric Administration's Climate Data Online service, and the CIMIS website, and for streamflow data are the County's Public Works Department Hydrology Section webpage and USGS National Water Information System Mapper.

The data from these monitoring entities are used to inform development of the MGB setting, hydrogeological conceptual model, and groundwater budget.

There are two weather stations in the MGB, both of which are monitored by the County (Figure 2-6). The two weather stations in the MGB include the Montecito (Station No. 325) and Summerland (Station No. 328) stations. The Montecito station has a continuous precipitation record that spans the period from water year 1926 to the present, while the Summerland station has a record that spans the period from water year 1971 to the present, with a data gap from water year 1996 to 2014.[4] In addition to the two stations in the MGB, there are a total of 20 weather stations within a 5-mile radius of the MGB, two of which are located nearby within MWD's service area boundary and are monitored by the County (Figure 2-6, Weather Stations and Average Annual Precipitation in the Plan Area (1981–2010)). The two stations that are outside the MGB but within the MWD service area include the Cold Springs Debris Basin (Station No. 210) and Doulton Tunnel (Station No. 231) stations. Additionally, the weather station with the longest and most complete measurement record in the vicinity of the MGB is the Santa Barbara station (Station No. 234) monitored by the County, which has a continuous precipitation record that spans the period from water year 1900 to the present. In addition, although there is no CIMIS station within the MGB, the closest CIMIS station is the Santa Barbara station (Station No. 107) located approximately 4 miles west of the MGB at the north end of the Santa Barbara Golf Club. This station has recorded reference evapotranspiration data for the region since 1993.

There is one active stream gauge in the MGB monitored by the County (Figure 2-6). This stream gauge (Station No. 2552/2555), which is located on Montecito Creek near the intersection of Hot Springs Road and Olive Mill Road, has recorded sub-hourly (40-minute) stream discharge and stage data since February 2016. Between February 2016 and April 2020 the highest mean daily discharge was 106.44 cubic feet per second (cfs) in March 2020. Stream discharge typically ceased during the summer months.

In addition to the Montecito Creek gauge, there is an inactive USGS stream gauge (Station No. 11119660) on San Ysidro Creek, located approximately 650 feet upstream of the MGB's northern boundary (Figure 2-6). The San Ysidro Creek gauge recorded mean daily discharge from October 1979 to September 1983. During this period, the mean daily stream discharge was 2.74 cfs. Stream discharge over the measurement record ranged from a mean daily discharge of 0.07 cfs in October 1982 to 108 cfs in January 1983. Table 2-3 lists the weather stations and stream gauges in the vicinity of the Plan Area.

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[4] A water year is defined as October 1 of the preceding calendar year to September 30 of the current calendar year. For example, water year 2019 is defined as the period from October 1, 2018, through September 30, 2019.

Table 2-3
Weather Stations and Stream Gauges in the Vicinity of the Plan Area

Station Name (Agency No./ID)	Latitude	Longitude	Elevation (Feet amsl)	Status	Period of Record
Weather Stations					
National Oceanic and Atmospheric Administration					
Juncal Dam, CA US (USC00044422)	34.490795	−119.506888	2,260	Active	1941–present
Montecito California, CA US (USR0000CMNC)	34.461395	−119.648088	1,500	Active	1996–present
Santa Barbara, CA US (USC00047902)	34.41669519	−119.6843875	16	Active	1893–present
Santa Barbara 1.9 NE, CA US (US1CASB0004)	34.44999519	−119.6999875	811	Active	2010–present
County of Santa Barbara					
Botanic Garden (321)	34.45388519	−119.7068875	800	Active	1944–present
Carpinteria Fire Station (208)	34.39693518	−119.5177876	30	Active	1948–present
Carpinteria USFS (383)	34.40193518	−119.4913876	120	Active	1948–present
Cater Water Treatment Plant (229)	34.45416519	−119.7302875	500	Active	1966–present
Cold Springs Debris Basin (210)	34.45110518	−119.6199876	519	Active	1964–present
Doulton Tunnel (231)	34.45777518	−119.5657876	1,775	Active	1931–present
Edison Trail (252)	34.44277517	−119.5077876	1,650	Active	1993–present
El Deseo Ranch (255)	34.49138518	−119.6955875	3,300	Active	1966–present
Gibraltar Dam (230)	34.52249518	−119.6821875	1,500	Active	1919–present
Jameson Dam (232)	34.49082517	−119.5068876	2,230	Active	1925–present
KTYD (227)	34.47110518	−119.6768875	2,375	Active	1968–present
Montecito (325)	34.42749518	−119.6402876	135	Active	1925–present
Santa Barbara (234)	34.42610519	−119.7035875	130	Active	1899–present
Santa Barbara City College (474)	34.40527519	−119.6885875	65	Active	1981–present
Santa Barbara Caltrans (335)	34.43860519	−119.7555875	160	Active	1954–present
Stanwood Fire Station (228)	34.44388519	−119.6905875	670	Active	1953–present
Summerland (328)	34.41527518	−119.5813876	85	Active	1970–present
California Irrigation Management Information System					
Santa Barbara (207)	34.43734819	−119.7374075	—	Active	1993–present
Stream Gauges					
County of Santa Barbara					
Montecito Creek (2552/2555)	34.429587	−119.640544	—	Active	2016–present
U.S. Geological Survey					
San Ysidro Creek (11119660)	34.45	−119.6219444	—	Inactive	1979–1983

Source: NOAA; CIMIS; County of Santa Barbara; USGS.
Notes: amsl = above mean sea level; USFS = U.S. Forest Service; — = data are not available.

2.1.2.5 Monitoring Network Grant Programs

Montecito Water District, as the GSA for the MGB, was awarded a Sustainable Groundwater Management (SGM) Grant funded by the California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access For All Act of 2018 (Proposition 68; Pub. Resources Code Section 80000, et Seq.) and the Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1: Pub. Resources Code, Section 79700 et seq.). The grant agreement was executed in May of 2020 and provided funds to the MBGSA for projects and planning toward the development of the GSP. The grant funded activities "associated with the planning, development, and preparation of a GSP…will incorporate appropriate Best Management Practices (BMPs) as developed by DWR and will result in a more complete understanding of the groundwater subbasin to support long-term sustainable groundwater management." The projects funded by the grant that are relevant to filling data gaps and achieving sustainability within the Basin are:

- Sea Water Intrusion Monitoring;
- Private Well Metering Pilot Program;
- Surface Water Flow Gage Installation; and
- Monitoring Well Construction;

Each project has been implemented and are now producing data relevant to the monitoring program and an understanding of initial conditions within the MGB. Once fully implemented, ongoing data from each project will support the Sustainability Goal established for the Basin and monitoring the Sustainable Management Criteria established in Chapter 3. Data from these projects will also support an update of the Basin Numerical Model (BNM) which has been developed to evaluate and manage the Basin. The grant projects are described below along with a description of how each component has been integrated into the GSP monitoring program.

2.1.2.5.1 Sea Water Intrusion Monitoring

The purpose of the seawater intrusion monitoring project is to determine the presence or lack of seawater intrusion within the MGB and to identify conditions conducive to its occurrence. An additional project goal is to help distinguish sources of chloride in coastal groundwater. This task will be accomplished by monitoring groundwater levels and quality in several pre-existing wells and at least one proposed new well located near the coastline (Figure 2-7, Existing Grant-Funded Monitoring Programs). The seawater intrusion monitoring network currently includes five groundwater wells, four located in Storage Unit 3 and one in the Toro Canyon Storage Unit. Additionally, a new dedicated monitoring well was constructed in southwestern part of the MGB in Storage Unit 3 to expand the seawater intrusion monitoring network and help address an identified data gap(Chapter 4). These wells will be used to assess existing and potential sea water intrusion risk and will be used as monitoring points for minimum thresholds related to groundwater quality, in particular chloride concentrations. Laboratory analysis of groundwater samples will be conducted quarterly for a period of approximately 3 years and semi-annually thereafter. In order to analyze water quality parameters related to incipient seawater intrusion and the source of saline groundwater, analytes will include iodide, bromide, and silica, in addition to chloride. Quarterly reports will be prepared and submitted to DWR in accordance with Grant requirements.

2.1.2.5.2 Private Well Metering Pilot Program

The purpose of the private well metering pilot program is to obtain a sample dataset of private well groundwater extractions in the MGB. This data will then be used in the estimation of total groundwater extraction from the MGB. The project includes installation of up to 45 meters on private wells. Future programs may include remote meter-read capabilities and incentives for voluntary participation.

2.1.2.5.3 Surface Water Flow Gage Installation

The purpose of the surface water flow gage installation project is to collect stream stage and discharge data to better approximate groundwater recharge from streams within the MGB. This project provides a direct method for estimating recharge from streams and improves the understanding of groundwater-surface water interactions within the MGB. Installation of temporary stream stage and discharge equipment and measurements of surface water flows on all the major creeks that transect the MGB began in late 2021. Additionally, semi-permanent stilling wells and one radar unit were installed on San Ysidro Creek, and one stilling well on Romero Creek to measure water levels and to estimate flow (Figure 2-7, Existing Grant-Funded Monitoring Programs). The difference in flow between the gauging sites on each creek will be used to estimate recharge to the MGB aquifer and assist in calibrating the Montecito Basin Numerical Model (MBNM). Monitoring program components include camara installation to document conditions at key locations, stream gages, and variable interval data loggers. It is anticipated that data will be downloaded approximately monthly.2.1.2.5.3 Monitoring Well Construction

The monitoring well construction project fills data gaps identified in the MGB, including aquifer and aquitard lithology and depositional extents, groundwater levels and quality, storage unit groundwater exchange, seasonal groundwater flow dynamics, and seawater intrusion. Through this project, the MBGSA has constructed two new dedicated monitoring wells: one located in Storage Unit 2, near the intersection of Oak Creek and the Arroyo Parida Fault, and the second located in the southwestern part of Storage Unit 3 near the coast. These wells are used to monitor groundwater levels, groundwater quality, and seawater intrusion in the MGB (Section 3.5.2.1).

2.1.3 Existing Management Plans

2.1.3.1 Groundwater Management Plan for the Montecito Water District

In 1992, the State Legislature provided an opportunity for local groundwater management with the passage of AB 3030, the Groundwater Management Act (California Water Code, Part 2.75). Many basins developed GWMPs to provide planned and coordinated monitoring, operation, and administration of groundwater basins with the goal of long-term groundwater resource sustainability. The Groundwater Management Act was first introduced in 1992 as AB 3030, and has since been modified by SB 1938 in 2002 and AB 359 in 2011. These significant pieces of legislation establish, among other things, specific procedures on how GWMPs are to be developed and adopted by local agencies.

MWD adopted a GWMP under AB 3030 in 1998 (MWD 1998). When it was published, the GWMP drew from existing data and sources and provided a review of groundwater conditions in the MGB to date. It also provided guidance for ongoing monitoring and management of groundwater in the MGB, such as wellhead/recharge area protection, well construction/abandonment procedures, ongoing groundwater level monitoring procedures, and control of groundwater contaminant sources, among others (MWD 1998). The GWMP included a safe yield estimate for the MGB of 1,650 AFY, based on an MWD study from 1980 (MWD 1998). The 1998 GWMP will be superseded by this GSP.

2.1.3.2 Santa Barbara County Integrated Regional Water Management Plan 2019 Update

The Santa Barbara County Integrated Regional Water Management Program began in 2005 following the passage of Proposition 50, the Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002. Chapter 8 of Proposition 50 authorized the legislature to appropriate $500 million for IRWM planning, the intent of which was to encourage agencies to develop plans using regional water management strategies for water resources and to develop projects using these IRWM strategies to protect communities from drought, protect and improve water quality, and improve local water security by reducing dependence on imported water. The Santa Barbara County IRWM developed and then adopted its first IRWM plan in 2007, and under Proposition 50 received $25 million for 14 countywide projects. The Santa Barbara County Integrated Regional Water Management Plan (IRWM Plan) was updated under the Proposition 84 Guidelines in 2013, and received 5.7 million for 13 countywide projects. In 2018, the region was awarded almost $900,000 in direct funds to disadvantaged communities, and the region applied for further implementation funds (up to $6.3 million) in spring 2019. It should be noted that there are no disadvantaged communities, severely disadvantaged communities, or economically distressed areas within the MGB (DWR 2020c).

In July 2019, another update to the IRWM Plan was prepared to ensure that the County remains eligible for funding under the Proposition 1 Guidelines (County of Santa Barbara 2019a). The Proposition 1 IRWM Grant Program provides funding for projects that help meet the long-term water needs of the state, including the need to decrease reliance on imported water sources, increase infrastructure resilience to the impacts of climate change, and locally manage and prioritize watershed resources and water infrastructure projects. The 2019 Update focused on improving the previous IRWM Plan and incorporating the outcome of the SGMA and the formation of groundwater sustainability agencies (County of Santa Barbara 2019a). The IRWM Plan region encompasses all of Santa Barbara County.

2.1.3.3 Urban Water Management Plan

Water supply management is outlined in the 2015 and 2020 Urban Water Management Plan (UWMP; MWD 2017; MWD 2021). All urban water suppliers (as defined in California Water Code Section 10617), including MWD, are required to prepare water management plans on a 5-year cycle.[5] These plans describe existing and planned water supply sources, identify human and/or environmental threats to water reliability, outline how they will meet state-mandated water conservation targets,[6] establish water shortage contingency plans, and assess whether their existing and future water supplies will be sufficient over a 20-year planning horizon. Projections of growth and land use in the service area along with drought scenarios are incorporated in the long-term water supply assessment. There are no entities considered to be agricultural water suppliers in the MGB and thus there are no agricultural water management plans relevant to the Plan Area.[7]

MWD's 2020 target for water conservation is 338 gallons per capita per day, compared to MWD's baseline calculation for the 10-year period ending in 2010 of 422 gallons per capita per day. MWD achieved the 2020 target and the 2015 interim target, having reduced per capita per day water use to 284 gallons in 2015. The 2015 UWMP prepared by MWD (MWD 2017) identifies ways to increase the diversity, reliability, and resilience (drought-proofing) of its water supply portfolio, and to protect the sustainability of its groundwater resources by limiting the amount of water MWD pumps from the MGB (MWD 2017). Table 2-4 summarizes MWD's water supply portfolio from 1995 to 2015. The majority of MWD's water supply comes from three major surface water sources (in order of decreasing volume): (1) Lake Cachuma/Cachuma Project water, (2) water from Jameson Lake and Santa Ynez River Tributary Diversions, and (3) SWP water. Collectively over the last 20 years, surface water has made up more than 95% of MWD's typical water year supply,

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[5] Per California Water Code Section 10617, an urban water supplier means a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly, to more than 3,000 customers or supplying more than 3,000 AFY of water.

[6] The Water Conservation Act of 2009 (i.e., SB X7-7) requires that the state reduce urban water consumption by 20% by the year 2020, as measured in gallons per capita per day.

[7] Per California Water Code Section 10608.12(a), an agricultural water supplier means a water supplier, either publicly or privately owned, providing water to 10,000 or more irrigated acres, excluding recycled water.

with Lake Cachuma (48%) and Jameson Lake (26%) representing the bulk of MWD's water supply. The SWP on average made up 15% of the water supply in an average year, although it has been as low as 0% in major drought years. MWD serves the remaining portion of its service area demand from its municipal supply wells in the MGB. The municipal supply wells have provided as little as 53 AF in 1999 to as much as 637 AF in 2015. MWD has the capacity to produce up to 700 AF of local groundwater, although this capability would only be used in an emergency drought situation and would require low utilization in following years to allow the MGB to recover (MWD 2017).

Table 2-4
Produced Water Supply Portfolio (1995–2015)
for the Montecito Water District Service Area

Water Source	20-Year Minimum		20-Year Maximum		20-Year Average (AF)	Average Percentage of Total
	AF	*Year*	*AF*	*Year*		
MWD Municipal Supply						
Fox Creek Diversion	1.9	2015	64	1998	8	0.1%
Jameson Lake	351	2015	2,279	1997	1,420	25.5%
Juncal Seepage	0	2014/15	145	1995	62	1.1%
Doulton Tunnel Infiltration	161	2015	851	2005	353	6.3%
Alder Creek Diversion	7.0	2015	448	1998	0	0.0%
MWD Groundwater Wells	53	1999	637	2015	250	4.5%
Lake Cachuma/Cachuma Project	467	2014	3,913	2013	2,661	47.8%
State Water Project	0	—	3,016	2007	808	14.5%
Total Municipal Supply	**3,839**	**1998**	**7,163**	**2007**	**5,562**	**100.0%**

Source: MWD 2017 (adapted from table T11).
Notes: AF = acre-feet; MWD = Montecito Water District; — = data are not available.

Across all surface water sources, there is a high range of water yield depending on water year type, which is consistent with the wide range between minimum and maximum amounts in Table 2-4. Besides climatological factors, constraints on surface water availability also include biological opinions for protection of endangered species, which is particularly relevant for SWP imports and for yield from Lake Cachuma. It should be noted that Table 2-4 does not include supplemental water purchases from other agencies. During extreme droughts, MWD has the ability to purchase supplemental water from other water agencies and transport it though SWP infrastructure. For example, over a 2-year period during the 2014–2015 drought, MWD purchased 6,006 AF of water from several outside water agencies. These purchases often involve an exchange component, whereby MWD owes a water "debt" to the agencies from which water was purchased, to be repaid over a specified timeframe (e.g., 10 years).

One of the primary challenges described in the UWMP is the low, and decreasing, reliability from surface water supplies, including MWD's local reservoirs, as well as imports of water from the SWP and Lake Cachuma (MWD 2017). Historically, the SWP has supplied on average 60% of the full allocation of 3,300 AFY, with annual allocations ranging from 5% to 100%. In addition, allocations to MWD from the Santa Ynez watershed supplying Lake Cachuma and Jameson Lake were reduced to zero during the 2015–2016 water year. MWD's proportionate share of water from Lake Cachuma is 10.3%, and MWD's maximum annual available supply from Lake Cachuma is 2,651 AFY. Water in Lake Cachuma is shared with four other member units, consisting of the Goleta Water District, the City of Santa Barbara, the Santa Ynez River Water Conservation District – Improvement District No. 1, and the Carpinteria Valley Water District. The current water supply capacity of Lake Cachuma is approximately 184,121 AF, with SWRCB administering water rights (under Water Right Order 94-5) that govern, among other things, maintaining the beneficial uses of the water for vegetation, fish, and downstream users. The protection of these beneficial uses and Southern California steelhead trout (*Oncorhynchus mykiss*) is an ongoing issue that is expected to constrain the amount of surface water available from Lake Cachuma.

The annual diversion maximum from Jameson Lake (including its Santa Ynez diversions) is 2,000 AF, as re-affirmed by the California Supreme Court in the 1998 Jordan decision (MWD 2017). As shown in Table 2-4, water diverted from Jameson Lake over the last 20 years has averaged approximately 26% of MWD's yearly production total, though the lake's share of MWD's total production has decreased to closer to 10% in recent years due to naturally occurring reservoir siltation and drought conditions. Yearly diversions over the past 20 years ranged from approximately 2,279 AFY in 1997 to a low of 351 AFY in 2015 (MWD 2017). Diversions over the past 3 years were greatly reduced due to a severe multi-year drought and no reservoir recharge.

Future sustainable management of these reservoirs could reduce annual deliveries from these sources to extend their supply during drought periods. The UWMP describes how these challenges will be met in the future, and documents a trend of decreasing per-capita water use by MWD customers, especially in response to statewide drought mandates restricting water use, and plans to maintain some of these decreases in the future (MWD 2017). There is an overall trend of increased water use efficiency by MWD customers alongside a trend of decreasing surface water reliability, in which surface water deficits are met by higher levels of groundwater pumping and purchases of supplemental water (MWD 2017).Opportunities described in the UWMP include continuing negotiations for a long-term water supply agreement for imported/purchased water from the City of Santa Barbara resulting from the Charles E. Meyer Desalination Plant, further investigating the feasibility of using recycled water from within MWD's service area and/or from neighboring agencies to offset potable water demand, groundwater banking programs, and continuing aggressive water conservation programs (MWD 2017). MWD has a water supply agreement with the City of Santa Barbara that provides MWD with 1,430 AFY of potable water irrespective of hydrologic conditions. This is made possible by the City's Charles E. Meyer

Desalination Plant. Deliveries commenced in January 2022 and the agreement has a term of 50 years. It should be noted that there is a limited opportunity (due to hydrogeologic conditions and lack of feasible locations) to implement a managed groundwater recharge program with advanced treatment recycled water in the MGB (GSI 2020). See Section 2.3.4, Surface Water Available for Groundwater Recharge or In-Lieu Use, for current status of potential water management opportunities.

Another approach previously used by MWD and described in the UWMP to respond to water supply shortages includes the adoption of temporary water meter moratoriums, which limit and control new water service connections, and/or the establishment of water use restrictions including water use allocations and penalties. These approaches were used from 1973 to 1997 and 2014 to 2019 with the adoption of Ordinances 47 and 92, respectively, and proved to be an effective strategy to decrease customer water demands (MWD 2017).

UWMPs provide valuable data on regional water demand and supply, provide a means of measuring how effective water conservation and water use efficiency efforts have been, and set the framework for evaluating and prioritizing future capital improvements. With groundwater being an important local source of water supply for the Plan Area, the sustainable management criteria as well as the projects and management actions developed in this GSP draw from information in prior UWMPs and are likewise expected to heavily inform the next UWMP cycle. The 2015 UWMP acknowledges how compliance with SGMA and development of this GSP will affect water management planning, such as the potential to collect additional information on groundwater use by private well operators, and to provide tools needed to more closely monitor groundwater use and thereby more accurately determine MGB balance and yield (MWD 2017).

2.1.4 Existing Groundwater Regulatory Programs

2.1.4.1 Porter-Cologne Water Quality Control Act and Clean Water Act Permitting

The Porter-Cologne Water Quality Control Act of 1969 (Porter-Cologne Act; codified in California Water Code, Section 13000 et seq.) is the primary state water quality control law for California. Whereas the federal Clean Water Act applies to all waters of the United States, the Porter-Cologne Act applies to waters of the state, which includes isolated wetlands and groundwater in addition to federal waters.[8] The Porter-Cologne Act is implemented by SWRCB and the nine RWQCBs. In addition to other regulatory responsibilities, the RWQCBs have the authority to conduct, order, and oversee investigation and cleanup where discharges or threatened discharges of waste to waters of the state could cause pollution or nuisance, including impacts to

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[8] "Waters of the state" are defined in the Porter-Cologne Act as "any surface water or groundwater, including saline waters, within the boundaries of the state" (California Water Code Section 13050[e]).

public health and the environment. The MGB is located along the southern tip of the Central Coast Region (RWQCB Region 3) and within the South Coast Hydrologic Unit, per the RWQCB Water Quality Control Plan for the Central Coastal Basin (Central Coast Basin Plan; RWQCB 2019). These statutes are relevant to the GSP in that they regulate the quality of point-source discharges (e.g., wastewater treatment plant effluent, industrial discharges, and on-site wastewater treatment systems (OWTSs) and non-point source discharges (e.g., stormwater runoff) to the underlying aquifer.

The Central Coast Basin Plan designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for all waters addressed through the Central Coast Basin Plan (California Water Code Sections 13240–13247). The Porter-Cologne Act provides the RWQCBs with authority to include in their Basin Plans water discharge prohibitions applicable to particular conditions, areas, or types of waste. The Central Coast Basin Plan is continually being updated to include amendments related to implementation of total maximum daily loads, revisions of programs and policies within the RWQCB Central Coast Region, and changes to beneficial use designations and associated water quality objectives. The beneficial uses for groundwater are identified in the Central Coast Basin Plan as being suitable for agricultural water supply, municipal and domestic water supply, and industrial use (RWQCB 2019). Unlike beneficial uses of surface water (which vary based on individual surface water), the RWQCB designates the same beneficial uses for all DWR-designated groundwater basins throughout the Central Coast Region.

The Central Coast Basin Plan defines water quality objectives for groundwater generally (for taste, odors, and radioactivity), as well specific to beneficial uses (i.e., municipal/domestic supply and agricultural supply). The water quality objectives for municipal/domestic supply are the same as primary drinking water standards (i.e., maximum contaminant levels [MCLs]) found in Title 22 of the California Code of Regulations. For agricultural uses of groundwater, the Central Coast Basin Plan provides water quality objectives consisting of maximum concentrations for various inorganic chemicals (including certain metals and nitrate) and guidelines for various physical and general mineral properties (RWQCB 2019, Tables 3-1 and 3-2). Although the Central Coast Basin Plan defines additional objectives specific to certain groundwater basins, there are no specific objectives identified for the MGB (RWQCB 2019).

It should be noted that the Central Coast Basin Plan addresses inland waters, coastal waters (enclosed bays, estuaries, and coastal lagoons), and groundwater, whereas the Water Quality Control Plan for Ocean Waters of California (Ocean Plan; SWRCB 2019a) establishes beneficial uses and water quality objectives for waters of the Pacific Ocean. Also, the Ocean Plan prescribes effluent quality requirements and management principles for waste discharges and specifies certain waste discharge prohibitions. The Ocean Plan also provides that SWRCB shall designate Areas of Special Biological Significance and requires wastes to be discharged a sufficient distance from these areas to assure maintenance of natural water quality conditions (SWRCB 2019a). There are no Areas of Special Biological Significance or Marine Protected Areas, as identified by SWRCB or the California Department of Fish and Wildlife, in or adjacent to the Plan Area, the closest being Campus Point State Marine Conservation Area, located offshore of Isla Vista.

The Porter-Cologne Act requires a "Report of Waste Discharge" for any discharge of waste (liquid, solid, or otherwise) to land or surface waters that may impair a beneficial use of surface or groundwater of the state. California Water Code Section 13260(a) requires that any person discharging waste or proposing to discharge waste—other than to a community sewer system—that could affect the quality of the waters of the state file a Report of Waste Discharge with the applicable RWQCB. For discharges directly to surface water (waters of the United States), a National Pollutant Discharge Elimination System (NPDES) permit is required, which is issued under both state and federal law; for other types of discharges, such as waste discharges to land (e.g., spoils disposal and storage), erosion from soil disturbance, or discharges to waters of the state (such as groundwater and isolated wetlands), Waste Discharge Requirements (WDRs) are required and are issued exclusively under state law. WDRs typically require many of the same best management practices (BMPs) and pollution control technologies as required by NPDES-derived permits.

The NPDES and WDR programs regulate construction, municipal, and industrial stormwater and non-stormwater discharges under the requirements of the Clean Water Act of 1972 and the Porter-Cologne Act, respectively. The construction and industrial stormwater programs are administered by SWRCB, whereas individual WDRs, low-threat waivers, and other MGB-specific programs are administered by the Central Coast RWQCB. Programs and policies that have particular relevance to the MGB include the following:

1. **Stormwater General Permits (Construction and Industrial General Permits)**. SWRCB and the Central Coast RWQCB administer a number of general permits that are intended to regulate activities that collectively represent similar threats to water quality across the state and thus can appropriately be held to similar water quality standards and pollution prevention BMPs. Construction projects more than 1 acre in size are regulated under the statewide Construction General Permit and are required to develop and implement a stormwater pollution prevention plan. Similarly, industrial sites are also required to develop a stormwater pollution prevention plan that identifies and implements BMPs necessary to address all actual and potential pollutants of concern. There are no entities within the MGB currently subject to an industrial stormwater pollution prevention plan (SWRCB 2019b).
2. **Irrigated Lands Regulatory Program.** Water discharges from agricultural operations include irrigation runoff, flows from tile drains, irrigation return flows, and stormwater runoff. These discharges can affect water quality by transporting pollutants, including

pesticides, sediment, nutrients, salts (including selenium and boron), pathogens, and heavy metals, from cultivated fields into surface waters and/or groundwater. To prevent agricultural discharges from impairing the waters that receive these discharges, the Irrigated Lands Regulatory Program (ILRP) regulates discharges from irrigated agricultural lands. This is done by issuing WDRs or conditional waivers of WDRs to growers. These orders contain conditions requiring water quality monitoring of receiving waters and corrective actions when impairments are found. Through a series of events related to the passage of SB 390 (Alpert), the ILRP originated in 2003. Initially, the ILRP was developed for the Central Valley RWQCB. As the Central Valley RWQCB ILRP progressed, a groundwater quality element was added to the filing requirement for agricultural lands that had previously been subjected to only surface water discharge concerns. To date, the different RWQCBs are in different stages of implementing the ILRP. The Central Coast RWQCB has a conditional waiver program for irrigated agricultural lands throughout the region, focusing on priority water quality issues such as pesticides and toxicity, nutrients, and sediments—especially nitrate impacts to drinking water sources. There are a number of enrollees to the program within the MGB in the Summerland and Toro Canyon areas.

3. **OWTS Requirements.** Requirements for the siting, design, operation, maintenance, and management of OWTSs are specified in SWRCB's OWTS Policy (SWRCB 2018). The OWTS policy sets forth a tiered implementation program with requirements based upon levels (tiers) of potential threat to water quality. The OWTS policy includes a conditional waiver for on-site systems that comply with the policy. Since 1991, on-site sewage disposal systems in Santa Barbara County have been regulated by the County Public Health Department, Environmental Health Services Division. Santa Barbara County regulations for on-site sewage disposal systems are contained in Article I, Chapter 18C of the County Code, which was most recently updated in 2015. These regulations set forth specific requirements related to (1) permitting and inspection of on-site systems; (2) septic tank design and construction; (3) drywell and disposal field requirements; and (4) servicing, inspection, reporting, and upgrade requirements. Standards pertaining to system sizing and construction are contained in the California (Uniform) Plumbing Code. Additional requirements for on-site sewage disposal systems in Santa Barbara County are adopted as part of community plans or as project-specific mitigation measures or conditions applied to development proposals lying within a designated "Special Problem Area" of the County (which includes Summerland). The Central Coast RWQCB approved Santa Barbara County's Local Agency Management Program, developed by Environmental Health Services with local stakeholders, on November 20, 2015, and it became fully effective January 1, 2016.

4. **Individual WDRs**. Individual WDRs are required for point source discharges to land not otherwise covered under a general permit program or conditional waiver. The purpose of individual WDRs are to define discharge prohibitions, effluent limitations, and other water quality criteria necessary to ensure discharges do not result in exceedances of Central Coast Basin Plan objectives for receiving waters, including groundwater. There is only one individual WDR in the Plan Area, consisting of a categorical waiver of WDR for certain small discharges of fruit and vegetable processing waste in Toro Canyon (Central Coast RWQCB Order No. R3-2004-0066). In addition, combined NPDES/WDRs are issued to two wastewater treatment facilities in the MGB:
    a. Montecito Sanitary District Wastewater Treatment Facility (Order No. R3-2012-0016, NPDES Permit CA0047899)
    b. Summerland Sanitary District Wastewater Treatment Plant (Order No. R3-2013-0042, NPDES Permit CA0048054)

    These facilities are subject to a monitoring and reporting program which requires regular sampling of influent, effluent and receiving waters to verify that the facilities are meeting applicable water quality standards (e.g., the Ocean Plan). Required submittals under the NPDES/WDR permits include a variety of monitoring, inspection, and technical reports that are submitted monthly and annually to the Central Coast RWQCB, as well as requirements for reporting and rectifying emergency/unplanned discharges (e.g., sanitary sewer overflows).

Implementation of the GSP would not affect the applicability or implementation of the regulatory programs discussed above, and continued implementation of Porter-Cologne Act and the Clean Water Act permitting would advance the GSP's sustainability goals related to water quality. The County requires new development and redevelopment projects proposed within the MGB to comply with NPDES permits, WDRs, and OWTS requirements as part of its permitting and approval process. These programs will continue to provide benefits to water quality by requiring both point and non-point discharges to comply with Central Coast Basin Plan water quality objectives and to be protective of Central Coast Basin Plan beneficial uses throughout SGMA's planning and implementation horizon. In addition, the application of stormwater permits means specific performance standards for capture and infiltration of stormwater runoff would be implemented where applicable, providing opportunities for enhanced recharge of the MGB.

2.1.4.2 Groundwater Well Permitting

Statewide standards for the construction, repair, reconstruction, or destruction of wells are found in DWR Bulletin 74-81 and 74-90 (i.e., California Well Standards) (DWR 1981, 1991). The California Well Standards include requirements to avoid sources of contamination or cross-contamination, proper sealing of the upper annular space (i.e., first 50 feet), disinfection of the well following construction work, use of appropriate casing material, and other requirements. In October 2017, Governor Brown signed SB 252, which became effective on January 1, 2018. SB 252 requires well permit applicants in critically overdrafted basins to include information about the proposed well, such as location, depth, and pumping capacity. The bill also requires the permitting agency to make the information easily accessible to the public and the GSAs. Based on available data and analysis, the MGB is not designated as critically overdrafted.

The Santa Barbara County Environmental Health Services issues groundwater well permits in the Plan Area. The Santa Barbara County Environmental Health Services notifies MWD of newly permitted wells in the Plan Area. The MWD uses information obtained from the County to maintain a database of parcels with private wells and ensure the parcel is enrolled in MWD's backflow and cross connection prevention program.

In addition, water wells drilled within the Coastal Zone qualify as "development" pursuant to Coastal Act Section 30106, and thus require a Coastal Development Permit (CDP), either from the County or the California Coastal Commission (Commission). The County adopted a Local Coastal Program (LCP) in 1982 and gained permitting authority within the Coastal Zone at that time. However, the Commission retains permitting authority within certain specified areas, including tidelands, submerged lands, and public trust lands. The Commission also retains appeal jurisdiction throughout many areas in the Coastal Zone, including in Environmentally Sensitive Habitat Areas (ESHAs) and within 100 feet of any stream, wetland, or other waterway. Therefore, a CDP from the County must be obtained for wells located within the certified LCP jurisdiction, and a CDP from the Commission must be obtained for wells located within their retained jurisdiction. Both the County and the Commission maintain land use maps that delineate their respective jurisdictions. Since the policies of the Coastal Act are incorporated into the County LCP, the development standards applied to new wells are similar regardless of which agency is issuing the CDP. Namely, Coastal Act Section 30231 states (emphasis added):

> The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, **preventing depletion of ground water supplies and substantial interference with surface waterflow**, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.

The County LCP also contains the following policies:

> Policy 2-2: The long-term integrity of groundwater basins or sub-basins located wholly within the coastal zone shall be protected. To this end, the safe yield as determined by competent hydrologic evidence of such a groundwater basin or sub-basin shall not be exceeded except on a temporary basis as part of a conjunctive use or other program managed by the appropriate water district. If the safe yield of a groundwater basin or sub-basin is found to be exceeded for reasons other than a conjunctive use program, new development, including land division and other use dependent upon private wells, shall not be permitted if the net increase in water demand for the development causes basin safe yield to be exceeded, but in no case shall any existing lawful parcel be denied development of one single family residence. This policy shall not apply to appropriators or overlying property owners who wish to develop their property using water to which they are legally entitled pursuant to an adjudication of their water rights.
>
> Policy 2-3: In the furtherance of better water management, the County may require applicants to install meters on private wells and to maintain records of well extractions for use by the appropriate water district.

Recently, Executive Order N-7-22 was signed into effect on March 28, 2022 in response to intensifying drought conditions across the state. Among other requirements, Order N-7-22 prohibits a county, city, or other public agency to: 1) approve a permit for a new groundwater well or for alteration of an existing well in a basin subject to SGMA and classified as medium- or high-priority without first obtaining written verification from a GSA managing the basin that the well would not be inconsistent with any sustainable groundwater management program, and not decrease the likelihood of achieving a sustainability goal for the basin; or 2) issue a permit for a new groundwater well or for alteration of an existing well without first determining that extraction of groundwater from the proposed well is not likely to interfere with the production and functioning of existing nearby wells, and not likely to cause subsidence that would adversely impact or damage nearby infrastructure. These requirements do not apply to permits for wells that will provide less than two acre-feet per year of groundwater for individual domestic users, or that will exclusively provide groundwater to public water supply systems as defined in section 116275 of the Health and Safety Code.

The MBGSA plans to evaluate the potential impacts of a new groundwater well or altered existing well on Basin groundwater resources on a case-by-case and cumulative basis by reviewing all available information about the well including, but not limited to, geographic location, planned use, and well construction specifications and periodically updating the MBNM. The MBGSA may implement specific management actions, including but not limited to, well registration, metering, or regional pumping allocations , in response to the occurrence, or potential occurrence, of undesirable results (Chapter 4).

2.1.4.3 Title 22 Drinking Water Program

The SWRCB DDW regulates public water systems in the state to ensure the delivery of safe drinking water to the public. A public water system is defined as a system for the provision of water for human consumption through pipes or other constructed conveyances that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year. Of the ten private water companies in the MGB, two (Lingate Mutual Water Company and Montecito Sea Meadows) are classified as public water systems and included in the SWRCB's Drinking Water Watch, a web portal to view public water systems location, facilities, sources, and samples. Private domestic wells, wells associated with drinking water systems with less than 15 residential service connections, industrial wells, and irrigation wells are not regulated by DDW. Single-parcel and multiple parcel/state small water systems are regulated by the County of Santa Barbara. SWRCB DDW enforces the monitoring requirements established in Title 22 of the California Code of Regulations for public water system wells, and all the data collected must be reported to SWRCB DDW. Title 22 also designates the MCLs for various waterborne contaminants, including volatile organic compounds, non-volatile synthetic organic compounds, inorganic chemicals, radionuclides, disinfection byproducts, general physical constituents, and other parameters. Water quality compliance monitoring of all source water is required every 12 to 108 months (1 to 6 years) depending on the constituent. For example, nitrate as nitrogen shall be tested for every 12 months, whereas gross alpha (radiological) is required to be tested for every 108 months. Additionally, public water systems are required to submit annual consumer confidence reports that detail the water quality testing results. Similarly, the County of Santa Barbara enforces the monitoring requirement established in Title 22 for single-parcel and multiple-parcel/state small water systems. Small water systems are required to complete water source yield and quality testing as part of the permit application process, and water quality testing at regular defined intervals upon receipt of an approved permit.

2.1.4.4 Water Supply Planning and Water Use Efficiency

Over the years, California has passed a series of Senate Bills, including SB X7-7, SB 610, SB 221, SB 1262, and most recently SB 606, that together outline the regulatory framework for water conservation and water supply planning, and for considering issues of water availability in the environmental and permitting process for land use plans, projects, and subdivisions. These bills have been codified in the California Water Code Sections 10608–10609.42, which establish water use and demand reduction targets; Sections 10610–10657, which address UWMPs; and Sections 10910–10914, which address water supply assessments, as well as California Government Code Section 66473.7 (part of the Subdivision Map Act of 1893), which contains requirements related to written verifications (i.e., "will-serve" letters). Collectively, these laws, along with the California Environmental Quality Act (CEQA) of 1970, prompt cities, counties, special districts, and water suppliers to evaluate growth in a broader geographic and temporal context, by coordinating land use planning with water availability and sustainability. MWD's UWMP is described in greater detail in Section 2.1.3, Existing Management Plans. SB 1262, which became effective in 2017, made changes to existing law to integrate to some extent existing law governing written verifications and water supply assessments with the passage of SGMA. The sections of the California Water Code addressing water supply now contain several provisions relating specifically to groundwater, which if used wholly or in part to supply a project or subdivision, triggers additional analytical steps that could expand the necessary scope of a CEQA document, water supply assessment, and/or written verification, as applicable. SB 1262 added language in the subdivision map act clarifying additional considerations for when part or all of the water supply comes from groundwater, especially in adjudicated basins, basins in critical overdraft, and/or basins designated as high or medium priority pursuant to SGMA. In addition to incorporating information from UWMPs, water supply assessments may incorporate relevant information from GSPs prepared pursuant to SGMA.

AB 1668 and SB 606, passed in May 2018, would require the SWRCB, in coordination with DWR, to adopt long-term standards for the efficient use of water, as provided, and performance measures for commercial, industrial, and institutional water use on or before June 30, 2022. The bill, among other things, establishes a standard for indoor water use of 55 gallons per capita daily to be reached by 2025, 52.5 gallons per capita daily beginning in 2025, decreasing to 50 gallons per capita daily beginning in 2030, or as determined jointly by DWR and SWRCB in accordance with necessary studies and investigations. DWR will also adopt long-term standards for outdoor residential water use and outdoor irrigation in connection with commercial, industrial, and institutional water use. With the 20% by 2020 conservation goal pursued in the Water Conservation Act of 2009, these bills extend UWMP requirements, but will measure compliance with uniform standards based on the aggregate amount of water that would have been delivered the previous year by an urban retail water supplier if all that water had been used efficiently (rather than relative to a water district's baseline). The legislation has a variance process available to allow for exceptions in special circumstances approved by DWR. AB 1668 continues the requirements for urban water suppliers to submit UWMPs every 5 years (though in years ending in 6 and 1 instead of 0 and 5), and makes water suppliers ineligible for *any* water grant or loan if it does not submit a UWMP. The bills also add requirements for agricultural water management plans to be organized by groundwater basin or sub-basin.

In December 2022, the Montecito Water District approved the Water Use Efficiency Plan (WUEP) which identifies 20 conservation measures to be implemented as part of a strategic conservation program intended to reduce water demands for customers overlying the MGB. The conservation measures include indoor rebates for high efficiency appliances and toilets, but focuses heavily on outdoor water use rebates such as mulch, drip irrigation, turf removal, and smart irrigation controllers. The WUEP includes an annual budget of approximately $500,000 towards water saving measures in 2023 and beyond.

2.1.4.5 Operational Flexibility and Conjunctive Management Considerations

Operational flexibility is a key consideration in integrated water resource management because it helps water purveyors adapt to known legal, operational, and environmental constraints and plan for an uncertain future, especially as it relates to drought resiliency and the effects of climate change. Operational flexibility can be measured over a given time horizon and/or geographic scale (e.g., water district service area) as the difference between available water supply and service area demand. Operational flexibility is maximized when a water purveyor has a large variety of sources in a water supply portfolio, when it has local control over such sources, and when such sources are connected to each other (e.g., conjunctively managed). On a general statewide scale, water purveyors are increasingly looking to minimize reliance on imported water supplies by promoting stormwater recharge, maximizing wastewater recycling, and sustainably developing local sources of water.

For the Plan Area, the delivery of Cachuma Project water is provided through cooperation with the U.S. Bureau of Reclamation and an interagency agreement that established the Cachuma Operation and Maintenance Board, which operates key distribution systems. The South Coast Conduit delivers water from Lake Cachuma to the south coast of Santa Barbara County. The Conduit's functionality and flexibility are essential to meeting both day-to-day needs and future demand. The nature and operation of the South Coast Conduit allows the south coast Cachuma member units to integrate their various sources of water to provide conjunctive use of several groundwater basins and water exchanges among water users along its length. The South Coast Conduit is also integrated with water treatment plant operations at the City of Santa Barbara Cater Water Treatment Plant, which provides treated water to the City of Santa Barbara, MWD, and the Carpinteria Valley Water District; and the Goleta Water District Corona Del Mar Water Treatment Plant, which provides treated water to the Goleta Valley. A series of integrated projects to protect the South Coast Conduit's integrity and increase its utility, reliability, and flexibility are an important part of the IRWM Plan (County of Santa Barbara 2019a).

MWD and other south coast water agencies collectively draw from a combination of sources—including the Cachuma Project, surface water imports from the SWP, recycled water (produced outside the MWD service area), and groundwater—which differ in terms of the volume available, area served, timing of peak availability, and reliability. Climate and regulatory constraints (e.g., water quality standards, water rights, and minimum environmental flows) have historically had a greater impact on the availability of surface water supplies. With the passage of SGMA and the sustainable management criteria established in this GSP (Chapter 3), once adopted, minimum thresholds may be established for each sustainability indicator. MWD has exercised its authority to manage the MGB in a manner that avoids critical overdraft and manages the MGB conjunctively with its surface water supplies in accordance with its adopted GWMP (MWD 1998). MWD's conjunctive use program allows the MGB to recharge in years of above-average precipitation so that groundwater can be extracted in years of below-average precipitation when surface water supplies are below normal (MWD 2017). MWD does not currently have a groundwater banking plan within the MGB due to limited local groundwater/aquifer production and storage capabilities (GSI 2020; MWD 2017).

The GSP complements and enhances existing projects and programs currently in place to maximize beneficial use of water resources and increase operational flexibility within the MGB and within MWD's jurisdiction as a whole. Because the south coast basins are all interconnected either physically or through water sources, the opportunity for operational flexibility exists and is being used by MWD and local water agencies.

2.1.5 Land Use Elements or Topic Categories of Applicable General Plans

The following section presents a review of population and land use characteristics of the Plan Area, and the various land use plans and their applicability to groundwater resource management. State law requires that all cities and counties adopt a comprehensive, long-term general plan that outlines physical development of the county or city. The general plan must cover a local jurisdiction's entire planning area so that it can adequately address the broad range of issues associated with the city or county's development. Ultimately, the general plan expresses the community's development goals and embodies public policy relative to the distribution of future public and private land uses. The general plan may be adopted as a single document or as a group of documents relating to subjects or geographic segments of the planning area.

Most of the planning documents relevant to the Plan Area fall under the umbrella of the Santa Barbara County Comprehensive Plan (Comprehensive Plan), which is a "living document" made up of many parts that are periodically updated by the County's Department of Planning and Development. The core structure of the document is to have broad countywide land use policies that then get refined in various community plans—the local setting, policy issues, and community concerns are taken into account through a public participation process. Land use plans within the California Coastal Zone must also be consistent with California Coastal Act of 1976 requirements and submitted to the California Coastal Commission (Commission) for review and approval. Planning departments along California's coastline, including the County of Santa Barbara, establish local coastal programs for this purpose. When a local coastal program is approved by the Commission, the Commission's coastal permitting authority over most new development is transferred to the local government, which applies the requirements of the local coastal program in reviewing proposed new developments. All elements of a general plan, whether mandatory or optional—including community plan principles, goals, objectives, policies, and plan proposals—must be internally consistent with each other and all elements have equal legal status (i.e., no element is legally subordinate to another).

The development and implementation of the GSP is relevant to several general plan and community plan elements, and vice versa, because both contain policies and implementation actions that are intended to be protective of water resources. All applicable land use plans acknowledge the major constraints on growth that the lack of water availability presents, and the County's general plans broadly encourage water conservation, and prohibit development, such as tentative map and subdivision approvals, unless the availability of water can be proven out. Several plan elements intersect, including the Conservation Element, the Environmental Resource Management Element, and the Groundwater Resources Element, and contain policies specifically aimed at water resources and groundwater sustainability.

In a few cases, identified below, the passage of SGMA and the adoption of this GSP render some of the land use plan policies or underlying assumptions within them out of date. Where this occurs, it is expected that future general plan and community plan updates, and/or updates to general plan theoretical buildout estimate, will consider the sustainability goals, sustainable management criteria, as well as the projects and management actions of this GSP, and revise the relevant land use plans accordingly.

2.1.5.1 Land Use and Population

The primary developed land uses in the Plan Area consist of residential with lesser amounts of agricultural, recreational, educational, and commercial (Figure 2-8, Current Land Use). Residential land makes up the vast majority of the developed land use in the Plan Area and generally consists of large (one or more acres), privately owned parcels. The remainder of the Plan Area is characterized by tracts of undeveloped natural hillsides and lowlands vegetated with native chaparral. Future development in Montecito is regulated by the County Department of Planning and Development, and further described below. Table 2-5 presents a summary of land uses in the Plan Area, separated between the California Coastal Zone portion and the rest of the MGB.

Table 2-5
Summary of Land Use in the Plan Area

Land Use	Number of Parcels	Area (Acres)	Percent of Total
Coastal Zone			
Single-Family Residential (> 1/2 acre)	460	766.1	13%
Single-Family Residential (< 1/2 acre)	755	195.0	3%
Multiunit Residential	564	56.7	<1%
Commercial	112	105.8	2%
Parks and Golf Courses	7	19.0	<1%
Institutional	15	60.6	<1%
Public Services/Infrastructure (including roads)[a]	26	422.1	7%
Undeveloped Open Space/Vacant Land	174	270.68	4%

Table 2-5
Summary of Land Use in the Plan Area

Land Use	Number of Parcels	Area (Acres)	Percent of Total
Subtotal	*2,113*	*1,896.0*	*31%*
Inland			
Single-Family Residential (> 1/2 acre)	1,714	2,814.3	46%
Single-Family Residential (< 1/2 acre)	622	152.2	2%
Multiunit Residential	63	31.7	<1%
Commercial	15	20.2	<1%
Parks and Golf Courses	16	158.3	3%
Institutional	30	287.4	5%
Public Services/Infrastructure (including roads)[a]	20	257.4	4%
Undeveloped Open Space/Vacant Land	238	527.1	9%
Subtotal	*2,718*	*4,248.7*	*69%*
Total[b]	**4,831**	**6,145**	**100%**

Source: County of Santa Barbara (2019c).

Notes:

[a] This land use includes road rights-of-way that were not included in the parcel data layer.

[b] Note that 210 acres of the overall total are within the City of Santa Barbara, including 61 acres of residential, 47 acres of golf course, 23 acres of undeveloped open space, 25 acres of commercial, 11 acres of institutional, and 43 acres of public services/infrastructure (including road rights-of-way that were not included in the parcel data layer).

The MGB intersects a small portion of the City of Santa Barbara, and intersects the following Census Designated Places: Montecito, Summerland, and Toro Canyon (MWD 2017). The population of the Plan Area is approximated from the analysis of population conducted for MWD's 2015 UWMP, which estimates a population of approximately 11,370 people (MWD 2017). The UWMP uses the DWR Online Population Tool to estimate population, but acknowledges that it may underestimate population for MWD's service area due to several factors unique to its customer base. The presence of institutional service connections such as Westmont College, which averages approximately 1,200 on-campus students each semester, may not be accounted for in the DWR Online Population Tool. Additionally, many Montecito residents may not be counted by census data because they are primary residents in another city or state and their Montecito residence is considered a secondary residence. In both cases, these customers still add demand to the potable water system but may not be accounted for by the DWR Population Tool. In order to comply with the guidelines of this UWMP, MWD has elected to use the DWR Online Population Tool results for planning purposes but also realizes that these numbers may underestimate actual population served (MWD 2017).

As shown in Table 2-6, the population is projected to increase slightly by 268 people by 2035, based on growth projections in the Santa Barbara County Association of Governments (SBCAG) Regional Transportation Plan and Sustainable Communities Strategy. Growth opportunities are limited because much of the community is already built out with low-density residential land uses.

In addition, substantial constraints on growth already exist and are expected to persist. These constraints consist of water availability, grading and slope limitations, coastal resources sensitivities, and quality of life and community character concerns. Some limited redevelopment may be anticipated, and is likely to primarily consist of mixed-use, multi-family development, or second/accessory dwelling units. The provision of affordable housing is a major challenge for the community, and the Montecito Community Plan (Community Plan; described in Section 2.1.5.2, Santa Barbara County Comprehensive Plan) addresses this challenge by allowing secondary dwelling units on certain commercial-zone properties and by increasing maximum densities on select existing residential parcels (County of Santa Barbara 1995).

Table 2-6
Population of the Plan Area

Source	Population					
	2010	*2015*	*2020*	*2025*	*2030*	*2035*
DWR Population Tool	11,292	10,461	—	—	—	—
DWR Population Tool (modified)	—	11,370	—	—	—	—
SBCAG Regional Transportation Plan and Sustainable Communities Strategy (straight-line interpolation of data from 2010 and 2035)	11,309	11,370	11,441	11,506	11,572	11,638

Source: DWR; SBCAG.
Note: DWR = California Department of Water Resources; SBCAG = Santa Barbara County Association of Governments; — = data are not available.

The Community Plan provides a theoretical buildout estimate that allows for 963 new residential units; however, it should be noted that these are from 1995, and that buildout to a theoretical maximum allowable density is unlikely given the previously mentioned constraints on growth. Based on MWD's land use data for the MGB, there are 363 parcels identified as vacant. For the few remaining vacant parcels, it should be noted that having a legally created lot that meets zoning requirements still may not be buildable due to a number of factors, such as floodplain and/or natural hazard issues (wildfire and/or mudflow), having legal access to roadways, having access to sewer or water, etc. Building permits are granted on a case-by-case basis by the County, and it is not possible to accurately estimate the number of legally buildable parcels in MGB.

It is important to note that DWR population tool calculates the 2015 number of persons per connection by creating a trend line of the persons per connection from 2000 to 2010 and continues that trend to the year 2015. Based on the data input to the DWR population tool, the year 2015 projected population for MWD's service area did not align with the population data from SBCAG as adopted in the 2040 Regional Transportation Plan and Sustainable Communities Strategy. The SBCAG population data was used to confirm the estimated population from the DWR Online Population Tool for the years 2010 and 2015. Table 2-6 provides population estimates by source and Figure 2-9, Census Designated Places and Population, shows population density.

2.1.5.2 Santa Barbara County Comprehensive Plan

This plan outlines land use and growth policies at the County-wide level, and has several elements particularly relevant to groundwater sustainability, including the following:

- **Conservation Element (County of Santa Barbara 2010).** The Conservation Element describes water resources, agricultural resources, ecological systems, historical and archaeological sites, and mineral resources, and recommends policies and programs designed to protect them.
- **Groundwater Resources Section (County of Santa Barbara 2009).** The Groundwater Resources Section is a stand-alone section of the Conservation Element that provides a review of groundwater resource limitations throughout the County, and establishes groundwater resource policies for each of the groundwater basins in the County. At the time of original publication in 1994, the total estimated gross supply of water for the MGB was estimated to range from approximately 4,770 to 4,930 AFY.
- **Environmental Resources Section (County of Santa Barbara 2009).** The Environmental Resource Management Element is a compendium of the Seismic Safety and Safety Element, the Conservation Element, and the Open Space Element and includes topics such as prime agricultural lands, slopes, biological resources, habitat areas, floodplain and floodways, and geologic hazards, among others.
- **Coastal Land Use Plan (County of Santa Barbara 2019b).** The Coastal Land Use Plan (CLUP) includes policies related to beach access, recreation, marine environment, environmentally sensitive habitat areas, agriculture, visual resources, coastal dependent energy, and industrial development. These policies establish standards for future growth and development in the Coastal Zone and supersede other policies.
- **Community Plans.** The Comprehensive Plan is supplemented by individual community plans that take into account the local setting, policy issues, and community concerns. The community plans applicable to the GSP Plan Area are the Montecito Community Plan (County of Santa Barbara 1995), the Summerland Community Plan (County of Santa Barbara 2014), and the Toro Canyon Plan (County of Santa Barbara 2004).

Each of the relevant land use plans is summarized in Table 2-7 and described below.

Table 2-7
Summary of General Plan and Community Plan Land Use Policies Relevant to Groundwater Sustainability in the Plan Area

Element	Policy/Action No.	Description	GSP Consistency
Santa Barbara County Comprehensive Plan			
Conservation Element – Groundwater Resources Section	**Goal 1**: To ensure adequate quality and quantity of groundwater for present and future County residents, and to eliminate prolonged overdraft of any groundwater basins.		
	Policy 1.1	The County shall encourage and assist all of the County's water purveyors and other groundwater users in the conservation and management, on a perennial yield basis, of all groundwater resources.	Consistent.
	Action 1.1.1	The County shall encourage and, where feasible, financially assist in continued studies of new or supplemental water sources and the more efficient use of existing sources, for the purpose of avoiding, reducing, or eliminating prolonged overdraft. To ensure that such water is used to reduce overdraft (as opposed to supplying only new uses), the County shall encourage water purveyors to give first priority to offsetting existing demands met by overdrafting groundwater supplies.	Consistent.
	Action 1.1.2	The County will seek the voluntary cooperation with purveyors during the early planning of any supplemental water sources that the purveyors propose or plan to develop. The County will coordinate with the purveyor, to the extent allowed by the purveyor, to ensure that: (1) environmental constraints are fully incorporated into the location and design of such projects; and (2) mitigations are applied to the fullest extent feasible and consistent with County permit conditioning policies and practices to minimize the magnitude of significant impacts.	Consistent.
	Policy 1.2	The County shall encourage innovative and/or appropriate, voluntary water conservation activities for increasing the efficiency of agricultural water use within the County.	Consistent.
	Action 1.2.1	The County shall provide support to the Soil Conservation Service, the Resource Conservation District, and other appropriate agencies to continue the Irrigation Management Program and other such water conservation and management efforts.	Consistent.
	Action 1.2.2	The County shall support the expansion of existing efforts by the U.C. Cooperative Extension/Farm Advisor, in cooperation with the Agricultural Commissioner, Soil Conservation Service, Resource Conservation District, and other appropriate agencies, to develop and update a verifiable comprehensive database on agricultural water use and conservation effectiveness. Such efforts should include incentives for groundwater users to collect and provide more accurate data, as needed to permit the development of more precise determinations of consumptive groundwater use.	Consistent, but SGMA now provides additional regulatory authority and tools to collect groundwater data.

Table 2-7
Summary of General Plan and Community Plan Land Use Policies Relevant to Groundwater Sustainability in the Plan Area

Element	Policy/Action No.	Description	GSP Consistency
	Policy 1.3	The County shall act within its powers and financial abilities to promote and achieve the enhancement of groundwater basin yield.	Consistent. MBGSA now has additional authorities to do the same.
	Policy 1.3.1	Where feasible and consistent with the County's applicable Comprehensive Plan element(s), the County shall encourage and assist appropriate agencies in ongoing or future projects and programs which increase groundwater recharge and basin yield, as long as such projects and programs can be shown not to degrade groundwater quality. Such activities could include, but would not be limited to, cloud seeding, range management, dams, and spreading basins.	Consistent. It should be noted, though, that the effectiveness and feasibility of managed recharge within the MGB has been determined to be limited (GSI 2020).
	Goal 2: To improve existing groundwater quality, where feasible, and to preclude further permanent or long-term degradation in groundwater quality.		
	Policy 2.1	Where feasible, in cooperation with local purveyors and other groundwater users, the County shall act to protect groundwater quality where quality is acceptable, improve quality where degraded, and discourage degradation of quality below acceptable levels.	Consistent.
	Action 2.1.1	In reviewing or preparing basin management plans under the Groundwater Management Act and other applicable law, the County shall consider both the quantity and quality of groundwater in affected basins. Pumpage that causes intrusion of poor quality water, if and where identified, should receive particular attention for improved management.	This policy should be updated to reflect SGMA, as it supersedes the Groundwater Management Act.
	Action 2.1.2	In basins or sub-basins with water quality problems, the County will encourage reduction of salt and other pollutant loading from all sources through cooperative, voluntary efforts and, where feasible, will take direct action in this regard.	Consistent. Note that while cooperative and voluntary efforts are preferred, SGMA gives MBGSA authority to mandate mitigation if sustainability criteria are threatened or exceeded.
	Policy 2.2	The County shall support the study of adverse groundwater quality effects which may be due to agricultural, domestic, environmental and industrial uses and practices.	Consistent.

Table 2-7
Summary of General Plan and Community Plan Land Use Policies Relevant to Groundwater Sustainability in the Plan Area

Element	Policy/Action No.	Description	GSP Consistency
	Action 2.2.1	The County shall cooperate in ongoing and future studies which determine the current and potential extent of agricultural, domestic, environmental and industrial pollutants in various County aquifers, and to ascertain better methods by which agriculturalists can prevent increasing pollutant loads in the future. Such studies should be coordinated with the basin planning and enforcement work done by the RWQCB and SWRCB, and should involve other appropriate agencies and groundwater users.	Consistent.
	Goal 3: To coordinate County land use planning decisions and water resources planning and supply availability.		
	Policy 3.1	The County shall support the efforts of the local water purveyors to adopt and implement groundwater management plans pursuant to the Groundwater Management Act and other applicable law.	These policies and actions should be updated to reflect SGMA, as it supersedes the Groundwater Management Act. MWD's 1998 Groundwater Management Plan prepared pursuant to the Groundwater Management Act is superseded by this GSP.
	Action 3.1.1.	The County shall encourage the preparers of groundwater management plans to consider environmental factors, including but not limited to the potential link between groundwater resources and riparian habitat.	
	Policy 3.2	The County shall conduct its land use planning and permitting activities in a manner which promotes and encourages the cooperative management of groundwater resources by local agencies and other affected parties, consistent with the Groundwater Management Act and other applicable law.	
	Action 3.2.1	The County Flood Control & Water Conservation District or the County Water Agency, as feasible and as requested by a local agency or agencies pursuant to the Groundwater Management Act, may assume responsibility in preparing a groundwater management plan pursuant to the Groundwater Management Act and other applicable law.	
	Policy 3.2	The County shall use groundwater management plans, as accepted by the Board of Supervisors, in its land use planning and permitting decisions and other relevant activities.	
	Action 3.3.1	The Board of Supervisors, in consultation with the County Planning Commission, shall accept a groundwater management plan which promotes and is consistent with the Goals of this Groundwater Resources Section of the Conservation Element. Such acceptance shall be rescinded where specific facts and circumstances indicate that a plan has been rendered inadequate to promote these Goals.	
	Action 3.3.2	The County shall conserve waters to the extent feasible through exercise of the County's discretionary land use planning and permitting decisions, and shall promote such conservation through related public and private actions.	

Table 2-7
Summary of General Plan and Community Plan Land Use Policies Relevant to Groundwater Sustainability in the Plan Area

Element	Policy/Action No.	Description	GSP Consistency
	Policy 3.4	The County's land use planning decisions shall be consistent with the ability of any affected water purveyor(s) to provide adequate services and resources to their existing customers, in coordination with any applicable groundwater management plan.	Consistent.
	Action 3.4.1	The County, in its planning activities, shall work cooperatively with local water purveyors, the County Water Agency, the County Flood Control and Water Conservation District, State and Federal agencies concerned with water resources, and private groups and individuals with particular interest and expertise related to water resources.	Consistent.
	Action 3.4.2	Santa Barbara County shall develop its land use plans and policies in a manner which takes into account all groundwater uses (e.g., domestic, agricultural, natural resources and habitats, etc.).	Consistent.
	Action 3.4.4	Santa Barbara County shall encourage and assist local water purveyors in developing adequate water supplies (groundwater, surface water, desalination, etc.) to serve their customers and communities consistent with the applicable general plan(s).	Consistent.
	Action 3.4.5	The County shall facilitate the efforts of purveyors to serve overlying landowners from the purveyor's system.	Consistent.
	Policy 3.5	In coordination with any applicable groundwater management plan(s), the County shall not allow, through its land use permitting decisions, any basin to become seriously overdrafted on a prolonged basis.	Consistent. Note that MGB is not designated as critically overdrafted by DWR.
	Action 3.5.1	Based on input from the County Water Agency and P&D, the Board, in coordination with the responsible water purveyor(s), shall designate any basins within the county as “seriously overdrafted” if the following conditions are present: Prolonged overdraft which results or, in the reasonably foreseeable future (generally within ten years) would result, in measurable, unmitigated adverse environmental or economic impacts, either long-term or permanent. Such impacts include but are not limited to seawater intrusion, other substantial quality degradation, land surface subsidence, substantial effects on riparian or other environmentally sensitive habitats, or unreasonable interference with the beneficial use of a basin's resources. The County's fundamental policy shall be to prevent such overdraft conditions.	Consistent. These now constitute the main sustainability indicators under SGMA. Note that MGB is not designated as critically overdrafted by DWR.
	Action 3.5.2	In seriously overdrafted basins, the County shall not approve discretionary development permits if such development requires new net extractions or increases in net extractions of groundwater, pending development and County acceptance of a basin management plan, consistent with the Groundwater Management Act or other applicable law, which adequately addresses the serious overdraft.	Consistent. Note that MGB is not designated as critically overdrafted by DWR.

Table 2-7
Summary of General Plan and Community Plan Land Use Policies Relevant to Groundwater Sustainability in the Plan Area

Element	Policy/Action No.	Description	GSP Consistency
	Policy 3.6	The County shall not make land use decisions which would lead to the substantial overcommitment of any groundwater basin.	Consistent.
	Policy 3.6	New urban development shall maximize the use of effective and appropriate natural and engineered recharge measures within project design, as defined in design guidelines to be prepared by the Santa Barbara County Flood Control and Water Conservation District (SBCFCWCD) in cooperation with P&D.	Consistent.
	Action 3.6.1	In cooperation with the USGS and local water purveyors, the County should conduct or participate in a study to identify in more detail those areas where natural and enhanced recharge is occurring or may occur in each of the County's major groundwater basins and develop detailed design guidelines for ways to protect recharge areas from further degradation.	Consistent. It should be noted, though, that the effectiveness and feasibility of managed recharge within the MGB has been determined to be limited.
	Policy 3.8	Water-conserving plumbing, as well as water-conserving landscaping, shall be incorporated into all new development projects, where appropriate, effective, and consistent with applicable law.	Consistent.
	Action 3.8.1	The County shall continue to encourage and, where feasible, financially participate in water-saving landscape experiments and education programs, such as those conducted by the Water Agency's Regional Water Conservation Program.	Consistent.
	Action 3.8.2	The County shall continue to develop and refine uniform standards and guidelines for water conservation in new development projects, which shall recognize that different physical characteristics within various areas may require more than a single set of standards and guidelines. All cities within the County shall be encouraged to adopt similar standards and guidelines.	Consistent.
	Policy 3.9	The County shall support and encourage private and public efforts to maximize efficiency in the pre-existing consumptive M&I use of groundwater resources.	Consistent.
	Action 3.9.2	The County, in consultation with the cities, affected water purveyors, and other interested parties, shall promote the use of consistent “significance thresholds” by all appropriate agencies with regard to groundwater resource impact analysis.	Consistent.

Table 2-7
Summary of General Plan and Community Plan Land Use Policies Relevant to Groundwater Sustainability in the Plan Area

Element	Policy/Action No.	Description	GSP Consistency
	Action 3.9.3	The County shall continue to refine and update its “significance thresholds” as new data becomes available and as overdraft conditions persist, as specified in the County’s CEQA Guidelines. The County’s acceptance of duly prepared and adopted groundwater management plans also may necessitate the adjustment of appropriate groundwater thresholds.	Consistent. MGB is not designated as critically overdrafted by DWR, and sustainable management criteria of this GSP may necessitate updated significance thresholds.
	Goal 4: To maintain accurate and current information on groundwater conditions throughout the County.		
	Policy 4.1	The County shall act within its powers and financial abilities to collect, update, refine, and disseminate information on local groundwater conditions.	Consistent.
	Action 4.1.1	The County Water Agency shall continue to monitor water levels from existing monitoring wells and, in coordination with the U.C. Cooperative Extension/Farm Advisor, shall request, on a voluntary basis, private and public water purveyors and major private groundwater users, including agricultural users, to provide periodic records of groundwater production. Unless deemed unnecessary by the Water Agency's Board of Directors for any year, the Agency shall compile an annual report on the status of pumping amounts, water levels, overdraft conditions, and other relevant data, and shall submit this report to the Board of Supervisors for its acceptance and possible further action. The annual report to the Board shall include a review of the results of all groundwater quality monitoring conducted in the County.	Consistent. For the MGB, the MBGSA will have this responsibility. The MBGSA will send annual reports required by DWR to the County as well.
	Action 4.1.2	The County, in consultation with the cities, other counties, affected water purveyors, and other interested parties, shall promote the use of consistent standards by all appropriate agencies with regard to groundwater resources.	Consistent. Note that sustainability criteria for basins under management of a GSP will be specific to each basin.
	Action 4.1.3	The County recognizes the need for more accurate data on all groundwater basins within the County and shall continue to support relevant technical studies, as feasible.	Consistent.
	Action 4.1.4	The County should identify areas where natural resources and habitats depend upon groundwater, and where such resources and habitats have been adversely affected by groundwater overdraft.	Consistent.

Table 2-7
Summary of General Plan and Community Plan Land Use Policies Relevant to Groundwater Sustainability in the Plan Area

Element	Policy/Action No.	Description	GSP Consistency
	Action 4.1.6	The service area boundaries of existing and planned private water companies shall be defined. These companies shall be requested to provide this information to P&D and the County Water Agency no later than 12/31/94 or, for subsequently organized companies, within six months of their final formation.	To be determined. The location of private water companies are included in this GSP as Figure 2-2.
	Action 4.1.7	The County recommends that all public and private water companies, districts, and agencies, to the extent legally possible, maintain mutual aid agreements with adjacent districts or private water companies in case of water shortages. Any such agreements shall be noted by the County Water Agency in its annual report (see Action 4.1.1). Such agreements would be based on short-term or emergency needs or identified economic benefits to all parties.	Consistent. Not currently existing.
	Action 4.1.8	All water districts and city water departments which have prepared a Water Conservation Plan (under the 1984 Urban Water Management Act) and/or other long-term water planning studies, shall be asked to submit a copy of such plan(s) to the County Water Agency and P&D for review and comment. P&D shall meet with these purveyors to discuss the population/land use projections and their current status.	Consistent.
	Action 4.1.9	The County Water Agency shall continue to work with local water purveyors and other appropriate entities to promote the efficient use of water by all users through education and incentive programs. Progress on such programs shall be reported by the County Water Agency in its annual report (see Action 4.1.1).	Consistent. GSP annual reports will be submitted to the County at the same time they are submitted to DWR.
	Action 4.1.10	The County shall continue to encourage and, where feasible, financially participate in USGS, DWR, SWRCB, and local water purveyors' studies of water quality in basins throughout the County.	Consistent.
	Action 4.1.11	The County shall continue to encourage and, where feasible, materially assist the seawater intrusion monitoring programs of the USGS, local water purveyors, and other appropriate agencies.	Consistent.
	Action 4.1.12	The County shall encourage and, where feasible, materially contribute to the refinement and updating of agricultural water use (“duty”) factors by the Soil Conservation Service, the U.C. Cooperative Extension/Farm Advisor, or other appropriate entities.	Consistent.
	Action 4.1.13	The County shall encourage and, where feasible, materially contribute to the refinement of estimates of agricultural water return flows by the State Department of Water Resources, the U.C. Cooperative Extension/Farm Advisor, or other appropriate entities.	Consistent.

Table 2-7
Summary of General Plan and Community Plan Land Use Policies Relevant to Groundwater Sustainability in the Plan Area

Element	Policy/Action No.	Description	GSP Consistency
Coastal Land Use Plan			
Montecito Planning Area	**Goal II.A**: Maintain orderly growth consistent with available resources and the semi-rural character of the community.		
	Policy II.A.I	In order to pace development with long-term readily available resources and services (i.e. water, sewer, roads, schools), the County shall not permit the number of primary residential units to exceed an annual rate of one half of one percent of the permitted 1989 housing stock unless specifically exempted by ordinance. This rate shall represent the maximum allocated residential growth rate until such time that the County determines, through a periodic public review of the status of services and infrastructure in the Montecito Planning Area, that further growth can be accommodated by acceptable and reliable supplies and capacities without diminishing the quality of life in the community.	Consistent.
	Policy II.A.II	A temporary reduction in the annual one-half percent dwelling unit permit rate and corresponding reduction in number of permit allocations for the Montecito Planning Area may be enacted by the Board of Supervisors, if the short term availability of resources is jeopardized by the continued allocation of such permits.	Consistent.
Development Planning Issues	Policy 2-1	In order to obtain approval for a division of land, the applicant shall demonstrate that adequate water is available to serve the newly created parcels except for parcels designated as “Not a Building Site” on the recorded final or parcel map.	Consistent.
	Policy 2-2	The long term integrity of groundwater basins or sub-basins located wholly within the coastal zone shall be protected. To this end, the safe yield as determined by competent hydrologic evidence of such a groundwater basin or sub-basin shall not be exceeded except on a temporary basis as part of a conjunctive use or other program managed by the appropriate water district. If the safe yield of a groundwater basin or sub-basin is found to be exceeded for reasons other than a conjunctive use program, new development, including land division and other use dependent upon private wells, shall not be permitted if the net increase in water demand for the development causes basin safe yield to be exceeded, but in no case shall any existing lawful parcel be denied development of one single family residence. This policy shall not apply to appropriators or overlying property owners who wish to develop their property using water to which they are legally entitled pursuant to an adjudication of their water rights.	Consistent. Terminology will be dated with adoption of this GSP, but spirit and intent is consistent.
	Policy 2-3	In the furtherance of better water management, the County may require applicants to install meters on private wells and to maintain records of well extractions for use by the appropriate water district.	To be determined.

Table 2-7
Summary of General Plan and Community Plan Land Use Policies Relevant to Groundwater Sustainability in the Plan Area

Element	Policy/Action No.	Description	GSP Consistency
	Policy 2-4	Within designated urban areas, new development other than that for agricultural purposes shall be serviced by the appropriate public sewer and water district or an existing mutual water company, if such service is available.	Consistent.
	Policy 2-5	Water-conserving devices shall be used in all new development.	Consistent.
	Policy 2-6	Prior to issuance of a development permit, the County shall make the finding, based on information provided by environmental documents, staff analysis, and the applicant, that adequate public or private services and resources (i.e., water, sewer, roads, etc.) are available to serve the proposed development. The applicant shall assume full responsibility for costs incurred in service extensions or improvements that are required as a result of the proposed project. Lack of available public or private services or resources shall be grounds for denial of the project or reduction in the density otherwise indicated in the land use plan. Where an affordable housing project is proposed pursuant to the Affordable Housing Overlay regulations, special needs housing or other affordable housing projects which include at least 50% of the total number of units for affordable housing or 30% of the total number of units affordable at the very low income level are to be served by entities that require can-and-will-serve letters, such projects shall be presumed to be consistent with the water and sewer service requirements of this policy if the project has, or is conditioned to obtain all necessary can-and-will-serve letters at the time of final map recordation, or if no map, prior to issuance of land use permits.	Consistent.
	Policy 2-7	Consistent with PRC Section 30604 (e), the County may deny a project for a period of up to one year if the Board of Supervisors finds that 1) a public agency has been specifically authorized to acquire the property on which the development is located, and 2) there are funds available or funds could reasonably be expected to be made available within one year for such acquisition.	Consistent.
	Policy 2-8	The County shall give equal priority to the following land uses in the coastal zone of Montecito and Summerland: -Expansion of public recreational opportunities -Visitor-serving commercial uses, i.e., restaurants, retail commercial, motels, etc. -Low and moderate income housing -Agricultural expansion	Agricultural expansion, if supplied with groundwater, may not be consistent with GSP sustainability goals. MWD is not issuing CWSAs for new Ag.

Table 2-7
Summary of General Plan and Community Plan Land Use Policies Relevant to Groundwater Sustainability in the Plan Area

Element	Policy/Action No.	Description	GSP Consistency
	Policy 2-11	All development, including agriculture, adjacent to areas designated on the land use plan or resource maps as environmentally sensitive habitat areas, shall be regulated to avoid adverse impacts on habitat resources. Regulatory measures include, but are not limited to, setbacks, buffer zones, grading controls, noise restrictions, maintenance of natural vegetation, and control of runoff.	Consistent.
Hazards – Hillside and Watershed Protection	Policy 3-18	Provisions shall be made to conduct surface water to storm drains or suitable watercourses to prevent erosion. Drainage devices shall be designed to accommodate increased runoff resulting from modified soil and surface conditions as a result of development. Water runoff shall be retained on-site whenever possible to facilitate groundwater recharge.	Consistent.
	Policy 3-19	Degradation of the water quality of groundwater basins, nearby streams, or wetlands shall not result from development of the site. Pollutants, such as chemicals, fuels, lubricants, raw sewage, and other harmful waste, shall not be discharged into or alongside coastal streams or wetlands either during or after construction.	Consistent.
Montecito Community Plan			
Biological Habitats	Policy BIO-M-I.20	Pollution of streams, sloughs, drainage channels, underground water basins, estuaries, the ocean, and areas adjacent to such waters shall be minimized.	Consistent.
Flooding and Drainage	Policy FD-M-2.1	Development shall be designed to minimize the threat of on-site and downstream flood potential and to allow recharge of the groundwater basin to the maximum extent feasible.	Consistent.
	Policy FD-M-4.6	Other than projects that are currently approved and/or funded, no further concrete channelization or major alterations of streams shall be permitted	Consistent.
Water	Policy WAT-M-1.1	In planning for future water supply, the County shall encourage reasonable, practical, reliable, efficient, and environmentally sound water policies.	Consistent.
	Policy WAT-M-1.2	The County should coordinate with MWD in order to encourage conservation and coordinate supplies with current and future demand.	Consistent.
	Action WAT-M-I.2.1	County shall work with MWD to promote educational programs which encourage water resource conservation.	Consistent.
	Development Standard WAT-M-I.2.1	Landscape plans, where required for development, shall include drip irrigation systems and/or other water saving irrigation systems.	Consistent.

Table 2-7
Summary of General Plan and Community Plan Land Use Policies Relevant to Groundwater Sustainability in the Plan Area

Element	Policy/Action No.	Description	GSP Consistency
	Policy WAT-M-1.3	The County (in conjunction with MWD) shall monitor the effects of development on water sources and the County shall prepare and make public a report regarding the status of Montecito Planning Area water supply and demand every five years or when circumstances substantially change (e.g., new water supplies become available).	Consistent.
	Policy WAT-M-1.4	The County Water Agency shall work cooperatively with the Montecito Water District, other local, state, and federal agencies, and private groups and individuals with particular interest and expertise related to water, in the pursuit of water allocation or conservation techniques and investigation of alternative water sources.	Consistent.
	Action WAT-M-1.4.1	The County shall coordinate with MWD in their review of discretionary development proposals.	Consistent.
	Policy WAT-M-1.5	When supplemental alternative water sources become available, a buffer of 10 percent between supply and demand should be maintained in reserve for periods of drought condition.	Consistent.
	Action WAT-M-1.5.1	If an overdraft situation should occur, the County shall encourage MWD to use new water supplies when available to reduce the overdraft caused by the District.	Consistent.

Notes: GSP = Groundwater Sustainability Plan; SGMA = Sustainable Groundwater Management Act; MBGSA = Montecito Basin Groundwater Sustainability Agency; MGB = Montecito Groundwater Basin; RWQCB = Regional Water Quality Control Board; SWRCB = State Water Resources Control Board; MWD = Montecito Water District; P&D = Planning and Development Department; DWR = California Department of Water Resources; M&I = municipal and industrial; CEQA = California Environmental Quality Act; U.C. = University of California; USGS = U.S. Geological Survey; PRC = California Public Resources Code; CWSA = Certificate of Water Service Availability.

Comprehensive Plan Elements

In the Groundwater Resources section of the Conservation Element, the County included several findings that generally remain accurate, although certain expectations, particularly with regard to the availability of SWP water, may no longer be accurate. For example, at the time of preparation (1994), the County recognized that new supplemental water sources, such as SWP water and augmentation of local supplies, would be available and could serve to replenish groundwater basins or be used in lieu of groundwater. As noted above in the summary of the latest UWMP, MWD is now planning for ongoing limitations and/or periodic drought-related curtailments of water supply from the SWP, and has determined that active/managed recharge of the MGB may be infeasible due to limitations in physical space, lack of adequate unsaturated thickness of the aquifer, and various environmental/regulatory considerations (e.g., water quality) (GSI 2020). Existing conditions therefore challenge the expectation contained in the Groundwater Resources section of the County's Comprehensive Plan (County of Santa Barbara 2009). Furthermore, the land use plans describe groundwater-related actions as voluntary cooperative and collaborative efforts that are not mandated under the regulatory schemes that existed at the time. With the passage of SGMA, this has changed.

Coastal Land Use Plan

In 1982, the County adopted the CLUP, which established land uses within the Coastal Zone. The CLUP and implementation program, which compose the County's local coastal program,[9] are designed as a separate coastal element to the County's Comprehensive Plan. The CLUP lays out the general patterns of development throughout the coastal areas of the County. Its purpose is to protect coastal resources while accommodating development within the Coastal Zone. The local coastal plan provides a high-level overview of land use planning policies aimed at compatibility and compliance with California Coastal Commission regulations protecting wildlife, aesthetic, and recreational resources in the Plan Area. The other Comprehensive Plan elements are applicable within the Coastal Zone; however, the CLUP takes precedence if a conflict exists between these two plans.

The CLUP acknowledges the general water resource limitations of the south coast area. Specifically, it states that Section 30231 of the California Coastal Act requires that depletion of groundwater supplies be prevented. Section 30241 requires that public service and facility expansions and non-agricultural development do not impair agricultural viability either through increased assessment costs or degraded air and water quality. It acknowledges that wastewater treatment and collection facilities were near capacity levels in Summerland and Montecito

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[9] As required by the California Coastal Act of 1976, the local coastal program is the land use plans, zoning ordinances, zoning district maps, and implementing actions which, when taken together, meet the requirements of, and implement the provisions and policies of the California Coastal Act.

(although the Montecito Sanitary District is at less than half capacity currently), which presented an additional constraint to development in these areas. It includes a number of development policies related to service system capacity and water availability (local coastal program Policies 2-1 through 2-6). Policies revolve around requiring developers to prove out the adequacy and sustainability of available water supply prior to approval of planned development, giving the County authority to require applicants to install meters on private wells and to maintain records of well extractions for use by the appropriate water district, and requiring maximum water conservation. The CLUP acknowledges that the Plan Area is experiencing constraints due to limited water resources, stating that because "buildout in these areas, i.e., the total number of housing units permitted under the land use plan, exceeds available water supplies, priorities for development are needed to assure that the priority land uses specified in Section 30254 of the Coastal Act are not precluded and that the depletion of groundwater supplies is prevented" (County of Santa Barbara 2019b, p. 24).

The CLUP has an implementing policy that directs the County to adopt a growth management ordinance that regulates the number of additional new primary residential units permitted each year by the Resource Management Department.

Montecito Community Plan

The Montecito Community Plan sets out specific goals relating to community development, public facilities and services, and resources and constraints. It states the objectives of the goals and names specific policies and actions to carry out those policies. The community plan also designates the type of land use (e.g., residential, commercial) allowed for each parcel within the Montecito Planning Area and the maximum density allowed for residential parcels (e.g., one dwelling unit allowed per acre in SRR-1.0 zones, 4.6 dwelling units allowed per acre in SRR-4.6 zones). These designations determine the amount of growth that can be expected through potential subdivision of land. Zoning for every parcel is then mapped to match the land use and density specified in the Plan. Community plan policies relevant to groundwater resources are provided in Table 2-7.

Summerland Community Plan

Summerland was originally subdivided in December 1888 as a spiritualist community. The new lots were generally divided in a grid pattern of 25 feet by 50 feet to accommodate tents for visitors on a steep slope north of what is now U.S. Highway 101. These small lots are one of the issues that still face the town today, as building on them can be challenging due to the small size of the lots and the steep slopes. Most of the Summerland Planning Area is within the Coastal Zone, with the exception of 22 parcels northeast of Ortega Ridge Road.

Summerland originally had water service provided by the Summerland Water District (which was formally dissolved and merged with MWD in 1995). In the mid-1980s, after the lifting of a moratorium that had been placed on new water meters due to the drought and severe water shortage of the later 1970s, Summerland Water District released 200 water meters, which overwhelmed the community with new construction and led to the designation of the area by the County as a "Special Problem Area" due to grading, flooding, and parking problems the growth brought with it. This kicked off a process to develop the Summerland Community Plan (County of Santa Barbara 2014), which, along with an accompanying final environmental impact report, was initially adopted in 1992 and most recently updated in 2014.

Toro Canyon Community Plan

Toro Canyon is bordered by the Summerland and Montecito Community Plan areas to the west, the Pacific Ocean to the south, the Los Padres National Forest to the north, and Rancho Monte Allegre and Carpinteria City limits to the east. The southern portion of Toro Canyon lies within the Coastal Zone.

Toro Canyon's 5,750 acres support large areas of agriculture (including greenhouses), low-density residential, some commercial and recreational areas, and undeveloped open space. The Toro Canyon Community Plan recognizes that steep slopes, poor soils, limited sewer service, sensitive habitats, fire hazard, and narrow winding roads seriously constrain intensified residential development in Toro Canyon. The community plan indicates that the Comprehensive Plan allows for up to 305 new units under theoretical buildout of general plan land use designation, but that it does not account for adopted County policy (e.g., the Montecito Growth Management Ordinance) or physical constraints such as access and fire protection, limited public road access, lack of adequate wastewater systems, sensitive habitat protection, and steep slopes, nor does it account for additional secondary residential uses such as residential second units and farm employee dwellings.

The Montecito and Carpinteria Sanitary Districts each serve small portions of Toro Canyon, although 80% of area residents rely on private septic systems for wastewater disposal. Large numbers of horses and domestic animals residing in Toro Canyon may be a source of water pollution.

Montecito Growth Management Ordinance

Montecito enacted the Montecito Growth Management Ordinance (MGMO), which recognizes the physical constraints on growth within the community, the desire to preserve the semi-rural character of the area, and the limited reach and expansion capabilities of existing public services and infrastructure. The MGMO adopts a 0.5% permit allocation growth rate (along with exemptions for affordable units and second residential units), compared to a pre-ordinance average population increase of 2.26% per year. The 0.5% annual permit allocation is equivalent to 19 units per year. With regard to water resources, the MGMO recognizes that large uncertainties exist with regard to the ability of the current and future water supply to accommodate existing and future water demands, and is one of the major reasons for the establishment of the MGMO, since it is viewed as preventing the accelerated rate of depletion and/or overdrafting of the MGB while encouraging cooperative efforts with water agencies and purveyors to obtain a long-range, acceptable, reliable source of water to serve the community. The MGMO is consistent with the goals and objectives of this GSP.

2.1.5.3 Other Planning/Land Use Considerations

It should also be noted that all discretionary projects proposed within the MGB are required to comply with CEQA. In 2019, the Governor's Office of Planning and Research released an update to the CEQA Guidelines that included a new requirement to analyze projects for their compliance with adopted GSPs. Specifically, the new applicable significance criteria include the following:

- Would the program or project substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?
- Would the program or project conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?

Therefore, to the extent to which general plans allow growth that could have an impact on groundwater supply, such projects would be evaluated for their consistency with adopted GSPs and for whether they adversely impact the sustainable management of the MGB. Under CEQA, potentially significant impacts identified must be avoided or substantially minimized unless significant impacts are unavoidable, in which case the lead agency must adopt a statement of overriding considerations.

The County has long implemented its own CEQA significance thresholds based on heightened public concern and awareness for the scarcity of the County's groundwater resources. Under County guidelines, "safe yield" is defined as "the maximum amount of water which can be withdrawn from a basin (or aquifer) on an average annual basis without inducing a long-term progressive drop in water level" (Baca 1992).[10] The Environmental Thresholds and Guidelines Manual prepared by the County (County of Santa Barbara 2018) outlines the appropriate use and application of various environmental impact thresholds as they relate to groundwater resources. The County originally determined in 1992 that the safe yield of the MGB was 1,215 AFY, with pumping that put the MGB into overdraft with an estimated "remaining life of available storage" at the time to be 37.5 years. For the Toro Canyon Groundwater Basin, the safe yield was estimated to be 270 AFY, and the Toro Canyon Groundwater Basin was determined not be in overdraft (Baca 1992). Historical safe yield estimates for the MGB are discussed in Section 2.2.3.3, Sustainable Yield.

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[10] Note that the safe yield definition in the CEQA significance thresholds is not the same as the SGMA definition.

2.1.6 Additional GSP Elements

Required GSP elements include those listed below (CWC 10727.4, 23CCR 354.8(g)). Each element that is applicable to the Basin includes a description of where within the GSP, it is addressed.

- Control of saline water intrusion – There are no existing saline water intrusion programs in the Basin. Information on seawater intrusion is included in Sections 2.2.4.3, 3.2.3, 3.3.4, and 3.4.3.
- Wellhead protection – Section 2.1.4.2 Well Permitting
- Migration of contaminated groundwater – Section 2.2.4.4 Groundwater Quality
- Well abandonment and well destruction program – Section 2.1.4.2 Well Permitting
- Replenishment of groundwater extractions – Section 2.3 Water Budget
- Conjunctive use and underground storage – Section 2.3 Water Budget
- Well construction policies – Section 2.1.4.2 Well Permitting
- Groundwater contamination cleanup, recharge, diversions to storage, conservation, water recycling, conveyance, and extraction projects – Section 2.1.4.2 Groundwater Quality
- Efficient water management practices – Section 2.1.4.5 Operational Flexibility and Section 2.1.5 Land use Elements oof Topic Categories of Applicable General Plans
- Relationships with State and federal regulatory agencies – Section 2.1.1.1 Land Use and Jurisdictions Within the Plan Area, 2.7.1.4 Summary of Initial Information on Relationships between State and Federal Regulatory Agencies, and Section 2.3, Water Resources Monitoring and Management Programs
- Land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity - Section 2.1.5 Land use Elements of Topic Categories of Applicable General Plans
- Impacts on groundwater dependent ecosystems – Section 2.2.4.6 Groundwater – Surface Water Connectivity and Section 2.2.4.7 Groundwater Dependent Ecosystems

2.1.7 Notice and Communication

Notification, communication, and collaboration have been conducted at all phases of GSP development including:

1. MBGSA Formation

2. Initial GSP Notification
3. GSP Development
4. Draft GSP Review and Comment

The MWD notified DWR of its intent to become the exclusive groundwater sustainability Agency on June 29, 2018. The required notification of intent to prepare the GSP was submitted to DWR on April 30, 2019. The notification specified the preparation of a single GSP for the entire Basin. The MBGSA has maintained a publicly available Sustainable Groundwater Management website that includes extensive information on the Basin, MBGSA Board, GSP process, including draft GSP chapters made available for public review, meetings and workshops, and opportunities for public involvement and comment. A Communications and Engagement Plan (CEP) was prepared by the MBGSA and adopted by the MBGSA Board on April 14, 2020 (Section 2.1.7.5). The CEP is a living document, the purpose of which is to provide a guide for public and stakeholder participation in the SGMA process. It is included as Appendix C of this GSP. There has been ongoing coordination with agencies having groundwater management responsibilities in the basins adjacent to the MBG; the City of Santa Barbara to the west and Carpinteria Valley Water District to the east. MOUs relevant to this coordination are included in Appendix B.

The MBGSA engaged with stakeholders regarding the SGMA process and groundwater management prior to DWR's reprioritization of the Basin from very low to medium priority (reprioritization finalized by DWR January 4, 2019) and during Basin Boundary Modification (approved by DWR February 2019). The GSP development phase included extensive outreach and engagement with the stakeholders including beneficial users, as described in more detail in Section 2.1.7.2, Public Meetings Summary and Section 2.1.7.5, Communication. The Draft GSP Review and Comment phase included a formal public comment period for the Draft GSP and response to comments, as discussed in Section 2.1.7.3, Summary of Comments and Responses. [Upcoming]

The final notification and engagement phase of GSP preparation will begin upon submittal of this GSP to DWR. This phase is ongoing with engagement of interested parties and stakeholders during implementation of the monitoring plan, annual and periodic updates, and GSP revision, as needed.

2.1.7.1 Summary of Beneficial Uses and Users

The beneficial uses of groundwater within the Basin include municipal, agricultural, and residential water supply. Beneficial users of groundwater and those interests potentially affected by groundwater management include municipal and private water purveyors, private well owners, local land use planning agencies, and environmental and recreational users (Table 2-8). There are no disadvantaged communities or federally recognized tribal lands within the Plan Area. The beneficial users of groundwater within the Plan Area are described in more detail in the following paragraphs.

Municipal Well Operators and Public and Private Water Purveyors. The Montecito Water District is the only Public Water Agency that operates groundwater wells within the Plan Area. Private water companies that operate groundwater wells include Wilkinson/Gill Water Company, Hot Springs/Montecito Creek Water Company, Ivydene Water Company, Lingate Lane Mutual Water Company, Miramar Addition and Improvement Company, Riven Rock Mutual Water Company, Toro Canyon Estates Mutual Water Company, Coyote Springs Water Company, Sea Meadows, and Sunshine Water Company (East Montecito Mutual Water Company) (Section 2.1.1.2). MWD comprises the MBGSA and input from private water companies has been solicited through the outreach methods described in Section 2.1.7.5. In addition, there has been coordination with private water companies as needed to prepare this GSP and implement the related grant projects.

Local Land Use Planning Agencies. Santa Barbara County and the California Coastal Commission have planning authority over the portions of the Plan Area within their jurisdictional boundaries. Input from Local Land Use Planning Agencies has been solicited through the outreach methods described in Section 2.1.7.5.

Environmental Users. Environmental uses of groundwater within the basin may include groundwater dependent ecosystems in the form of riparian and aquatic habitat. The MBGSA has taken steps to incorporate the interests of environmental users in the development of the GSP through a review and documentation of the potential interconnectedness of surface and groundwater in the Subbasin as described in Section 2.2.4.7. Additionally, environmental stakeholders were invited to attend public meetings and comment on the public draft of the GSP. Comments on the public draft were incorporated into the final GSP.

Table 2-8
Stakeholder Categories in the Plan Area

Category of Interest	Stakeholder Groups	Engagement Purpose
General Public	General Public	Inform and solicit input on sustainable groundwater management within the Basin
Land Use	Montecito Water District County of Santa Barbara City of Santa Barbara Carpinteria Water District California Coastal Commission Montecito Association	Collaboration on land use policies and requirements to ensure mutual compatibility and support

Table 2-8
Stakeholder Categories in the Plan Area

Category of Interest	Stakeholder Groups	Engagement Purpose
Private Users	Wilkinson/Gill Water Company Hot Springs/Montecito Creek Water Company Ivydene Water Company Lingate Lane Mutual Water Company Miramar Addition and Improvement Company Riven Rock Mutual Water Company Toro Canyon Estates Mutual Water Company Coyote Springs Water Company Sea Meadows Sunshine Water Company (East Montecito Mutual Water Company)	Assess needs and impacts of residential use and collaborate to ensure sustainable groundwater management
Urban/Agriculture Users/Golf Courses	Montecito Water District Avocado, Wine and Grape, and Citrus Growers Valley Club Birnam Wood Golf Club Montecito Club	Collaborate to ensure mutually beneficial sustainable management of groundwater
Environmental and Ecosystem	Montecito Trails Foundation California Department of Fish and Wildlife	
Integrated Water Management	Integrated Regional Water Management Program (Santa Barbara County Region)	Inform, involve, and collaborate to improve regional sustainability

2.1.7.2 Public Meetings and Workshops Summary

Following is a list of meetings at which MBGSA business was conducted and workshops, the sole purpose of which was to inform and solicit input from the public and stakeholders. Included in the list is meetings of the stakeholder and public advisory Committees. Each meeting listed was advertised in advance and provided opportunity for input from the public.

- April 29, 2019 - MBGSA Board Meeting
- July 24, 2019 - MBGSA Board Meeting
- October 8, 2019 - MBGSA Board Meeting
- November 14, 2019 - MBGSA Financial Committee Meeting
- December 19, 2019 - MBGSA Strategic Planning Committee
- January 14, 2020 - MBGSA Board Meeting
- January 21, 2020 - MBGSA Strategic Planning
- February 7, 2020 – MBGSA Strategic Planning Meeting
- February 24, 2020 – MBGSA Public Workshop
- March 10, 2020 – MBGSA Finance Committee Meeting
- April 1, 2020 – MBGSA Strategic Planning/Finance Committee Meetings

- April 14, 2020 – MBGSA Board Meeting
- June 12, 2020 – Technical Advisory Committee Meeting
- June 18, 2020 - Stakeholder Advisory Committee Meeting
- June 24, 2020 – MBGSA Board Meeting
- July 21, 2020 – MBGSA Finance Committee Meeting
- July 28, 2020 – MBGSA Board Meeting
- September 16, 2020 – Technical Advisory Committee Meeting
- September 24, 2020 – Stakeholder Advisory Committee Meeting
- October 13, 2020 – MBGSA Board Meeting
- November 10, 2020 – Montecito Association Board Meeting
- December 11, 2020 – Technical Advisory Committee Meeting
- December 17, 2020 – MBGSA Stakeholder Advisory Committee Meeting
- January 12, 2021 – MBGSA Board Meeting
- January 13, 2021 – Summerland Citizens Association Board Meeting
- April 2, 2021 – Technical Advisory Committee Meeting
- April 14, 2021 – MBGSA Board Meeting
- September 17, 2021 - Technical Advisory Committee Meeting
- October 12, 2021 - MBGSA Board Meeting
- December 2, 2021 - Technical Advisory Committee Meeting
- January 11, 2022 - MBGSA Board Meeting
- March 28, 2022 - Technical Advisory Committee Meeting
- April 1, 2022 – Strategic Planning Committee Meeting
- May 11, 2022 – Public Workshop
- September 11, 2022 – Strategic Planning Meeting
- September 26, 2022 – Technical Advisory Committee Meeting
- October 11, 2022 – MBGSA Board Meeting

Note that the list will be updated as additional meetings occur. Need to add Stakeholder meetings]

2.1.7.3 Summary of Comments and Responses

The MBGSA released a public draft of the GSP on [DATE]. A public workshop was held on [DATE], to present the Public Draft GSP, answer questions, and solicit comments. The comment period was open between [DATE] and [DATE]. Formal comments were accepted in writing only. The comments were submitted electronically via email or via the MBGSA Public Comment Form to [Website Address]. A total of XX comment letters were received. Before completing this Final

GSP, the public comments received on the Draft GSP were reviewed and, where appropriate, incorporated into this Final GSP. Public comments on the Draft GSP are included in Appendix xx.

2.1.7.4 Summary of Initial Information on Relationships between State and Federal Regulatory Agencies

MBGSA has not entered into any formal agreements with the federal government regarding preparation or administration of this GSP or groundwater management pursuant to SGMA, Section 10720.3(c). There are no federally recognized Indian Tribes within the Plan Area.

MBGSA recognizes the need for both formal and informal consultation with state and federal regulatory agencies throughout the implementation of the GSP. MBGSA includes the following state and federal regulatory agencies on its list of interested parties:

- United States Forest Service
- California Department of Fish and Wildlife
- California Coastal Commission
- California Department of Water Resources

2.1.7.5 Communication

A Public Communication and Engagement Plan was developed for this GSP (Appendix C). The purpose of the Public Communication and Engagement Plan (CEP) is to create a common understanding and transparency throughout the groundwater sustainability planning process, including fulfilling the requirements of SGMA as described in 23 CCR §354.10.d. The Public Outreach and Engagement Plan conforms to DWR Guidance and introduces groundwater management and summarizes the SGMA background and role of MBGSA (DWR 2018). The CEP identifies the goals and outcomes of the outreach process; identifies opportunities for public engagement and provides a discussion of how public input and response will be incorporated; describes how MBGSA encourages the active involvement of diverse social, cultural, and economic elements of the population within the Basin; and describes the method by which MBGSA will inform the public about GSP and groundwater management progress.

MBGSA has provided ongoing opportunities for stakeholder involvement in the GSP development including the development and maintenance of a dedicated MBGSA website (https://montecitogsa.com/). Among other functions, the website includes agendas, minutes, and presentations for meetings; draft GSP chapters; a form by which the public may submit comments; the GSP schedule; and additional GSP technical information. The Public Draft GSP was available online for [NUMBER] days, including an official [NUMBER]-day public comment period.

MBGSA encouraged active participation from stakeholders through the GSP development process.

2.2 BASIN SETTING

2.2.1 Historical, Current, Projected Climate

2.2.1.1 Precipitation

The climate of the south coast of Santa Barbara County and the MGB is Mediterranean, with warm, dry summers and cool, often wet, winters. Precipitation is variable across the region due to the high relief, east–west-trending, transverse Santa Ynez Mountains. Average rainfall increases with elevation in the Santa Ynez Range, with the top of the range receiving nearly twice the precipitation of elevations at or near mean sea level (County of Santa Barbara 2019a). The Parameter-Elevation Regressions on Independent Slopes Model 30-year (1981–2010) digital elevation model precipitation grid shows that the average annual precipitation in the MGB ranges from about 18 inches per year along the southern edge of the MGB near the coast to nearly 26 inches per year in the northernmost parts of the MGB (Figure 2-6). The region also experiences significant year-to-year and decadal variability in precipitation, in which extended dry periods are followed by consecutive wet years. This variability is evident from the precipitation record of weather stations in and near the MGB (Figure 2-10, Water Year Precipitation). In typical wet years, large winter storms from the Pacific Ocean deliver heavy precipitation (DWR 2015).

Based on length of record and proximity to the MGB, the five most representative weather stations for climate analysis are the Montecito, Summerland, Doulton Tunnel, Cold Springs Debris Basin, and Santa Barbara stations. Average water year precipitation data for the five weather stations for the period from 2000 to 2019 (20-year period) are provided in Table 2-9. Based on this 20-year record, the mean water year precipitation in the vicinity of the MGB ranges from 17.51 inches (Santa Barbara station) to 25.59 inches (Doulton Tunnel station), for a combined mean precipitation of 21.14 inches (Summerland station is excluded from calculation of mean precipitation due to limited data).

Table 2-9
Average Water Year Precipitation from 2000 to 2019 for Select Rain Gauges in the Vicinity of the MGB

Water Year	**Rain Gauge**				
	Montecito (No. 325)	*Summerland (No. 328)*[a]	*Cold Springs Debris Basin (No. 210)*[b]	*Doulton Tunnel (No. 231)*	*Santa Barbara (No. 234)*
	Measured Precipitation (Inches)				
2000	22.61	—	25.21	28.58	22.75
2001	26.46	—	30.04	33.53	25.81
2002	10.36	—	11.04	11.89	9.20
2003	26.26	—	30.80	30.37	24.79
2004	11.82	—	15.37	15.27	10.70
2005	42.01	—	50.58	62.40	37.05
2006	24.30	—	29.81	31.57	22.33
2007	7.30	—	8.91	9.64	6.62
2008	19.64	—	26.12	21.71	17.41
2009	12.05	—	16.23	19.94	11.84
2010	21.62	—	29.82	39.88	20.43
2011	30.79	—	42.50	46.02	28.49
2012	10.73	—	15.99	15.66	11.63
2013	10.22	—	14.68	16.53	8.98
2014	7.67	—	10.57	10.13	8.06
2015	9.63	10.11	12.76	14.36	10.55
2016	11.31	10.68	13.90	15.35	11.62
2017	26.79	26.18	28.83	36.18	26.55
2018	9.71	10.61	—	16.47	9.52
2019	22.01	21.22	29.37	36.33	25.85
Average	**18.16**	**15.76**	**23.29**	**25.59**	**17.51**

Source: County of Santa Barbara; NOAA.
Notes: — = data are not available.

[a] Water year precipitation data are not available for the Summerland Station for the years 2000–2014.

[b] Water year precipitation data are not available for the Cold Springs Debris Basin Station for the year 2018.

Cumulative departure from mean precipitation over the historical record shows considerable variability in precipitation and several wet and dry periods (Summerland station is excluded from evaluation due to limited data) (Figure 2-10).

The precipitation record for the Montecito station spans the period from water year 1926 to 2019. Over this period, the cumulative departure from the mean precipitation shows several short- and long-term wet and dry sequences. Between 1926 and 1934 the cumulative departure from mean precipitation curve declines, indicating either a relatively short-term decrease, or trailing end of a long-term decrease, in precipitation. The apparent short-term decrease is followed by a decadelong increase in precipitation from 1934 to 1944. From 1944 to 1977 the cumulative departure from mean precipitation curve generally declines again, indicating a dry period that extended over 33 years. From 1977 to 2006 the cumulative departure from mean precipitation curve generally trends upward again, with the exception of 4 consecutive years of below-average precipitation from 1987 to 1990. From 2006 to 2019 the cumulative departure from mean curve again steadily declines, indicating an extended dry period. As can be seen on Figure 2-10, 1998 was the wettest year on record (54.43 inches), while 2007 was the driest year on record (7.30 inches). Water year 2019, the most recent water year, was an above-average water year, with 22.01 inches of precipitation measured at the Montecito station.

Precipitation Year Types

Individual water years at the Montecito station were categorized based on total measured precipitation as a percentage of the station average precipitation using the following criteria: "critical" if precipitation below 50% of station average, "dry" if between 50% and 75%, "below normal" if between 75% and 100%, "above normal" if between 100% and 150%, and "wet" if above 150% of the station average precipitation. Based on the above criteria, for the entire period of record for the Montecito station there were 9 years identified as critical, 29 years identified as dry, 17 years identified as below normal, 28 years identified as above normal, and 11 years identified as wet (Table 2-10).

Table 2-10
Montecito Groundwater Basin Water Year Types

Precipitation Year Category	Percent of Mean Precipitation	Number of Years
Critical	Below 50	9
Dry	50 to 75	29
Below normal	75 to 100	17
Above normal	100 to 150	28
Wet	Above 150	11

Note: Average precipitation at Montecito station from water year 1926 to 2019 is 19.82 inches.

2.2.1.2 Temperature

Temperatures in the vicinity of the MGB fluctuate on a seasonal basis from warm summers to cool winters. The weather station in the vicinity of the MGB with the longest and most complete temperature record is the National Oceanic and Atmospheric Administration Santa Barbara station (Station No. 47902), which spans the period from 1893 to present. Based on the Santa Barbara station, the average annual temperature is 60.6°F, ranging from an average low of 43.2°F in January to an average high of 75.3°F in September. The historical all-time minimum and maximum temperature recorded at the Santa Barbara station are 20°F and 108°F, respectively.

2.2.1.3 Evapotranspiration

Reference evapotranspiration (ETo) in the MGB is based on data collected at the nearest CIMIS station (Station No. 107; Figure 2-6) on a daily basis between 2010 and 2019. The average ETo measured at CIMIS Station 107 between 2010 and 2019 (10-year period) is 43.95 inches, or 3.66 feet, per year (Table 2-11). In contrast, the average annual precipitation in the MGB is approximately 21.14 inches per year, or about one-half the average ETo for the area. The ETo values calculated from the CIMIS data reflect the amount of water that could be transpired by grass or alfalfa if supplied by irrigation, but do not represent the actual transpiration from any specific crop or native vegetation. To calculate the evapotranspiration rate for a specific vegetation type, the ETo is multiplied by a crop coefficient that adjusts the water consumption for each crop relative to the water consumption of alfalfa.

Table 2-11
Monthly and Yearly Reference Evapotranspiration Totals for CIMIS Station No. 107 from 2010 to 2019 (Inches)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
2010	1.64	2.10	4.20	4.36	5.94	4.66	4.91	5.19	3.85	2.84	2.28	1.20	43.17
2011	1.96	2.29	3.30	4.74	5.77	3.96	5.14	5.07	3.56	3.21	1.95	1.79	42.74
2012	2.12	2.67	3.39	4.26	5.66	4.94	5.19	5.73	4.33	3.63	1.92	1.39	45.23
2013	2.03	2.52	3.39	4.27	5.70	4.49	4.83	5.15	4.44	3.32	2.04	2.00	44.18
2014	2.20	2.30	3.70	5.00	6.02	5.17	5.43	5.26	4.38	3.55	2.32	1.47	46.80
2015	1.91	2.38	4.05	4.71	4.58	4.79	5.01	5.26	4.42	3.65	2.61	2.01	45.38
2016	1.64	3.22	3.71	4.95	4.11	4.94	5.59	4.93	3.61	2.76	1.99	1.30	42.75
2017	0.96	1.29	3.95	4.91	4.97	5.06	4.76	3.78	3.33	3.95	2.07	1.91	40.94
2018	1.83	2.68	3.30	4.92	4.56	5.05	6.00	5.61	3.86	3.45	2.24	1.73	45.23
2019	1.67	2.02	3.87	4.32	3.98	3.12	5.71	5.71	4.79	4.17	2.19	1.51	43.06
Average	**1.80**	**2.35**	**3.69**	**4.64**	**5.13**	**4.62**	**5.26**	**5.17**	**4.06**	**3.45**	**2.16**	**1.63**	**43.95**

Source: CIMIS.
Note: CIMIS = California Irrigation Management Information System.

According to the State of California Evapotranspiration Map developed by CIMIS, the MGB is located within Evapotranspiration Zone 10, with an annual average ETo of 49.1 inches, or 4.09 feet (CIMIS 1999). This regional average ETo estimate is comparable to the ETo measured at CIMIS station 107 (Table 2-11).

2.2.1.4 Projected Climate

As described above, historical and current precipitation data for the MGB indicate significant inter-annual and decadal scale fluctuations in precipitation associated with variability in the magnitude and number of storm events that occur over a given period. To evaluate climate change impacts on precipitation in the MGB, DWR-projected 2030 and 2070 precipitation change factors were applied to the historical precipitation record of the Montecito and Doulton Tunnel stations.

Climate change data are provided by DWR in both tabular and spatial formats. These data consist of monthly adjustment factors (e.g. change factors) used to scale historical precipitation and evapotranspiration data. To determine which change factor grid cell values to apply to the Montecito and Doulton Tunnel stations, the station locations were overlain by the change factor model grid in a geographic information system (GIS). Based on the spatial data, the Doulton Tunnel Station falls within model grid cell 9269; however, the Montecito station, and the majority of the MGB, is located outside the change factor model grid. To avoid unrealistic increases in projected precipitation due to the orographic enhancement the Santa Ynez Mountains have on precipitation patterns in the MGB, the precipitation change factor values of the nearest "coastal" model grid (grid cell 10150) were applied to the Montecito station precipitation record. Additionally, the change factor dataset covers the period from January 1915 to December 2011. For water years after 2011, change factor values for the pre-2011 water year with the most similar mean annual precipitation were used.

Based on the Montecito station historical precipitation record, mean water year precipitation is projected to increase by 0.20 inches and 0.64 inches by 2030 and 2070, respectively. Based on the Doulton Tunnel station historical precipitation record, mean water year precipitation is projected to increase by 0.09 inches and 0.72 inches by 2030 and 2070, respectively.

Projected Drought Severity

Water supply planning is predicated, in part, on the most severe drought anticipated to occur during the planning period. There are various methods to determine the drought to be used for planning purposes, including the most severe drought that has occurred since historical climate records have been kept, the most severe indicated by dendrochronology, or other indirect methods. Ideally, the "design" drought takes into account expected trends from long-term climate change. Figure 2-10 shows Santa Barbara precipitation since 1900 along with the cumulative departure from mean. Note that several dry periods have occurred during that time, with varying lengths and rainfall shortages. Drought severity is generally predicted to intensify due to greater inter-annual precipitation variability and projected warming upwards of 7°C (12.6°F) by the end of the century. According to downscaled global climate model simulations for a mid-twenty-first century 20-year dry spell in California, it is predicted that an extended drought would have a precipitation deficit comparable to the greatest precipitation deficit observed historically, but with temperatures 1°C to 3°C (1.8°F to 5.4°F) above historical levels, depending on whether the drought occurs earlier or later in the twenty-first century (Pierce et al. 2018).

2.2.2 Hydrogeologic Conceptual Model

The hydrogeologic conceptual model provides the framework for the development of water budgets, analytical and numerical models, and monitoring networks. Additionally, the hydrogeologic conceptual model serves as a tool for stakeholder outreach and communication, and assists with the identification of data gaps. A hydrogeologic conceptual model does not compute specific quantities of water flowing through or moving into or out of a basin, but rather provides a general understanding of the physical setting, characteristics, and processes that govern groundwater occurrence and movement within a basin. The parameters of the hydrogeologic conceptual model developed for the Plan Area are depicted on Figure 2-11, Hydrogeologic Conceptual Model. These parameters include basin boundaries, stratigraphy, land use, and the components of inflow and outflow from the MGB. The following subsections detail the geologic and hydrogeologic characteristics of the MGB.

The MGB underlies the central coastal plain of the Transverse Ranges Geomorphic Province. The Transverse Ranges Geomorphic Province is characterized by east–west-trending mountain ranges from Point Arguello at the coast, inland to the San Bernardino Mountains. The province includes the offshore Channel Islands, which are similar in orientation and geologic composition to the mainland (CGS 2002). The southernmost mountains of the Transverse Ranges are the Santa Monica Mountains. The Transverse Ranges are actively uplifting in response to compression along an east–west-trending section of the San Andreas Fault (CGS 2002). The Transverse Ranges Geomorphic Province's northern boundary is the east–west-trending Santa Ynez Fault, along which uplift of the Santa Ynez Mountains is occurring. The southern Transverse Ranges boundary is the Santa Monica Fault Zone, at the southern base of the Santa Monica Mountains.

The MGB underlies the terraces and plains between the Santa Ynez Mountains to the north and the Pacific Ocean to the south (Figure 2-12a, Dibblee Geologic Map, and Figure 2-12b, Dibblee Geologic Map Model). The underlying geologic structure of the MGB consists of downward-folded (synclinal) bedrock of the southern Santa Ynez Mountains underlying an unconsolidated sediment-filled depression (Figure 2-13, A–A′ Geologic Cross Section). Several faults transect the MGB trending in a general east–west direction. These faults delineate the boundaries of what many historical reports and studies have treated as three distinct groundwater storage units (Figures 2-12a and 2-12b). Toro Canyon, a fourth storage unit located along the eastern MGB boundary, has been designated as well, presumably based on the relative isolation of aquifer deposits from the other aquifers to the east and west (Figure 2-14, B–B′ Geologic Cross Section, and Figure 2-15, C–C′ Geologic Cross Section). A topographic high portion of the MGB, located west of Toro Canyon Creek in the southeastern portion of the MGB, is devoid of unconsolidated water-bearing deposits and is excluded from the MGB as defined by DWR (Figures 2-12a, 2-12b, and 2-14).

Geologic Units

The geologic units of the MGB are of two general types: (1) consolidated rocks, which compose the east–west-trending Santa Ynez Mountains and underlie the MGB, and (2) the unconsolidated sediments that overlie the basement rock and compose the MGB aquifer and surficial geology (Muir 1968). The boundary between the consolidated and unconsolidated rocks represents an unconformity across which lithological units representing millions of years are missing. The geologic units underlying the MGB are described below from oldest to youngest.

Tertiary Age Consolidated Rocks

Tertiary age consolidated rocks of the southern side of the Santa Ynez Mountains are folded beyond vertical where they are exposed in the areas surrounding the MGB (Figures 2-12a and 2-13). Note that Figure 2-12b provides a key for the features shown in Figure 2-12a. Similarly, Figure 2-16, Geologic Cross Sections Legend, provides a key for the features shown in Figures 2-13, 2-14, and 2-15. Sedimentary Eocene age consolidated sandstone, shale, siltstone, and mudstone formations of marine origin include the Juncal, Matilija, Cozy Dell, and Coldwater sandstone.[11] The combined thickness of these exceeds 15,000 feet (Muir 1968).

Overlying the Coldwater sandstone is the Sespe Formation, a terrestrial red to pink silt shale and claystone with interbedded sandstone and conglomerate. The Sespe Formation is of Oligocene age,[12] and outcrops sporadically throughout the MGB (Figure 2-12a). Overlying the Sespe are several Miocene age units, which include the Vaqueros, Rincon, and Monterey Formations.[13] While the Vaqueros Formation consists mainly of thickly bedded, fine-grained sandstone, the Rincon Formation is primarily claystone and siltstone. The Monterey Formation, which is found in small outcrops on the eastern and western margins of the MGB, is a weathered white and siliceous shale and limestone (Figure 2-12a).

The total thickness of the consolidated rocks underlying the MGB is about 20,000 feet (GTC 1974).

Quaternary Age Poorly Consolidated to Unconsolidated Deposits

Unconsolidated deposits of Pleistocene to Holocene age unconformably overlie the consolidated Tertiary bedrock filling the structural depression of the coastal plain with sediments eroded mainly

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[11] From about 56 million to 34 million years before present.

[12] From about 34 to about 23 million years before present.

[13] From about 23 million to 5.4 million years before present

from the uplifted areas north of the MGB (Muir 1968).[14, 15] The groundwater resources of the MGB exist primarily within these deposits (see Section 2.2.3, Principal Aquifers and Aquitards).

Santa Barbara Formation

The Late Pliocene–Early Pleistocene Santa Barbara Formation is of marine origin and directly overlies the consolidated Monterey Formation throughout much of the coastal plain of Santa Barbara County (GTC 1974).[16] However, the Santa Barbara Formation is present in only limited parts of the MGB where it does not crop out, and is present only at depth (Figures 2-13 and 2-14). The formation is mostly brown to grey, weakly consolidated, massive siltstone and sandstone with some clay (GTC 1974). The formation is as thick as 2,200 feet in some areas of the south coast of Santa Barbara County. However, uplift and erosion have reduced or eliminated the formation in much of the MGB (GTC 1974). The formation is present only in the southwest part of the MGB (DWR 2004), where it is thought to be on the order of a couple hundred feet thick (GTC 1974). Therefore, it is not considered to be a significant source of groundwater in the MGB (DWR 2004).

Casitas Formation

The Pleistocene Casitas Formation is of continental origin and is present in each of the MGB storage units, where it consists of variable lithology including yellow to brown gravel, sand, silt, clay, and cobbles (Muir 1968). Where the Santa Barbara Formation is absent, the Casitas Formation unconformably overlies the older consolidated bedrock (Figure 2-13). Where the Santa Barbara Formation is present, it may grade, or finger, into the overlying Casitas Formation. Data from oil wells and other borings indicate the Casitas Formation is between 500 and 600 feet thick in the MGB.

Due to a tendency for the formation to coarsen upward, it is mainly the upper formation that yields water to wells (DWR 2004). Within the MGB, the Casitas Formation is characterized by discontinuous and lenticular zones of fine-grained clay and sandy clay, resulting in discontinuous aquifers and aquicludes (GTC 1974). The aquifer in this formation is confined or partially confined in some parts of the MGB, including on the north side of the Arroyo Parida Fault (DWR 2004).

Alluvial and Terrace Deposits

Surficial alluvial and terrace deposits of Pleistocene to Holocene age unconformably overlie the Casitas Formation and include terrace, alluvial fan, stream channel, and beach sand deposits up to 500 feet thick (Muir 1968). Pleistocene deposits include older alluvium, terraces, and fanglomerate. Such deposits include red-brown boulders and cobbles in a matrix of sand and clay

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[14] From about 2.6 million to 11,700 years before the present.
[15] From about 11,700 years before the present to the present.
[16] From about 5.3 million to 2.6 million years before the present.

(GTC 1974). Holocene deposits are mainly present in the south part of the MGB and in creek channels, where they consist of unconsolidated deposits of gravel, sand, silt, and clay. Older deposits are not easily distinguished from Holocene formations due to their similar lithology and gradation or interfingering of contacts (GTC 1974). Alluvial and terrace deposits yield limited quantities of groundwater to shallow screened wells (GTC 1974).

Basin Bottom

SGMA regulations require description of the “definable bottom of the basin” (Section 354.14) and DWR guidance documents suggest several different ways to define the basin bottom (DWR 2016). It may be defined based on physical properties, such as the transition from permeable unconsolidated sediment to bedrock, or by water quality considerations, such as the depth below which water is unusable for most potable or agricultural purposes due to poor water quality. Although groundwater is present in the fractures of consolidated bedrock of pre-Pliocene Tertiary age, and water from these formations recharges the unconsolidated sediments, the formations are known to yield poorly and unpredictably to groundwater wells (GTC 1974). Therefore, the bottom of the Santa Barbara Formation, where present, and bottom of the Casitas Formation are the basin bottom as defined for this GSP. Depth to the basin bottom varies by location, but in general the unconsolidated, water-bearing MGB deposits extend to a maximum depth of about 1,200 feet below ground surface (GTC 1974).

Geologic Structure

After an extended period of deposition during the mid-Tertiary period, the Transverse Ranges were subject to intense compression and folding in response to movement along the east–west-oriented part of the San Andreas Fault (Harden 2004). As a result of this and subsequent episodes of folding, the Santa Ynez Mountains were uplifted and the Tertiary bedrock deformed into the folds illustrated in Cross Sections A–A′, B–B′, and C–C′ (Figures 2-13, 2-14, and 2-15, respectively). Storage Unit 1, north of the Arroyo Parida Fault, overlies the east–west-trending hinge line and north limb of a large syncline (Cross Section A–A′; Figure 2-13). Notably, the beds of the syncline are overturned, dipping to the north such that any groundwater infiltrating the consolidated bedrock tends to flow to the north, away from the MGB. Additional folds include the Summerland Syncline and Loon Point Anticline within the Toro Canyon area (Cross Section C–C′; Figure 2-15). Major faulting within the MGB and the south coast of Santa Barbara County as a whole occurred subsequent to the major episodes of folding (Upson 1951).

The MGB has been divided in previous reports and studies into groundwater storage units based on the presence of several faults (Figures 2-12a and 2-12b). Storage Unit 1 extends from the Arroyo Parida Fault to the northern boundary of the MGB, Storage Unit 2 from the Arroyo Parida Fault south to the Montecito Fault, and Storage Unit 3 from the Montecito Fault to the Pacific

Ocean (the MGB's southern boundary). The Fernald Point Fault trends in a northeasterly direction from where it enters the coast west of Summerland, and terminates against the Arroyo Parida Fault (Figures 2-12a and 2-12b). Each of these faults offsets the consolidated bedrock underlying the MGB, in some areas by as much as thousands of feet (Cross Section A–A′; Figure 2-13). In parts of the MGB, there is evidence that the faults offset the unconsolidated formations that compose the MGB's aquifers, and act as barriers to groundwater flow (GTC 1974). An additional fault, the Rincon Creek Fault, trends in an east–west direction an unknown distance off the south coast (USGS 2020).

Major Faults

The USGS has grouped all of the major faults in the MGB under the fault system name "Mission Ridge Fault System," and used different fault section names from those of older reports, including GTC (1974). However, the fault traces are similarly located by each source, with the exception of the Rincon Creek Fault Zone (see description below). The fault names from GTC (1974) are used herein to more clearly distinguish between the faults being described.

Arroyo Parida Fault

The Arroyo Parida Fault trends east–west and composes the southern boundary of Storage Unit 1. It is a steeply dipping normal fault (GTC 1974) with some left lateral movement (USGS 2020). It has been considered to act as a significant barrier to groundwater flow in historical reports.

Montecito Fault

The Montecito Fault was first described by GTC (1974) to be a steeply dipping or vertical fault, with the north side having moved upward in relation to the south. It forms the southern boundary of the uplifted block that has been designated as Storage Unit 2. Historical reports have indicated that the fault acts as a significant barrier to groundwater flow (GTC 1974).

Rincon Creek Fault Zone

The Rincon Creek Fault has been variously located from approximately 1,000 feet offshore of the MGB (GTC 1974), to more than 1 mile offshore (USGS 2020). The location is important because the fault may be instrumental in the degree to which seawater intrusion may occur within the MGB. Based on the geology shown in the north–south cross section (Cross Section A–A′; Figure 2-13), the greater the distance of the offshore fault, the greater the exposure of unconsolidated units and the potential for seawater intrusion. Regardless of the postulated location of the fault, previous reports and studies have disagreed as to the extent to which the fault acts as a barrier to seawater intrusion (see Section 2.2.4.3, Seawater Intrusion). Although the USGS Quaternary Faults Web Application includes few details regarding the fault orientation and sense of movement, GTC

(1974) describes the fault as a southward-dipping reverse fault based on oil well logs (Cross Section A–A′; Figure 2-13).

Fernald Point Fault

Designated the Arroyo Parida Section of the Mission Ridge Fault System by the USGS (2020), the Fernald Point Fault is steeply dipping (>60º) in variable directions, as reported by various researchers (GTC 1974). Therefore, it is unclear whether the fault is a normal or reverse fault. GTC (1974) shows the fault as vertical, with the west side uplifted relative to the east side. It is along the Fernald Point Fault that the Summerland Hills are postulated to have been uplifted relative to the rest of the MGB (GTC 1974).

Groundwater Storage Units

Although several of the prominent regional faults had been mapped and referenced in early reports (Upson 1951; Muir 1968), and storage units defined in the MGB and throughout the south coast of Santa Barbara County, it was with the designation of the Montecito Fault that the MGB storage units were designated as referenced in their current configuration (GTC 1974). Sources that have referred to or have used the storage units as designations for various calculations since their definition by GTC (1974) include Hoover (1980a), MWD (1998), Slade (1991), and DWR (2004), among others.

Although historical reports commonly include the Toro Canyon Storage Unit with the Carpinteria Groundwater Basin, the Toro Canyon Storage Unit was defined by DWR as part of the MGB (DWR 2004). DWR has designated none of the storage units as sub-basins (DWR 2020b).[17] However, per the SGMA Guidelines, areas within the MGB may be defined as separate Management Areas for the purpose of facilitating sustainable management (Section 354.20). The decision to define any of the storage units as management areas may be based on several factors including the extent of hydrogeologic separation, unique land use, and data availability. Different sustainability criteria may be defined for individual management areas as long as there is a consistent definition of undesirable results throughout the basin.

The presence of faults does not, in itself, justify the designation of storage units within a basin unless hydrogeologic separation is evident. Such evidence has commonly included significant differences in water levels and disrupted gradients across faults, indicating that the faults act to prohibit or significantly inhibit flow across them. Groundwater elevation contour maps for the years 1961 and 1970 (GTC 1974) and 1983 and 1991 (Slade 1991) illustrate significant differences across the faults that define Storage Units 1, 2, and 3. More recent groundwater elevation contour

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[17] A “sub-basin” is defined as “any subdivision of a basin based on geologic and hydrologic barriers or institutional boundaries, as further described or defined in Bulletin 118.” Title 23, California Code of Resources, Chapter 1.5: Groundwater Management, Subchapter 1: Groundwater Basin Boundaries, Article 2: Definitions(g)(2).

maps (see Section 2.2.4.1, Groundwater Elevation Data) suggest that the Montecito and Arroyo Parida Faults are not effective barriers to groundwater flow; however, accurate portrayal of actual groundwater elevations across the faults have been subject to researcher interpretation and to the limitations of data availability (and data were sparse at times, particularly in Storage Unit 2). See Section 2.2.4.1, Groundwater Elevation Data, for a discussion of groundwater levels and the historical influence of major faults.

Because historical studies and reports, including DWR (2004), have recognized the four MGB storage units, this GSP continues to do so. However, the degree to which the storage units are hydrogeologically independent is considered in establishing sustainability criteria and management areas (Section 2.4).

2.2.3 Principal Aquifers and Aquitards

Water-bearing units in the MGB include the Santa Barbara Formation; the Casitas Formation, which is the primary aquifer; and the alluvium and terrace deposits. The Santa Barbara Formation is thought to be generally confined, although it does not occur extensively throughout the MGB (DWR 2004). The Casitas Formation may be confined in isolated areas in the MGB, such as along the north side of the Arroyo Parida Fault, whereas the alluvium and terrace deposits are mostly unconfined (DWR 2004). The Casitas Formation is graded, with the upper portions of the formation being coarser than the lower portions (MWD 1998). Therefore, wells that are screened throughout the Casitas Formation yield groundwater preferentially from shallower depths. Several parts of the aquifer have shown discontinuous confining or semi-confining clay layers, resulting in laterally discontinuous or inconsistent recharge (GTC 1974).

2.2.3.1 Aquifer Properties

Well logs indicate that many wells are screened across multiple geologic formations, and historical studies often treat the MGB as having a single unconfined aquifer, evaluating aquifer properties by storage unit as opposed to by depth (Slade 1991). Table 2-12 lists aquifer properties by storage unit from several historical sources.

Table 2-12
Aquifer Properties

Storage Unit	Hydraulic Conductivity (Feet/Day)[a]	Specific Yield (%)			
		GTC 1974[b]	*Hoover 1980*[b]	*Slade 1991*[c]	*DWR 1999*[d]
1	1.2	7	4.5	4 to 5	—
2	—	8	5	4	—
3	1.2	8	7.4	4 to 9	—
Toro Canyon	1.0	7	6	6	—
Average	—	—	**6.5**	**6**	**11**

Sources: GTC 1974; Hoover 1980a; Slade 1991; DWR 1999; Dudek 2015.
Notes: GTC = Geotechnical Consultants Inc.; DWR = California Department of Water Resources; — = data are not available.
[a] Based on analysis of pumping test results from select wells (Dudek 2015).
[b] Based on lithologic data from 27 wells located across the Montecito Groundwater Basin.
[c] Based on well lithologic data; assumes higher specific yield for shallower sediments.
[d] Based on lithologic data from 48 boreholes; does not include Toro Canyon Storage Unit.
Specific yield is approximately equal to the storativity for unconfined aquifers.

2.2.3.2 Groundwater in Storage

Historical estimates of groundwater in storage in the MGB are shown in Table 2-13. Estimates from Muir 1968, GTC 1974, and Hoover 1980a are within approximately 25% of each other. Variations in the geometry calculated for each storage unit and in the determination of specific yield are responsible for the differences (Slade 1991). The Slade (1991) estimates are as much as one order of magnitude smaller than the others. This is mainly because the Slade (1991) estimates are for "usable" groundwater in storage, which Slade (1991) defines as groundwater that is economically recoverable and of sufficient quality for beneficial uses. For the MGB, this includes only the groundwater elevation above which seawater intrusion may occur (Slade 1991). Note that groundwater in storage and usable groundwater in storage fluctuates with groundwater elevation and is thus dependent on the climate and groundwater extraction during the period of calculation.

Table 2-13
Historical Estimates of Groundwater in Storage

Storage Unit	Groundwater in Storage (Acre-Feet)			
	Muir 1968	*GTC 1974*	*Hoover 1980a*	*Slade 1991*[a]
1	67,800	25,000	18,227	8,770
2	—	2,600	3,186	730
3	29,000[b]	92,600	81,424	4,990
Toro Canyon	—	8,680	9,081	1,620
Total	**97,000**	**128,880**	**111,918 (9,480)**[c]	**16,110**

Sources: Muir 1968; GTC 1974; Hoover 1980a; Slade 1991.
Notes: GTC = Geotechnical Consultants Inc.; — = data are not available.
[a] Maximum usable groundwater in storage, based on spring 1983 water levels.
[b] Estimate includes Storage Unit 2.
[c] Value in parentheses is for usable storage that can be economically withdrawn and not result in seawater intrusion.

2.2.3.3 Sustainable Yield

The sustainable yield of the MGB has been estimated by multiple researchers over many decades. The definition and method of determining the sustainable yield (also called "safe" or "perennial" yield) has varied, resulting in varying estimates, and sometimes unequal comparisons. As defined by SGMA, sustainable yield is "the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin, and including any temporary surplus that can be withdrawn annually from a groundwater supply without causing an undesirable result." (DWR

2016). Previous sustainable yield estimates for the MGB are listed in Table 2-14. An estimate of the sustainable yield based on current understanding of the hydrogeology, water budget, and projected future conditions is described in Section 2.3.7.

Table 2-14
Previous Estimates of Sustainable Yield

Storage Unit	Sustainable Yield (Acre-Feet/Year)				
	Muir 1968	*GTC 1974*	*Hoover 1980a*	*Loaiciga 2015*	*County 2015*
1	—	—	550	545	—
2	—	—	100	38	—
3	—	—	700	409	—
Toro Canyon	—	—	300	130	—
Total	**2,500**	**1,200**	**1,650**	**1,122**	**1,350**

Sources: Muir 1968; GTC 1974; Hoover 1980a; Loaiciga 2015; County of Santa Barbara 2015a.
Notes: GTC = Geotechnical Consultants Inc.; — = data are not available.

2.2.4 Historical and Current Groundwater Conditions

The following subsections address current and historical conditions related to each of the undesirable results identified under SGMA, including groundwater elevation, change in storage, sustainable yield, seawater intrusion, groundwater quality, land subsidence, groundwater–surface water connectivity, and groundwater dependent ecosystems.

2.2.4.1 Groundwater Elevation Data

Historical Groundwater Levels

The predominant direction of groundwater flow within the MGB is southward, toward the Pacific Ocean. Groundwater elevations are highest along the northern boundary of the MGB and gradually decrease to near mean sea level along the southern boundary at the coast.

Historical groundwater elevations indicate a similar flow pattern in the past to what is observed currently. Groundwater elevations in 1961 and 1970 indicate a groundwater flow from north to south in Storage Units 1, 2, and Toro Canyon, and a southwestern flow direction in Storage Unit 3 (GTC 1974). The maps also indicate a general north-to-south flow direction along the MGB boundaries, suggesting minimal groundwater exchange with adjacent basins. In 1961 groundwater elevations ranged from a high of 350 feet amsl in the northern part of Storage Unit 1 to a low of −20 feet amsl in the southwestern part of Storage Unit 3 near the coast. Groundwater elevations below sea level indicate a potential for seawater intrusion to occur. Groundwater elevations in 1961 also appear to drop by about 150 feet across the Montecito Fault, coincident with the boundary between Storage Units 2 and 3. Groundwater elevation data were sparse for the Toro

Canyon Storage Unit in 1961, but groundwater elevations were approximately 10 to 20 feet amsl in the southern part of the unit near the coast. The contours for 1970 are similar to those for 1961, but indicate that groundwater elevations were slightly higher in Storage Unit 3 in 1970, reaching a low of 0 feet amsl at the coast, and again the potential for seawater to have entered the MGB given that seawater is denser than freshwater (GTC 1974).

Groundwater elevation data collected in the winter 1991 indicate that groundwater elevations ranged from about 450 feet amsl in the northern part of Storage Unit 1 to 0 feet amsl throughout Storage Unit 3, and ranged from 140 feet amsl near the center of Toro Canyon Storage Unit to 0 feet amsl along the coast (Slade 1991). Groundwater elevations differed by approximately 120 feet on either side of the Arroyo Parida Fault, or the boundary between Storage Units 1 and 2, but groundwater elevations do not differ across the Montecito fault, as had been previously reported.

Additional groundwater elevation contour maps were prepared for spring 1995, an above-average water year following a relatively wet period, and fall 2015, a below-average precipitation water year following an extended dry period, using static (non-pumping) groundwater level monitoring data provided by MWD (Figure 2-17, Groundwater Elevation Contours Spring 1995, and Figure 2-18, Groundwater Elevation Contours Fall 2015, respectively). Insufficient data were available to generate contours for the Toro Canyon Storage Unit because there are only two wells with groundwater level data, and the maps are also constrained by a significant lack of data for Storage Unit 2. In spring 1995, groundwater elevations ranged from a high of over 600 feet amsl in the northern part of Storage Unit 1 to a low of about 2 feet amsl in Storage Unit 3 and the Toro Canyon Storage Unit near the coast. In fall 2015, groundwater elevations ranged from a high of over 600 feet amsl in the northern parts of Storage Unit 1 to a low of about −60 feet amsl in the eastern part of Storage Unit 3, and to −2 feet amsl near the coast, thus indicating the potential for seawater intrusion to have occurred. In addition to the apparent pumping-related depression centered around well 3-12a (Paden 2) located in the eastern part of Storage Unit 3, the fall 2015 contours show several less-pronounced potential pumping depressions in the central part of Storage Unit 1. The contours for spring 1995 and fall 2015 do not indicate a significant vertical change in groundwater elevation across the Arroyo Parida or Montecito Faults; however, groundwater level data are generally lacking for Storage Unit 2 and limited to the two wells on the western edge of the storage unit. A compilation of groundwater hydrographs for the basin is included as Appendix D.

Current Groundwater Levels

Current groundwater levels in the MGB were measured in spring and fall 2019, and are shown on Figure 2-19, Groundwater Elevation Contours Spring 2019, and Figure 2-20, Groundwater Elevation Contours Fall 2019, respectively. Measured groundwater elevations in spring 2019 ranged from a high of 739.17 feet amsl in the northern part of Storage Unit 1 (well 1-43), to a low of −12.29 feet amsl in the eastern part of Storage Unit 3 (well 3-12a), and to about 0 feet amsl near the coast (well 3-7) (Figure 2-19). Measured groundwater elevations in fall 2019 were similar to those measured in spring and ranged from a high of 726 feet amsl in well 1-43, to a low of −12.29 feet amsl in well 3-12a, and to about 0 feet amsl near the coast (well 3-7; Figure 2-20).

Several apparent pumping-related depressions were exhibited in the data collected in both spring and fall 2019. In both years, depressed groundwater levels were observed near the center and in the eastern part of Storage Unit 3, where measured groundwater elevations were approximately 12 feet below mean sea level. In addition, several smaller potential pumping-related depressions were observed in the central part of Storage Unit 1. A comparison between the spring and fall 2019 groundwater elevation contours indicates that groundwater levels remained relatively stable throughout the year, with a slight decline in water levels observed in most wells in fall 2019 (Figures 2-19 and 2-20).

Groundwater Level Trends

The earliest available groundwater level data for the MGB are from the early 1940s. Although sparse, data indicate that the period from the late 1940s to the mid-1960s generally represents a MGB-wide low water level period, with the exception of 1959, which according to Muir (1968) was a year that MGB storage was at a maximum (GTC 1974; Upson 1951). During this time, a reversed gradient was present in the southern part of Storage Unit 3 and Toro Canyon Storage Unit, where water levels were up to 25 feet below mean sea level near the coast (GTC 1974). The depressed groundwater levels persisted in Toro Canyon Storage Unit through the 1950s, and in Storage Unit 3 until the mid-1960s (GTC 1974). Groundwater levels slightly rebounded and stabilized from the late 1960s until the mid-1980s, at which point groundwater levels began dropping rapidly. Beginning in the late 1980s, groundwater levels declined across the MGB, and in 1991 reached the lowest levels recorded in MGB history at that time (Slade 1991). Hydrographs for key indicator wells (wells identified as being representative of groundwater conditions and having the longest and most complete historical records) show that from the late 1980s to the early 1990s groundwater levels declined up to approximately 75 feet in Storage Unit 1 (well 1-15) and approximately 50 feet in Storage Unit 3 (well 3-8) (Figure 2-21, Groundwater Levels in Key Indicator Wells). Groundwater level measurements in the principal aquifer in Storage Unit 2 and the Toro Canyon Storage Unit were not available during this time period. This MGB-wide low water level period corresponded with a dry climatic period characterized by 4 years of below-average precipitation coupled with the highest rate of groundwater production ever recorded by MWD at the time, at 532 AF, in 1990.

After the low water level and dry climatic period of the early 1990s, groundwater level data indicate that water levels rebounded to near 1990s levels in response to increased precipitation and reduced groundwater pumping. Groundwater levels remained relatively stable through the late

1990s until about the mid-2000s, at which point groundwater extraction rates began to increase again and an extended dry climatic period set in. Over a 12-year period between 2007 and 2019, groundwater levels declined by approximately 70 feet in Storage Unit 1 (well 1-15), which is equivalent to an average rate of decline of approximately 5.8 feet per year (Figure 2-21). The magnitude and rate of groundwater level decline in the other MGB storage units over the same period was about half that of Storage Unit 1 or less, with an observed groundwater level decline in Storage Unit 3 of 34 feet, or a rate of 2.8 feet per year (well 3-8; Figure 2-21).

Data Gaps

Review of geologic information, well completion reports, and existing groundwater elevation data for the MGB suggest that the MGB is largely unconfined and is composed of a single aquifer unit. Therefore, the spatial (vertical) distribution of existing well infrastructure may be adequate to determine the minimum threshold for chronic groundwater lowering. In addition, the lateral distribution suggests that existing wells are adequate to meet SGMA requirements; however, groundwater level data from Storage Unit 2 and the Toro Canyon Storage Unit are limited spatially and/or temporally. In both storage units only two wells are routinely monitored for groundwater levels, and in the Toro Canyon Storage Unit the length of the monitoring record is limited. Additional groundwater level data in Storage Unit 2 would aid in verifying the degree to which the Arroyo Parida and Montecito Faults act as partial barriers to groundwater flow, and in the Toro Canyon Storage Unit would provide for better spatial characterization of groundwater level trends.

2.2.4.2 Estimated Change in Storage

Estimates of the change of groundwater in storage in the MGB are based on numerical model results from the Montecito Basin Numerical Model (MBNM; Section 2.3.1). Between 1970 and 2019, the MBNM estimates that groundwater in storage declined by a total volume of approximately 3,400 AF, which corresponds to an average annual decline of approximately 70 AFY, and about a 10% decline in total usable storage in the MGB. As described in Section 2.3.4, groundwater in storage in the MGB is strongly influenced by climate conditions, declining during periods of drought, and recovering in normal and above normal water years. The net decline in groundwater storage between 1970 and 2019 reflects the drought conditions encountered in the basin at the end of 2019. Groundwater conditions that correspond to this change in groundwater in storage are described in detail in Section 2.3.

2.2.4.3 Seawater Intrusion

The term “seawater intrusion” is defined by DWR as the advancement of seawater (saline water) into a groundwater supply that results in the degradation of water quality in the basin, and includes seawater from any source (DWR 2016). Under natural conditions, fresh groundwater discharging to the coast prevents seawater from encroaching landward. When groundwater is extracted from a coastal aquifer, the seaward movement of freshwater is reduced and the resultant decrease in hydraulic head[18] can cause the lateral and subsequently vertical encroachment of seawater into the freshwater zones of the aquifer. Seawater intrusion associated with groundwater overdraft has occurred to some degree in many coastal aquifers around the world, as well as the West Coast of the United States.

There have been several hydrogeologic studies (Upson 1951; Muir 1968; GTC 1974; Hoover 1980b; Slade 1987; Loaiciga 2015) of the coastal groundwater basins of southern Santa Barbara County that have considered the issue of seawater intrusion. A few of the studies (GTC 1974; Hoover 1980b; Slade 1987; Loaiciga 2015) have specifically focused on the MGB, while others (Upson 1951 and Muir 1968) have discussed conditions in adjacent basins or at the regional scale. The results of the studies that have been completed thus far have generally been inconclusive as to the areal and vertical extent of seawater intrusion, or its occurrence at all, in the MGB. Note that sea level rise associated with climate change may increase the potential for seawater intrusion[19].

The issue of seawater intrusion in the south coast basins of Santa Barbara County was first considered by Upson (1951), who recognized that the potential for seawater intrusion to occur exists and that such encroachment would doubtless occur if excessive groundwater pumping were to continue; however, the author concluded that there was no evidence of seawater intrusion as of 1946. Upson (1951) noted that in the early 1940s, groundwater extraction exceeded safe yield in the Goleta and Carpinteria groundwater basins.

Muir (1968) revealed that groundwater levels near the coast in the area of Santa Barbara and the western part of the Montecito area had been below mean sea level since 1960. As a result, seawater had intruded into the surficial aquifer deposits directly adjacent to the coast, but had only affected wells less than 50 feet deep and deep wells with improper sanitary seals. Limited groundwater quality data suggested that only the shallow deposits had been affected and that no horizontal migration of seawater had occurred at depth into the deeper water-bearing deposits. Muir (1968) concluded that horizontal migration of seawater into the deeper units of the aquifer was unlikely because there is no direct connection between the deep aquifer units and the ocean due to an offshore fault (i.e., Rincon Creek Fault) that serves as an effective saltwater barrier.

Geotechnical Consultants Inc. (GTC 1974) reported that chloride concentrations measured in several wells located in and adjacent to the MGB suggested water quality degradation, but that none of the concentrations were "high enough to prove total and complete sea water intrusion." Geotechnical Consultants Inc. (GTC 1974) surmised that "there exists a narrow zone along the

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[18] Hydraulic head is an indicator of the total energy available to move ground water through an aquifer. Hydraulic head is measured by the height to which a column of water will stand above a reference datum (Taylor and Alley 2002).

[19] DWR projects sea level rise of 15 cm and 45 cm by years 2030 and 2070, respectively.

coast into which there has been some horizontal migration of sea water," and concurred with previous investigations that the Rincon Creek Fault is an effective barrier to seawater intrusion into the deeper aquifer units.

Hoover (1980b) acknowledged the work of previous studies that concluded that structural and stratigraphic geologic features effectively seal deeper aquifer deposits and preclude seawater intrusion, but noted that recent monitoring by USGS indicated a measurable deterioration of water quality in the deeper deposits of the Santa Barbara Groundwater Basin and the southwestern portion of the MGB (no hydrogeologic barrier between the two basins is believed to exist). However, the author hypothesized that chemical degradation of the deeper water-bearing units would only occur if water levels were lowered substantially below mean sea level for significant periods of time (5 years or more). Hoover (1980b) also pointed out that poor water quality within the shallow aquifer deposits in the south coast basins is a normal occurrence and is not considered a significant problem.

Slade (1987) reviewed historical MGB well water level and quality data and arrived at the following conclusions concerning seawater intrusion: (1) there are no data on the effectiveness of the offshore Rincon Creek Fault as a continuous barrier to the landward migration of seawater in to the deeper Santa Barbara Formation-type deposits; (2) the shallow sediments are in hydraulic connection with the ocean because the Rincon Creek Fault is likely only effective as a barrier at depth; (3) an irregular zone of poor water quality exists along the coast such that wells are typically restricted to depths of 120 to 150 feet or less; (4) groundwater samples collected from some older and/or shallow wells near the coast have had chloride concentrations upwards of 2,000 milligrams per liter (mg/L); and (5) groundwater elevations in wells near the coast were at or below mean sea level from the late 1940s until 1970, and have never been higher than 11 feet amsl. Additionally, Slade (1987) recommended that protection measures be implemented, including a 500-foot-wide buffer strip along the coastline where no groundwater extractions would occur and maintaining groundwater above 5 feet amsl to maintain a minimal seaward gradient of the water table (Slade 1987, 1991).

Most recently, Loaiciga (2015) conducted a review of all previous investigations concerning the issue of seawater intrusion in the MGB and also reviewed historical chloride concentrations in groundwater. Loaiciga (2015) found that chloride concentrations between 312 mg/L and 1,220 mg/L have been measured in wells in the MGB, which may constitute evidence of sweater intrusion. Loaiciga (2015) then asserted that there is ample evidence that there is no impervious seawater barrier to the MGB, and stressed that water quality and level monitoring in the MGB is inadequate.

DWR requires that seawater intrusion be monitored using chloride concentrations, or other measurements convertible to chloride concentrations unless a proxy is used (see Chapter 3, Sustainable Management Criteria). A review of available historical water quality data for wells in the MGB indicates that there are at least nine wells that have had chloride concentrations greater than 250 mg/L (the recommended MCL for California drinking water standards), all of which are located in Storage Unit 3, and two of which are public water supply wells.. The nine wells that have had elevated chloride concentrations include the following: Ennisbrook 2, Ennisbrook 5 (4N/26W-17J02S), 4N/27W-13R01S, 4N/26W-19D02S, 4N/26W-20B01S, 4N/26W-20H01S, 4N/26W-19H02S, 4N/26W-19H03S, and 4N/27W-24A01S. Two of the nine wells, 4N/26W-20B01S and 4N/26W-19D02S, have had concentrations over 1,000 mg/L, with measured chloride concentrations of 1,220 mg/L and 2,180 mg/L, respectively. In addition, chloride concentrations measured in samples from a well (4N/27W-24D02S) located to the west of the MGB in the Santa Barbara Groundwater Basin increased historically from 78 mg/L in December 1950 to 2,000 mg/L in March 1978 (Figure 2-22, Groundwater Wells with Elevated Chloride Concentrations).

Based on previous investigations, there is historical evidence of poor groundwater quality in wells located along the coast in the MGB, and particularly in Storage Unit 3. In addition, groundwater elevations in the MGB have at times been depressed along the coast such that the seaward gradient of freshwater may not been of sufficient magnitude to preclude encroachment of seawater into the MGB. There are varying opinions as to the extent to which the Rincon Creek Fault may act as a barrier to seawater intrusion. The location and hydrogeologic characteristics of the fault/fault zone is not well known and it has been mapped as occurring from a few hundred feet to more than a mile offshore.

Current SWI Conditions

The MBGSA received grant funding for several projects related to GSP development and implementation (Section 2.1.2.5). The SWI intrusion component of the grant included the designation of five existing wells with which to monitor sea water intrusion (Figure 2-7). These wells were selected, in part based on the availability of limited historical water quality data. Additional data was collected for several months in 2021 with which to establish baseline water quality conditions with respect to SWI. The samples were analyzed for multiple constituents including TDS, Cl, Na, HCO3, Ca, Mg, K, Br, I, Si, and SO4. The ionic composition of the groundwater was compared to that of seawater to evaluate the likelihood of SWI. Historical and current ion concentrations were averaged for comparison to that of typical seawater. The results illustrated in Figure 2-23 indicate little similarity between the constituent proportions and concentrations of well water to that of seawater including chloride and TDS, both of which are significant indicators of seawater intrusion. Piper diagrams are used to further evaluate the occurence of SWI and to detect changes in groundwater chemistry that may be indicative of oncoming SWI (Figure 2-24). The diagrams include plots of significant seawater constituent proportions including Mg, Ca, Cl, HCO3, and SO4 (shown as milliequivalent percentages) for each historical and recent sample as compared to that of seawater which is represented on each plot. In general, groundwater impacted by a saline source, whether seawater or other sources of saline water in the aquifer, show an increasing dominance of chloride relative to sulfate and bicarbonate. As saline water migrates into freshwater aquifers, smaller anions such as chloride, migrate and mix with fresh groundwater ahead of the main seawater plume. Sodium follows close behind chloride, and due to its high concentration, often exchanges with calcium and magnesium adsorbed to the aquifer solids. The leading part of a saline plume is characterized by elevated concentrations of chloride, calcium, and magnesium relative to sodium, bicarbonate, and sulfate. With arrival of the main saline plume, the cation composition of the impacted water changes such that sodium predominates, and magnesium surpasses calcium (Dudek 2015a). The piper diagrams show no significant recent or historical similarity between well and sea water nor has there been migration of well water quality toward that of seawater.

The ratios of Na/Cl and Cl/HCO3 over time were calculated and graphed as an indication of potential incipient sea water (Figures 2-25 and 2-26). Lower Na/Cl ratios (less than 0.86) and higher Cl/HCO3 ratios (greater than 1.3) ratios may indicate incipient SWI (Jones et al. 1999, Korfali & Jurdi 2010).

Except for Well 5, the ratios exhibited by samples from each well do not indicate the presence of seawater intrusion. Some historical and recent samples from Well 5 exhibit ratios that may indicate incipient seawater intrusion but other factors, such as return flows from local land use may also influence the ratios. The analyses conducted as an indication of current SWI conditions are preliminary with additional data needed to constrain the source of the constituents. However, the data suggests a lack of significant historical or current SWI. Implementation of the SWI monitoring program described in Section 2.1.2.5, and expanded monitoring in the Toro Canyon Storage Unit, will provide the means by which to monitor changes in SWI indicators and to implement management strategies to prevent potential SWIs.

2.2.4.4 Groundwater Quality

Groundwater quality in the Plan Area has been monitored routinely since at least the early 1980s, with the coverage and frequency of monitoring increasing over time, as MWD and other public water systems kept up with MGB management activities (MWD 1998). Previously published information on groundwater quality is included in numerous reports, documents, and datasets, including the following:

- **USGS Reports**. USGS published early reports on the MGB hydrogeology, including testing of groundwater quality. More recently, it published a report for a larger south coast study area (all south coastal Santa Barbara County basins) based on water quality and ancillary data it collected in 2011 from 23 sites, and on water quality data from the SWRCB

Division of Drinking Water (DDW) database for the period between January 24, 2008, and January 23, 2011 (USGS 2016).

- **DWR Reports**. An earlier version of DWR Bulletin 118 provides information on general chemistry within the MGB based on data from MWD from the late 1990s (DWR 2004).

- **MWD Reports**. The 1998 Basin Management Plan provides a description of a general nature regarding threats to water quality and some of the primary constituents of concern in MGB, but is based on limited data on total dissolved solids (TDS) and nitrate concentrations collected from samples in the 1970s and the mid-1990s (MWD 1998). Earlier reports from Slade (1984 and 1987) and Hoover (1979) analyzed TDS, chloride, and boron concentrations and sodium adsorption ratio as part of the hydrogeologic characterization and delineation of the extent of the usable groundwater in storage for regional reclamation project efforts.

- **County Reports**. The County has published limited summaries and studies of groundwater quality within the background reports for its General Plan (County of Santa Barbara 2012), and also for its IRWM Plan (County of Santa Barbara 2019a). The information contained in these reports is focused on groundwater levels, providing general summaries of groundwater quality.

- **Raw Data**. Several agencies, including MWD, DWR, USGS, and SWRCB, manage databases of groundwater quality analysis results for various purposes. This includes GAMA, which compiles groundwater data from multiple sources into its database, as well as the USGS National Water Information System Mapper. Review of these data sources indicated that the spatial (lateral) distribution of wells in Storage Unit 3 is adequate to meet SGMA requirements for water quality monitoring, but there are insufficient water quality data for Storage Unit 1, Storage Unit 2, and the Toro Canyon Storage Unit to fully characterize groundwater quality. Generally, data on water quality is available for only a subset of wells in the MGB, and routine and consistent water quality sampling sufficient to establish trends over time is occurring for an even smaller subset of wells (primarily municipal wells). Data on pertinent groundwater quality constituents are analyzed below.

SWRCB DDW, besides requiring that treated water supplies be sampled to demonstrate compliance with drinking water quality standards, also requires MWD and other water purveyors in the Plan Area to characterize the source water quality by collecting and analyzing raw water samples from their drinking water systems (including groundwater wells). The standard suite of water quality constituents that are tested for includes major cations and anions (including nitrate as nitrogen[20]), nitrogen, metals (boron, copper, iron, manganese, and zinc), alkalinity, TDS, and physical parameters (electrical conductance, temperature at collection, and pH). Additional constituents are analyzed from certain wells as needed based on location and local water quality issues. Every 3 years, MWD analyzes groundwater samples for additional organic constituents; currently the Amapola, Ennisbrook 2, Ennisbrook 5, Paden 2, and T. Mosby MWD production wells are the most routinely and frequently sampled wells in the Plan Area.

Summary of Groundwater Quality Standards

Groundwater quality within the Plan Area is governed by both natural and anthropogenic factors, either of which can cause adverse impacts on groundwater quality, as measured against two major standards. The first consists of Central Coast Basin Plan water quality objectives, which establish both narrative and numeric groundwater quality standards aimed at preserving existing and potential beneficial uses. In the MGB, these beneficial uses consist of agricultural water supply, municipal and domestic water supply, and industrial use (RWQCB 2019). For many constituents, the Central Coast Basin Plan incorporates by reference state drinking water standards (described below) as the appropriate water quality objective for groundwater with municipal beneficial use. For agricultural beneficial uses, the Central Coast Basin Plan incorporates water quality standards derived from the University of California Agricultural Extension Service guidelines (RWQCB 2019). SWRCB and the Central Coast RWQCB use these Central Coast Basin Plan water quality objectives as a basis for establishing the terms of NPDES Permits and WDRs (e.g., effluent limitations, discharge specifications, and receiving water limitation) for point-source (e.g., wastewater treatment discharges) and non-point-source (e.g., urban and agricultural runoff) discharges within the Plan Area.

The second set of standards consists of California drinking water MCLs administered and enforced by SWRCB DDW under the California Safe Drinking Water Act, as codified in Title 22 of the California Code of Regulations.[21] The California Safe Drinking Water Act prescribes enforceable primary MCL standards for five major categories of drinking water contaminants: microorganisms, disinfectants and disinfection byproducts, inorganic chemicals, organic chemicals, and radionuclides (i.e., radioactive forms of elements).[22] In addition, secondary MCLs have been established for non-health concerns, based on aesthetic issues such as taste, odor, or color in the water. SWRCB and the U.S. Environmental Protection Agency have established secondary MCLs for at least 15 contaminants. With regard to chemical contaminants that do not

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[20] Note that, by convention, this GSP expresses nitrate in terms of nitrate as nitrogen. “Nitrate,” “nitrate-N,” “nitrate-nitrogen,” and “NO_3-N” all refer to nitrate as nitrogen, with an MCL of 10 mg/L.

[21] An MCL (maximum contaminant level) is the maximum concentration of a contaminant allowed in water delivered to a user of any public water system.

[22] Note that primary drinking water standards established by SWRCB under the California Safe Drinking Water Act are equivalent or more stringent than those set by the U.S. Environmental Protection Agency under the federal Safe Drinking Water Act.

have established MCLs, SWRCB establishes notification levels, which are health-based advisory levels. When chemicals are found at concentrations greater than their notification levels, certain reporting requirements apply. In addition, SWRCB has established response levels at two to three times higher than each notification level, at which SWRCB recommends removal of a drinking water source from service to protect public health. SWRCB has established notification levels and response levels for at least 30 constituents.

Summary of Groundwater Quality Conclusions

Based on all sources reviewed, including previous reports and data from MWD, USGS groundwater studies, the County's IRWM Plan, and SWRCB's GAMA database, the groundwater quality in the Plan Area is generally suitable for agricultural and domestic uses (MWD 1998; DWR 2004; County of Santa Barbara 2019a; SWRCB 2020a). Elevated concentrations of TDS, nitrate, manganese, and iron (as identified by concentrations exceeding applicable water quality standards) have been detected in the MGB, but these concentrations have not been persistent over time. Furthermore, release of organic constituents of concern (e.g., gasoline, motor oils, methyl tert-butyl ether (MTBE)/tertiary butyl alcohol (TBA)/other fuel oxygenates, gasoline) to groundwater have occurred but these releases remain close to the source and the sites associated with the releases have all received regulatory closure.[23] Regulatory closure means that remediation goals have been successfully met and that residual contamination in soil and groundwater, if any, has been contained and is not spreading. Chloride concentrations are addressed in the previous section on seawater intrusion.

Review of Regulatory Cleanup Sites, Historic Oilfields, and Septic Systems

Both the Department of Toxic Substances Control's EnviroStor database and SWRCB's GeoTracker database were reviewed for information on the nature and status of regulatory cleanup sites located within the Plan Area. These sites consist of a mix of commercial, industrial, and public land uses, predominantly consisting of automobile service stations along the U.S. Highway 101 corridor and within the Montecito Village area. Figure 2-27, Regulatory Cleanup Program Sites, shows the locations and status of cleanup site cases within the MWD service area, along with the primary potential media of concern (e.g., soil or groundwater) for each. All cleanup site cases where groundwater was identified as a potential medium of concern are labeled on Figure 2-27. All GeoTracker sites in the MGB have received closure from SWRCB in accordance with its low-threat closure policy, indicating that contaminant releases have been remediated and adequately contained (as shown by contaminant plumes that have been either stable or decreasing in extent and concentration). Table 2-15 provides a comprehensive summary of each regulatory cleanup site case in the MGB. The sites that have had the greatest water quality impact consist of leaking underground storage tank sites in the southwest corner of the MGB in and around the Coast

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[23] Releases of organic constituents of concern are primarily associated with past and current fuel service stations.

Village area in Storage Unit 3. The only closed case that is near a municipal water supply well is in the Montecito Village area (Chevron Station No. 9-1789), where related soil and groundwater investigations found the release to be contained and limited to the area immediately surrounding the dispenser islands, with elevated constituents in groundwater now limited to one monitoring well, and with a contaminant extent that is stable or decreasing.

As shown on Figure 2-27, the community of Summerland was historically an oil-producing area, and as such contains a high number of inactive, plugged, and/or abandoned oil wells, as shown in the California Department of Conservation's Geologic Energy Management Division (formerly the Division of Oil, Gas, and Geothermal Resources) database of oil and gas wells. Between 1896 and the 1920s, there were as many as 11 piers off the coast for offshore wells; this was the location of the world's first offshore oil wells drilled from piers (CSLC 2011). Since that time, the wells have been removed, capped, and sealed and the old piers have been removed. Some natural oil seeps are still present, and a small area of seepage thought to be from an inshore oil well (Becker well) was observed at the beach surface in 2011 (CSLC 2011). The California State Lands Commission conducts weekly inspection and monitoring of the Summerland beach area, and Summerland residents report to the County when oil surfaces on the beach or visible oil sheen is in the water (CSLC 2011).

In addition to regulatory cleanup sites and historical oilfields, septic tanks—if in disrepair or otherwise not operating as intended—represent another potential point source of contamination (e.g., nitrogen, bacteria, and pathogens) to the groundwater aquifer. On-site wastewater treatment systems (OWTSs) are used by residences in the inner rural and rural areas located north of U.S. Highway 101 into the foothills. Parcels range in size from small to very large, with a median area of approximately 2 acres. The poor soils and difficult terrain in the foothills make the siting and use of OWTS challenging. Consequently, Toro Canyon, the Buena Vista and Cold Springs Creek drainages, and Sycamore Canyon were identified as focus areas for the County's Local Agency Management Program for OWTS, which estimates that there could be 876 OWTSs in the MGB (County of Santa Barbara 2015b). Groundwater from the MGB supplies some semi-rural residences, several small public and semi-public water systems, and a small amount of agricultural uses. Title 22 of the California Code of Regulations requires that state small water systems monitor the bacteriological quality of their water on a quarterly basis. In addition, Chapter 34B of the Santa Barbara County Code requires that the water system operators monitor for nitrates and nitrites once every 3 years. The County Department of Environmental Health Services proposes to use the water quality data from the El Bosque Mutual Water Company water system as part of the Local Agency Management Program's monitoring element for the MGB (County of Santa Barbara 2015b).

Table 2-15
Regulatory Cleanup Site Database Review

Project/Site Name	Site Type/ Cleanup Program	Potential Media of Concern	Potential Contaminants of Concern	Case Status (Date)	Comment
DTSC EnviroStor Database					
AGF & ASF Redistribution Center	Military Evaluation (FUDS)	None Specified	None Specified	Inactive – Needs Evaluation (7/1/2005)	Current land use is for the Four Seasons Resort.
Toro Canyon Road Elementary	School Investigation	Soil	Arsenic, DDD, DDE, DDT	Inactive – Withdrawn (11/29/1999)	Initially identified due to historic use of property for citrus orchards. Initial investigation for Carpinteria Unified School District.
Montecito Union Elementary School Investigation	School Investigation	No Media Affected	No Contaminants Found	Inactive – Action Required (2/6/2018)	School site investigation for Montecito Union School District. Minor area of OCP found but addressed via confirmation sampling during construction phase.
SWRCB GeoTracker Database					
Equilon Enterprises LLC/Shell	LUST Cleanup Site	Gasoline	Aquifer used for drinking water supply, Soil	Completed – Case Closed (9/30/2016)	A fuel dispenser leak was discovered in 1999. Site investigations occurred from 2000 through 2013. Air sparge/ soil-vapor extraction/dual-phase extraction remedial actions were conducted at the site in 2012 and 2013. Contaminant plume modeling for benzene, MTBE, and gasoline-range petroleum hydrocarbons (TPH-g) show that the plumes have been stable or decreasing In extent since 2005. The site was determined to meet the LTCP in 2016.
Hanna Property	LUST Cleanup Site	Gasoline	Aquifer used for drinking water supply, Soil	Completed – Case Closed (5/19/2011)	The site was formerly occupied by a pool supply business and is currently occupied by a retail outlet. Prior to 2000, the site contained two 1,000-gallon and one 550-gallon gasoline USTs, and a 35-gallon water separator tank. A potential leak was discovered during and after tank removal activities in 2000. Remediation consisted of removal of contaminated soil. Groundwater contamination at the site remained below MCLs for 13 sampling events, and residual soil contamination was determined to be de minimis in nature. The site was determined to meet the LTCP in 2011.

Table 2-15
Regulatory Cleanup Site Database Review

Project/Site Name	Site Type/ Cleanup Program	Potential Media of Concern	Potential Contaminants of Concern	Case Status (Date)	Comment
Chevron ss# 9-1572	LUST Cleanup Site	Gasoline	Aquifer used for drinking water supply, Soil	Completed –- Case Closed (5/4/2011)	Existing service station with three 10,000-gallon underground gasoline tanks, one 10,000-gallon diesel tank, and one 1,000-gallon used oil tank. Elevated fuel concentrations were discovered during a dispenser upgrade in 1998. Groundwater was initially impacted, but have naturally attenuated since impacted soils were removed and disposed of. The site was determined to meet the LTCP in 2011.
Former Montecito Fire Station	LUST Cleanup Site	Gasoline	Aquifer used for drinking water supply	Completed – Case Closed (1/7/2010)	The site was reopened as a LUST site in 2003 after fuel oxygenates were detected in an off-site well (MW-5) located at 1476 East Valley Road, where MTBE and TBA were detected. Agency staff reviewed the file and determined that the Former Montecito Fire Station was not the source of the contaminants detected off site, and that further investigation was not warranted.
TOSCO – 76 Station #0535	LUST Cleanup Site	Gasoline	Aquifer used for drinking water supply, Soil	Completed – Case Closed	The site contains two 12,000-gallon gasoline USTs and one 600-gallon waste oil AST. A release was discovered in 1993 during a product piping failure, and the extent of the release was investigated between 1993 and 2001, in which TPH-g, BTEX, EDC, and fuel oxygenates were detected. Groundwater impacts were determined to be limited to the site and the street immediately downgradient. A pump and treat system and soil vapor extraction began in 2003, and by 2009, confirmation sampling confirmed the absence of COCs above MCLs in groundwater, and the site was determined to meet the LTCP in 2010.

Table 2-15
Regulatory Cleanup Site Database Review

Project/Site Name	Site Type/ Cleanup Program	Potential Media of Concern	Potential Contaminants of Concern	Case Status (Date)	Comment
Chevron ss#9-1789	LUST Cleanup Site	MTBE/TBA/Other Fuel Oxygenates, Gasoline	Aquifer used for drinking water supply, Soil	Completed – Case Closed (2/5/2013)	Soils were discovered to be impacted by UST leak during confirmation sampling of tank removal activities in 1997. Subsequently, groundwater was found to be impacted with TPH-g, BTEX, and MTBE. Additional groundwater monitoring wells were installed, some with ORC filter socks to assist in site remediation. Contaminated soils were removed and characterized. Residual impacts were found to be limited to the area immediately surrounding the dispenser islands, the elevated constituents in groundwater are now limited to one monitoring well, and the contaminant extent is stable or decreasing. The site was determined to meet the LTCP in 2013.
Summerland Texaco	LUST Cleanup Site	Gasoline	Aquifer used for drinking water supply, Soil	Completed – Case Closed	Soils were discovered to be impacted by UST leak during UST removal and upgrade activities in 2000. Impacted soils were removed and disposed of along with 46,000 gallons of groundwater generated by dewatering the tank pit. Three monitoring wells installed in 2004 and sampled until 2012, confirming that by that time, COCs has not been detected. The site was determined to meet the LTCP in 2013.
Montecito Water District	LUST Cleanup Site	Diesel, Gasoline	Aquifer used for drinking water supply, Soil, Soil Vapor, Well used for drinking water supply	Completed—Case Closed	Two USTs were discovered to have leaked in 1989 during removal activities. Groundwater monitoring activities occurred over 20 years (1990 through 2011), with remediation consisting of soils excavation and disposal event in 1989 (8 cubic yards), soil excavation and aeration in 1992 (80 cubic yards), and soil vapor extraction in 1992–1995 (7,510 pounds). The site was determined to be closed in 2013, as concentrations of 1,2-DCA, EDB, MTBE, TBA, and lead had decreased to below MCLs after remediation.

Table 2-15
Regulatory Cleanup Site Database Review

Project/Site Name	Site Type/ Cleanup Program	Potential Media of Concern	Potential Contaminants of Concern	Case Status (Date)	Comment
Historic oil well investigation	Non-Case Information	Crude Oil	Soil	Informational Item (8/19/2016)	An area of stained soil at 12 feet bgs was discovered and tested. The Count"s hazardous materials unit reviewed the testing results and determined that no further action was warranted, unless the extent of the stained soil was discovered to be greater during property development.
Private Residences (8 individual cases)	LUST/Cleanup Program Sites	Gasoline, diesel, heating oil/fuel oil, waste oil/motor/ hydraulic/ lubricating, lead	Aquifer used for drinking water supply, Soil	Completed – Case Closed (varies)	Private residences, all of which have received case closure following investigation and/or remediation activities. Cases primarily involve issues discovered during property development or redevelopment, such as stained soils, or degraded/leaking USTs/ASTs. Impact were found to be limited to soil, the affected soils were removed, residual soil concentrations were found to be below MCLs, and the sites were determined to meet the LTCP.

Source: SWRCB; DTSC.

Notes: DTSC = Department of Toxic Substances Control; FUDS = Formerly Used Defense Sites Database; OCP = organochlorine pesticides; SWRCB = State Water Resources Control Board; LUST = leaking underground storage tank; MTBE = methyl tertiary-butyl ether; TPH-g = total petroleum hydrocarbons as gasoline; LTCP = SWRCB Low-Threat Closure Policy; UST = underground storage tank; MCL = maximum contaminant level; LUFT = leaking underground fuel tank; TBA = tertiary butyl alcohol; AST = aboveground storage tank; BTEX = benzene, toluene, ethylbenzene, and xylene; EDC = ethylene dichloride; COC = contaminant(s) of concern; ORC = oxygen release compound; 1,2-DCA = 1,2-dichloroethane (=ethylene dichloride); EDB = ethylene dibromide; bgs = below ground surface.

Site locations labeled on Figure 2-27.

Groundwater Quality by Constituent

DWR (2004) has characterized the groundwater in the MGB as composed of two chemical types. South of the Arroyo Parida Fault, groundwater has calcium bicarbonate character; however, north of the fault it has sodium sulfate character. TDS concentrations range from 600 to 1,100 mg/L (MWD 1998). Analyses of data from four public supply wells show an average TDS of 698 mg/L in the MGB, with a range of 526 to 778 mg/L (DWR 2004). DWR (2004) also noted that iron and manganese concentrations in wells had exceeded federal standards at the time of the assessment. More recently, an assessment of groundwater quality by USGS (2016) for the whole South Coast Region (consisting of a 48-square-mile study area comprising the MWD along with the Goleta, Foothill, Santa Barbara, and Carpinteria groundwater basins) found that inorganic constituents were more prevalent and generally occurred at higher relative concentrations than organic constituents. For inorganic constituents with human health benchmarks, relative concentrations were high in 5.3% of the primary aquifer system and moderate in 32% (USGS 2016). Boron and fluoride were the primary inorganic constituents with human health benchmarks (MCLs) present at high relative concentrations. For inorganic constituents with aesthetic-based benchmarks (California Department of Public Health secondary maximum contaminant levels [SMCLs]), relative concentrations were high in 58% of the USGS study area and moderate in 37%. Iron, manganese, sulfate, and TDS were the inorganic constituents with aesthetic-based benchmarks present at high relative concentrations (USGS 2016).

In contrast to inorganic constituents, organic constituents with human-health benchmarks were not detected at high relative concentrations in the primary aquifer system in the USGS study area. Of the 218 organic constituents analyzed for, 10 were detected, 9 of which had human-health benchmarks. Relative concentrations of organic constituents were moderate in 11% of the primary aquifer system. The volatile organic compounds present at moderate relative concentrations included MTBE (11%), 1,2-dichloroethane (5.6%), and tetrachloroethene (PCE) (1.4%, spatially weighted). All pesticides were present at low relative concentrations or not detected. The special interest constituent perchlorate was present at moderate relative concentrations in 50% of the primary aquifer system and at low relative concentrations in 17%. Pharmaceutical compounds and N-nitrosodimethylamine (NDMA) were not detected at concentrations greater than or equal to method detection limits in the Santa Barbara study unit.

In its 1998 GWMP, MWD reported water quality in the MGB as good to moderately good, and as having calcium bicarbonate character to the south of the Arroyo Parida Fault and sodium sulfate character to the north of the fault (MWD 1998). In addition, it found that concentrations of iron, manganese, and nitrates that exceeded federal standards, such as during drought periods when less freshwater was available to recharge the aquifer, suggested a link between decreasing groundwater level elevations and declines in groundwater quality, specifically relating to nitrate (MWD 1998).

A review of groundwater quality data in GAMA since the previously discussed assessments indicates that groundwater quality conditions in the MGB have not changed. Table 2-16 presents a review of each contaminant of concern, the comparison concentration value, and the number and percentage of wells that have exceeded the comparison concentration at any time and from any sample within the period of record for the well. Table 2-16 also shows the maximum concentration and the well number and date for each constituent evaluated. Consistent with previous assessments, water quality constituents that have been detected anytime in the past in exceedance of state or federal water quality standards (for both human health and aesthetic/odor benchmarks) include TDS, nitrate, chloride, iron, manganese, boron, sulfate, and fluoride, and in historical cleanup site cases, organic constituents. Many of the wells included in the GAMA database consist of cleanup site monitoring wells drilled for the purpose of characterizing underground storage tank site cases (discussed under Review of Regulatory Cleanup Sites, Historic Oilfields, and Septic Systems), and the organic constituents detected are related to those sites and not representative of the groundwater occurring throughout the MGB. Elevated metals consist of manganese and iron, although concentrations detected above SMCLs in municipal wells have been brief.

With respect to nitrate and TDS, concentration graphs over time are provided in Appendix 2B for each of the municipal wells (current and former) in the GAMA database. MWD municipal wells that have exceeded TDS or nitrate concentrations are as follows (SWRCB 2020a):

- **Ennisbrook Well No. 2.** The TDS concentration briefly exceeded the SMCL (of 1,000 mg/L) in one sample from January 2014 (nearly 1,500 mg/L) but has otherwise remained below it throughout the period of record (1991 through 2018). Nitrate (as N) concentrations have remained below the MCL (of 10 mg/L) throughout the period of record.

- **Ennisbrook Well No. 5.** The TDS concentration exceeded the SMCL (of 1,000 mg/L) in 2005 and has remained above it ever since, with three exceptions in 2014, 2016, and 2017. Since 2014, TDS concentrations in this well have been in the range of 1,400 to nearly 1,900 mg/L. Nitrate (as N) concentrations have remained below the MCL (of 10 mg/L) throughout the period of record (1991 through 2018).

- **T. Mosby Well.** TDS concentrations have remained below the SMCL (of 1,000 mg/L) throughout the period of record (2017 through 2019). Nitrate concentrations in this well briefly exceeded the MCL (of 10 mg/L) in May 2017 but have otherwise remained below the MCL.

- **Other Municipal Wells.** TDS and nitrate (as N) concentrations in all other municipal wells in the GAMA database (Amapola well, well 1, well 1 [coastal], and Padden well 2) remained below the SMCLs and MCLs throughout the period of record.

Concentration maps of manganese and iron indicated that several areas of the MGB have at one point or another exceeded MCLs in municipal wells. However, review of municipal wells with exceedances indicates that exceedances either occurred earlier in the period of record, or more recently, for brief, momentary periods (e.g., T. Mosby well, Ennisbrook wells, Amapola well) (SWRCB 2020a). It should be noted that MWD treats all raw groundwater to meet applicable water quality standards prior to delivery to customers.

Table 2-16
GAMA Groundwater Quality Monitoring Summary by Constituent (All Years)

Constituent	Number of Wells Sampled	Comp. Conc.	Comp. Conc. Value	Unit	Wells above Comparison Concentration at Any Time		Wells above½2 Comparison Concentration at Any Time		Maximum Concentration (Date)	Notes/Comments
					No.	*Percent*	*No.*	*Percent*		
Salts and TDS										
TDS	91	SMCL	1,000	mg/L	33	36.3%	86	94.51%	3,630 (Well No. USGS-342511119390701 on 1/6/1965)	Highest concentrations in SU 3 in shallow remediation wells, though TDS is also somewhat elevated in SU 1 as well; some municipal wells affected by TDS higher than SMCLs
Nitrate as N	95	MCL	10	mg/L	8	8.4%	34	35.79%	23.4 (Well No. T0608300630-MW-4A on 2/11/2015)	No clear spatial pattern, though appears lower in SU 1
Chloride	77	SMCL	500	mg/L	8	10.4%	13	16.88%	2,180 (Well No. USGS-342511119390701 on 1/6/1965)	Concentrated in SU 3
Organic Constituents										
Benzene	119	MCL	1	µg/L	39	32.8%	45	37.82%	30,000 (Well No. T0608300630-MW-2A on 8/25/2010)	Areas of very high concentrations are around cleanup sites (Chevron, Texaco, and Shell Stations) and have since decreased, though certain areas still exceed MCLs, one near T. Mosby Well, but these

Table 2-16
GAMA Groundwater Quality Monitoring Summary by Constituent (All Years)

Constituent	Number of Wells Sampled	Comp. Conc.	Comp. Conc. Value	Unit	Wells above Comparison Concentration at Any Time		Wells above½2 Comparison Concentration at Any Time		Maximum Concentration (Date)	Notes/Comments
					No.	*Percent*	*No.*	*Percent*		
										are in shallow monitoring wells
MTBE	112	MCL	13	µg/L	34	30.4%	40	35.71%	62,000 (Well No. T0608300545-MW-1 on 8/16/2005)	Areas of very high concentrations are around cleanup sites (Chevron, Texaco, and Shell Stations) and have since decreased, with cleanup site monitoring wells showing a decrease over time to below MCLs
Tetrachloroethene (PCE)	78	MCL	4.85	µg/L	0	0.0%	3	3.85%	4.85 (Well No. T060833156–-MW3 on 10/4/2006	One-off detection at Hanna Property cleanup site…all other results not detected or <½2 MCL
Perchlorate	22	MCL	6	µg/L	0	0.0%	0	0.00%	2.69 (Well No. USGS-342500119370001 on 4/21/2016)	Not detected above½2 MCL
Trichloroethene (TCE)	86	MCL	5	µg/L	0	0.0%	0	0.00%	1.3 (Well No. T0608300630-MW-15A on 3/18/2013)	Not detected above½2 MCL
DBCP	81	MCL	0.2	µg/L	0	0.0%	0	0.00%	Not detected	Not detected
1,2,3-Trichloropropane	82	MCL	0.005	µg/L	0	0.0%	0	0.00%	Not detected	Not detected

Table 2-16
GAMA Groundwater Quality Monitoring Summary by Constituent (All Years)

Constituent	Number of Wells Sampled	Comp. Conc.	Comp. Conc. Value	Unit	Wells above Comparison Concentration at Any Time		Wells above½2 Comparison Concentration at Any Time		Maximum Concentration (Date)	Notes/Comments
					No.	*Percent*	*No.*	*Percent*		
Inorganic Constituents and Trace Metals										
Arsenic	29	MCL	10	µg/L	0	0.0%	2	6.90%	7 (Ennisbrook Well 02 on 5/25/1994)	No clear spatial pattern
Manganese	33	SMCL	50	µg/L	17	51.5%	21	63.64%	1,420 (Well No. USGS-342536119370601 on 7/23/1973)	Highest concentrations in USGS monitoring wells with fairly ubiquitous elevated concentrations across the sub-basin; concentrations in excess of MCLs in active municipal wells (Ennisbrook well 2 and Paden well 2) have been brief one-offs
Cr^{6}	30	HBSL	0.2	µg/L	0	0.0%	2	6.67%	0.2 (Well Nos. 1 and 2 on 6/6/2003 and 3/17/2003)	No clear spatial pattern
Uranium	13	MCL	20	pCi/L	0	0.0%	0	0.00%	2.69 (Las Entradas Well 02 on 7/20/2005)	Not detected above½2 MCL
Iron	48	SMCL	300	µg/L	15	31.3%	22	45.83%	18000 (Well No. USGS-342511119390701 on 1/6/1965)	No obvious spatial pattern, and graphs show sharp, short-lived spikes.

Table 2-16
GAMA Groundwater Quality Monitoring Summary by Constituent (All Years)

Constituent	Number of Wells Sampled	Comp. Conc.	Comp. Conc. Value	Unit	Wells above Comparison Concentration at Any Time		Wells above½2 Comparison Concentration at Any Time		Maximum Concentration (Date)	Notes/Comments
					No.	*Percent*	*No.*	*Percent*		
Boron	62	NL	1	mg/L	2	3.2%	8	12.90%	1.11 (Municipal Well No. SB-14 on 2/9/2011)	No clear spatial pattern
Fluoride	64	MCL	2	mg/L	2	3.1%	13	20.31%	2.37 (Municipal Well No. SB-14 on 2/9/2011)	No clear spatial pattern
Sulfate	101	SMCL	500	mg/L	4	4.0%	32	31.68%	590 (Well No. T0608300630-MW-5A on 1/7/2010)	No clear spatial pattern, except elevated in shallow wells at cleanup sites

Source: SWRCB.

Notes: GAMA = Groundwater Ambient Monitoring and Assessment Program; TDS = total dissolved solids; SMCL = secondary maximum contaminant level; mg/L = milligrams per liter; SU = Storage Unit; MCL = California/Federal maximum contaminant level; MTBE = methyl tertiary butyl ether; µg/L = micrograms per liter; DBCP = 1,2-dibromo-3-chloropropane; Cr^6 = hexavalent chromium; HBSL = Health Based Screening Level (cancer or non-cancer health effect); pCi/L = picocuries per liter; NL = notification level.

2.2.4.5 Land Subsidence

Land subsidence resulting from aquifer deformation may be of two kinds: elastic or inelastic. Elastic deformation occurs with the compression and expansion of sediments due to pore pressure changes that occur with fluctuations in water levels (Borchers and Carpenter 2014). Therefore, elastic deformation may be cyclical in nature, corresponding to seasonal groundwater recharge or groundwater extraction. Critically, elastic deformation does not result in permanent loss of pore space. Inelastic deformation results in irreversible land subsidence and is commonly related to water extraction from fine-grained sediments within clay or silt aquitards (Borchers and Carpenter 2014). Permanent land subsidence related to groundwater withdrawal generally occurs in an unconfined aquifer when groundwater elevations drop below the historical range. Land subsidence may result from causes other than withdrawal of groundwater, such as vertical displacement from tectonic forces.

Although subsidence has been largely unmonitored until recently, the MGB is at low risk for subsidence (DWR 2014). In addition, there is little or no documentation of physical evidence of subsidence, such as well casing failure, infrastructure disruption, or earth fissures. The aquifer is mostly unconfined with laterally discontinuous fine-grained layers (Section 2.2.2, Hydrogeologic Conceptual Model, and Section 2.2.3, Principal Aquifers and Aquitards). Inelastic compaction of coarse-grained sediment is usually negligible (Borchers and Carpenter 2014).

InSAR Vertical Displacement Data

Land subsidence data are included in DWR's SGMA Data Viewer. Although data from USGS and DWR extensometers are available for parts of California, none are located near Santa Barbara's south coast or within Santa Barbara County. The SGMA Data Viewer includes vertical displacement data for the MGB derived from InSAR (Interferometric Synthetic Aperture Radar). The TRE Altamira InSAR Dataset is collected by the European Space Agency from the Sentinel-1A satellite for California from January 2015 through September of 2019 and processed by TRE Altamira (DWR 2020d). Random sampling of the 100-meter by 100-meter (328-foot by 328-foot) calculation grid cells in the MGB indicate that the vast majority of the MGB has experienced total vertical displacement of less than a quarter-inch of uplift or subsidence during the time period measured (Figure 2-28, Land Subsidence; DWR 2020d). As noted, variations in land surface elevation may result from temporary elastic or tectonic deformation. Available data indicate insignificant subsidence, likely from causes other than inelastic deformation.

2.2.4.6 Groundwater–Surface Water Connections

Groundwater and surface water are commonly hydraulically connected. The degree of connectivity plays a significant role in the potential for depletions of interconnected surface water to occur. The primary surface water features in the MGB are streams. In general, streams may be classified as gaining, losing and connected, or losing and disconnected. Stream–aquifer exchanges are controlled by several factors, including stream discharge and stage, the magnitude and distribution of hydraulic conductivities of the streambed and aquifer sediments, streambed thickness and its variation, the hydraulic gradient between the stream and the aquifer, and the geometric/morphological characteristics of the stream channel (Barlow and Leake 2012). DWR (2016) identifies monitoring of streamflow as a necessary component of the water budget analysis and for evaluation of stream depletions associated with groundwater extractions.

Montecito Creek, Oak Creek, San Ysidro Creek, Romero Creek, and Toro Canyon Creek are all streams within the MGB that have been identified as having a potential connection to groundwater (see Section 2.2.4.7, Groundwater Dependent Ecosystems). However, available stream gauge data are limited and cannot be used to quantify stream gains or losses. According to the USGS National Hydrography Dataset (NHD), all five creeks are classified as intermittent streams within the MGB,[24] with the exception of an approximately 1-mile reach of Toro Canyon Creek within the MGB that is classified as perennial (Figure 2-29, Potential Groundwater Dependent Ecosystems).[25] Based on the apparent change in stream type from perennial to intermittent near the MGB boundary (see Figure 2-29), all of the creeks potentially have a losing interface coincident with where the underlying geology transitions from primarily bedrock to unconsolidated material.

Montecito Creek is depicted by the USGS NHD as a perennial stream 0.25 miles north of the MGB boundary, but enters the MGB as an intermittent stream (Figure 2-29). Stream discharge data recorded since February 2016 at an active gauge on Montecito Creek within the MGB indicate that streamflow has typically ceased during the summer months. Oak Creek is classified by the USGS NHD as an intermittent stream from its origin approximately 0.5 miles north of the MGB boundary to where it enters the Pacific Ocean (Figure 2-29). San Ysidro Creek is listed by the USGS NHD as a perennial stream from its origin to approximately the MGB boundary, where it transitions to an intermittent stream (Figure 2-29). Historical stream discharge data recorded between October 1979 and September 1983 at a gauge (which has since become inactive) located approximately 650 feet upstream and outside of the MGB indicate that streamflow has typically persisted through the summer months. The main stem of Romero Creek is depicted by the USGS NHD as a perennial stream from its origin to approximately the northern MGB boundary, where it transitions to an intermittent stream (Figure 2-29). Toro Canyon Creek is classified by the USGS NHD as a perennial stream from its origin to approximately 1 mile south of the northern MGB boundary, where it transitions to an intermittent stream (Figure 2-29).

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[24] Stream in which surface flows cease for some duration each year.

[25] Stream in which surface flows persist year-round.

As discussed above, existing stream gauge data are limited and cannot be used to quantify the degree of stream–aquifer connectivity within the MGB at this time. The analysis so far has relied on the USGS NHD stream classifications to identify creeks and stream reaches that are perennial as compared to intermittent. To adequately characterize the interaction between groundwater and surface water within the MGB, additional monitoring of groundwater levels and streamflow conditions is needed. With implementation of the grant funded stream gaging program, surface water flow and duration will be gauged in several additional locations and used to categorize the character of the primary drainages (See Section 2.1.2.5). Flow data at these gauges are being logged and will be reported to DWR with each annual and periodic update. Section 3.5, Monitoring Program, explains the proposed actions to evaluate groundwater–surface water interactions and the risk of stream depletion.

2.2.4.7 Groundwater Dependent Ecosystems

A groundwater dependent ecosystem (GDE) is a plant and animal community that depends on groundwater for survival(Rohde et al. 2018). GDEs can include wetlands, streams, springs and seeps, and terrestrial vegetation. These communities are especially reliant on groundwater during dry seasons and droughts. GDEs have social, economic, and environmental benefits that include their ability to improve water quality, support biodiversity, and provide places for recreation. Depletion of groundwater levels in the vicinity of GDEs can threaten their existence (Rohde et al. 2018). GDEs are defined under the SGMA as “ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface” (Title 23 CCR Section 351(m)).

Freshwater Species that may Inhabit the Plan Area

The Plan Area may provide suitable habitat to support a variety of aquatic and terrestrial freshwater species, several of which are listed as threatened, endangered, and/or species of special concern (Appendix E-1). According to the California Freshwater Species Database version 2.0.9, threatened and/or endangered species that may be found in the Plan Area include the Willow Flycatcher (*Empidonax traillii* and *Empidonax traillii brewsteri*), Bald Eagle (*Haliaeetus leucocephalus*), Tidewater Goby (*Eucyclogobius newberryi*), Southern California steelhead (*Oncorhynchus mykiss*), *Chloropyron maritimum maritimum*, *Nasturtium gambelii*, and California Red-legged Frog (*Rana draytonii*). While these databases identify habitat that may support these species, additional studies are required to characterize their curreant presence in the MGB and the degree to which they rely on groundwater.

Overview of the NCCAG Dataset within the Plan Area

Groundwater is critical to sustaining springs, wetlands, and perennial flow (baseflow) in streams as well as to sustaining vegetation such as phreatophytes that directly tap groundwater. In response to SGMA, the Natural Communities Commonly Associated with Groundwater (NCCAG) dataset was provided by DWR and The Nature Conservancy (TNC) as a reference dataset and starting point for GSAs to review and validate the mapped features and supplement the dataset as necessary with the GSA's understanding of local surface water hydrology, groundwater conditions, and geology within the groundwater basin (Rohde et al. 2018).

The MBGSA has prepared a GDE analysis using the NCCAG tools as described here and in Appendix E-1 through and E-3. It is included in this GSP as an initial step toward identifying and sustainably managing GDEs. The tools provided, in conjunction with existing data, are inadequate to accurately describe the location, type, and health of groundwater dependent vegetation and habitat. Relevant data gaps within the Basin include surface water flow and shallow groundwater elevations proximal to creeks and potential GDEs. Therefore, the MBGSA has not yet set sustainable management criteria (SMCs) for GDEs and plans to reassess the available data and establish SMCs following implementation of relevant projects and management actions during GSP update (Section 2.1.2.5 and Chapters 3).

The NCCAG provides methods to evaluate vegetation health based on remote sensing of greenness and moisture content. It does not distinguish between factors impacting GDE health including moisture availability related to climate trends, perched groundwater (which is not impacted by groundwater extraction), surface water flow, irrigation runoff, and atmospheric humidity. Nor does the NCCAG address potential steelhead habitat that may occur within the Basin (Section 3.2.6). An additional source of uncertainty is watershed and vegetation response to the 2017 Thomas fire and January 2018 debris flow which significantly altered the topography and occurrence of GDEs the Basin, specifically along creek corridors.

The Natural Communities dataset is comprised of 48 publicly available state and federal agency mapping datasets including but not limited to the following: VegCAMP—The Vegetation Classification and Mapping Program, California Department of Fish and Wildlife; CALVEG—Classification and Assessment with Landsat Of Visible Ecological Groupings, U.S. Department of Agriculture Forest Service; NWI V 2.0—National Wetlands Inventory (Version 2.0), U.S. Fish and Wildlife Service; FVEG—California Department of Forestry and Fire Protection, Fire and Resources Assessment Program; USGS National Hydrography Dataset; and Mojave Desert Springs and Waterholes (Mojave Desert Spring Survey). After the previously described vegetation, wetland, seeps, and springs data were compiled into the NCCAG dataset, data were screened to exclude vegetation and wetland types less likely to be associated with groundwater and retain types commonly associated with groundwater (Rohde et al. 2018).

Within the MGB, the NCCAG dataset identified 48 individual vegetation communities and 8 wetland communities that may depend on groundwater (polygons). Figure 2-29 shows the aerial extent of the communities and Table 2-17 provides a summary of the communities by vegetation/wetland type.

Table 2-17
Summary of NCCAG Dataset within the MGB

Natural Community Commonly Associated with Groundwater	Number of Polygons	Acres
Vegetation Dataset		
Coast Live Oak	46	508.9
Riparian Mixed Hardwood	2	14.2
Total	**48**	**523.1**
Wetland Dataset		
Palustrine, Forested, Seasonally Flooded	6	16.0
Riverine, Unknown Perennial, Unconsolidated Bottom, Semi-permanently Flooded	2	0.8
Total	**8**	**16.8**

Source: DWR 2020e.

The predominant phreatophyte species identified within the MGB is coast live oak and the predominant wetland type is palustrine, forested, seasonally flooded (Table 2-17 and Figure 2-29). Together, these two vegetation/wetland types account for approximately 97% of the ecosystems that may rely on groundwater within the MGB. The remaining approximately 3% of NCCAG mapped communities include riparian mixed hardwood vegetation and riverine, unknown perennial, unconsolidated bottom, semi-permanently flooded wetland communities (Table 2-17 and Figure 2-29).

Methods for Identifying Groundwater Dependent Ecosystems

Due to the extent of individual vegetation/wetland units identified in the NCCAG dataset, individual communities were aggregated into larger GDE evaluation units by watershed, comprising six evaluation units in total. Individual vegetation/wetland communities within each GDE evaluation unit were characterized by reviewing the NCCAG dataset alongside available measured groundwater elevations, aerial photographs, lithologic data, and Landsat[26] data aggregated by TNC. TNC used Landsat data to calculate historical variations in the Normalized Derived Vegetation Index (NDVI) and Normalized Derived Moisture Index (NDMI) for the period 1985 to 2018 (Klausmeyer et al. 2019). These indices provide a quantitative measure of vegetation greenness and moisture content during prolonged dry periods. Long-term variations in NDVI and

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[26] The Landsat mission is the longest running satellite monitoring program used to capture space-based images of the Earth's surface every 16 days. Landsat is managed by NASA and records visible, near-infrared, middle-infrared, and thermal wavelengths reflected from the Earth's surface. TNC aggregated this data to generate NDVI and NDMI.

NDMI may act as a proxy for vegetation health. Groundwater elevation measurements, aerial photographs, lithologic data, and NDVI and NDMI indicators were reviewed following the general guidelines outlined by TNC (Rohde et al. 2018). Vegetation/wetland communities were characterized as: (1) priority potential groundwater dependent ecosystems or (2) potential groundwater dependent ecosystems. Vegetation/wetland communities were characterized as priority potential groundwater dependent ecosystems if NDVI and/or NDMI were positively correlated (correlation coefficient[27] greater than or equal to 0.6) with groundwater levels in the principal aquifer (groundwater levels at the closest representative monitoring point [RMP] well with a long-term data record), and groundwater levels measured at nearby wells (<1 kilometer [km] from the vegetation/wetland community) have been shallower than 36 feet bgs. This criteria for groundwater depth is based on the reported maximum rooting depth for coast live oak (Steinberg 2002). Alternatively, vegetation/wetland communities were characterized as potential groundwater dependent ecosystems if NDVI and/or NDMI were not correlated with groundwater levels, the community persisted during periods when underlying groundwater levels were much deeper than 36 feet bgs, the source of water sustaining the community was not easily identifiable, groundwater levels underlying the community have not been measured, or vegetation health indices were not available. Some exceptions to the above characterization criteria were made on a case-by-case basis, such as in areas where groundwater levels are regularly less than 36 feet bgs, and where the thickness of the alluvial deposits that comprise the principal aquifer are known to be thin. Depth to groundwater was the primary metric used to characterize the vegetation and wetland communities.

Summary of GDE Characterization

This section describes the results of the GDE characterization in the MGB. Data supporting the characterization of each unit is described in detail in Appendix E-1 through E-3. Due to the existence of significant data gaps in relevant indicators within the Basin, this analysis is preliminary, provided as a starting point for the potential establishment of GDE SMCs with the five-year GSP update.

A total of 25 communities identified by the NCCAG dataset were characterized as priority potential groundwater dependent ecosystems (highlighted polygons in Figure 2-29). The communities consist of coast live oak and riparian mixed hardwood vegetation. The priority potential GDEs are located along Montecito, Oak, Romero, and San Ysidro creeks. Vegetation health trends are positively correlated with groundwater levels and/or groundwater levels underlying the communities have

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[27] The correlation coefficient is a measure of the strength of the linear relationship between two variables. The correlation coefficient assumes values ranging between +1 and -1, with 0 indicating no relationship, +1 indicating a perfect positive linear relationship, -1 indicating a perfect negative linear relationship. Generally, correlation coefficient values between 0 and ±0.3 indicate a weak linear relationship, values between ±0.3 and ±0.7 indicate a moderate linear relationship, and values between ±0.7 and ±1.0 indicate a strong linear relationship.

frequently been less than 36 feet bgs (e.g., wells 1-15, 1-21, 1-31, 1-49, 3-2, and 3-23 in Appendix D). Groundwater may support these vegetation communities and there is potential for the communities to be impacted by groundwater pumping.

A total of 31 communities identified by the NCCAG dataset were characterized as potential groundwater dependent ecosystems (non-highlighted polygons in Figure 2-29). The communities consist of coast live oak; riverine, unknown perennial, unconsolidated bottom, semi-permanently flooded; and palustrine, forested, seasonally flooded vegetation and wetland communities. Vegetation health trends are not correlated with groundwater levels or vegetation health indices are not available, groundwater levels beneath the communities are generally greater than 36 feet bgs and the communities are in areas with relatively shallow depth to bedrock (see Figure 2-30, Depth to Bedrock) where groundwater is not actively extracted from the principal aquifer, or there is limited available groundwater level data to characterize groundwater conditions underlying the communities. These communities may be supported by areal precipitation and intermittent surface flows emanating from the contributing watershed. Further characterization of these communities and their potential dependence on groundwater through the GSP implementation period is warranted (see Section 3.5.7.3).

2.3 WATER BUDGET

This section of the GSP presents the historical, current, and projected water budget analysis for the MGB. The water budget prepared for this GSP is designed to, “provide an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current, and projected water budget conditions, and the change in volume of water stored” (GSP Emergency Regulations §354.18)

The historical water budget was prepared for the 45-year period from water year 1970 through the end of water year 2014; the current water budget was prepared for the five-year period from water year 2015 through water year 2019; and the projected water budgets were prepared for the 50-year period from water year 2020 through the end of water year 2069 (23 CCR 354.18(c) (2) (B)). Water years are defined as October 1 through September 30 of the following year (e.g., the 2018 water year begins on October 1, 2017 and ends on September 30, 2018). Individual components of the water budget are described in units of acre-feet (AF) or acre-feet per year (AFY).

Estimates of the individual components of the water budgets for the historical, current, and projected conditions in the MGB are based on simulation results from the Montecito Basin Numerical Model (MBNM). The MBNM includes a watershed model and groundwater flow model that simulates the effects of native and non-native water supplies and demands on groundwater conditions across the MGB. The watershed model and groundwater model are loosely coupled by extracting estimates of stream flow and precipitation recharge from the watershed model and using these outputs as inputs to the groundwater model. Use of the MBNM to develop water budgets for the MGB facilitates spatial and temporal characterization of basin inflows, outflows, and changes in storage by water year type and water supply reliability (Section 354.18 (c) (2)). An overview of the MBNM is provided in Section 2.3.1.

Sections 2.3.2 and 2.3.3 provide an overview of the sources of groundwater recharge and discharge in the Basin. These sections also provide a general description of how each groundwater recharge/discharge source is represented in the MBNM and provide an estimate of the average annual quantities throughout the historical period as well as an estimate of the historical sustainable yield. In addition, these sections also provide a description of previous estimates of average annual water budget components. Quantitative assessments of the historical, current, and projected water budgets are provided in section 2.3.4 and are accompanied by tabular and graphical representations of the historical, current, and projected water budgets included in Appendix F.

2.3.1 Surface Water and Groundwater Model

The MBNM is a numerical flow model that simulates surface water and groundwater processes across the MGB and the contributing watershed that drains to the MGB. Surface water processes are simulated using the USGS modular modeling code, Precipitation Runoff Modeling System (PRMS). Groundwater processes are simulated using the USGS finite-difference modeling code, MODFLOW-NWT. These two codes are loosely coupled by extracting estimates of groundwater recharge and surface water flows from the PRMS module and using these model-estimates as inputs to the MODFLOW-NWT model.

The PRMS and MODFLOW models of the MBNM were developed using a coincident model grid that extends from the northern boundary of the contributing watershed to the coastal boundary between the MGB and Pacific Ocean, covering the entire extent of the B118 Basin Boundary for the MGB (Figure 2-31). The model was built using a 131 row x 169 column rectilinear grid with nodes spaced 229 feet apart to simulate surface water and groundwater fluxes. The grid is oriented in the north-south direction with the lower left corner located at an easting and northing of 6,055,221.7579 and 1,975,663.687 feet relative to the California State Plane NAD 83 Zone 5 coordinate system.

The MBNM was designed to evaluate water supplies, demands, and changes in storage in the MGB throughout the historical (October 1, 1969 - September 30, 2014), current (October 1, 2014 through September 30, 2019), and projected periods (October 1, 2020 -September 30, 2069) . The PRMS model of the MBNM utilizes a daily-time step to capture variations in climatic conditions that drive watershed processes and the MODFLOW model of the MBNM utilizes a monthly timestep to simulate groundwater conditions across the MGB. The daily time-step outputs from the PRMS model are averaged over the monthly timescale and used as inputs to the MODFLOW model.

Calibration of the PRMS and MODFLOW models were conducted separately using a combination of automated calibration tools and manual calibration techniques. The PRMS model was calibrated to potential evapotranspiration measurements (PET) collected at the CIMIS station located in Santa Barbara and daily streamflow measurements collected at the San Ysidro gauge located directly north of the MGB Basin Boundary (Figure 2-6). The MODFLOW model was calibrated to groundwater elevation measurements collected from 27 wells that are monitored as part of MWD's groundwater monitoring program.

2.3.1.1 MBNM Watershed Model (PRMS)

Watershed processes simulated by PRMS as part of the MBNM include precipitation, evapotranspiration, surface water runoff, and soil zone processes. Variation in both the rate and location of each process is controlled by local climatic conditions, land surface properties, and soil characteristics.

Data characterizing land surface properties, soil characteristics, and climatic conditions were aggregated from a combination of measured and geospatial datasets. Industry standard geospatial datasets used during the development of the MBNM included LANDFIRE data for vegetation coverage, National Land Coverage Dataset for the distribution of impervious land coverage, soil maps from the United States Department of Agriculture (USDA) SSURGO and STATSGO database, and land surface elevations from the National Elevation Dataset 10-m digital elevation model (DEM) (Gardner et al, 2018). These data were mapped onto the MBNM model grid and were used to generate estimates of PRMS-specific parameters that constrain surface water runoff properties, surface water flow directions, vegetation coverage and evapotranspiration demands, and soil zone storage and conductance. Modeled climatic conditions in the MBNM were characterized using a network of precipitation and climate measurement stations located across the MGB and contributing watershed.

Simulation results from the PRMS model of the MBNM provide estimates of three key quantities that constrain native groundwater supplies and demands in the MGB: (1) the volumes and rates of surface water runoff across the watershed, (2) the volumes and rates of precipitation infiltration, and (3) the evapotranspiration demands.

2.3.1.1.1 Surface Water Runoff

The MBNM simulates precipitation at the grid-cell level and performs a water balance calculation that meets the evapotranspiration demands, fills surface depressions and plant canopy storage, and allows for precipitation to infiltrate into the underlying soils. Precipitation that is in excess of these demands is routed downhill to adjacent model cells as surface runoff before discharging to the stream segment that drains the local sub-watershed.

In addition to runoff derived from excess precipitation, the PRMS module of the MBNM allows water stored in the soil zone to discharge to ground surface and contribute to local runoff. This occurs when land surface topography changes such that the elevation of the soil water column is higher than the elevation of the neighboring model cell. The direction of surface water and soil water flow is constrained by the local topography of the watershed. Flow directions were calculated in the MBNM using the USGS Cascade Routing Tool software (Henson et. al, 2013).

The total summation of precipitation excess and soil zone discharges to land surface were used to generate estimates of streamflow inputs for the MODFLOW model of the MBNM. To do this, the daily time-step outputs were extracted from PRMS and averaged over the monthly timescale to generate inputs for the MODFLOW streamflow routing package (SFR). The SFR packages simulate streamflow processes in MODFLOW by routing surface runoff to downstream segments, where surface water can either recharge groundwater, be consumed by evapotranspiration, or be fed by groundwater discharging to land surface.

2.3.1.1.2 Volumes and Rates of Precipitation Infiltration

Precipitation was simulated in the MBNM using precipitation measurements collected at six climate measurement stations located across the Montecito watershed (Figure 2-31; Table F-1). Precipitation measured at these climate stations were mapped across the MBNM model grid using internally computed regressions between daily precipitation and elevation. The linear regression between precipitation and elevation at each model cell was calculated using measured data from the two precipitation measurement stations located at the most similar elevations to the land surface elevation of each cell. Figure 2-32 shows the reference climate station associated with each cell in the MBNM.

Precipitation that is not evaporated, stored in surface depressions or the vegetation canopy, or lost to surface runoff will infiltrate into soils that underlie land surface. Once in the soil zone, water can flow downhill to neighboring model cells, discharge to land surface, be consumed by evapotranspiration, or recharge the groundwater aquifer. The soil zone is a key link between surface water and groundwater processes in the MBNM. The rate and relative magnitude of each process is influenced by local topography and soil characteristics.

Soil zone characteristics were constrained in the MBNM using the USDA SSURGO and STATSGO database. This database provides estimates of soil composition, available water holding capacity, saturated hydraulic conductivity, and soil depth across the Montecito Watershed. The USDA databases estimates these soil properties over much larger spatial scales than the MBNM model grid and therefore does not capture local variability that may affect infiltration rates. To account for this, the soil-zone parameters generated using this data were used as initial estimates of soil properties and were adjusted during model calibration.

2.3.1.1.3 Evapotranspiration

The MBNM estimates evapotranspiration (ET) demands across the Montecito watershed using a modified Jensen-Haise formulation for potential evapotranspiration (PET). This formulation estimates PET based on average air temperature, solar radiation, and two empirical parameters that incorporate the effects of altitude, vapor pressure, and plant coverage (Markstrom et. al, 2015).

Average air temperatures in the MBNM were constrained using daily values of minimum and maximum temperature measured at the NOAA Santa Barbara climate station (station ID: GHCND:USC00047902; Figure 2-6). Minimum and maximum daily air temperature were mapped across the MBNM model domain using monthly temperature adjustment factors calculated using PRISM monthly normal temperature minimum and maximum datasets.

Coefficients of the modified Jensen-Haise equation that incorporate the effects of altitude, vapor pressure, and plant coverage on PET were adjusted during calibration of the PRMS model. Calibration of PRMS-estimated PET was preformed using PET data collected at the CIMIS climate measurement station located in Santa Barbara (CIMIS Station ID: 107).

2.3.1.2 MBNM Groundwater Model (MODFLOW-NWT)

The MBNM uses MODFLOW-NWT, a newton formulation of MODFLOW-2005 that improves numerical representation of unconfined aquifers, to characterize the effects of groundwater supplies, demands, and interactions with adjacent basins on groundwater conditions in the MGB. These processes are constrained by locally measured aquifer properties, boundary interactions, and anthropogenic stresses, as well as native stresses, such as stream flow and precipitation recharge, estimated by the PRMS model of the MBNM. Boundary conditions in the MODFLOW model of the MBNM change at the monthly timescale.

Groundwater flow processes in the MBNM are simulated using a three-layer model that extends vertically downward from land surface to depths exceeding 1,000 feet bgs (Figure 2-30). The principal aquifer, which consists of the Casitas Formation, Santa Barbara Formation, and alluvial and terrace deposits (Section 2.2.3), is represented using the upper two model layers; the thickness and lateral extent of the principal aquifer, as represented in the MBNM, was determined through the use of geologic maps, previously developed cross-sections (GTC, 1974), and by identifying the contact between water-bearing materials and bedrock from 95 lithologic logs. The lithologic logs and geologic maps did not provide sufficient information to vertically differentiate between the Casitas Formation, Santa Barbara Formation, and younger alluvial and terrace deposits. The multi-layer approach to representing the principal aquifer was selected to better represent vertical gradients across the MGB that result from depth-discrete groundwater extractions, infiltration of surface water and precipitation, and interactions with the underlying bedrock. Groundwater conditions in the MBNM were simulated in MODFLOW using convertible model layers.

2.3.2 Inflow to Groundwater System

2.3.2.1 Recharge from Rainfall Infiltration

Direct recharge from precipitation is a significant source of recharge to the MGB. The MBNM simulates precipitation recharge through a loose-coupling between groundwater recharge estimates extracted from the PRMS model of the MBNM and surface infiltration inputs applied to the unsaturated zone processes simulated by the MODFLOW model of the MBNM. Applying these groundwater recharge estimates to the unsaturated zone rather than directly to the water table incorporates the natural time delay between precipitation events and corresponding groundwater recharge.

During the period from water year 1970 through water year 2014, simulation results from the MBNM indicate that the MGB received approximately 6,000 AFY of precipitation recharge (Table F-2). Average annual precipitation recharge was highest in Storage Unit 1, which was recharged with approximately 2,940 AFY of precipitation (50% of the average annual precipitation recharge to the Basin). Precipitation recharge in Storage Unit 2, Storage Unit 3, and Toro Canyon averaged approximately 600 AFY, 1,350 AFY, and 860 AFY, respectively (Table F-3).

Estimates of precipitation recharge computed by the MBNM are higher than historical estimates of precipitation recharge to the Basin. These historical estimates were based on simplified empirical models that relate deep percolation to cumulative rainfall for Ventura County watersheds (DPW 1933) and do not directly incorporate the local soil and land surface characteristics across the MGB. Using this approach, Hoover (1980a) estimated that, of the approximately 9,800 AF of precipitation that falls on the MGB in an average year, approximately 500 AF recharge the aquifer. Muir (1968) estimated average recharge from rainfall for the periods 1868 to 1964, 1944 to 1964, and 1949 to 1959, concluding an estimated average recharge for the MGB of 1,570 AFY. The MGB area used by Muir (1968) for this calculation was approximately 30% smaller than that for the MGB as currently defined by DWR.

2.3.2.2 Mountain Front Recharge

The south face of the Santa Ynez Mountains, directly north of the MGB, is mapped by the U.S. Department of Agriculture as Rock Outcrop–Maymen Complex (Rb and MbH; Figure 2-33, Soils Map). These areas are characterized by 50% to 100% sloping unweathered bedrock underneath several inches of sandy loam with very high runoff (Hydrologic Soil Group D; USDA 2020). In addition, the MGB is structurally bound on the east and west by outcrops of the Monterey Shale (TM), Rincon Formation (Tr), and Sespe Formation (Tsp; Figure 2-12A). Precipitation that falls on these bedrock outcrops may recharge the MGB via subsurface underflows.

Simulation results from the MBNM indicate that the MGB receives approximately 430 AFY of mountain front recharge (Table F-2). Approximately 200 AFY, or 50% of the total mountain front recharge, occurred via underflows from the Santa Ynez Mountains into Storage Unit 1 and Toro Canyon. Approximately 230 AFY of mountain front recharge occurred via underflows from the outcrops of Monterey and Rincon Formation on the eastern boundary of the MGB and along Ortega Ridge, which separates Storage Units 2 and 3 from Toro Canyon (Table F-3).

2.3.2.3 Creek Recharge

Infiltration of creek flow is the largest source of recharge to the MGB (Table F-2). Watersheds along the south coast of Santa Barbara County are largely "flashy" in nature, having low or no flow for much of the year and reaching high or flood-stage flows for short periods with intense storms and saturated conditions. The amount of recharge from a creek is most accurately estimated as the difference between flow at gauges located near the creek's entry to the groundwater basin and where it discharges from the basin. Such flow data is largely lacking for the MGB (see Section 2.2.4.6, Data Gaps). This MBGSA is currently implementing grant-funded projects that will provide for gauging of some of the MGB's largest creeks, thereby providing more accurate future estimates of recharge in the MGB (see Section 2.1.2.5**)**.

Estimates of creek recharge were extracted from the MODFLOW model of the MBNM. As previously noted, estimates of streamflow inputs to the MODFLOW model of the MBNM were based on average monthly flows extracted from the PRMS model of the MBNM. The MBNM simulates surface water-groundwater interactions using the MODFLOW streamflow routing (SFR) package.

Results from the MODFLOW model indicate that the MGB historically received an average of approximately 6,890 AFY of creek recharge (Table F-2). These recharge values are strongly correlated to water year type, with the MBNM indicating that the MGB received an average of approximately 5,100 AFY and 8,100 AFY of creek recharge during critically dry and wet water years, respectively (Table F-2).

Numerical model results from the MBNM indicate that approximately 50% of the creek recharge to the MGB occurs in Storage Unit 3 (Table F-3). This portion of the Basin is characterized by shallower topographic changes than the higher-elevation storage units that lie along the base of the Santa Ynez Mountains.

Stream flows within the Watershed are actively measured by Santa Barbara County division of Public Works using one gauge located along Montecito Creek (Figure 2-6). This gauge was designed to measure peak flows during large storms and historical stream flow measurements are of variable quality and uncertain. Because these data are uncertain, they were not used during model calibration.

In addition to the Montecito Creek gauge, stream flows were historically measured within the Montecito Watershed along San Ysidro creek (Figure 2-6; USGS Gauge 11119660 San Ysidro Creek). Stream flows were measured along San Ysidro creek at this gauge between October 1, 1979 and September 29, 1983 Stream flows simulated in the MBNM were calibrated to flows measured at this gauge during the 3-year period from 1980 through 1983. The relatively short period of record available for model calibration indicates that simulated surface water flows, and corresponding model estimates of creek recharge, are uncertain.

2.3.2.4 Inflow from Consolidated Rock

The consolidated sedimentary rock that delineates the MGB bottom contains groundwater in fractures, joints, and bedding planes that contribute recharge to the unconsolidated sediments of the MGB (GTC 1974). In some parts of the MGB, and in the foothills to the north of it, some wells extract groundwater from bedrock, mainly from the sandstones of the Sespe and Coldwater Formations (Hoover 1979). Yields from wells completed in these formations are generally very low and inconsistent (GTC 1974). The quantity of inflow contributed to the unconsolidated formations of the MGB depends, in part, on the groundwater elevation in the MGB.

The MBNM simulates groundwater interactions with the consolidated rock using a general head boundary condition that allows groundwater to flow out of, or into, the consolidated rock based on the simulated groundwater elevation within the principal aquifer. The elevation of the general head boundary conditions was held constant throughout the simulation and was equal to the elevation of the contact between the principal aquifer and consolidated rock. The general head boundary conductance was adjusted as part of the MODFLOW model calibration.

Results from the MBNM indicate that the MGB received an average of approximately 600 AFY of recharge from consolidated rocks that underly the Basin (Table F-2). This estimate is similar to previous estimates of 250 AFY (Hoover, 1979) and 300 AFY (Muir, 1968) that are based on simplified aquifer and hydraulic gradient assumptions that neglect local variations in groundwater conditions and aquifer materials across the MGB

The MBNM indicates that most of the recharge from underlying consolidated rocks occurs in Storage Unit 1, where groundwater elevations change dynamically with water year type (Table F-2). The MBNM indicates that Storage Unit 1 is recharged with approximately 300 AFY of water that originates from bedrock underlying the Basin. The MBNM indicates that recharge from the underlying consolidated rock provided approximately 115 AFY, 60 AFY, and 100 AFY to Storage Unit 2, Storage Unit 3, and Toro Canyon, respectively.

2.3.2.5 Irrigation Return Flow

There are several factors that influence the quantity of recharge from irrigation return flow. Primary among them is land use. Irrigation occurs in the MGB with residential landscaping, agriculture, and turf, such as that used for golf courses and cemeteries. Climate influences the amount of irrigation that is needed for a particular plant type through precipitation amount and frequency and temperature. In addition, methods of irrigation have become more efficient over time, resulting in a reduction in applied water and therefore a reduction in return flow to the aquifers. With increased awareness of the need for water conservation due to recent droughts, plant types in the MGB have likely become more drought tolerant.

MWD maintains historical estimates of water sales within its service area dating back to water year 1950. These historical estimates of water sales were mapped onto the MBNM model grid and applied as a specific flux recharge source using the MODFLOW WEL package. The water delivery volume was scaled at each model grid by assuming that 80% of the total delivery was used for outdoor applications, and 15% of the water used for outdoor purposes infiltrated beyond the soil zone, providing a source of recharge to the Basin. These estimates of outdoor water usage and corresponding infiltration volumes are based on MWD records and estimates of irrigation use. Based on this approach, it is estimated that irrigation return flows provided approximately 430 AFY of recharge to the MGB.

2.3.2.6 Septic System and System Loss Return Flow

There are approximately 920 parcels in the MGB that have septic wastewater disposal systems (Figure 2-34, Parcels with Septic Systems). Based on an estimated 86 gallons per person per day and 2.4 people per household, there is a potential for about 212 AFY of return flow from septic systems effluent.[28]

Recharge from septic systems was modeled in the MBNM by mapping the parcels with septic (Figure 2-34) onto the MBNM model grid. The average 212 AFY recharge rate was distributed uniformly across each parcel and applied as a specified flux recharge boundary condition using the MODFLOW WEL package. Recharge from septic system return flows are incorporated into the "Return Flows" category of Table F-2.

MWD regularly tracks "water losses," a category that encompasses meter inaccuracies, undocumented/unauthorized releases, flushing of reservoirs or system lines, water main breaks, and fire hydrant use in addition to leaking water mains and service lines. In sum, these sources are estimated to amount to about 10% of MWD's supply (MWD 2017). Of these categories, only

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[28] Indoor water use estimated from winter water use (lowest water use time of year, when irrigation is unlikely). People per household for the period from 2014 to 2018 is from U.S. Census Bureau's QuickFacts (2020), accessed June 20, 2020.

leaking water mains and service lines are likely to have the potential to recharge groundwater. In 2015, total water losses were approximately 390 AF. Given the small percentage of total water losses that are likely attributable to leaking water mains and service lines, recharge from this source is considered negligible. Accordingly, total water losses from MWD’s water delivery system were not incorporated as a source of recharge in the MBNM.

2.3.2.7 Groundwater Exchange with Adjacent Basins

The MGB is hydraulically connected along its southeastern and southwestern boundaries to the Santa Barbara Basin and Carpinteria Basin (Figure 2-31). Along these boundaries it is possible for the MGB to gain or lose groundwater to the adjacent basins. Where groundwater flow is mainly southward and parallel to the boundaries, the water exchange is limited or negligible. The direction of groundwater flow in these areas may change over time in response to natural sources of discharge or recharge and where localized groundwater recharge and discharge occurs.

The MBNM simulates groundwater exchanges between the MGB and adjacent basins using general head boundary conditions. Groundwater exchanges across the general head boundaries are calculated by the MODFLOW model and depend on the user-specified boundary conductance, user-specific boundary head, and internally calculated groundwater elevation within the MGB basin boundary. Groundwater elevations along these general head boundaries were held constant throughout time and equal to the average groundwater elevation measured at nearby groundwater monitoring wells. Along the jurisdictional boundary between the MGB and the Santa Barbara Basin, a constant groundwater elevation of 5 ft. msl, which is equal to the mean elevation measured at well 4N27W13R01S, was used for the general head boundary. Along the jurisdictional boundary between the MGB and the Carpinteria Basin, a constant groundwater elevation of 3 ft. msl, which is equal to the mean elevation measured at well 4N26W23A02S, was used for the general head boundary.

Results from the MBNM indicate that approximately 5 AFY and 90 AFY of groundwater flow into the MGB from the Santa Barbara Basin and Carpinteria Basin, respectively. Combined, these two sources of recharge account for less than 1% of the average annual recharge to the MGB. These results are consistent with groundwater elevation contour maps that suggest the primary direction of flow near these jurisdictional boundaries is north to south (Figures 2-17 through 2-20).

2.3.2.8 Groundwater Exchange with Seawater at the Coast

The MGB is hydraulically connected to the Pacific Ocean along its southern boundary (Figure 2-31). Groundwater elevations that drop below mean sea level may provide the potential for seawater intrusion into the MGB. In the MGB, historical studies have postulated that a near-shore fault zone precludes significant seawater intrusion into the MGB. Section 2.2.4.3 summarizes the historical information and conclusions regarding seawater intrusion in the MGB and Section 3.2.3 explains what is known about the current state of seawater intrusion and the proposed actions to evaluate the occurrence and risk of seawater intrusion.

Groundwater interactions with the Pacific Ocean were modeled in the MBNM using a general head boundary condition. Model cells that were directly adjacent to the Pacific Ocean were given a constant head value equal to the freshwater head equivalent of seawater. The freshwater head equivalent was calculated by multiplying the principal aquifer thickness by 0.025, which represents the relative density difference between seawater and freshwater (USGS 2003). The implementation of this boundary condition allows water to enter the MGB when simulated groundwater elevations in Storage Unit 3, Toro Canyon, and Summerland drop below mean sea level, and allows water to flow out of the model domain when groundwater elevations are higher than mean sea level.

Results from the MBNM indicate that approximately 40 AFY of seawater enters the MGB from the Pacific Ocean (Table F-2). The MBNM indicates that the majority of this occurs at depth in the southwestern portion of Storage Unit 3, where the principal aquifer is approximately 1,000-feet thick. The 40 AFY of seawater flux into the MGB accounts for less than 1% of the total inflows to the Basin and is within the uncertainty of the model.

2.3.3 Outflow from Groundwater System

2.3.3.1 Groundwater Extraction

Groundwater extraction has fluctuated significantly over time in response to land use, climate, and water supply sources. Private groundwater extractions are thought to have generally declined from the 1920s, prior to the formation of MWD, to the late 1970s due to the availability of additional water sources, including Jameson Reservoir (completed in 1930) and Cachuma Reservoir (completed in 1953). Additionally, the availability of SWP water beginning in 1997 helped MWD offset groundwater supplies with imported water. With increased development of the MGB and restrictions on the use of MWD-supplied water during drought periods, including 1986 to 1991 and 2011 to 2017, construction of groundwater wells and extraction of groundwater by private parties increased (Figure 2-35 and Figure 2-36). Such extractions include those by private water companies, agricultural operations, and institutional and private landscaping. Non-municipal groundwater extractions have been largely unmetered or unreported and estimates of their magnitude have all required indirect methods.

Number of Groundwater Wells

Santa Barbara County code requires that all new wells be permitted through the Environmental Health Department. Santa Barbara County's ordinance requires standards that meet or exceed state standards (Santa Barbara County Well Standards Ordinance No. 5046). Although most wells have been permitted prior to construction, accurately determining the number of currently functioning wells at any particular time is difficult. Historical estimates of the number of wells include 368 total wells in 1979, 93 of which were active production wells (Hoover 1980a), and 535 active production wells in 2014 (Dudek 2017).

To estimate the number of currently producing wells located in the MGB, and those close enough to impact groundwater conditions in the MGB aquifer, data from all available sources were collected, processed, reviewed for redundancy and accuracy, and entered into the project data management system. Sources from which data were collected included the following:

- California Department of Water Resources well completion database
- Santa Barbara County Environmental Health Services well permit and completion files
- Montecito Water District records
- Historical consultant reports and databases

Results of the data acquisition and processing are shown on Figure 2-36, Groundwater Well Locations and Number of Wells per Square Mile. The total number of wells in the MGB is estimated to be 908, some of which are presumed to be inactive. The number of active wells in the MGB was estimated using the analysis described in the section below. The MGB Data Management System contains the well database which will be continuously reviewed and updated throughout the GSP implementation to incorporate site reconnaissance data and information on newly constructed wells.

Groundwater Extraction Estimates

Historical groundwater extractions were estimated for the period from water year 1950 through 2019 as part of this GSP development and development of the MBNM. This analysis builds on previous estimates of historical extraction rates that utilized historical imported water supplies, land use type, and estimates of irrigated acreage (Hoover, 1980; Dudek 2017). However, unlike previous studies, estimates of groundwater extractions for development of the GSP and MBNM were designed to estimate extraction volumes on a well-by-well basis.

To perform this analysis, a detailed review of district records, Santa Barbara DEH's well completion report database, and DWR's well completion report database was performed to identify wells that might be constructed and active within the MGB boundaries. Based on this review, wells were then mapped onto the Basin using site reconnaissance information or data available on well completion reports and permits. These wells were then joined to Assessor's Parcel layer to identify irrigated land that each well may be providing water for.

Irrigation demands at each parcel were specified by aggregating Santa Barbara County's Land Use data into six land use categories (Table F-4). Water use factors were assigned to each parcel based on this land use categorization (Table F-4) and were based on regional CIMIS data, local knowledge, and regional estimates of agricultural land water use (DWR, 2021).

In September 2020, DWR contracted Quantum Spatial Inc. to generate estimates of irrigated land coverage within the MWD service area boundaries. Estimates of irrigated land acreage were generated using remote satellite data and advanced machine learning techniques to identify irrigable area within single-family and multi-family residential parcels (Quantum Spatial Inc., 2020). These estimates of irrigable area were combined with the water use factors to generate estimates of total water demand for each parcel containing a groundwater well. The estimated groundwater extraction rate at each well was calculated by computing the difference between the parcel's irrigation demand and MWD's estimated delivery to each parcel. Groundwater wells were assumed to be inactive when MWD's deliveries met the parcel's irrigation demands.

Table F-5 summarizes the results from this analysis and demonstrates that groundwater extractions from privately-owned wells comprise most extractions within the MGB. Between 1970 and 2015, private wells have accounted for between 54% and 95% of the total extractions in the MGB. Private well extractions steadily increased from 1970 through 2014, averaging approximately 340 AFY in the 1970s and 900 AFY between 2000 and 2014 (Table F-5). In water year 2014, results from this analysis suggest that approximately 360 privately owned wells actively extracted groundwater within the MGB. Like the trends in private well extractions, groundwater extractions by MWD steadily increased between water year 1970 and water year 2014. In the 1970's, MWD extracted an average of approximately 100 AFY; between water year 2000 and 2014, MWD extracted approximately 310 AFY (Table F-5).

Estimates of groundwater extractions presented in Table F-5 include production volumes from wells located within the Montecito Groundwater Basin boundary that may be screened across both the principal aquifer and the underlying consolidated rocks. Groundwater extractions from the underlying consolidated materials may indirectly effect groundwater conditions within the principal aquifer of the MGB by impacting vertical gradients between the two geologic materials; these effects are simulated by the MBNM using the general head boundaries discussed in Section 2.3.1.4.

To account for wells screened across both the principal aquifer and consolidated rocks, groundwater extractions within the MBNM were simulated using the MODFLOW Multi-Node Well (MNW2) package. The MODFLOW MNW2 package allows the user to specify well-construction details and automatically adjusts pumping within the well as the well screen becomes desaturated. The implementation of this package provides further refinement of the production well estimates presented in Table F-5 and facilitates estimates of groundwater extractions that occur only from the principal aquifer throughout time.

Groundwater production from within the principal aquifer of the MGB is presented in Table F-2**.** The extraction volumes presented here are lower than the total volumes presented in Table F-5, because they do not include groundwater extractions from the consolidated rocks that underly the Basin. Over the period from 1970 through 2014, results from the MBNM indicate that an average of approximately 720 AFY of groundwater was extracted from the Basin.

Previous Estimates of Groundwater Extractions within the MGB

Historical extraction estimates have been made by various researchers for MGB and climate conditions at that time. MWD extractions were mostly measured and documented and are therefore known with a high degree of certainty, although some inconsistencies in reported extraction volumes for certain years have been observed. Extractions from private entities were all estimated using indirect methods. Such methods generally include water demand calculations based on land use category, acreage, and water use factor (i.e., crop coefficient). Table 2-20 shows extraction estimates from historical studies. Previous estimates of groundwater production from the MGB are in general agreement with the estimates used to simulate groundwater extractions in the MBNM.

Table 2-20
Previous Estimates of Groundwater Extraction

Year	Source	Groundwater Extraction (AFY)		
		MWD	*Private*[a]	*Total*[a]
1929	Hoover 1980a	—	—	1,658
1954	Hoover 1980a	0[b]	—	1,322
1961	Hoover 1980a	0	—	872
1974	GTC 1974	110[c]	300	410
1979	Hoover 1980a	187	458	645
1980–1990	Slade 1991	—	—	936[d]
2011–2015	Dudek 2017	421[e]	2,001	2,422

Source: GTC 1974; Hoover 1980a; Slade 1991; Dudek 2017.
Notes: AFY = acre-feet per year; — = data are not available; MWD = Montecito Water District; GTC = Geotechnical Consultants Inc.

[a] All values are estimated.
[b] GTC 1974 reports MWD groundwater extraction totaled 102 acre-feet in 1954; however, Hoover 1980a and MWD report 0 acre-feet..
[c] MWD reports groundwater extraction totaled 47 acre-feet in 1974.
[d] Average for period from 1980 to 1990.
[e] Average for period from 2011 to 2015.

2.3.3.2 Groundwater Exchange with Seawater at the Coast

Results from the MBNM indicate that groundwater outflow to the Pacific Ocean is a significant source of groundwater discharge from the MGB. Between water year 1970 and 2014, the MBNM indicates that an average of approximately 6,650 AFY of groundwater discharged to the Pacific Ocean (Table F-2). This accounts for approximately 45% of the total groundwater outflows from the Basin.

2.3.3.3 Groundwater Discharges to Creeks

Groundwater in the MGB discharges to Romero Creek, Montecito Creek, Oak Creek, San Ysidro Creek, Picay Creek, Toro Canyon Creek, and their contributing creeks, when underlying groundwater elevations are above the bottom elevation of each stream channel. Groundwater conditions that cause this are influenced by local pumping, climatic conditions, upstream creek leakage, and interactions with the underlying consolidated rocks.

Groundwater discharges to creeks in the MGB were estimated by the MBNM. As discussed in Section 2.3.1.3, the MBNM simulates surface water-groundwater interactions using the MODFLOW streamflow routing package (SFR) package. Creek leakage and groundwater discharges to creeks are calculated during each monthly stress period in the MBNM using computed groundwater elevations, stream stages, and calibrated values of streambed conductance.

The MBNM estimates that an average of approximately 3,390 AF of groundwater discharged to creeks annually from the MGB (Table F-2). Historically, this accounted for approximately 23% of the total groundwater outflows from the MGB. The MBNM indicates that most of these discharges occur in Storage Units 2 and 3 (Table F-3). As noted in Section 2.3.1.3, the limited availability and lack of quality streamflow measurements within the MGB affects the quantitative assessment of the MBNM's representation of surface water-groundwater interactions in the Basin. Accordingly, the MBNM-estimated groundwater discharges to creeks is a large source of uncertainty in the MBNM-estimated water budget for the Basin.

2.3.3.4 Groundwater Discharges to Land Surface

The principal aquifer in the MGB is characterized by thin alluvial deposits where the Basin boundary intersects outcrops of the Sespe, Rincon, and Monterey formations (Figure 2-12A). These deposits have relatively low storage capacity. Periods of elevated precipitation recharge to these deposits can lead to simulated groundwater elevations in the MBNM that exceed land surface elevation and create locally ponded groundwater on land surface. The MBNM treats this water as saturation-excess, or Dunnian, runoff. Groundwater that discharges to land surface under these conditions is routed downstream to the local stream segments where it either recharges the MGB or flows out to the Pacific Ocean.

Results from the MBNM indicate that approximately 2,790 AFY of groundwater discharged to land surface as saturation excess runoff (Table F-2). Approximately 30% of this occurred in Storage Unit 1, which is dynamically stressed with the largest fluxes of precipitation recharge (Table F-3).

2.3.3.5 Groundwater Outflows to Adjacent Basins

As discussed in Section 2.3.2.7, the MGB is hydraulically connected to varying degrees with the Santa Barbara Basin and Carpinteria Valley Basin (Figure 2-31). The MBNM estimates that an average of approximately 250 and 230 AFY of groundwater flowed out of the MGB to the Santa Barbara Basin and Carpinteria Valley Basin, respectively (Table F-2). Compared to the simulated inflows, the MBNM indicates that approximately 245 AFY and 140 AFY of groundwater flows out of the MGB to the Santa Barbara Basin and Carpinteria Basin, respectively (Table F-2).

2.3.3.6 Groundwater Outflows to Consolidated Rock

As discussed in Section 2.3.2.4, groundwater stored in the principal aquifer of the MGB is hydraulically connected, to varying degrees, with groundwater stored within the fractures and joints of the underlying consolidated rocks. These interactions are simulated in the MBNM using general head boundary conditions, which allow the direction, magnitude, and location of groundwater exchanges between the bedrock and alluvium to change depending on the simulated groundwater elevations in the principal aquifer.

The MBNM estimates that an average of approximately 475 AFY of groundwater flows out of the MGB into the consolidated rocks that underlie the Basin (Table F-2). Of this, approximately 250 AFY occurs in Storage Unit 1, which is receives the largest volume of precipitation recharge in the Basin and is comprised of alluvium that is relatively thin along the northern boundary of the MGB. The combination of large precipitation recharge and thin alluvium leads to steep vertical gradients that drive dynamic interactions between bedrock and groundwater in the principal aquifer.

2.3.4 Change in Annual Volume of Groundwater in Storage

Historical annual changes in groundwater in storage were calculated by the MBNM from 1970 water year through the 2014 water year. Estimates of the annual change in groundwater in storage were extracted from the MBNM using the B118 Basin Boundary shown in Figure 2-1. Historical change in groundwater in storage is presented over the entire historical period and further aggregated by water year type. Water year type definitions are provided in Section 2.2.1.1.

2.3.4.1 Change in Annual Volume of Groundwater in Storage

Throughout the 45-year historical record, the MBNM estimates that groundwater in storage declined by an average of approximately 130 AFY (Table F-2).

The MBNM estimates that groundwater in storage decreased by an average of approximately 1,300 AFY in critically dry water years and increased by an average of 3,300 AFY in wet water years. During dry and below normal water years, the MBNM estimates that groundwater in storage declined by approximately 2,000 AFY and 800 AFY. The correlation between water year type and simulated change in storage demonstrates the strong link between climatic variations and groundwater conditions in the MGB.

Figure 2-37 shows the historical cumulative change in groundwater in storage in the MGB. Between water year 1970 and 1983, groundwater in storage fluctuated between a surplus of groundwater in storage of approximately 750 AF and a deficit of approximately 4,700 AF. Between water years 1983 and 1990, precipitation recharge was approximately 40% lower than the long-term average (Table F-2), which resulted in a declining limb in the cumulative change in storage curve. In water year 1990, groundwater in storage was approximately 5,500 AF lower than conditions at the start of water year 1970. Precipitation recharge between 1990 and 1998 was approximately 33% higher than the long-term average, which resulted in a general increasing trend in the cumulative change in storage. In water year 1998, the MBNM indicates that there was approximately 1,400 AF groundwater storage surplus compared to conditions at the beginning of water year 1970.

Between water years 2012 and 2014, precipitation recharge to the MGB averaged approximately 2,000 AFY, or 33% of the long-term average (Table F-2). Over this same period, groundwater production gradually increased to a historical-high groundwater extraction rate of approximately 1,500 AFY in water year 2014. Between water year 2012 and 2014, groundwater in storage declined by approximately 6,000 AF (Figure 2-37).

2.3.5 Quantification of Historical, Current, and Future Water Budget

Each GSP is required to include an accounting of the total annual volume of surface water and groundwater entering and leaving the basin during historical, current, and projected conditions (22 CCR 354.18). Historical conditions for the Plan Area were defined using data for the period between water years 1970 and 2014. Current conditions for the Plan Area were defined using data for the period between water years 2015 and 2019. The projected water budgets were prepared for the 50-year period from the water year 2020 and 2069. A summary of the water budget for the historical, current, and projected water budgets are provided in Section 2.3.5.1, 2.3.5.2, and 2.3.5.3.

2.3.5.1 Quantification of Historical Water Budget

Section 354.18(c) (2) of the GSP Emergency Regulations state that historical water budget information shall be, "used to evaluate availability and reliability of past surface water supply deliveries and aquifer response to water supply and demand trends relative to water year". The water budget discussed in this section provides a historical accounting of surface water availability, groundwater inflows, groundwater outflows, and corresponding changes to the volume of groundwater in storage between the water years 1970 and 2014. Estimates of the individual water budget components are based on simulation results from the MBNM.

Table F-6 tabulates the water year-type distribution between water years 1970 and 2014 in the Basin. Climate during this 45-year period was generally dry, with 24 out of the 45-year historical record characterized as "below normal", "dry", and "critically dry" water year-types. Over the same period, 21 water years were characterized as "above normal" or "wet" water year-types.

Historical Surface Water Availability

Surface water has historically accounted for an average of approximately 85% of the total water supplied with MWD's service area (Table F-7 and F-5). Surface water supplies consist of locally and regionally derived supplies, such as Cachuma Lake, Jameson Lake, and diversions from Fox Creek and Alder Creek, as well as imported State Water Project water purchased by MWD as member of the Central Coast Water Authority (MWD 2017). MWD's full annual Table A allocation is 3,300 AFY (MWD 2017).

In addition to these sources of surface water, MWD also purchases supplemental State Water Project water to augment water supplies to its service area. These supplemental purchases require an exchange of equal or greater purchase volumes to the State Water Project over a ten year period (MWD 2017). At the end of 2014, MWD's water debt as part of this program was 2,721 AF (MWD 2017).

Table F-7 shows historical surface water availability to the MGB. Between 1970 and 2014, locally and regionally derived surface water supplies have provided an average of approximately 4,500 AF of water to MGB. Of this, approximately 52% was from Lake Cachuma and approximately 33% from Jameson Reservoir (Table F-7).

Table F-7 demonstrates that regional and locally derived surface water supplies were relatively consistent during dry, below normal, above normal, and wet water years. During critically dry water years, surface water supplies to the MGB averaged approximately 3,500 AFY, which is approximately 20% lower than the historical average surface water supplies to the Basin.

MWD began importing state water project water to the MGB in water year 1999 (Table F-7). Since then, MWD has imported an average of approximately 900 AFY of State Water Project water to augment water supplies in its service area. Imported water volumes are highly variable with a maximum importation volume of 2,582 AF in water year 2008, to a minimum importation volume of 0 AF in water years 2001, 2006, and 2011. State Water Project water importations were highest during critically dry water years, when MWD imported an average of approximately 2,300 AFY (Table F-7).

Inflows to Groundwater System

Between water years 1970 and 2014, the MBNM estimates that groundwater in the MGB was recharged at an average rate of approximately 14,660 AFY (Table F-2; Figure 2-38). Average annual groundwater recharge varied by water year type: during critically dry water years, the MBNM estimates that the MGB was recharged at an average rate of approximately 9,100 AFY, and during wet water years, the MBNM estimates that the MGB was recharged at an average rate of approximately 24,100 AFY (Table F-2).

The largest sources of groundwater recharge were creek recharge and precipitation recharge. Combined, these two sources recharge the MGB at an average rate of 12,900 AFY, providing approximately 87% of the total recharge to the Basin. Both recharge sources are correlated with water year type. During critically dry water years, the MBNM estimates that creek flows and precipitation recharged the MGB at an average rate of approximately 5,000 AFY and 2,300 AFY, respectively. During wet water years, the MBNM estimates that creek flows and precipitation recharged the MGB at an average rate of approximately 8,100 AFY and 14,000 AFY, respectively (Table F-2).

Recharge from irrigation return flows and septic system leaching provided an average of approximately 650 AF of recharge to the MGB annually (Table F-5). Recharge from these two sources are not strongly correlated with water year type and reflect the relatively consistent water supplies delivered by MWD to customers within the MGB boundary.

During the 1970-2014 period, the MGB received approximately 1,100 AFY of recharge from adjacent basins, mountain front recharge, and exchanges with the underlying consolidated rocks (Table F-2). Exchange between the alluvium and underlying consolidated rocks was the largest source of recharge via subsurface exchanges. Historically, these exchanges provided approximately 600 AF of recharge annually, and were largest during dry water year types (Table F-2).

Outflows from Groundwater System

Between water years 1970 and 2014, the MBNM estimates that approximately 14,800 AF of groundwater was removed from the Basin annually (Table F-2). The MBNM estimates that average annual outflows were correlated with water year type: during critically dry water years, the MBNM estimates that approximately 10,500 AFY of groundwater was removed from the Basin, and during wet water years, the MBNM estimates that approximately 20,800 AFY of groundwater was removed from the Basin.

The MBNM estimates that the largest source of groundwater outflows occurred via groundwater discharges to the Ocean. Over the 45-year historical period, the MBNM estimates that approximately 6,700 AFY of groundwater flowed out of the Basin to the Pacific Ocean; historically, this accounted for approximately 45% of the total groundwater outflows from the MGB (Table F-2). The MBNM estimates that groundwater discharges to the Ocean are correlated with water year type; during critically dry water years, the MBNM estimates that approximately 4,400 AFY of groundwater flows out of the MGB to the Ocean, and during wet water years, the MBNM estimates that approximately 8,700 AFY of groundwater flows out of the MGB to the Ocean (Table F-2).

The second largest source of groundwater outflows from the Basin occurs in the form of groundwater discharges to creeks. Between water year 1970 and 2014, the MBNM estimates that approximately 3,400 AF of groundwater discharged from the MGB to overlying creeks (Table F-2). The MBNM estimates that these groundwater-surface water interactions were correlated with water year type and resulted in average loss of 4,900 AFY of groundwater during wet water years (Table F-2). Results from the MBNM indicate that approximately 30% of the average annual groundwater losses to creeks occurs in Storage Unit 3 (Table F-3).

Results from the MBNM indicate that saturation excess runoff and subsurface exchanges with adjacent basins and underlying consolidated rocks historically resulted in approximately 4,000 AF of groundwater losses annually (Table F-2). Of these sources, saturation excess runoff and groundwater exchanges with underlying consolidated rocks are most strongly correlated with water year types. During wet water years, when precipitation rates exceeded 150% of the long-term average, the MBNM suggests that approximately 4,700 AFY of groundwater was removed from the MGB as surface runoff and approximately 770 AFY infiltrated into the underlying consolidated rocks (Table F-2).

Results from the MBNM indicate that approximately 720 AF of groundwater was extracted from the principal aquifer of the MGB annually (Table F-2). Groundwater extractions from the MGB have increased throughout the historical period, from an average of approximately 300 AFY in the 1970s to an average of approximately 1,000 AFY during water years 2004 through 2014 (the last ten years of the historical period; Table F-2). The long-term average of 720 AFY reflects the gradual transition from historical low production volumes of approximately 250 AFY in 1970, to historical high production volumes of approximately 1,500 AFY in water year 2014. As noted in Section 2.3.3.1, these extraction rates are less than the estimated total extractions from wells completed within the MGB boundary due to wells located near the bedrock outcrops being completed across the alluvium and into the underlying bedrock. Historically, groundwater extractions from the MGB were correlated with water year type, with the highest extraction rates occurring during critically dry and dry water year types (Table F-2).

Change in Groundwater Storage

Throughout the historical period, the MBNM estimates that groundwater in storage declined at an average annual rate of approximately 130 AFY (Table F-2). This resulted in a total cumulative loss of groundwater in storage of approximately 5,900 AF between water years 1970 and 2014 (Table F-2; Figure 2-37).

Results from the MBNM indicate that change in groundwater in storage in the MGB is correlated with water year type. During critically dry, dry, and below normal water year types, the MBNM estimates that groundwater in storage declined at average rates of approximately 1,400, 2,000, and 800 AFY, respectively. During above normal, and wet water year types, the MBNM estimates that groundwater in storage in the MGB increased at an average rate of approximately 500 and 3,400 AFY, respectively.

2.3.5.2 Quantification of Current Water Budget

Climate during the water year 2015-2019 period was generally dry, with three out of the five water years characterized as dry or critically dry. During this period, water year precipitation averaged approximately 80% of the long-term historical average, and ranged from 48% of the long-term average (WY 2015 and WY 2019) to 135% of the long-term average (WY 2017).

Surface Water Availability

Table F-8 shows surface water supplies to the MGB between water years 2015 and 2019. During this period, locally and regionally derived surface water supplies have provided an average of approximately 1,400 AF of water to MGB. This is approximately 70% lower than the historical availability of surface water to the MGB (Table F-7 and Table F-8).

The largest decline in surface water availability compared to historical conditions is associated with the availability of local and regional surface water supplies. Between water years 2015 and 2019, MWD imported an average of approximately 770 AFY of surface water from the Cachuma Reservoir and an average of approximately 300 AFY of surface water from the Jameson Reservoir.

This is approximately 70% lower than historical surface water availability from the Cachuma Reservoir and approximately 80% lower than historical surface water availability from the Jameson Reservoir (Table F-8).

Between water years 2015 and 2019, MWD imported an average of approximately 1,900 AFY of State Water Project water to the MGB (Table F-8). This is approximately 1,000 AFY more than the historical average importations by MWD (Table F-7). MWD imported the largest volume of water to the Basin in water year 2018, a critically dry water year during which surface water from the Cachuma Reservoir was not available for delivery to the Basin (Table F-8).

Inflows to Groundwater System

Between water years 2015 and 2019, the MBNM estimates that groundwater in the MGB was recharged at an average rate of approximately 11,200 AFY (Table F-9). This is approximately 3,400 AFY, or 25%, lower than the historical average annual recharge rate to the MGB.

Similar to historical conditions, largest sources of groundwater recharge to the MGB were creek recharge and precipitation recharge. Combined, these two sources recharge the MGB at an average rate of 9,800 AFY, providing over 85% of the total recharge to the Basin. Because water years 2014 through 2019 were drier than the long-term average, precipitation recharge and creek recharge were approximately 1,300 and 1,800 AFY lower than the historical recharge rates, respectively (Table F-9 and Table F-2).

The decline in surface water supplies during the current conditions period led to a reduction in the average annual recharge from irrigation return flows and septic system discharges compared to historical conditions. Between water years 2015 and 2019, the MGB was recharged at an average rate of approximately 380 AFY, which is approximately 210 AFY less than historical conditions. Similarly, groundwater recharge from bedrock exchanges and interactions with adjacent basins was approximately 900 AFY of recharge to the MGB, which is approximately 220 AFY less than historical conditions (Table F-9).

Outflows from Groundwater System

Between water years 2015 and 2019, the MBNM estimates that approximately 10,700 AF of groundwater discharged from the Basin annually (Table F-9). This is approximately 4,000 AFY less than historical rates and is primarily attributed to a reduction in groundwater discharges to the Pacific Ocean (Table F-9 and Table F-2). Over the 5-year current condition period, the MBNM estimates that an average of approximately 4,400 AF of groundwater discharged from the MGB to the Pacific Ocean annually (Table F-9), which is approximately 2,300 AFY less than historical conditions due to historical drought conditions.

The reduction in surface water supplies under current conditions corresponds with an increase in groundwater production from the MGB. Between water years 2015 and 2019, approximately 1,400 AFY of groundwater was extracted from the Basin, which is approximately twice the historical average groundwater extraction rate (Table F-9). Groundwater extractions peaked in the water year 2017, which correspond to the water year with the lowest surface water supply in the Basin.

Results from the MBNM indicate that saturation excess runoff and subsurface exchanges with adjacent basins and underlying consolidated rocks historically resulted in approximately 2,600 AF of groundwater losses annually (Table F-9). Of these sources, saturation excess runoff and groundwater exchanges with underlying consolidated rocks provided the largest source of groundwater discharges

Change in Groundwater Storage

Between water years 2015 and 2019, the MBNM estimates that groundwater in storage increased at an average annual rate of approximately 500 AFY (Table F-9).

2.3.5.3 Quantification of Future Water Budget

Each GSP is required to include projected water budgets in order to estimate, "future baseline conditions of supply, demand, and aquifer response to Plan implementation, and to identify uncertainties of these projected water budget components" (23 CCR 354.18I 3). To assess these future conditions, the projected water budgets are required to utilize a 50-year projection horizon that incorporates the most recent land use and population data, projected water demands and surface water availability, and shall be used to evaluate the potential impacts of climate change on basin operations.

Two future scenarios were assessed using the MBNM as part of this GSP preparation: (i) a *Future Baseline* scenario, and (ii) a *Climate Change* scenario. These scenarios were developed to project groundwater conditions in the MGB based on anticipated total water supplies, demands, and climatological uncertainties. Projects were not simulated in either the Future Baseline or Climate Change scenario because available data indicates that the MGB is not currently experiencing, and has not historically experienced, undesirable results (Chapter 3). The assumptions used to develop each scenario are described below, in Section 2.3.5.3.1.

2.3.5.3.1 Projected Water Budget Assumptions

Simulated Climate Conditions

Future groundwater conditions in the MGB were simulated using the hydrologic record measured from October 1, 1969 through September 30, 2019 (e.g. water year 1970 through 2019). This period of the hydrologic record is the same as that assessed during the historical and current condition periods (Sections 2.3.5.1 and 2.3.5.2) and represents long-term average conditions in the basin. Over this 50-year period from 1970-2019, the MGB received an average of approximately 16.2 inches of precipitation annually[29] and the daily minimum and maximum temperatures averaged 51º and 71º Fahrenheit, respectively. For the *Future Baseline* simulation, daily measurements of precipitation, minimum temperature, and maximum temperature were used to simulate climate for the water year 2020 to 2069 period.

To simulate the effects of climate change in the *Climate Change* scenario, DWR's 2070 central tendency climate change factors were applied to the 1970-2019 precipitation and temperature measurements. These change factors are monthly precipitation and evapotranspiration adjustment factors that represent the average simulated effects of climate change based on 20 different global climate projections (DWR 2018b). Application of DWR's 2070 central tendency change factors to the 1970-2019 measured hydrology resulted in an average increase of approximately 0.3 inches of rain to the MGB annually and caused minimum and maximum temperatures to increase, on average, 5º Fahrenheit. This results in a slightly wetter but warmer climate simulated in the *Climate Change* scenario compared to the *Future Baseline* scenario.

Land Use, Community Buildout

Land use and population growth have remained relatively consistent since formation of the MWD in 1921 (MWD 2020). Over the 5-year period from 2016 through 2020, MWD estimated that the total population within its service area, which extends beyond the MGB, increased by approximately 150 persons (MWD 2020). This is approximately equal to a 0.25% increase in population growth annually.

As a conservative estimate of population growth for water demand forecasting, MWD assumed that future growth within its service area would occur at a rate of 0.4% annually (MWD 2020). As stated in the 2020 UWMP, this assumes that 420 of the 500 buildable lots remaining in MWD's service area are used for single family and multi-family residences. Population growth is anticipated to result in an average annual increase in water demand of approximately 0.5% (MWD 2020). MWD anticipates being able to meet these water demands during normal water years (MWD 2020).

These estimates of increasing water demand due to projected community buildout are incorporated into the simulated groundwater production rates simulated in both future scenarios (e.g. see *Simulated Water Demands – Groundwater Demands*).

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[29] Based on data measured at NOAA climate station located in Santa Barbara (Station ID: GHCND: USC00047902)

Simulated Water Demands

Surface Water Availability and Demands

As part of their 2020 UWMP, MWD projected the anticipated surface water supply availability as part of a *Drought Reliability Assessment*. This assessment provided estimates of surface water supply availability during a 5-year drought period that ranged from approximately 3,500 to 5,100 AFY. During the recent drought encountered between water years 2011 and 2019, surface water supplies to MWD ranged between approximately 5,900 AF in water year 2012 to approximately 2,900 AF in water year 2017 (Tables F-7 and F-8). These ranges of surface water supplies are similar to those projected to be available during the 5-year *Drought Reliability Assessment* prepared by the MWD.

To provide a conservative estimate of surface water availability throughout the 50-year GSP planning and implementation horizon, it was assumed that approximately 3,300 AFY of surface water supplies would be imported by MWD and served within the boundaries of the MGB for both the *Future Baseline* and *Climate Change* scenarios. This is at the low-end of the anticipated surface water availability (MWD 2020), but is equal to the average surface water supplies available to the basin during the period from water year 2015 to water year 2019 (Table F-8).

Groundwater Demands

Future groundwater production rates in both future scenarios were based on the average 2015-2019 groundwater production from the MGB. Groundwater extractions by MWD, the sole municipal water provider in the MGB, were increased at a rate 0.5% annually to reflect the anticipated increase in water demands within the MGB (MWD 2020). This results in a maximum extraction rate by MWD of approximately 650 AF in water year 2069, which falls within the historical annual extraction rates utilized by MWD (Tables F-2 and F-9).

For the *Future Baseline* scenario, groundwater production via private wells were held constant at the 2015-2019 average annual groundwater extraction rate. These rates were held constant throughout the simulation because private well production is not anticipated to be affected by increasing demands that result from future community buildout. The average 2015-2019 extraction rate is approximately 45% higher than the historical average and reflects the recent increase in new groundwater well construction and utilization in the MGB (Tables F-2 and F-9).

To account for the increasing evapotranspiration demands in the *Climate Change* scenario, groundwater production rates were adjusted using DWR's 2070 central tendency evapotranspiration change factors. These change factors were applied differentially depending on well use type, according to the following criteria:

- **Private wells:** Private wells are used within the MGB predominantly to support landscape irrigation, small water systems, and small-scale agricultural. Because the majority of the groundwater pumped from these wells supports irrigation, 100% of the monthly groundwater production from each private well was multiplied by DWR's 2070 central tendency evapotranspiration change factors.

- **Non-potable MWD Wells:** MWD operates six groundwater production wells the extract groundwater for the MGB to support irrigation. Groundwater pumped from these wells are not used as a source of potable water supply. Accordingly, 100% of the monthly groundwater production from each non-potable MWD-operated well was adjusted by DWR's 2070 central tendency evapotranspiration change factors.

- **Potable MWD Wells:** MWD operates six groundwater production wells that supplement potable water supplies. Groundwater pumped from these wells is blended with MWD's surface water supplies and delivered throughout the MGB via MWD's potable water distribution network. MWD estimates that approximately 78% of the water served through their potable water distribution network is used outdoors to support landscape irrigation. Based on this data, 78% of the monthly pumping from all MWD-operated potable groundwater wells was adjusted by DWR's 2070 central tendency evapotranspiration change factors.

The application of DWR's 2070 central tendency evapotranspiration change factors to pumping in the *Climate Change scenario*, as described above, resulted in an approximately 7% increase in the average annual future groundwater production rate from the MGB compared to the *Future Baseline* scenario.

2.3.5.3.2 Future Baseline Scenario

This section describes projected water budgets from the MBNM for the *Future Baseline* scenario. Individual water budget components are described in terms of annual average water budget components in units of acre-feet (AF) or acre-feet per year (AFY). The assumptions used to develop this scenario are described in Section 2.3.5.3.1.

Inflows to Groundwater System

Between water years 2020 and 2069, the MBNM estimates that groundwater in the MGB was recharged at an average rate of approximately 14,500 AFY (Table F-11). This is approximately equal to the historical average annual recharge rate to the MGB (Table F-13). Similar to historical conditions, largest sources of groundwater recharge to the MGB were creek recharge and precipitation recharge. Combined, these two sources recharge the MGB at an average rate of 12,800 AFY, providing approximately 90% of the total recharge to the Basin.

Similar to precipitation recharge and creek recharge, inflows from mountain front recharge, bedrock recharge, return flows, and the surrounding groundwater basin are projected to be approximately equal to historical conditions (Table F-13).

Outflows from Groundwater System

Between water years 2020 and 2069, the MBNM estimates that approximately 14,500 AF of groundwater discharged from the basin annually (Table F-11). This is approximately 300 AFY less than the historical average rate groundwater discharge rate (Table F-13). Over the 50-year projection horizon, the MBNM estimates that approximately 6,000 AFY of groundwater will discharge to the Pacific Ocean, which is approximately 700 AFY lower than the historical average discharge rate (Table F-13). The 700 AFY reduction in groundwater discharges to the Pacific Ocean is due to the approximately 700 AFY projected increase in groundwater production compared to the historical period (Table F-13).

Results from the MBNM indicate that saturation excess runoff and subsurface exchanges with adjacent basins and underlying consolidated rocks historically resulted in approximately 3,800 AF of groundwater losses annually (Table F-2). Of these sources, saturation excess runoff and groundwater exchanges with underlying consolidated rocks provided the largest source of groundwater discharges. These discharge rates and sources are similar to the historical period (Table F-13).

Change in Groundwater Storage

Under the Future Baseline conditions, the MBNM estimates that groundwater in storage will increase at an average rate of approximately 35 AFY (Table F-11). This is within the uncertainty of the numerical model. Therefore, it is anticipated that groundwater in storage will remain stable in the MGB throughout the 50-year implementation horizon (Figure 2-39).

2.3.5.3.3 Climate Change Scenario

This section describes projected water budgets from the MBNM for the *Climate Change* scenario. Individual water budget components are described in terms of annual average water budget components in units of acre-feet (AF) or acre-feet per year (AFY). The assumptions used to develop this scenario are described in Section 2.3.5.3.1.

Inflows to Groundwater System

Between water years 2020 and 2069, the MBNM estimates that groundwater in the MGB was recharged at an average rate of approximately 14,300 AFY (Table F-11). This is approximately 300 AFY less than the historical average, which largely reflects the reduction of creek recharge in the MGB (Table F-13). Under the simulated *Climate Change* scenario, the largest sources of groundwater recharge to the MGB remain creek recharge and precipitation recharge. Combined, these two sources recharge the MGB at an average rate of 12,800 AFY, providing approximately 90% of the total recharge to the Basin.

Precipitation recharge and creek recharge, inflows from mountain front recharge, bedrock recharge, return flows, and the surrounding groundwater basin are projected to be approximately equal to historical conditions (Table F-13).

Outflows from Groundwater System

Between water years 2020 and 2069, the MBNM estimates that approximately 14,300 AF of groundwater discharged from the basin annually (Table F-11). This is approximately 500 AFY less than the historical average rate groundwater discharge rate (Table F-13). The lower than historical discharge rate is partially attributable to the lower-than average recharge rates that result from the warmer climate projected across the basin. Throughout this period, groundwater production from the MGB is estimated to average approximately 1,600 AFY, which is approximately 900 AFY, or 125%, higher than the estimated historical production rate in the MGB (Table F-13).

Under the projected *Climate Change* scenario, the MBNM estimates that approximately 5,800 AFY of groundwater will discharge to the Pacific Ocean, which is approximately 800 AFY lower than the historical average discharge rate (Table F-13). The 800 AFY reduction in groundwater discharges to the Pacific Ocean is largely due to the increase in groundwater production compared to the historical period (Table F-13).

Results from the MBNM indicate that saturation excess runoff and subsurface exchanges with adjacent basins and underlying consolidated rocks historically resulted in approximately 3,700 AF of groundwater losses annually (Table F-9). Of these sources, saturation excess runoff and groundwater exchanges with underlying consolidated rocks provided the largest source of groundwater discharges. These discharge rates and sources are similar to the historical period (Table F-13).

Change in Groundwater Storage

Under the Future Baseline conditions, the MBNM estimates that groundwater in storage will increase at an average rate of approximately 38 AFY (Table F-11). This is within the uncertainty of the numerical model. Therefore, it is anticipated that groundwater in storage will remain stable in the MGB throughout the 50-year implementation horizon. The similarity in simulated change in storage between the *Future Baseline* and *Climate Change* scenarios indicate that, under the simulated conditions, the MGB is not anticipated to experience overdraft conditions regardless of the climate conditions encountered in the MGB (Figure 2-39).

2.3.6 Discussion of Model Calibration and Uncertainties

The MBNM was calibrated using groundwater elevation measurements collected at 18 wells across the MGB (Model Documentation forthcoming). Calibration wells were selected based on their construction information, record of measurement, and confidence in historical measurement accuracy. Proper usage of the BNM is largely informed by the model's ability to reproduce historical groundwater levels at these 27 wells. For the period from 1970 through 2019, the normalized model error[30] is approximately 6%. A common modeling guideline for assessing model calibration is that the normalized model error should be less than 10% (e.g., SWRCB 2021, Anderson et al 2015). The 6% normalized model error indicates that the BNM provides sufficient description of the MGB's response to pumping, climate, and interactions with the surrounding environments. However, because the simulated water levels are influenced by the representation of uncertain model inputs, the resulting estimates of water budgets, sustainable yield, and sustainable management criteria are inherently uncertain.

To assess the influence of model input uncertainty on model predictions, a global sensitivity analysis of the MBNM was performed by generating 1,250 random realizations of the original calibrated model and post-processing results from these model runs to characterize the fraction of predictive uncertainty attributable to key model inputs. This analysis focused on quantifying the influence of modeled aquifer properties (e.g. aquifer conductivities and storage properties, streambed characteristics, etc.) on overall predictive uncertainty. Results from the global sensitivity analysis indicate that the MBNM is most sensitive to hydraulic conductivity[31] and specific yield[32] values defined for Storage Unit 1 and the Young Alluvial deposits that follow creek channels and fan out across Storage Unit 3. These properties are well-constrained by pump test data; the fact that the highest-sensitivity parameters are well-constrained by measured data increases confidence in the MBNM's use to develop water budgets, estimate the sustainable yield, and inform sustainable management criteria for the MGB.

Following these two parameters, the MBNM is most sensitive to the estimated conductance[33] of the Arroyo Parida Fault, hydraulic conductivity of Storage Unit 2, and conductance of creek channel bottoms along Oak Creek, Montecito Creek, Romero Creek, and San Ysidro Creek. The lack of groundwater elevation measurements or pump test data in Storage Unit 2 limits direct

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[30] Model error is calculated using the root mean square error between measured groundwater elevations and simulated groundwater elevations extracted from the BNM. The normalized model error is calculated by dividing the root mean square error by the range in groundwater elevations measured in the basin.

[31] The aquifer's capacity to transmit groundwater

[32] The ease with which an aquifer releases groundwater

[33] The ease with which groundwater passes through a fault zone

characterization of both the conductance of the Arroyo Parida Fault and hydraulic conductivity of Storage Unit 2. Similarly, the lack of historical stream flow measurements in the MGB largely limits characterization of surface water-groundwater interactions across the MGB and corresponding estimates of creek bed conductance. Accordingly, these properties are identified as data gaps that would benefit from additional data acquisition throughout GSP implementation.

In addition to characterizing the fraction of model uncertainty attributable to each model input, the 1,250 random realizations were used to characterize model uncertainty associated with predictions of average annual change in storage and average annual flow across the MGB's boundary with the Pacific Ocean. Uncertainty in these estimates was quantified by calculating the mean and standard deviation of each model output across all 1,251 model realizations (e.g. the original calibrated model and the 1,250 random realizations). Analysis of uncertainty in average annual change in groundwater in storage and net flux of groundwater to the Pacific Ocean yielded confidence intervals of -130 ± 34 AFY[34] and -6,600 ± 3,100 AFY[35], respectively. Based on this, a conservative estimate of average annual change in groundwater storage between water years 1970 and 2019 is a decline of approximately 160 AFY. Similarly, a conservative estimate of the net discharge of groundwater to the Pacific Ocean is approximately 3,500 AFY. Importantly, this conservative estimate for discharge of groundwater to the Pacific Ocean indicates that historical groundwater conditions in the MGB were not conducive to seawater intrusion.

Discussion of Simulated Drawdown

Results from the MBNM indicate that the largest sources of groundwater recharge to the MGB are precipitation recharge and infiltration of surface water flows through creek beds (Section 2.3.1). Combined, these two sources have provided an average of approximately 90% of the total recharge to the MGB (Section 2.3.5.1). The model estimates of precipitation and creek recharge are based on simulation results from the watershed model module of the MBNM, which is constrained with very limited data characterizing stream flows and surface water-groundwater interactions across the basin. As a result, these components of recharge are subject to a high degree of uncertainty (Section 2.3.1).

A result of the uncalibrated surface water inflows and precipitation recharge is a bias in the simulated groundwater elevations that locally limit the MBNM's ability to reproduce measured groundwater elevation declines during drought. This bias is most prevalent in the northern parts of Storage Unit 3, adjacent to the Montecito Fault. In this part of the basin, the MBNM underestimates groundwater level declines by up to approximately 60 feet (e.g. at the Ennisbrook 5 well). An assessment of the numerical model results suggest that this is likely the result of elevated stream

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[34] Negative value denotes a decline in the volume of groundwater in storage.

[35] Negative values denote a discharge of groundwater to the Pacific Ocean

flows entering the basin. These modeled stream flows are extracted directly from the largely uncalibrated watershed module of the MBNM.

The MBGSA is currently implementing a project to better characterize surface water flows in the MGB. Data from this project will inform future model updates of the MBNM and will be incorporated into the numerical model during the first 5-years of GSP implementation. The MBGSA plans to reassess the estimates of native recharge and influence of model-predictions of drought-related groundwater elevation decline.

2.3.7 Quantification of Overdraft

The GSP Emergency regulations require that the water budget, "include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions" if the Basin is found to be experiencing overdraft (23 CCR 354.18, Water Budget). Groundwater overdraft is defined in DWR Bulletin 118 as:

> *"…the condition of a groundwater basin or subbasin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years, during which the water supply conditions approximate average conditions. Overdraft can be characterized by groundwater levels that decline over a period of years and never fully recover, even in wet years"* (DWR 2004).

Groundwater elevation measurements and numerical model results indicate that the volume of groundwater in storage generally fluctuate in response to wet and dry climate cycles. For example, during the drought in the late 1980s through the early 1990s, groundwater elevations declined by as much as 50 to 100 feet, then recovered back to historical average conditions in response to the wet period of the mid- to late-1990s (e.g. see wells 1-3, 1-10, 1-13, 3-8, 3-9, 3-15, etc.; Appendix D). Similar to the drought in the late 1980s through the early 1990s, groundwater elevations showed significant declines during the period from 2011-2016, a period where average annual precipitation was 78% of the long-term average. While groundwater elevations have stabilized below historical average levels in localized regions of the MGB near the northern extent of the basin (e.g. wells 1-5, 1-8, and 1-32), groundwater elevation measurements generally demonstrate that groundwater levels have recovered in response to the above normal and wet water years of 2017 and 2019 (e.g. wells 1-3, 1-11, 1-18, 3-2, 3-12a, 3-26 Appendix D). This recovery is reflected in the numerical model results from the MBNM, which indicates that groundwater in storage has declined at an average rate of approximately 70 AFY between 1970 and 2019, which is close to the range of predictive uncertainty in the MBNM (Section 2.3.6).

2.3.7 Estimate of Sustainable Yield

Title 23 Section 354.18 requires that each GSP develop an estimate of the sustainable yield using information and data presented in the water budget for the basin. SGMA legislation defines the sustainable yield as the, "maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including temporary surplus, that can be withdrawn annually from groundwater supply without causing undesirable results" (CWC Section 107271). Undesirable results are defined under SGMA as significant and unreasonable impacts to six different indicators:

- Chronic lowering of groundwater levels
- Reduction of groundwater in storage
- Degradation of water quality
- Land Subsidence
- Depletion of Interconnected Surface Water
- Seawater Intrusion

Each of these sustainability indicators is applicable to the MGB and will be monitored through implementation of this GSP (see Chapter 3 for discussion). However, as noted in Sections 2.2.4.4, 2.2.4.6, and 2.2.4.7, data gaps exist in the basin that limit quantitative characterization of the extent to which groundwater usage in the MGB impacts water quality degradation and depletion of interconnected surface waters. These data gaps are currently being reduced through grant-funded projects and re-evaluation of the MBGSA's monitoring network and schedule. Because the historical relationship between these two indicators and groundwater pumping is not well defined, the historical and current condition water budgets extracted from the MBNM were used to develop an estimate of the safe yield of the MGB, which is defined as, "the maximum quantity of water which can be withdrawn annually from groundwater supply without causing a gradual lowering of groundwater levels resulting in the eventual depletion of supply" (Babbit et al 2018).

Groundwater usage in the MGB is estimated to have increased throughout the historical period from approximately 300 AF in 1970 to a maximum of approximately 1,700 AFY in 2016. Over the 10-year period from 2010 through 2019, groundwater usage showed response to local climate conditions, but is more reflective of anticipated usage in the basin. This 10-year period of the climate record includes both dry, normal, and above normal water years (Table F-2 and F-9), and was, therefore, used as the base period for calculation of the historical safe yield of the MGB.

During the 2010-2019 period, groundwater production from the MGB averaged approximately 1,250 AFY. Over this same period, the MBNM estimates that groundwater in storage increased by approximately 60 AFY. Adding these two values together leads to an estimate of safe yield for the MGB of approximately 1,310 AFY. Based on the historical data presented in this chapter, this estimate of historical safe yield is also protective of seawater intrusion to the MGB.

2.3.7.1 Estimate of Future Sustainable Yield

The MBNM was used to project groundwater conditions in the MGB through water year 2069 (Section 2.3.5.3). Under the Climate Change Scenario, groundwater production in the MGB is estimated to average approximately 1,600 AFY, which is higher than historical production and reflects anticipated community buildout and increasing irrigation demands that result from climate change. Despite the higher-than-historical groundwater production rates, results from the Climate Change Scenario indicate that undesirable results are not anticipated to occur when groundwater is produced from the MGB at 1,600 AFY (see discussion in Chapter 3). Because of this, the future sustainable yield of the MGB is estimated to be approximately 1,600 AFY. The fact that the future sustainable yield is higher than the historical safe yield reflects the fact that: (1) the MBNM predicts that large volumes of groundwater discharge to the Pacific Ocean annually, and (2) climate change is anticipated to lead to an increase in average annual precipitation in the MGB.

As noted in Section 2.3.6, the numerical model results are subject to uncertainty due to model-generated estimates of precipitation recharge and creek flows. These uncertainties are reflected not only in the model estimates of surface water-groundwater interactions, but also in the annual rate of groundwater discharges to the Pacific Ocean. The MBGSA is currently implementing projects to reduce data gaps associated with these model estimates and plan to incorporate these data into future model revisions. Accordingly, the model-estimated future sustainable yield will be re-evaluated as the MBNM is revised to incorporate these data and as part of the periodic GSP evaluations.

2.3.8 Surface Water Available for Groundwater Recharge or In-Lieu Use

MWD has initiated several programs and feasibility studies for the purpose of planning for long-term reliability and diversity of water supplies. Existing water supplies in the MGB are described in Section 2.1.3.3, Urban Water Management Plan. In addition to the water supplies described in Section 2.1.3.3, the GSA is evaluating opportunities to utilize and deliver recycled water in-lieu of groundwater production. Additional water may be available through SWP water and Northern California programs and local reservoir operations modification (Bachman 2007).

MWD's diverse water supply portfolio, which includes local surface water, imported water, desalination water, and local groundwater, is anticipated to provide sufficient supply to satisfy demands in normal and single dry-year conditions (MWD 2021). The projected water supplies and demands were incorporated into the future scenarios and estimates of future groundwater demands on the MGB (Section 2.3.5.3). Groundwater demands may vary in the future in response to recycled water availability. The effects of these new water supplies on groundwater demands and corresponding groundwater conditions will be evaluated throughout GSP implementation as projects develop in the MGB.

2.3.4.1 Recycled Water

MWD commissioned studies for the use of recycled water (Woodard & Curran 2018, Carollo 2022) and the potential to augment groundwater supplies using such water (GSI 2020). Recycled water sources considered were the Montecito Sanitary District, the City of Santa Barbara, and the Summerland Sanitary District. Non-potable, indirect potable, and direct potable reuse alternatives were considered. The indirect potable reuse scenarios considered were all for groundwater augmentation using aquifer storage and recovery wells. Two areas of the MGB in Storage Unit 1 and Storage Unit 3 were determined to have potential for low injection rates during drought conditions when water levels are low (approximately 35 AFY and 75 AFY, respectively). However, the cost, uncertainty, and low yield of such a project suggest a low feasibility. Direct potable reuse options were evaluated but were considered to be infeasible due to the current absence of regulations and potential high costs. Non-potable reuse projects for irrigation of cemeteries and golf courses were the preferred alternatives, yielding up to about 450 AFY (Woodard & Curran 2018).

In 2022, Carollo Engineers (Carollo) completed the *Enhanced Recycled Water Feasibility Study* (Carollo 2022). The study performed a detailed analysis of four potential recycled water projects including one non potable reuse project and three potable reuse projects. The study established the top ranked project as a regional Indirect Potable Reuse (IPR) project involving advanced purification of treated wastewater at the Montecito Sanitary District and its injection into the Carpinteria Groundwater Basin for short-term storage before use. The next steps suggested in the study include groundwater modeling, environmental review and preliminary (30%) design. Attached to the Study are nine technical memoranda that inform the Study and its conclusion.

The GSA plans to perform a complete environmental review and prepare a preliminary (30%) design of this IPR project as part of early GSP implementation (chapter 4 reference – forthcoming). As part of this early-design phase, the GSA anticipates evaluating near-term and long-term benefits to groundwater storage and demands in the MGB. Because this project is in early-design and conceptualization phases, the potential impacts were not incorporated in the future scenarios developed for this GSP. As the project is further developed, future model and GSP evaluations will incorporate project details and benefits, as appropriate, into characterization of future groundwater demands and sustainable yield.

2.3.4.2 Ocean Desalination

MWD has a 50-year water supply agreement with the City of Santa Barbara that will provide MWD with 1,430 AFY of potable water irrespective of hydrologic conditions. This agreement is made possible by the City's operation of its Charles E. Meyer Desalination Plant (Section 2.1.3.3). Water deliveries in accordance with this agreement began in January 2022.

2.3.4.3 Imported Water

Supplemental Water Purchases

MWD has historically leveraged SWP infrastructure to compensate for reduced water supplies during drought conditions. Supplemental water may be purchased from other state water contractors (MWD 2017). . This allows the flexibility for MWD to supplement local supplies when needed and return water when a surplus exists. However, in accordance with their goal of reducing reliance on SWP water, MWD has no plans to leverage supplemental water purchases in the future.

Groundwater Banking Programs

Additional imported water supply flexibility is afforded by opportunities to take and store water from groundwater banking programs throughout the state. Such programs typically require the recovery of less water than was initially banked to account for losses and compensation. MWD has historically banked groundwater with the Dudley Ridge Water District and has been a partner in the Semitropic Water Storage District Groundwater Banking Program since 2017. The program allows the MWD 4,500 AF of storage with guaranteed recovery of 1,500 AFY, with a 10% leave-behind. As of the beginning of 2019, MWD had banked 900 AF with the Semitropic Water Storage District Groundwater Banking Program and planned to bank at least 1,000 AF for the year (MWD 2019).

2.4 MANAGEMENT AREAS

The MBGSA intends to manage the MGB as a whole and, therefore, has not defined specific management areas as part of this Plan. The need to develop management areas and manage the MGB on a more localized basis will be re-evaluated throughout GSP implementation.

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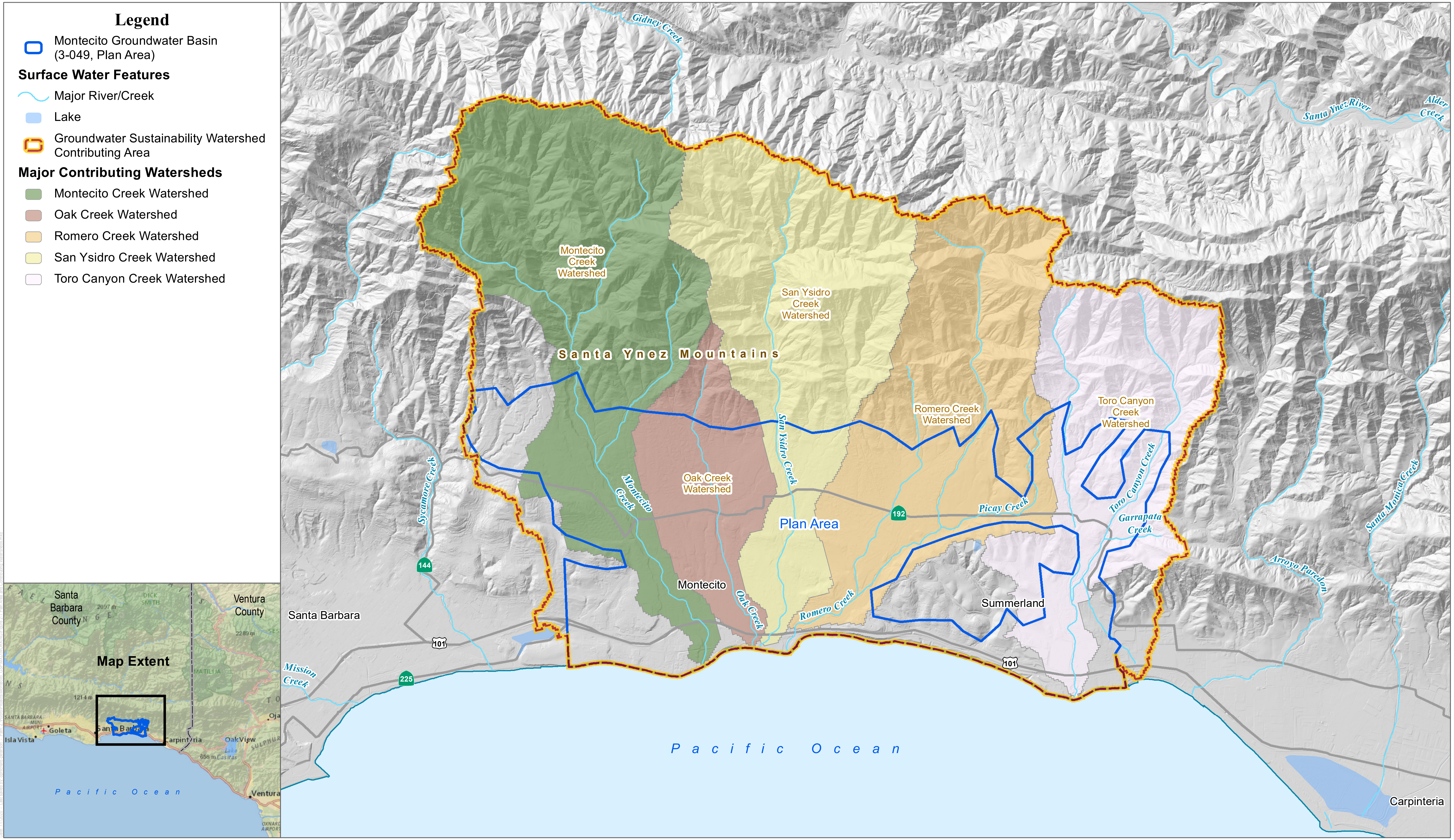

DRAFT

DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; USGS; StreamStats

DUDEK

FIGURE 2-1

Plan Area and Contributing Watersheds

Groundwater Sustainability Plan for the Montecito Basin

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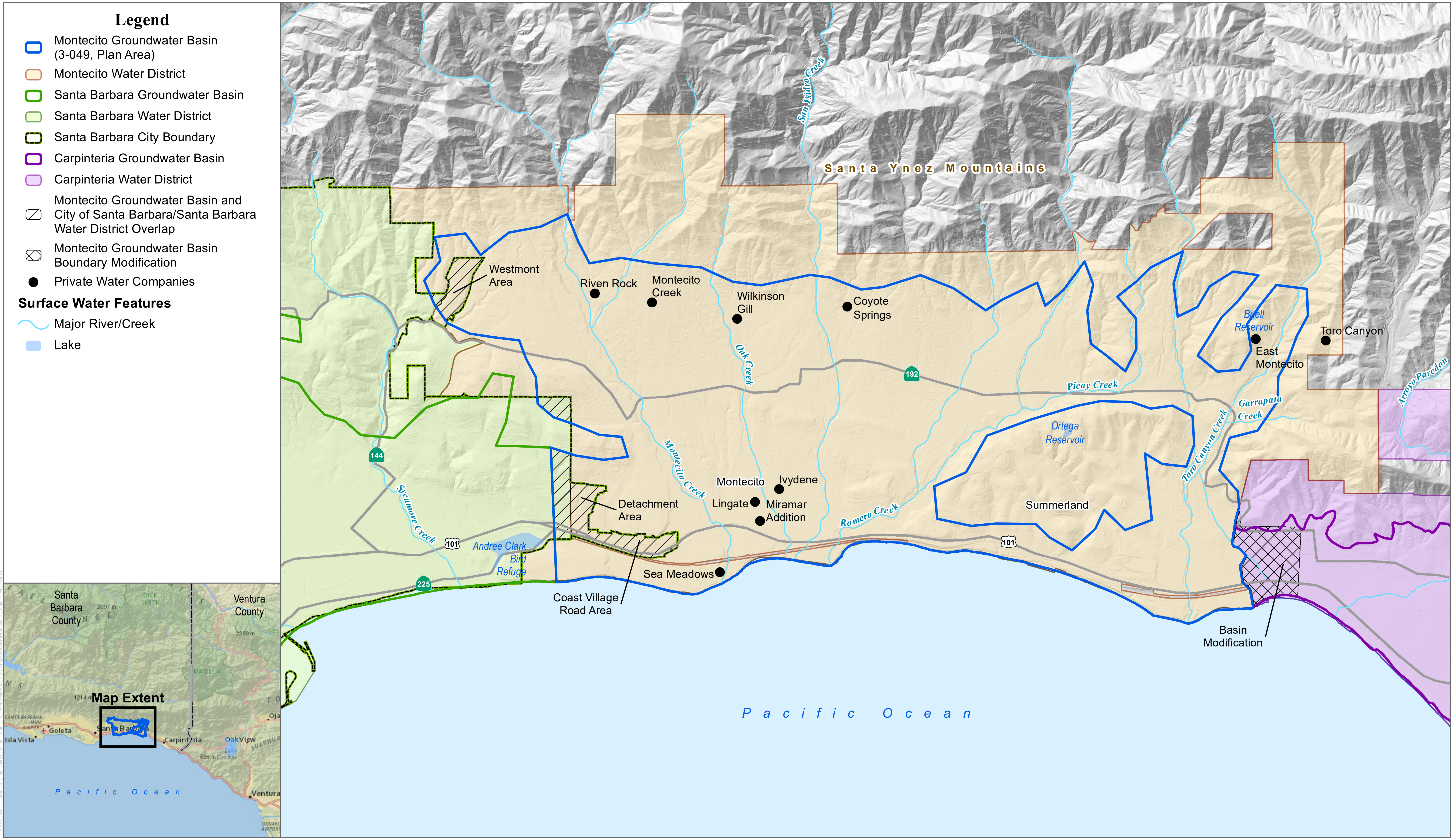

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DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; USGS; County of Santa Barbara

DUDEK

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FIGURE 2-2

Water Purveyors within and Adjacent the Groundwater Sustainability Agency Boundary

Groundwater Sustainability Plan for the Montecito Basin

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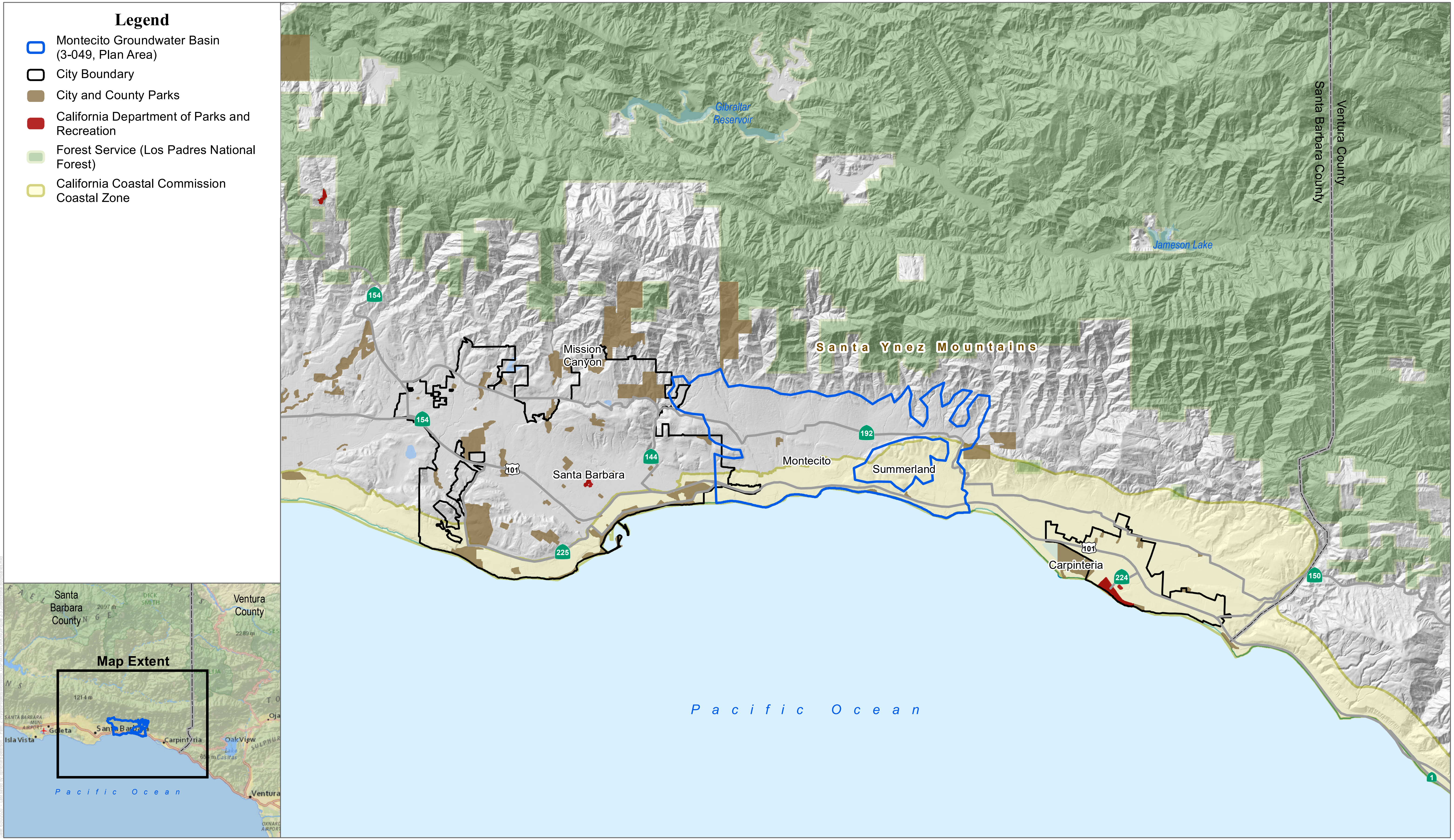

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DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; USGS; County of Santa Barbara

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FIGURE 2-3

Jurisdictional Boundaries

Groundwater Sustainability Plan for the Montecito Basin

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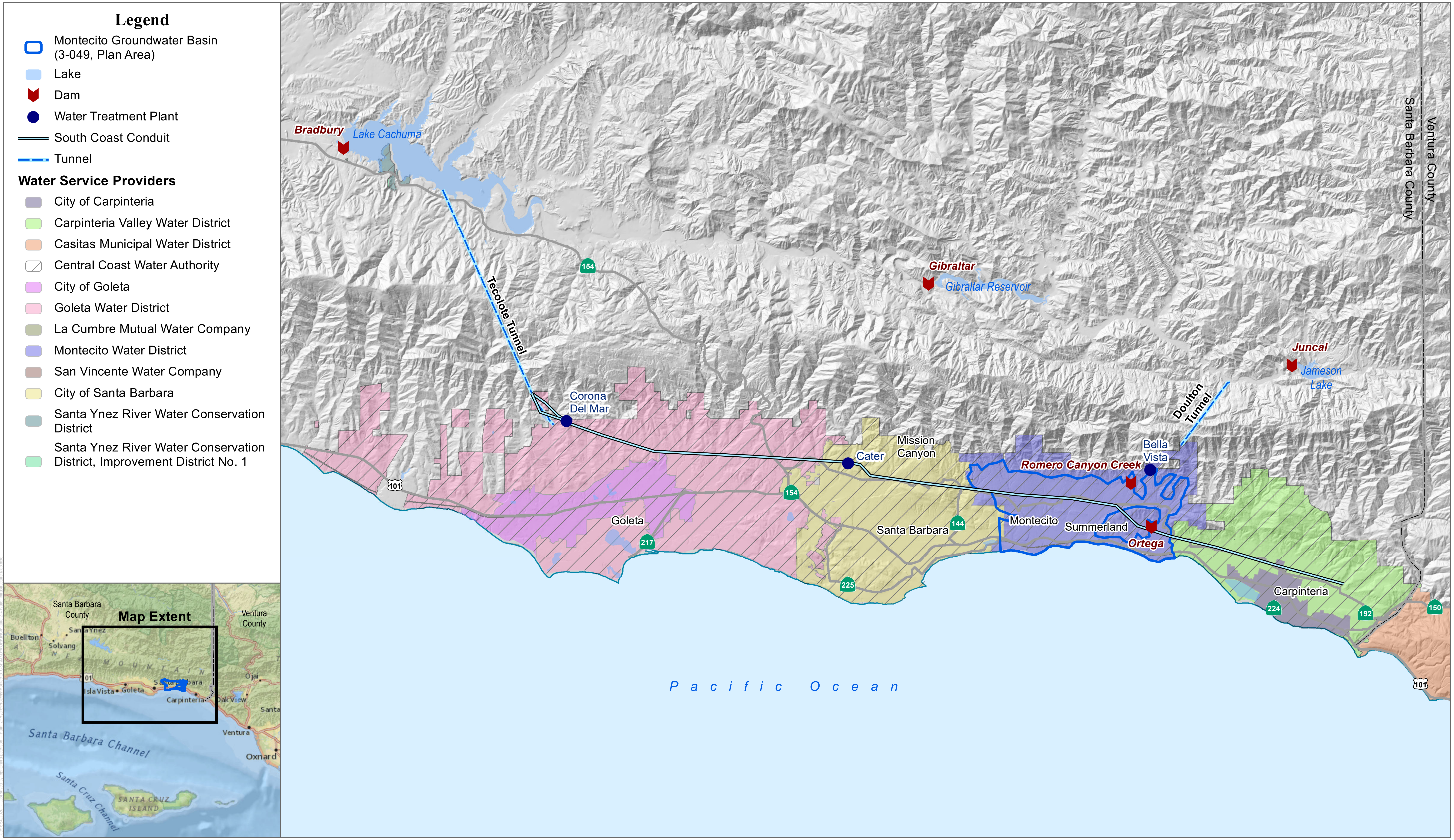

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DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; County of Santa Barbara

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FIGURE 2-4

Water Infrastructure Map

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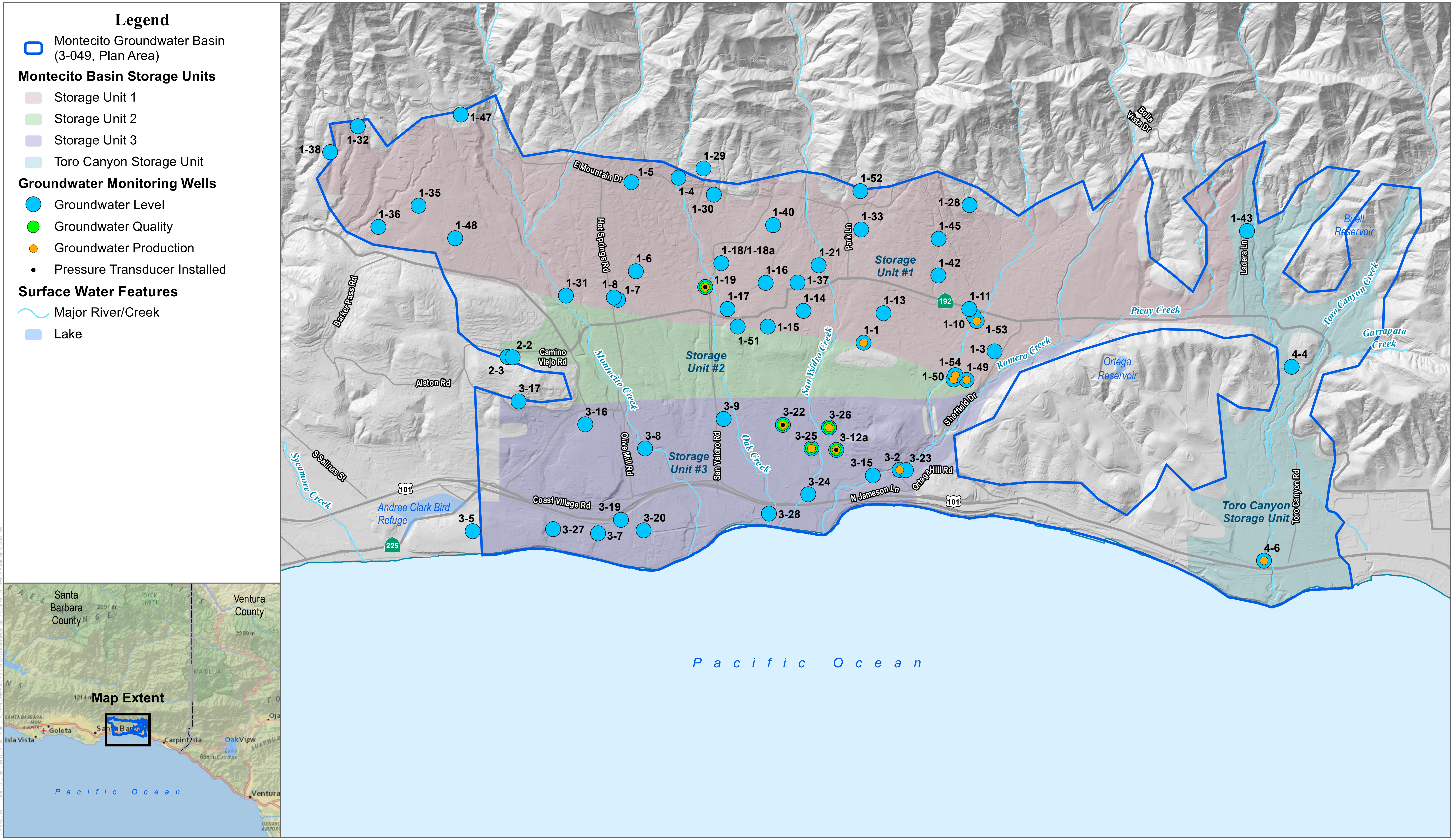

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DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; USGS; County of Santa Barbara; Montecito Water District

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FIGURE 2-5

Current Groundwater Monitoring Network

Groundwater Sustainability Plan for the Montecito Basin

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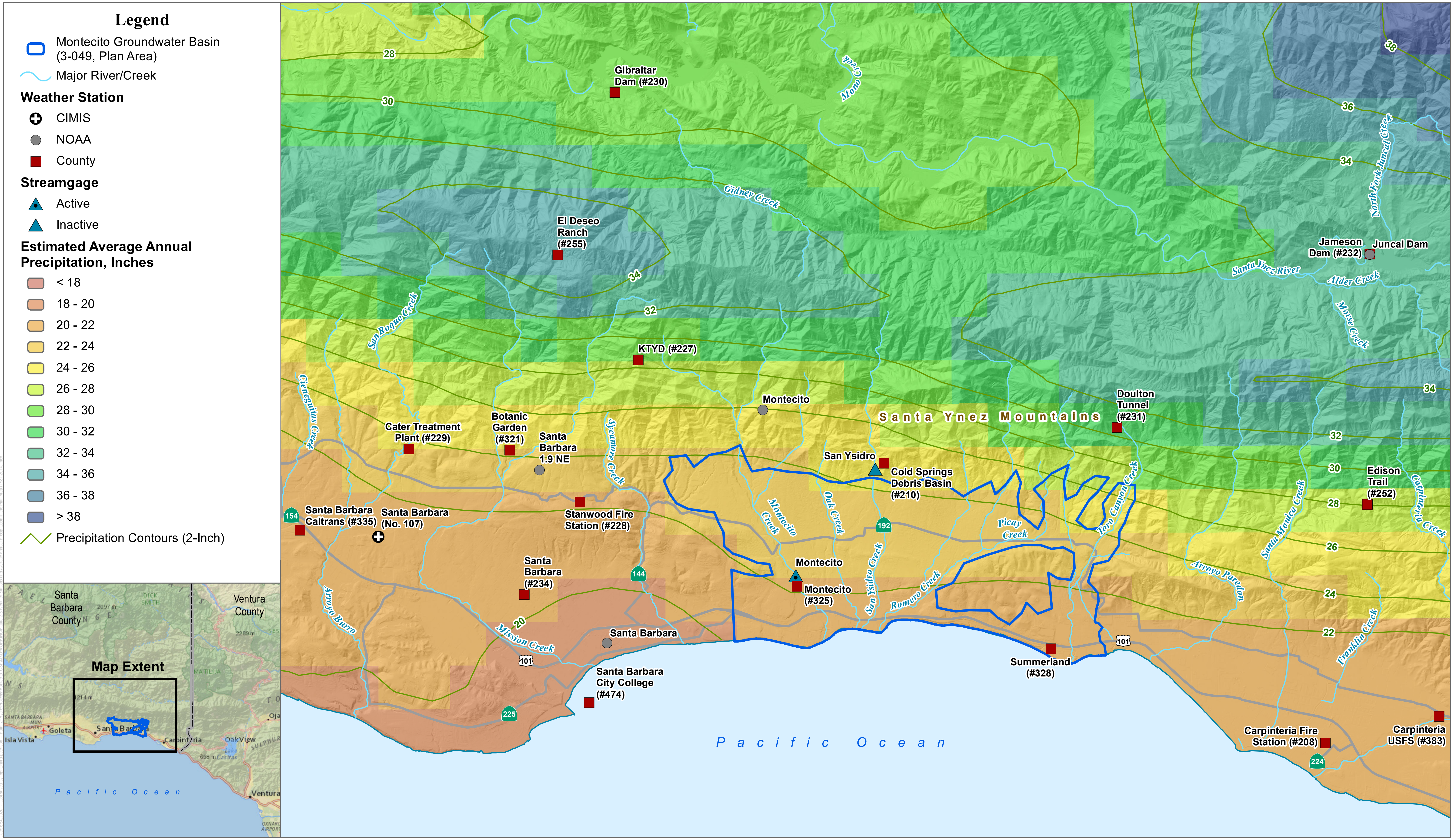

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DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; USGS; County of Santa Barbara; NOAA; CIMIS; PRISM

DUDEK

FIGURE 2-6

Weather Stations and Average Annual Precipitation in the Plan Area (1981-2010)

Groundwater Sustainability Plan for the Montecito Basin

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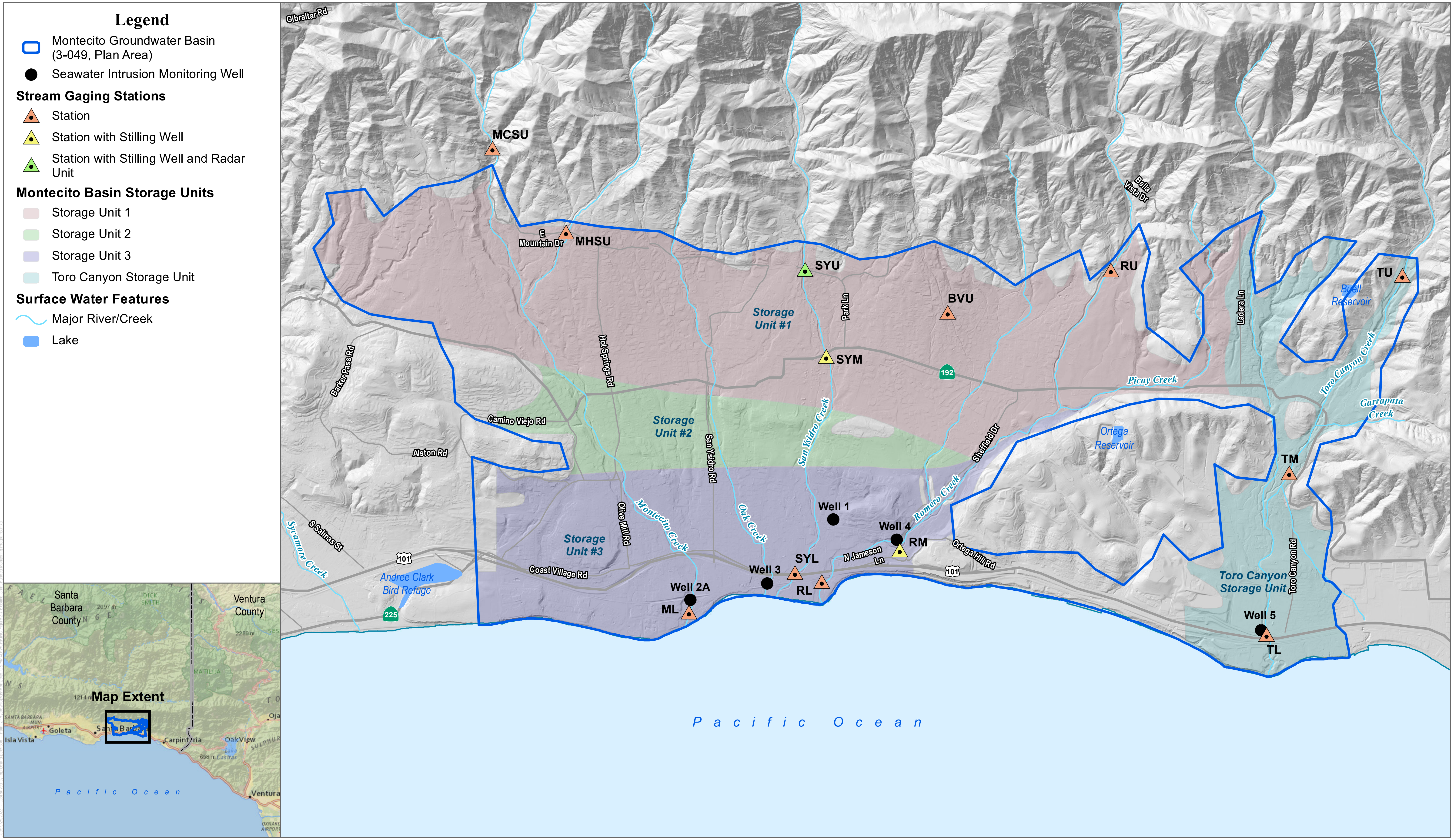

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DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; USGS; County of Santa Barbara

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0 0.5 1 Miles

FIGURE 2-7

Existing Grant Funded Monitoring Programs

Groundwater Sustainability Plan for the Montecito Basin

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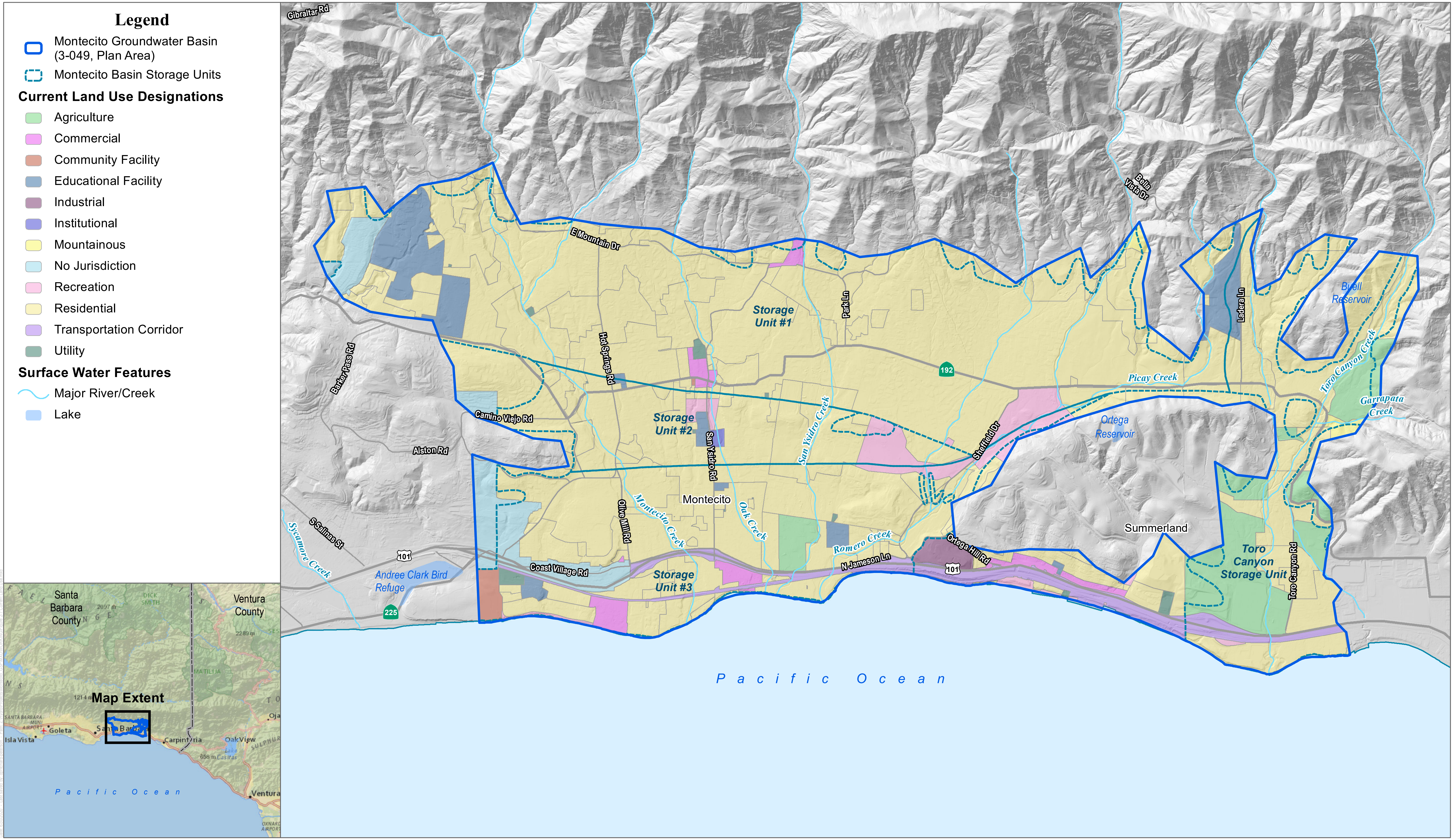

DRAFT

DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; USGS; County of Santa Barbara

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0 0.5 1 Miles

FIGURE 2-8

Current Land Use

Groundwater Sustainability Plan for the Montecito Basin

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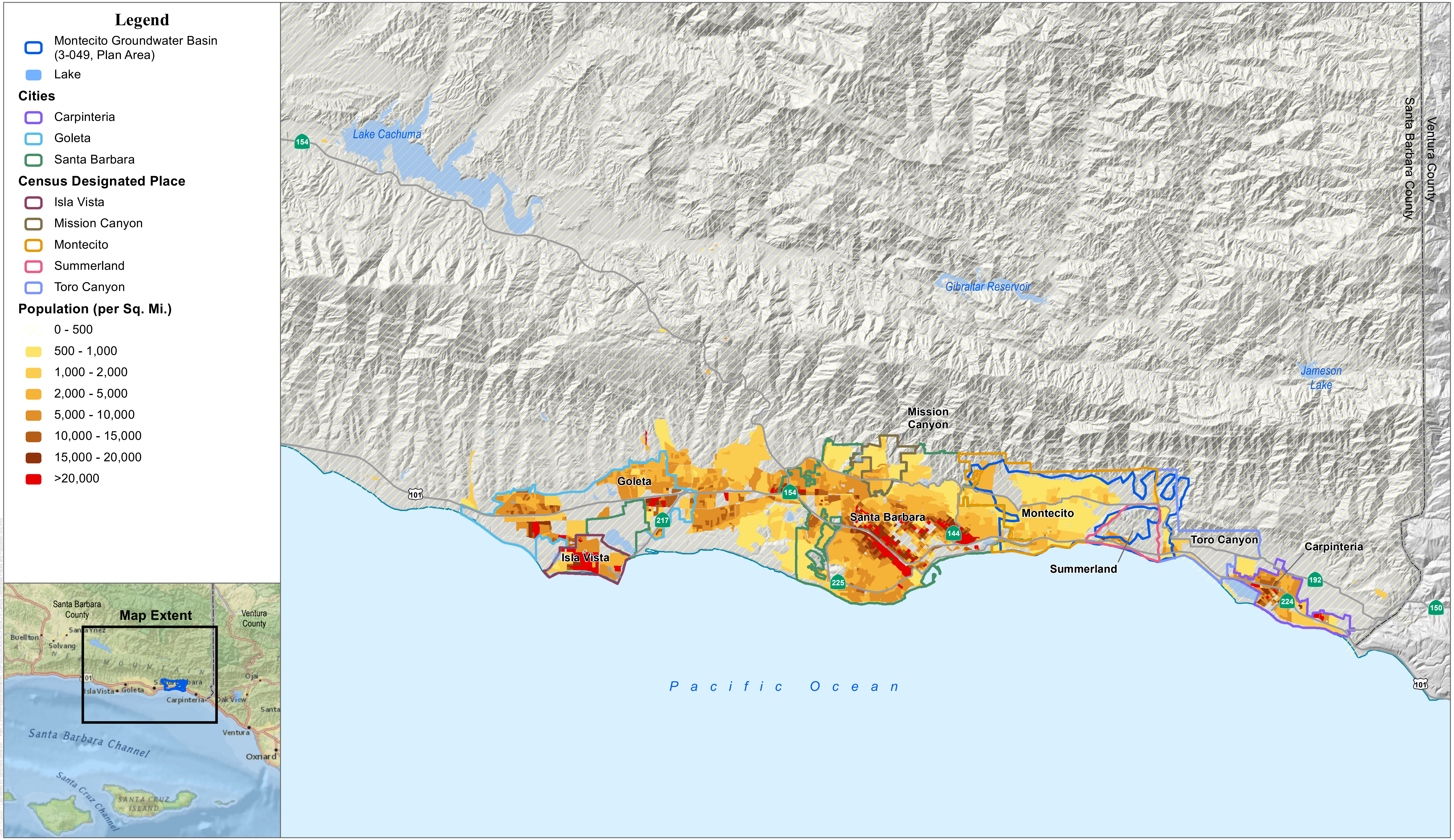

DRAFT

DATUM: NAD 1983 DATA SOURCE: ESRI; County of Santa Barbara; Census 2017

DUDEK

0 2 4 Miles

FIGURE 2-9

Census Designated Places and Population

Groundwater Sustainability Plan for the Montecito Basin

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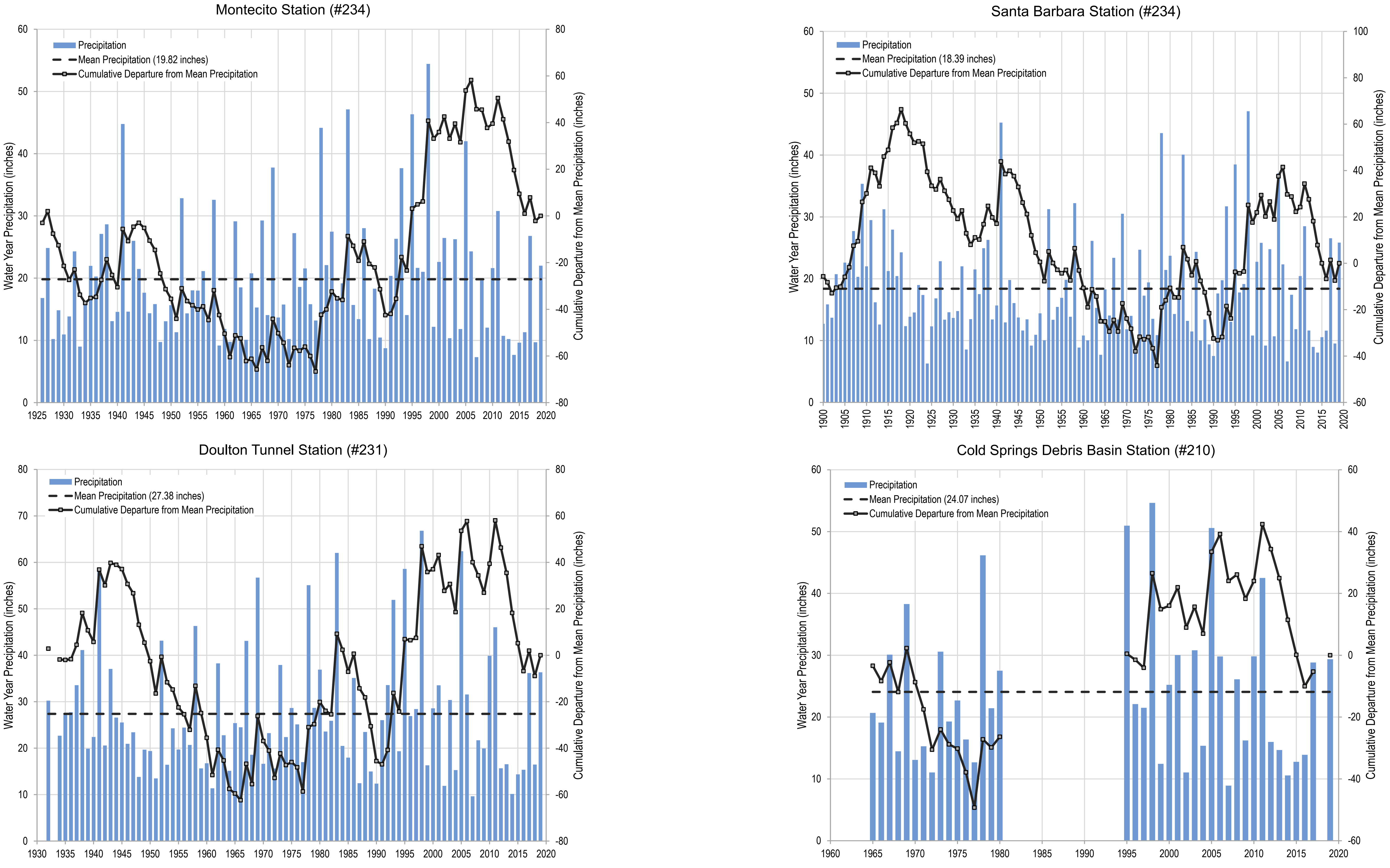

SOURCE: County of Santa Barbara

NOTE: Water year is October 1 through September 30

FIGURE 2-10

Water Year Precipitation

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Montecito GSP Hydrologic Conceptual Model

LEGEND

- □ Montecito Groundwater Basin
- 🟪 Storage Unit #1
- 🟩 Storage Unit #2
- 🟨 Storage Unit #3
- 🟦 Toro Canyon Storage Unit
- — Creeks
- — Quaternary Faults
- Cachuma/State Water Project
- Consolidated Rock Interface
- ⋯ Water table
- Well

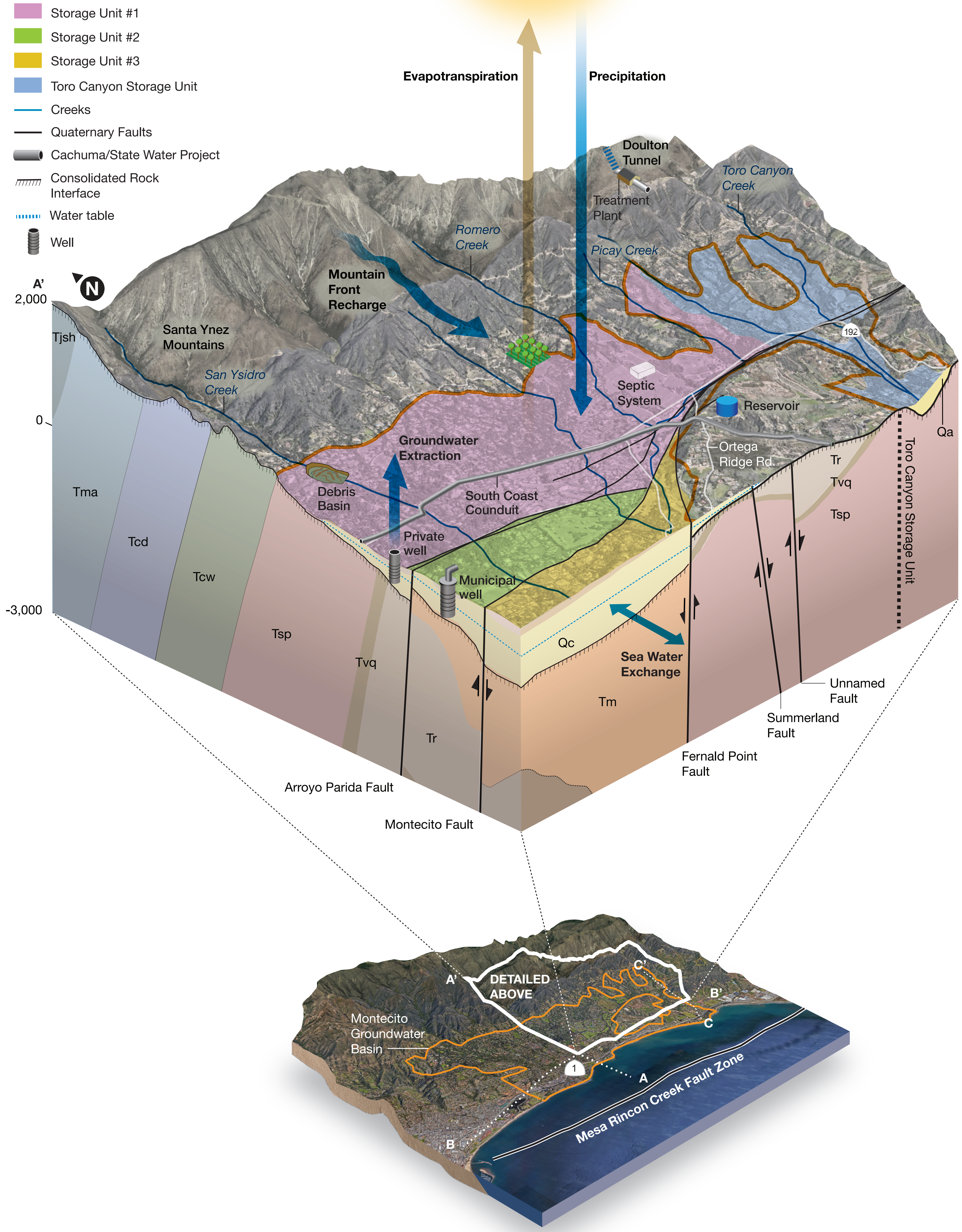

FIGURE 2-11

Hydrogeologic Conceptual Model

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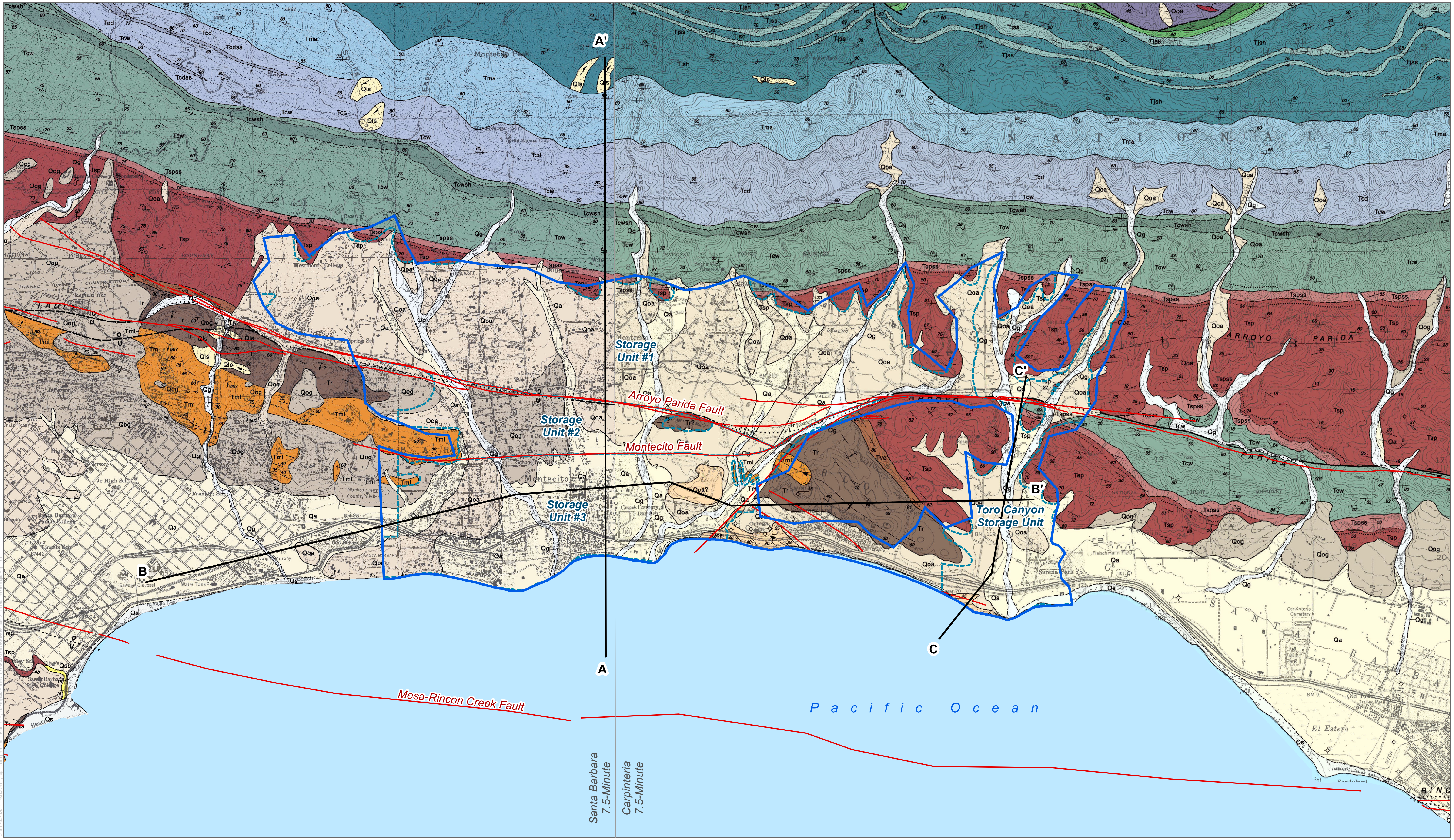

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DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; USGS; Dibblee

DUDEK

0 0.5 1 Miles

FIGURE 2-12A

Dibblee Geologic Map

Groundwater Sustainability Plan for the Montecito Basin

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▢ Montecito Groundwater Basin (3-049, Plan Area)

▢ Montecito Basin Storage Units

— Cross Section Location

— Quaternary Faults

Qs / Qg / Qa

SURFICIAL SEDIMENTS

Qs *Beach sand deposits*
Qg *Stream channel deposits, mostly gravel and sand*
Qa *Alluvium: unconsolidated floodplain deposits of silt, sand and gravel*

Qls

LANDSLIDE DEBRIS

Qog / Qoa

OLDER DISSECTED SURFICIAL SEDIMENTS

Qoa *Former alluvial deposits of silt, sand and gravel, in places weakly consolidated; local unconformities at base*
Qog *Cobble-boulder fan gravel and fanglomerate deposits composed largely of sandstone detritus*

— *UNCONFORMITY* —

Qca

CASITAS FORMATION
Nonmarine; early to middle (?) Pleistocene age

Qca *Weakly consolidated alluvial deposits: gray to tan cobble-boulder gravel and gray to reddish sand and clay*

— *UNCONFORMITY* —

Tm / Tml

MONTEREY SHALE
Marine; early to late Miocene age

Tm *Upper shale unit: white-weathering, thin bedded, hard, platy to brittle siliceous shale; Mohnian Stage*
Tml *Lower shale unit: white weathering, soft, fissle to punky clay shale with interbeds of hard siliceous shale and thin limestone strata; lower Mohnian to uppermost Saucesian Stages*

Tmss

UNAMED SANDSTONE
(TEMBLOR SANDSTONE OF DIBBLEE, 1966)
Shallow marine; early Miocene age

Tmss *Light gray to tan fossiliferous arkosic sandstone and pebble conglomerate; local unconformity (?) at base; exposed north of Santa Ynez fault*

Tr

RINCON SHALE
marine; early Miocene age

Tr *Poorly bedded gray clay shale and siltstone, locally concretionary; Saucesian and upper Zemorrian Stages*

Tvq

VAQUEROS SANDSTONE
Shallow marine; early Miocene age

Tvq *Massive to thick bedded, light greenish-gray to tan, fine grained sandstone, locally calcareous; Zemorrian Stage*

Tsp / Tspss

SESPE FORMATION
Nonmarine; predominantly Oligocene age

Tsp *Maroon, red and green silty shale or claystone with interbedded red tan and gray sandstone; red arkosic sandstone and conglomerate at base*
Tspss *Red to pink sandstone and red claystone*

Tcw / Tcwsh

COLDWATER SANDSTONE
Marine; late Eocene age

Tcw *Hard, tan, bedded arkosic sandstone with minor interbeds of greenish-gray siltstone and shale; local oyster shell beds common in upper part; Narizian Stage*
Tcwsh *Greenish-gray siltstone and shale with occasional interbeds of tan sandstone*

Tcd / Tcdss

COZY DELL SHALE
Marine; late Eocene age

Tcd *Dark gray, argillaceous to silty micaceous shale with minor light gray to tan arkosic sandstone; Narizian Stage*
Tcdss *Light gray to tan arkosic sandstone with minor interbeds of gray micaceous shale*

Tma / Tmash

MATILIJA SANDSTONE
Marine; middle to late Eocene age

Tma *Hard, thick bedded, tan to mottled light greenish-gray arkosic sandstone with thin partings to thick interbeds of gray micaceous shale; lower Narizian and upper Ulatisian Stages*
Tmash *Gray micaceous shale with minor tan sandstone interbeds; exposed north of Santa Ynez fault*

Tjsh / Tjss

JUNCAL FORMATION
Marine; early(?) to middle Eocene age

Tjsh *Dark gray micaceous shale with minor thin interbeds of hard, gray-white to tan arkosic sandstone; lower Ulatisian(?) to upper Penutian(?) Stages*
Tjss *Hard, gray-white to tan arkosic sandstone with minor interbeds of dark gray micaceous shale*

Tsb / Tsbs

SIERRA BLANCA LIMESTONE
Shallow marine; early Eocene age
(exposed north of Santa Ynez fault)

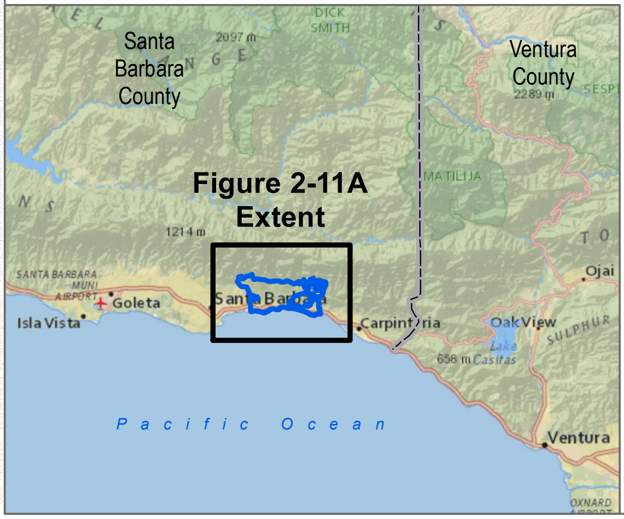
Tsb *Hard, massive, white-weathering, sandy algal limestone*
Tsbs *Hard, light gray calcareous sandstone, locally fossiliferous*

— *UNCONFORMITY* —

Ksh / Kush / Kuss / Kucg

UNAMED MARINE STRATA
(Kush, Kuss, Kucg – Jalama ? Formation)
Late Cretaceous age

Ksh *Gray micaceous clay shale with minor interbeds of hard, gray-white to tan arkosic sandstone; exposed north of Santa Ynez fault*
Kush *Dark gray to black micaceous clay shale with minor interbeds of hard tan arkosic sandstone*
Kucg *Gray to brown cobble conglomerate of granitic, porphyritic-andesitic, and quartzitic detritus in arkosic sandstone matrix*
Kuss *Hard, light gray to tan arkosic sandstone with minor interbeds of micaceous shale*



DRAFT

DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; USGS; Dibblee

DUDEK

0 5 10 Miles

FIGURE 2-12B

Dibblee Geologic Map Legend

Groundwater Sustainability Plan for the Montecito Basin

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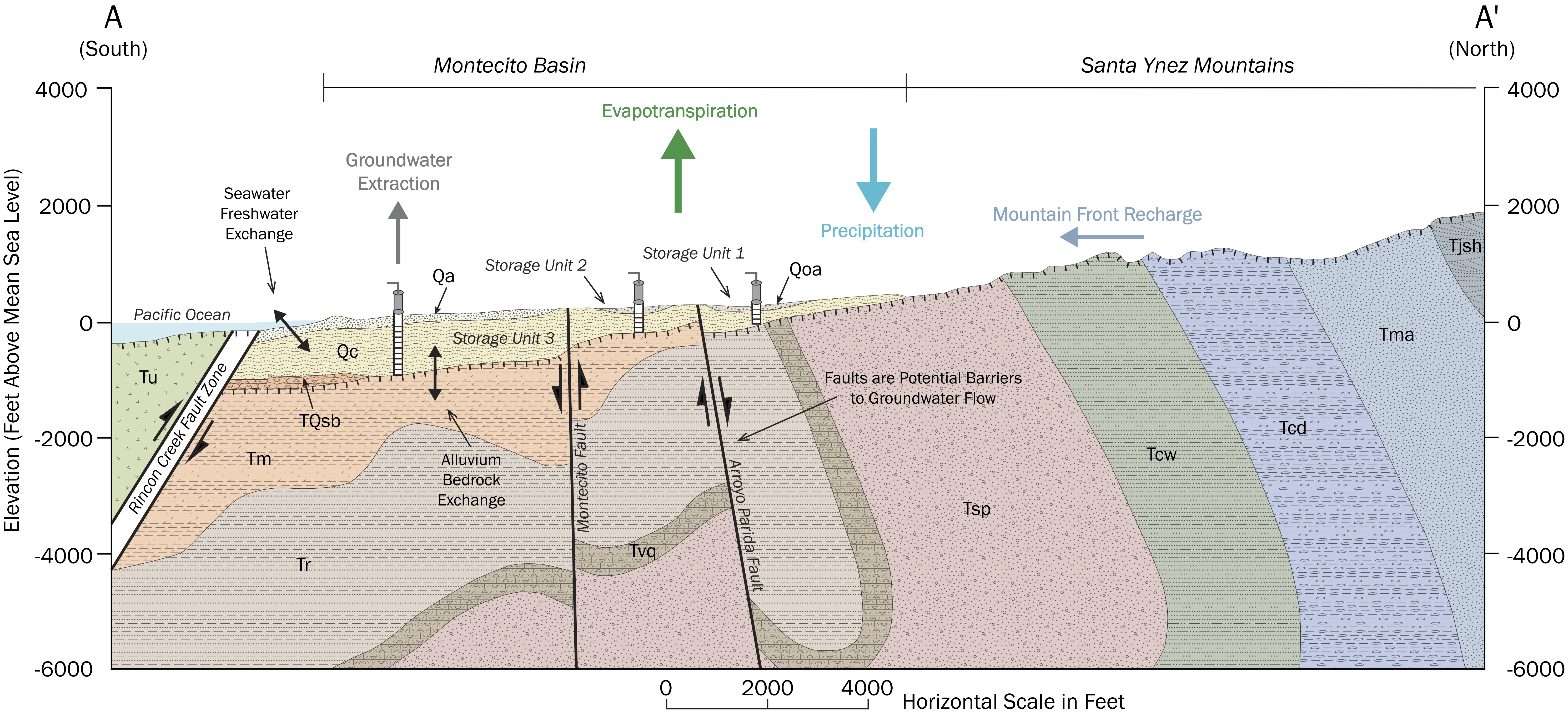

DRAFT

SOURCE: Adopted from GTC 1974

DUDEK

FIGURE 2-13

A-A' Geologic Cross Section

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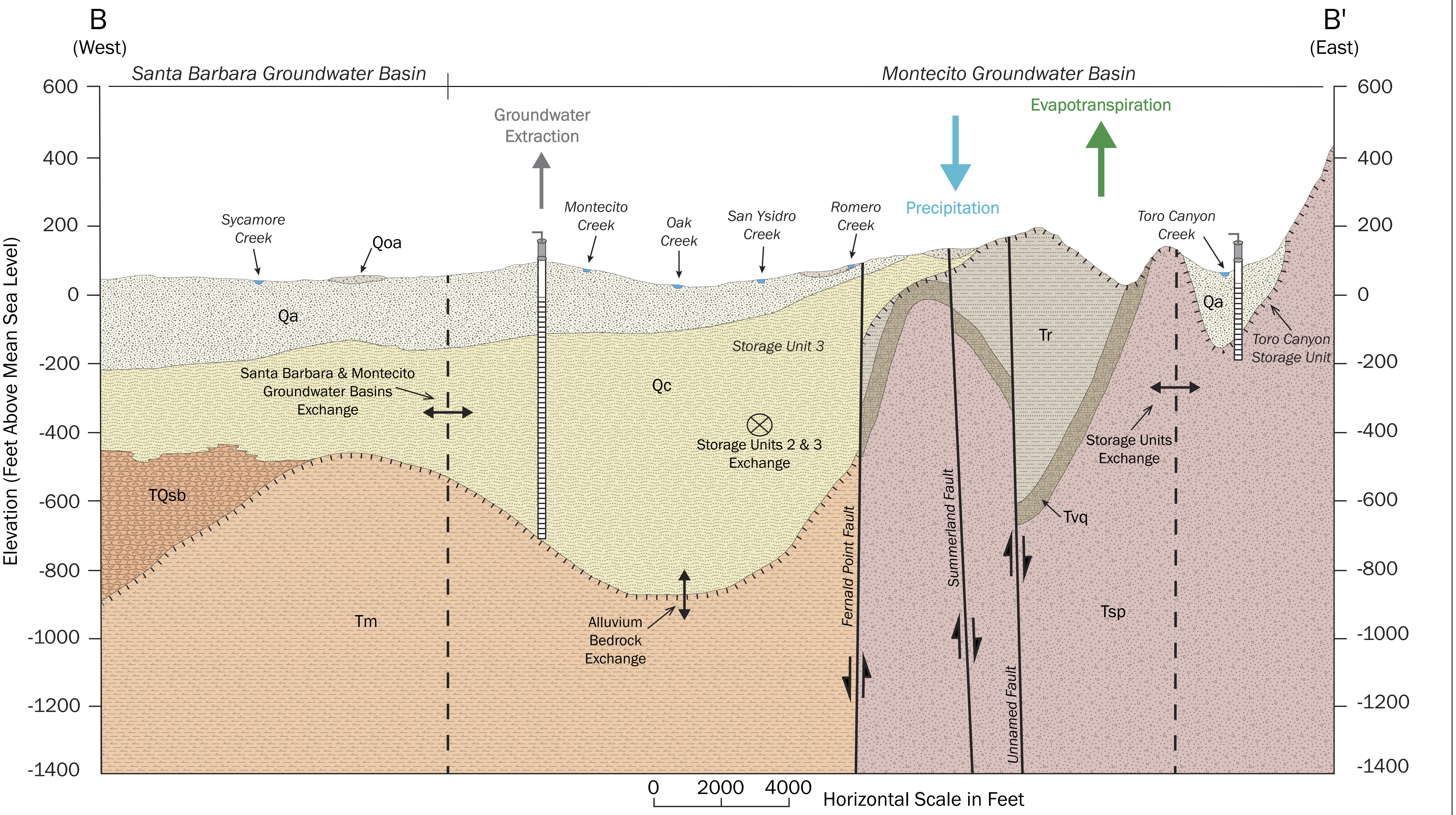

DRAFT

SOURCE: Adopted from GTC 1974

DUDEK

FIGURE 2-14

B-B' Geologic Cross Section

Groundwater Sustainability Plan for the Montecito Basin

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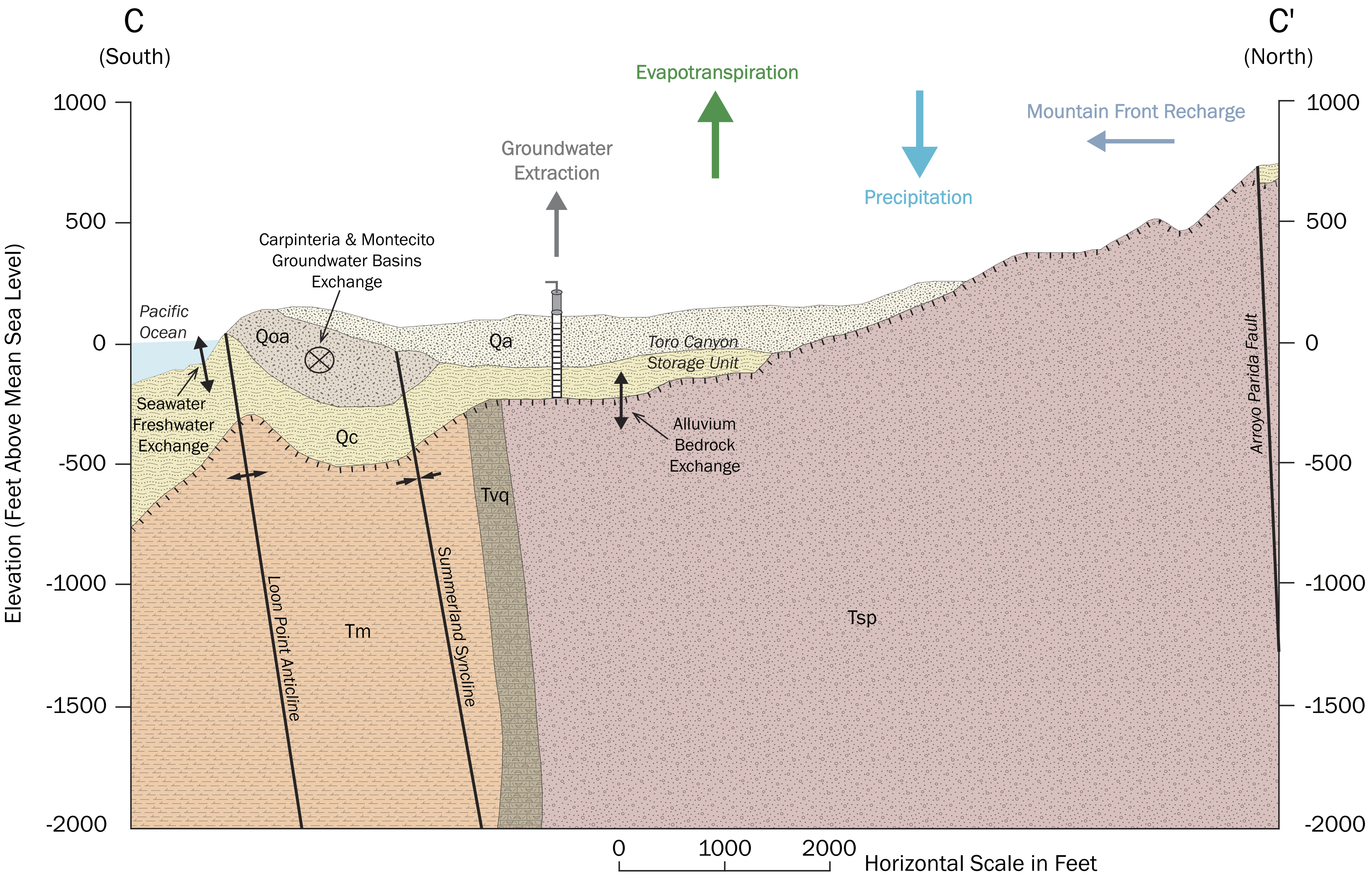

DRAFT

SOURCE: Adopted from GTC 1974

DUDEK

FIGURE 2-15

C-C' Geologic Cross Section

Groundwater Sustainability Plan for the Montecito Basin

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Qa	Alluvium: lenticular clay, silt, sand and gravel
Qoa	Older alluvium and riviera fanglomerate: boulder, cobble, and sand deposits
Qc	Casitas formation: lenticular sand, clay, and gravel (non-marine)
TQsb	Santa Barbara formation: fossiliferous sandstone (marine)
Tm	Undifferentiated Monterey formation: hard siliceous shale and soft organic shale (marine)
Tr	Undifferentiated Rincon formation: claystone and siltstone (marine)
Tvq	Vaqueros formation: fossiliferous sandstone (marine)
Tsp	Undifferentiated Sespe formation: conglomerate, sandstone, siltstone (marine)
Tcw	Coldwater formation: sandstone and siltstone (marine)
Tcd	Cozy Dell formation: shale, minor sandstone (marine)
Tma	Matilija formation: sandstone (marine)
Tjsh	Juncal formation: shale and sandstone (marine)
Tu	Undifferentiated Tertiary rocks
╷╷╷╷╷╷	Bottom of water-bearing units
	Groundwater well
⊗	Groundwater exchange flow between storage units or basins
┆	Groundwater basin boundary
|	Fault

DRAFT

SOURCE: Adopted from GTC 1974

DUDEK

FIGURE 2-16

Geologic Cross Sections Legend

Groundwater Sustainability Plan for the Montecito Basin

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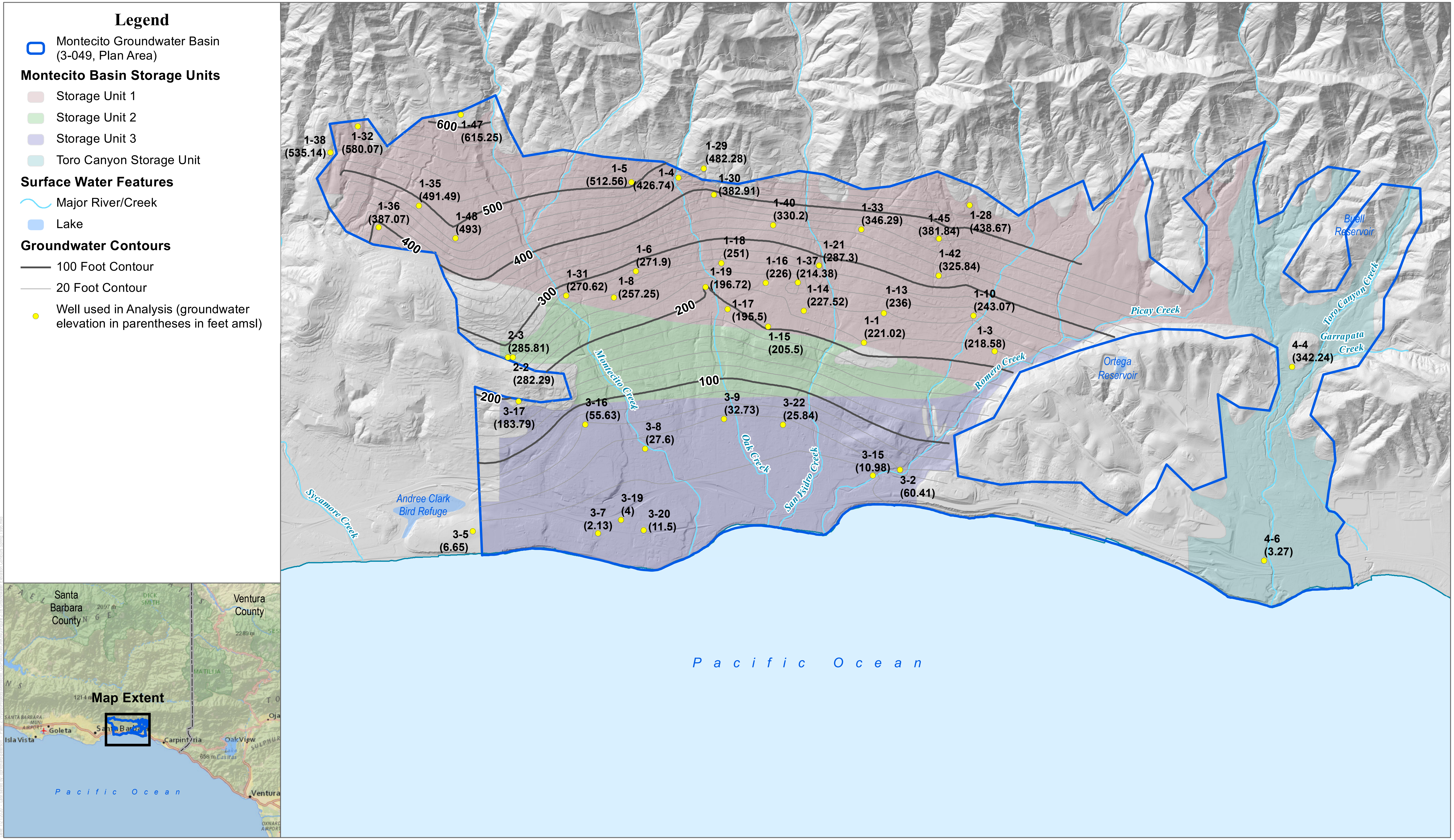

DRAFT

DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; County of Santa Barbara; Montecito Water District

DUDEK

0 0.5 1 Miles

FIGURE 2-17

Groundwater Elevation Contours Spring 1995

Groundwater Sustainability Plan for the Montecito Basin

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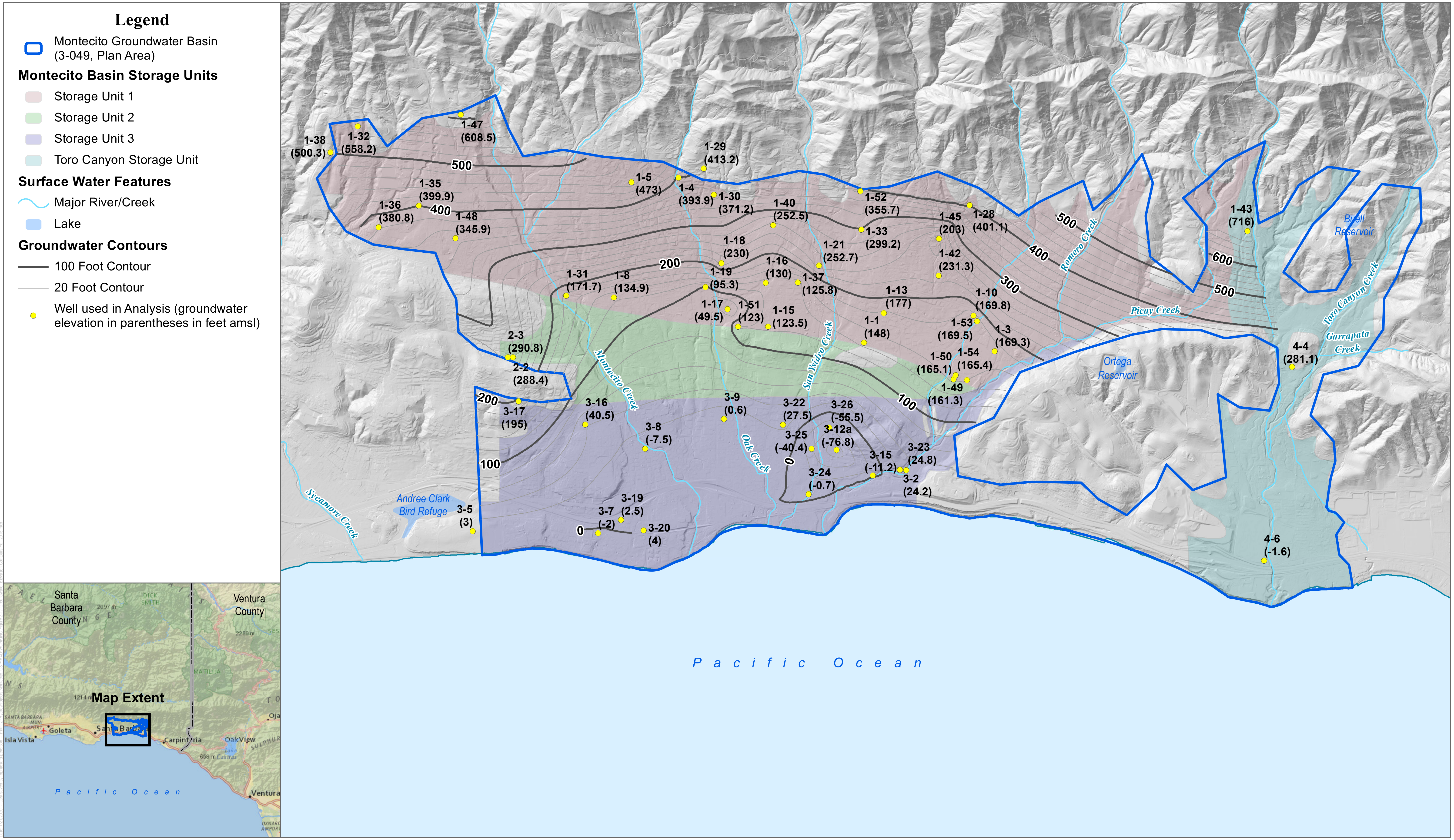

DRAFT

DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; County of Santa Barbara; Montecito Water District

DUDEK

0 0.5 1 Miles

FIGURE 2-18

Groundwater Elevation Contours Fall 2015

Groundwater Sustainability Plan for the Montecito Basin

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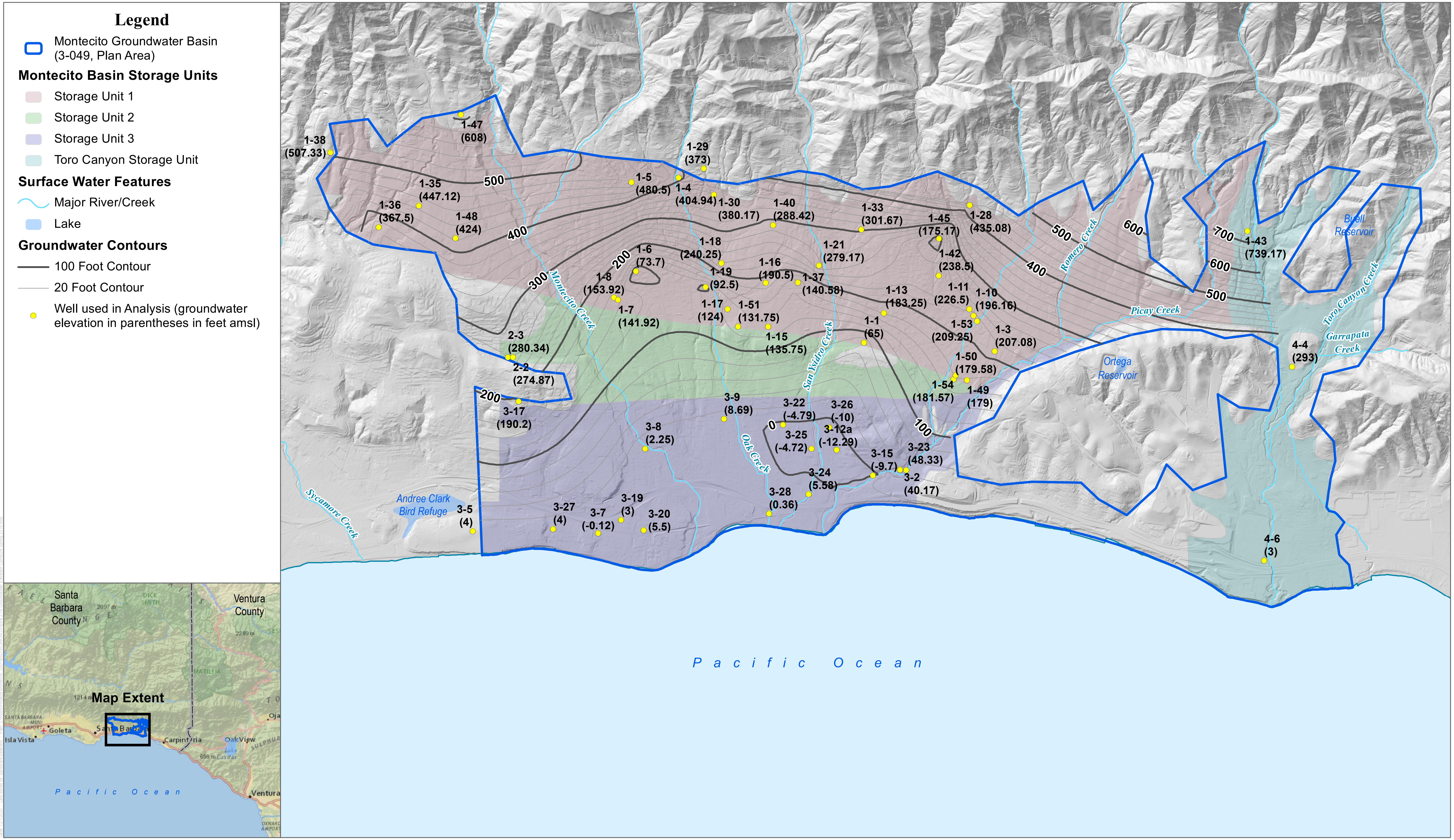

DRAFT

DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; County of Santa Barbara; Montecito Water District

DUDEK

0 0.5 1 Miles

FIGURE 2-19

Groundwater Elevation Contours Spring 2019

Groundwater Sustainability Plan for the Montecito Basin

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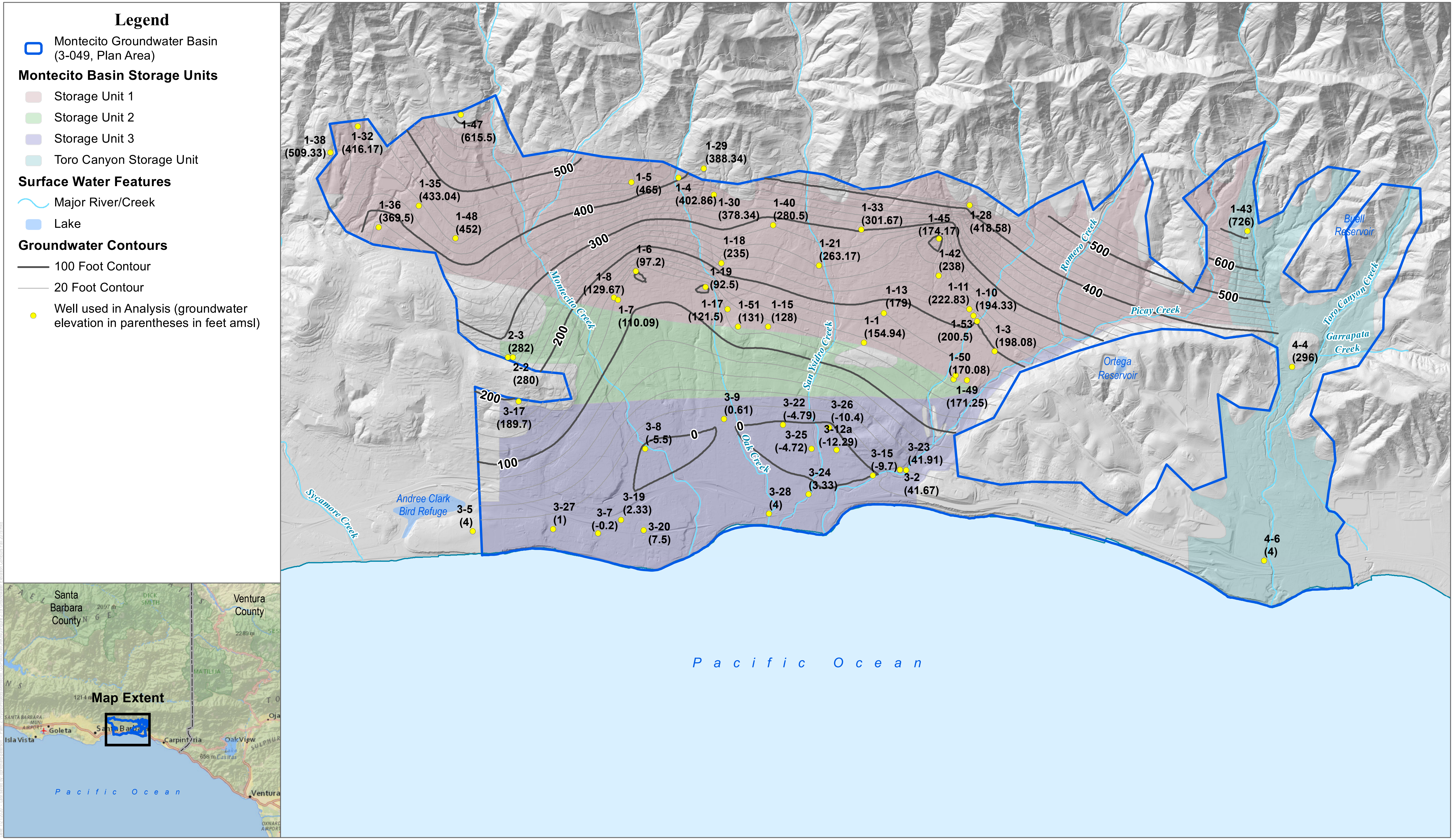

DRAFT

DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; County of Santa Barbara; Montecito Water District

DUDEK

0 0.5 1 Miles

FIGURE 2-20

Groundwater Elevation Contours Fall 2019

Groundwater Sustainability Plan for the Montecito Basin

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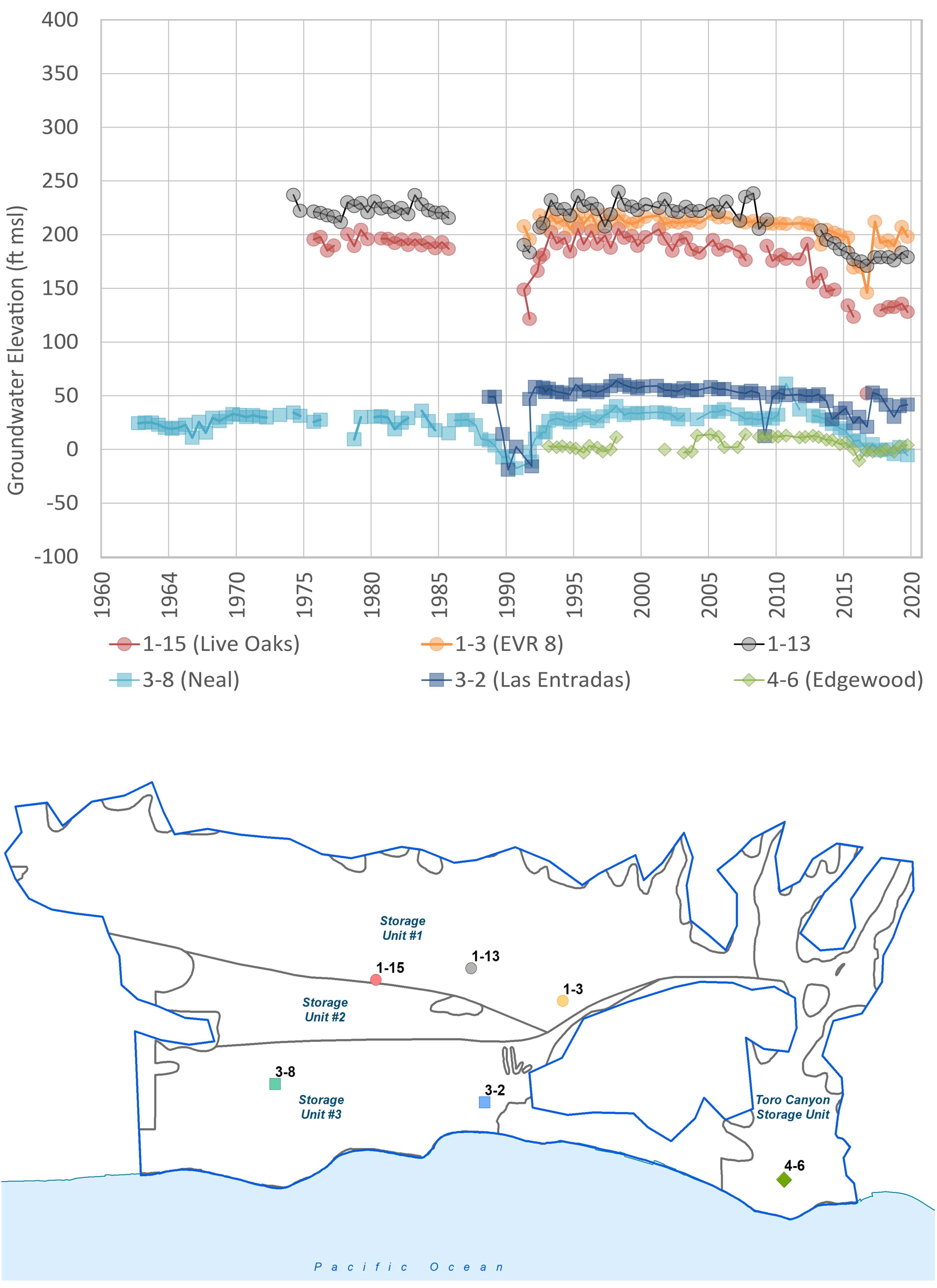

DRAFT

SOURCE: Montecito Water District

DUDEK

FIGURE 2-21

Groundwater Levels in Key Indicator Wells

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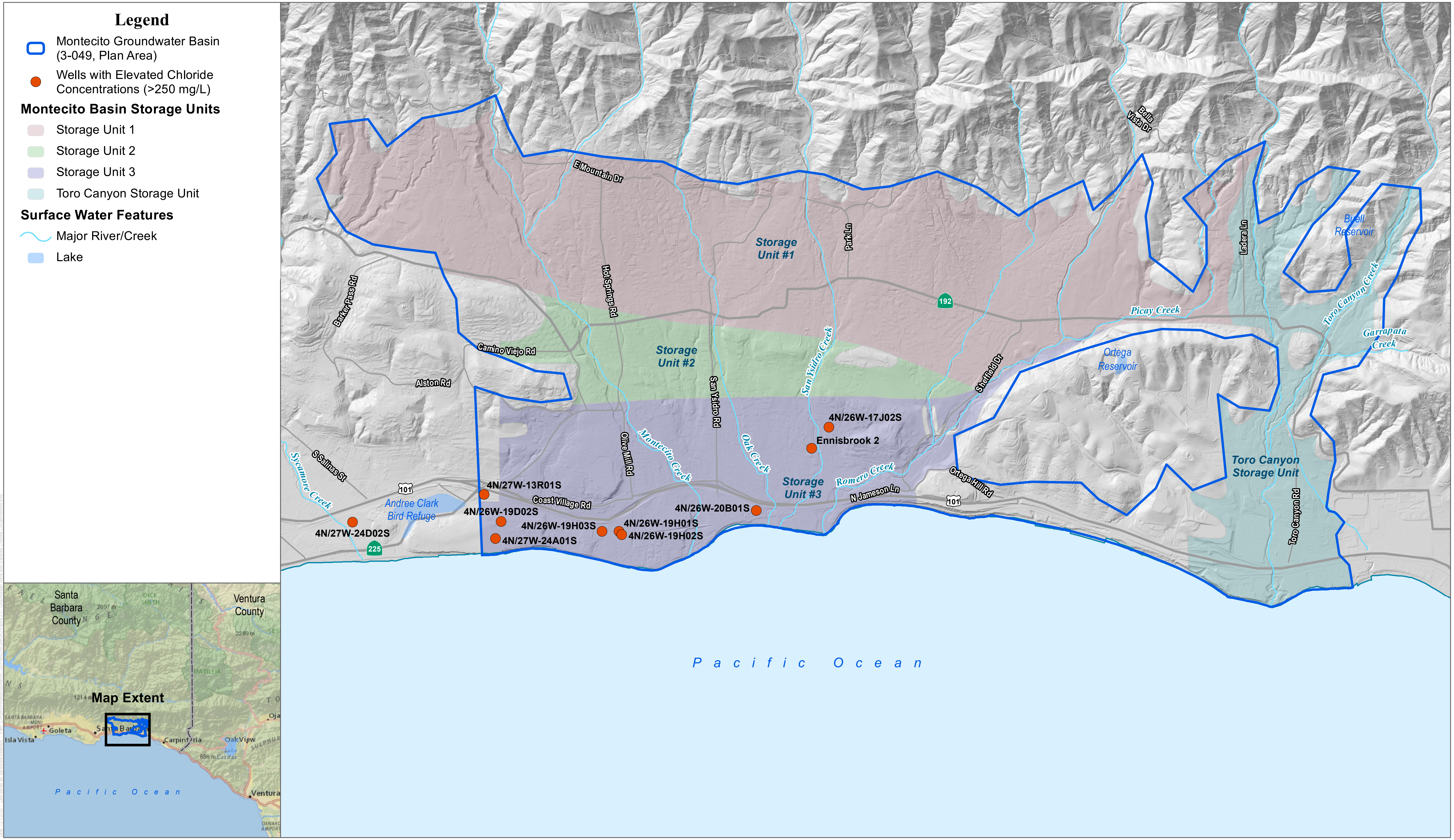

DRAFT

DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; USGS; County of Santa Barbara; Montecito Water District

DUDEK

0 0.5 1 Miles

FIGURE 2-22

Groundwater Wells with Elevated Chloride Concentrations

Groundwater Sustainability Plan for the Montecito Basin

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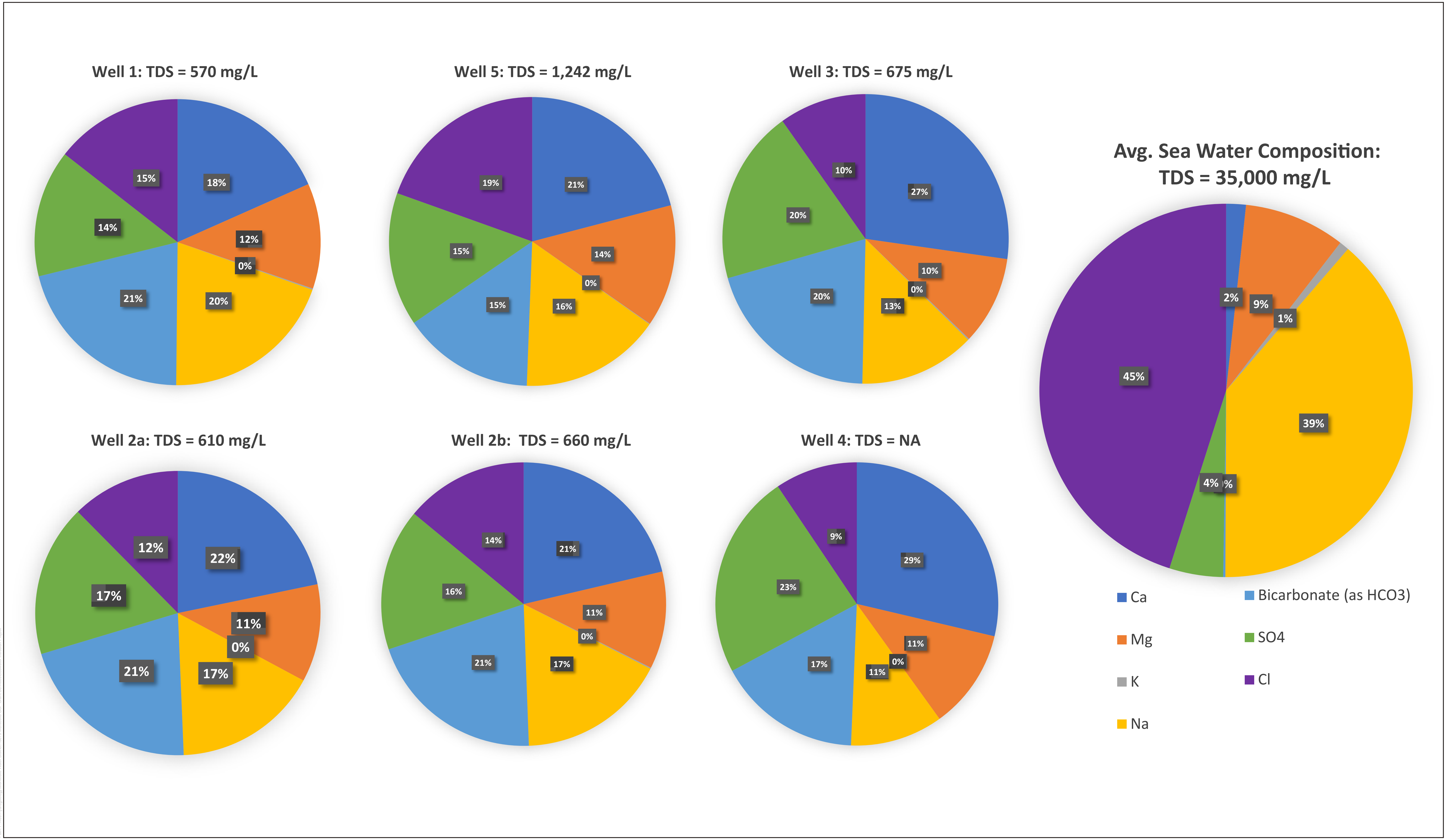

SOURCE:

FIGURE 2-23

Seawater Intrusion Monitoring Wells Water Quality Composition Pie Charts

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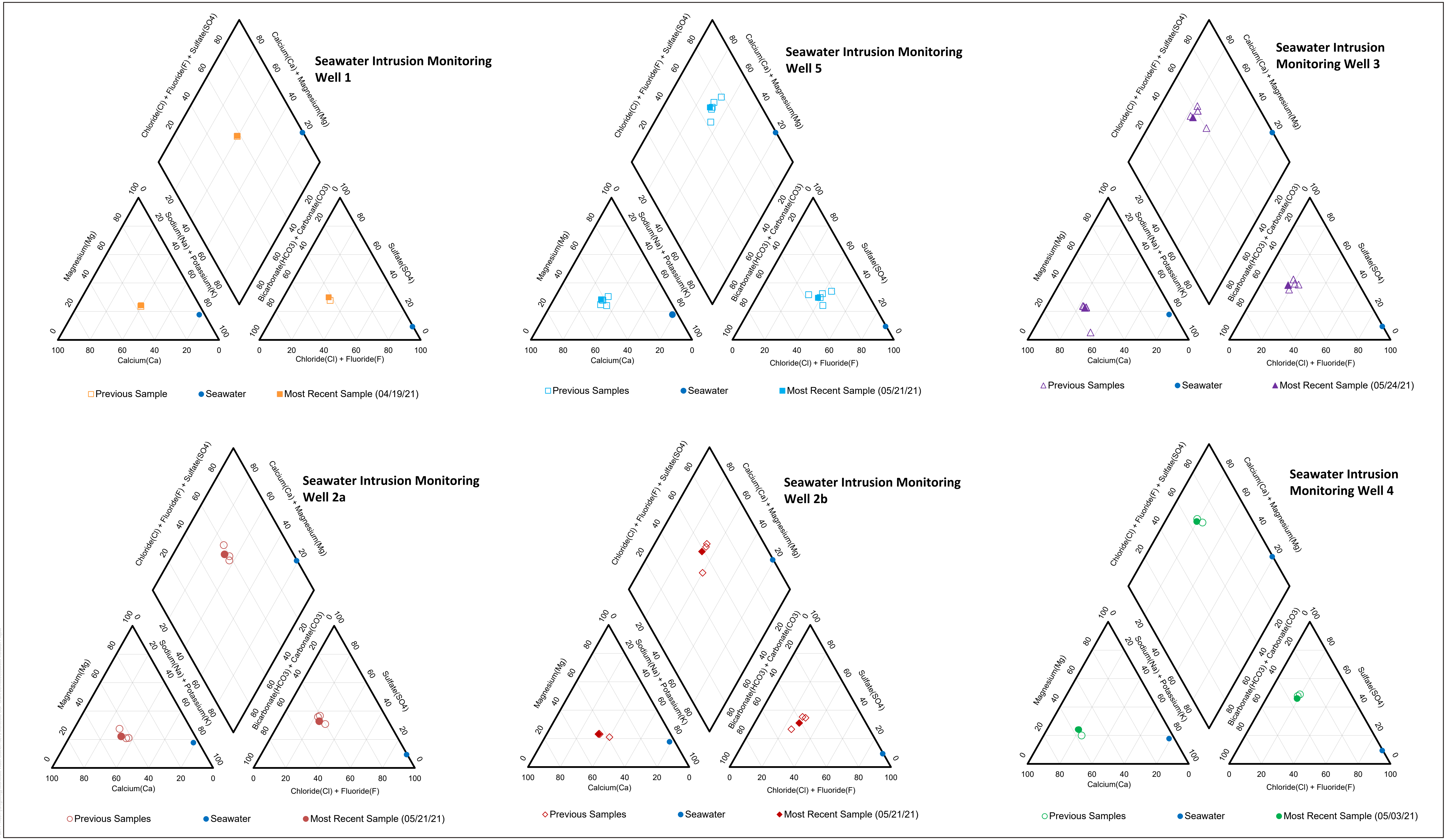

SOURCE:

DUDEK

FIGURE 2-24

Seawater Intrusion Monitoring Wells Water Quality Piper Plots

Groundwater Sustainability Plan for the Montecito Basin

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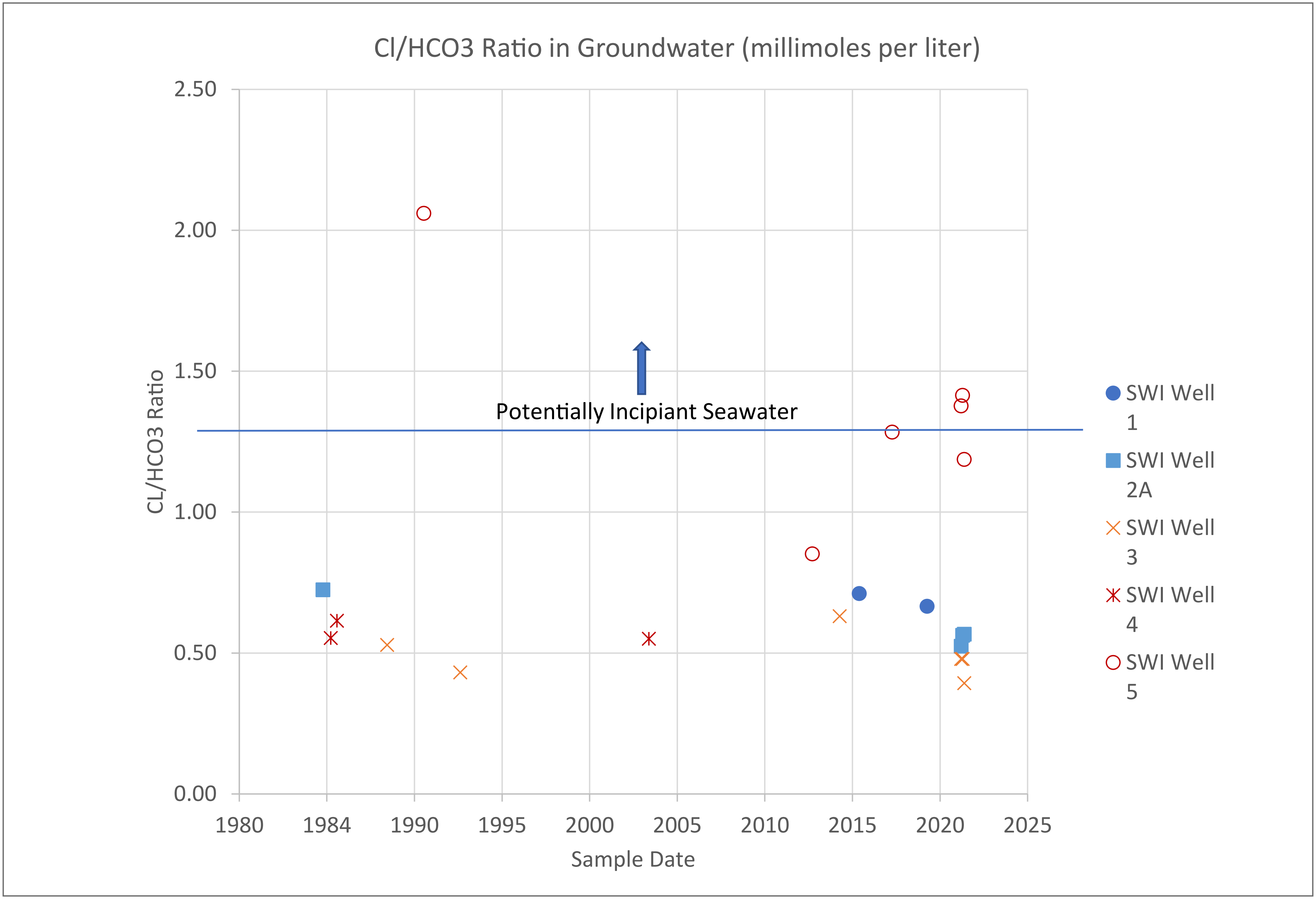

Figure 2-25

Seawater Intrusion Monitoring Wells: Ratio of Chloride (Cl^-) to Bicarbonate (HCO_3^-) concentrations in groundwater

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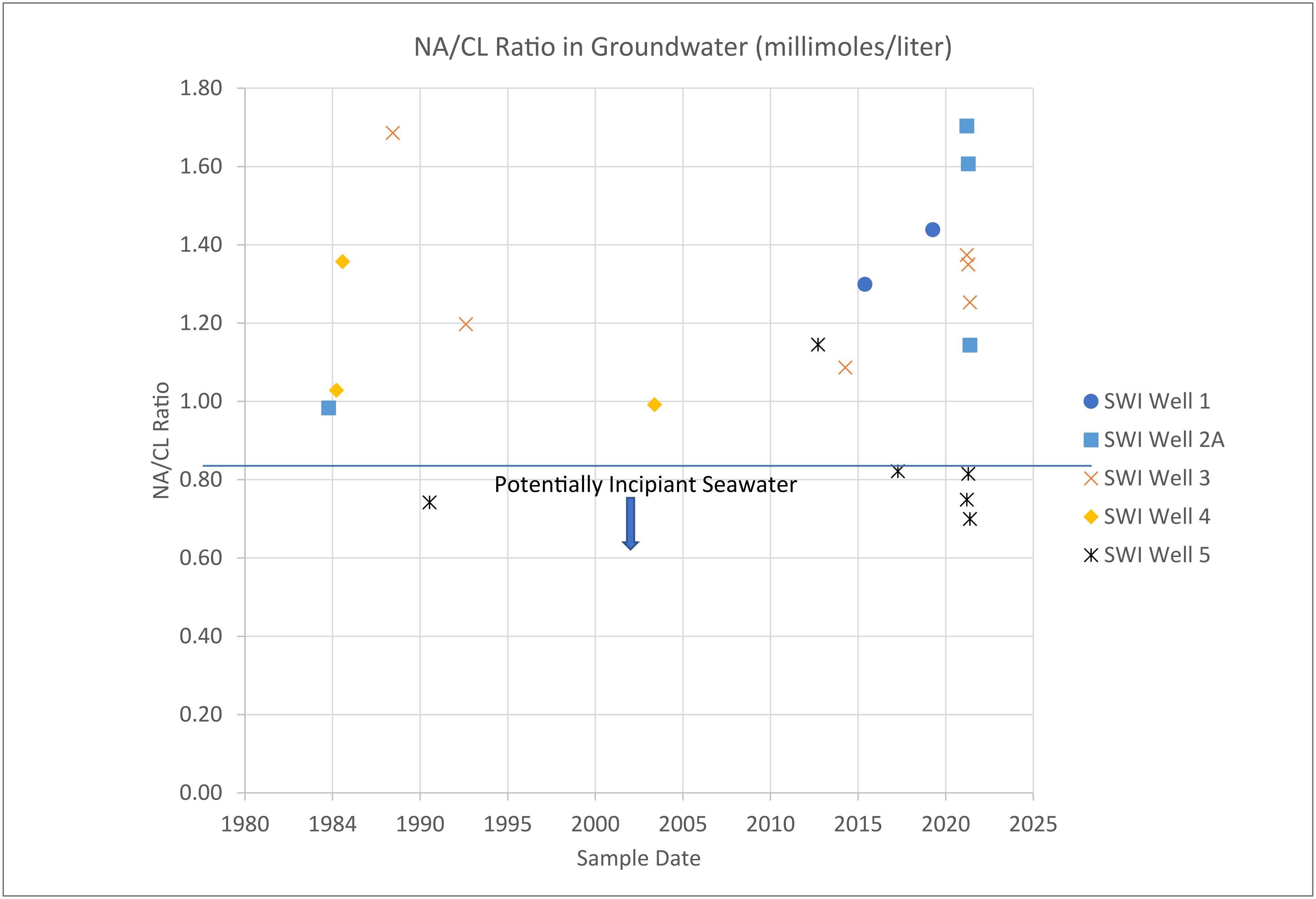

Figure 2-26

Seawater Intrusion Monitoring Wells: Ratio of Sodium (Na^+) to Chloride (Cl^-) concentrations in groundwater

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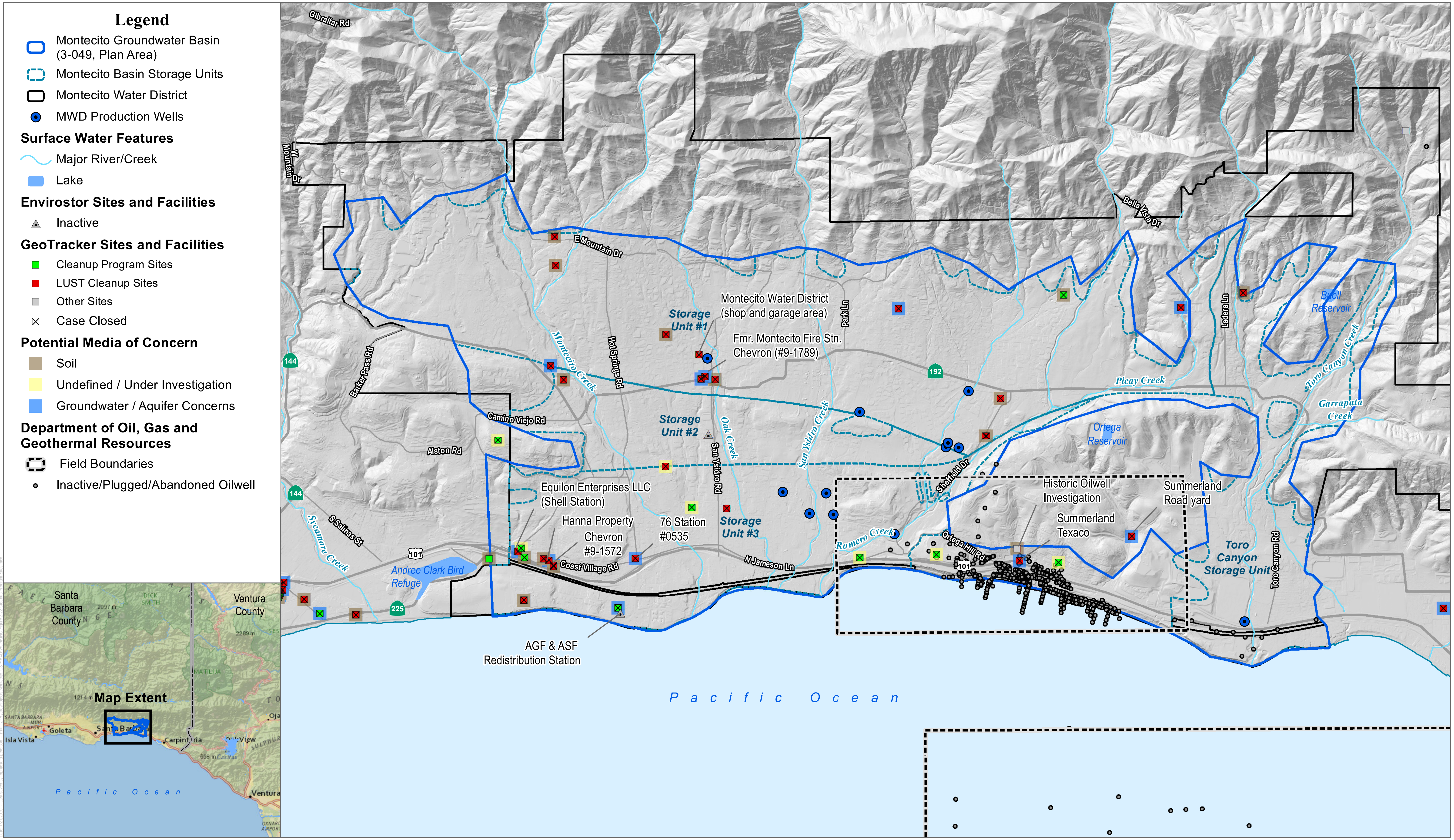

DRAFT

DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; USGS; County of Santa Barbara; NWIS Mapper; SWRCB (Geotracker); DTSC (Envirostor)

DUDEK

0 0.5 1 Miles

FIGURE 2-27

Regulatory Cleanup Program Sites

Groundwater Sustainability Plan for the Montecito Basin

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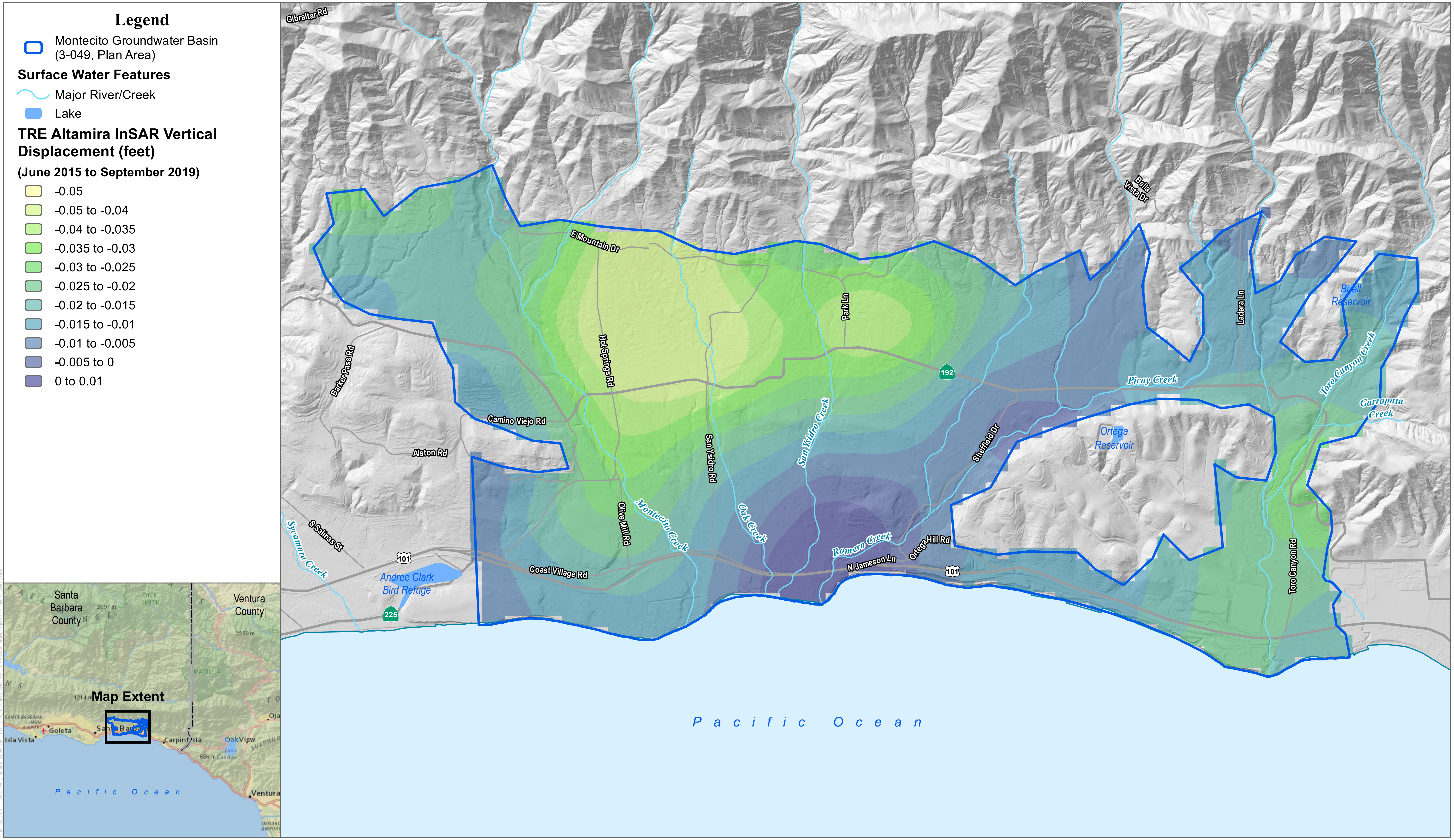

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DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; USGS; County of Santa Barbara

DUDEK

FIGURE 2-28

Land Subsidence

Groundwater Sustainability Plan for the Montecito Basin

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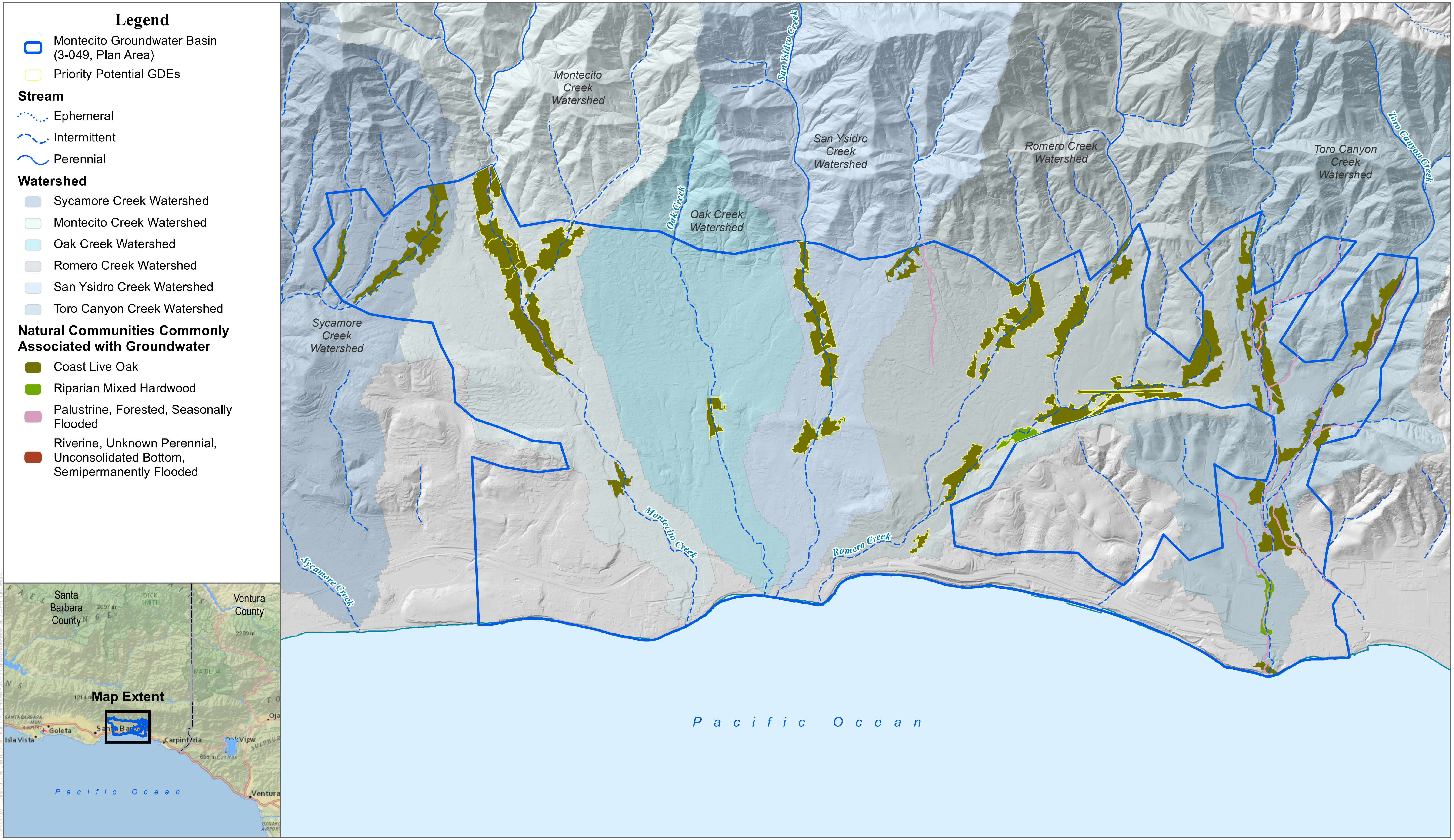

DRAFT

DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; USGS

DUDEK

0 0.5 1 Miles

FIGURE 2-29

Potential Groundwater Dependent Ecosystems

Groundwater Sustainability Plan for the Montecito Basin

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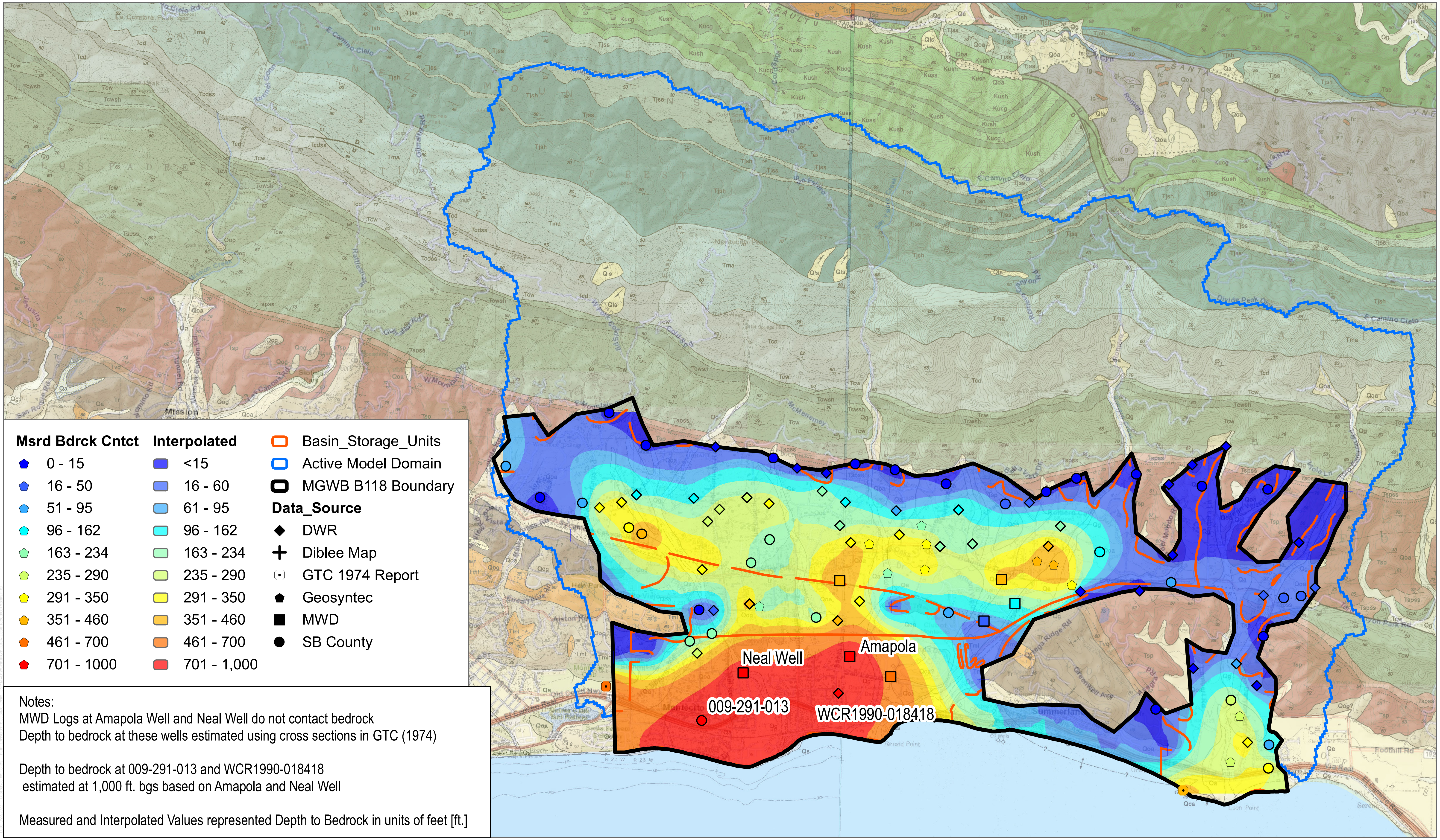

Notes:
MWD Logs at Amapola Well and Neal Well do not contact bedrock
Depth to bedrock at these wells estimated using cross sections in GTC (1974)

Depth to bedrock at 009-291-013 and WCR1990-018418
estimated at 1,000 ft. bgs based on Amapola and Neal Well

Measured and Interpolated Values represented Depth to Bedrock in units of feet [ft.]

SOURCE: Source

DRAFT

DUDEK

FIGURE 2-30

Measured and Estimated Depth to Bedrock in the Montecito Groundwater Basin

Montecito Groundwater Basin Groundwater Sustainability Plan

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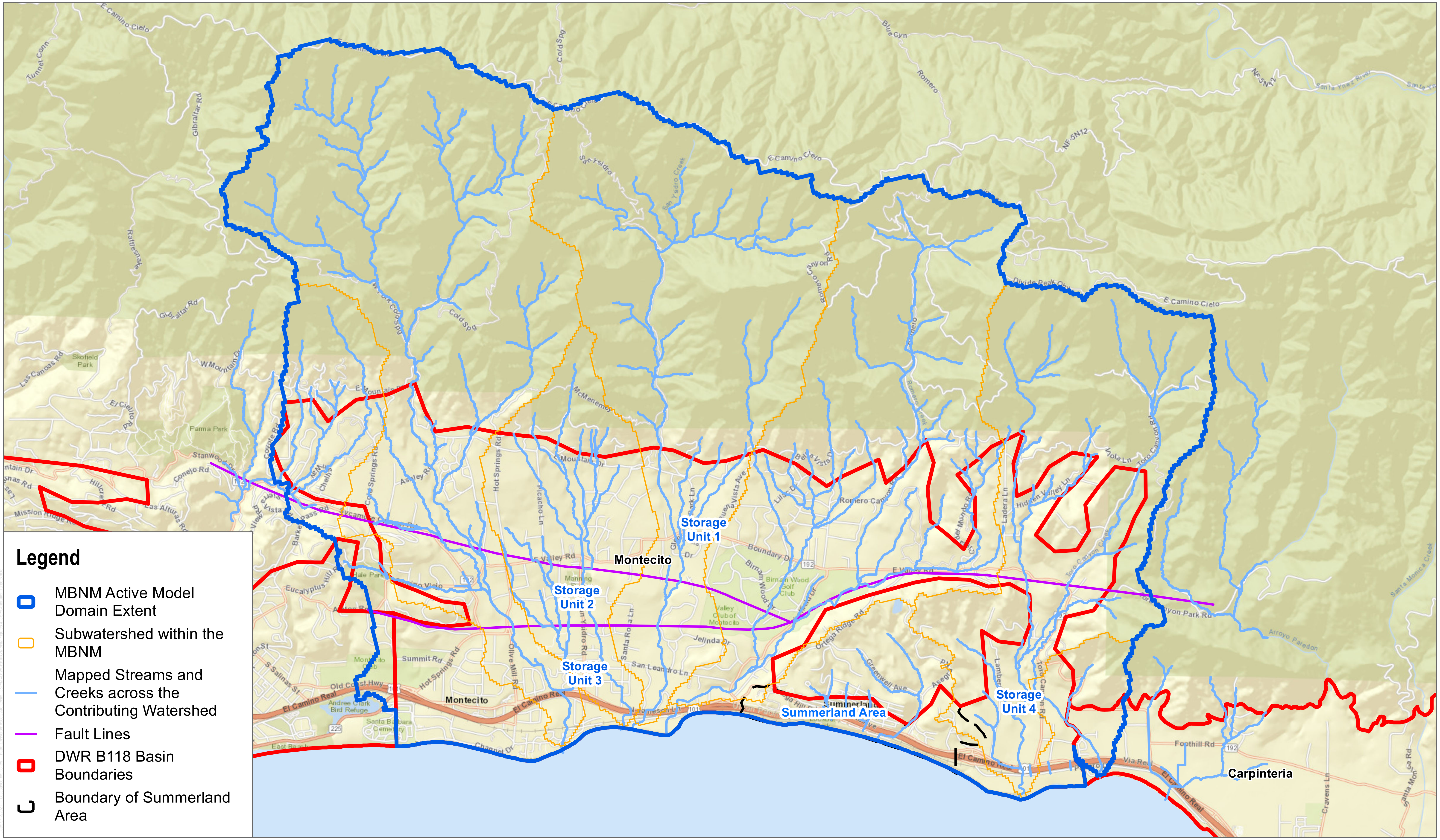

SOURCE: MWD

DRAFT

DUDEK

0 1,650 3,300 Feet

FIGURE 2-31

MBNM Active Model Domain and Primary Watershed Features

Montecito Groundwater Basin Groundwater Sustainability Plan

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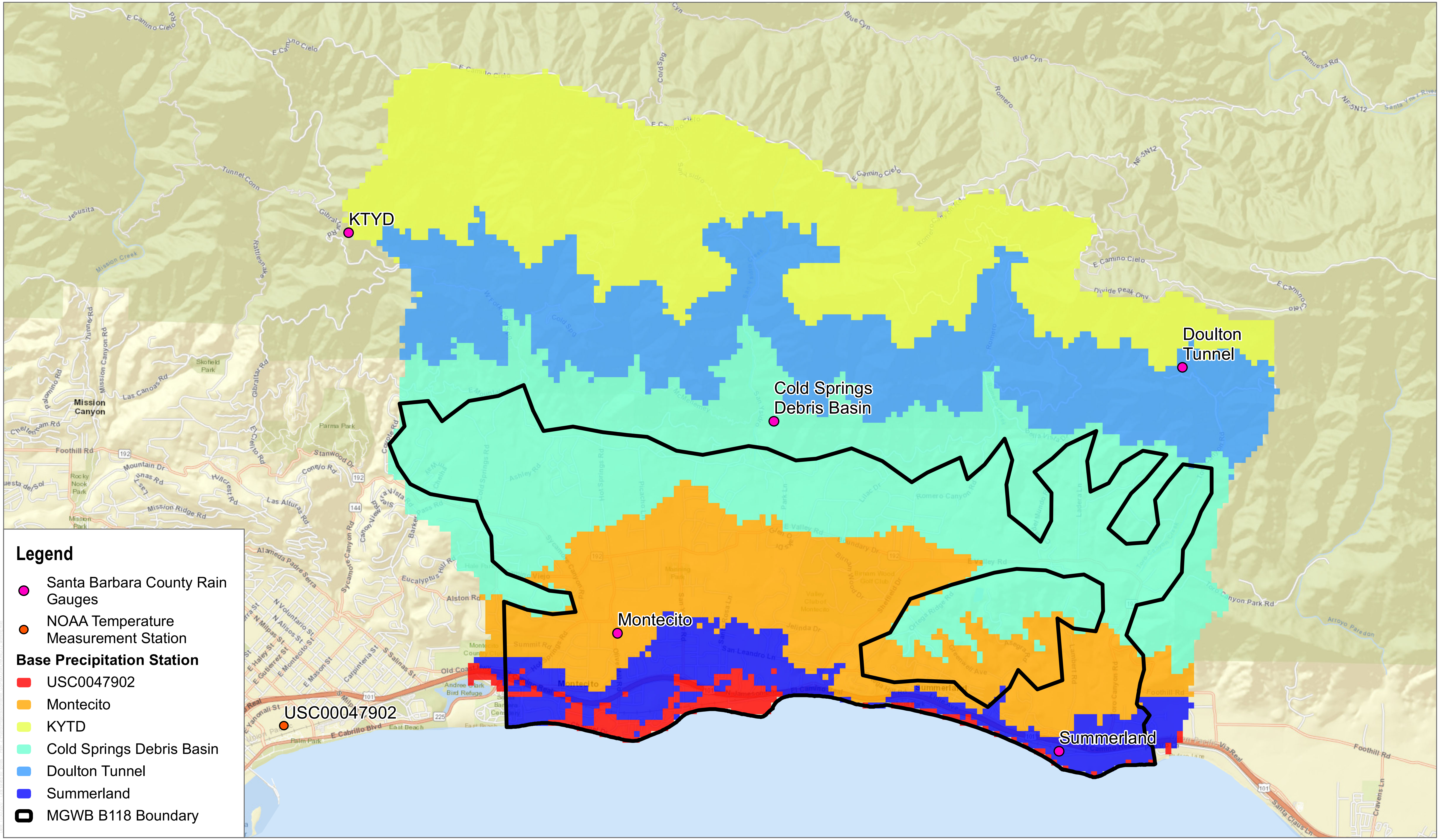

SOURCE: USGS, MWD

DRAFT

DUDEK

FIGURE 2-32

Climate measurement stations and corresponding reference stations used in the MBNM

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DRAFT

DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; USGS; County of Santa Barbara; USDA NRCS

DUDEK

0 0.5 1 Miles

FIGURE 2-33

Soils Map

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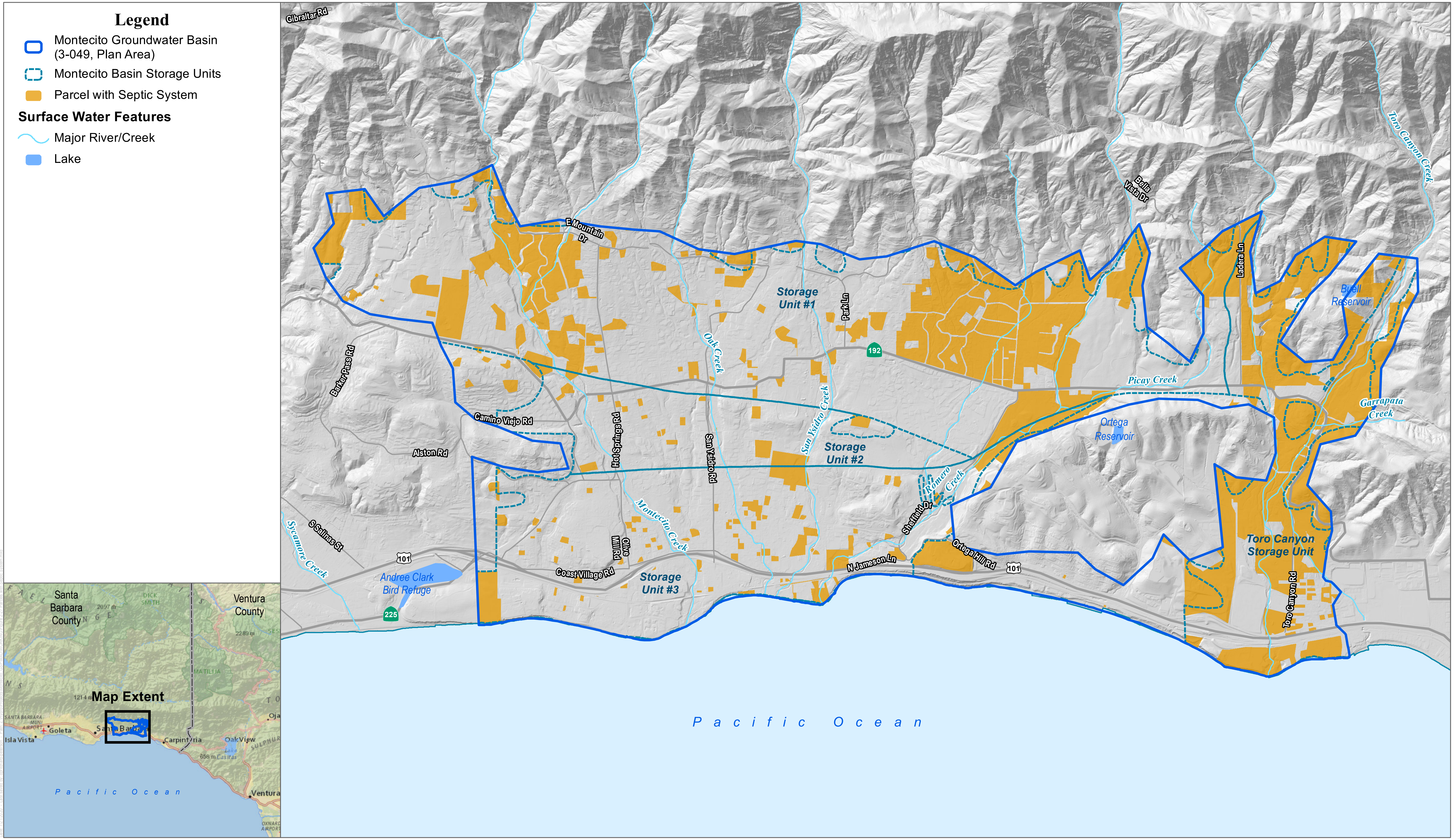

DRAFT

DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; USGS; County of Santa Barbara

0 0.5 1 Miles

FIGURE 2-34

Parcels with Septic System

Groundwater Sustainability Plan for the Montecito Basin

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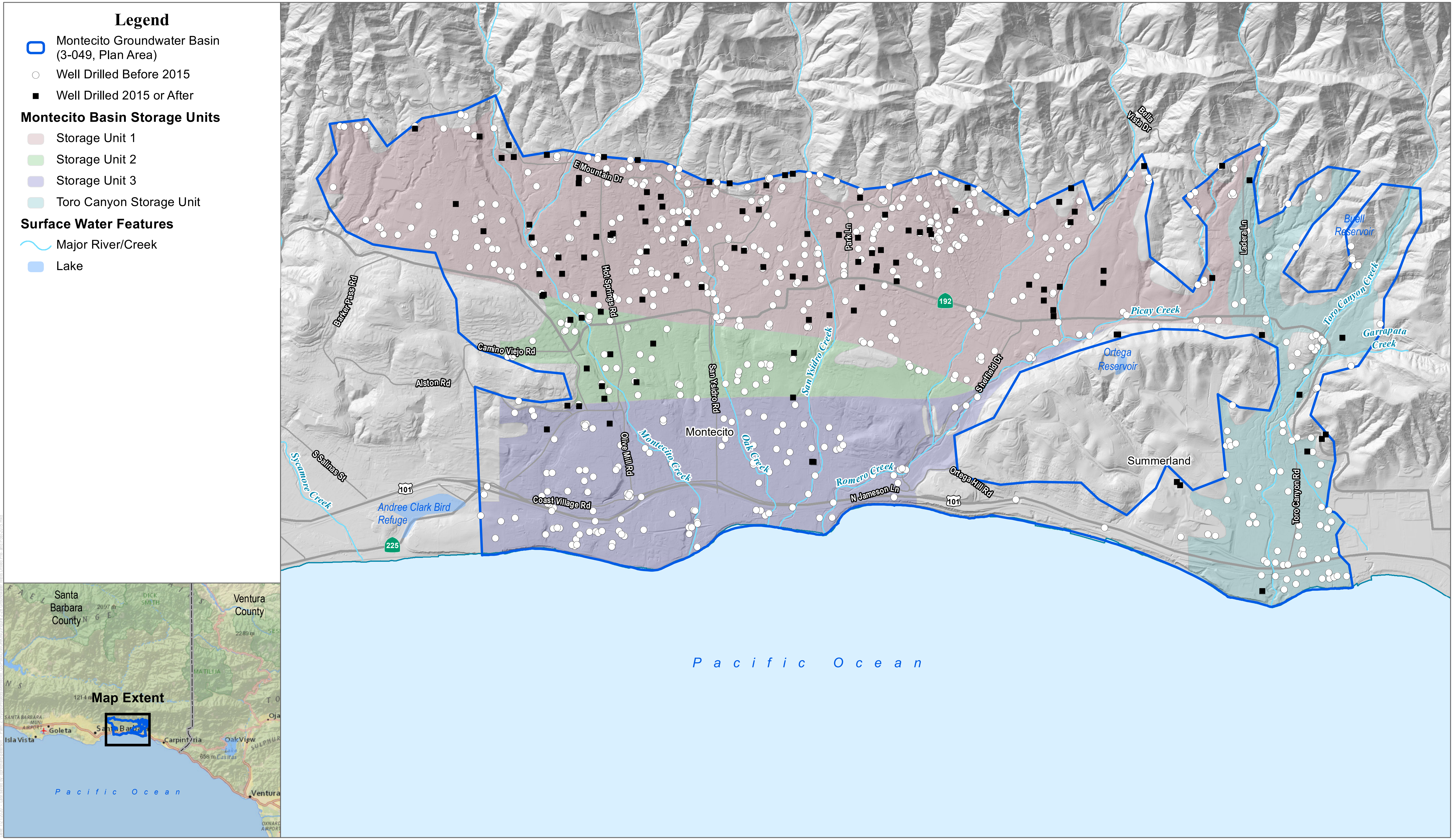

DRAFT

DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; USGS; County of Santa Barbara; NWIS Mapper; Montecito Water District

DUDEK

0 0.5 1 Miles

FIGURE 2-35

Groundwater Wells Drilled Pre- vs. Post-2015

Groundwater Sustainability Plan for the Montecito Basin

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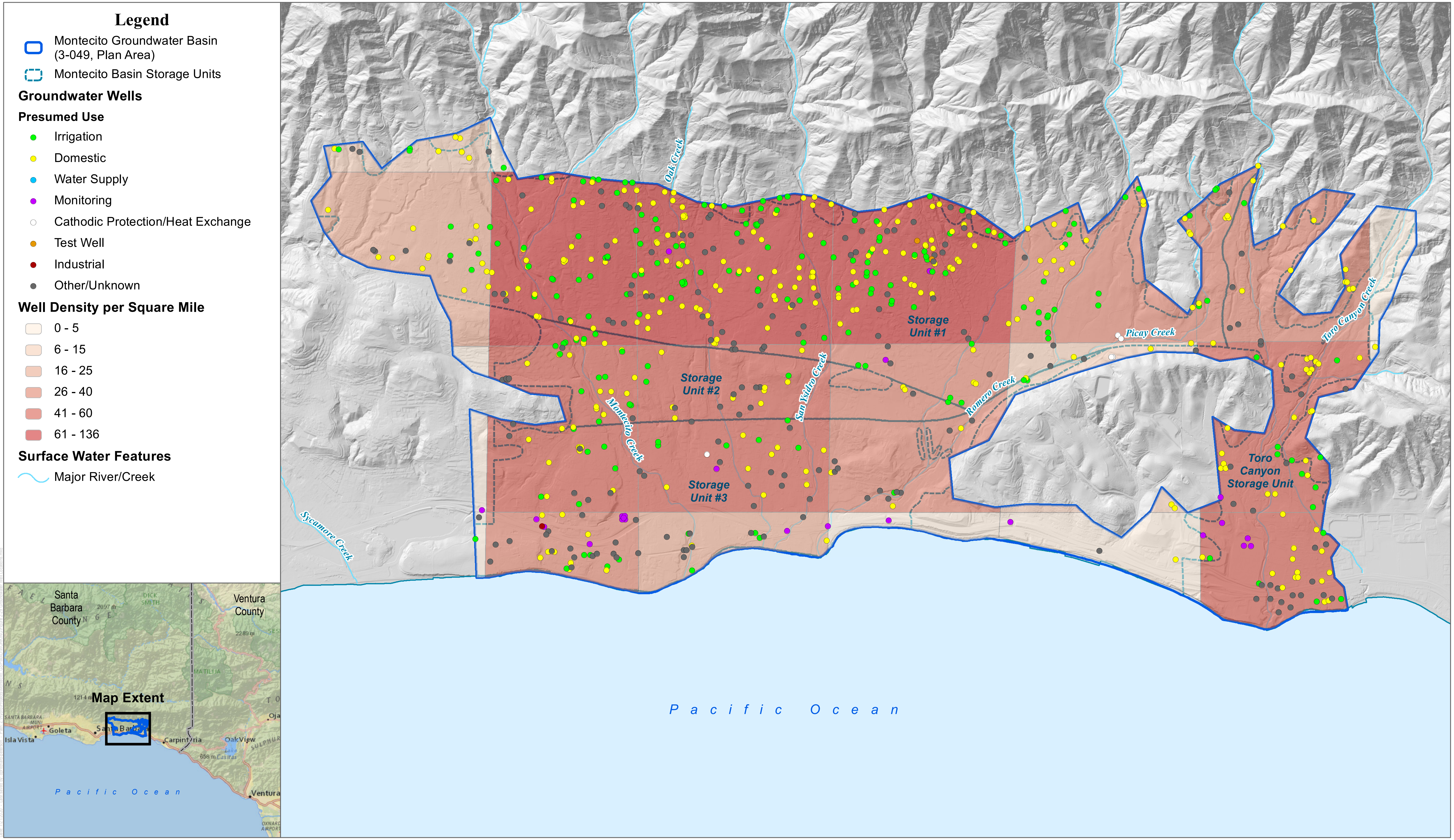

DRAFT

DATUM: NAD 1983 DATA SOURCE: ESRI; DWR; USGS; County of Santa Barbara; NWIS Mapper; Montecito Water District

DUDEK

0 0.5 1 Miles

FIGURE 2-36

Groundwater Well Locations and Well Density per Square Mile

Groundwater Sustainability Plan for the Montecito Basin

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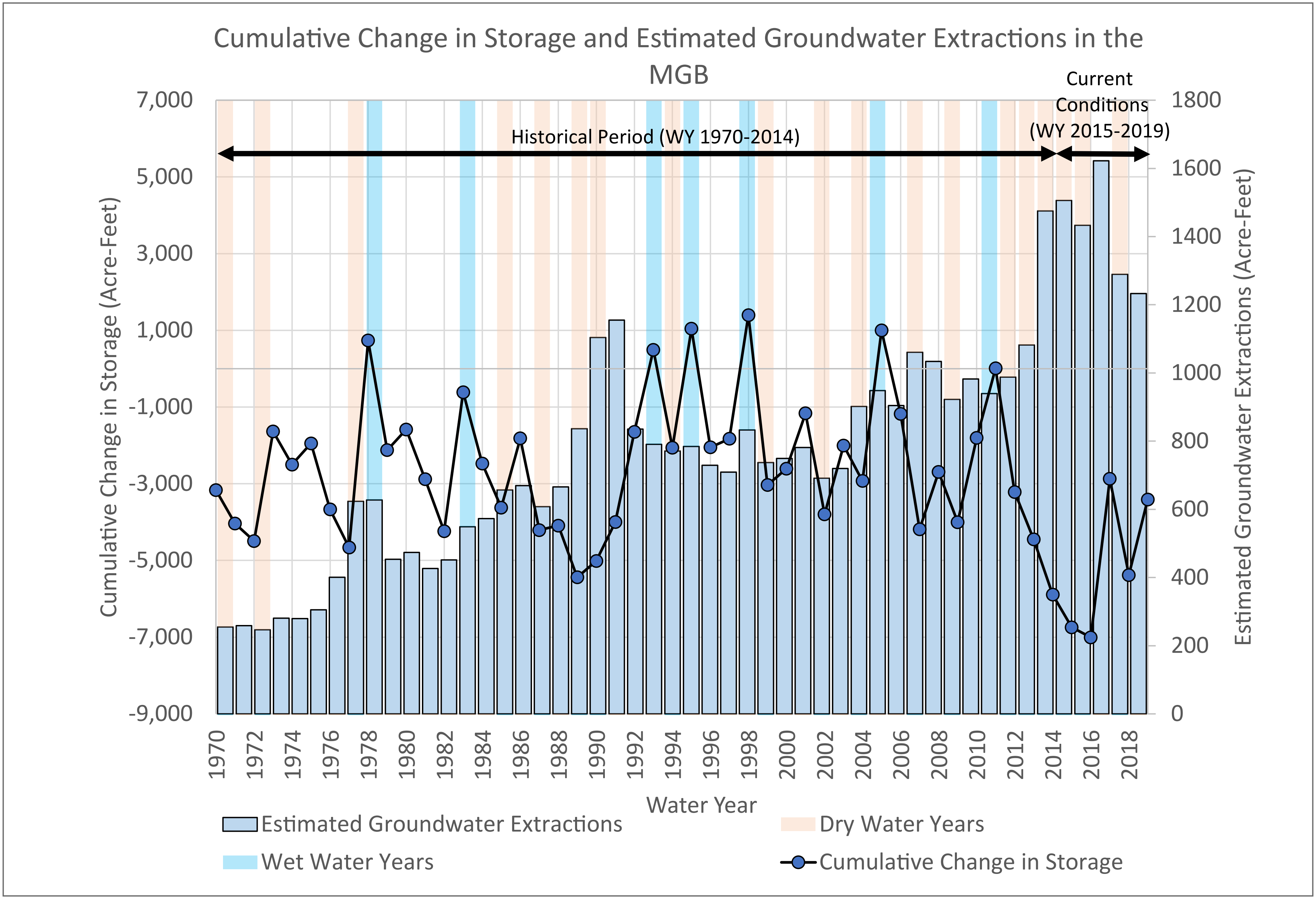

Figure 2-37

Change in Groundwater in Storage and Annual Groundwater Extractions (WY 1970-2019) in the MGB

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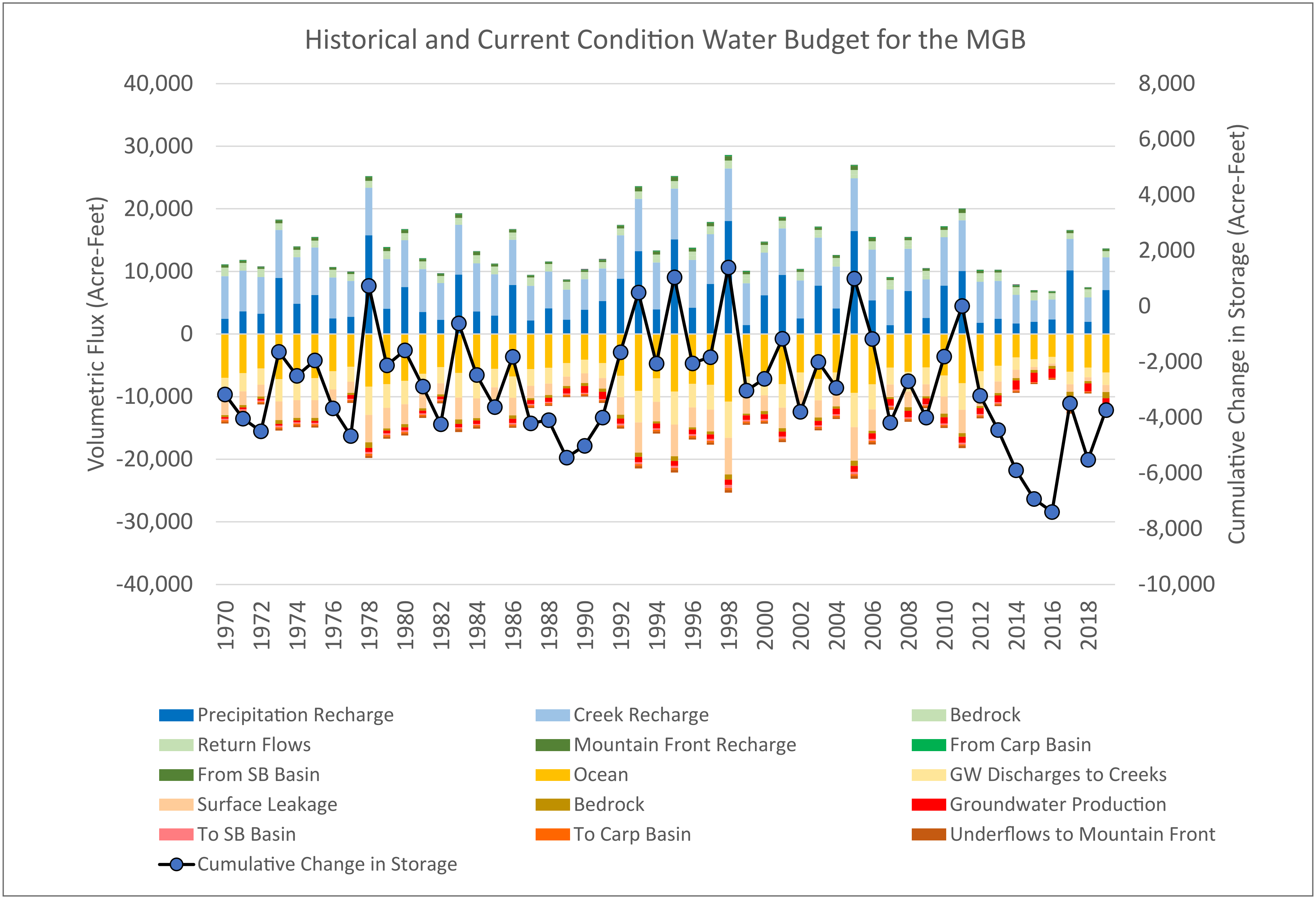

Figure 2-38

Groundwater Budget (WY 1970-2019) for the MGB

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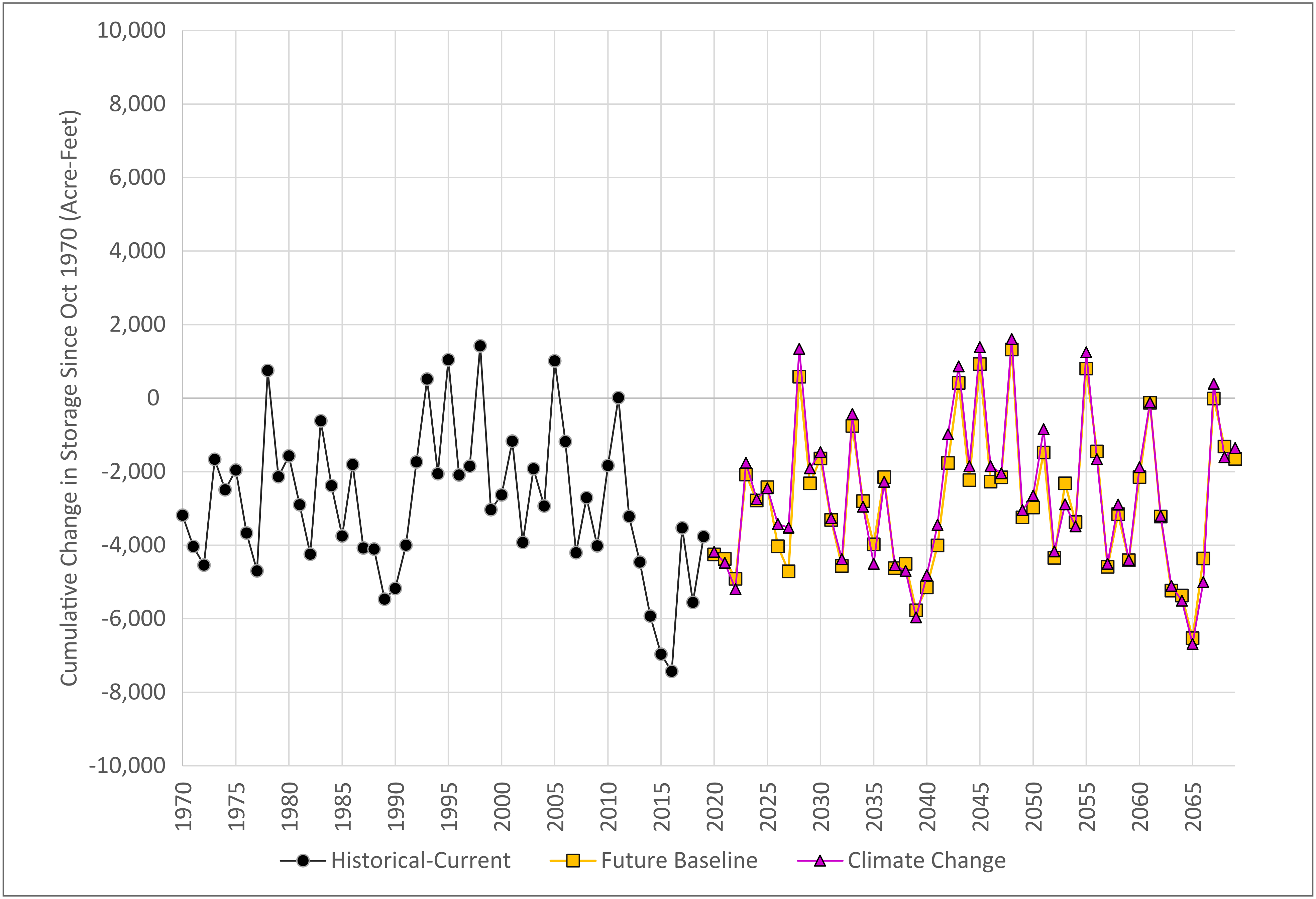

Figure 2-39

Historical, Current, and Projected Change in Groundwater in Storage (WY 1970-2069) in the MGB