MISSION CREEK SUBBASIN SGMA

wood.

KJ Kennedy Jenks

Mission Creek Subbasin Alternative Plan Update

In Compliance with the Sustainable Groundwater Management Act

Volume I

Prepared For:
Coachella Valley Water District
Desert Water Agency
Mission Springs Water District

November 2021

MISSION CREEK SUBBASIN SGMA

PREPARED FOR
COACHELLA VALLEY WATER DISTRICT
DESERT WATER AGENCY
MISSION SPRINGS WATER DISTRICT

Mission Creek Subbasin Alternative Plan Update

In Compliance with the Sustainable Groundwater Management Act

PREPARED BY:

wood.

Kennedy Jenks

MISSION CREEK SUBBASIN ALTERNATIVE PLAN UPDATE

ACKNOWLEDGEMENTS

The Mission Creek Subbasin Management Committee appreciates and acknowledge the funding contribution from the California Department of Water Resources (CDWR) Funding for the Mission Creek Subbasin Alternative Plan Update has been provided in part by the California Drought, Water Parks, Climate, Coastal Protection and Outdoor Access for All Act of 2018 (Proposition 68) through agreement with CDWR.

Mission Creek Subbasin Management Committee

51501 Tyler Street	**1200 S. Gene Autry Trail**	**66575 2nd St**
Coachella, CA 92236	**Palm Springs, CA 93364**	**Desert Hot Springs, CA 92240**
760-398-2651	**760-323-4971**	**760-329-6648**
GM: Jim Barrett, PE	**GM: Mark Krause, PE**	**GM: Arden Wallum, PE**

Plan Manager: Zoe Rodriguez del Rey, Water Resources Manager, Coachella Valley Water District, (760) 398-2661 ext. 2389, E-mail: ZRodriguezdelRey@cvwd.org

Mission Creek Subbasin Consulting Team

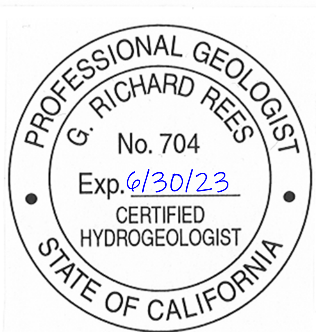
Wood Environment & Infrastructure Solutions, Inc. and Kennedy/Jenks Consultants, Inc. compose the consulting technical team for the Mission Creek Subbasin Alternative Plan Update.

Mission Creek Subbasin Alternative Plan Update
Coachella Valley Water District
Desert Water Agency
Mission Springs Water District

November 23, 2021

This report was prepared by the staff of
Wood Environment & Infrastructure Solutions, Inc.
under the supervision of the Engineer(s) and/or
Geologist(s) whose seal(s) and signature(s) appear hereon.

The findings, recommendations, specifications, or professional opinions are presented within the limits described by the client, in accordance with generally accepted professional engineering and geologic practice. No warranty is expressed or implied.



G. Richard Rees, CA PG 6612, CA CHG 704
Principal Hydrogeologist

David M. Bean, CA PG 5618, CA CHG 606
Principal Hydrogeologist

Kennedy Jenks

This report was prepared by the staff of Kennedy/Jenks Consultants, Inc. under the supervision of the Engineer(s) whose seal(s) and signature(s) appear hereon.

Mission Creek Subbasin Alternative Plan Update

Coachella Valley Water District
Desert Water Agency
Mission Springs Water District

November 23, 2021

The findings, recommendations, specifications, or professional opinions are presented within the limits described by the client, in accordance with generally accepted professional engineering and geologic practice.

Sachiko Itagaki, PE C50221
Principal Engineer

Table of Contents

Volume I

List of Tables

List of Figures

Volume II

List of Appendices

Acronyms, Abbreviations, and Glossary

Acronym	Definition
°F	Degrees Fahrenheit
AD	Assessment District
AF	Acre-Feet
AFY	Acre-Feet per Year
AFY/Ac	Acre-Feet per Year per Acre
Agencies	Coachella Valley Water District (CVWD), the Desert Water Agency (DWA), and the Mission Springs Water District (MSWD)
AOB	Area of Benefit
BCM	Basin Characterization Model
bgs	below ground surface
CDWR	California Department of Water Resources
COCs	Constituents of concern
CRA	Colorado River Aqueduct
CVMSHCP	Coachella Valley Multi-Species Habitat Conservation Plan
CV-SNMP	Salt and Nutrient Management Plan for the Coachella Valley Groundwater Basin
CVWD	Coachella Valley Water District
CWA	Coachella Water Authority
DAC	Disadvantaged Community
DCF	Delta Conveyance Facility
DDW	Division of Drinking Water
DEH	Department of Environmental Health
Delta	Sacramento-San Joaquin River Delta
DHSSB	Desert Hot Springs Subbasin
DHS	Desert Hot Springs
DWA	Desert Water Agency
EQ	Equation
GAMA	Groundwater Ambient Monitoring and Assessment Program
GHB	General Head Boundaries
GHSA	Garnet Hill Subarea
GIS	Geographic Information System

Acronym	Definition
GRF	Groundwater Replenishment Facility
GRP	Groundwater Replenishment Program
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GUI	Graphic User Interface
GWMP	Groundwater Management Planning Act
GWV	GWVistas™ Version 8.03
HFB	Horizontal Flow Barrier
ID-8	Improvement District-8 (in CVWD's service area)
InSAR	Interferometric Synthetic Aperture Radar
IRWM	Integrated Regional Water Management
IWA	Indio Water Authority
IWFM	Integrated Water Flow Model
Kh	Hydraulic conductivity
Kv	Vertical hydraulic conductivity
Kennedy Jenks	Kennedy/Jenks Consultants, Inc.
MC/GH WMP	Mission Creek/Garnet Hill Water Management Plan
MC-GRF	Mission Creek Groundwater Replenishment Facility
MCL	Maximum Contaminant Level
MCSB	Mission Creek Subbasin
MDMWC	Myoma Dunes Mutual Water Company
MFR	Mountain Front Recharge
MGD	Million Gallons per Day
µg/L	Micrograms per Liter
mg/L	Milligrams per liter
MOU	Memorandum of Understanding
msl	Mean sea level
MSWD	Mission Springs Water District
MWD	Metropolitan Water District of Southern California
MWH	MWH Americas, Inc. (now Stantec)
N	Nitrogen

Acronym	Definition
NL	Notification Level
NRMS	Normalized root mean square
NRW	Non-revenue Water
N/TDS	Nitrates/Total Dissolved Solids
PEST	Parameter Estimation
pCi/L	Picocuries per liter
Program	Colorado River Basin Salinity Control Program
PWS	Public Water System
QSA	Quantification Settlement Agreement
RAC	Replenishment Assessment Charge
RCDEH	Riverside County Department of Environmental Health
RCFCWCD	Riverside County Flood Control and Water Conservation District
RUWMP	Regional Urban Water Management Plan
RWRF	Regional Water Reclamation Facility
RWQCB	Colorado River Basin Regional Water Quality Control Board
ROA	Result-Oriented Activities
SCAG	Southern California Association of Governments
SB	Senate Bill
SGMA	Sustainable Groundwater Management Act
SMCLs	Secondary Maximum Contaminant Levels
SNMP	Salt and Nutrient Management Plan
SWP	State Water Project
SWR	Storm Water Resources
SWRCB	State Water Resources Control Board
SWRCB-DDW	State Water Resources Control Board, Division of Drinking Water
Sy	Specific yield
TAZ	Transportation Analysis Zones
TDS	Total Dissolved Solids
UCR-CCB	University of California Riverside-Center for Conservation Biology
USBR	United States Bureau of Reclamation
USEPA	United States Environmental Protection Agency

Acronym	Definition
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VSD	Valley Sanitary District
WMP	Water Management Plan
Wood	Wood Environment & Infrastructure Solutions, Inc.
WWR-GRF	West Whitewater Groundwater Replenishment Facility
WWTP	Wastewater Treatment Plant
WY	Water Year
Yuba Accord	Yuba River Accord Dry Year Water Purchase Program

Executive Summary

Introduction

The Coachella Valley Water District (CVWD), the Desert Water Agency (DWA), and the Mission Springs Water District (MSWD) (collectively the Agencies) form the Management Committee within the Mission Creek Subbasin (MCSB) and Garnet Hill Subarea (GHSA) of the Indio Subbasin in the northern part of the Coachella Valley Groundwater Basin as shown on **Figure ES-1**. The MCSB and GHSA are important to the local communities as groundwater resource areas, and the Agencies are committed to reliably meeting local demands and protecting water quality in a sustainable and cost-effective manner. This MCSB Alternative Plan Update (Alternative Plan Update) has been prepared to meet specific requirements of the Sustainable Groundwater Management Act (SGMA) as it applies to the MCSB. The CVWD and DWA are the Groundwater Sustainability Agencies for the MCSB under SGMA. This Alternative Plan Update is also intended to support water management planning for both the MCSB and the GHSA. SGMA requirements for the GHSA, however, are addressed in the Water Management Plan Update for the Indio Subbasin prepared separately by Todd Groundwater and Woodard & Curran (Todd/W&C, 2021). The consultant teams working in both subbasins have coordinated for groundwater modeling and climate change assumptions.

The foundation for this Alternative Plan Update is the 2013 Mission Creek/Garnet Hill Water Management Plan (MWH, 2013 [2013 MC/GH WMP]) and Bridge Document (Stantec, 2016 [2016 Bridge Document]). Together, those documents met the requirements to be considered an alternative to a groundwater sustainability plan (GSP) (Alternative Plan) under the SGMA. In 2019, the California Department of Water Resources (CDWR) approved the Alternative Plan, finding it functionally equivalent to a GSP. The MCSB is distinctive in that only nine subbasins throughout the State have an approved Alternative Plan. The first 5-year update to the Alternative Plan is due for submittal to CDWR on January 1, 2022.

The Agencies have prepared this Alternative Plan Update to:

- Ensure that the most current projections for population growth, land use, imported water supply, and other future conditions are incorporated into water management planning for the region.
- Update the groundwater flow model for the Planning Area for use as a tool in evaluating potential groundwater management actions.
- Review historical information along with current and projected future environmental and demographic conditions to define undesirable results and develop objectives and thresholds to maintain groundwater sustainability.
- Provide an analysis of future projected groundwater demand based on population growth and other factors and estimate future projected supplies for groundwater replenishment to use in forecasting future groundwater production and supplies.

- Develop scenarios for forecasting groundwater conditions based on future demands and supplies assuming future hydrologic conditions are drier than the long-term historical average (climate change assumptions) and assuming continuation of long-term average hydrologic conditions as a baseline and compare forecasted groundwater conditions to sustainability criteria.
- Address specific actions recommended in the CDWR's 2019 SGMA Alternative Assessment Staff Report and Statement of Findings.

Water Management Background

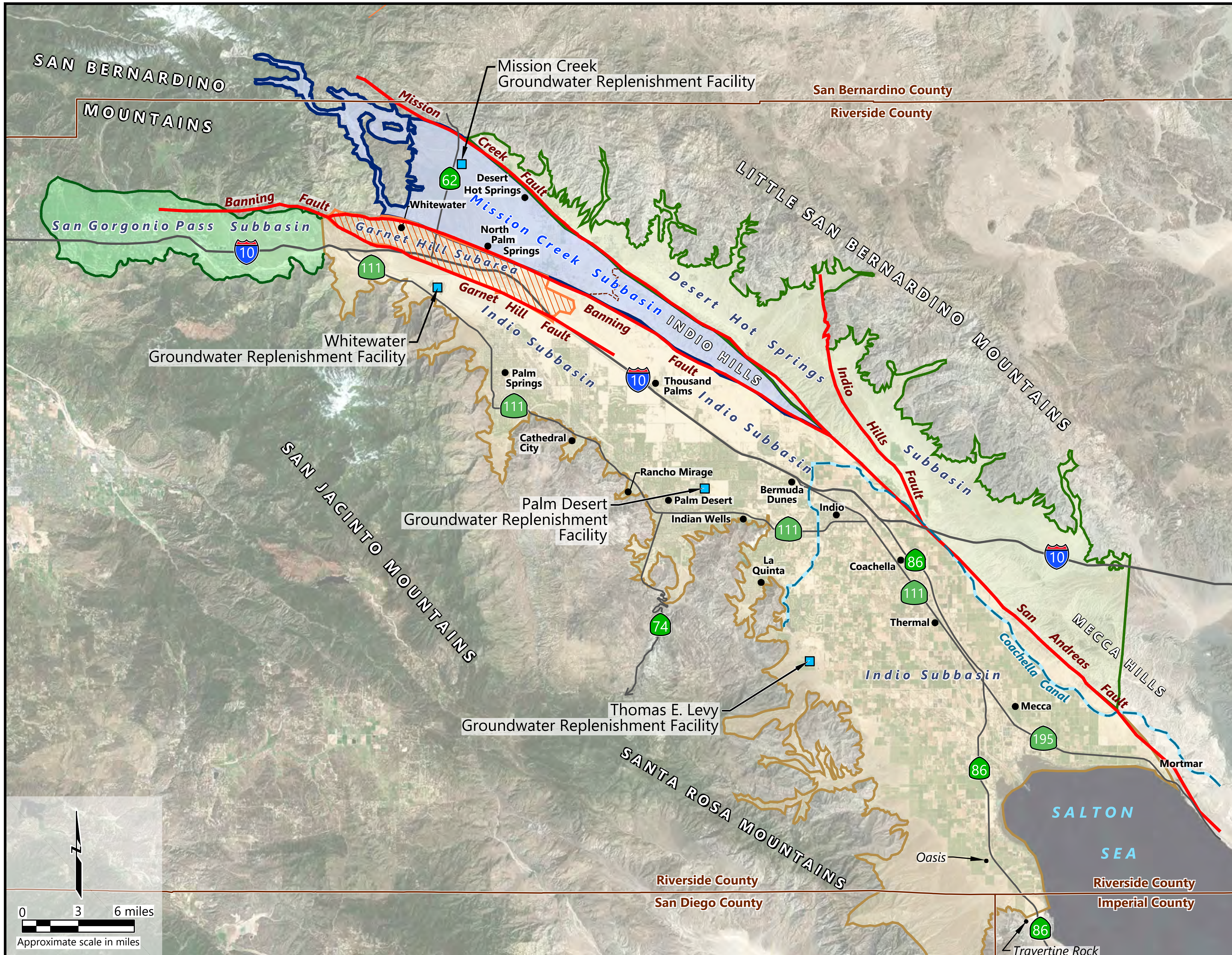
Declining water levels in the MCSB triggered discussions between MSWD, CVWD, and DWA as early as 1984 regarding the need to recharge imported water to replenish groundwater in the MCSB. To control the water level decline, the CVWD and DWA, with a resolution of support from MSWD, embarked on a MCSB groundwater replenishment program in 2002 by constructing the Mission Creek Groundwater Replenishment Facility (MC-GRF) for recharge of imported water. The MC-GRF received the first replenishment water in late 2002. Cooperative management of groundwater replenishment in the MCSB was initiated on April 8, 2003, when CVWD and DWA entered into the Mission Creek Groundwater Replenishment Agreement. This agreement was updated and replaced by the 2014 Mission Creek Water Management Agreement.

In December 2004, MSWD, DWA, and CVWD reached an agreement to settle litigation regarding water rights and groundwater basin adjudication. The 2004 Settlement Agreement stated that the Agencies would jointly prepare plans for the management of the MCSB and GHSA. The MCSB Management Committee was formed as a result of the 2004 Settlement Agreement to exchange information, express ideas, and discuss the management of water resources in the MCSB, GHSA, and Indio Subbasin. A Memorandum of Understanding (MOU) among CVWD, DWA, and MSWD was executed on July 27, 2009, to prepare the 2013 MC/GH WMP and develop a groundwater model of the MCSB and GHSA. The 2013 MC/GH WMP was prepared for the MCSB and GHSA as required by the 2004 Settlement Agreement to address the water management needs of these areas.

Planning Area

Overview of Planning Area

Figure ES-2 presents the Planning Area with the boundaries of the MCSB, GHSA of the Indio Subbasin, DHSSB, the main Indio Subbasin and the boundaries of the Agencies in the Planning Area, including the CVWD, DWA and MSWD. The Planning Area contains the City of Desert Hot Springs, and small portions of the cities of Palm Springs, Cathedral City, and Indio. The water retailers for the Planning Area include CVWD and MSWD. DWA does not have any retail service area within the Planning Area.



Explanation

- Mission Creek Subbasin
- Desert Hot Springs Subbasin
- San Gorgonio Pass Subbasin
- Indio Subbasin
- Garnet Hill Subarea of Indio Subbasin
- Fault
- Indio Hills boundary
- Coachella Canal

Basemap modified from an undated drawing by Krieger & Stewart Engineering, subbasin boundaries from "Mission Creek and Garnet Hill Subbasins Water Management Plan Final Report", January 2013, and an aerial photo from Esri World Imagery- Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, dated 10-15-2017.

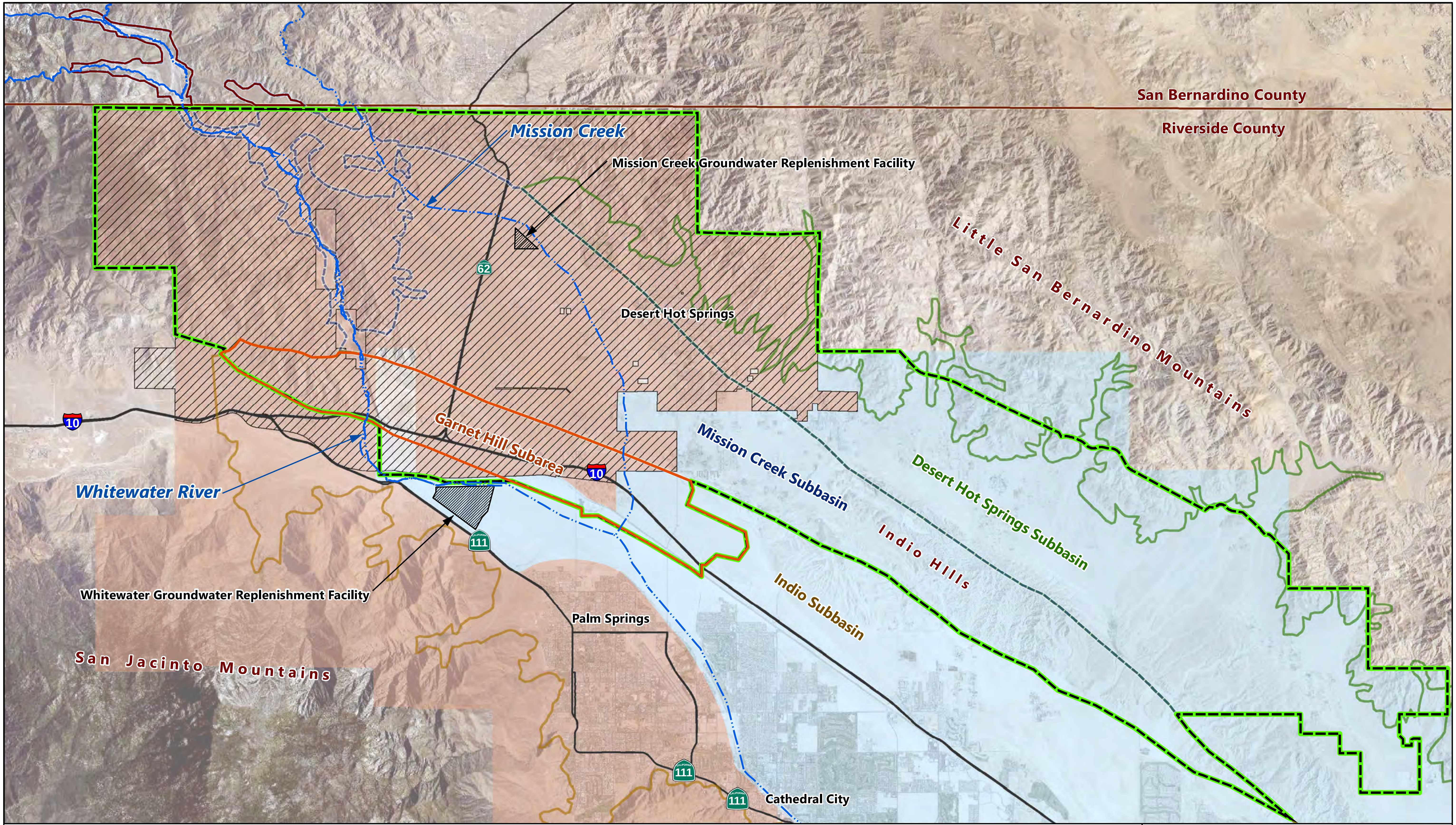
Note:

All locations are approximate.

COACHELLA VALLEY GROUNDWATER BASIN
SUBBASINS and GARNET HILL SUBAREA
Mission Creek Subbasin Alternate Update
Coachella Valley, California

By: jrw	Date: 9/30/2021	Project No. CM19167351
wood.		Figure ES-1

Plot Date: 10/18/2021 3:44:31 PM, Plotted by: pat.herring
Drawing Path: Y:\CM19167351 (MISSION CREEK ALTERNATE)\ESRI\ALTERNATIVE UPDATE\ACAD\1-1_CV BASIN-SUBBASINS_V2.DWG, Subbasins



Explanation

- Facility
- Planning Area
- Streams
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet HIll Subarea of Indio Subbasin
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin
- Coachella Valley Water District (CVWD)
- Desert Water Agency (DWA)
- Mission Springs Water District (MSWD)

0 6,000 12,000
Approximate Scale in Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

PLANNING AREA AND WATER AGENCY AREAS
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: pah	Date: 9/8/2021	Project No.: CM19167351
wood.	Figure	ES-2

Date: 10/13/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update\1-3_Water_Agencies.mxd

Land Use

Land use within the Planning Area is based on the Riverside County General Plan (Riverside County, 2019), which was verified with the Western Coachella Valley Area Plan and the City of Desert Hot Springs General Plan. Single family residential land use predominates within the Planning Area, with some areas of higher density multi-family and mobile home park residential use. Some industrial and commercial land use areas support residential uses. Other areas within the Planning Area are unlikely to require water because they are owned by the federal government, too rugged for development, or located within established conservation areas. These areas include the Whitewater River channel area, upper reaches of the Mission Creek channel area, San Bernardino Mountains, Little San Bernardino Mountains, and much of the Indio Hills.

Environmental Factors

The Planning Area includes significant environmental resources that are in established conservation areas or are on federal lands that can limit development and water usage. Within the Planning Area, the Coachella Valley Multi-Species Habitat Conservation Plan (CVMSHCP) designates about 95,600 acres of land within 14 conservation areas while there are almost 65,000 acres of federal land in national forest or under management by the Bureau of Land Management.

Groundwater-Dependent Ecosystems

The CVMSHCP identified one known groundwater dependent ecosystem (natural community) called mesquite hummocks and four potential groundwater dependent ecosystems in the MCSB (CVAG, 2016). Mesquite hummocks were historically found throughout the Coachella Valley (CVAG, 2016). Most are present along the Banning and San Andreas Faults where groundwater levels historically have been within about 50 feet of the ground surface. Mesquite hummocks are found within sand dunes at the Willow Hole Conservation Area in the MCSB and in seven other CVMSHCP Conservation Areas outside of the MCSB. The extent and health of the mesquite hummocks have declined in recent years. Preliminary studies have been conducted to identify the potential causes of these declines (UCR-CCB, 2020). These factors included presence of non-native athel tamarisks (salt cedar) that cause lower groundwater levels through transpiration of large quantities of groundwater (evaporative pumping), insect damage, below average precipitation, fire, and off-road vehicle use. Regional groundwater levels have increased in the southern part of the subbasin following active management and groundwater recharge efforts that began in 2002. The health of the mesquite hummocks and groundwater levels will continue to be monitored as part of the CVMSHCP Monitoring and Management Program.

Other potential groundwater dependent ecosystems in the MCSB identified in the review included Sonoran cottonwood-willow riparian forest, southern sycamore-alder riparian woodland, desert fan palm oasis woodland, and desert dry wash woodland. Although each of these communities may potentially be groundwater dependent, they are located in areas where regional groundwater is too deep (more than 100 feet deep) for the community to be dependent (desert dry wash woodland community in the Mission Creek channel wash for example), or in areas of geographic or hydrogeologic isolation from the main MCSB (southern fan palm oasis woodland communities in the southern Indio Hills and Sonoran cottonwood-willow riparian forest in the upper Whitewater River channel for example).

Demand Projections

Reliable estimates of future water needs are required for regional water planning. Routine revision and refinement of water demand projections for the region are necessary due to the wide range of variables influencing future water demand. These include changes to economic trends, population, employment, seasonality, environmental needs, water conservation efforts, regulations, and land use. These factors can rapidly change the demographics of a region and corresponding water demands.

As shown on **Figure ES-3**, the 2016 Southern California Association of Governments (SCAG) projections indicate a population increase in the Planning Area from 47,883 persons in 2016 to 88,310 persons in 2045 (SCAG, 2020), which is an 84% increase or an average annual growth rate of 2.1%. These population projections estimate roughly 20,000 fewer people by the year 2045 than previously estimated in the 2013 MC/GH WMP (shown by the dashed blue line in **Figure ES-3**).

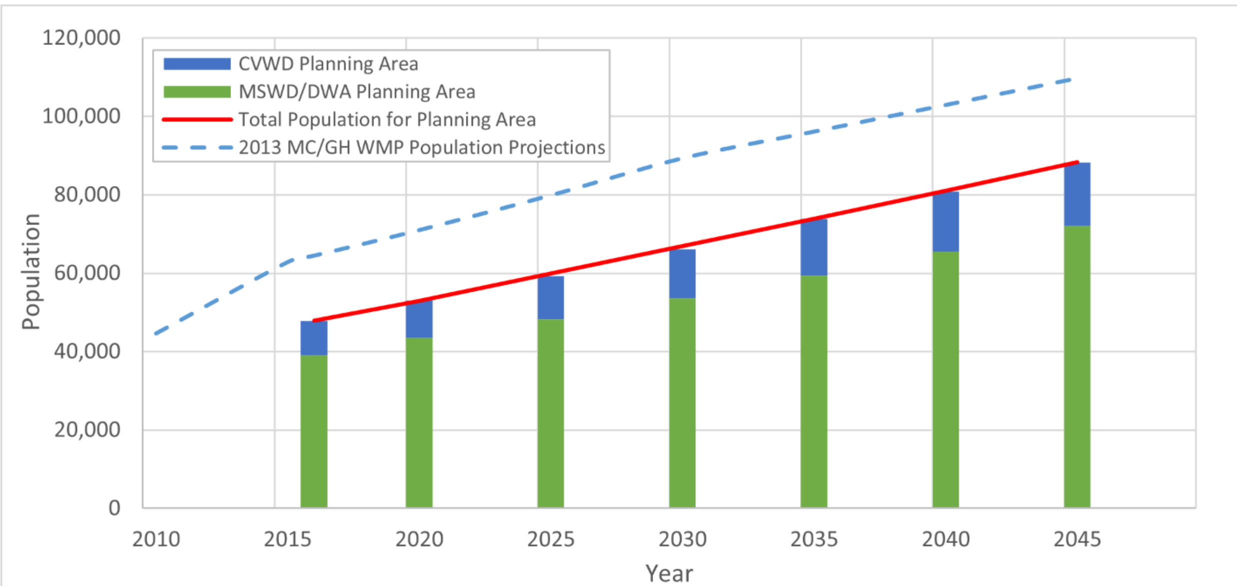


Figure ES-3: Population Projections from 2010 to 2045

The demand projections include analysis of historical water demands, future population growth forecasts, and future indoor water use savings from typical water fixture replacements (passive conservation). This analysis was used to estimate future demands as follows:

- **Historical water demands** were based on three types of available data including municipal meter data, private well meter data, and estimates of unmetered private groundwater wells.
- **Estimated future water demands** refer to the amount of water needed to be pumped to meet customer demand and account for municipal and private water demands, system water losses, and ongoing water conservation efforts. Future water demands are estimated using historical water demand, land use, and population projections, and are

forecast over a 25-year planning period, from 2020 through the planning horizon in year 2045.

The resulting analysis estimates that future municipal and private water demands in the Planning Area will increase from 15,123 acre feet per year (AFY) in 2020 to 20,792 AFY in 2045, an increase of 5,669 AFY or approximately 37%. **Figure ES-4** shows the projected increase in total demand for the Planning Area.

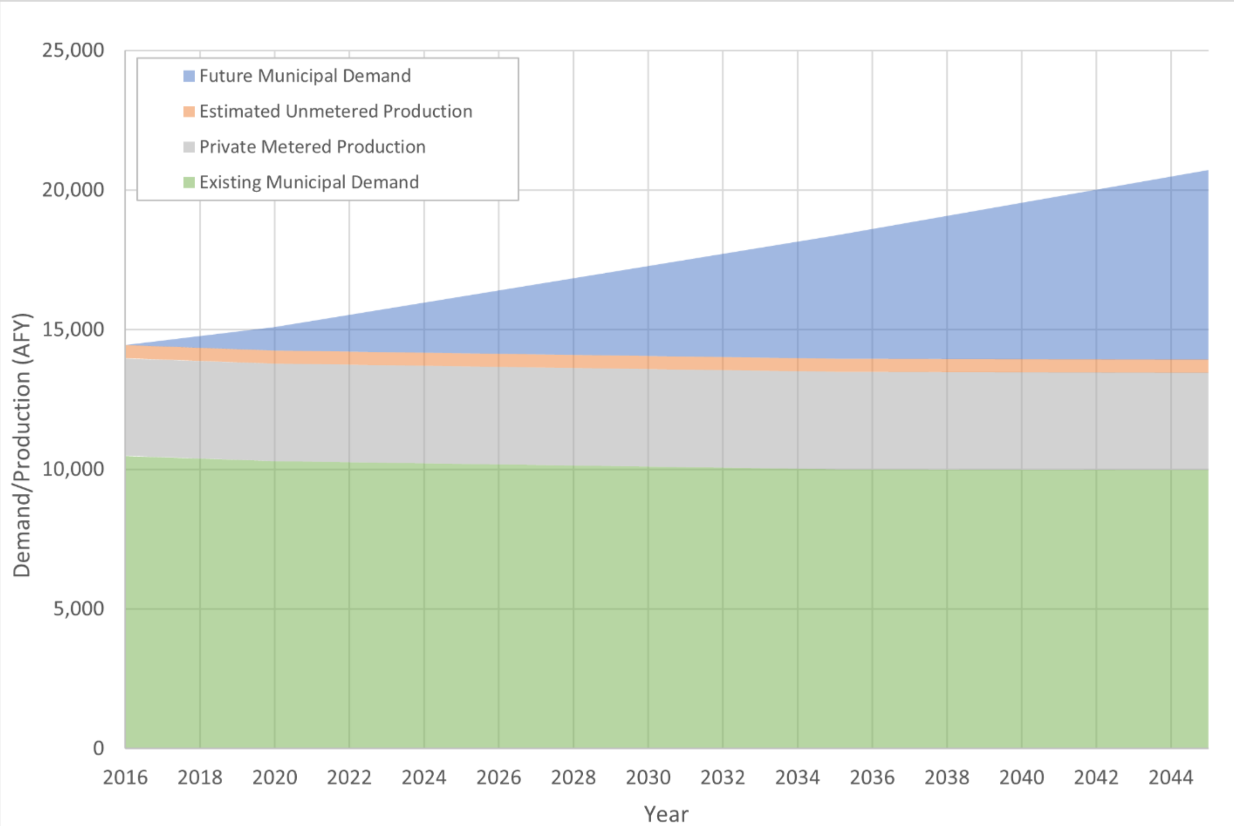


Figure ES-4: Total Demand Projections for the Planning Area

Overview of Water Resources

Section 4 describes the various water resources utilized within the MCSB, GHSA, and DHSSB including surface water (precipitation and streamflow), imported water, wastewater treatment and disposal, and return flow from groundwater uses. Each water resource component is summarized below.

Surface Water

Surface water in the MCSB, GHSA, and DHSSB includes precipitation and streamflow in addition to runoff from several drainage areas within the Subbasin. Average annual precipitation in the Planning Area is about 5.2 inches. The streamflow in Mission Creek, the only stream with a consistent flow and a stream gauge in the main MCSB, has an average annual runoff of 1,818 acre-feet per year. The upper reaches of the Whitewater River are also located in MCSB but in an area that is geographically and hydraulically isolated from the main MCSB where groundwater production occurs. The upper reaches of the Whitewater River consist primarily of government-owned land. Ten other watersheds in the San Bernardino and Little San Bernardino Mountains that drain into the Planning Area also contribute runoff to the MCSB in the form of mountain front recharge.

Imported Water

In addition to natural replenishment from precipitation and stream flow, the MCSB receives artificial replenishment of imported water. CVWD and DWA each have a Water Supply Contract for State Water Project (SWP) water with a combined Table A Amount of 194,100 AFY (including 94,100 AFY of SWP Table A water and an additional 100,000 of SWP Exchange water described below). There are no physical facilities to deliver SWP water to the Coachella Valley. Instead, CVWD and DWA entered into separate agreements with Metropolitan Water District of Southern California (MWD), under which CVWD and DWA transfer their SWP water to MWD as SWP Exchange water, and in turn receive imported water through the MCSB turnout of MWD's Colorado River Aqueduct (CRA). In addition to the SWP Table A contracts, CVWD and DWA have entered into other agreements for water transfers/exchanges (e.g., Yuba Accord, Article 21, and Lake Perris Dam Seepage Recovery Project). CVWD and DWA have also engaged in agreements to increase the reliability of SWP supplies including the Delta Conveyance Facility (DCF) and Sites Reservoir Project.

SWP Table A deliveries vary based on a number of factors and have ranged from 5% to 100% of the SWP Table A allocation over the last 20 years. Assumed future SWP Table A final allocations were based on the 2019 SWP Delivery Capability Report (CDWR, 2020a). Although this report estimated delivery reliability of 58% declining to 52% by 2040 based on the long-term average, this Alternative Plan Update recognizes the significant potential reduction in reliability associated with climate change and Delta export litigation and instead assumes 45% reliability through the planning horizon. Future SWP deliveries are expected to increase as new projects are in planning to improve SWP reliability and increase deliveries as described above. In addition, urban growth and associated water demand in the MCSB will result in slightly more SWP Exchange water being delivered to MCSB than the Indio Subbasin based on agreements to proportion the SWP Exchange water (estimated to increase from approximately 8% of the total SWP Table A amount in 2020 to approximately 10% of the total SWP Table A amount in 2045). Combining these factors, the assumed future imported water delivered to the MC-GRF is estimated to increase from an average of 7,143 AFY in 2020 to 12,536 AFY in 2045.

Wastewater/Recycled Water

The Planning Area includes areas connected to the MSWD wastewater treatment system through sewer connections (sewered areas) and areas on septic systems (unsewered areas). MSWD plans to continue to convert these unsewered areas onto the municipal wastewater collection and treatment system, with these conversions expected to be complete by 2035. The municipal wastewater from sewered parts of the MCSB and DHSSB is treated and disposed in the MCSB through evaporation/percolation ponds at the MSWD Horton and Desert Crest Wastewater Treatment Plants (WWTPs). MSWD is also constructing the Regional Water

Reclamation Facility (RWRF) in the GHSA. Construction is scheduled to begin at the end of 2021. Currently there is no recycled water produced or used in the MCSB; however, there are plans to do so once MSWD constructs new treatment processes and distribution mains. MSWD plans to add tertiary treatment facilities at the RWRF with off-site spreading facilities, as well as tertiary treatment and on-site recharge via existing spreading basins at the existing Horton WWTP.

Groundwater

Groundwater is the only current source of water used for municipal supply and for private pumpers in the Planning Area and most of the groundwater produced and used in the Planning Area is pumped from the MCSB. Groundwater production in the MCSB increased from approximately 4,580 AFY in 1979 and peaked at approximately 17,010 AFY in 2006. Groundwater production in the MCSB has declined since 2006 with total production below 14,000 AFY in 2015, 2016, and 2019. The declines are attributed primarily to conservation efforts. Approximately 90% of metered groundwater production in the MCSB is for urban water use (urban use is comprised of municipal and recreational - including golf course irrigation). The remaining approximately 10% of metered groundwater production is for agricultural or industrial purposes.

In the CDWR Statement of Findings, the CDWR requested evaluation of potential groundwater use in the Indio Hills. A review of existing groundwater wells was conducted. No groundwater wells were found in the Indio Hills. Land use in the Indio Hills, as identified through review of aerial photographs, suggests that any groundwater production from the Indio Hills for domestic purposes is limited based on the limited number of structures present. In addition, the demand analyses included a review of developable parcels to assess where future demand would occur. The findings indicated that much of the Indio Hills in the MCSB is unavailable for development because of land set aside for conservation or because the land is too rugged and steep for development.

Groundwater Levels in the MCSB

Groundwater levels in the MCSB began to decline prior to the 1970s with increasing groundwater production. In the 1990s, the Agencies recognized that continued lowering of groundwater levels in the MCSB was not sustainable and, if continued, could have undesirable results ranging from increased energy costs for groundwater pumping to the need to deepen existing private and public wells. As a result, DWA and CVWD developed and implemented plans to recharge imported water into the MCSB. Groundwater levels in the MCSB began to increase after an imported water recharge program began in 2002 at the MC-GRF. **Figure ES-5** shows groundwater recharge to the MC-GRF and groundwater level response. From 2002 through 2019, a total of 165,276 AF was delivered to the MC-GRF for direct replenishment. The average recharge for this period was approximately 9,180 AFY with recharge volumes ranging from 0 to 33,210 AFY. This figure shows the positive impact of groundwater recharge on reversing the downward trend and the eventual stabilization of groundwater levels above 2009 levels.

Groundwater Quality

Water quality from municipal water supply well data are summarized for selected parameters considered potential constituents of concern based on current or historical concentrations exceeding SWRCB primary California drinking water standards or Maximum Contaminant Levels (MCLs) for drinking water in the larger Coachella Valley Groundwater Basin. These constituents include arsenic, fluoride, uranium, and nitrate. Hexavalent chromium was also included in the review because the SWRCB is in the process of evaluating the economic feasibility of setting an MCL for hexavalent chromium.

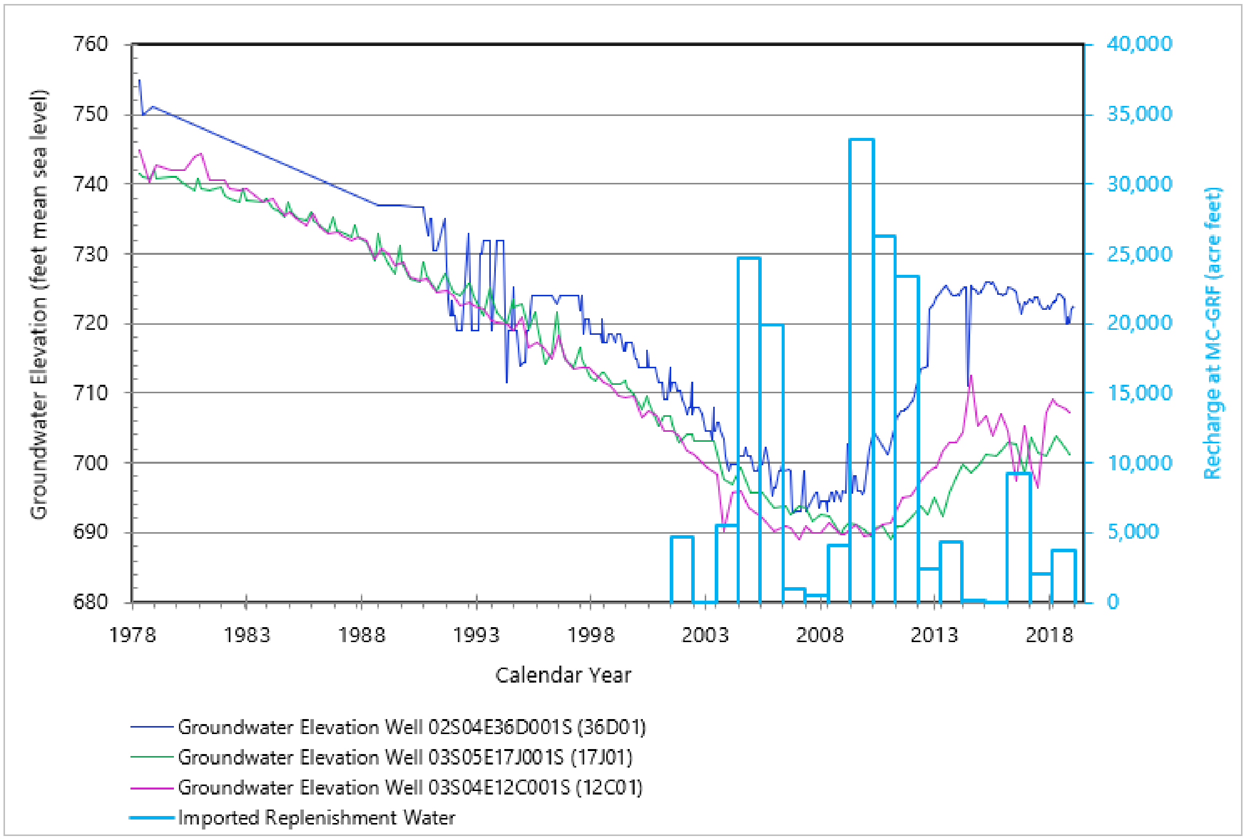


Figure ES-5: Hydrographs of Wells with Groundwater Replenishment at the MC-GRF

Of the water supply wells with available data for review, uranium activity was the only constituent of concern that has historically exceeded its primary MCL of 20 picocuries per liter (pCi/L). The two wells that historically exceeded the MCL for uranium activity are in the northwestern part of the MCSB and the elevated uranium activity in this area is attributed to the natural occurrence of uranium in sediments deposited in a limited area based on geomorphology. One well was removed from operation due to uranium activity. Based on the available data for drinking water supply wells, from 2015 through 2020, no wells exceeded the MCL for uranium activity. During this time, wells with elevated uranium activity showed a downward trend in the activity, potentially due to the influence of groundwater recharge activities at the MC-GRF.

Total dissolved solids (TDS) were also considered a constituent of concern in groundwater because they have been increasing in the MCSB over time due to groundwater use and return flow, fertilizer use, wastewater percolation, and recharge of higher TDS imported water. TDS are a measure of the combined amount of inorganic salts dissolved in water. No fixed Consumer Acceptance Contaminant Level has been established for TDS. Instead, TDS is regulated by Secondary Maximum Contaminant Levels (SMCLs) or Consumer Acceptance Contaminant Level Ranges for TDS, set by the SWRCB: a recommended 500 milligrams per liter (mg/L) level, an upper 1,000 mg/L level, and a short-term 1,500 mg/L limit. While primary MCLs are health-based standards, SMCLs, such as those for TDS, are based on aesthetic concerns (e.g., taste, color, and odor). For the data evaluated in the Planning Area, four water supply wells have had TDS concentrations between the recommended level and upper level of the SMCL and none have exceeded the upper level. TDS is being evaluated on a regional scale as part of the Coachella Valley Salt and Nutrient Management Plan (CV-SNMP) described in Section 6.

As noted in the 2013 MC/GH WMP, CRA water used for recharge in the MCSB generally has higher TDS concentrations than local groundwater. Use of CRA water involves salt loading to the MCSB and local increases in TDS concentrations. CVWD and DWA have investigated alternatives including direct importation and recharge of lower TDS SWP water at the MC-GRF. Direct importation of SWP, however, would require extensive construction for a conveyance pipeline from western Riverside County. The project would involve significant cost, technical constraints, environmental constraints/impacts, and would result in only limited benefits. In addition, direct importation of SWP water would most likely result in the loss of approximately 100,000 AFY of CRA water that results from the exchange of SWP water for CRA water from MWD. Another alternative considered involves salt removal prior to recharge using reverse osmosis. This alternative has its own constraints including permitting, environmental, technical, and financial feasibility issues.

Groundwater Modeling

A three-dimensional groundwater flow model was developed to evaluate existing groundwater conditions in the MCSB and to develop forecast scenarios for future water conditions. The model is an update to previous groundwater modeling efforts developed between 1974 and 2013. These models were developed by the United States Geological Survey (USGS) and other parties to evaluate and quantify hydrogeologic conditions in the MCSB and surrounding area including consideration of natural mountain front and precipitation recharge, artificial recharge, return flows from water uses in the area. The model developed by PSOMAS (2013) was used as the primary basis for the groundwater model update for this Alternative Plan Update. The updated model (MCSB Model) incorporates all the planned objectives for updating and improving the existing model, including:

- Expanding the previous model domain to include the DHSSB and expanding the model to include the Indio Hills.
- Extending the model simulation period from 1936 through 2009 to 1936 through 2019.
- Incorporating more robust estimates of the role that mountain front recharge plays in the hydrogeology of the area.

- Recalibrating the updated model to available groundwater elevation observations.
- Evaluating the inter-subbasin underflows across faults.
- Coordinating with the Indio Subbasin modeling team regarding the amount of underflow across the Banning Fault and Garnet Hill Fault.

The main Indio Subbasin (southwest of the Garnet Hill Fault separating the GHSA from the main Indio Subbasin) was intentionally not included in this modeling effort, because it is being modeled for the Indio Subbasin Water Management Plan Update (Indio Subbasin 1997-2019 model). The MCSB Model was made consistent with the 1997-2019 Indio Subbasin model by adopting the Indio Subbasin hydraulic properties in the GHSA (the area in which the two models overlap) and the simulated underflow across the Garnet Hill Fault from the GHSA to the main Indio Subbasin.

The MCSB Model was calibrated for the period 1936 through 2019. It was calibrated to 7,128 groundwater elevations in 58 wells and simulated underflow between subbasins. Calibration results indicate that the model meets industry standards for calibration.

The MCSB Model was used to simulate groundwater elevations and to estimate general inflows and outflows for various subareas of the active model domain. These inflows and outflows were used to approximate the water balances for the MCSB, DHSSB, and GHSA. Review of the water balances illustrates the role the natural recharge has on groundwater storage in each of the subbasins/subareas and the importance of recharge of imported water in the MCSB, especially during times of below average precipitation.

The MCSB Model was also used to evaluate underflow from the DHSSB to the MCSB to address CDWR's Statement of Findings request to, "provide reasoning and evidence for the expectation that maintaining groundwater levels above 2009 is expected to reduce water quality impacts of higher TDS groundwater flowing into the MCSB from the DHSSB." The conclusions of this evaluation were that: 1) MC-GRF recharge and other management actions are expected to maintain average MCSB groundwater levels at or above historical low conditions (2009 conditions), 2) maintaining these MCSB groundwater levels through recharge at the MC-GRF will not result in appreciably greater groundwater underflows (~ 100 AFY) across the fault than occurred under pre-2009 groundwater level conditions, and 3) the Mission Creek Fault underflow is only a small component of inflow to the MCSB and any modest increase in groundwater underflow due to groundwater level differences across the fault is only a fraction of the total natural recharge. Therefore, no significant and unreasonable groundwater quality impacts due to underflow from the DHSSB to the MCSB are anticipated with groundwater levels in the MCSB maintained at or above 2009 groundwater levels.

Sustainability Criteria

The Alternative Plan Update has incorporated SGMA Sustainable Management Criteria to guide water resources management in the main MCSB. Sustainable Management Criteria for the MCSB were developed based on available information developed for the Hydrogeologic Conceptual Model (HCM), the characterization of groundwater conditions, the groundwater balance, discussion with the Agencies, and feedback solicited from the public.

Four Sustainability Indicators relevant to the MCSB based on historical or current conditions include:

- **Chronic lowering of groundwater levels** – Historically, groundwater levels declined by up to approximately 60 feet in the MCSB between 1970 and 2009.
- **Reduction of groundwater storage** – As described in Section 4, groundwater storage in the MCSB was reduced as a result of declining groundwater levels between 1970 and 2009.
- **Degraded water quality** - As described in Section 4.6, naturally occurring uranium activity is the only historical constituent of concern that exceeded drinking water regulatory thresholds. Uranium has not exceeded regulatory thresholds in any drinking water supply well in the MCSB in the past five years. Total dissolved solids (TDS) concentrations in groundwater have been increasing in the subbasin over time due to groundwater use and return flow, fertilizer use, wastewater percolation, and recharge of higher TDS imported water. TDS will be evaluated regionally for the CV-SNMP. Nitrate concentrations are well below MCL in the MCSB; however, nitrate is considered a constituent of concern because concentrations have the potential to increase over time due to fertilizer use and wastewater percolation in the MCSB.
- **Land subsidence** – No evidence of subsidence in the MCSB has been documented. The subbasin is an alluvial basin with some fine-grained sediments at depth. Therefore, the potential for subsidence cannot be eliminated without gathering additional information.

In the MCSB, there is sufficient evidence to eliminate **depletion of interconnected surface waters** and **seawater intrusion** from further consideration.

Nine Representative Monitoring Sites (referred to as Key Wells in this document) were selected based on available water level history and spatial coverage in MCSB and will be used for comparison of actual MCSB groundwater conditions with the MCSB Sustainable Management Criteria for the three Sustainability Indicators directly related to groundwater levels (lowering of groundwater levels, reduction in groundwater storage, and land subsidence). Wells used in the assessment of potential degraded water quality for the constituents of concern uranium and nitrate will be based on the available data but are expected to include most of the Key Wells.

Table ES-1 provides a summary of the Sustainable Management Criteria for each of the four relevant Sustainability Indicators. The table includes a description of the Minimum Thresholds and Measurable Objectives. **Table ES-1** also includes a description of the conditions that will result in an undesirable result based on the measurements for each sustainability criteria.

Table ES-1: Sustainable Management Criteria Summary

Sustainability Indicator	Minimum Thresholds	Measurement	Measurable Objectives	Undesirable Result
Chronic lowering of groundwater levels	Set to one standard deviation of water levels in the well between 2002 and 2019 below the known or estimated 2009 water level of the well	Measured through nine Key Wells (see **Table 6-4**) spatially distributed throughout the main MCSB	Set to 2009 groundwater elevations	Four Key Wells (~45%) each exceed their Minimum Threshold for three consecutive years
Reduction in groundwater storage	Set at the storage volume represented by the Average Minimum Threshold for groundwater levels in the nine Key Wells. (i.e., the average of the Minimum Thresholds in all nine Key Wells is 692 feet msl).	Comparison of average annual groundwater levels in Key Wells with the average of Key Well water level Minimum Thresholds (692 feet msl)	Set to 2009 subbasin groundwater storage	The average groundwater level in the Key Wells falls below the average Minimum Threshold for three consecutive years
Subsidence	To be evaluated based on results of USGS study (see Section 6.5)	To be evaluated based on results of USGS study. In the interim, review CDWR ground level vertical displacement data and use the groundwater minimum thresholds as a proxy for subsidence potential	To be evaluated based on USGS study (see Section 6.5)	To be evaluated based on USGS Study (see Section 6.5)
Degraded groundwater quality	For constituents of concern (COC) currently only nitrate and naturally occurring uranium, the Minimum Threshold will be no exceedances of California MCLs for drinking water. Exceedances only apply to drinking water supply wells that regularly test for the parameters. A minimum Threshold for TDS will be determined based on the findings of the CV-SNMP Update (in progress, see Section 6.6).	Groundwater quality data provided by the Agencies and downloaded annually from state and local sources	Same as the Minimum Threshold	For the COCs identified, the concentration/activity of the constituent shall not exceed the MCL. If there is an exceedance, the exceedance will be investigated. Undesirable results for TDS will be determined based on the findings of the CV-SNMP Update (in progress, see Section 6.6).

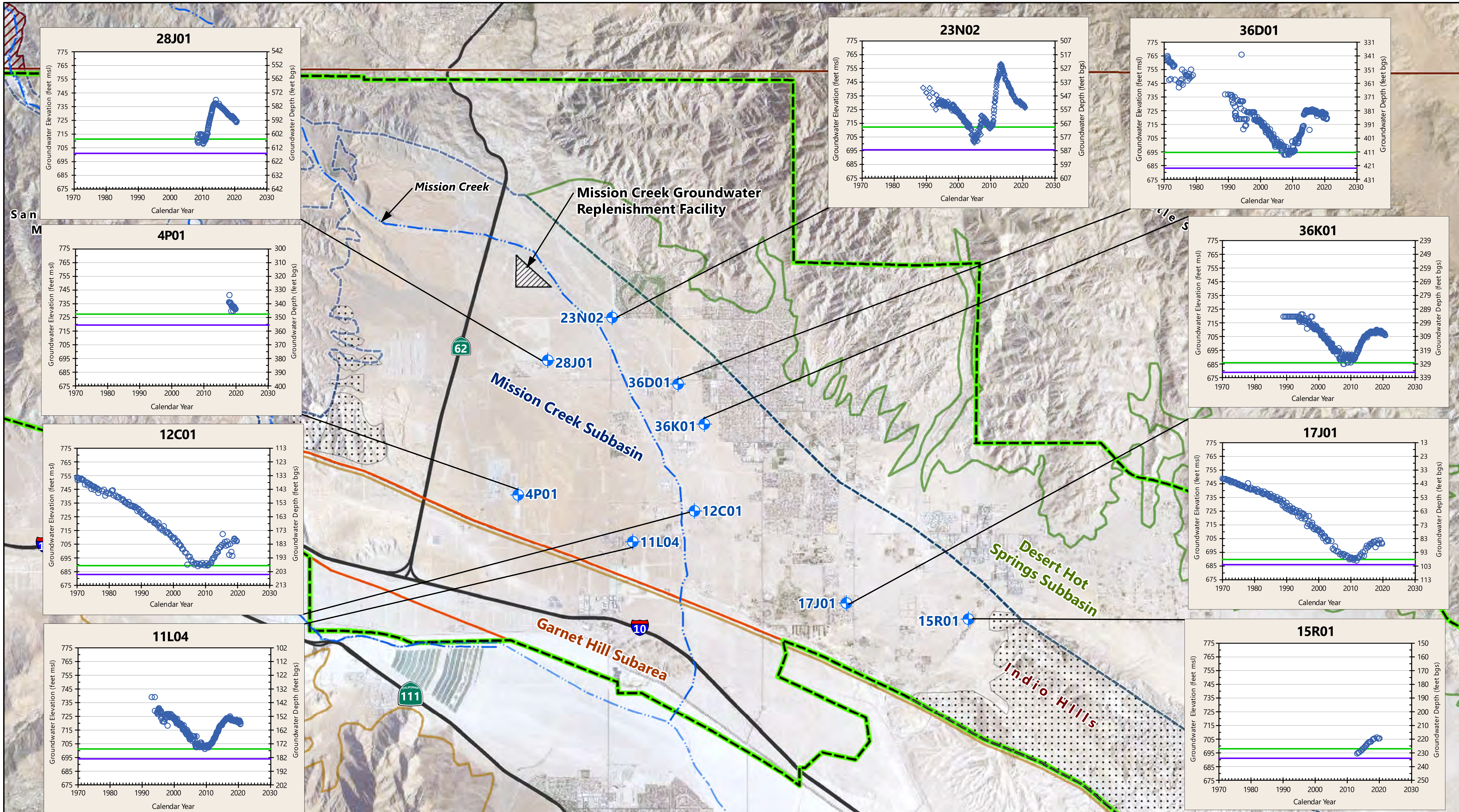
Two sustainability criteria are subject to additional information that is currently being developed. As described in Section 6.5, the potential for land subsidence in the MCSB is being reviewed by the USGS and may result in monitoring of ground surface elevations. The results of this evaluation are not expected until 2025. In the meantime, groundwater levels will be considered as a proxy indicator of the potential for subsidence and CDWR ground level monitoring data (Interferometric Synthetic Aperture Radar data) will be evaluated annually as part of the SGMA Annual Report.

As described in Section 6.6 and as suggested by CDWR Staff, the Agencies are working toward a Colorado River Basin Regional Water Quality Control Board (RWQCB)-approved Coachella Valley Salt and Nutrient Management Plan (CV-SNMP) to address basin-wide management of salts and nutrients. The objective of the CV-SNMP is to sustainably manage salt and nutrient loading in the Coachella Valley Groundwater Basin in a manner that protects its beneficial uses. When completed, the updates to the existing CV-SNMP described in the CV-SNMP Development Workplan approved by the RWQCB on October 4. 2021 will effectively provide the basis for groundwater quality Sustainable Management Criteria for TDS in the MCSB. Based on the Workplan schedule, the Sustainable Management Criteria for TDS will likely be established as part of the next Alternative Plan Update scheduled for completion by January 1, 2027.

Figure ES-6 shows the nine Key Well locations along with hydrographs of groundwater levels and the Minimum Threshold and Measurable Objective for each Key Well. The Measurable Objectives were based on the 2013 MC-GH WMP stated objective to maintain average groundwater water levels in the MCSB above 2009 levels. Minimum Thresholds were based on setting a threshold slightly below the known or estimated 2009 groundwater levels to allow for operational flexibility. Having a slightly lower threshold for groundwater levels is also consistent with the objective of maintaining the average groundwater level at or above 2009 levels. The Minimum Thresholds were based on each Key Well's recent historical groundwater fluctuations (2002 to 2019) to account for the well's specific groundwater level variability. The Minimum Thresholds were then reviewed for potential impacts to known public and private production wells. The findings of this review indicated no impacts to existing production wells where well construction information was available. Minimum Thresholds ranged from as little as 2.5 feet lower that the Measurable Objective to as much as 16 feet below the Measurable Objective. The well with the highest variability is the well closest to the MC-GRF and the variability results from the episodic nature of groundwater recharge at this facility.

Reduction in groundwater storage will be measured using groundwater levels in the nine Key Wells. These wells are spatially distributed in the main MCSB subbasin where groundwater production occurs. Groundwater storage will be compared to 2009 groundwater storage levels by comparing the average groundwater level of all the Key Wells with the average groundwater level for these wells in 2009 (actual levels or estimated levels using the groundwater model).

Comparing the hydrographs in **Figure ES-6** with the Measurable Objectives shows that all the Key Wells have been above their respective Measurable Objectives (2009 groundwater levels) for more than a decade and the Agencies are successfully managing groundwater resources in the MCSB sustainably.



Explanation

- Monitoring well (Key Well)
- Groundwater Replenishment Facility
- Planning Area
- Streams
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet Hill Subarea of Indio Subbasin
- Low permeability/non-water bearing sediments/bedrock
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin
- Groundwater elevation/depth
- Measurable objective
- Minimum threshold
- bgs Below ground surface
- msl Mean sea level

0 4,000 8,000
Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

KEY WELLS WITH MINIMUM THRESHOLDS AND MEASURABLE OBJECTIVES
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: pah/jrw | Date: 9/8/2021 | Project No.: CM19167351

wood.

Figure ES-6

Date: 9/8/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternative)\Esri\Alternative Update\6-4_Key_Well_Min_Mon.mxd

Water Management Forecasting

To conduct evaluation of alternative water management scenarios, a 50-year MCSB forecast model was developed using the water demand forecast provided in Section 3, the imported water forecast provided in Section 4.2, and plans for recycled water use described in Section 4.3. The model also incorporated information and scenario assumptions developed during discussions with the Agencies and public input.

The objective of the 50-year MCSB forecast model was to evaluate the sustainable use of groundwater within the MCSB under several potential future water management and hydrologic scenarios. Sustainability was evaluated by:

- Comparing groundwater elevations at selected Key Wells within the MCSB to the Sustainable Management Criteria, Measurable Objective, and Minimum Threshold for each Key Well as described in Section 6; and
- Calculating the annual and cumulative change in groundwater storage in the MCSB and comparing the cumulative change in storage to 2009 conditions.

Three water management forecast scenarios were simulated to evaluate the potential effects of projects that may be implemented to enhance water supplies in the MCSB. As described in Section 7.2.2, each of the three scenarios was evaluated assuming future climate conditions will be similar to the historical period of record and assuming future conditions will be drier as a result of climate change. This resulted in a total of six scenarios described in **Appendix B**. The Wood Team and the Management Committee agreed the two scenarios involving additional projects and climate change assumptions are reasonable and conservative and should be the focus of MCSB planning. A baseline scenario is presented with and without climate change for comparison of the impact of the climate change assumptions. The following paragraphs present the nomenclature and general characteristics of these four scenarios. Additional details about these scenarios and the other two non-climate-change scenarios are included in **Appendix B**.

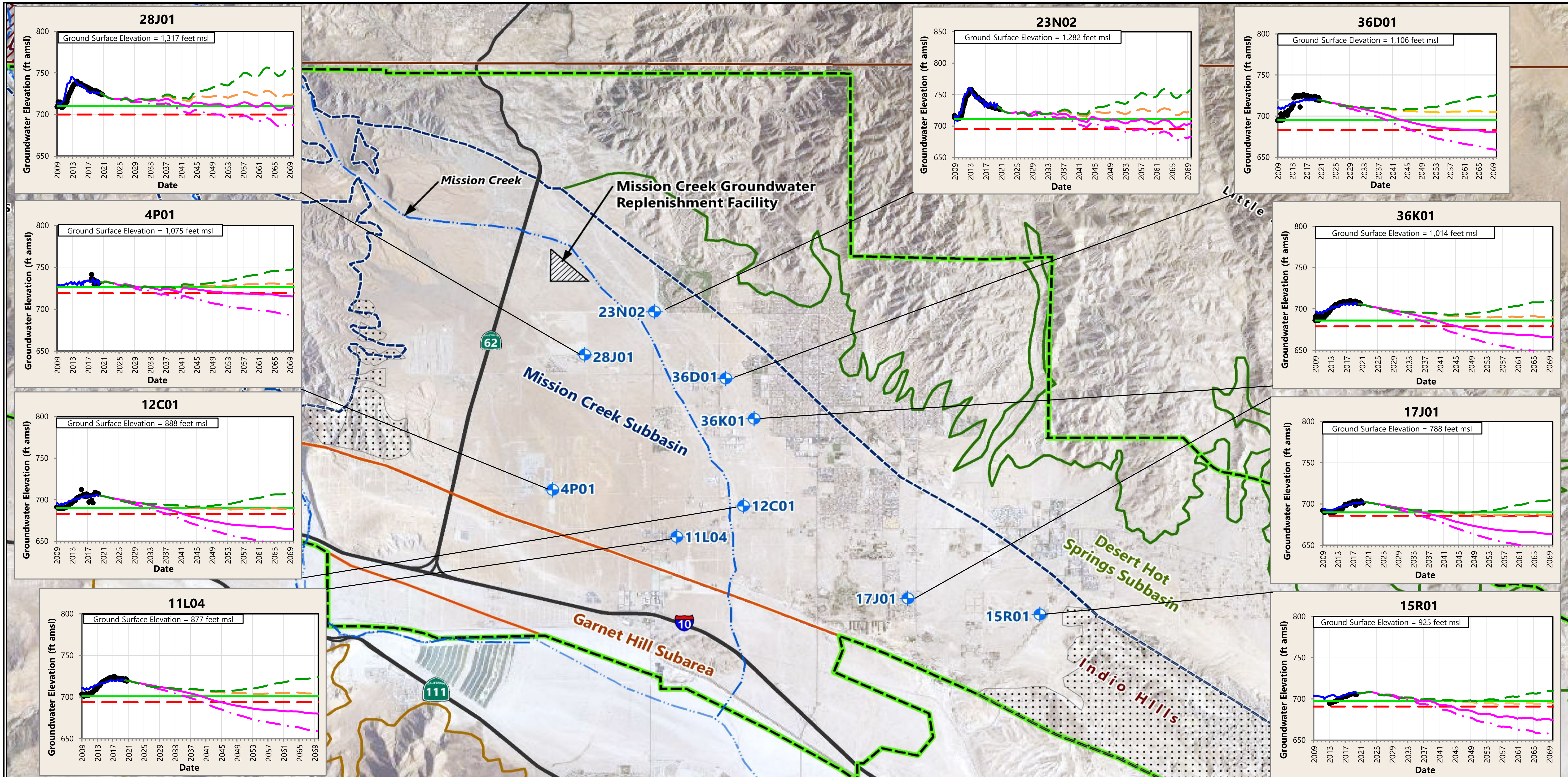
- The **Baseline** scenario provides a “benchmark” for evaluating the effects of water management activities and climate change on groundwater levels in the MCSB. It is not a potential operational scenario for the MCSB. The Baseline scenario includes the current understanding of pumping demand based on population growth described in Section 3. Population was projected through the 2045 planning horizon and held constant thereafter. The Baseline scenario assumes the current SWP Table A water and a SWP delivery reliability of 45% through the planning horizon. In addition, the Baseline scenario includes an increase in the proportion of SWP water delivered to the MC-GRF over the planning horizon (from approximately 8% of the total to 10% of the total) based on the increasing proportion of production between the MCSB and the Indio Subbasin. The Baseline scenario also includes operation of the Regional Water Reclamation Facility (RWRF) in the GHSA, which is scheduled to begin construction by the end of 2021. This project will result in the conveyance of a portion of the wastewater treated for recharge or reuse in the MCSB to the RWRF in the GHSA. The Baseline scenario assumes that this conveyance out of MCSB is permanent. The Baseline scenario also includes longer-term programs that are within the control of the Agencies and have a high certainty of being implemented on schedule based on historical implementation of similar programs (e.g., MSWD planned septic to sewer conversions). The mountain front recharge of this simulation assumed that the precipitation for the 50-year forecast period would be similar to conditions that occurred for the 50-year period from 1970 through 2019.

- The **Baseline with Climate Change** scenario is the same as the Baseline scenario but assumes mountain front recharge for a 50- year period based on continuation of a 25-year period of below normal precipitation (i.e., drought) from 1995 through 2019. This scenario also includes the assumption that, as modeled by CDWR in its 2019 SWP Delivery Capability Report (CDWR, 2020), climate change is anticipated to result in a decrease of SWP deliveries of 1.5% by 2045.
- The **Near-Term Projects with Climate Change** scenario builds on the Baseline with Climate Change scenario by adding water management projects planned for implementation prior to 2035. Projects in the near-term category include the Lake Perris Seepage Recovery Project (described in Section 3) to augment the imported water supply starting in 2023, and construction of a pipeline to bring treated water from the RWRF back into the MCSB for use as recharge starting in 2028.
- The **Future Projects with Climate Change** scenario builds on the Near-Term Projects scenario with Climate Change by adding water management projects that are planned for implementation starting in 2035 and beyond. Projects in the future category include the Sites Reservoir (2035) and Delta Conveyance Facility (2045) projects that should result in increased reliability of SWP water deliveries.

The scenarios were evaluated using simulated hydrographs for nine Key Wells in the MCSB and using simulated water balances. **Figure ES-7** presents hydrographs of observed 2009-2019 groundwater elevations and 2020-2069 forecast groundwater elevations for the Baseline, Baseline with Climate Change, Near-Term Projects with Climate Change, and Future Projects with Climate Change scenarios. The simulations indicate the following:

- Under the Baseline scenario, groundwater levels in all nine Key Wells fall below their respective Measurable Objective through the planning horizon of 2045. Groundwater levels in five Key Wells fall below their Minimum Threshold. The long-term cumulative water balance (compared to 2009 conditions) remains positive. This scenario suggests that conveyance of wastewater out of the MCSB has a long-term negative impact on groundwater levels in the MCSB. Under the Baseline with Climate Change scenario, groundwater levels in all wells fall below their respective Measurable Objectives, and six wells fall below their Minimum Threshold during the planning horizon. The long-term cumulative water balance is negative. Consequently, the assumptions used for the Baseline scenario (no new water supply projects and conveyance of a portion of the wastewater permanently out of the MCSB) are unsustainable for both non-climate change and climate change conditions.

K:\CM19167351 (CVWD Alt update)\Final Report Figure\00 Appendix B\Appendix_B_Forecast_Figures_v30_02-11-22 Figure ES7, ES8, 7-6, 7-11, B13, and B32 v2



Monitoring well (Key Well)	Garnet Hill Subarea of Indio Subbasin
Groundwater Replenishment Facility	Lower permeability/non-water bearing sediments/bedrock
Planning Area	Desert Hot Springs Subbasin
Streams	Indio Subbasin
Highway/road	Mission Creek Subbasin

Observed	Simulated
Measurable Objective	Minimum Threshold
Baseline	Baseline w/CC
Near-term Projects w/CC	Future Projects w/CC

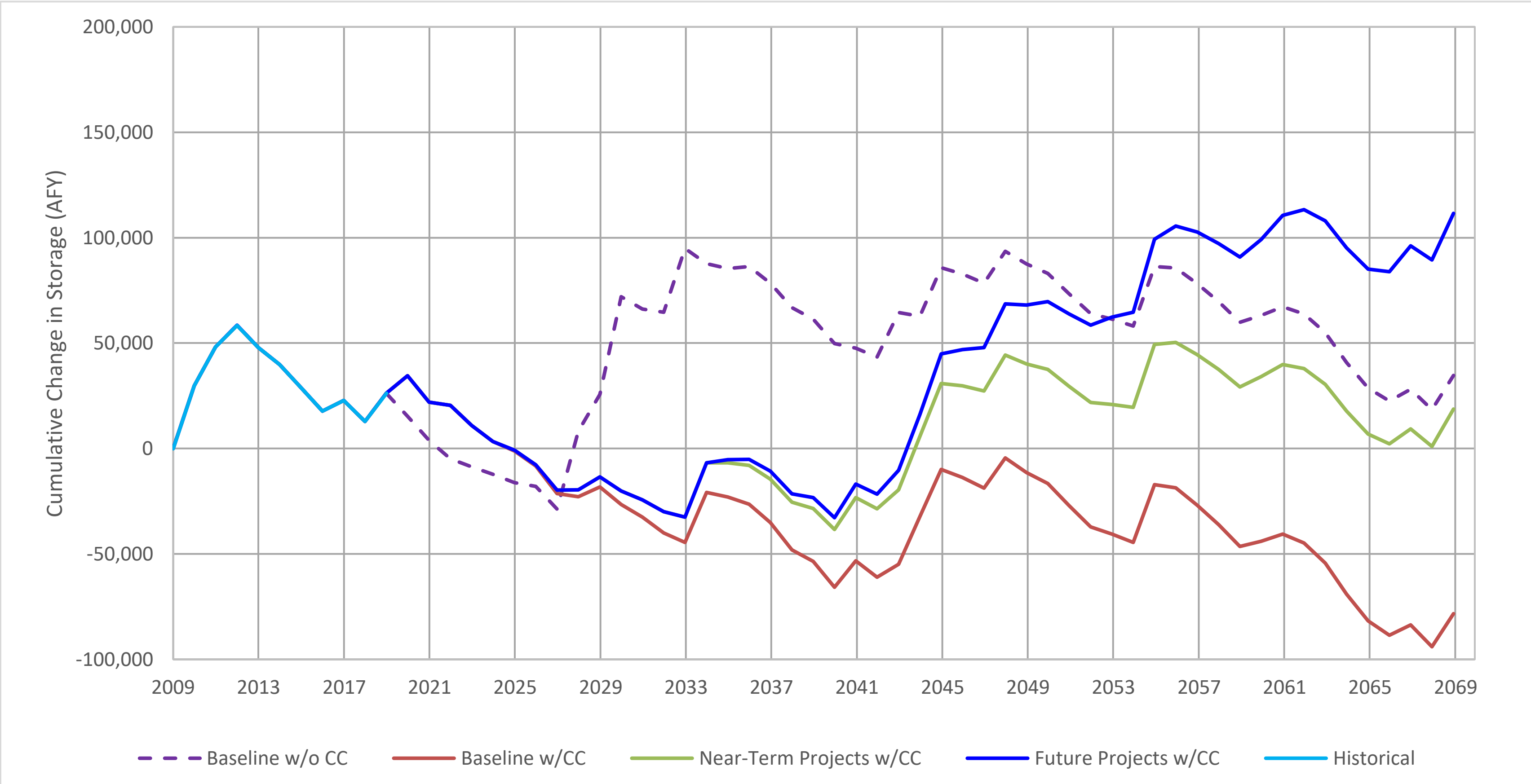
Note:
Ground surface elevation in feet above mean sea level.

0 4,000 8,000
Approximate Scale n Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA.water.CA.gov.

FORECAST SIMULATION RESULTS FOR KEY WELLS WITH MEASURABLE OBJECTIVES AND MINIMUM THRESHOLDS
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: grr/pah	Date: 03/09/2022	Project No.: CM19167351
wood.	Figure	ES-7



Abbreviations:
AFY = Acre feet per year
MCSB = Mission Creek Subbasin
w/o CC = with out Climate Change
w/CC = with Climate Change

Note: 2009-2019 Cumulative Change in Storage derived from calibrated model.

COMPARISON OF SIMULATED MCSB CUMULATIVE CHANGE IN STORAGE
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: dmb	Date: 02/14/2022	Project No.: CM19167351

wood.

Figure **ES-8**

- Under the Near-Term Projects with Climate Change scenario, groundwater levels in four of the Key Wells fall below their Measurable Objectives, and five of the Key Wells remain above their Measurable Objectives through the planning horizon of 2045. All wells remain above their Minimum Thresholds through the planning horizon and the long-term cumulative water balance is slightly positive. Conveyance of the treated wastewater from the RWRF back to the MCSB for evaporation/percolation and new water supply ranging from 233 AFY in 2023 to 265 AFY in 2045 results in a sustainable condition in the MCSB through the planning horizon.
- Under the Future Projects with Climate Change scenario, groundwater levels in three of the Key Wells fall below their Measurable Objective, and six of the Key Wells remain above their Measurable Objectives through the planning horizon of 2045. Well 4P01 falls below its Measurable Objective in 2029 by 3.1 feet and then rebounds in 2041. Two wells that fall below their Measurable Objective (15R01 and 17J01) are in the southern part of the MCSB and only fall below their Measurable Objectives by 1.6 feet and 0.4 feet, respectively. Wells 4P01 and 15R01 have limited historical records and the Measurable Objectives for these wells are considered provisional. All wells remain above their Minimum Thresholds through the planning horizon, and the long-term cumulative water balance is positive. The Future Projects with Climate Change scenario conditions are sustainable and show greater increases in groundwater storage compared to the Near-Term Projects with Climate Change scenario.

Projects and Management Actions

As discussed throughout the Alternative Plan Update, Projects and Management Actions (PMAs) previously developed and implemented by the Agencies, described in the 2013 MC/GH WMP, resulted in groundwater sustainability for the MCSB as follows:

1. Groundwater recharge beginning in 2002 has reversed lowering of groundwater levels and associated depletion of groundwater storage that began in the MCSB in the 1970s. Groundwater levels throughout most of the MCSB and at all the designated Key Wells have been above 2009 groundwater levels for more than a decade, and
2. Parties are addressing salt loading in the MCSB through development of an updated CV-SNMP.

As described in Section 7, ongoing PMAs and implementation of planned PMAs will allow for sustainability as future demands increase, even under an assumption of climate change conditions that assume lower natural recharge and constraints on artificial recharge.

The Agencies have been utilizing an adaptive management strategy for groundwater management since before the adoption of the 2013 MC-GH WMP. Adaptive management provides the flexibility needed to meet the demand needs in the MCSB and avoid undesirable results when conditions change.

The existing and planned PMAs are categorized into five major categories, including:

- Water Conservation

- Water Supply
- Water Quality Protection, including CV-SNMP activities
- SGMA Implementation
- Well Management.

Water conservation activities have supported the water management achievements in the Planning Area and are important to continue moving forward. Water conservation projects implemented include urban water conservation and education programs, tracking water conservation effectiveness through the Regional Urban Water Management Plan (RUWMP), conducting a regional conservation study, and implementing water shortage contingency plans.

Water supply projects are critical to groundwater sustainability in the MCSB. CVWD and DWA continue to invest in long-term, statewide water projects and are working with MWD and the CDWR to improve the reliability of SWP water and acquire additional supplies. Water supply projects include: 1) continue existing imported water replenishment programs, and 2) secure new water sources and improve reliability of existing water sources. These projects include SWP Lake Perris Dam Seepage Recovery Project, the SWP DCF Project, and the SWP Sites Reservoir Delivery Project). In addition, construction of tertiary treatment at MSWD’s RWRF and Horton WWTP will provide recycled water suitable for recharge or non-potable reuse in the MCSB.

Water quality protection projects include a broad suite of active water quality protection programs that are implemented by local agencies, as well as collaboratively in the Planning Area. Water quality protection projects include: 1) conversion from septic to sewer in a majority of MSWD’s service areas, 2) construction of the RWRF with nitrogen removal, 3) tracking water quality regulatory actions, 4) water well source assessment and protection coordination, 5) engaging in planning processes to protect water quality, 6) educating the public on groundwater quality issues, 7) implementing the CV-SNMP Development Workplan, 8) implementing CV-SNMP Groundwater Monitoring Program Workplan, 9) installing additional water quality monitoring wells, and 10) evaluating occurrence and risk of uranium migration.

SGMA implementation includes projects required by SGMA or that otherwise support meeting SGMA requirements. These projects include: 1) continuing with the existing MCSB Management Committee structure, 2) conducting subsidence evaluation with the USGS, 3) maintaining and managing water-related data, 4) preparing the SGMA Annual Reports, 5) preparing the Five-Year Alternative Plan Updates, and 6) pursuing funding opportunities for SGMA-related projects.

Well management projects will improve data collection regarding well locations and pumping and allow for the identification of wells that need to be destroyed. The well management projects include: 1) management of well construction, abandonment, and destruction by working with the Riverside County Department of Environmental Health, 2) initiating a subbasin well inventory, and 3) consider expanding groundwater production reporting (extending reporting requirement down to the de minimis user threshold of two AFY or less established by SGMA).

Plan Evaluation and Implementation

This Alternative Plan Update provides a review of the current groundwater conditions in the MCSB and confirms that the Agencies are already managing the subbasin in a sustainable manner. Based on predicted future water demands, this Alternative Plan Update identifies that additional groundwater production will be needed through the planning period of 2045 (Section 3). As described in Sections 4 and 8, the Agencies have identified options for obtaining additional imported water supplies and increasing water supply reliability through the planning period. The additional imported water supplies will address potential future conditions that are outside of the Agencies' control, including climate change and regulatory changes.

To evaluate future conditions, the groundwater model for the MCSB was updated and used to evaluate a range of water management and hydrologic scenarios. The results of these forecast scenarios, described in Section 7, were compared with the Sustainable Management Criteria for water levels described in Section 6. The water management forecast modeling shows that the Agencies can maintain sustainable groundwater levels in the MCSB under assumed drier climate change conditions through the planning period by continuing the ongoing PMAs and implementing the planned Near-Term and Future Projects. In fact, the Near-Term Projects are the only projects required to maintain sustainability, but Future Projects may address additional demands past 2045. Because groundwater levels in the MCSB also drive sustainability criteria for change in groundwater storage and subsidence, these two Sustainability Indicators also indicate sustainability through the planning period and model forecast period.

Groundwater quality will be evaluated on an ongoing basis. The Agencies continue to support the efforts to update the CV-SNMP by implementing the CV-SNMP Development Workplan which includes development of recommended numeric objectives for TDS concentration in groundwater that are both protective of beneficial uses while also providing maximum benefit of groundwater. This Alternative Plan Update demonstrates that there is no substantial increase in inflow of elevated TDS groundwater from the DHSSB into the MCSB across the Mission Creek Fault due to lower groundwater levels in the MCSB.

As the Agencies continue to follow an adaptive management approach, MCSB conditions will be evaluated using the monitoring data and the sustainability objectives and thresholds established in Section 6, Sustainable Management Criteria, and through development and submittal of SGMA Annual Reports and Five-Year Updates to the Alternative Plan. Together, these actions will support water management to meet projected demands and maintain groundwater sustainability.

The Management Committee will implement the provisions of SGMA and this Alternative Plan Update under legal authority established in the California Water Code (CWC), specifically, CVWD and MSWD – Water Code §30000-33901; DWA – Water Code Appendix Chapter 100.

1.0 Introduction

The Coachella Valley Water District (CVWD), the Desert Water Agency (DWA), and the Mission Springs Water District (MSWD), collectively the Agencies, form the Management Committee within the Mission Creek Subbasin (MCSB) and Garnet Hill Subarea (GHSA) of the Indio Subbasin in the northern part of the Coachella Valley Groundwater Basin. The Coachella Valley Groundwater Basin also includes the San Gorgonio Pass Subbasin, Indio Subbasin, and Desert Hot Springs Subbasin (DHSSB) (**Figure 1-1**). The Indio Subbasin includes additional subareas beyond the GHSA. For this document, those additional subareas are not differentiated and are grouped together as the main Indio Subbasin. **Figure 1-2** presents the planning area (Planning Area, defined in Section 1.4.3) with the boundaries of the MCSB, GHSA of the Indio Subbasin, DHSSB, and the main Indio Subbasin. **Figure 1-3** presents the boundaries of the Agencies in the Planning Area, including the CVWD, DWA, and MSWD.

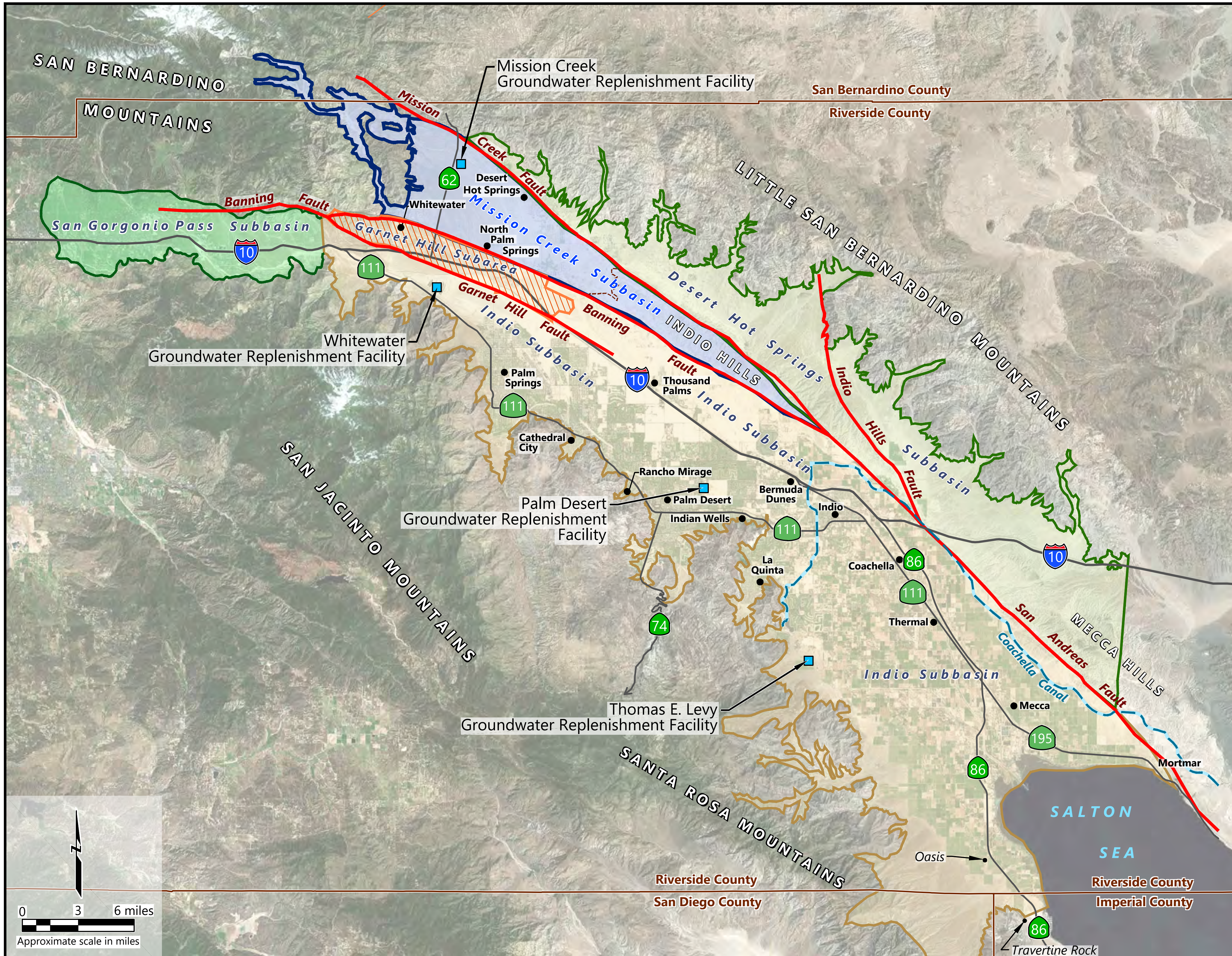
The Agencies understand the importance of the MCSB and GHSA as groundwater resource areas to the local communities and are committed to reliably meeting local demands and protecting water quality in a sustainable and cost-effective manner. As such, the Agencies engaged Wood Environment & Infrastructure Solutions, Inc. (Wood) and Kennedy/Jenks Consultants, Inc. (Kennedy Jenks) to prepare this MCSB Alternative Plan Update to specifically meet requirements of the Sustainable Groundwater Management Act (SGMA) for the MCSB and to provide future water management planning for both the MCSB and the GHSA. SGMA requirements for the GHSA are addressed in the Indio Subbasin Water Management Plan Update prepared separately by Todd Groundwater and Woodard & Curran (Todd/W&C, 2021).

This section provides an overview of the purpose and need for this Alternative Plan Update. This section also provides an overview of the Alternative Plan Update organization, background, development process, relationships to other planning efforts, and description of stakeholder involvement.

1.1 Purpose and Need for the MCSB Alternative Plan Update

SGMA requires Groundwater Sustainability Agencies (GSAs) be established in medium- or high-priority groundwater basins[1] to develop and implement approved Groundwater Sustainability Plans (GSPs) or Alternative Plans to sustainably manage the subbasins. The MCSB, identified as Subbasin 7-021.02 Coachella Valley Mission Creek by the State of California Department of Water Resources (CDWR), is designated as “medium-priority” by CDWR. The MCSB is unique in that it is one of only nine subbasins throughout the State of California (State) with an approved Alternative Plan. CVWD and DWA are the GSAs for the MCSB.

[1] The SGMA uses the term “basin” to refer to a groundwater basin. However, this can also apply to a subbasin such as the MCSB.



Explanation

- Mission Creek Subbasin
- Desert Hot Springs Subbasin
- San Gorgonio Pass Subbasin
- Indio Subbasin
- Garnet Hill Subarea of Indio Subbasin
- Fault
- Indio Hills boundary
- Coachella Canal

Location Map
Not to Scale

Basemap modified from an undated drawing by Krieger & Stewart Engineering, subbasin boundaries from "Mission Creek and Garnet Hill Subbasins Water Management Plan Final Report", January 2013, and an aerial photo from Esri World Imagery- Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, dated 10-15-2017.

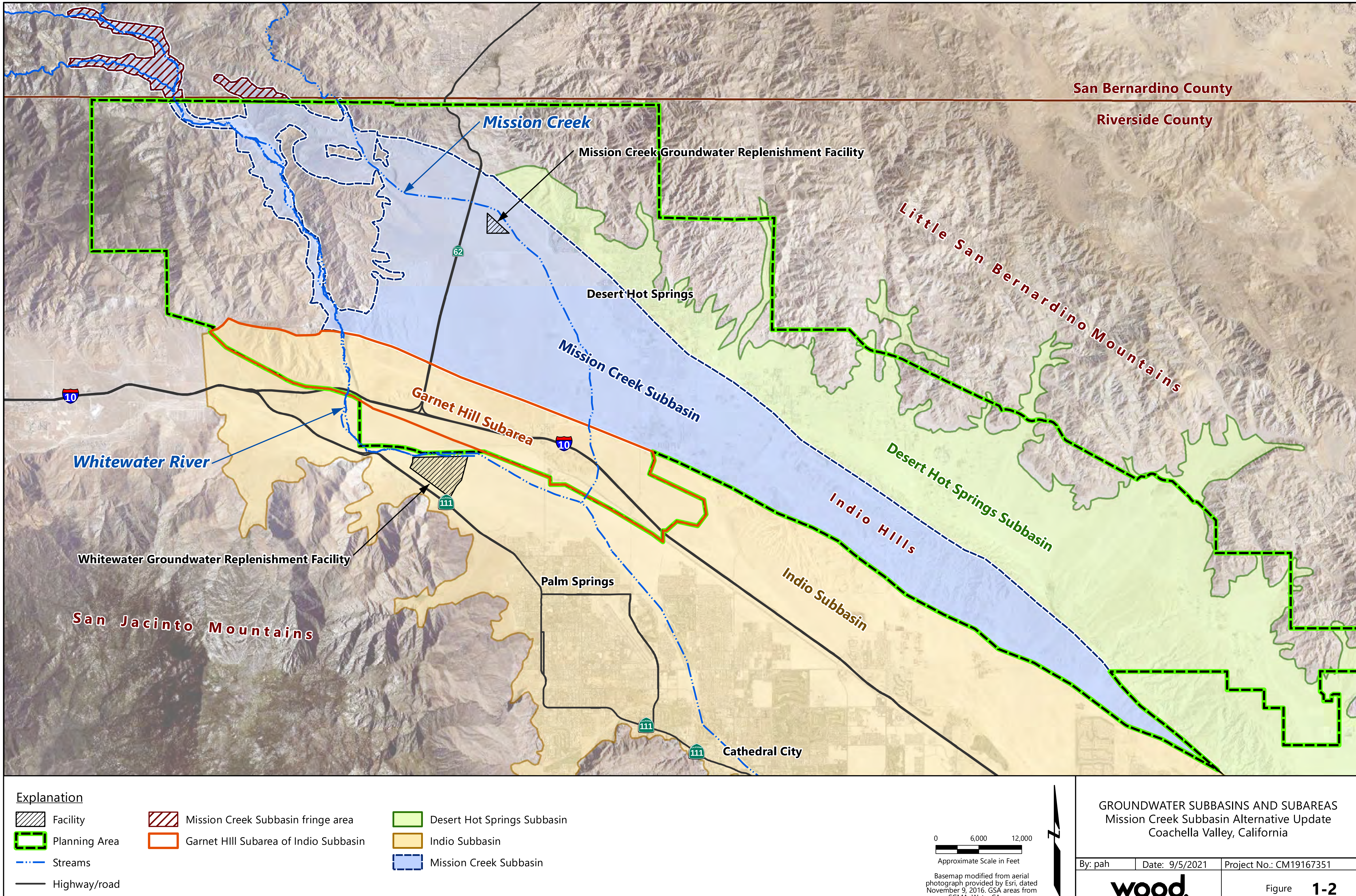
Note:

All locations are approximate.

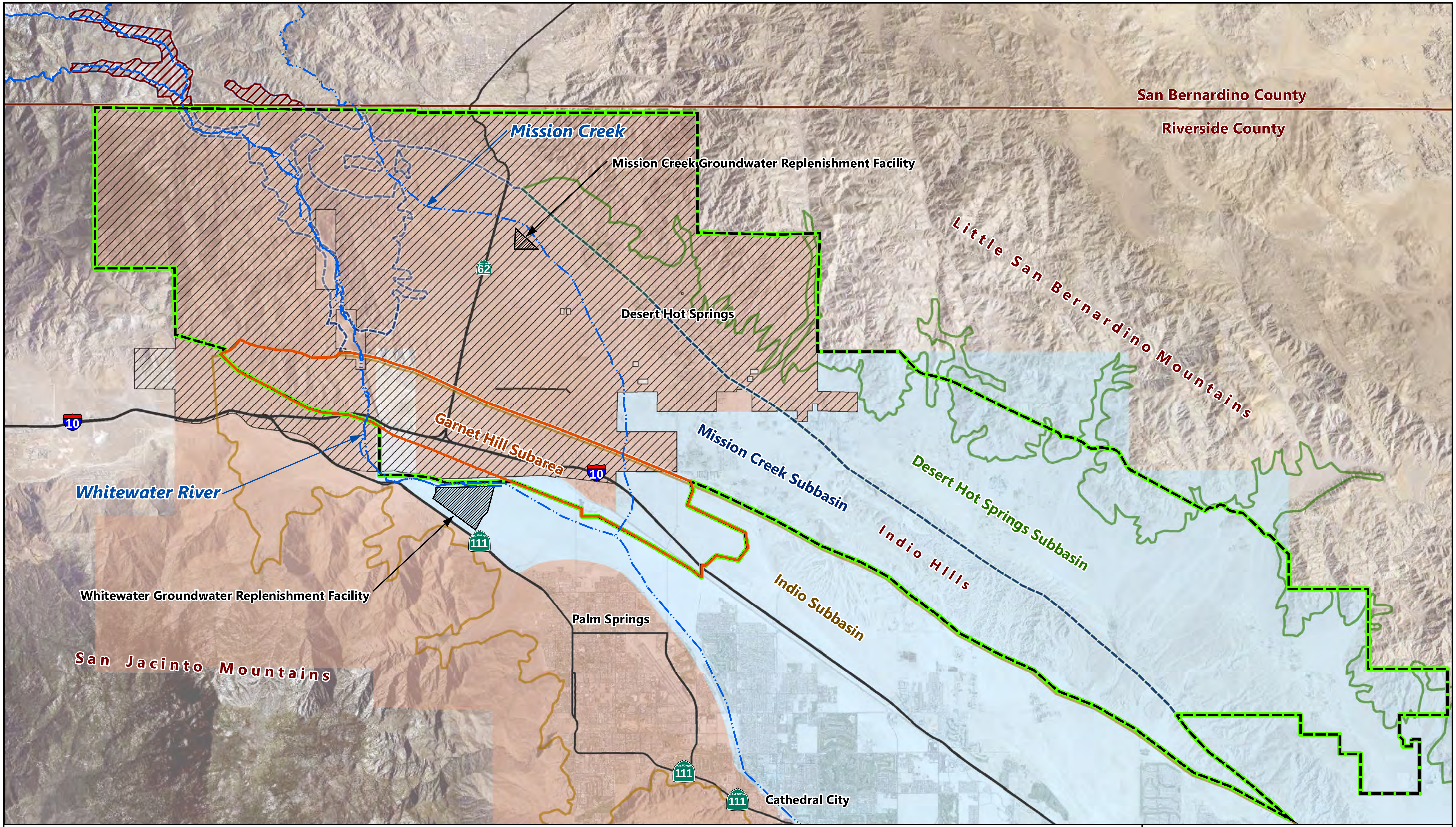
COACHELLA VALLEY GROUNDWATER BASIN
SUBBASINS and GARNET HILL SUBAREA
Mission Creek Subbasin Alternate Update
Coachella Valley, California

By: jrw	Date: 9/30/2021	Project No. CM19167351
wood.		Figure 1-1

Plot Date: 10/18/2021 3:44:31 PM, Plotted by: pat.herring
Drawing Path: Y:\CM19167351 (MISSION CREEK ALTERNATE)\ESRI\ALTERNATIVE UPDATE\ACAD\1-1_CV BASIN-SUBBASINS_V2.DWG, Subbasins



Date: 9/5/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update\1-2_GW_Subbasins_Areas.mxd



Explanation

- Facility
- Planning Area
- Streams
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet HIll Subarea of Indio Subbasin
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin
- Coachella Valley Water District (CVWD)
- Desert Water Agency (DWA)
- Mission Springs Water District (MSWD)

0 6,000 12,000
Approximate Scale in Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

WATER AGENCIES
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: pah | Date: 9/7/2021 | Project No.: CM19167351

wood.

Figure 1-3

Date: 9/8/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update\1-3_Water_Agencies.mxd

1.1.1 SGMA Alternative Plan

The SGMA recognizes the efforts many areas, such as the Coachella Valley, have made in developing and implementing groundwater management by allowing existing groundwater management plans to be submitted as an alternative to preparing a GSP. California Water Code § 10733.6 describes three voluntary alternative paths to preparing and submitting a SGMA-compliant Alternative Plan as defined in the California Code of Regulations (CCR, 2016; CWC, 2016):

> *(a) If a local agency believes that an alternative described in subdivision (b) satisfies the objectives of this part, the local agency may submit the alternative to the department for evaluation and assessment of whether the alternative satisfies the objectives of this part for the basin.*
>
> *(b) An alternative is any of the following:*
> *(1) A plan developed pursuant to Part 2.75 (commencing with Section 10750) or other law authorizing groundwater management.*
> *(2) Management pursuant to an adjudication action.*
> *(3) An analysis of basin conditions that demonstrates that the basin has operated within its sustainable yield over a period of at least 10 years. The submission of an alternative described by this paragraph shall include a report prepared by a registered professional engineer or geologist who is licensed by the state and submitted under that engineer's or geologist's seal.*
>
> *(c) A local agency shall submit an alternative pursuant to this section no later than January 1, 2017, and every five years thereafter.*
>
> *(d) The assessment required by subdivision (a) shall include an assessment of whether the alternative is within a basin that is in compliance with Part 2.11 (commencing with Section 10920). If the alternative is within a basin that is not in compliance with Part 2.11 (commencing with Section 10920), the department shall find the alternative does not satisfy the objectives of this part.*

SGMA requires that GSPs and Alternative Plans be updated every five years. CDWR has given the GSAs a deadline of January 1, 2022 for submittal of the first MCSB Alternative Plan Update, per CDWR's Alternative Plan Approval Letter (CDWR, 2019a). The Alternative Plan Update will be reviewed and updated as needed at least every five years, as required by SGMA.

1.1.2 Foundation for Alternative Plan Update

The foundation for this Alternative Plan Update is the 2013 Mission Creek/Garnet Hill Water Management Plan (MWH, 2013 [2013 MC/GH WMP]) and Bridge Document (Stantec, 2016 [2016 Bridge Document]). Together, those documents described how the 2013 MC/GH WMP and supporting documents met the requirements of the SGMA and thus are considered an Alternative to a GSP (Alternative Plan) under the SGMA. These documents are further detailed in Section 1.4.1. On July 17, 2019, the CDWR approved the Alternative Plan, finding it functionally equivalent to a GSP.

This Alternative Plan Update reflects the following perspectives:

- From a SGMA perspective, the GHSA of the Indio Subbasin is part of the Indio Subbasin Water Management Plan Update and Indio Subbasin annual reporting prepared separately (Todd/W&C, 2021).
- From a water management planning perspective, the MCSB and the GHSA are hydrologically interrelated because the fault that separates these subbasins is only a partial barrier to groundwater flow, and the steep hydraulic gradients across the fault results in subsurface outflow from MCSB to the GHSA (Wood, 2020).
- From an institutional perspective, multiple agency boundaries overlap the MCSB and GHSA and the Agencies have agreed to collaborate on management of the MCSB and GHSA as a result of the Settlement Agreement between CVWD, DWA, and MSWD, which is further discussed in Section 1.3.

Although there is an ongoing dispute over groundwater management jurisdiction, the Agencies collaboratively prepared this Alternative Plan Update as the MCSB Management Committee. The Agencies also prepare MCSB SGMA Annual Reports in accordance with the annual reporting requirements of SGMA.

1.1.3 Purpose for Alternative Plan Update

The MCSB Management Committee prepared this Alternative Plan Update to:

- Ensure that the most current projections for population growth, land use, imported water supply, and other future conditions are incorporated into water management planning for the region.
- Update the groundwater model for the Planning Area for use as a tool in evaluating potential groundwater management actions.
- Review historical information along with current and projected future environmental and demographic conditions to define undesirable results and develop objectives and thresholds to maintain groundwater sustainability.
- Provide an analysis of future projected groundwater demand-based population growth and other factors and estimate future projected supplies for groundwater replenishment to use in forecasting future groundwater production and supplies.
- Develop scenarios for forecasting groundwater levels based on future demands and supplies assuming future hydrologic conditions are similar to historical long-term average conditions and assuming future hydrologic conditions are drier than the long-term historical average (climate change assumptions) and compare these forecasted water level conditions to groundwater sustainability criteria.
- Address specific actions recommended in the CDWR's 2019 SGMA Alternative Assessment Staff Report and Statement of Findings (CDWR, 2019a; 2019b).

1.2 Plan Organization

The following lists each section in the Alternative Plan Update, along with a summary of the section's topic:

- **Section 1 – Introduction** provides a brief background of the need for an Alternative Plan Update, the purpose of the Alternative Plan, SGMA, the relation to other planning efforts, and a description of the general report organization.
- **Section 2 – Plan Setting** describes the Planning Area (including all groundwater basins and subbasins within the area), the land uses and demographics within the Planning Area, and the water infrastructure within the area.
- **Section 3 – Demand Projections** provides historical and future water demands for the Planning Area.
- **Section 4 – Water Resources** describes each water supply type within the Planning Area, including local surface water, imported water, wastewater/recycled water, and local groundwater conditions including groundwater use.
- **Section 5 – Groundwater Model Update** presents a discussion about the groundwater model and calibration update, summarizing the characteristics for the MCSB, GHSA, and DHSSB.
- **Section 6 – Sustainable Management Criteria** provides the SGMA Objective and Sustainable Management Criteria for the MCSB.
- **Section 7 – Water Management Forecasting** presents and discusses the findings of the model forecast for the MCSB for projected changes in water demand due to population increases. Forecasts include a baseline scenario of no projects referred to as the Baseline Scenario, a scenario with near-term projects (projects anticipated in less than five years) referred to as the Near-Term Projects scenario, and a scenario of future projects (those anticipated within the 25-year planning horizon) referred to as the Future Protects scenario. Each of these scenarios were evaluated under conditions of long-term historical hydrology and under conditions of persistent below normal precipitation that became the basis for the three climate change scenarios. The climate change condition was presented as the most conservative of the scenarios for Near-Term Projects and Future Projects scenario. The MCSB is the focus of groundwater model forecasting and results of the forecasting are compared with the Sustainable Management Criteria for MCSB developed in Section 6.
- **Section 8 – Projects and Management Actions** describes project and management actions that are ongoing and planned in the MCSB. This section also includes a discussion on the implementation of the projects and management actions, how this implementation has successfully maintained groundwater sustainability over the last decade, and how the future project and management actions will continue to maintain groundwater sustainability through the end of the planning horizon (2045).

The appendices of the report provide more detailed information supporting the report sections:

- **Appendix A – Groundwater Flow Model Calibration Report** provides a detailed description of the groundwater model assumptions and model update process.
- **Appendix B – Groundwater Flow Model Update Forecasts** provides a detailed description of the updated model forecast scenarios.
- **Appendix C – Water Demand Supporting Information** provides additional detail about the calculations and assumptions used to support the estimation of historical and future water requirements and production by Agency.
- **Appendix D – Communications and Engagement Plan** describes the communication and engagement process as well as the stakeholders involved in the planning effort.
- **Appendix E – Monitoring and Reporting** provides information on the monitoring networks and reporting plan.
- **Appendix F – Completed Projects, Deferred Projects, and Removed Projects** lists the projects that are incorporated into current projects or are no longer active and the reasoning for removing the project.
- **Appendix G – Project Identification Cross Reference Table** describes the project numbering associated with the 2013 MC/GH WMP and the current project numbering used in this Alternative Plan Update.
- **Appendix H – Comments and Responses** presents feedback from stakeholders throughout the Alternative Plan Update review process.
- **Appendix I – Agency Resolutions Adopting the Alternative Plan Update** presents the resolution adopting the Alternative Plan Update from each Agency Board of Directors.

1.3 Background and Prior Planning Efforts

As summarized in Section 1.1.2, this Alternative Plan Update is founded on several prior planning efforts that are detailed below.

1.3.1 MCSB Management Area and Management Committee Formation

Concerns about lowering of groundwater levels in Coachella Valley Groundwater Basin date back to 1913 when CVWD was formed to secure water supplies. CVWD took steps to secure water supplies from the Colorado River that led to the completion of the Coachella Branch of the All-American Canal in 1948 to deliver imported water to the southeastern Coachella Valley. CVWD and DWA contracted with the State of California for water from the State Water Project (SWP) in the early 1960s with the first deliveries of imported water to the northwestern part of the Coachella Valley in 1973 through an exchange of SWP water for Colorado River Aqueduct (CRA) water and recharge of this imported water at the Whitewater River Groundwater Replenishment Facility (WWR-GRF) in the Indio Subbasin. There were no imported water deliveries to the MCSB, and declining water levels triggered discussions between MSWD, CVWD, and DWA as early as 1984 regarding the need to recharge imported water to replenish groundwater in the MCSB.

To control the water level declines, the CVWD and DWA, with a resolution of support from MSWD's Board of Directors, embarked on a MCSB groundwater replenishment program in 2002 using imported water and constructed the Mission Creek Groundwater Replenishment Facility (MC-GRF). The MC-GRF received the first replenishment water in late 2002. Cooperative management of groundwater replenishment in the MCSB was initiated on April 8, 2003 when CVWD and DWA entered into the Mission Creek Groundwater Replenishment Agreement for the cooperative management and recharge of imported water and allocating recharge facility costs between the two agencies. This original agreement has since been updated and replaced by the 2014 Mission Creek Water Management Agreement.

In October 2003, MSWD filed action in the Superior Court of the State of California against CVWD and DWA seeking a writ of mandate, declaratory relief for prescriptive and appropriative water rights, and declaratory and injunctive relief for a physical solution of a groundwater basin. MSWD sought adjudication of the subbasin, challenged the validity of the replenishment assessments in the Indio Subbasin[2] and MCSB, and questioned the impact that the quality of the imported CRA water would have on MCSB groundwater. Both CVWD and DWA filed responses challenging the complaint.

In December 2004, MSWD, DWA, and CVWD reached an agreement to settle outstanding litigation. The agreement included provisions regarding payment of outstanding replenishment assessments, establishment of a three-party management committee consisting of CVWD, DWA, and MSWD, shared costs for basin studies, and development of a water management plan for the MCSB and the GHSA. An addendum to the 2004 Settlement Agreement specifies that water supplies available through CVWD's and DWA's SWP contracts will be allocated and delivered to the West Whitewater Subbasin Management Area of the Whitewater River (also known as the Indio) Subbasin and the Management Area of the MCSB, based on the percentage of total annual groundwater and surface water production in the Management Areas.

The MCSB Management Committee was formed as a result of the 2004 Settlement Agreement. The stated purpose of the Management Committee is to "exchange information, express ideas and otherwise discuss in a free, comprehensive, and frank manner any and all aspects regarding the management of resources within the Mission Creek Subbasin." The Management Committee is composed of at least one member or representative of each of the Agencies.

A Memorandum of Understanding (MOU) among CVWD, DWA, and MSWD was executed on July 27, 2009, to prepare the 2013 MC/GH WMP and develop a groundwater model of the MCSB and GHSA. The 2013 MC/GH WMP was prepared for the MCSB and GHSA as required by the 2004 Settlement Agreement to address the water management needs of these areas. The MCSB Management Committee developed the following Mission Statement for the 2013 MC/GH WMP:

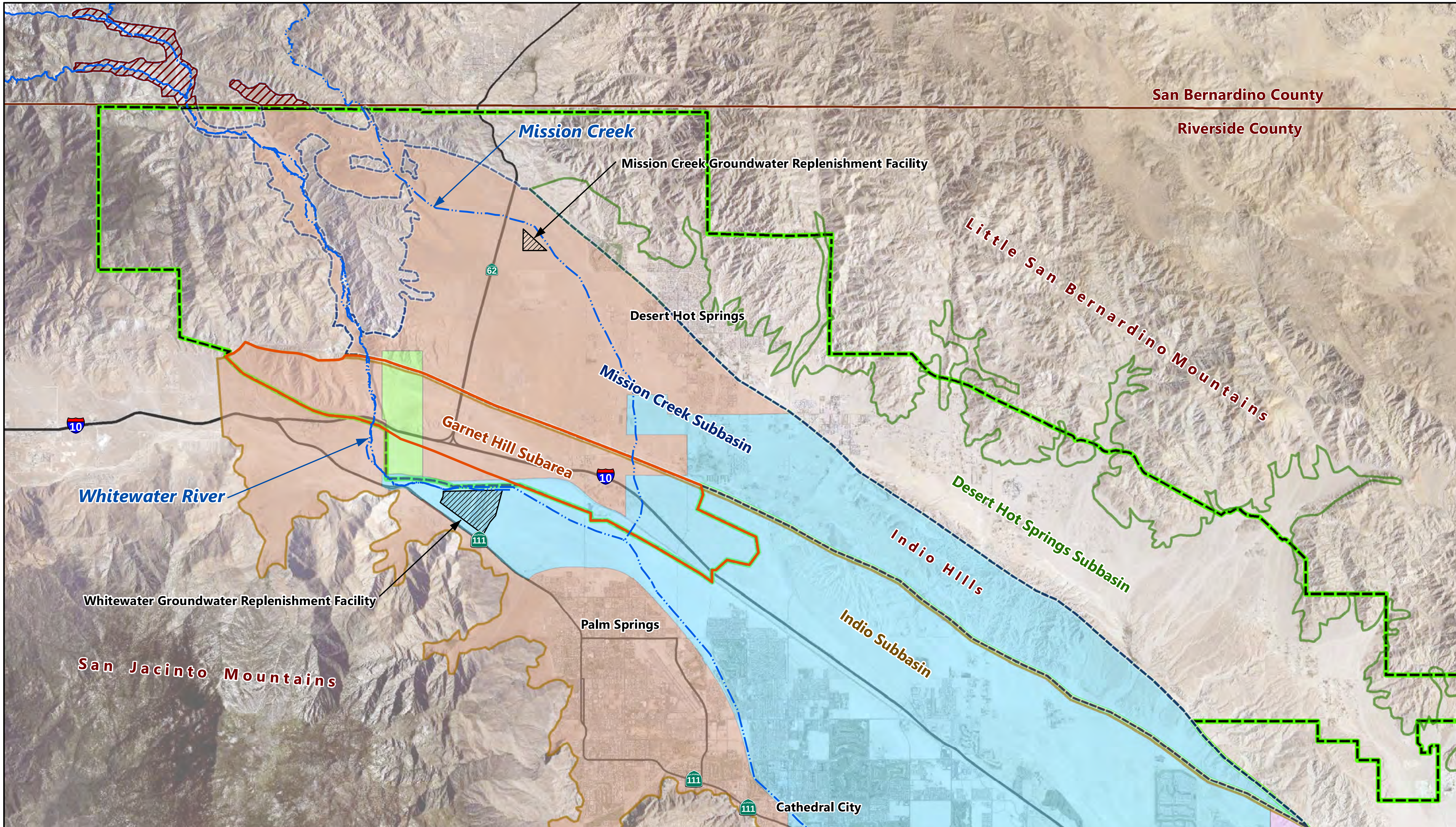
> *"The purpose of the Mission Creek and Garnet Hill Water Management Plan is to manage the water resources to meet demands reliably and protect water quality in a sustainable and cost-effective manner."*

[2] The Indio Subbasin is also identified as the Whitewater River Subbasin by the United States Geological Survey (USGS, 1980).

1.3.2 Mission Creek Subbasin GSAs

CVWD, MSWD, and DWA have legal authorities established in the California Water Code. Under the SGMA, each agency has filed separate Notices of Election with CDWR to become GSAs to manage the MCSB within the areas shown on **Figure 1-4**:

- **CVWD** – submitted its notice of election for the portion of the MCSB within its boundaries (CVWD, 2015) and was approved by the CDWR as an exclusive GSA to manage the MCSB within that area.
- **DWA** – submitted its notice of election for a large portion of the MCSB, which includes an area also located within the boundaries of MSWD. The CDWR designated DWA as an exclusive GSA for all portions of the MCSB located within DWA's boundaries, including those portions that overlie MSWD boundaries.
- **MSWD** – submitted a notice of election for the portion of the MCSB located within its boundaries, and this notice of election was rejected by the CDWR because it included areas also located within DWA's boundaries. MSWD later filed an amended notice of election for a three-square mile area included by DWA in its notice of election, but not within DWA's boundaries. MSWD's amended notice of election was filed without prejudice to its initial notice of election (MSWD, 2016). The CDWR designated the three-square mile area as DWA and MSWD "overlap" (see **Figure 1-4** for the location of this GSA notice overlap area). The overlap status of the DWA and MSWD three-square mile area has not been resolved. MSWD's initial notice of election, and DWA's claim of exclusive status over MSWD's service area are the subject of pending litigation, known as *Mission Springs Water District v. Desert Water Agency, et al.*, Riverside County Superior Court, Case No. PSC 1600676.



Explanation

- Facility
- Planning Area
- Streams
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet HIll Subarea of Indio Subbasin
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin

Groundwater Sustainability Agency (GSA) Areas

- Coachella Valley Water District (GSA Exclusive Area)
- Desert Water Agency (GSA Exclusive Area)
- Indio Water Authority (GSA Exclusive Area)
- Overlap Area of GSA Notices by Desert Water Agency and Mission Springs Water District

0 6,000 12,000

Approximate Scale in Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

GROUNDWATER SUSTAINABILITY AGENCY AREAS
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: pah	Date: 9/7/2021	Project No.: CM19167351
wood.		Figure 1-4

Date: 9/7/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update\1-4_GW_Sust_Agency_Areas.mxd

1.4 Purpose and Need for the MCSB Alternative Plan Update

1.4.1 Previous Planning Efforts

The 2013 MC/GH WMP was prepared for the MCSB and GHSA to guide management of groundwater resources and protect water quality in a sustainable and cost-effective manner. The water management objectives of the 2013 MC/GH WMP were to:

- Meet current and future demands with a 10 percent supply buffer,
- Eliminate long-term groundwater overdraft,
- Manage and protect water quality,
- Comply with state and federal laws and regulations, and
- Manage future costs.

In 2016, the SGMA Bridge Document (2016 Bridge Document) was developed to demonstrate that the 2013 MC/GH WMP was functionally equivalent to the requirements for a GSP. The 2016 Bridge Document described how the 2013 MC/GH WMP meets each of the requirements of the SGMA.

In December 2016, the MCSB Management Committee submitted the 2013 MC/GH WMP, the 2016 Bridge Document, and supporting materials as an Alternative Plan for the MCSB.

The Alternative Plan was approved by the CDWR in a SGMA Alternative Assessment Staff Report dated July 17, 2019 (CDWR, 2019a) and a Statement of Findings Regarding the Approval of the MCSB Alternative Plan (CDWR, 2019b). As summarized by the CDWR (2019c), the Alternative Plan:

- Satisfied the objectives of the SGMA by successfully demonstrating that implementation of the Agencies' existing water management plan is likely to lead to groundwater sustainability for the MCSB within the statutory timelines identified in the SGMA.
- Demonstrated an acceptable understanding of the hydrogeology, groundwater conditions, and water budget for the subbasin.
- Established goals for the subbasin, including maintaining groundwater levels above 2009 conditions, meeting water demands, and managing and protecting groundwater quality.
- Stated that while utilizing supplies from the Colorado River has assisted in correcting historical overdraft, it is also contributing to salt loading in the subbasin. The Alternative Plan stated that the region has developed a Salt and Nutrient Management Plan (SNMP) and is working to have that plan approved by the Colorado River Basin Regional Water Quality Control Board (RWQCB).

Based on these findings, the CDWR provided recommendations to address in the first five-year update to the Alternative Plan, which is due by January 1, 2022. These recommendations are summarized below.

1.4.2 Alternative Plan Compliance with the SGMA Requirements for Mission Creek Subbasin

Items specifically identified by CDWR as recommended actions (in bold), as described in CDWR's July 16, 2019 staff report, are summarized below along with the section of this report that addresses each comment.

1. **Evaluate the Indio Hills for current and future groundwater use.** The Indio Hills have been included in the Planning Area for this Alternative Plan Update and are therefore included in discussion of demand projections and land use in Section 3. Groundwater use in the Indio Hills is discussed in Section 4.

2. **Incorporate an approved SNMP into future iterations of this Alternative Plan Update and continue to study the rate and level of increased salt content in groundwater due to importation of Colorado River water.** As discussed in Section 1.5.3, the Agencies are working with other water and wastewater agencies in the Coachella Valley Groundwater Basin to develop an updated SNMP for the Coachella Valley Groundwater Basin, Coachella Valley Salt and Nutrient Management Plan (CV-SNMP). This has involved preparing a SNMP Development Workplan to define the approach to be used to update the CV-SNMP in a collaborative manner that addresses management of salts and nutrients from all sources, including the importation of Colorado River water, to protect beneficial uses, comply with the Recycled Water Policy, and to address the specific findings and recommendations provided by RWQCB staff. The SNMP Development Workplan includes a Groundwater Monitoring Program Workplan (West Yost, 2020) to define the updated SNMP monitoring network, including wells needed to address network gaps, which will be used to monitor the spatial and vertical distribution of salts and nutrients in the Basin. **Appendix E** provides a summary of water quality monitoring for the CV-SNMP.

3. **Provide reasoning and evidence for the expectation that maintaining groundwater levels above 2009 is expected to reduce water quality impacts of higher TDS groundwater flowing into the MCSB from the DHSSB.** Groundwater underflow across the Mission Creek Fault separating the MCSB from the DHSSB was reviewed as part of the MCSB groundwater model update (**Appendix A** and Section 5). As summarized in Section 5.7.3.1, the conclusions of this review are that: (1) MC-GRF recharge and other management actions are expected to maintain average MCSB groundwater levels at or above historical low conditions (2009 conditions), (2) maintaining these MCSB groundwater levels through recharge at the MC-GRF will not result in appreciably greater groundwater underflows across the fault than occurred under pre-2009 groundwater level conditions, and (3) the Mission Creek Fault underflow is only a small component of recharge to the MCSB and any modest increase in groundwater underflow due to groundwater level differences across the fault is only a fraction of the total natural

recharge. Therefore, no significant and unreasonable groundwater quality impacts are anticipated with groundwater levels in the MCSB maintained at or above 2009 groundwater levels.

Section 7.5.3 describes the estimates of the Mission Creek Fault underflow from DHSSB to MCSB under the model forecast of groundwater management. The forecast scenarios show lower average underflow across the Mission Creek Fault through the planning horizon of 2045 than the average underflow from 1978 through 2001, when groundwater levels where higher than 2009 and prior to groundwater recharge near Mission Creek Fault.

4. **Provide groundwater-level criteria from specific groundwater monitoring wells that will be used to demonstrate compliance with the 2009 groundwater levels threshold or describe in detail how 2009 groundwater levels are determined and how they can be quantitatively compared to water levels on an ongoing basis.** Section 6 defines Measurable Objectives as the 2009 groundwater levels, describes how these levels were determined, and identifies specific monitoring wells, idented as "Key Wells" that will be monitored. Available monitoring well construction information and the process for measurement of the Key Wells is provided in **Appendix E**.

1.4.3 Planning Area Overview

The Management Committee defined a water management planning area (Planning Area) that includes the MCSB and GHSA, as well as the portion of the DHSSB east of the MCSB and a small portion of the main Indio Subbasin south of the GHSA (**Figure 1-2**). The groundwater subbasins and the subarea in the Alternative Plan Update include:

- **MCSB** – the Planning Area includes the entirety of the alluvial MCSB, except for a fringe portion of the Subbasin located in San Bernardino County that is largely wilderness area and outside the Agencies' boundaries.
- **GHSA** – for the purposes of the SGMA, the GHSA is contained within the Indio Subbasin and is included in the Indio Subbasin Water Management Plan Update. An MOU regarding the governance of the Indio Subbasin under the SGMA has been entered into by the Indio Subbasin GSAs, which are the City of Coachella (a municipal corporation acting through, and on behalf of, the CWA), CVWD, DWA, and the City of Indio (a municipal corporation acting through, and on behalf of, the Indio Water Authority [IWA]). Through this MOU, these agencies have agreed to coordinate and cooperate regarding implementation of the SGMA within their respective jurisdictions to ensure that the sustainability goals of the SGMA are met within the Indio Subbasin, including the GHSA.
- **DHSSB** – potable water pumped from the MCSB is utilized within the area overlying this subbasin and is an important groundwater demand component of the MCSB. DHSSB has been designated as a low priority basin by CDWR and does not have a GSP or Alternative Plan.

The Planning Area for this Alternative Plan Update is shown with the agency areas on **Figure 1-4**. A more detailed description of the plan setting is provided in Section 2. The Alternative Plan Update Planning Area is the same as the 2013 MC/GH WMP Planning Area with the following exceptions:

- This Alternative Plan Update Planning Area includes the Indio Hills to address a CDWR recommendation to include current and future water use in the Indio Hills; and
- This Alternative Plan Update Planning Area includes all the MSWD boundary to the northwest of the MCSB and GHSA and north of the MCSB, including portions of the DHSSB.

1.4.4 Annual Reports

The Management Committee has also been preparing annual documents that describe water management in the MCSB, including the annual reports required by the SGMA (SGMA Annual Reports) and CVWD's and DWA's engineer's reports on water supply and replenishment assessment (Engineer's Reports).

- The SGMA Annual Reports summarize groundwater conditions, including groundwater elevation data, groundwater extraction data, local and imported surface water contributions, groundwater balance estimates, and change in groundwater storage for each water year. These reports also describe progress on the implementation of projects and management actions specified in the Alternative Plan. The Agencies have submitted SGMA Annual Reports for the MCSB since submittal of the Alternative Plan (Stantec, 2018a; Wood, 2019 and 2020).
- The Engineer's Reports are prepared to comply with the Water Code, which allows CVWD and DWA the power to levy and collect water replenishment assessments within the respective area of benefits (AOBs) and to implement groundwater replenishment programs to help mitigate groundwater overdraft. CVWD's authority is granted under California Water Code Sections 31630-31639 and DWA's authority is granted under California Water Code Appendix Chapter 100 – Desert Water Agency Law, Section 100-15.4,
- The CVWD's Engineer's Report (Wildermuth, 2019 and 2020) includes the groundwater replenishment and assessment program for the Mission Creek Subbasin, West Whitewater River Subbasin, and East Whitewater River Subbasin AOBs that lie within CVWD's service area and is managed by CVWD.
- The DWA's Engineer's Report (Krieger & Stewart, 2019 and 2020) includes the groundwater replenishment and assessment program for the West Whitewater River Subbasin and Mission Creek Subbasin AOBs that lie within DWA's service area and is managed by DWA.

CVWD, DWA, Coachella Water Authority (CWA), and IWA are the GSAs for the Indio Subbasin. These agencies prepare the SGMA annual reports for the Indio Subbasin, which includes the GHSA (Stantec, 2018b and 2019; Todd Groundwater, 2020).

1.5 Relationship to Other Planning Efforts

The following planning efforts have a nexus with this Alternative Plan Update because of geographic proximity, overlapping planning areas, evaluation of similar projects, and inter-related aspects of long-range water resources planning for the region.

1.5.1 SGMA in Adjacent Subbasins

The SGMA requirements apply to basins and subbasins designated by CDWR as medium- or high-priority to halt overdraft and bring groundwater basins into balanced levels of pumping and recharge.

Two adjacent subbasins in the area are also designated as medium priority: (1) the Indio Subbasin and (2) the San Gorgonio Pass Subbasin. As noted earlier, the Indio Subbasin Water Management Plan is also being updated and is anticipated to be submitted by January 1, 2022. A GSP is being created for the San Gorgonio Pass Subbasin, which includes three GSAs working together to produce one GSP and involves the following collaborating agencies: DWA, MSWD, Cabazon Water District, the City of Banning, the Banning Heights Mutual Water Company, and the San Gorgonio Pass Water Agency. The San Gorgonio Pass Subbasin GSP is anticipated to be submitted by the January 31, 2022 deadline. As such, the MCSB Alternative Plan Update is being coordinated with the planning and reporting efforts for these adjacent subbasins.

1.5.2 Regional Urban Water Management Plan

The six urban water suppliers in the Coachella Valley – CVWD, CWA, DWA, IWA, MSWD, and Myoma Dunes Mutual Water Company (MDMWC) – agreed to prepare a 2020 Regional Urban Water Management Plan (UWMP) to include regional and individual agency content and other necessary elements as set forth in CDWR’s 2020 UWMP Guidebook. The Regional UWMP was subsequently prepared to aid in long-term water resources planning and to help ensure that adequate water supplies are available to meet existing and future urban water needs. The 2020 Coachella Valley Regional UWMP is complete and was submitted to CDWR on July 1, 2021.

1.5.3 Salt and Nutrient Management Plan

SNMPs are mandated by the State of California’s Recycled Water Policy, adopted in 2009 and amended in 2018. The policy encourages the use of recycled water from municipal wastewater sources as it becomes an increasingly important source of water for California. Since recycled water contains salts and nutrients, SNMPs are required to evaluate current and future recycled water projects and ensure that groundwater basins are adequately managed to protect groundwater beneficial uses. In June 2015, CVWD, DWA, and IWA submitted the CV-SNMP to evaluate recycled water projects for the protection of long-term water supplies and to ensure recycled water reliability within the Coachella Valley. On February 19, 2020, these agencies received a letter from the RWQCB providing findings and recommendations on the 2015 CV-SNMP. As a result, the Coachella Valley urban water and wastewater agencies, CVWD, CWA/Coachella Sanitary District, City of Palm Springs, DWA, IWA, MSWD, MDMWC, and Valley Sanitary District (VSD), collectively the CV-SNMP Agencies, committed to preparing a CV-SNMP Development Workplan (Development Workplan) to define the scope of work for updating the 2015 CV-SNMP. The Development Workplan was required to include a groundwater monitoring workplan with an enhanced monitoring network, identification of data gaps, and a plan to fill the gaps.

The CV-SNMP Agencies submitted the CV-SNMP Groundwater Monitoring Program Workplan (GMP Workplan) to the RWQCB in December 2020 (West Yost, 2020). The GMP Workplan outlines an expanded groundwater monitoring program that will sufficiently determine whether concentrations of nitrates and total dissolved solids (TDS), collectively N/TDS, in groundwater are consistent with water quality objectives. The RWQCB approved the GMP Workplan in February 2021. The GMP Workplan covers all subbasins within the Coachella Valley Groundwater Basin; includes sampling from the deep, shallow, and perched zones of the aquifer; focuses on critical areas near large water reclamation facilities that are also known as wastewater treatment plants (WWTPs), groundwater replenishment facilities (GRFs), and other potential sources of salt and nutrient loading; and emphasizes areas near production wells. The GMP Workplan establishes the monitoring network, sampling frequency, and reporting. Annual reporting of water quality data from this program is scheduled to begin in 2022.

The CV-SNMP partners submitted the Development Workplan to the RWQCB on September 2, 2021 (West Yost, 2021). The RWQCB approved the workplan on October 4, 2021. The Development Workplan outlines a scope of work for updating the CV-SNMP in accordance with the Recycled Water Policy and addresses RWQCB recommendations. Implementation of the Development Workplan includes public outreach and a technical advisory committee, characterization of current groundwater quality and salt and nutrient loading, developing N/TDS forecasting methodologies, completing forecasting for multiple scenarios, establishing management zones, and recommending TDS objectives. The implementation schedule for the Development Workplan concludes with a final CV-SNMP submitted to the RWQCB in October 2026.

1.5.4 Integrated Regional Water Management Plan

As stated in the *2009 California Water Plan Update:* "The broad purpose of Integrated Regional Water Management (IRWM) is to promote a regional planning and implementation framework to comprehensively address water supply, quality, flood, and ecosystem challenges and to implement integrated solutions through a collaborative multi-partner process that includes water managers, tribes, non-governmental organizations, State, federal, and local governments, and disadvantaged communities." Consistent with this, the Coachella Valley IRWM Plan was created by the CWA, CVWD, DWA, IWA, MSWD, and VSD and last updated in 2018 to outline an integrated regional approach for addressing water management issues through a process that identifies and involves water management stakeholders from the Coachella Valley. The 2018 plan was also expanded to include a Stormwater Resources Plan component. The goal of the IRWM Plans is to secure long-term water supply reliability within California by first recognizing the inter-connectivity of water supplies, then encouraging the development and implementation of projects that yield multiple benefits for water supplies, water quality, and natural resources.

1.6 Stakeholder Involvement

Stakeholder communication and engagement was conducted as part of this Alternative Plan Update to engage stakeholders within the Planning Area and to meet the SGMA requirements. Stakeholders invited to participate included public and private water users, tribal representatives City and County Land Use Planning agencies, neighboring GSAs, as well as state and federal agencies with focused effort on Disadvantaged Communities (DACs). The goals of public engagement were to understand the needs and increase participation of stakeholders and communities within the Planning Area and increase awareness and understanding of this Alternative Plan Update. In addition to e-mail notices regarding the four public workshops, a website to communicate the activities of this Alternative Plan Update was also developed at MissionCreekSubbasinSGMA.org, which provides public workshop presentations, answers to frequently asked questions, Spanish-language materials, and contact information. Outreach to DAC included targeted telephone calls and e-mails to organizations serving DAC communities to encourage participation. The Communication and Engagement Plan included in **Appendix D** contains elements of the stakeholder involvement process and a list of organizations represented by stakeholders.

2.0 Plan Setting

This section describes the Planning Area, including a description of the Planning Area, land uses, demographics, water infrastructure, and environmental factors.

2.1 Planning Area Description

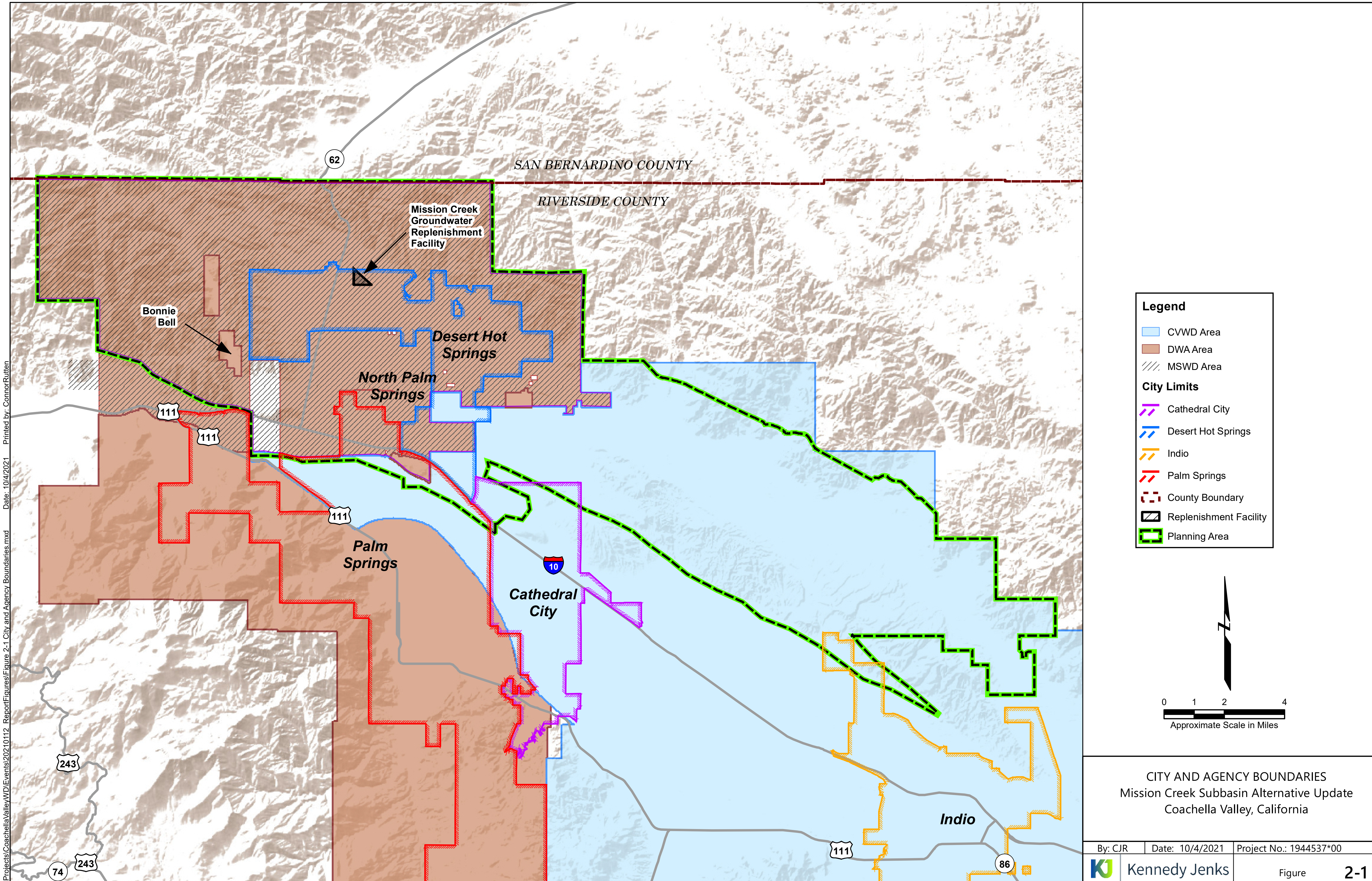
The Planning Area is located within the northwestern portion of the Coachella Valley Groundwater Basin. The Coachella Valley is located northwest of the Salton Sea within the Colorado Desert (CDWR, 2004) in southern California (**Figure 1-1)**. The valley is about 65 miles long and covers an area of approximately 400 square miles. It is bordered by the San Jacinto and Santa Rosa Mountains on the southwest, the San Bernardino Mountains on the northwest, the Little San Bernardino Mountains and the Mecca Hills on the northeast, and the Salton Sea on the southeast. The Coachella Valley is drained primarily by the Whitewater River, which discharges into the Salton Sea via the Coachella Valley Stormwater Channel. Land-surface elevations vary from more than 230 feet below sea level at the Salton Sea to more than 10,000 feet above sea level at the peaks of the San Jacinto and San Bernardino mountains. The San Bernardino, San Jacinto, and Santa Rosa Mountains impede the eastward movement of storms and create a rain shadow, which results in an arid climate and greatly reduces the contribution of direct precipitation as a source of recharge to groundwater in the Coachella Valley.

The MCSB lies within the northwestern portion of the Coachella Valley Groundwater Basin. The Planning Area for this Alternative Plan Update includes the Mission Creek Subbasin (MCSB) and the Garnet Hill Subarea (GHSA) of the Indio Subbasin, as well as portions of the Desert Hot Springs Subbasin (DHSSB). As noted in Section 1, for the purposes of Sustainable Groundwater Management Act (SGMA) compliance, this Alternative Plan Update only addresses the MCSB. For the purpose of water management, groundwater from the MCSB is used to meet water demands both inside and outside the MCSB. Therefore, the Planning Area covers a larger area than the MCSB boundary. For example, the northern portion of the Planning Area (in both Mission Springs Water District [MSWD] and the Coachella Valley Water District [CVWD] service areas) overlies the DHSSB, which receives groundwater pumped from the MCSB. Therefore, the portion of the DHSSB that currently receives or potentially could receive groundwater from the MCSB in the future is included in the Planning Area. The GHSA is included in the Planning Area to be consistent with the 2013 Mission Creek/Garnet Hill Water Management Plan (MWH, 2013 [2013 MC/GH WMP]).

2.1.1 Agencies and Governments

The Planning Area contains the City of Desert Hot Springs (City of DHS), and small portions of the cities of Palm Springs, Cathedral City, and Indio, as well as unincorporated areas of Riverside County, including North Palm Springs, and Bonnie Bell (as shown on **Figure 2-1)**. Each incorporated city serves as the land use planning agency within its jurisdictional boundary, and Riverside County serves as the land use planning agency for unincorporated areas. The three major water agencies in the Planning Area are CVWD, Desert Water Agency (DWA), and MSWD, as described previously. The water retailers for the Planning Area include CVWD and MSWD. DWA does not have any retail service area within the Planning Area. A description of each agency follows.

Sources: Esri, USGS, NOAA



Z:\Projects\CoachellaValleyWD\Events\20210112_ReportFigures\Figure 2-1 City and Agency Boundaries.mxd Date: 10/4/2021 Printed by: ConnorRutten

CITY AND AGENCY BOUNDARIES
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: CJR | Date: 10/4/2021 | Project No.: 1944537*00

Kennedy Jenks

Figure 2-1

MSWD is a public water and wastewater agency organized under the County Water District Law (MWH, 2013). Formed in 1953 as the Desert Hot Springs County Water District, MSWD covers 135 square miles and serves more than 13,300 retail water customers and 9,200 wastewater customers. MSWD's boundary for its retail service area encompasses the City of DHS, portions of unincorporated Riverside County, and portions of the City of Palm Springs, and the communities of Bonnie Bell and North Palm Springs. The MSWD service area is shown in hatch on **Figure 2-1**. The majority of the MSWD service area within the Planning Area overlies the DWA jurisdictional area.

DWA is an independent special district organized under the Desert Water Agency Law (MWH, 2013) and was formed in 1961 to contract for State Water Project (SWP) water to replenish the Coachella Valley Groundwater Basin. Since that time, DWA's responsibilities have expanded to include retail water service, water recycling, and power generation. DWA's institutional boundary as an imported water replenishment agency extends over approximately 325 square miles (MWH, 2013) and is shown in brown on **Figure 2-1**. DWA does not provide any retail water or wastewater services within the Planning Area. The majority of DWA's jurisdiction area within the Planning Area, overlies the MSWD service area, which is shown as brown with hatch pattern on **Figure 2-1**.

CVWD is a public agency organized under the County Water District Law and was formed in 1918 (MWH, 2013). CVWD has a jurisdictional area shown in blue on **Figure 2-1** that covers approximately 1,000 square miles and delivers irrigation water to more than 60,000 acres of agricultural land and potable water to more than 110,000 customers. The agency also provides wastewater collection, treatment, recycling and disposal, regional stormwater protection, groundwater management, and water conservation services. CVWD obtains imported water from the SWP, which is exchanged with the Metropolitan Water District of Southern California (MWD) for Colorado River water through the Colorado River Aqueduct (CRA). The agency also receives water from the Colorado River that is delivered to the Indio Subbasin primarily via the Coachella Canal. CVWD provides water service within CVWD's Public Water System (PWS) Improvement District-8 (ID-8), shown in red on **Figure 2-1**, that overlies and uses groundwater from the MCSB. CVWD does not provide wastewater collection in the Planning Area **Figure 2-1**.

2.1.2 Groundwater Basin, Subbasins, and Subareas

Although there is interflow of groundwater throughout the Coachella Valley Groundwater Basin, fault barriers, constrictions in the groundwater basin profile, and areas of low permeability limit and control movement of groundwater. Based on these factors, the Coachella Valley Groundwater Basin is divided into subbasins including the Indio, Mission Creek, Desert Hot Springs, and San Gorgonio Pass subbasins as shown on **Figure 1-1**. The Indio, Mission Creek, and San Gorgonio Pass Subbasins are designated as medium-priority basins and require compliance with the SGMA while the DHSSB is a very low-priority basin and does not require compliance with the SGMA.

The Coachella Valley subbasins delineate areas underlain by geological formations that readily yield stored groundwater to water wells and offer natural reservoirs for the regulation of water supplies. More detailed descriptions of the groundwater basins, subbasins and subareas in the Planning Area are provided in the following sections.

2.1.2.1 Mission Creek Subbasin

The MCSB is designated Number 7-21.02 in California Department of Water Resources (CDWR) Bulletin 118 (2020) and is within the northwestern Coachella Valley in the north-central portion of Riverside County, California. Several small portions of the MCSB lie outside the boundaries of the GSAs (**Figure 1-2**). These fringe areas are in San Bernardino County and are not included within the boundaries of a local water district. Portions of the fringe areas are located within designated U. S. Forest Service or U. S. Bureau of Land Management wilderness areas with less than one square mile being privately owned. Except for the relatively small privately owned portion, the fringe areas fall within the recently designated Sand to Snow National Monument. Discussions with the County of San Bernardino indicated it had no interest in being a GSA for this area. Because development in this fringe area is restricted by land ownership and wilderness/national monument designation, it was excluded from GSA coverage (Wood, 2020).

The Mission Creek Fault and the Banning Fault form the northeastern and southwestern boundaries of the subbasin, respectively. Groundwater level differences across the Banning Fault, between the MCSB and the GHSA, are on the order of 200 to 250 feet. Similar groundwater level differences exist across the Mission Creek Fault between the MCSB and DHSSB (MWH, 2013). The groundwater level differences indicate that the faults form partial barriers to groundwater flow in and out of the MCSB.

The northwestern end of the MCSB includes the active and paleo stream channels of the Whitewater River at an elevation of approximately 5,000 feet above mean sea level (msl). The Whitewater River channel and paleochannel are largely uninhabited, except for the small community of Bonnie Bell. The main MCSB (outside of the Whitewater River channel and northern paleochannel) extends from the base of the San Bernardino Mountain foothills southeastward into the western portion of the Indio Hills. Much of the MCSB is undeveloped and supports sparse desert vegetation.

The City of DHS and the community of North Palm Springs are in the central part of the MCSB. Palm Springs city limits also extend into the MCSB, and the city limit ends just south of the community of North Palm Springs. Individual homes and smaller communities are scattered across the northwestern and other parts of the MCSB. The Indio Hills are largely uninhabited and are comprised of semi-consolidated sediments of low permeability in the groundwater-saturated zone and are not considered part of the main MCSB area for groundwater resources (Wood, 2020).

Groundwater is stored in the alluvial sediments of the MCSB, which extend to a depth as great as 3,000 feet below ground surface (bgs) and are underlain by semi-consolidated, semi-permeable sediments (GCI, 1979). MCSB has an estimated total storage capacity of 2.6 million acre-feet (AF) (CDWR, 1964). The natural inflows to the MCSB include infiltration of runoff in the creeks and washes (e.g., Mission Creek, Big Morongo Creek, Little Morongo Creek, and the Morongo Wash), subsurface mountain front recharge, and subsurface inflow from the DHSSB. Additional sources of recharge include wastewater percolation, septic system percolation, and return flow infiltration from water applied for urban, agricultural, recreational (such as golf course irrigation), and industrial uses. When available, a significant source of recharge to the MCSB is artificial recharge of imported water to the MCSB at the Mission Creek Groundwater Replenishment Facility (MC-GRF) (Wood, 2020).

The primary outflow is through groundwater production for urban, agricultural, and industrial uses. CVWD and MSWD produce the most groundwater in the MCSB for delivery to their retail customers in the MCSB and adjacent DHSSB. Groundwater is also pumped from the adjacent GHSA for use in the MCSB. In addition, there are several individual groundwater pumpers that produce more than 25 acre-feet per year (AFY) in the CVWD service area and 10 AFY in the DWA jurisdictional area that are required to meter pumping and are assessed a replenishment assessment charge (RAC). There are other private wells located in the MCSB that are not required to report their well production to CVWD or DWA based on annual production falling below the agencies' reporting limits of 25 and 10 AFY, respectively. These pumpers are referred to as minimal pumpers and their groundwater use is estimated. Other outflows of groundwater from the MCSB include evapotranspiration from phreatophytes in shallow groundwater areas and subsurface outflow to the Indio Subbasin, including outflow to the GHSA (Wood, 2020).

2.1.2.2 Garnet Hill Subarea of the Indio Subbasin

The area between the Garnet Hill Fault and the Banning Fault is known as the GHSA of the Indio Subbasin (see **Figure 2-1**). The Garnet Hill Fault is a branch of the San Andreas Fault system consisting of a series of northwest-trending right-lateral faults with active folds at each stepover. These folds are expressed as a series of small hills between each fault segment (MWH, 2013).

The GHSA is considered an unconfined aquifer with a saturated thickness of 1,000 feet or more and an estimated total storage capacity on the order of 1.0 million AF (CDWR, 1964). The GHSA is naturally recharged by subsurface flow from the MCSB and runoff from the Whitewater River watershed on the west. Irrigation return flow and discharges from municipal and individual subsurface wastewater disposal systems also contribute to recharge but are considered minimal.

Although some recharge to this subarea may come from Mission Creek and other streams that flow through during periods of high flood flows, the main sources of recharge to the subarea are channel infiltration and subsurface flow in the Whitewater River, subsurface flow through the semi-permeable sedimentary deposits that underlie Whitewater Hill, and subsurface flow across the Banning Fault from the MCSB.

2.1.2.3 Desert Hot Springs Subbasin

Parts of the Planning Area overlie the DHSSB, designated as Subbasin No. 7-21.03 in CDWR Bulletin 118 (CDWR, 2003). The DHSSB is included in water management planning for the MCSB because a significant portion of the groundwater pumped from the MCSB is delivered for use by residential, commercial, industrial and some agricultural customers in the DHSSB. The DHSSB is located adjacent to the MCSB and trends northwest-southeast along the foothills of the Little San Bernardino Mountains. Within the Planning Area, the subbasin is bounded on the southwest by the Mission Creek Fault, which also corresponds to the uplift of the semipermeable rocks of the Indio Hills. This fault acts as a partial groundwater barrier, directing groundwater flow in a southeasterly direction in the subbasin. The subbasin is comprised of late Pleistocene and

Recent unconsolidated heterogeneous alluvial deposits consisting primarily of coarse sand and gravel (CDWR, 2003). Groundwater storage capacity of the subbasin is estimated at approximately 4.1 million AF (CDWR, 1964). Naturally occurring hot thermal springs occur along the Mission Creek Fault in the DHSSB and have been actively pumped for over 50 years to supply local resorts (MWH, 2013). Although water from the DHSSB is not used for domestic consumption, approximately 23 resorts rely on these thermal springs for spas, resorts, and more (Visit DHS, 2020). No specific management plan exists for the DHSSB, and groundwater pumping and water level data are sparse.

2.2 Land Use

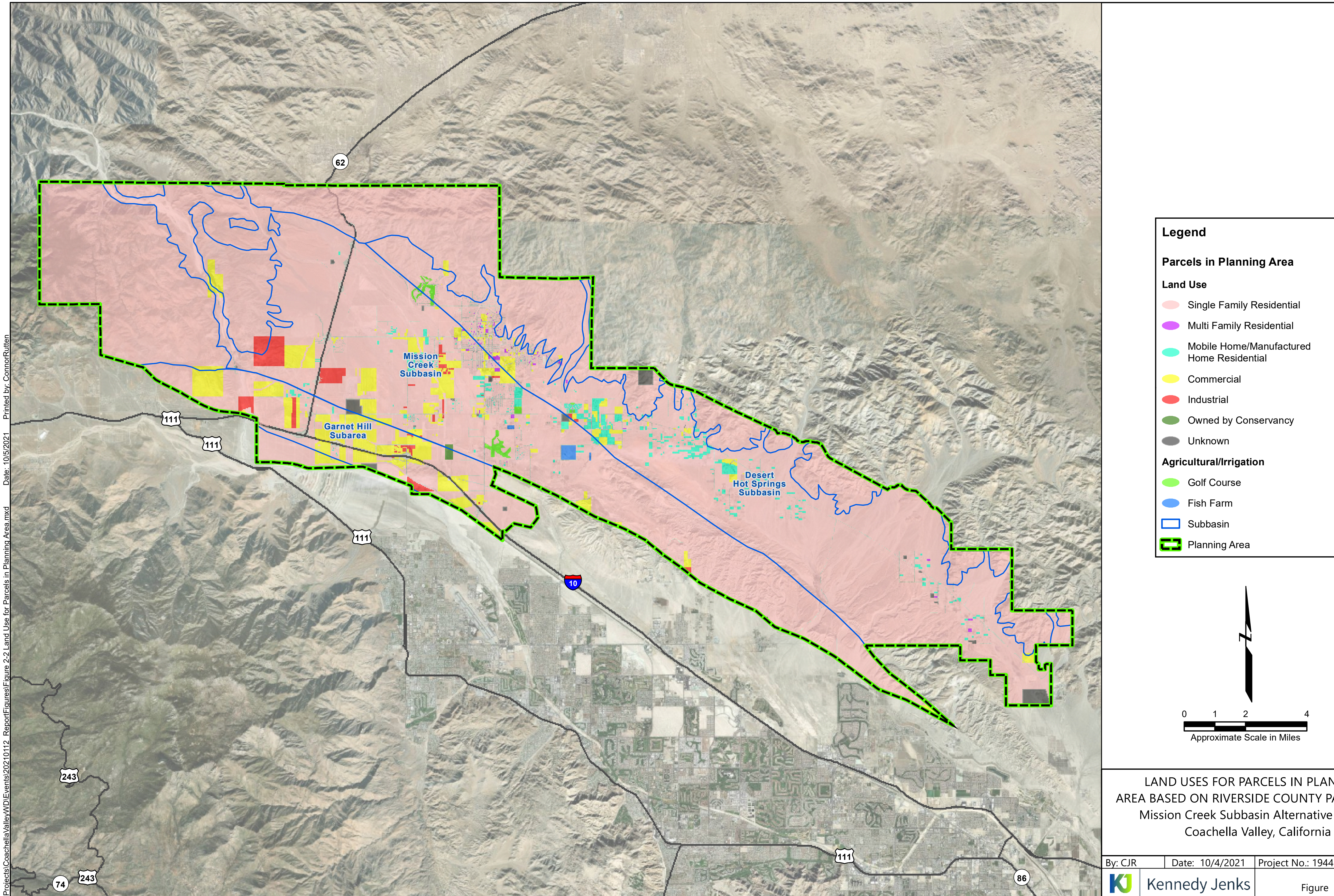
Land use categories provide a good indicator of water demands and can be used to estimate future water demands based on planned developments identified in a city or county General Plan. Land use designations for this Alternative Plan Update, shown on **Figure 2-2**, are based on the land uses described in the Riverside County General Plan (Riverside County, 2019), which were verified with the Riverside County General Plan, Western Coachella Valley Area Plan (Riverside County, 2012) and the City of DHS General Plan (City of Desert Hot Springs, 2007). The following simplified land use classifications are used in this Alternative Plan Update for the water demand projections, described in Section 3:

- Agricultural/Irrigation, which includes subcategories of Fish Farm and Golf Course.
- Commercial, which includes shopping centers, offices, spas, resorts, and hotels.
- Owned by Conservancy, which includes parcels currently owned by conservancies.
- Industrial, which includes business parks, light industrial, and general industrial.
- Single Family Residential, which includes single-family dwellings (with and without secondary units) of varying densities.
- Multi-Family Residential, which includes duplexes, triplexes, and apartments of varying densities.
- Mobile Home/Manufactured Home Residential, which includes high-density mobile home parks.
- Unknown (No category provided by Riverside County; however, using aerial imagery, most “Unknown” parcels appeared to be Single Family Residential parcels).

Tourism has historically driven land use development patterns in the Planning Area and has increased since 1914, when Cabot Yerxa unearthed mineral water in the Desert Hot Springs area (Cabot’s Museum, 2020).[3] The northern Coachella Valley attracts visitors and residents in search of a warmer climate and hot mineral waters. There are approximately 23 spas and resorts related to the thermal springs located in Desert Hot Springs as well as several resorts and golf courses, and regional activities such as the Coachella Festival and the Indian Wells Tennis Tournament, all of which attract visitors and residents to the area.

[3] https://www.cabotsmuseum.org/the-water/

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



LAND USES FOR PARCELS IN PLANNING AREA BASED ON RIVERSIDE COUNTY PARCEL DATA
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: CJR | Date: 10/4/2021 | Project No.: 1944537*00

Kennedy Jenks

Figure 2-2

Z:\Projects\CoachellaValleyWD\Events\20210112_ReportFigures\Figure 2-2 Land Use for Parcels in Planning Area.mxd Date: 10/5/2021 Printed by: ConnorRutten

2.2.1 City of Desert Hot Springs General Plan Update

During the development of this Alternative Plan Update, an updated City of DHS General Plan was adopted that has not yet been captured in the growth forecast used in the Alternative Plan Update. The City of DHS General Plan Update is discussed in Section 3, Demand Projections.

2.3 Planning Area Demographics

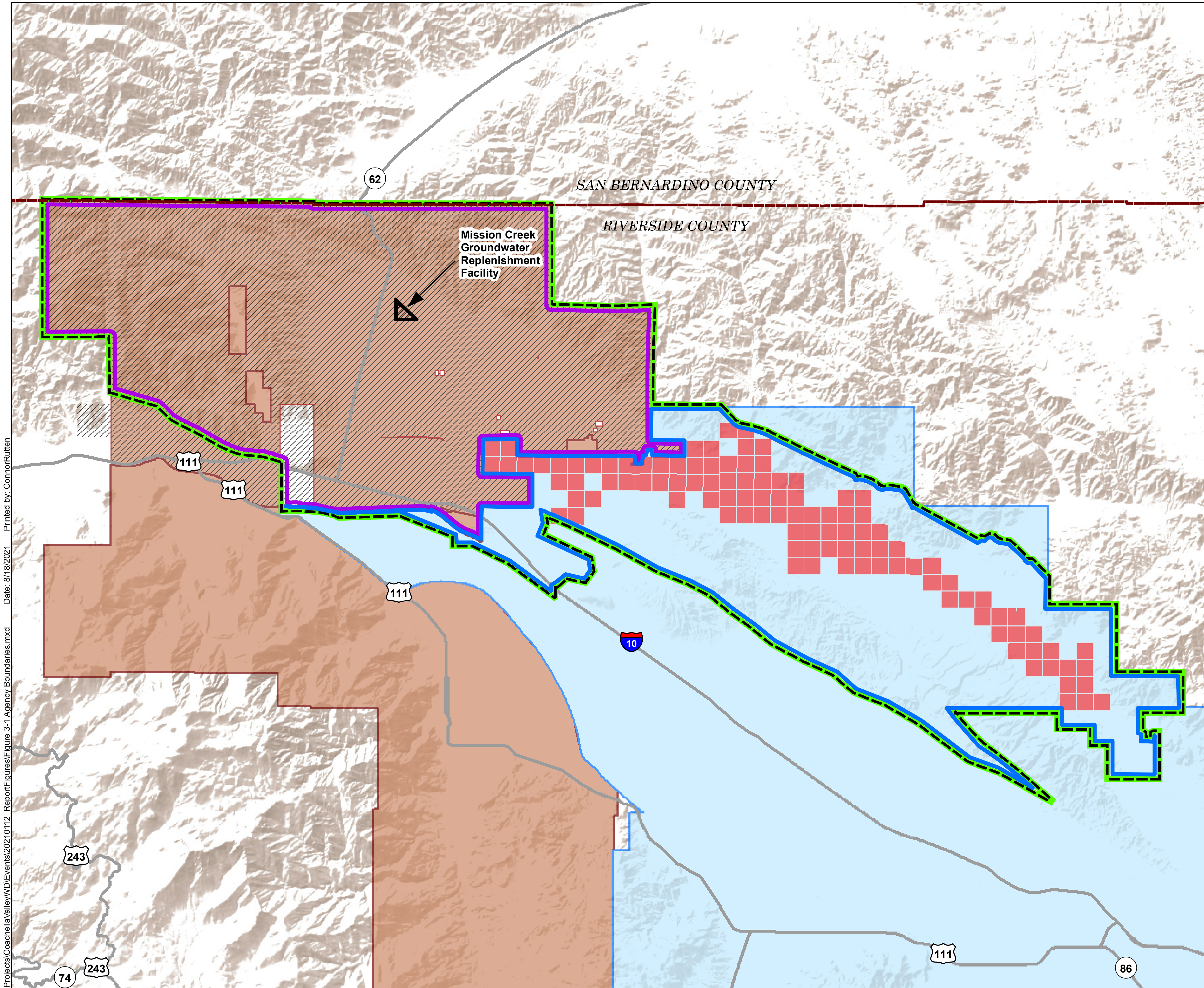
Similar to land use, population trends provide a good indicator of water demands, particularly to estimate future water demand growth. This Alternative Plan Update utilizes Planning Area demographics based on population information from the Southern California Association of Governments' (SCAG) regional growth forecast contained in the 2020 Regional Transportation Plan and Sustainable Communities Strategy (SCAG, 2020). The forecast includes population projections released in November 2017 and includes base year estimates for 2016 and projections for years 2020, 2035, and 2045.

SCAG used Transportation Analysis Zones (TAZ), which are similar to census block groups, in their population projections to identify where and how much population growth is expected to occur in each subarea. These population projections are developed based on local community input, economic data, and input from state agencies such as the Economic and Human Development Policy Committee and the California Department of Finance. These projections are regularly updated based on the latest available data and trends to maintain both accurate and meaningful population projections for Southern California.[4] SCAG is in the process of updating their population projections for the Southern California region based on recent 2020 census data; however, the updated dataset was not available for integration into this planning document when the analysis began.

SCAG population projections are provided in Geographic Information System (GIS) polygon format for each TAZ and were processed for the Planning Area by agency areas. As illustrated with the purple boundary on **Figure 2-3**, the northern portion of the Planning Area is referred to in this Alternative Plan Update as the MSWD/DWA Planning Area. The MSWD/DWA Planning Area encompasses DWA's area shown in brown and MSWD's area shown in hatch pattern on **Figure 2-3**. The remainder of the Planning Area to the southeast is referred to in the Alternative Plan Update as the CVWD Planning Area. The CVWD Planning Area, shown with a blue boundary on **Figure 2-3**, includes all CVWD's area within the Planning Area including PWS ID-8. These two planning areas are described in greater detail in Section 3, Demand Projections. **Table 2-1** shows SCAG population projections for the two planning areas.

[4] Source: SCAG Website: https://scag.ca.gov/growth-forecasting

Sources: Esri, USGS, NOAA



Z:\Projects\CoachellaValleyWD\Events\20210112_ReportFigures\Figure 3-1 Agency Boundaries.mxd Date: 8/18/2021 Printed by: ConnorRutten

AGENCY BOUNDARIES AND PLANNING AREAS
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: CJR | Date: 8/18/2021 | Project No.: 1944537*00

Kennedy Jenks

Figure 2-3

Table 2-1: SCAG Population Projections for Planning Area

Year	CVWD Planning Area		MSWD/DWA Planning Area		Total Planning Area	
	Population	% Annual Increase[b]	Population	% Annual Increase[b]	Population	% Annual Increase[b]
2016[a]	8,875	-	39,008	-	47,883	-
2020	9,454	1.59	43,539	2.79	52,993	2.57
2035	14,399	2.84	59,472	2.10	73,872	2.24
2045	16,232	1.21	72,078	1.94	88,310	1.80

[a] 2016 population values are estimated based on existing population census data (not projected values).
[b] Percent (%) Annual Increase is assumed to be constant between listed time periods.

2.4 Water Infrastructure Overview

This subsection provides an overview of the water infrastructure that supports groundwater production and recharge within the Planning Area.

2.4.1 Groundwater Production

Of the two retail water purveyors in the Planning Area, MSWD has higher groundwater production from the MCSB and the GHSA. MSWD's service area also overlies the DHSSB, which is served potable water from the MCSB. DWA does not have any groundwater production facilities in the MCSB or GHSA. CVWD has four active production wells located in the south-central portion of the MCSB. Similar to MSWD, CVWD's service area also overlies the DHSSB, which is served potable water from the MCSB.

CVWD and DWA are authorized by the California Water Code to levy a RAC for the purposes of replenishing groundwater supplies within their areas. The authorizing legislation requires the installation of water measuring devices on all wells when the collective production for a producer's wells exceeds the RAC thresholds for the respective agency (25 and 10 AFY for CVWD and DWA, respectively). Consequently, all production wells that participate in the RAC programs are metered. From 2015 to 2019, groundwater was extracted from 26 metered wells subject to the RAC, including municipal pumping and 14 privately owned wells. In addition to the metered RAC pumping, it is estimated that there is an additional 500 AFY of groundwater pumping in the MCSB by minimal pumpers that are not subject to the RACs or metering requirements.

Approximately 90 percent (%) of the metered groundwater produced in the MCSB is produced for municipal and recreational use (including golf course irrigation). The remaining approximately 10% of metered groundwater is produced for agricultural or industrial purposes (Wood, 2020). The average annual production over the five-year period from 2015 through 2019 in the MCSB was 13,869 AFY (including municipal pumping, private metered RAC pumping, and an estimated 500 AFY of unmetered pumping from minimal pumpers). The five-year average annual production by private RAC pumpers for non-municipal use was 1,417 AFY within CVWD's service area and 2,073 AFY in DWA jurisdictional area. Groundwater production volumes are presented each water year in the MCSB Annual Report.

Groundwater for retail delivery is currently produced from one MSWD well in the GHSA. The average annual production over the five-year period from 2015 to 2019 for this well was 445 AFY. One private well in the GHSA is metered and the average annual production over the five-year period from 2015 to 2019 for this well was 14 AFY. Unmetered pumping by private pumpers is considered minimal in the GHSA.

For the DHSSB, no recent records for groundwater extraction were available. Annual pumping from the subbasin was estimated at approximately 1,700 AFY in the late 1990s (Mayer et al., 2007).

2.4.2 Groundwater Replenishment Infrastructure

A conveyance system to deliver SWP water directly to the Coachella Valley does not currently exist. However, CVWD and DWA have purchased rights to SWP water and entered into an agreement with MWD to exchange their SWP water allocations for Colorado River water (SWP Exchange Water). This exchange agreement allows the two agencies to take advantage of MWD's CRA, which passes through the Coachella Valley. DWA acquired approximately 190 acres of land adjacent to the CRA in the MCSB to construct spreading basins for recharge of CRA water. In 1997, MWD constructed a 48-inch turnout from the CRA for DWA's recharge site just south of Indian Avenue and west of Worsley Road in the northern part of MCSB. After construction of the spreading basins, recharge activities in the MCSB began at the MC-GRF in November 2002.

Figure 2-3 shows the location of the MC-GRF, which is used to recharge imported water in the MCSB. The MC-GRF is owned, operated, and maintained by DWA, with cost share by CVWD. This facility is used to recharge a portion of CVWD's and DWA's SWP water allocation. The remainder of their allocations is recharged outside of the MCSB in the western area of the Indio Subbasin.

CVWD and DWA pay the CDWR's expenses for capital and fixed operation and maintenance for the delivery of their SWP water delivered to MWD. MWD then delivers SWP Exchange Water to the MCSB at no cost. The CDWR's charges are recovered in two ways by CVWD and DWA. One portion of delivery cost is recovered from SWP property taxes while the remainder of the costs is recovered from the RAC. The SWP property tax portion is generally used to pay SWP water fixed/capital costs while the RAC portion funds other expenses such as power, operation, and maintenance costs.

2.5 Environmental Factors

This section describes the environmental resources of the Coachella Valley that are relevant to the Planning Area and its population projections, anticipated demands, and groundwater resources that are considered in this Alternative Plan Update.

The Coachella Valley Multi-Species Habitat Conservation Plan (CVMSHCP) provides a regional vision for balanced growth to meet the requirements of federal and state endangered species laws, while promoting enhanced opportunities for recreation, tourism, and job growth. The CVMSHCP aims to conserve open space and protect plant and animal species. By providing comprehensive compliance with federal and state endangered species laws, the CVMSHCP not only safeguards the desert's natural resources for future generations, but also allows for more timely construction of roads and other infrastructure essential to improving quality of life in the Coachella Valley (CVCC, 2020).

The CVMSHCP was approved by the United States Fish and Wildlife Service (USFWS) in October 2008 and was amended most recently in August 2016, which brought MSWD into the plan. The purpose of the CVMSHCP is to balance the goals of maintaining biological diversity and meeting economic growth objectives in the CVMSHCP Plan Area through the designation of open space. Drawing from state and federal regulatory laws governing the protection of threatened and endangered species, the CVMSHCP is based on the California and the Federal Endangered Species Acts (ESA), National Environmental Policy Act, Natural Community Conservation Planning Act, the California Fish and Game Code, and the California Environmental Quality Act. **Figure 2-4** shows the habitat conservation areas in and around the Planning Area, which are based on established ecological systems, biological corridors, and jurisdictional factors (CVCC, 2020). **Table 2-2** summarizes the acreage of each designated conservation area within the Planning Area.

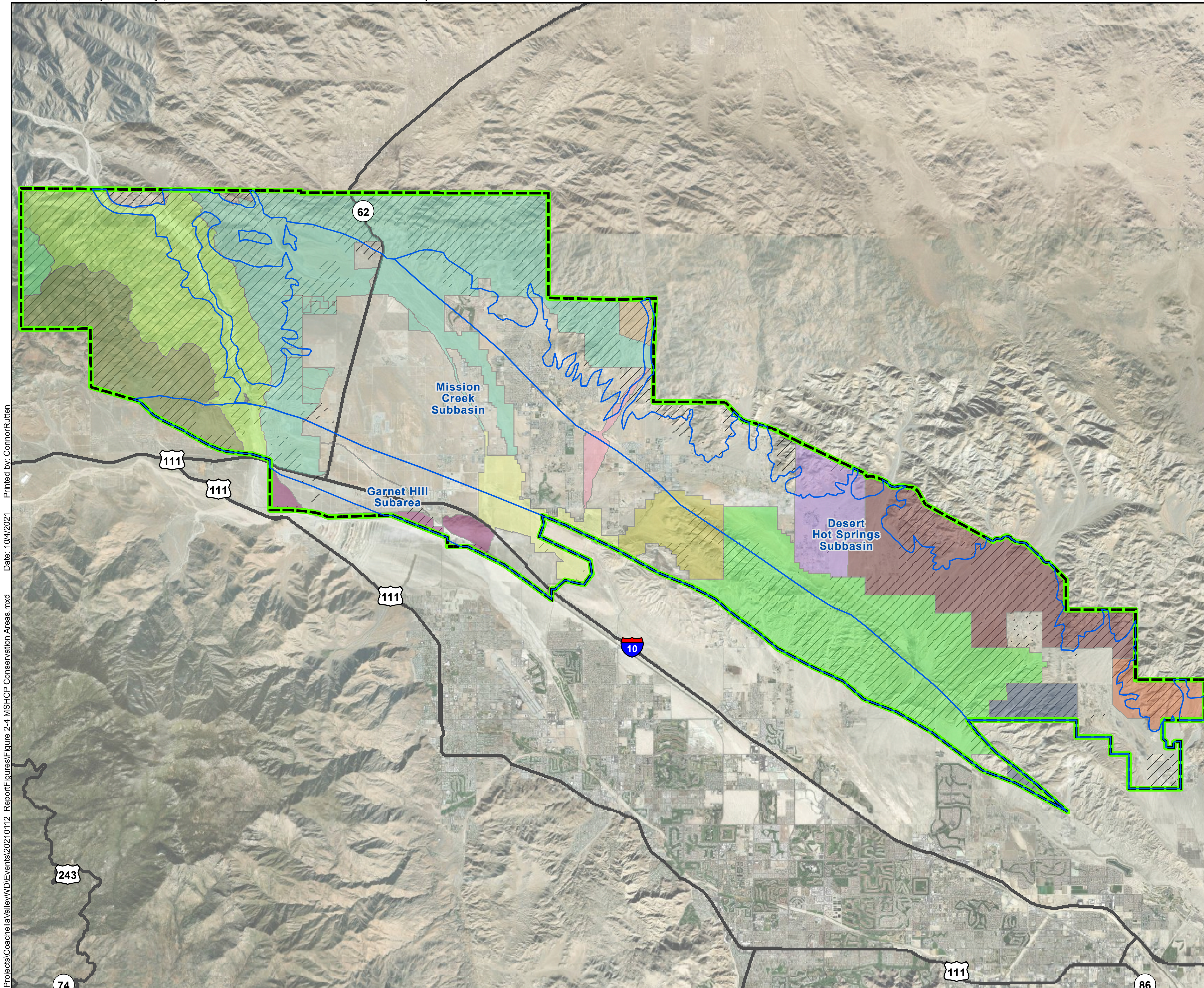
Within the Planning Area, the CVMSHCP designates about 95,600 acres of land within 14 conservation areas. As signatories to the CVMSHCP, CVWD and MSWD are obligated to fully implement the terms and conditions of the CVMSHCP and the Second Amendment to the Implementing Agreement.[5] Both agencies are ongoing participants in the CVMSHCP.

Table 2-2: Conservation Areas in Planning Area

Conservation Area Designation	Acreage within Planning Area (acres)
Cabazon Conservation Area	845
Desert Tortoise and Linkage Conservation Area	2,169
Edom Hill Conservation Area	3,299
Indio Hills Palms Conservation Area	1,843
Indio Hills/Joshua Tree National Park Linkage Conservation Area	11,631
Joshua Tree National Park Conservation Area	772
Long Canyon Conservation Area	809
Stubbe and Cottonwood Canyons Conservation Area	8,057
Thousand Palms Conservation Area	17,340
Upper Mission Creek/Big Morongo Canyon Conservation Area	26,088
West Deception Canyon Conservation Area	3,926
Whitewater Canyon Conservation Area	14,064
Whitewater Floodplain Conservation Area	1,509
Willow Hole Conservation Area	3,254
Total	**95,606**

[5] https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=131208&inline

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Legend

Conservation Area

- Cabazon
- Desert Tortoise and Linkage
- Edom Hill
- Indio Hills Palms
- Indio Hills/Joshua Tree National Park Linkage
- Joshua Tree National Park
- Long Canyon
- Stubbe and Cottonwood Canyons
- Thousand Palms
- Upper Mission Creek/Big Morongo Canyon
- West Deception Canyon
- Whitewater Canyon
- Whitewater Floodplain
- Willow Hole
- Federal Lands
- Subbasin
- Planning Area

N

0 1 2 4

Approximate Scale in Miles

MULTI SPECIES HABITAT CONSERVATION PLAN AREAS

Mission Creek Subbasin Alternative Update

Coachella Valley, California

By: CJR	Date: 10/4/2021	Project No.: 1944537*00
Kennedy Jenks		Figure 2-4

Z:\Projects\CoachellaValleyWD\Events\20210112_ReportFigures\Figure 2-4 MSHCP Conservation Areas.mxd Date: 10/4/2021 Printed by: ConnorRutten

Table 2-3 summarizes the acreages of federal lands within the Alternative Plan Update Planning Area. United States federal lands were not considered suitable for future growth due to federal ownership.

Table 2-3: Federal Lands in Planning Area

Federal Lands Classification	Acreage within Alternative Plan Update Planning Area (acres)
Bureau of Indian Affairs	4
Bureau of Land Management	51,493
Forest Service	5,064
Local Government	377
National Park Service	826
Small Tract	5,192
Undefined	1,976
Total	**64,932**

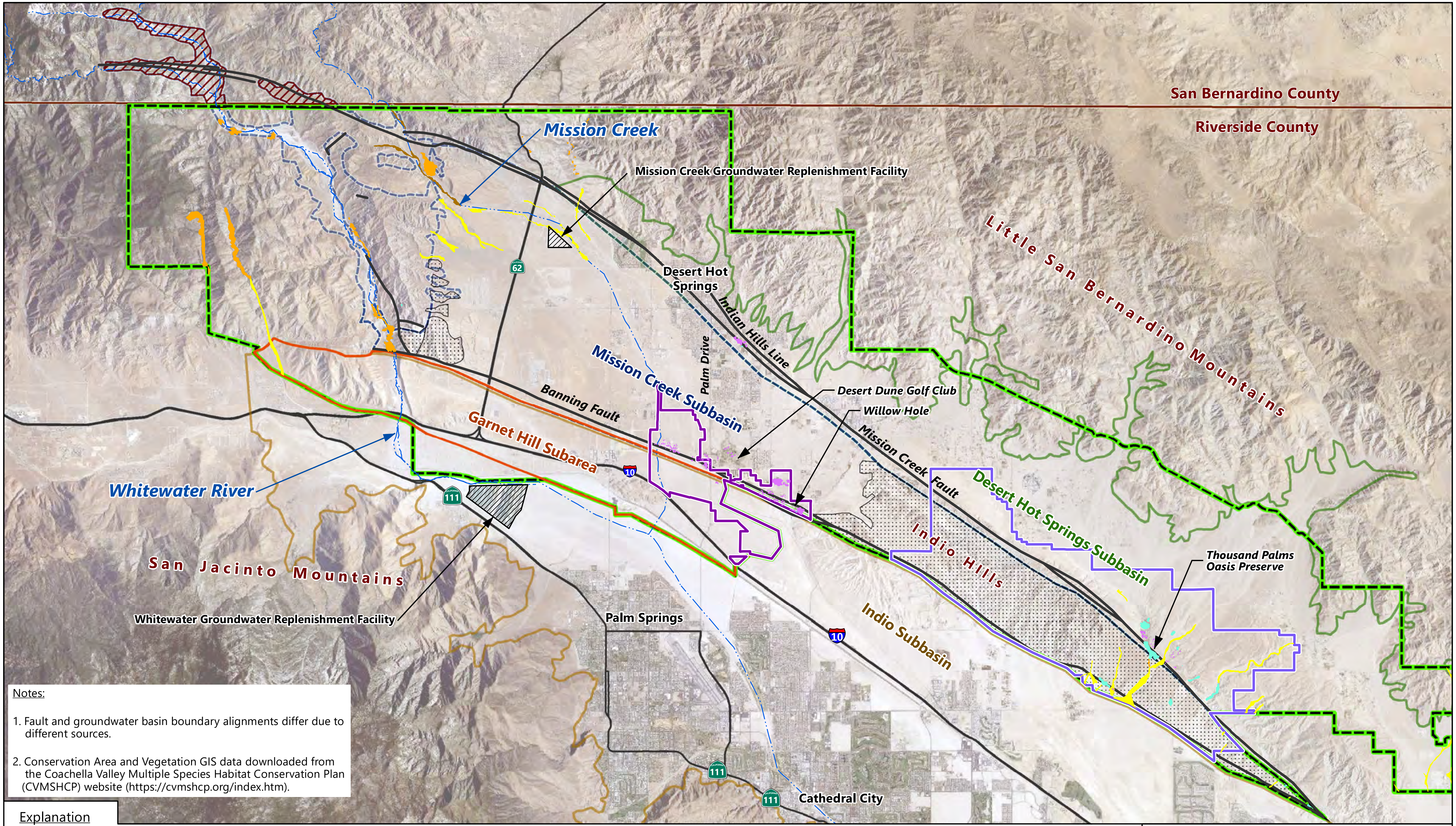
2.6 Known and Potential Groundwater Dependent Ecosystems in the MCSB

The CVMSHCP identified one known groundwater dependent ecosystem (natural community) and four potential ecosystems in the MCSB that may be groundwater dependent (CVAG, 2016). The primary groundwater dependent ecosystem in the MCSB is mesquite hummocks. Four other natural communities that may be groundwater-dependent include: (1) Sonoran cottonwood-willow riparian forest, (2) southern sycamore-alder riparian woodland, (3) desert fan palm oasis woodland, and (4) desert dry wash woodland. These four communities are located either outside the influence of groundwater management activities in the MCSB or in areas where regional groundwater occurrence is of sufficient depth that groundwater management activities will not impact the communities.

2.6.1 Mesquite Hummocks

Mesquite hummocks were historically found throughout the Coachella Valley (CVAG, 2016). They occupied about 8,300 acres of the Coachella Valley in 1939 but were reduced to less than 1,000 acres by 1998. Most are present along the Banning and San Andreas Faults where groundwater levels historically have been within about 50 feet of the ground surface. They have been impacted in the past several decades, potentially by the factors discussed below.

The mesquite hummock natural community is composed of stands of honey mesquite (*Prosopis glandulosa* var. *torreyana*). In areas with active wind-blown sand movement, mesquite hummocks provide structure that can be a nucleus for accumulating and stabilizing large quantities of aeolian sand. Mesquite hummocks are found within sand dunes at the Willow Hole Conservation Area in the MCSB (**Figure 2-5**). Mesquite hummocks also occur on level terrain such as at the margins of Palm Oases in the DHSSB and just outside of the MCSB (at the far southeastern end of the MCSB as shown on **Figure 2-5**).



Notes:

1. Fault and groundwater basin boundary alignments differ due to different sources.
2. Conservation Area and Vegetation GIS data downloaded from the Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) website (https://cvmshcp.org/index.htm).

Explanation

- Facility
- Planning Area
- Streams
- Highway/road
- Fault
- Mission Creek Subbasin fringe area
- Garnet Hill Subarea of Indio Subbasin
- Low permeability/non-water bearing sediments/bedrock
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin

Conservation Areas

- Thousand Palms
- Willow Hole

CVMSHCP Vegetation Natural Communities

- Desert dry wash woodland
- Desert fan palm oasis woodland
- Sonoran cottonwood-willow riparian forest
- Southern sycamore-alder riparian woodland
- Mesquite hummocks

0 6,000 12,000
Approximate Scale in Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA.Water.CA.gov.

KNOWN AND POTENTIAL GROUNDWATER DEPENDENT ECOSYSTEMS
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: pah	Date: 9/7/2021	Project No.: CM19167351
wood.		Figure 2-5

Date: 9/8/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternative)\Esri\Alternative Update\2-5_MCS_Planning_Biological_Map.mxd

Mesquite hummocks are typically associated with high soil moisture and often associated with springs or fault areas that result in relatively high groundwater conditions (i.e., near surface or relatively shallow groundwater conditions). Honey mesquite has been categorized as a facultative phreatophyte, meaning that it can shift its primary water uptake between a relatively deep tap root (recorded at up to 170 feet deep) to shallower near-surface roots that take in water from rainfall events. While this suggests that honey mesquite can thrive either with high groundwater conditions or with precipitation alone, all long-lived honey mesquite stands in the Coachella Valley occur where there are relatively high groundwater conditions, often associated with fault zones (UCR-CCB, 2020).

To evaluate groundwater level impacts on mesquite hummocks, a 2014 study by the University of California Riverside-Center for Conservation Biology (UCR-CCB) for the CVMSHCP used ground-penetrating radar along the surface of the dunes associated with mesquite stands to assess the depth to groundwater. Findings showed probable near-surface (high) groundwater at one vigorous stand, but at all other sites there was no groundwater detected from the surface using this method (UCR-CCB, 2020). Ground penetrating radar, however, is not a precise method of measuring depths to groundwater. The 2014 study did not include depth to groundwater level measurements in nearby wells for calibration of the ground penetrating radar survey (CVWD, 2014). Overall, the study was inconclusive regarding depth to groundwater and the presence of mesquite stands. Regional well records studied showed increases in depth-to-water over time, but the data were not at a scale fine enough to definitively attribute declines in mesquite stands to groundwater level declines.

Mesquite hummocks are present in eight Conservation Areas designated by the CVMSHCP: Cabazon, Willow Hole, Thousand Palms, Indio Hills Palms, East Indio Hills, Dos Palmas, Coachella Valley Stormwater Channel and Delta, and Santa Rosa and San Jacinto Mountains (CVAG, 2016). Of those eight CVMSHCP Conservation Areas, only the Willow Hole Conservation Area contains mesquite hummocks within the MCSB, as discussed below. Nearly all the approximately 125 acres of mesquite hummocks mapped in the Willow Hole Conservation Area are within the MCSB. **Figure 2-6** presents the Willow Hole Conservation area in greater detail, showing that a small area of mesquite hummocks occurs in the GHSA. This figure also shows the location of monitoring wells used to monitor groundwater levels in the Willow Hole Conservation Area.

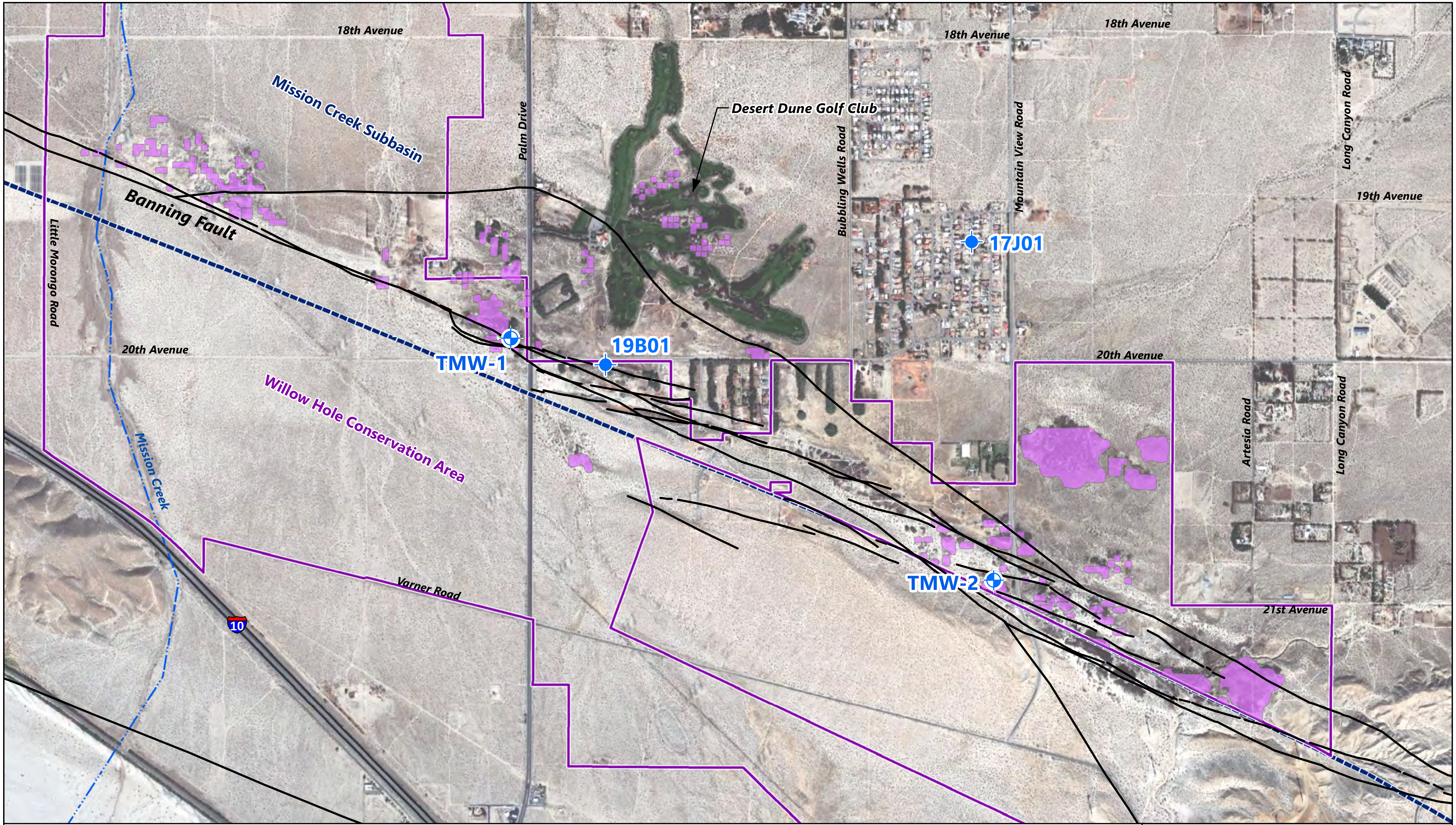
The CVMSHCP intends to ensure that approximately 114 acres in the Willow Hole Conservation Area are conserved. This largely continuous community extends west of Palm Drive and lies along the Banning Fault, which is a branch of the San Andreas Fault Zone, south of Desert Hot Springs.

High groundwater conditions in the Willow Hole Conservation Area are caused by the Banning Fault acting as a partial barrier to groundwater flow and low-permeability sediments of the Indio Hills to the southeast restricting southeasterly groundwater flow. The Banning Fault in this area consists of en echelon faults, that is, closely spaced parallel or subparallel faults that may overlap (see **Figure 2-6**). These conditions may result in unique, relatively small groundwater subareas between the fault splays that are not directly linked to the main MCSB or the GHSA.

The presence of localized distinct groundwater subareas is supported by depth to groundwater data in the Willow Hole area that show a wide range in groundwater levels in August 2018. MSWD installed groundwater monitoring wells TMW-1 and TMW-2 in 2018 to monitor groundwater levels in association with a mesquite hummocks restoration program (EnviroLogic, 2019). The monitoring wells are located approximately 2 miles apart as shown on **Figure 2-6**. In August 2018, the depths to groundwater in TMW-1 and TMW-2 were approximately 50 and 36.5 feet bgs, respectively. These groundwater levels are consistent with reported groundwater levels (i.e., within about 50 feet of ground surface) in areas where mesquite hummocks historically have been found. However, groundwater monitoring just south of Desert Dunes Golf Club at well 03S05E19B001S (19B01), shown on **Figure 2-6**, indicated groundwater depths of approximately 5 feet bgs in 2018 and 2019 (Wood, 2020). This well historically exhibited flowing artesian conditions, meaning that the hydraulic head (the height to which water will rise in the well casing) is greater than ground surface, resulting in discharge of water from the wellhead unless the well casing extends a sufficient height above ground, or the well is capped. These differences in depth to groundwater over relatively small distances in this area of modest topographic relief, that preclude ground surface level differences explaining the observed depth to groundwater level differences, are consistent with a localized influence of faulting on hydrogeologic conditions in the area.

Groundwater monitoring at well 03S05E17J001S (17J01), located approximately 0.5 miles east of the Desert Dunes Golf Club Fault and approximately 0.65 miles northeast of a mapped fault (**Figure 2-6**), indicates depth to groundwater of about 85 feet bgs in 2018 and 2019 (Wood, 2020). This is considered representative of regional groundwater levels and occurs in an area where mesquite hummocks have not been observed.

Additional evidence of the unique groundwater conditions near the Banning Fault is found in continuous monitoring of depth to water in the mesquite hummock monitoring wells as reported by EnviroLogic (2019). Continuous water level monitoring indicated that well TMW-2 responded almost immediately to a heavy precipitation event on February 14, 2019 (nearly 3.7 inches in 24 hours) with water levels rising by approximately 1.5 feet. Water levels stayed at this elevated level for at least 4 months following the precipitation (EnviroLogic, 2019). Well TMW-1, conversely, showed no immediate response to this precipitation and only a potential long-term response (less than a few tenths of an inch over several months). Groundwater in the same connected aquifer tends to respond similarly to precipitation. The different response in these two similarly constructed wells further supports the conclusion that the high groundwater levels in wells TMW-1, TMW-2, and 19B01 represent localized, somewhat isolated, conditions that vary from groundwater levels in the surrounding area.



Explanation

- Monitoring well for mesquite hummock habitat reporting
- Monitoring well for Sustainable Groundwater Management Act Annual Reporting
- Streams
- Highway/road
- Fault
- Mission Creek Subbasin
- Mesquite hummocks
- Willow Hole Conservation Area

Notes:

1. Fault alignments downloaded from Riverside County Data Portal (https://gis.rivco.org).
2. Vegetation GIS data downloaded from the Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) website (https://cvmshcp.org/index.htm).

0 750 1,500

Approximate Scale in Feet

Basemap modified from aerial photograph provided by Esri and Maxam, dated November 3, 2018.

WILLOW HOLE CONSERVATION AREA
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: pah	Date: 10/4/2021	Project No.: CM19167351
wood.		Figure 2-6

Date: 10/4/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update\2-6_Willow_Hole_Conv_Area.mxd

The ongoing CVMSHCP Monitoring and Management Program will assess the hydrological regimes that are essential to maintenance of mesquite hummocks in the Conservation Areas. As part of that monitoring, UCR-CCB conducted a preliminary study looking for potential causes of declines in mesquite (UCR-CCB, 2020). Their objective was to identify the causes of declines in Coachella Valley mesquite hummocks, determine how quickly declines are occurring, and to suggest what may be done to stop them. The preliminary study determined that possible factors in mesquite hummocks declines are decreasing groundwater levels, the presence of non-native athel tamarisk (salt cedar) that cause lower groundwater levels through transpiration of large quantities of groundwater (evaporative pumping), insect damage, below average precipitation, fire, and off-road vehicle use. Regionally, groundwater levels have increased in the southern part of the basin following active management and groundwater recharge efforts that began in 2002. Groundwater levels in well 17J01 began increasing in about 2011 and have remained at a depth range of approximately 95 to 90 feet bgs since 2014. Water levels in well 19B01 have generally been in the depth range of approximately 4 to 7 feet bgs since 2002.

The health of the mesquite hummocks and groundwater levels will continue to be monitored as part of the CVMSHCP Monitoring and Management Program.

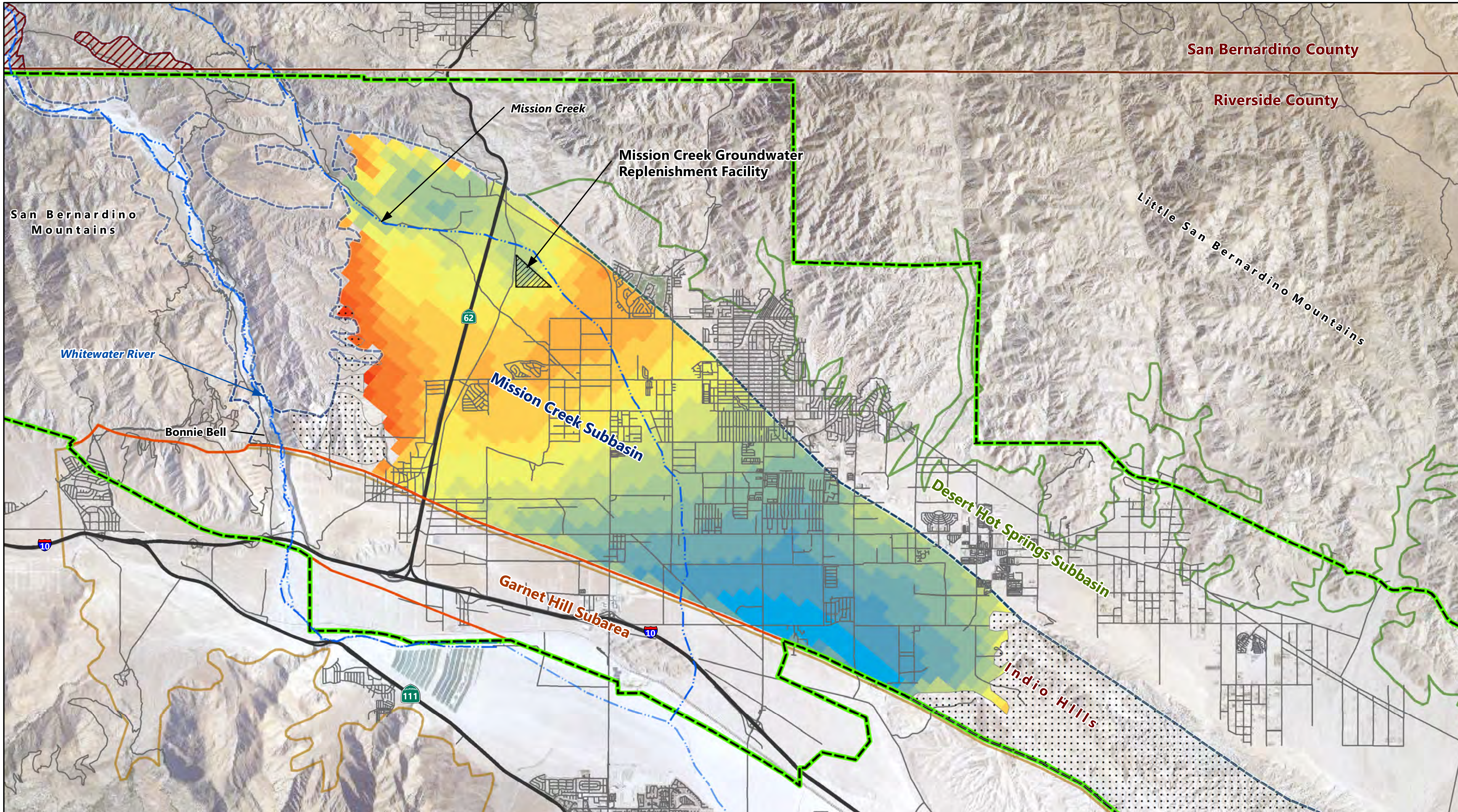
2.6.2 Other Potential Groundwater Dependent Ecosystems

The four other natural communities occurring within the MCSB that may be groundwater-dependent under specific conditions include: Sonoran cottonwood-willow riparian forest, southern sycamore-alder riparian woodland, desert fan palm oasis woodland, and desert dry wash woodland. The locations of these communities in the MCSB are shown on **Figure 2-5**. Although each of these communities may potentially be groundwater dependent, they do not appear to be in areas where groundwater management would impact them.

Potentially groundwater-dependent Sonoran cottonwood-willow riparian forest, desert fan palm oasis woodland, and desert dry wash woodland ecosystems are in the southern part of the Thousand Palms Conservation Area at the far southeastern end of MCSB near the Thousand Palms Oasis Preserve and within an erosional gap of the low-permeability Indio Hills. This portion of the MCSB is located approximately 10 miles southeast of known pumping in the main MCSB. Groundwater in this area is not expected to be impacted by any activities in the main part of the MCSB.

Potentially groundwater-dependent southern sycamore-alder riparian woodland and Sonoran cottonwood-willow riparian forest ecosystems occur in the northwestern MCSB along the Mission Creek stream course. The Sonoran cottonwood-willow riparian forest also occurs along the southern Whitewater River channel. The locations of these plant communities suggests that they are associated with surface water runoff in the Mission Creek and Whitewater River. In addition, these plant communities in the northwestern part of the MCSB are located at least three miles northwest of the nearest known groundwater pumping and in an area where groundwater is relatively deep (several hundred feet or deeper). Consequently, groundwater pumping in the MCSB is not expected to influence groundwater in these areas.

A potentially groundwater-dependent desert dry wash woodland ecosystem occurs in the northwestern MCSB in association with the Mission Creek stream channel, Big Morongo Creek stream channel, and other unnamed drainages in hills separating the Whitewater River channel from the main MCSB. The location of this ecosystem community suggests that it is associated with surface water runoff in these drainages. This ecosystem covers areas where depth to regional groundwater is at least several hundred feet bgs, including near the MC-GRF. Even during periods of increased groundwater recharge, the depth to groundwater in these areas is several hundred feet. **Figure 2-7** illustrates this point with the depth to regional groundwater estimated at more than several hundred feet in in the northwestern part of the main MCSB in June 2019. This does not preclude shallower groundwater in localized or extensive perched zones at shallower depths that could support localized ecosystems. However, these perched zones, if present, would not be impacted by pumping in the main MCSB. Consequently, groundwater fluctuations in the main MCSB are not anticipated to have any impact on this ecosystem.



Explanation

- Facility
- 2022 Planning Area
- Streams
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet Hill Subarea of Indio Subbasin
- Low permeability/non-water bearing sediments/bedrock
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin

Depth to groundwater (feet below ground surface), derived from the Mission Creek groundwater model.

<50	201 - 250	401 - 450	601 - 700
51 - 100	251 - 300	451 - 500	701 - 800
101 - 150	301 - 350	501 - 550	801 - 900
151 - 200	351 - 400	551 - 600	>900

0 4,000 8,000
Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

DEPTH TO GROUNDWATER IN
MAIN MISSION CREEK SUBBASIN
JUNE 2019
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: pah/jrw | Date: 9/7/2021 | Project No.: CM19167351

wood.

Figure 2-7

3.0 Demand Projections

3.1 Introduction

Reliable estimates of future water needs are required for regional water planning. Routine revision and refinement of water demand projections in the region are necessary due to the wide range of variables influencing future water demand. These include changes to economic trends, population, employment, seasonality, environmental needs, water conservation efforts, regulations, and land use. These factors can rapidly change the demographics of a region and corresponding water demands.

Water demand projections in the 2013 Mission Creek/Garnet Hill Water Management Plan (MWH, 2013 [2013 MC/GH WMP]) were based, in part, on projected population growth in the Planning Area. The Planning Area has experienced significantly less population growth than projected in the 2013 MC/GH WMP (detailed in Section 1), with corresponding lower water demands compared to these earlier projections. The analysis presented in this report uses more-current population projections as the basis for projected future water demands, as described below.

Using available information from published reports and historical water use data for the Planning Area, this report section develops updated water demand projections for the 25-year planning horizon (2020-2045) established for this Alternative Plan Update. The projections in this report update future water demands to align with the updated (lower) population forecasted for the Planning Area by 2045. Projections are presented in 5-year increments from 2020 through 2045 and include consideration of conservation savings.

The estimates of water demands are broken into two major categories of: (1) municipal demand, and (2) demand from private pumping. Municipal demands in the Planning Area are met by Coachella Valley Water District (CVWD) and Mission Springs Water District (MSWD) within their respective retail service areas. Historical demands from each retail service area were used to develop demand projections for two regions of the Planning Area, as described in Section 3.3.

Private pumping in the Planning Area consists of: (1) small private wells for individual residences that are unmetered, and (2) larger private wells for agricultural, golf, and industrial demands that are metered and report their groundwater production to CVWD or Desert Water Agency (DWA), depending on their location relative to the agencies' boundaries.

Demand projections for the two categories, municipal and private pumping, were developed separately and combined into total demand projections for the Planning Area.

3.2 Factors Affecting Water Demand Projections

Factors such as recent land use planning and future California regulations regarding water conservation may affect water demand projections in the Planning Area as described below.

Revised Growth Forecast – The Southern California Association of Governments (SCAG) released new socioeconomic growth forecasts in early 2020 that significantly reduced previously projected increases in population, housing, and employment in the region. SCAG forecasts are developed in coordination with city and county municipalities and are based on the land use designations in their adopted General Plans.

During the development of this Alternative Plan Update, an updated City of Desert Hot Springs (City of DHS) General Plan was adopted in May 2020 that has not yet been captured in SCAG's growth forecast. The Final Environmental Impact Report for the 2020 City of DHS General Plan Update (City of Desert Hot Springs, 2020) plans for higher-than-expected growth, which could result in higher-than-expected increases in water demand. While full growth is unlikely to occur over the 25-year planning horizon, the General Plan Update includes several water supply policies/mitigation measures such as consultation with local water agencies to plan for adequate supplies. In addition, the General Plan Update conveys the need to recognize any immediate water supply constraints, consider long-term availability of water in the approval of development projects, and perform a coordinated review process with local water resources management agencies. The water supply policies/mitigation measures link the City's project approval and building permitting to the water resources agencies' ability to manage resources consistent with approved water management plans, like this Alternative Plan Update and Urban Water Management Plans.

An additional mitigation measure identified in the Final Environmental Impact Report is for the City of DHS to prepare an annual report of building permits issued and land use approvals for submittal to MSWD and CVWD to allow the agencies to estimate related water use increases and identify concerns and issues regarding the adequacy of water supply for permits or approvals. These mitigation measures can lessen some of the uncertainty associated with water needs from the City of DHS planning area. In addition, the revised growth forecasts can be incorporated into future updates of the Alternative Plan, as appropriate.

Long-term Conservation Regulations – Water conservation has long been a part of water management in California and in the Planning Area. Following the 2012-2016 drought, California passed two major pieces of conservation legislation, Assembly Bill 1668 (Friedman) and Senate Bill 606 (Hertzberg) that further emphasize water conservation. As outlined in *Making Conservation A California Way of Life* (DWR and SWRCB, 2018), the legislation requires establishment, implementation, reporting, and enforcement of urban water use objectives, along with agricultural water use efficiency. These objectives and standards are currently in development and future impacts are uncertain in the near-term. Current expected conservation impacts based on existing standards, such as improved efficiency water fixtures (see **Appendix C**), are included in this analysis. Applicable future conservation can be incorporated into subsequent updates of the Alternative Plan as the requirements of these standards become apparent.

3.3 Municipal Demand

This section summarizes the process used to develop municipal water demand projections for the Planning Area. The Planning Area includes the retail service areas of two water agencies – CVWD and MSWD – and overlies all or portions of four groundwater subbasins/subareas: Mission Creek Subbasin (MCSB), Desert Hot Springs Subbasin (DHSSB), Garnet Hill Subarea

(GHSA) of the Indio Subbasin and a small portion of the main Indio Subbasin, as shown on **Figure 1-3**.

For the purposes of analysis, the Planning Area was divided into two regions as shown on **Figure 3-1**.

1. **CVWD Planning Area** is the portion of the CVWD area that is within the Planning Area. The CVWD Planning Area is delineated by a blue boundary on **Figure 3-1**. Water consumption meter data from CVWD's Improvement District No. 8 (ID-8), shown in red, was used to develop water demand projections for the entirety of the CVWD Planning Area.
2. **MSWD/DWA Planning Area** encompasses DWA's area, shown in brown, and MSWD's area, shown in hatch pattern, within the Planning Area. The MSWD/DWA Planning Area is delineated by a purple boundary on **Figure 3-1**. Water consumption meter data from MSWD's retail service area was used to develop water demand projections for the entirety of the MSWD/DWA Planning Area.

A description of the Planning Area, including jurisdictional boundaries for each agency, is provided in Section 1.4.3 and Section 2.1.

3.3.1 Municipal Demand Methodology

This section summarizes the process used to develop municipal demand projections for the Planning Area. The municipal demand projections rely upon data that, in raw form, may not be readily conditioned for the analysis. A detailed account of the process for converting available data into per-capita consumption units to develop demand projections is provided in **Appendix C**. A high-level overview of the sources and analysis of available data and the associated demand methodology is provided below.

3.3.1.1 Data Sources

Available data sources were identified and prepared for use in demand projections as described below:

1. **Historical Meter Data**: Historical meter data, used for the purposes of customer billing, are available for ID-8 and MSWD's retail service areas. CVWD meter data from 2010 to 2019 were used to analyze recent historical municipal water use trends within the ID-8 Service Area. MSWD meter data from 2014 to 2019 were used to analyze recent historical municipal water use trends within their retail service area. Average consumption based on meter data was calculated for each agency and integrated into future demand projections.
2. **Riverside County Land Use Data**: Land use data provides information about existing parcels and future development. Geographical Information System (GIS) mapping was used to assist in identifying the general distribution, location, and extent of land uses, such as housing type (single family residential, multi-family residential, etc.), business, industry, open space, agriculture, natural resources, recreation, and public/quasi-public uses that may influence future development and water demand. Land use data were

used to identify the land use associated with existing meters and to align future growth projections with allowable land uses within the Planning Area.

3. **SCAG Regional Growth Forecast**: Socioeconomic forecasts of population and households are provided by the SCAG for 2016, 2020, 2035, and 2045 within the Planning Area (SCAG, 2019). SCAG develops the forecasts throughout southern California using enhanced forecasting methods and interactive public outreach. SCAG's latest forecasts used in this analysis project less growth by 2045 when compared to the forecasts included in the 2013 MC/GH WMP.

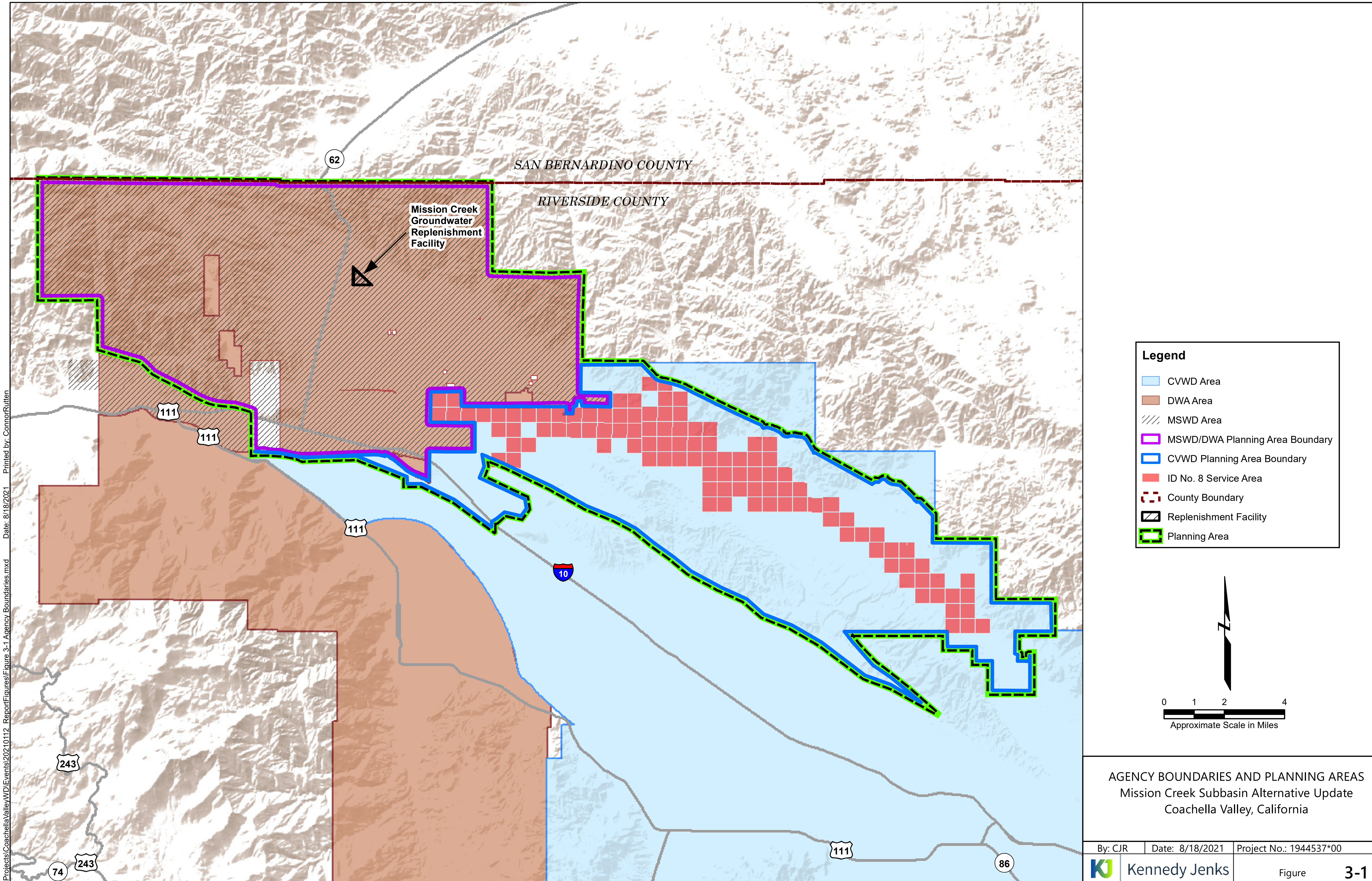
3.3.1.2 Methodology

Following the identification and preparation of available data, the analysis developed municipal unit consumption factors and adjustments, and accounted for water losses, as summarized below:

1. **Municipal Unit Consumption per Person:** Municipal unit consumption factors by land use type (acre-feet per year per acre [AFY/Ac]) were developed based on historical meter data and existing developed parcels data. SCAG persons per household information and parcel data were used to convert the municipal unit consumption factors to municipal unit consumption per person (AFY/person) for each land use type. The product of calculated municipal unit consumption per person and SCAG future population estimates was used to project residential consumption at a rate consistent with population growth projections.
2. **Adjustment to Unit Consumption for Commercial/Industrial Usage**: Since residential growth is generally accompanied by commercial/industrial growth, existing parcel data were used to establish the relationship between residential and commercial/industrial use within the Planning Area. The analysis assumes that this ratio of residential to commercial/industrial use will remain consistent over the planning horizon.
3. **Passive Conservation Adjustment**: Projected consumption was adjusted to account for future indoor water use savings from the typical replacement of water fixtures and appliances with higher efficiency models.
4. **Water Loss**: Annual water loss as a percentage was calculated based on the difference between annual metered groundwater production and annual metered consumption data within the ID-8 and MSWD retail service areas, respectively. The average percent water loss over this period was used to calculate the annual water loss applied to future projected consumption. The total water loss was then used to adjust projected consumption to calculate total water demand as described below. In this report, water loss includes all non-revenue water such as leaks, metering errors, or record-keeping issues.
5. **Projected Water Demand**: Projected municipal water demand was calculated using projected municipal consumption and the water loss adjustment:

$$Projected\ Demand = Projected\ Consumption + Water\ Loss$$

Sources: Esri, USGS, NOAA



Z:\Projects\CoachellaValleyWD\Events\20210112_ReportFigures\Figure 3-1 Agency Boundaries.mxd Date: 8/18/2021 Printed by: ConnorRutten

AGENCY BOUNDARIES AND PLANNING AREAS
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: CJR | Date: 8/18/2021 | Project No.: 1944537*00

Kennedy Jenks

Figure 3-1

More detail regarding data sources, processing of data, and demand methodology is provided in the sections below. For a more in-depth discussion of demand methodology, see **Appendix C**.

3.3.2 Metered Consumption

Consumption is defined as water consumed by end users as measured by customer meters. Metered retail water delivery was provided by the municipal service providers (MSWD and CVWD). The municipal consumption in the Planning Area is primarily residential with small amounts of commercial and industrial uses.

Consumption for the CVWD Planning Area was obtained from the ID-8 meter data. Consumption for the MSWD/DWA Planning Area was obtained from MSWD meter data. Together, the CVWD Planning Area consumption and MSWD/DWA Planning Area consumption provide historical consumption for the entire Planning Area. Meter datasets provided associated assessor's parcel numbers or addresses that were matched to Riverside County land use data, described in Section 3.3.3. This information allowed consumption by usage type to be assigned across the entire Planning Area. The metered usage types in this analysis were grouped according to the following Riverside County land use categories: single-family residential, multi-family residential, mobile home residential, commercial, and industrial uses. Historical consumption analyses and results are presented next for the CVWD Planning Area and the MSWD/DWA Planning Area.

3.3.2.1 CVWD Planning Area

The meter dataset from ID-8 was used with Riverside County land use data to provide metered consumption by land use type for a 10-year period from 2010-2019. Metered consumption by usage type was used as a foundation for estimating the demand projections for the entire CVWD Planning Area. The ID-8 meter dataset contained 3,410 customer meters spanning 1,483 parcels. All 3,410 meters were geolocated within the CVWD Planning Area. Some parcels had multiple meters in the dataset that are likely associated with meter replacements or other changes to meter numbers that occurred from 2010-2019.

For the 10-year period, the CVWD Planning Area had an average annual consumption of 2,355 AFY, which includes an average of 11 AFY from construction meters that were not geolocated. **Figure 3-2** shows the total annual consumption for 2010-2019 by land use type. Overall, 73 percent (%) of average consumption is for Single Family Residential accounts, while 96% of average consumption is for all residential uses (single-family, multi-family, and mobile home/manufactured home).

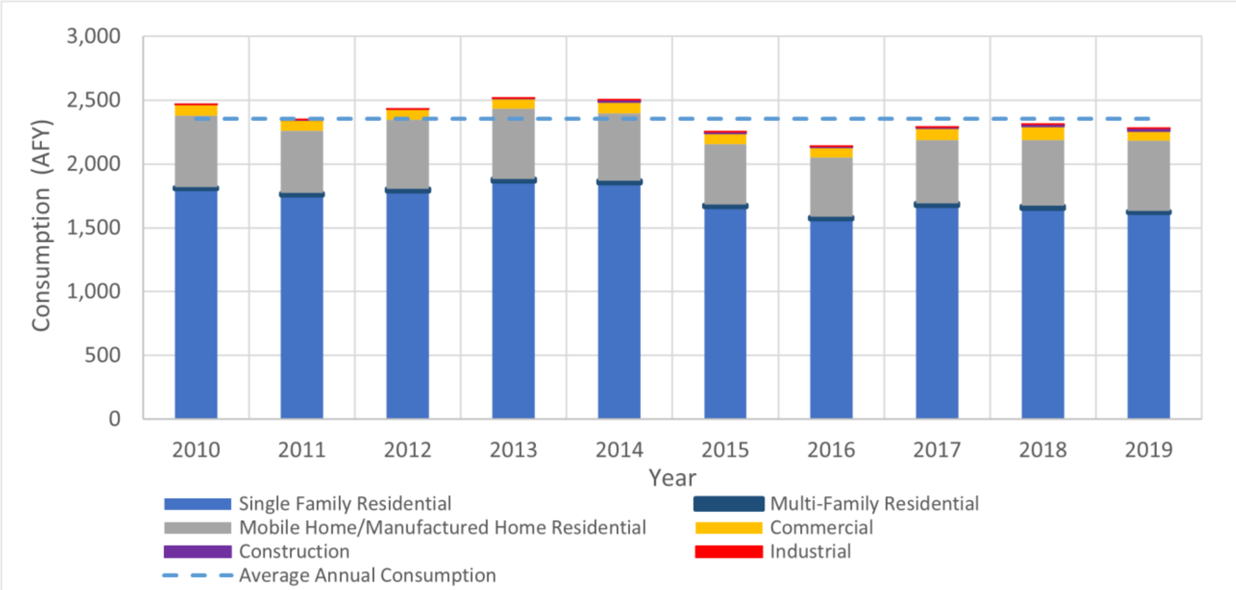
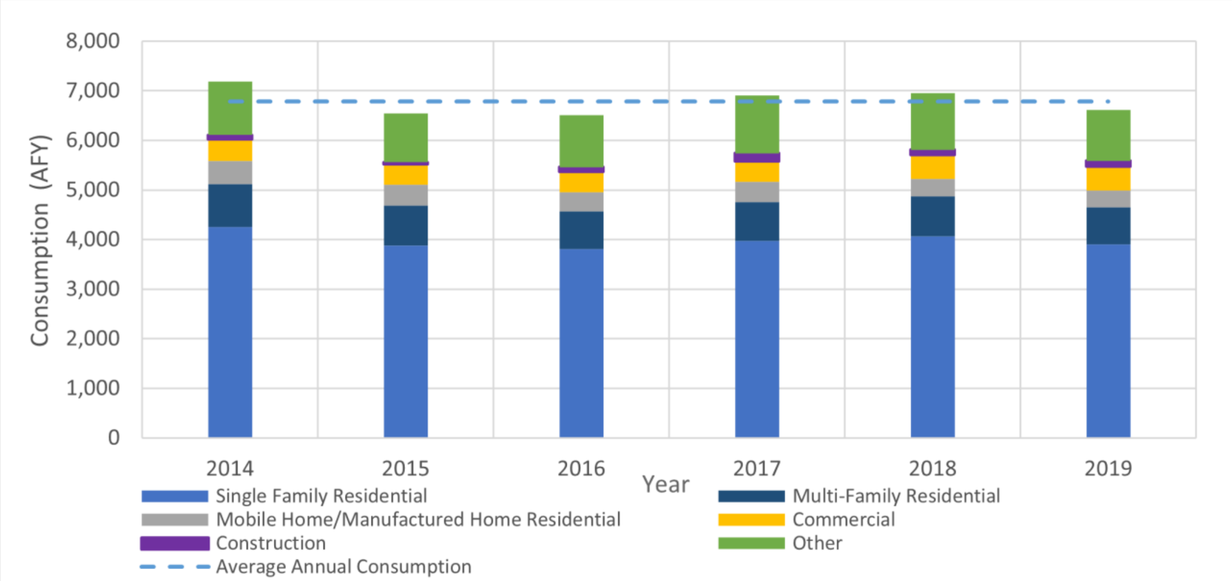


Figure 3-2: Annual Consumption by Land Use Type in the CVWD Planning Area (2010-2019)

3.3.2.2 MSWD/DWA Planning Area

MSWD provides retail water service within the MSWD/DWA Planning Area. The MSWD billing dataset provided consumption by usage type for a six-year period from 2014 to 2019 and was used to estimate municipal demand projections for the entire MSWD/DWA Planning Area. There were 13,140 accounts in the MSWD dataset associated with 12,168 parcels and 23,655 meters. A detailed review of the MSWD dataset indicated that multiple meters may be associated with a single parcel due to meter number and customer changes. The MSWD dataset also includes meters associated with irrigation or temporary construction meters that did not have parcel or address information.

Figure 3-3 shows the total annual consumption for 2014 to 2019 by land use type. For the six-year period, the area had an average annual consumption of 6,783 AFY of which 58.7% was for Single Family Residential and 76.2% of all consumption was for all residential uses.



Note: Other includes irrigation, schools, and other institutional users.

Figure 3-3: Annual Consumption by Land Use Type in the MSWD/DWA Planning Area (2014-2019)

3.3.2.3 Metered Consumption Summary

Averages of historical metered consumption for the CVWD and MSWD/DWA Planning Areas were calculated as the basis for future demand projections. The majority of consumption in both areas is from Single Family Residential usage, as illustrated in **Table 3-1**. Water uses for other land uses are discussed in **Appendix C,** Section C.3.3.3.

Table 3-1: Historical Municipal Consumption within the Planning Area

Agency	Average Consumption (AFY)			Total Average Consumption (AFY)
	Single-Family Residential	Multi-Family/ Mobile Home Residential	All Other Categories[1]	
CVWD Planning Area	1,721	537	97	2,355
MSWD/DWA Planning Area	3,980	1,189	1,614	6,783
Total For Planning Area	**5,701**	**1,726**	**1,711**	**9,138**

[1]Includes meters that could not be geolocated to a specific parcel.

3.3.3 Land Use Inventories

Land use data were used to categorize existing meters according to land use to develop agency-specific land use factors. This ensures that the municipal demand projections are consistent with local general plans and do not exceed the allowable land uses within the Planning Area.

Land use data were downloaded from Riverside County's 2019 Parcel and Land Use GIS Portal (Riverside County, 2019). Riverside County GIS data includes Single Family Residential, Multi-Family Residential, mobile home/manufactured home residential, commercial, industrial, and other uses which are assigned to each parcel.

The parcel analysis also used:

- Federal Lands and Coachella Valley Multi-Species Habitat Conservation Plan (CVMSHCP) land use GIS data to identify areas unlikely to be developed; and
- Aerial imagery to verify land use classifications.

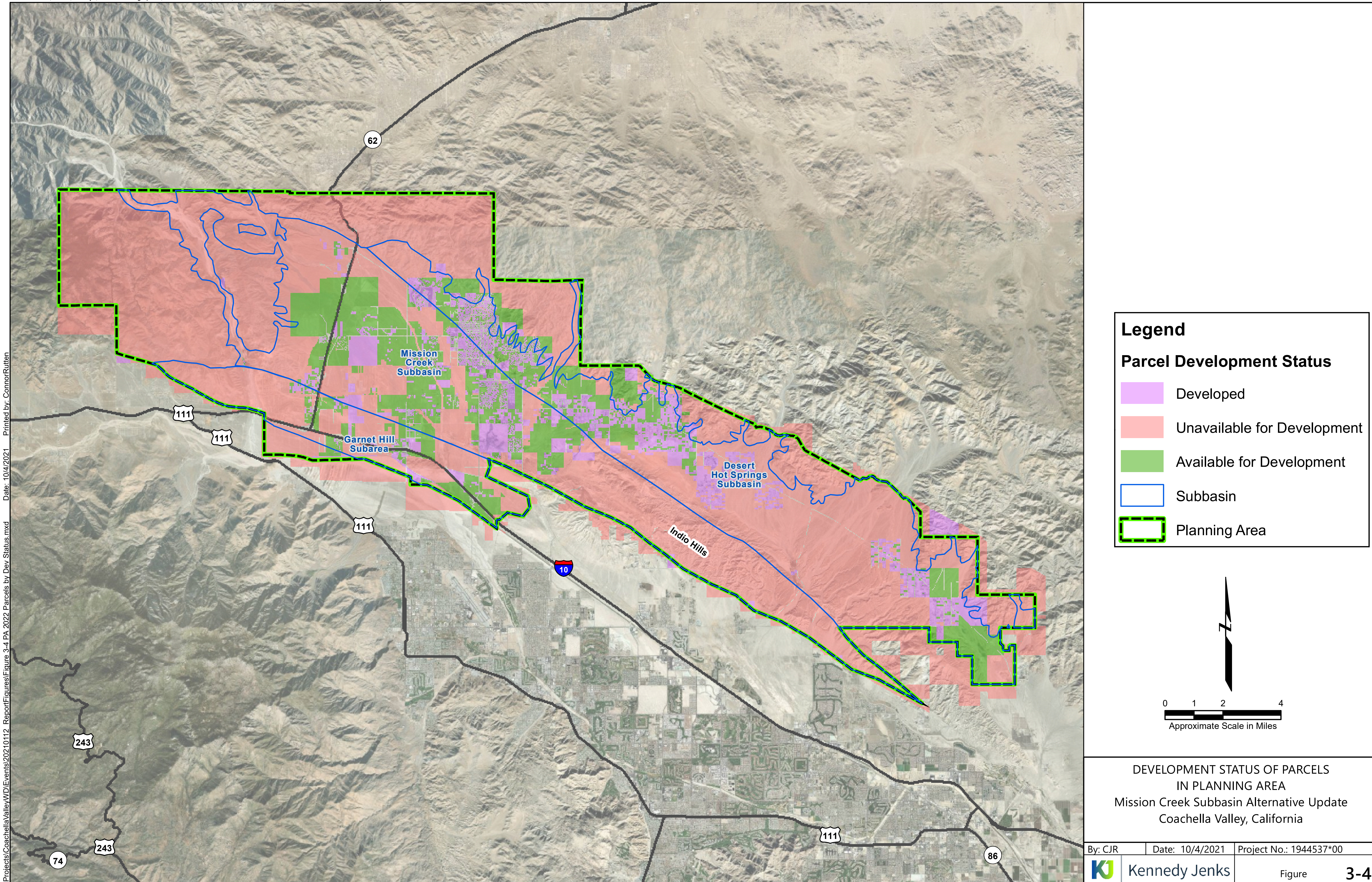
This analysis used a simplified development status to distinguish which parcels may develop in the future and result in additional demand. Each parcel in the Planning Area was assigned a development status to indicate the likelihood of development as described below and presented on **Figure 3-4**:

- "**Developed**" parcels – have an existing structure (based on parcel taxable structures information) or a geolocated meter on the parcel based on assessor's parcel numbers from CVWD and MSWD meter datasets. Developed parcels are assumed to be unavailable for further development as they are already developed.
- "**Unavailable for Development**" parcels – include those located within CVMSHCP areas, owned by the federal government, or explicitly owned by an energy/utility company (solar panels or wind farm). Parcels that are likely precluded from development (rugged mountain terrain, etc.) were identified through use of aerial imagery.
- "**Available for Development**" parcels – consist of undeveloped parcels where development could occur that do not fall within the previous category.

As shown on **Figure 3-4**, nearly all the parcels that are "developed" or "available for development" are in the central part of the MCSB, generally near the municipal service areas of CVWD and MSWD. This is consistent with typical patterns of urban growth, which expands from existing developed areas. The parcels "unavailable for development" are primarily located in the Indio Hills area as well as in the Whitewater River channel and the western most portions of the Planning Area, including the federally owned fringe areas of the MCSB.

Parcel analysis, in combination with the land use analysis, showed that most parcels available for development are Single Family Residential parcels, which aligns with the existing high proportion of residential use. In addition, a large amount of the acreage in the Planning Area is "unavailable for development" because it is federally owned or part of a dedicated conservation area (e.g., CVMSHCP).

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



DEVELOPMENT STATUS OF PARCELS
IN PLANNING AREA
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: CJR | Date: 10/4/2021 | Project No.: 1944537*00

Kennedy Jenks

Figure 3-4

Z:\Projects\CoachellaValleyWD\Events\20210112_ReportFigures\Figure 3-4 PA 2022 Parcels by Dev Status.mxd Date: 10/4/2021 Printed by: ConnorRutten

3.3.4 SCAG Population Projections for the Planning Area

Municipal demand projections require population projections to determine the rate of growth expected in the Planning Area. The SCAG regional growth forecast is currently the most recent and most detailed data available for the Planning Area. SCAG forecasts are based on jurisdictional general plans and intended to represent the most likely growth scenario, considering a combination of recent and past trends and regional growth policies. In the Coachella Valley, this forecast includes less growth than previously forecasted within the planning horizon. In this analysis, population estimates for the Planning Area were coupled with existing average per person annual consumption (unit consumption, see Section 3.3.5) to develop demand projections at five-year increments through 2045.

Often, development of previously undeveloped land, referred to as "greenfield development," on the urban fringe has been the method of accommodating growth in the Coachella Valley. SCAG's recent forecasts have increasingly looked toward infill development on vacant land in urbanized areas and the redevelopment of existing properties as a mechanism for accommodating future growth. The Planning Area includes both greenfield and infill development. Within that context, the ratios of land use classifications and related water consumption in the CVWD Planning Area and MSWD/DWA Planning Area are expected to remain consistent over the planning horizon because of the high proportion of residential use.

The red line on **Figure 3-5** shows the SCAG population projections for the Planning Area. The 2016 SCAG projections result in a population increase from 47,883 persons in 2016 to 88,310 persons in 2045, which is an 84% increase or an average annual growth rate of 2.1%. These projections result in roughly 20,000 fewer people by the year 2045 than the 2013 MC/GH WMP population projections, which are shown by the dashed blue line in **Figure 3-5**. The population growth rate in the 2013 MC/GH WMP is similar to that from the 2015 SCAG projection; however, the large projected increase in population from 2010-2015 was not realized. Additional details on 2016 SCAG projections can be found in **Appendix C**, Section C.2.

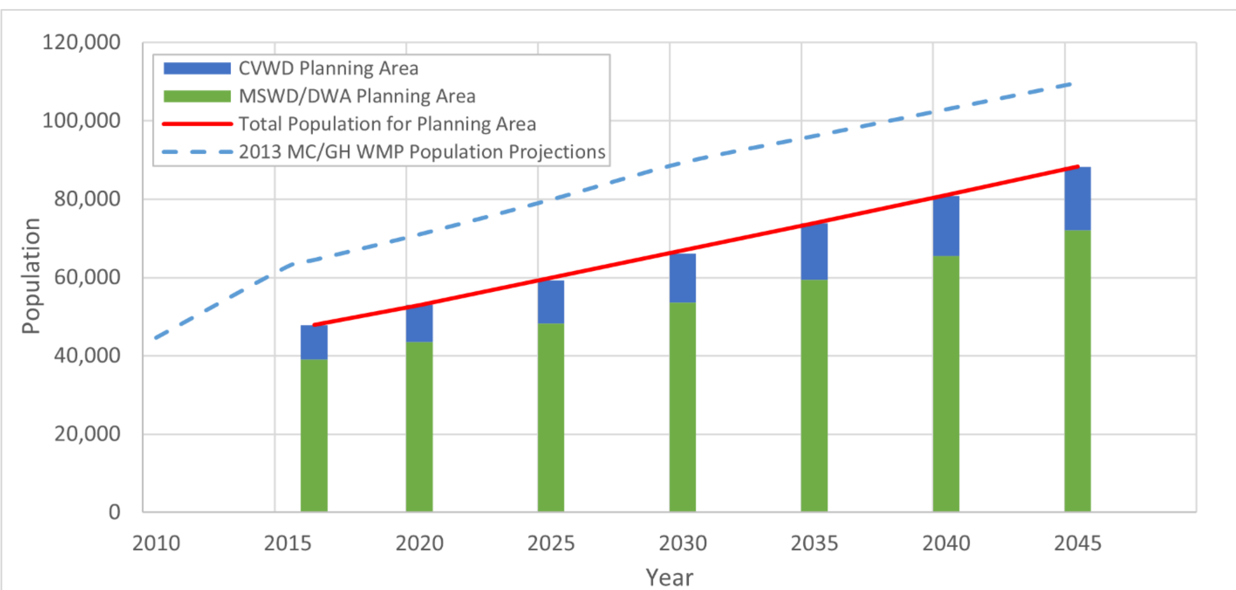


Figure 3-5: Population Projections from 2010 to 2045

3.3.5 Municipal Unit Consumption per Person

The simplest and most direct means of forecasting water consumption is to use current per-capita water consumption multiplied by expected future population. Using meter data combined with land area in the CVWD Planning Area and MSWD/DWA Planning Area, consumption can be calculated in terms of AFY/Ac for a range of land use types. Residential (single family, multi-family, mobile home/manufactured home) land use is the most prominent in the Planning Area and forms the basis for other land uses in the municipal unit consumption analysis.

For parcels with meters, using the average residential parcel size, in acres per parcel, and the average number of persons per residential parcel, in persons per parcel, unit consumption in terms of AFY/person was calculated as shown in the equation below.

$$\frac{Consumption\ (AFY)}{\cancel{Acres}} * \frac{\cancel{Average\ Area\ (Acres)}}{\cancel{Parcel}} * \frac{\cancel{Parcel}}{Average\ Persons} = \frac{Consumption\ (AFY)}{Person}$$

From Existing Meter Data

From Existing Parcel Data

From SCAG Data

Projected consumption for a given year was calculated as:

Municipal Unit Consumption (AFY/person) * Persons Projected by SCAG for each year.

To provide projections for other land use types, unit consumption factors were developed for commercial and industrial uses as described in the following section.

3.3.5.1 Commercial/Industrial Adjustment

Using other land use types to adjust per-capita consumption estimates provides more accurate projections than simple per-capita projections based only on residential land use. This was done by aligning population growth with the expected types of development and land uses listed in general and specific plans.

To account for commercial/industrial growth associated with the population growth from residential development, the existing parcel data were used to establish ratios of acres between residential, commercial, and industrial land uses. These ratios were then used to establish average historical AFY/person factors for commercial and industrial uses for the CVWD Planning Area and MSWD/DWA Planning Area as presented in **Table 3-2** and detailed in **Appendix C** (see Section C.3.5). Residential parcels in the CVWD Planning Area are larger than residential parcels in the MSWD/DWA Planning Area, resulting in a lower persons/acre value in the CVWD Planning Area than the MSWD/DWA Planning Area as described in **Appendix C**.

Table 3-2: Average Unit Consumption by Land Use Type and Area[1]

Usage Type	CVWD Planning Area Average Unit Consumption (AFY/Ac)	MSWD/DWA Planning Area Average Unit Consumption (AFY/Ac)
Single-Family Residential	0.38	1.50
Multi-Family Residential	0.55	3.04
Mobile Home/Manufactured Home Residential	1.24	1.47
Commercial	0.65	1.68
Industrial	0.09	0.70

[1] Acreage data for each land use are based on 2019 Riverside County Land Use Inventories.

Based on historical population and water consumption, **Table 3-3** presents per-capita unit consumption (AFY/person) by area for use in the demand projections. As described in Section 3.5, per-capita water use is a factor used with population growth to develop projections for future water demands.

Table 3-3: Average Per-Capita[1] Unit Consumption by Area

Land Use Type	CVWD Planning Area Average Per-Capita Consumption (AFY/Person)	MSWD/DWA Planning Area Average Per -Capita Consumption (AFY/Person)
Single-Family Residential	0.26	0.11
Multi-Family Residential	0.003	0.01
Mobile Home/Manufactured Home Residential	0.08	0.01
Commercial	0.01	0.02
Industrial	0.0002	0.001

[1] Population data used to develop per-capita consumption were based on SCAG 2016 (SCAG, 2020b.)

3.3.6 Passive Conservation Adjustment

Conservation adjustments were used to refine demand projections. Passive conservation is the result of the typical replacement of indoor plumbing fixtures and appliances such as toilets, sinks, washers/dryers, and dishwashers with more efficient models over time. As new homes are constructed and older homes are upgraded/renovated, more water-efficient fixtures and appliances are anticipated, resulting in a decrease in overall per-capita municipal unit consumption. The impact of passive conservation was calculated to provide savings of approximately 837 AFY in municipal water consumption in the Planning Area by 2045 (136 AFY in the CVWD Planning Area and 701 AFY in MSWD/DWA Planning Area). Overall, passive conservation amounts to a reduction of approximately 5.4% in future municipal consumption in

2045. **Appendix C** provides the methodology and assumptions applied to estimate passive conservation adjustments (see Section C.3.7). Key assumptions are listed below:

- Analysis of passive conservation focused on the replacement of indoor fixtures and appliances. While savings can be achieved by replacement of outdoor irrigation fixtures (e.g., drip irrigation, sprinkler heads, etc.), there is a limited amount of outdoor irrigation occurring in the Planning Area when compared to other parts of Coachella Valley.
- Housing age data were used to estimate the effects of indoor passive conservation, primarily through assumptions regarding age of indoor fixtures. California Department of Finance data were available only for City of DHS. These data were extrapolated for the entire Planning Area. To avoid overestimating projected savings from passive conservation in older homes, the analysis assumed that all homes constructed prior to 2003 have already updated fixtures to 2011 water fixture standards. This assumption balanced projected passive conservation and prevented weighting older homes too heavily in the analysis.
- For consistency with municipal estimates, unmetered private well consumption serving residential customers (see Section 3.4.2) was also adjusted over the planning period to account for passive conservation.

This reduction in consumption is conservative and reasonable given the anticipated growth in population and housing stock over the next 25 years. Greater and more rapid levels of conservation, including outdoor conservation, may be achieved through active conservation programs being implemented by the Agencies.

Table 3-4 summarizes the projected municipal consumption in the Planning Area, showing the consumption projections, the savings resulting from passive conservation, and the final adjusted consumption projections. Projected consumption is based on population projections, unit consumption estimates by land use type, and adjustments for passive conservation. A detailed description of assumptions used to calculate projected consumption is provided in **Appendix C**.

Table 3-4: Projected Municipal Consumption for the Planning Area

Year	Existing and Projected Consumption for Planning Area (AFY)	Estimated Savings from Passive Conservation (AFY)	Projected Planning Area Consumption with Passive Conservation (AFY)
2020	9,927	212	9,715
2025	11,039	367	10,672
2030	12,150	522	11,628
2035	13,261	678	12,583
2040	14,383	757	13,626
2045	15,505	837	14,668

3.3.7 Water Loss Adjustment

Water losses refer to real losses, such as leaks and spills, or the physical water lost from a utility's storage tanks and pressurized distribution system up to the point of measured customer consumption. To reduce water losses, the agencies conduct meter testing with a proactive meter replacement program and conduct leak detection and repair on agency infrastructure. Although MSWD and CVWD conduct annual water loss audits to evaluate losses using the American Water Works Association water audit software, CVWD's audit is conducted on the entire water district and is not available for the subareas of public water systems, such as ID-8.

To provide a uniform calculation of water loss for both agencies, water loss was calculated using a demand and consumption approach. This approach compares the demand, which is the metered groundwater production, with the metered consumption. The difference in the water produced (demand) and water consumed by the customer as measured by the customer meter is the water loss:

$$Demand - \ Consumption = Water\ Loss$$

A water loss adjustment is calculated by using the average annual water loss as a percentage of demand (average annual water loss percent):

$$Average\ Annual\ Water\ Loss\ \% = \frac{Average\ Demand - Average\ Consumption}{Average\ Demand}$$

The Average Annual Water Loss % was then applied to the annual projected consumption to calculate the annual projected demand:

$$Projected\ Consumption * (1 + Average\ Annual\ Water\ Loss\ \%) = \ Projected\ Demand$$

Because future demand will be met by groundwater production, the calculation also provides an estimate of projected municipal groundwater production.

3.3.7.1 CVWD Planning Area

Groundwater pumped to meet demand averaged 2,854 AFY from 2010 to 2019 in the CVWD Planning Area. Annual percent water loss ranged from 8.3% to 24.3% for this period. The average percent water loss for the 10 years was 17.2% of groundwater production. A breakdown of metered consumption and municipal groundwater production in the CVWD Planning Area is provided in **Appendix C**.

3.3.7.2 MSWD/DWA Planning Area

Groundwater pumped to meet demand averaged 7,650 AFY from 2014 to 2019 in the MSWD/DWA Planning Area. Annual percent water loss ranged from 8.8% to 14.1% for this period. The average percent water loss for the 6 years was 11.3%. A breakdown of MSWD billed consumption and municipal groundwater production is provided in **Appendix C**.

3.3.8 Total Projected Municipal Demand

Total projected municipal demand is shown on **Figure 3-6** and increases from 10,485 AF in 2016 to 16,759 AF in 2045. Total municipal demand for year 2016 is based on the actual demands from existing customers in the CVWD and MSWD municipal service areas. Demand from these existing customers continues in the future and is shown as Existing CVWD Planning Area and Existing MSWD/DWA Planning Area on **Figure 3-6**. Existing municipal demands within the Planning Area were adjusted for passive conservation.

For year 2020 and future years, the future water demand is forecasted by multiplying the projected population by the unit consumption and then adjusting for passive conservation and water loss. As shown, total future demands include existing and projected future demands in the CVWD and MSWD/DWA Planning Areas.

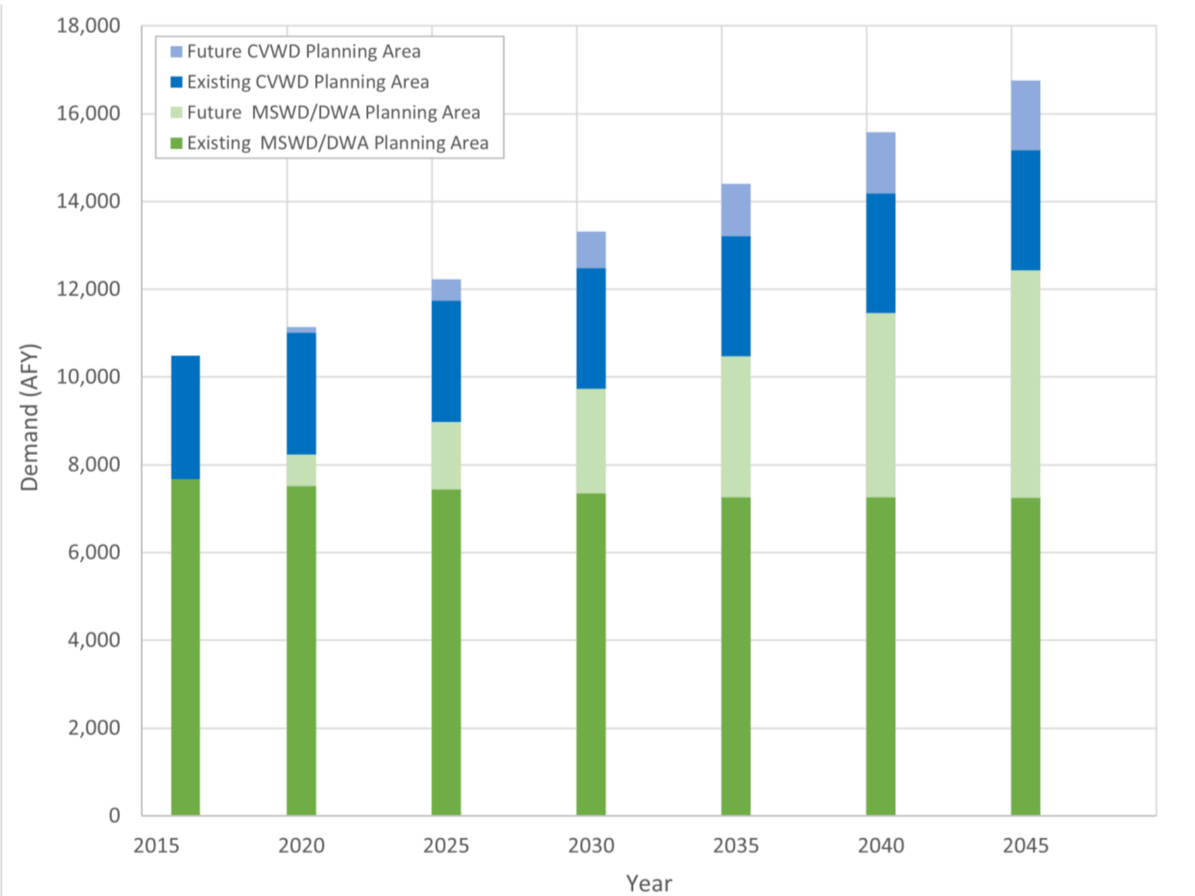


Figure 3-6: Projected Municipal Demand in the CVWD and MSWD/DWA Planning Areas

3.4 Private Groundwater Production

In addition to the municipal water demand, other types of demand must be accounted for when estimating total demand in the Planning Area. Other demands in the Planning Area include private wells serving agricultural, golf, and industrial demands, as well as residences and businesses. Private well pumping falls into two categories (see Section 2.4.1):

1. Metered well production from larger wells serving agricultural, golf, and industrial demands that is subject to the Replenishment Assessment Charge (RAC) levied by DWA or CVWD, depending on location, and
2. Estimated unmetered production from smaller private wells that produce groundwater below the CVWD or DWA thresholds for reporting (25 AFY and 10 AFY, respectively).

3.4.1 Metered Private Groundwater Production

As described in Section 2.4.1, metered groundwater pumping data for the years 2015 to 2019 were extracted for 15 private wells subject to the CVWD or DWA RAC. Pumping from 14 of the private wells averaged 3,490 AFY for the MCSB portion of the Planning Area (1,417 AFY in the CVWD Planning Area and 2,073 AFY in the MSWD/DWA Planning Area). The remaining private well, which is in the GHSA, has an average pumping of 13.9 AFY. These metered private wells provide irrigation for golf course properties (73%), agricultural uses such as fish farms and equestrian facilities (18%), and industrial uses (9%).

The average metered private groundwater demand in the Planning Area from 2015-2019 was 3,504 AFY. This metered private groundwater demand is assumed to remain constant through the planning horizon.

3.4.2 Unmetered Private Groundwater Production

Unmetered groundwater demand is estimated to be a smaller percentage of the total water demand in the Planning Area. Estimates of this demand relied on extrapolation from available metered municipal and private pumping data. Nearly all the unmetered private well pumping is believed to occur for domestic purposes within the CVWD area of the MCSB.

Previous reports estimated that unmetered private well pumping within the Planning Area was approximately 500 AFY (Wood, 2021). Unmetered pumping is from private groundwater pumpers that produce less than the reporting thresholds established by CVWD and DWA (25 AFY and 10 AFY, respectively). As a result, these pumpers (minimal pumpers) are not required to report groundwater pumped or pay the RAC.

Using SCAG population estimates and CVWD meter data, the population in the CVWD Planning Area that is outside the ID-8 service area was assumed to be served by unmetered private pumping. Applying the CVWD residential average unit consumption, unmetered private well pumping was estimated to be 479 AFY. More detail on this analysis is provided in **Appendix C**. Unmetered private demand is assumed to remain constant over the planning horizon but decreases slightly over time due to passive conservation (see discussion in Section 3.3.6).

3.5 Total Projected Demand

The final water demand projections for the Planning Area (i.e., the amount of groundwater pumping needed to meet demand projections) are calculated by combining all demands including:

- Projected groundwater production required to meet current and future municipal demands.
- Historical private metered groundwater production subject to the RACs is assumed to remain constant through the planning horizon.
- Estimated unmetered private well demand is assumed to remain stable through the planning horizon but is adjusted for passive conservation.

As shown on **Figure 3-6**, total municipal demand is expected to increase from 11,145 AFY in 2020 to 16,822 AFY by 2045, an increase of 5,677 AFY or approximately 50%. Estimated unmetered private well demand decreases slightly over the planning period from 474 AFY in 2020 to 466 AFY in 2045, as a result of passive conservation. Metered private well demand is assumed to be constant over the planning period (3,504 AFY).

In summary, total projected demand between 2020 and 2045 increases from 15,123 AFY (in 2020) to 20,792 AFY (in 2045), an increase of 5,669 AFY or approximately 37%.

Table 3-5 presents water demand projections for the Planning Area in five-year increments.

Table 3-5: Demand Projections for the Planning Area

Year	Municipal Demand (AFY)	Unmetered Private Well Demand (AFY)	Metered Private Well Demand (AFY)	Total Projected Demand (AFY)
2020	11,145	474	3,504	15,123
2025	12,245	472	3,504	16,221
2030	13,346	469	3,504	17,319
2035	14,447	466	3,504	18,417
2040	15,634	466	3,504	19,604
2045	16,822	466	3,504	20,792

Figure 3-7 presents projected demand as a stacked graph. Existing municipal and unmetered private domestic demand is carried forward in five-year increments and declines slightly as it is adjusted for passive conservation over time (see green and orange areas on **Figure 3-7**). No change in existing metered private pumping is assumed and no passive conservation adjustment is applied to this type of use (see gray area on **Figure 3-7**). The final demand component shown on **Figure 3-7** (blue area) shows future municipal groundwater demand resulting from population growth and development. The total of the stacked graphs shows the projected total groundwater demand for the Planning Area.

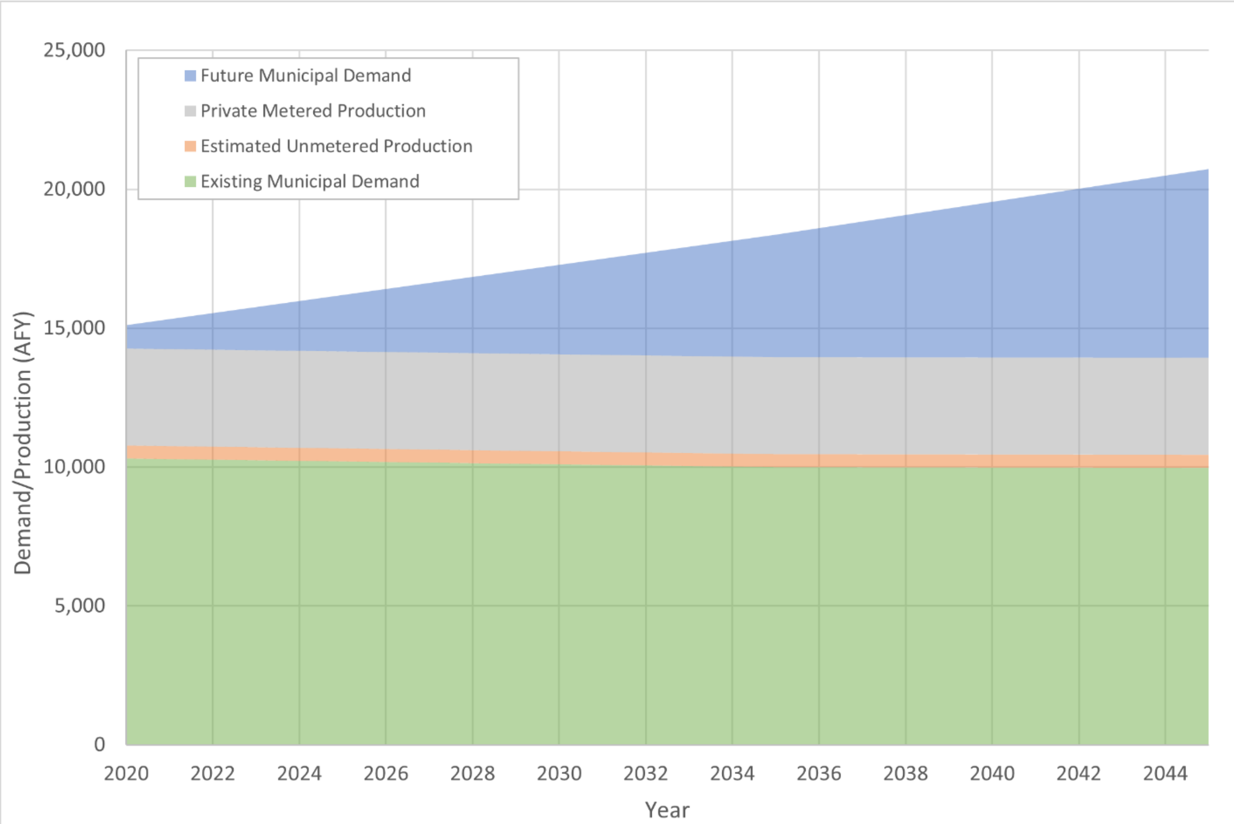


Figure 3-7: Total Demand Projections for the Planning Area

4.0 Water Resources

This section describes the various water resources utilized within the Mission Creek Subbasin (MCSB), Garnet Hill Subarea of the Indio Subbasin (GHSA), and Desert Hot Springs Subbasin (DHSSB) including surface water (precipitation and streamflow), imported water, and wastewater treatment and disposal. This section also describes groundwater conditions in the Planning Area with a focus on recent years since submittal of the Alternative Plan in 2016. Additional details for historical groundwater extraction and wastewater return flows are provided in discussion of the groundwater modeling effort in Section 5 and **Appendix A**.

4.1 Local Surface Water

Surface water in the MCSB, GHSA, and DHSSB includes streamflow in addition to runoff from several drainage areas. The various types of surface water occurring in the area, including precipitation, streamflow, and related drainage areas, are described in the following sections.

4.1.1 Precipitation and Temperature

Table 4-1 provides a summary of climate statistics based on 30 years of temperature and precipitation data from 1991 to 2020 (referred to as the 1991-2020 30-year climate normals) at the Palm Springs Airport, located approximately two miles south of the GHSA's southern boundary (**Figure 4-1**). Average maximum temperatures exceed 100 degrees Fahrenheit (°F) in the months of June, July, August, and September. Average maximum temperatures in May and October are in the low to mid 90s°F and average maximum temperatures in the months of November through April range from 69.2°F to 87.6°F. Average minimum temperatures range from 47.6°F in January to 79.8°F in August. Most of the precipitation occurs during December through February with an average precipitation of 0.68 inches in December, 1.14 inches in January, and 1.11 inches in February. Brief but heavy rains occur from thunderstorms in the summer months (referred to as desert monsoons) resulting in an average monthly precipitation of 0.25 inches in July, 0.14 inches in August, and 0.24 inches in September.

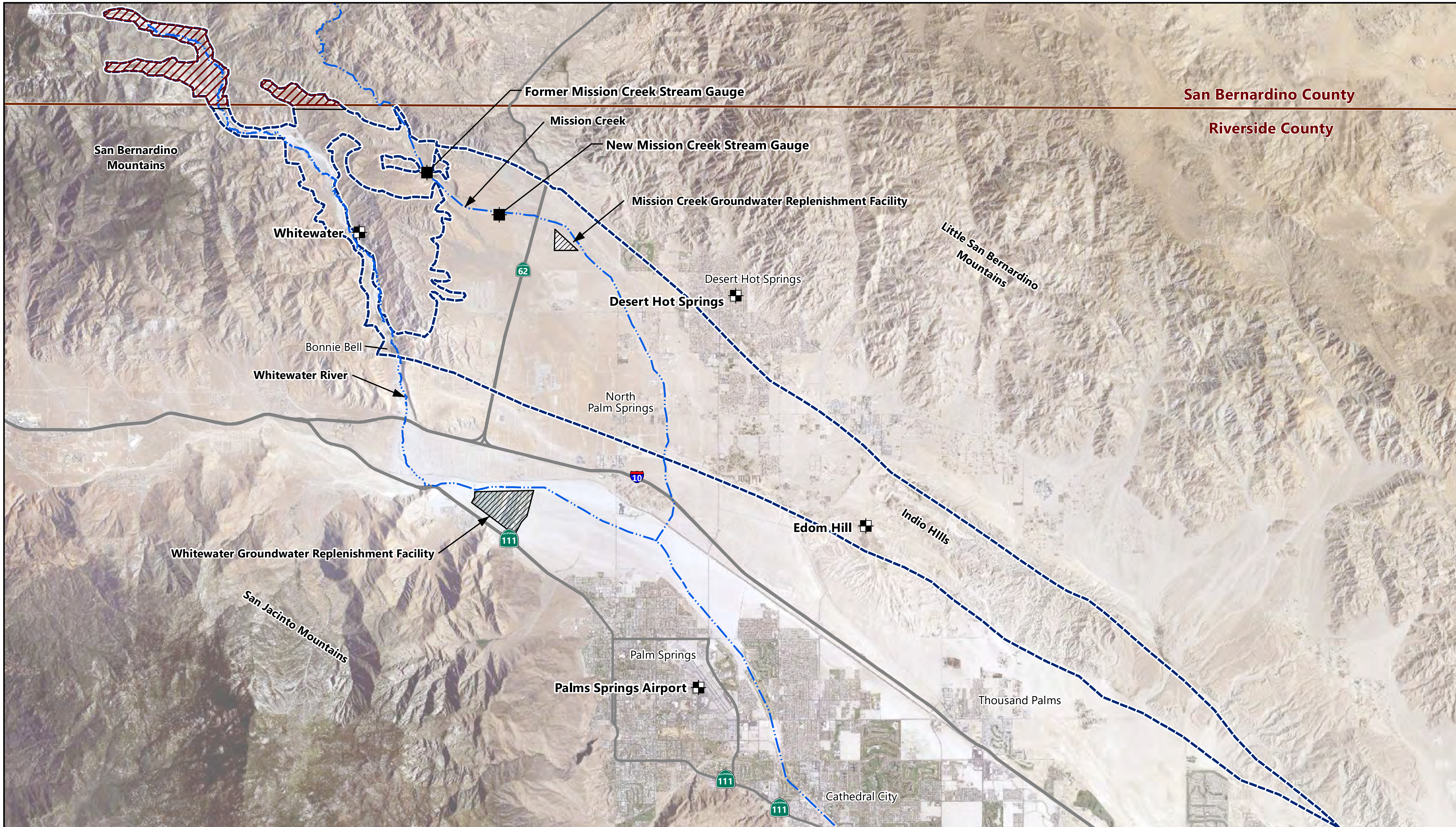
Table 4-1: Climate Summary – Monthly Normals 1991 to 2020, Palm Springs Airport

	January	February	March	April	May	June
Average Maximum Temperature (°F)	70.5	73.7	80.6	86.7	94.7	103.6
Average Minimum Temperature (°F)	47.6	49.7	54.4	59.1	65.9	72.7
Average Temperature (°F)	59.0	61.7	67.5	72.9	80.3	88.2
Average Precipitation (inches)	1.14	1.11	0.51	0.09	0.02	0.00
	July	**August**	**September**	**October**	**November**	**December**
Average Maximum Temperature (°F)	108.6	108.1	101.8	91.1	78.7	69.2
Average Minimum Temperature (°F)	79.4	79.8	74.4	64.5	53.4	46.2
Average Temperature (°F)	94.0	94.0	88.1	77.6	66.0	57.7
Average Precipitation (inches)	0.25	0.14	0.24	0.20	0.23	0.68
					Average Temperature (°F)	**75.6**
					Average Annual Precipitation (inches)	**4.61**

Notes:
Temperature and precipitation based on data collected from the Palm Springs Airport from 1991 through 2020, NOAA NCEI 1991-2020 Normals Access.

Annual precipitation from Water Year (WY) 1960-1961 to WY 2018-2019 for the Riverside County Flood Control and Water Conservation District station at Desert Hot Springs is shown on **Figure 4-2**. The rain gauge station is in the DHSSB as shown on **Figure 4-1**. This station is used for the plot of annual precipitation because it has the longest record (59 years) of the three stations located within the Planning Area. The other two stations, Whitewater and Edom Hill, have shorter periods of record (extending back to WY 1975-1976 and WY 2008-2009, respectively).

The precipitation that occurs within the tributary watersheds of the Planning Area either evaporates, is consumed by native vegetation, percolates directly into underlying alluvium and fractured rock, or becomes runoff. A portion of the flow percolating into the soil and bedrock of the mountain watersheds surrounding the MCSB, GHSA, and DHSSB eventually becomes subsurface inflow to these groundwater bodies.



Explanation

- Rain gauge location
- Stream gauge location
- Facility
- Streams
- Highway/road
- Mission Creek Subbasin fringe area

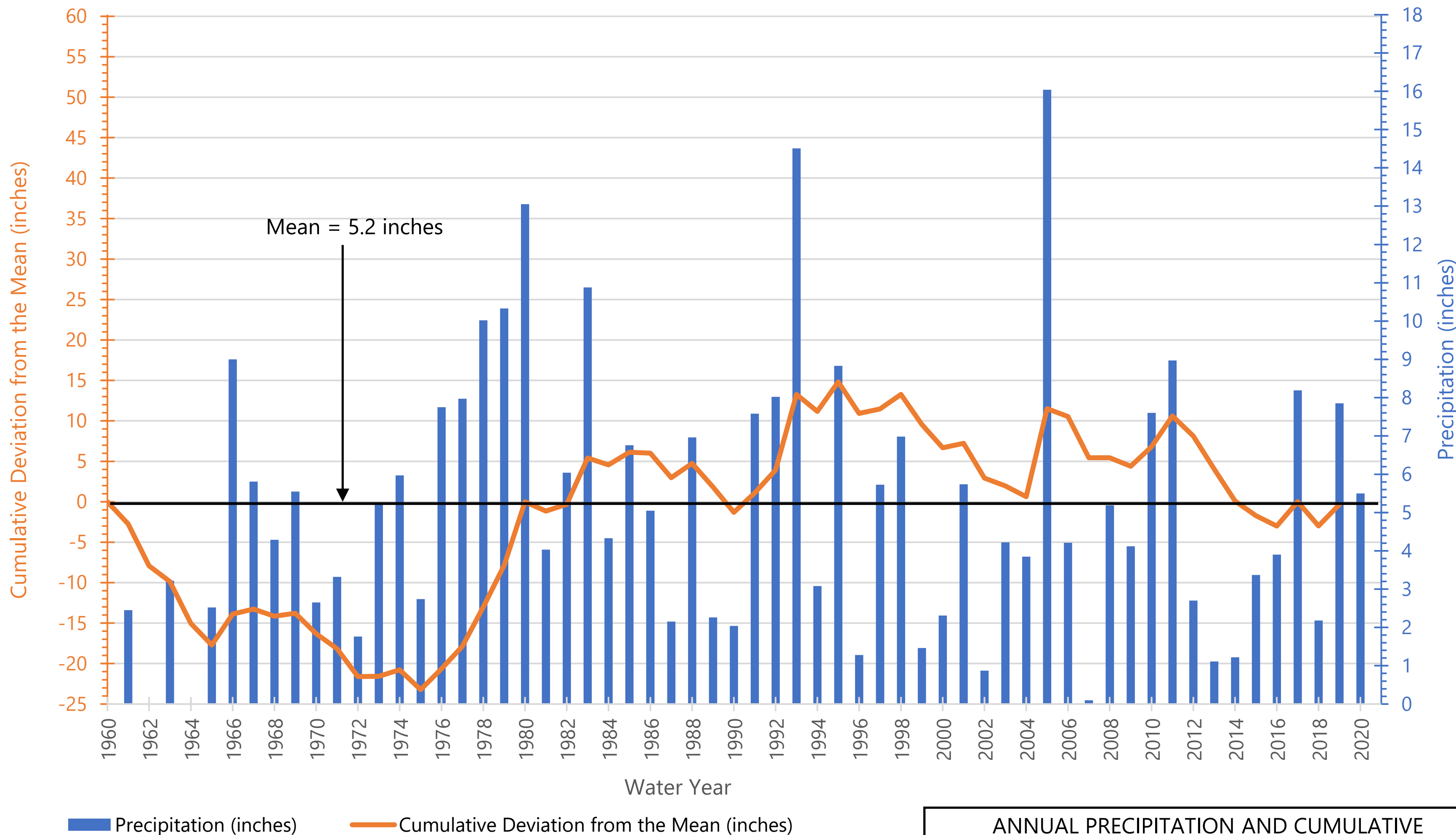
0 6,000 12,000
Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

RAIN AND STREAM GAUGING STATIONS
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: pah	Date: 11/22/2021	Project No.: CM19167350
wood.		Figure 4-1

Date: 9/8/2021 Printed by: pat.herring
Path: C:\Users\pat.herring\Documents\Projects\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update\4-1_Gauge_Sta.mxd



Notes:
No precipitation reported in WY 1961-1962 and WY 1963-1964.
Cumulative Deviation from Mean starts WY 1959-1960 with an assumed mean precipitation.

ANNUAL PRECIPITATION AND CUMULATIVE DEPARTURE FROM THE MEAN AT DESERT HOT SPRINGS RAIN GAUGE STATION
Mission Creek Alternative Update
Coachella Valley, California

By: grr	Date: 11/22/2021	Project No.: CM19167351
wood.		Figure 4-2

4.1.2 Drainage Area

Natural recharge in the MCSB, GHSA, and DHSSB occurs as infiltrated surface water flows and subsurface inflows. Due to the relatively high evapotranspiration rates compared to precipitation, recharge from direct precipitation on the valley floor and in the low-lying hills at the northwest part of the MCSB (east of Whitewater River) is considered to be negligible.

Surface water flow in the MCSB, GHSA, and DHSSB consists of temporary or intermittent streams that originate in the San Bernardino and Little San Bernardino mountains.

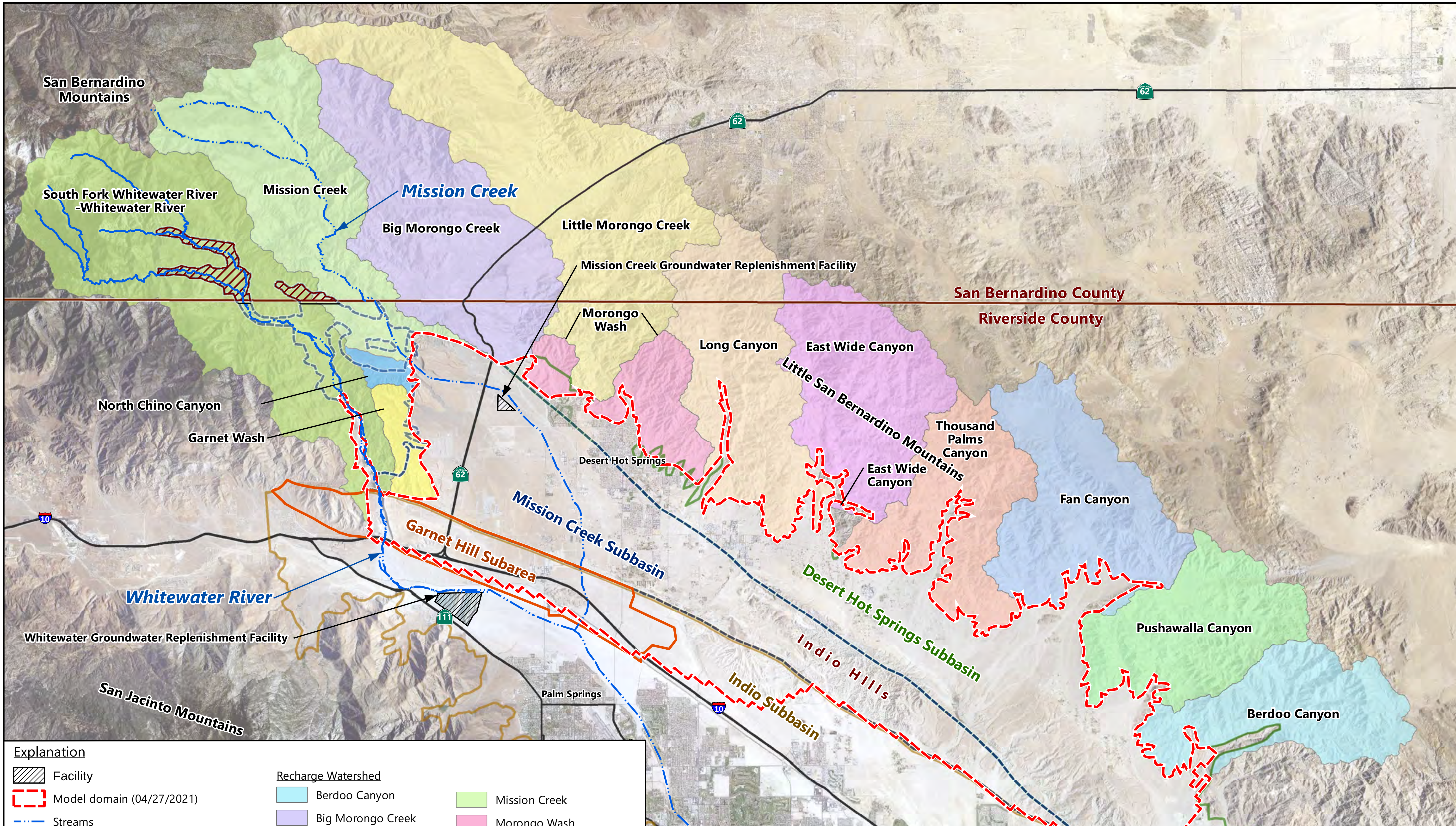
Mission Creek is the only stream that flows to the valley floor on a consistent basis and a stream gauge is maintained by the United States Geological Survey (USGS) (described in Section 4.1.3). Surface water flow in this stream typically infiltrates into the ground a short distance from its entrance into the MCSB. Additionally, streams flowing through Big Morongo, Little Morongo, and Long canyons occasionally reach the valley floor for short periods of time during localized, intense storms in the mountains (MWH, 2013). None of the surface flow from the local watercourses is sufficiently reliable to be used directly for municipal, industrial, or agricultural uses. However, a portion of this runoff naturally replenishes groundwater in the MCSB, GHSA, and DHSSB as mountain front recharge.

The GHSA, MCSB, and DHSSB in the upper portion of the Coachella Valley receive mountain front recharge from 11 watersheds in the San Bernardino and Little San Bernardino Mountains including the South Fork Whitewater River, Mission Creek (gauged streamflow described in Section 4.1.3), North Chino Canyon,[6] Garnet Wash, Big Morongo Canyon, Little Morongo Canyon, Morongo Wash, Long Canyon, East Wide Canyon, Thousand Palms Canyon, Fan Canyon, Pushawalla Canyon, and Berdoo Canyon. These watershed areas are shown on **Figure 4-3**. Mountain front recharge from these watersheds is discussed in Section 5 and in **Appendix A**.

4.1.3 Gauged Streamflow

The USGS measures streamflow at one gauging station in the MCSB, shown on **Figure 4-4**. On February 14, 2019, runoff generated by a storm event altered the channel of Mission Creek at the gauging station to a degree that the USGS was no longer able to gauge streamflow at that location (Wood, 2020). Mission Creek stream flows were estimated using nearby stream gauges until a new stream gauge was installed in December 2019 at a location approximately 1.4 miles downstream of the old location (**Figure 4-1**). Mission Creek stream flows are reported each year in the MCSB Annual Reports. The average stream flow from WY 2017 to WY 2019 was 850 acre-feet per year (AFY). **Figure 4-4** shows total discharges from water year 1968 through 2019. The average water year annual average runoff from the Mission Creek based on 52 years of record (WY 1968 to WY 2019) was 1,818 AFY (Wood, 2020). Only a small portion of the stream flow measured at the gauging station will recharge groundwater in the MCSB. This is due to evapotranspiration, moisture being trapped in the vadose zone above the water table, and surface outflow of the creek into the Indio Subbasin in some years.

[6] The Chino Canyon Watershed includes the Chino Canyon in the San Jacinto Mountains and a much smaller canyon in the northwest part of the MCSB. The watershed in the MCSB was assigned the name North Chino Canyon Watershed.



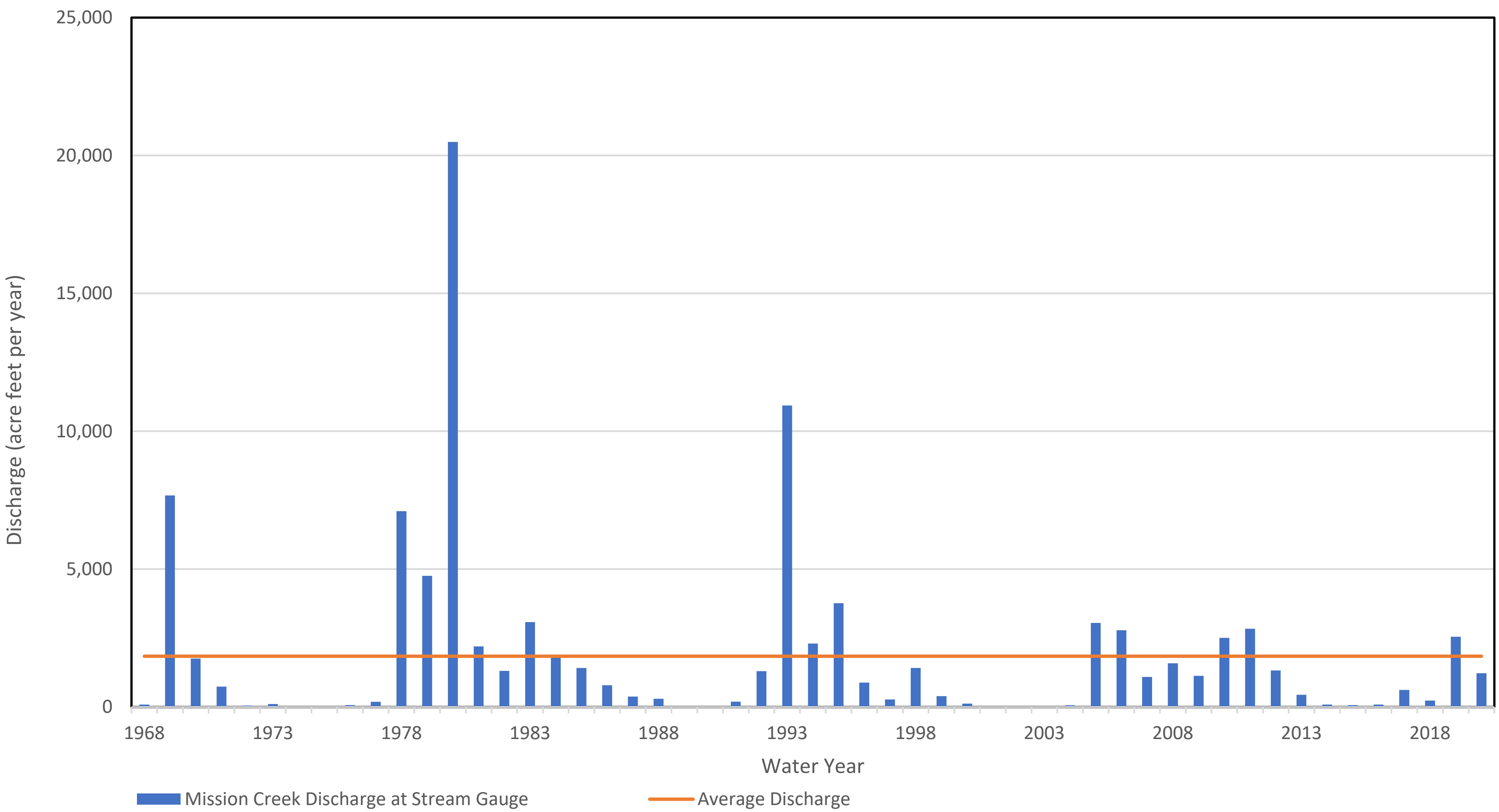
Note:

North Chino Canyon watershed is the north part of the Chino Canyon-Whitewater River watershed. The main portion of this watershed is in the San Jacinto Mountains.

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

MOUNTAIN FRONT RECHARGE WATERSHEDS
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: pah	Date: 9/7/2021	Project No.: CM19167351
wood.		Figure 4-3



Abbreviation:
AFY = Acre feet per year

Note: The Mission Creek gauging station was moved approximately 1.4 miles south in December 2019.

Source: USGS Current Water Conditions, https://waterdata.usgs.gov/ca/nwis/inventory/?site_no=10257600

WATER YEAR DISCHARGE AT MISSION CREEK STREAM GAUGE
Mission Creek Alternative Update
Coachella Valley, California

By: grr	Date: 10/17/2021	Project No.: CM19167351
wood.		Figure 4-4

4.2 Imported Water

In addition to natural replenishment from precipitation and stream flow, the MCSB receives artificial replenishment from imported State Water Project (SWP) water. The SWP is managed by the California Department of Water Resources (CDWR) and includes more than 705 miles of aqueduct and conveyance facilities extending from Lake Oroville in Northern California to Lake Perris in Southern California. The SWP has contracts to deliver 4.172 million AFY to the State Water Contractors. The State Water Contractors consist of 29 public entities with long-term contracts with CDWR for all, or a portion of, their water supply needs.

CVWD and DWA each have a Water Supply Contract with CDWR for SWP water with a combined Table A Amount of 194,100 AFY, as detailed in Section 4.2.1. Currently, there are no physical facilities to deliver SWP water to the Coachella Valley. Instead, CVWD and DWA entered into separate agreements in 1967 with Metropolitan Water District of Southern California (MWD), under which CVWD and DWA transfer their SWP water to MWD as SWP Exchange Water. In exchange, MWD delivers an equal amount of Colorado River water from the Colorado River Aqueduct (CRA) to CVWD and DWA. The original 1967 Exchange Agreements have been updated over time and were most recently re-established in the 2019 Amended and Restated Agreement for Exchange and Advance Delivery of Water (CVWD, 2019).

The following sections describe the various sources, reliability, and reliability enhancement programs for current and future SWP Exchange Water that allow for replenishment of CRA water in the Indio Subbasin and MCSB. In addition, there is a section describing the projection of the SWP Exchange Water delivery to MCSB and the Indio Subbasin and a section describing two potential forecast scenarios for the future use of SWP Exchange Water; one forecast based on historical hydrology, and the other forecast based on climate change hydrology. These forecasts are applied in the groundwater model forecast provided in Section 7.

Imported water availability and use for the MCSB and Indio Subbasin are interrelated. To ensure consistency in the description of imported water projection of future imported water supplies and model scenarios have been coordinated between the Indio Subbasin and MCSB consulting teams.

4.2.1 SWP Table A Water

Each SWP contract contains a “Table A” exhibit that defines the maximum annual amount of water each contractor can receive excluding certain interruptible deliveries. CDWR uses Table A amounts to allocate available SWP supplies and some SWP project costs among the contractors. Each year, CDWR determines the amount of water available for delivery to SWP contractors based on hydrology, reservoir storage, the requirements of water rights licenses and permits, water quality, and environmental requirements for protected species in the Sacramento-San Joaquin River Delta (Delta). The available supply is then allocated according to each SWP contractor’s Table A amount.

CVWD’s and DWA’s collective increments of Table A water are listed in **Table 4-2**. Original Table A SWP water allocations for CVWD and DWA were 23,100 AFY and 38,100 AFY, respectively, for a combined amount of 61,200 AFY. CVWD and DWA obtained a combined

100,000 AFY transfer from MWD under the 2003 Exchange Agreement. In 2004, CVWD purchased an additional 9,900 AFY of SWP Table A water from the Tulare Lake Basin Water Storage District (Tulare Lake Basin) in Kings County (DWR, 2004). In 2007, CVWD and DWA made a second purchase of Table A SWP water from Tulare Lake Basin totaling 7,000 AFY (DWR, 2007a and 2007b). In 2007, CVWD and DWA also completed the transfer of 16,000 AFY of Table A SWP water from the Berrenda Mesa Water District in Kern County (DWR, 2007c and 2007d). These latter two transfers became effective in January 2010. With these additional transfers, the total SWP Table A Amount for CVWD and DWA is 194,100 AFY.

Previously, the 100,000 AFY MWD Transfer obtained under the 2003 Exchange Agreement included a "Call Back" component that allowed MWD to call-back the 100,000 AFY and assume the entire cost of delivery if it needed the water. In 2019, the Amended and Restated Agreement for Exchange and Advance Delivery of Water (CVWD, 2019) ended MWD's right to call-back that 100,000 AFY of Table A water.

Table 4-2: State Water Project Table A Amounts

Agency	SWP Table A Amount (AFY)					
	Original SWP Table A	Tulare Lake Basin Transfer #1	Tulare Lake Basin Transfer #2	MWD Transfer	Berrenda Mesa Transfer	Total
CVWD	23,100	9,900	5,250	88,100	12,000	**138,350**
DWA	38,100	--	1,750	11,900	4,000	**55,750**
Total	61,200	9,900	7,000	100,000	16,000	**194,100**

Source: 2018/19 Annual Report (Wood, 2020)

4.2.2 Other SWP Water Types

There are other types of SWP water that can be purchased, such as individual water purchase opportunities and transfers/exchanges. These may be conveyed to CVWD and DWA as available, but no commitments exist.

Yuba Accord

In addition to SWP Table A contracts, in 2008 CVWD and DWA entered into separate agreements with CDWR for the purchase and conveyance of supplemental SWP water under the Yuba River Accord Dry Year Water Purchase Program (Yuba Accord). This program provides dry year supplies through a water purchase agreement between CDWR and Yuba County Water Agency, which settled long-standing operational and environmental issues over instream flow requirements for the lower Yuba River. The amount of water available for purchase varies annually and is allocated among participating SWP contractors based on their Table A amounts. CVWD and DWA may purchase up to 1.72 percent (%) and 0.69%, respectively, of available Yuba Accord water, in years it is made available.

Yuba Accord deliveries have varied from zero to a total of 2,664 AFY to CVWD and DWA in 2013. Over the ten-year period from 2010-2019, the average annual amount of Yuba Accord water purchased by the GSAs was 651 AFY. This Alternative Plan Update assumes the same 10-year average of Yuba Accord deliveries annually through 2045.

Article 21

Another type of SWP water is Article 21 "Interruptible Water" (described in Article 21 of the SWP water contracts), which is water that State Water Contractors may receive on a short-term basis in addition to their Table A water if they request it in years when it is available. Article 21 water is used by many Contractors to help meet demands in low allocation years. Article 21 water is not available every year, amounts vary when it is available, and it is proportionately allocated among participating Contractors. The availability and delivery of Article 21 water cannot interfere with normal SWP operations and cannot be carried over for delivery in a subsequent year.

The State Water Contractors believe that as reliability increases over time with operation of the Delta Conveyance Facility (DCF, see description below), Article 21 water will become more available to Contractors for purchase. This Alternative Plan Update assumes that once the DCF is constructed, approximately 10,600 AFY in Article 21 water will be available to DWA and CVWD on average annually.

4.2.3 Advance Deliveries

The 1984 Advance Delivery Agreement (amended in 2019 by the Amended and Restated Agreement for Exchange and Advance Delivery of Water [CVWD 2019a]) allows MWD to deliver up to 800,000 AFY of Colorado River water to be credited against its future SWP exchange water obligations. Advance deliveries of exchange water are highly variable and tend to be concentrated in wet years, with the Indio Subbasin providing the majority of the storage. The Advance Delivery Account balance for 2003 – 2019 ranged from 44,601 acre-feet (AF) in 2009 to 391,155 AF in 2019.

4.2.4 SWP Imported Water Reliability

SWP supplies vary annually due to weather and runoff variations in Northern California and regulatory limitations on exports from the Delta.

Delta Exports

The SWP's and Central Valley Project's (CVP; managed by USBR) exports from the Delta have decreased since 2005 due to several key environmental decisions. While the SWP primarily serves the State's population and economic growth, the CVP serves the State's agricultural industry. In 2005, the United States Fish and Wildlife Service (USFWS) released a Biological Opinion that Delta export (combined SWP and CVP) pumping operations would not jeopardize the continued existence of the Delta smelt, a small, endangered fish endemic to the Delta. Environmental groups challenged the action and in May 2007, federal Judge Oliver Wanger ruled that the Biological Opinion was faulty in its assumptions and needed to be performed again. In 2008, the USFWS and National Marine Fisheries Service released a new Biological Opinion that addressed Delta fisheries, restricting operations of the SWP and CVP diversion pumps. In 2009, Judge Wanger struck down the USBR acceptance of the new Biological Opinion, saying USBR failed to comply with the National Environmental Policy Act related to cutbacks in water exports for Central Valley farmers.

In 2009, the Sacramento-San Joaquin Delta Reform Act of 2009 (Delta Reform Act) established the Delta Stewardship Council to create a comprehensive, long-term, legally enforceable plan to guide management of the Delta's water and environmental resources. The Delta Plan (Delta Stewardship Council, 2013) includes policies and recommendations to achieve "coequal goals," which means the two goals of providing more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. In 2016, USBR and CDWR developed the California WaterFix, a twin-tunnels alternative focused on conveyance and ecosystem improvements to significantly reduce reverse flows and fish species impacts associated with the existing south Delta intakes. In 2019, USFWS and National Marine Fisheries Service issued revised Biological Opinions (USFWS, 2019) to address California WaterFix. Concurrently, USBR issued the 2018 Addendum (USBR, 2018) to the 1986 Coordination Operation Agreement (USBR, 1986) with accompanying SWP and CVP operations changes which reduced SWP exports and increased CVP exports, along with more conservative operation of Lake Oroville. In 2019, Governor Newsom directed state agencies to proceed with modernizing Delta conveyance with a single tunnel project (see DCF description below).

SWP Reliability

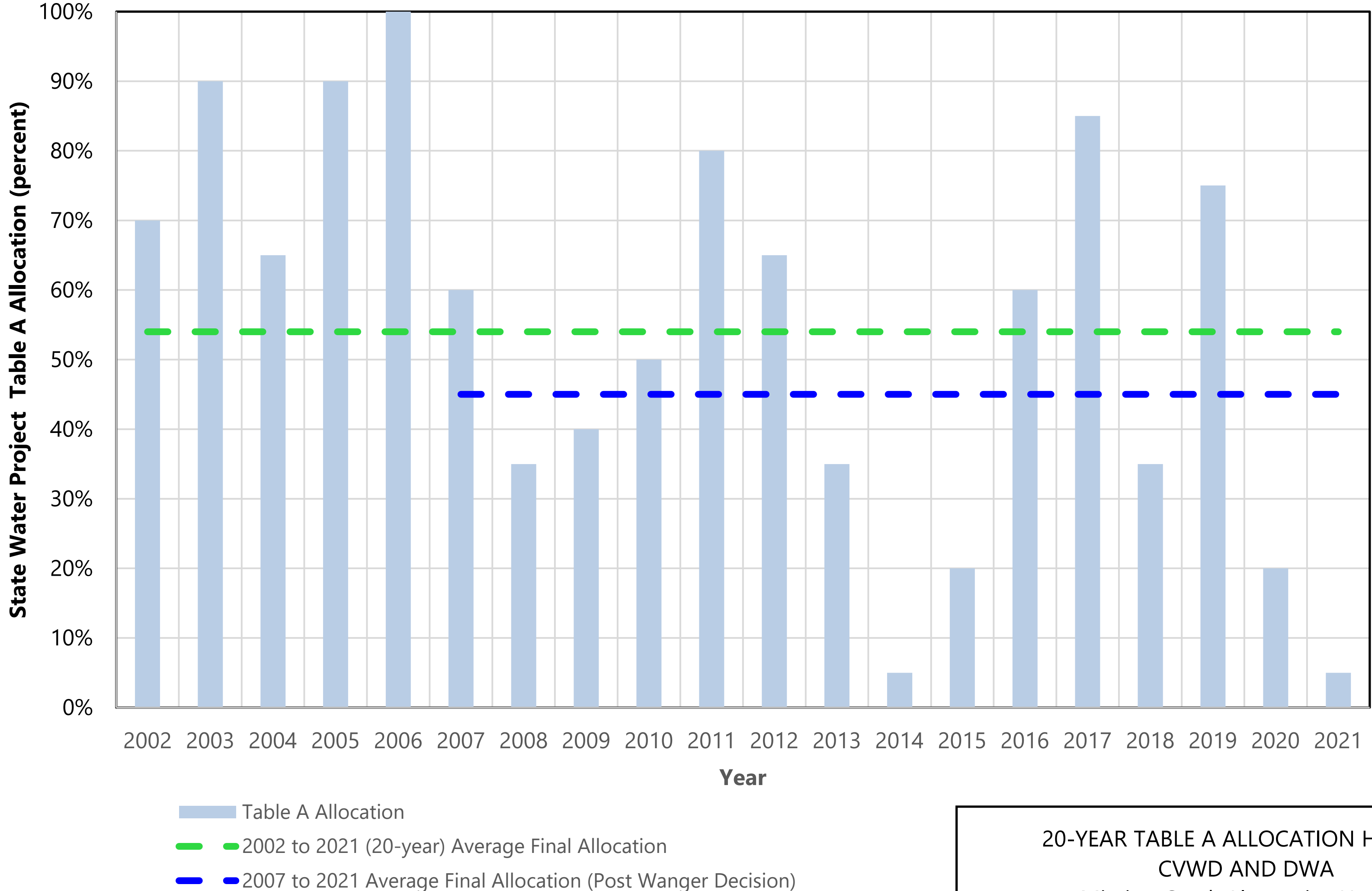
State Water Contractors are required to submit annual delivery schedules to the CDWR for a suite of potential water allocations; for example, delivery schedules for 15%, 30%, 50%, 60%, and 100% allocations were provided for calendar year 2021. CDWR makes an initial SWP Table A allocation for planning purposes, typically in December, prior to the start of each calendar year. Throughout the year, as additional information regarding water availability becomes available and CDWR performs hydrologic analyses, the SWP allocation/delivery estimates are updated. Typically, the final SWP allocation for the year is derived by June, and although not typical, can still be updated into the Fall. **Table 4-3** presents the historical draft and final Table A allocations over the past 20 years (i.e., 2002 to 2021). Note that CVWD's and DWA's contracted Table A amounts increased in 2004, 2005, and 2010.

Table 4-3: Historical SWP Table A Allocations, CVWD and DWA (2002–2021)[1]

Year	100% Table A Volume (AFY)	Water Year Type	SWP Initial Allocation (%)	SWP Final Allocation (%)
2002	61,200	Dry	20%	70%
2003	61,200	Above Normal	20%	90%
2004	71,100	Below Normal	35%	65%
2005	171,100	Above Normal	40%	90%
2006	171,100	Wet	55%	100%
2007	171,100	Dry	60%	60%
2008	171,100	Critically Dry	25%	35%
2009	171,100	Dry	15%	40%
2010	194,100	Below Normal	5%	50%
2011	194,100	Wet	25%	80%
2012	194,100	Above Normal	60%	65%
2013	194,100	Critically Dry	30%	35%
2014	194,100	Critically Dry	5%	5%
2015	194,100	Critically Dry	10%	20%
2016	194,100	Above Normal	10%	60%
2017	194,100	Above Normal	20%	85%
2018	194,100	Critically Dry	15%	35%
2019	194,100	Above Normal	10%	75%
2020	194,100	Below Normal	10%	20%
2021	194,100	Critically Dry	5%	5%
		20-year Average	**24%**	**54%**
		14-year Average Since Wanger Decision	**20%**	**45%**

[1]Source: CDWR, 2018, Bulletin 132-18 and notices to contractors https://water.ca.gov/programs/state-water-project/management/swp-water-contractors.

Final SWP allocations between 2002 and 2021 have ranged from a high of 100% in 2006 to a low of 5% in 2014 and 2021. **Figure 4-5** shows the variability of Table A allocations for the period 2002 through 2021. The reliability of SWP deliveries has declined since 2007 when Judge Wanger overturned the Biological Opinion about Delta export pumping operations (2007 Wanger decision). This decision significantly impacted CDWR's ability to convey SWP supplies across the Delta for export. Since the 2007 Wanger decision, SWP final allocations have averaged 45% annually. This period has also been marked by six critically dry years.



Notes:
Source: CDWR, 2018, Bulletin 132-18 and https://water.ca.gov/programs/state-water-project/management/swp-water-contractors.

20-YEAR TABLE A ALLOCATION HISTORY
CVWD AND DWA
Mission Creek Alternative Update
Coachella Valley, California

By: grr	Date: 9/30/2021	Project No.: CM19167351
wood.		Figure 4-5

Future SWP Deliveries

CDWR's Final SWP Delivery Capability Report 2019 (CDWR, 2020a) was released in August 2020. The delivery reliability of water from the SWP system is an important component in the water supply planning of the SWP Contractors. SWP delivery amounts were modeled for the 2019 SWP Delivery Capability Report using the CalSim II simulation model that incorporates the historical range of hydrologic conditions from Water Years 1922 through 2003. CDWR's analysis determined that long-term average SWP deliveries across all water years from 1922 to 2015 was 2,414,000 AF, or 58% of the maximum of the 4,133,000 AFY available for export from the Delta (note that this is slightly lower than the combined maximum SWP Table A amounts for all SWP Contractors). **Table 4-4** provides a summary of the SWP delivery amounts for existing conditions using the CalSim II modeling for the 2019 SWP Delivery Capability Report. The CalSim II model uses historical record from 1922 to 2003. By using this 82-year historical record, the delivery estimates modeled for existing conditions reflect a reasonable range of potential hydrologic conditions from wet years to critically dry years.

Table 4-4: Estimated Average, Wet-, and Dry-Period Deliveries of SWP Table A Water

	Estimated SWP Table A Deliveries (AFY)	Percent of Maximum SWP Table A for Export (4,133,000 AFY)
Long-Term Average	2,414,000	58%
Wet Periods		
Single Wet Year (1983)	4,008,000	97%
2-Year (1982-1983)	3,750,000	91%
4-Year (1980-1983)	3,330,000	81%
6-Year (1978-1983)	3,210,000	78%
10-Year (1978-1987)	2,967,000	72%
Dry Periods		
Single Dry Year (1977)	288,000	7%
2-Year Drought (1976-1977)	1,311,000	32%
4-Year Drought (1933-1934)	1,228,000	30%
6-Year Drought (1987-1992)	1,058,000	26%
8-Year Drought (1929-1936)	1,158,000	28%

Source: 2019 SWP Delivery Capability Report (CDWR, 2020a)

CDWR's analysis further showed a decreasing trend in the future long-term average. The Technical Addendum to the 2019 SWP Delivery Capability Report (CDWR, 2020b) provides a "Future Conditions with Climate Change and 45 cm Sea Level Rise Scenario" which projects a further decrease in SWP delivery over time. Although the 2019 SWP Delivery Capability Report estimates delivery reliability of 58% declining to 52% by 2040 (CDWR, 2020a), based on the long-term average, this Alternative Plan Update recognizes the significant reduction in reliability associated with climate change and Delta export litigation and instead assumes 45% reliability through the planning horizon.

4.2.5 Delta Conveyance Facility

The DCF is a state project that would improve SWP reliability and result in increased deliveries in the future. The DCF would construct and operate new conveyance facilities in the Delta, primarily a new tunnel to bypass existing natural channels used for conveyance. New intake facilities would be in the north Delta along the Sacramento River. The new facilities would provide an alternate location for diversion of water from the Delta and would be operated in coordination with the existing south Delta pumping facilities.

Construction of the DCF will improve water supply reliability for State Water Contractors by addressing in-Delta conveyance, with its myriad of constraints. Because the SWP currently relies on the Delta's natural channels to convey water, it is vulnerable to earthquakes, climate change, and pumping restrictions established to protect in-stream species and habitats. Certain pumping restrictions in the south Delta can prevent the SWP from reliably capturing water when it is available, especially in wet weather. The DCF would add new diversions in the north Delta to promote a more resilient and flexible SWP in the face of unstable future conditions. Combined with the current through-Delta method, the addition of DCF is referred to as the "dual conveyance" system.

CVWD and DWA have approved a 2-year agreement to advance their share of funding for DCF planning and design costs. The Agreement in Principle for the Delta Conveyance Facility was approved in November 2020, as outlined in **Table 4-5**. A very preliminary estimate of the DCF benefits is 500,000 AFY. DWA and CVWD approved their participation levels of 1.52% and 3.78%, respectively. This would restore 26,500 AFY in SWP deliveries to CVWD and DWA over and above current conditions, allocated between 60% to Table A and 40% to Article 21. With DCF construction, SWP reliability is assumed to increase to 59% as an annual average. DCF deliveries are expected to begin in year 2040.

Table 4-5: DCF Supply Amounts

Description	CVWD	DWA	Total
Table A Supply (AFY)	11,340	4,560	15,900
Article 21 Supply (AFY)	7,560	3,040	10,600
Annual Estimate (AFY)	18,900	7,600	26,500
Share of DCF (%)	3.78%	1.52%	5.30%

4.2.6 Lake Perris Dam Seepage Recovery Project

In 2017, MWD and CDWR began preliminary planning for recovery of seepage below the Lake Perris Dam and delivery of the recovered water to MWD in addition to its current allocated Table A water. The project is composed of installing a series of five pumps placed down-gradient from the face of the Lake Perris Dam that will pump water that has seeped from the lake into the groundwater. The recovered water will be pumped into a collection pipeline that discharges directly into MWD's CRA south of Lake Perris.

CVWD and DWA were invited to partner in the project with MWD, and the parties signed an agreement with CDWR in 2021 to fund environmental analysis, planning, and preliminary design. An additional agreement (or amendment to the existing Exchange Agreement) will be needed to exchange a proportional share of the recovered seepage water, as outlined in **Table 4-6** below, for Colorado River water delivered by MWD to the West Whitewater River Groundwater Replenishment Facility (WWR-GRF) and the Mission Creek Groundwater Replenishment Facility (MC-GRF) (MWD, 2020) through MWD's CRA. The project is estimated to recover approximately 7,500 AFY, with 2,753 AFY for delivery to CVWD and DWA, and is anticipated to begin delivery of 233 AFY to the MC-GRF in 2023 increasing to 268 AFY by 2045.

Table 4-6: Lake Perris Seepage Recovery Amounts

Description	MWD	CVWD	DWA	Total
Share of Lake Perris Dam Seepage Recovery (%)	63.3%	32.3%	4.4%	100%
Annual Estimate (AFY)	4,747	2,425	328	7,500

4.2.7 Sites Reservoir Project

The Sites Reservoir Project would capture and store stormwater flows from the Sacramento River for release in dry years. Sites Reservoir would be situated on the west side of the Sacramento Valley, approximately 10 miles west of Maxwell, California. When operated in coordination with other Northern California reservoirs such as Shasta, Oroville, and Folsom, which function as the backbone to both the SWP and the Central Valley Project, Sites Reservoir would increase flexibility and reliability of statewide water supplies in drier periods.

In 2019, CVWD and DWA both entered into an agreement with the Sites Project Authority for the next phase of planning for the Sites Reservoir (Sites Project Authority, 2019; 2020). The Sites Project Authority's goals are to make water supply and storage capacity available to water purveyors within the Sacramento River watershed, and in other areas of California, who are willing to purchase water supply from the Sites Reservoir Project. CVWD and DWA are participating members at 10,000 AFY and 6,500 AFY levels, respectively, as shown in **Table 4-7**. This Alternative Plan Update assumes approximately 30% conveyance losses, for total delivery of 11,550 AFY to CVWD and DWA. The portion of Sites Reservoir Project estimated to be delivered to MCSB is 1,124 AFY beginning in 2035.

Table 4-7. Sites Reservoir Supply Amounts

Description	CVWD	DWA	Total	Total After 30% Conveyance Loss
Percent of Sites Reservoir Supply	5.2%	3.4%	8.6%	--
Annual Estimate (AFY)	10,000	6,500	16,500	11,550

4.2.8 Projected SWP Delivery to Subbasins

All SWP Exchange water delivered to DWA and CVWD is recharged at: (1) the WWR-GRF in the Indio Subbasin or (2) the MC-GRF in the MCSB. SWP water is allocated between the subbasins in accordance with the 2014 Mission Creek Water Management Agreement (CVWD and DWA, 2014). This includes any water that is paid for or planned to be paid for by the SWP tax or split between the RAC paid by West Whitewater River and Mission Creek Area of Benefit (AOB),[7] including Table A, Article 21, and Yuba Accord water, in addition to any future increase in Table A reliability (i.e., DCF), Lake Perris Seepage, and Sites Reservoir supplies.

Available SWP supply allocated to MC-GRF and WWR-GRF is based on proportional groundwater production between the Mission Creek Management Area and the West Whitewater River Management Area, to be balanced over a 20-year period beginning December 2004. In 2020, total assessable production in the Mission Creek Management Area (inclusive of CVWD's AOB and DWA's AOB) was 14,244 AF, while total assessable production in the West Whitewater River Management Area (again inclusive of CVWD's AOB and DWA's AOB) was 153,979 AF (CVWD, 2020).

Based on a cumulative total of 168,223 AF in assessable production between the two management areas, this resulted in an 8%/92% split between the Mission Creek and West Whitewater River Management Areas in 2020. As shown in **Table 4-8**, the projected allotment of SWP exchange water to the two Management Areas was calculated as 8 increasing10% to MC-GRF and 92 decreasing to 90% to WWR-GRF by 2045. Urban growth and associated water demand in the MCSB will result in slightly more SWP Exchange water being delivered to that subbasin over time. This Alternative Plan Update is coordinated with the Indio Subbasin Water Management Plan Update to establish production estimates and associated SWP delivery estimates for the two Management Areas through the 2045 planning horizon.

4.2.9 Use of SWP Exchange Water

This Alternative Plan Update accounts for all anticipated SWP Exchange water to be recharged at WWR-GRF and MC-GRF (as described above) to ensure that all available supply is used. In order to fully use available SWP exchange supplies, the CVWD and DWA will continue to replenish

[7] The Indio Subbasin is also identified as the Whitewater River Subbasin by the United States Geological Survey (USGS, 1980). The USGS name is the basis for the names for the Whitewater River AOB.

groundwater at maximum delivery levels and pursue additional SWP supplies as they become available. This Alternative Plan Update considers two SWP Exchange delivery scenarios:

1. Historical hydrology – Table A deliveries at 45% through 2045 based on average SWP reliability since the 2007 Wanger decision and uncertainty about the future of Delta exports.
2. Climate change assumptions– Table A deliveries at 45% in 2020 are reduced by 1.5% incrementally through 2045.

Scenario modeling described in Section 7: Water Management Forecasting assumes annual variability of Table A deliveries associated with different projected climate years. However, Yuba Accord, Lake Perris Seepage, Sites Reservoir, and DCF supplies are assumed at their full anticipated amounts each year. The projected estimates for all potential SWP Exchange Water are shown in **Table 4-8**.

Table 4-8: Forecast of SWP Table A Supplies to WWR-GRF and MC-GRF

SWP Component	2020	2025	2030	2035	2040	2045
Table A Amount	194,100	194,100	194,100	194,100	194,100	194,100
Assumed SWP Reliability	45%	45%	45%	45%	45%	45%
Average Table A Deliveries with Assumed SWP Reliability	**87,345**	**87,345**	**87,345**	**87,345**	**87,345**	**87,345**
Yuba Accord	651	651	651	651	651	651
Lake Perris Seepage	0	2,752	2,752	2,752	2,752	2,752
Sites Reservoir	0	0	0	11,550	11,550	11,550
Delta Conveyance Facility (Additional SWP Table A/Article 21)	0	0	0	0	0	26,500
Sum of SWP Supplies	**87,996**	**90,748**	**90,748**	**102,298**	**102,298**	**128,798**
Foreseeable Production (AFY)						
West WWR Management Area Production	150,336	155,338	160,640	165,955	170,754	175,202
% West WWR Management Area	92%	92%	91%	91%	91%	90%
Mission Creek Management Area Production	13,281	14,369	15,455	16,543	17,717	18,892
% Mission Creek Management Area	8%	8%	9%	9%	9%	10%
Total Estimated Production	**163,617**	**169,707**	**176,095**	**182,498**	**188,471**	**194,094**
Estimated Replenishment (AFY)						
WWR-GRF Replenishment	80,853	83,065	82,783	93,025	92,682	116,262
MC-GRF Replenishment	7,143	7,683	7,965	9,273	9,616	12,536

4.3 Wastewater/Recycled Water

The Planning Area includes areas connected to the Mission Springs Water District (MSWD) wastewater treatment system through sewer connections (sewered areas) and areas on septic systems (unsewered areas). All of the CVWD portion of the Planning Area (**Figure 1-3**) that overlies the DHSSB and MCSB is unsewered and there is currently no Master Plan to convert this area to sewer. Septic to sewer conversions will be driven by future development in this area. Most of the denser population areas in the MSWD/DWA Area (primarily within the City of Desert Hot Springs) in the DHSSB and MCSB are sewered, under conversion to sewer, or have plans for initial conversion to sewer to start between 2022 and 2035 (estimated by MSWD, based on previous septic to sewer conversions). The less densely populated areas of the DHSSB and MCSB and all of the GHSA are unsewered. In the next two years, MSWD plans to sewer a commercial industrial area north of the intersection of the I-10 freeway at Indian Avenue in the GHSA.

The municipal wastewater from parts of the MCSB and DHSSB that are sewered is treated and disposed in the MCSB through evaporation/percolation ponds at the MSWD Horton and Desert Crest Wastewater Treatment Plants (WWTPs). Disposal volumes for each treatment plant are listed in **Table 4-9**. In water years 2017-2019, an average of 2,090 AF of wastewater was treated, all of which was disposed through percolation and evaporation. MSWD is currently constructing the Regional Water Reclamation Facility (RWRF) in the GHSA near I-10 and Indian Avenue to increase wastewater treatment capacity regionally and will divert flows from the Horton WWTP which is nearing capacity.

Table 4-9: Wastewater Treatment and Disposal in the Mission Creek Subbasin - WY 2017 to 2019

Wastewater Treatment Plant	WY 2017 (AF)	WY 2018 (AF)	WY 2019 (AF)	Average (AFY)
MSWD – Horton WWTP	1,955	2,032	2,130	2,039
MSWD – Desert Crest WWTP	49	53	50	51
Total	**2,004**	**2,085**	**2,180**	**2,090**

Currently, there is no recycled water produced or used in the MCSB; however, there are plans to do so once MSWD constructs new treatment processes and distribution mains. MSWD plans to add tertiary treatment at the RWRF with off-site spreading facilities as well as tertiary treatment and on-site recharge via existing spreading basins at the existing Horton WWTP.

4.4 Groundwater Use

Groundwater is the only current source of water available for direct municipal supply and private pumpers in the Planning Area and most of the groundwater production used in the Planning Area is pumped from the MCSB. This section provides information on the long-term historical groundwater pumping in the MCSB because of the reliance of the Planning Area on groundwater from this subbasin. A summary of the recent extraction in the MCSB and GHSA beginning in WY 2017, the first year of Sustainable Groundwater Management Act (SGMA) annual reporting for the MCSB and Indio Subbasins, is provided to summarize groundwater use in these subbasins as reported in the SGMA Annual Report. More detailed information regarding groundwater production, including the period prior to WY 2017, is presented in report Section 5, **Appendix A**, and in the 2016 Bridge Document. This section also summarizes the limited available information on DHSSB groundwater production.

4.4.1 Long-term Groundwater Extraction in the MCSB

The long-term groundwater extraction in the MCSB is shown on **Figure 4-6**. Groundwater production increased from approximately 4,580 AFY in 1979 and peaked at approximately 17,010 AFY in 2006. Groundwater production has declined since 2006 with total production below 14,000 AFY in 2015, 2016, and 2019. The declines are attributed primarily to conservation efforts.

4.4.2 Recent Groundwater Extraction in the MCSB

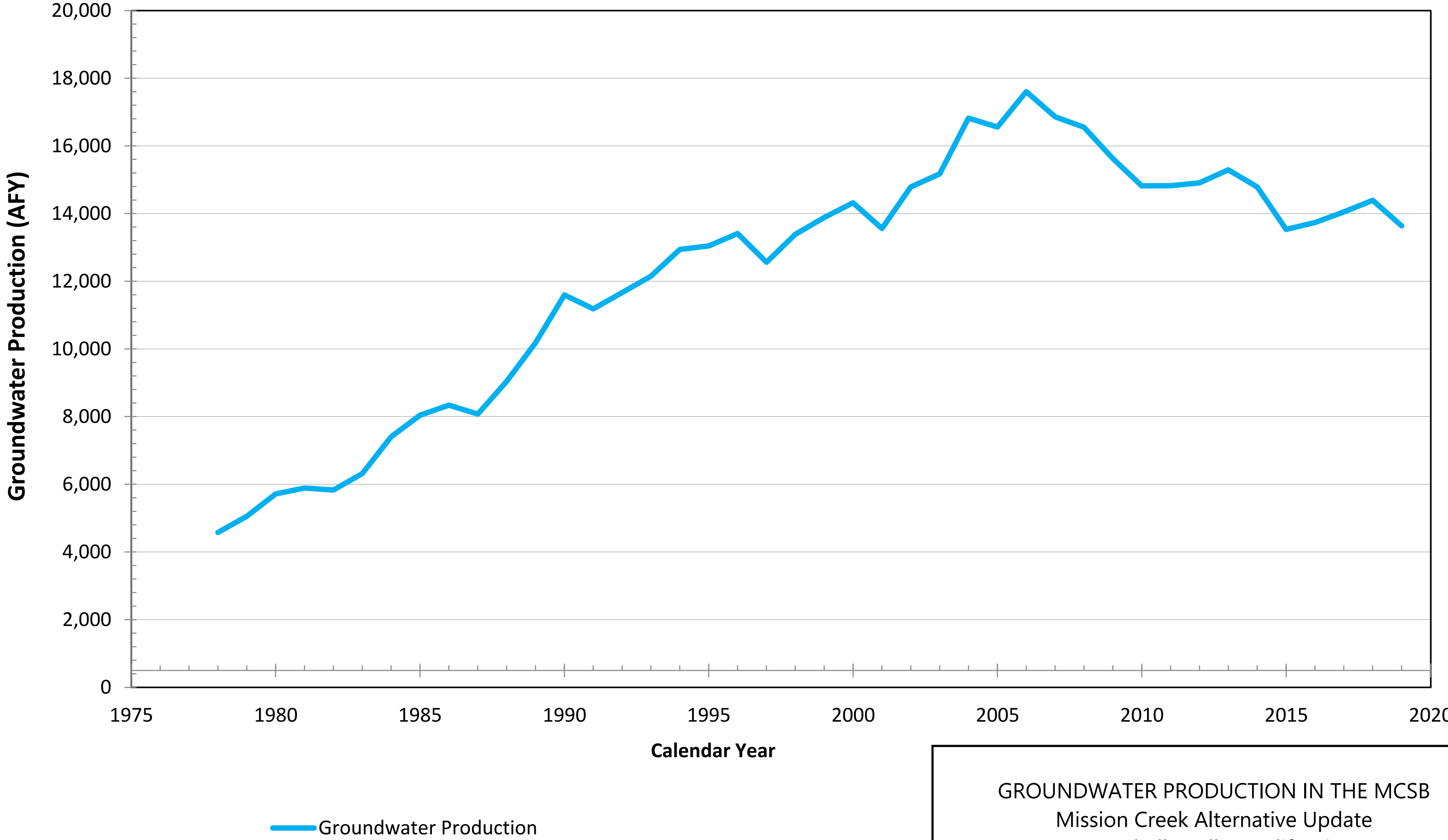
Approximately 90% of metered groundwater production in the MCSB is for urban water use (urban use is comprised of municipal and recreational - including golf course irrigation). The remaining approximately 10% of metered groundwater production is for agricultural or industrial purposes.

All production wells that participate in the replenishment assessment programs are metered. However, previous estimates indicate that there could be about 500 AFY of unreported pumping of groundwater for unknown uses by minimal pumpers (defined as extracting less than 25 AFY and 10 AFY within the CVWD and DWA AOBs, respectively). Estimated groundwater production by minimal pumpers was previously discussed in Section 3.4.2. As indicated in **Table 4-10**, an average of 14,046 AFY of groundwater was extracted from the MCSB from WY 2017 to WY 2019. Groundwater was extracted for agriculture, industrial and urban use and included the estimated 500 AFY of groundwater extracted by minimal pumpers. Analyses of water use in the MCSB suggests recent minimal pumper production, which is believed to occur almost exclusively within the CVWD planning area, is closer to 479 AFY as described in Section 3.4.2. Given the uncertainty in this estimated value and that it does not include some minimal pumper production outside of the CVWD planning area, it is rounded to 500 AFY for reporting purposes.

Table 4-10: Groundwater Extractions by Water Use Sector in the MCSB (WY 2017 to 2019)

Water Use Sector	Average Annual Groundwater Extractions (AFY)	Method of Measurement	Measurement Accuracy[4]
Agriculture[1]	621	100% metered	±1%
Industrial	285	100% metered	±1%
Urban[2]	12,640	100% metered	±1%
Environmental	0	Not applicable	Not applicable
Undetermined[3]	500	100% estimated	±25%
Total Average Annual Production	**14,046**	--	--

Notes: Source: MCSB Annual Reports (Stantec, 2018, Wood, 2019 and 2020).
1. Includes fish farms.
2. Includes municipal and recreational use (e.g., golf course irrigation).
3. Estimated production by minimal pumpers who are not required to report production to CVWD (<25 AFY) or DWA (<10 AFY).
4. Percent values are approximate.



Abbreviations:
AFY = acre feet per year

GROUNDWATER PRODUCTION IN THE MCSB
Mission Creek Alternative Update
Coachella Valley, California

By: grr	Date: 11/22/2021	Project No.: CM19167351
wood.	Figure	4-6

Figure 4-7 shows the general location of groundwater production (excluding minimal pumpers) in the MCSB and summarizes the annual average production for WY 2017 through WY 2019 within Public Land Survey System sections (i.e., township sections).

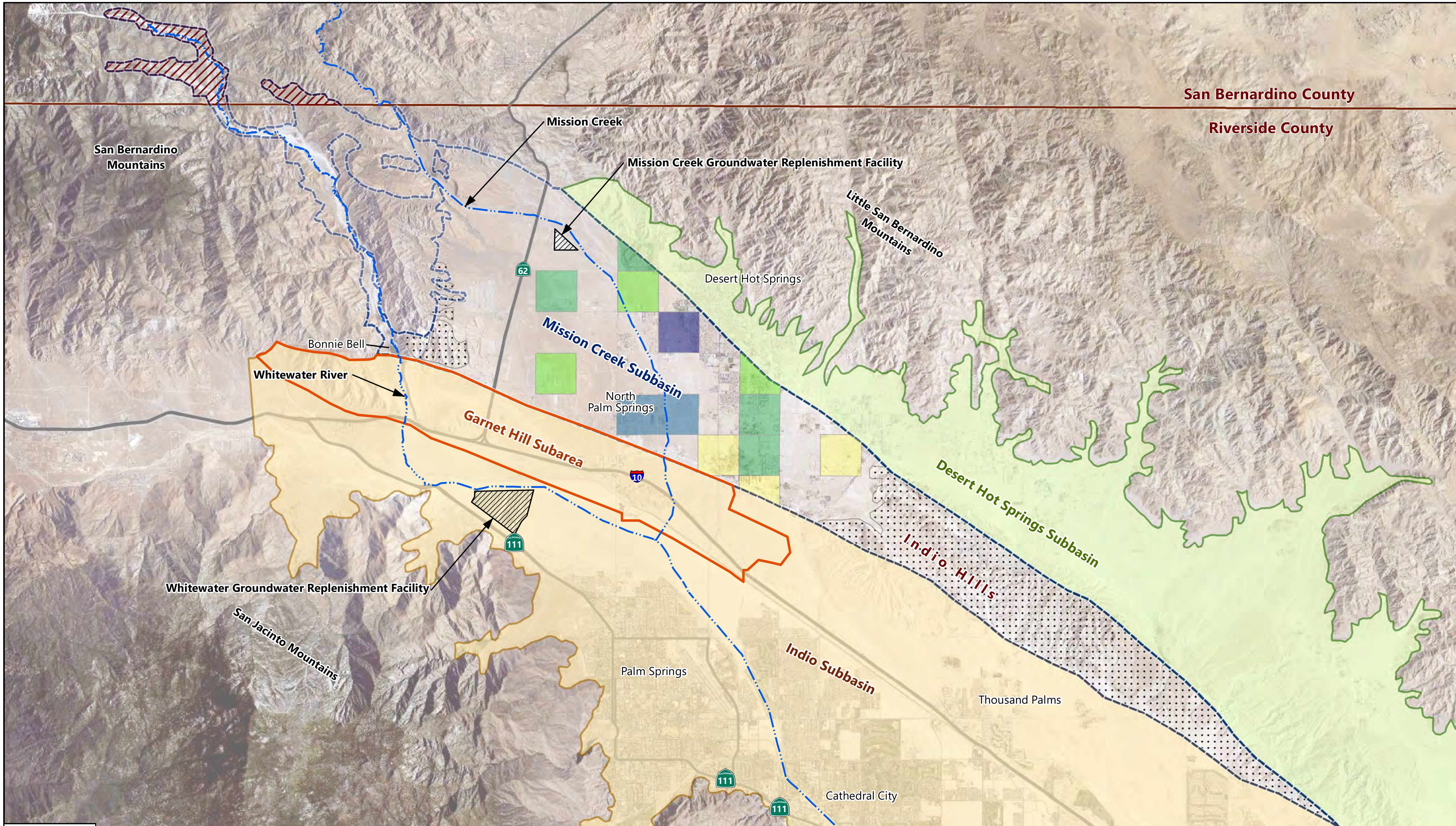
Township sections are arranged in a grid and each section overlies an area of approximately one square mile. Where township sections extend beyond the MCSB boundary, the sections have been trimmed to show only that part of the township section that overlies the MCSB. Total water year annual average groundwater production for each section is indicated by a color representing a range of production. Groundwater production, above minimal pumper thresholds, occurs within the main portion of the MCSB. No groundwater pumping is documented in the Indio Hills within the MCSB or in the far northwestern parts of the subbasin (upper Mission Creek and Whitewater River channel).

4.4.3 Recent Groundwater Extraction in the GHSA

Groundwater extraction for the GHSA is documented in the annual reports for the Indio Subbasin. One active municipal well is in the GHSA and a portion of the production from this well is exported from the GHSA to the MCSB (Wood, 2020). For WY 2017 to WY 2019, an average of 294 AFY of groundwater was extracted from the GHSA and an average of 188 AFY was exported for use in the MCSB. A private well used for industrial purposes is also active in the GHSA. For WY 2017 to WY 2019, an average of approximately 14 AFY was extracted from this private well.

4.4.4 Estimated Groundwater Extraction in the DHSSB

Historically, groundwater resources in the DHSSB have remained relatively undeveloped primarily due to elevated dissolved mineral content in the groundwater. The Agencies do not operate any production wells in this subbasin. Current understanding and historical data indicate that there is much less groundwater pumping in the DHSSB than in the MCSB, though the mineralized groundwater is used at spas and resorts overlying the DHSSB. Historical pumping data are estimated based on a groundwater modeling study for the area (Mayer, 2007). Information from the study indicated relatively stable groundwater pumping of approximately 1,700 AFY in the subbasin from the early 1970s to the late 1990s. It is assumed that recent and future groundwater use in the DHSSB is and will be similar to the long-term historical use.



Explanation

- Facility
- Streams
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet Hill Subarea of Indio Subbasin
- Low permeability/non-water bearing sediments/bedrock
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin

Groundwater Production by Area (Acre-Feet per Year)

- 0 - 100
- 101 - 500
- 501 - 1,000
- 2,000 - 3,000
- 4,000 - 5,000

Note:
Grid squares are based on township section and are approximately one square mile except where truncated by subbasin boundary. Total pumping is shown in sections where recent historical pumping exceeded minimal producer thresholds.

0 6,000 12,000
Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016.

AVERAGE ANNUAL GROUNDWATER PRODUCTION IN THE MCSB WY 2017-2019
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: pah | Date: 9/7/2021 | Project No.: CM19167351

wood.

Figure 4-7

Date: 9/7/2021 Printed by: pat.herring
Path: W:\Projects\CM19167352 (MissionCrk)\esri\Plan_Assessment\4-7_MSCB_GW_Production_Areas.mxd

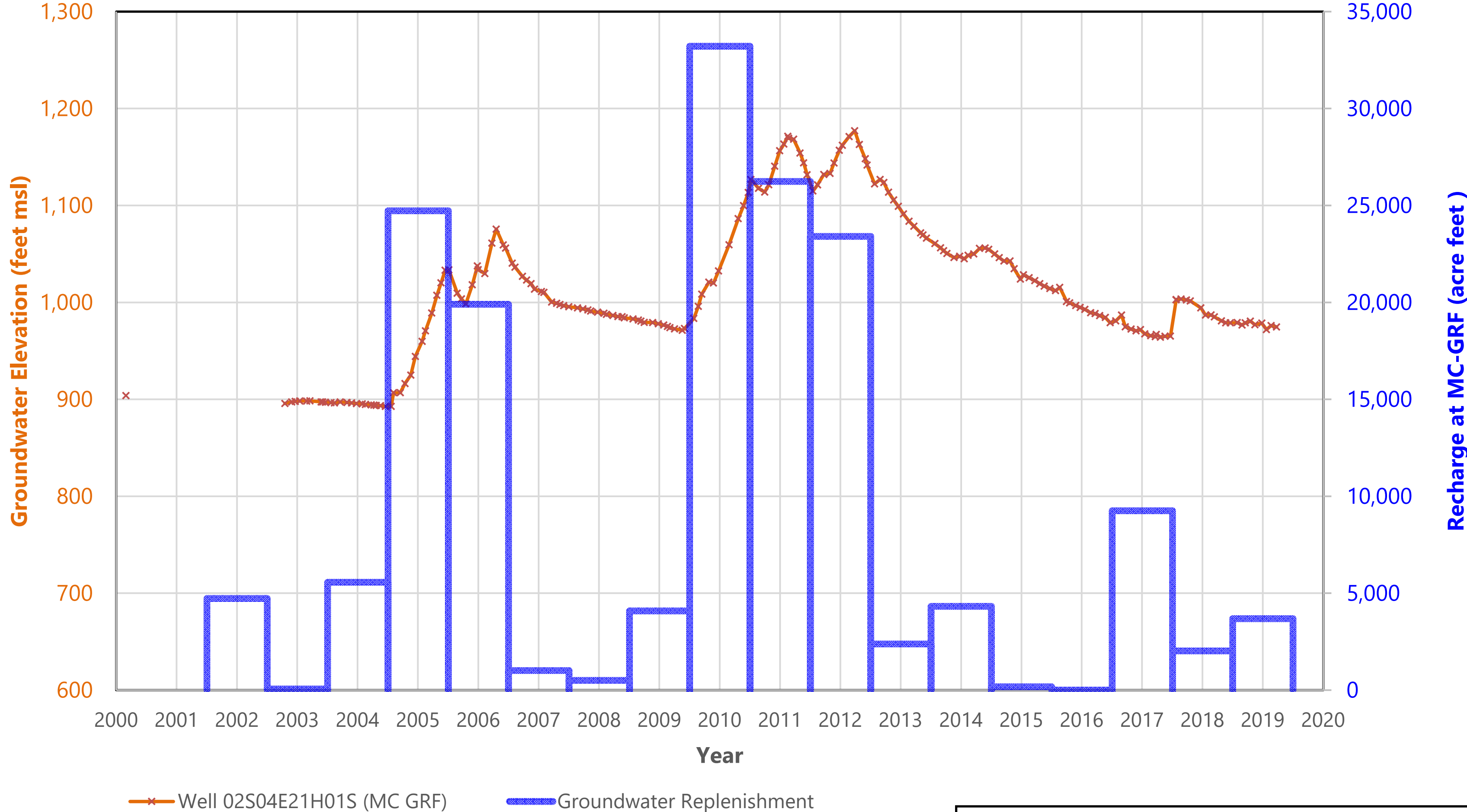
4.5 MCSB Net Groundwater Extraction and Groundwater Levels

Groundwater levels in the MCSB began to decline prior to the 1970s with increasing groundwater production. In the 1990s, the Agencies recognized that continued lowering of groundwater levels in the MCSB was not sustainable and, if continued, could have undesirable results ranging from increased energy costs for groundwater pumping to the need to deepen existing private and public wells. As a result, the Agencies developed and implemented plans to recharge imported water into the MCSB. Groundwater levels in the MCSB began to increase after an imported water recharge program began in 2002 at the MC-GRF. **Figure 4-8** shows groundwater recharge to the MC-GRF since the commencement of recharge activities in 2002. From calendar year 2002 through 2019, a total of 165,276 AF was delivered to the MC-GRF for direct replenishment. The average recharge for this period was approximately 9,180 AFY with recharge volumes ranging from 0 to 33,210 AFY.

It is conservatively estimated that 2% of the water delivered for recharge is evaporated from the spreading facilities and 98% of the water reaches the underlying groundwater basin (Wood, 2020). **Figure 4-8** includes a plot of groundwater levels in a monitoring well located at the south end of the MC-GRF. The plot shows that recharge efforts resulted in groundwater elevations rising near the recharge facility by more than 250 feet between 2005 and 2012 as a result of multiple years of high-volume recharge. Since this period of high-volume recharge, groundwater levels have come down by approximately 140 feet, which is still more than 100 feet higher than 2002 groundwater levels.

Figure 4-9 shows groundwater elevations for wells farther downgradient from the MC-GRF with water level measurements extending back to 1978. Groundwater recharge at the MC-GRF is also shown on this plot. A downward trend in groundwater elevations in the MCSB is evident from 1978 through at least 2007. Following initiation of groundwater recharge, groundwater levels stabilized and then began to rebound. For wells located at a distance from the MC-GRF, there is a time delay before the wells responded to recharge. **Figure 4-10** shows the location of the wells represented by hydrographs on **Figure 4-8** and **Figure 4-9** at a different scale to compare all wells on the same plot.

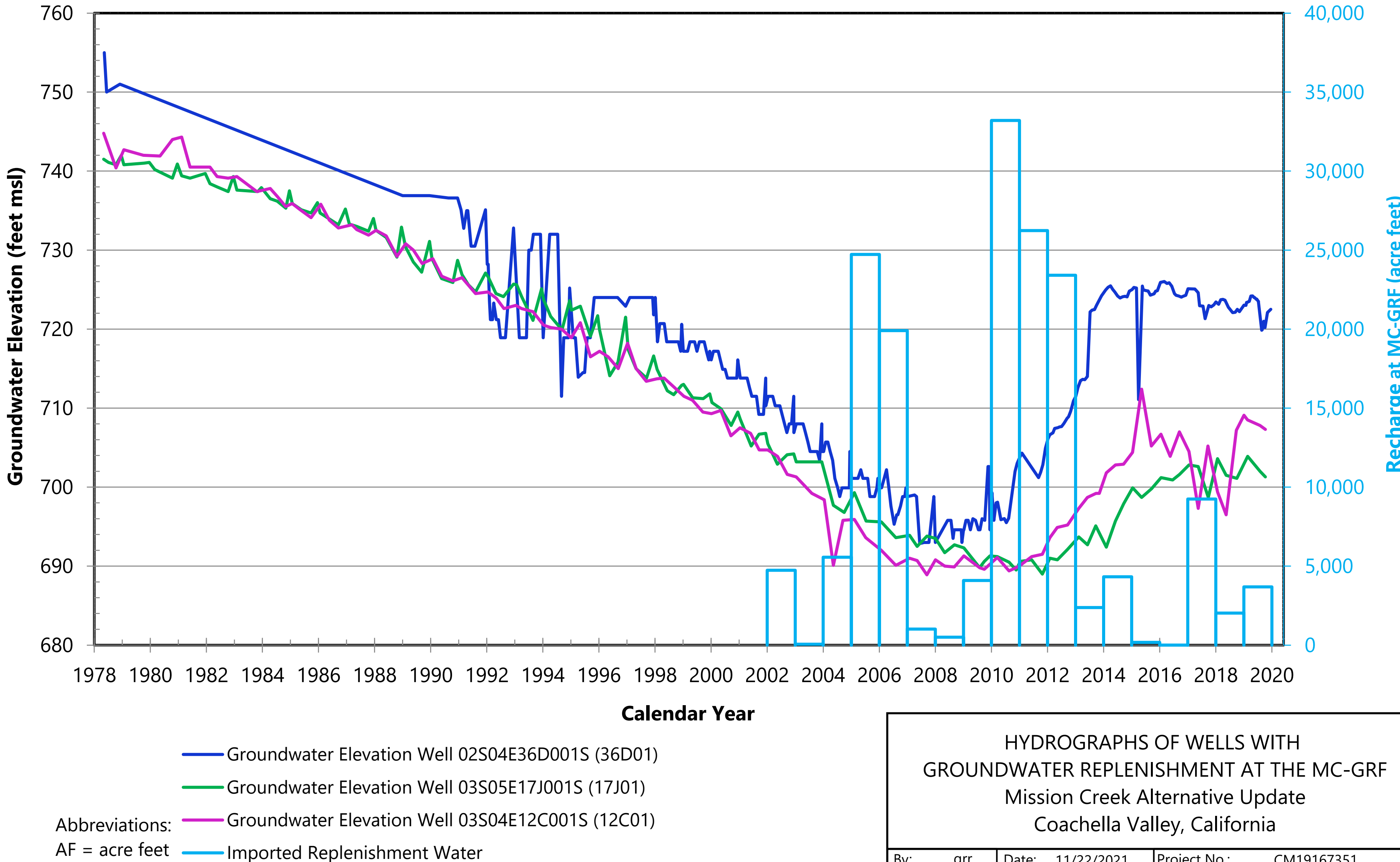
All three of these figures shows the positive impact of groundwater recharge on reversing the downward trend and eventual stabilization of groundwater levels above 2009 levels.



Abbreviations:
MC-GRF = Mission Creek Groundwater Replenishment Facility
msl = mean sea level

GROUNDWATER REPLENISHMENT AT THE MC-GRF
AND HYDROGRAPH OF WATER LEVEL RESPONSE
Mission Creek Alternative Update
Coachella Valley, California

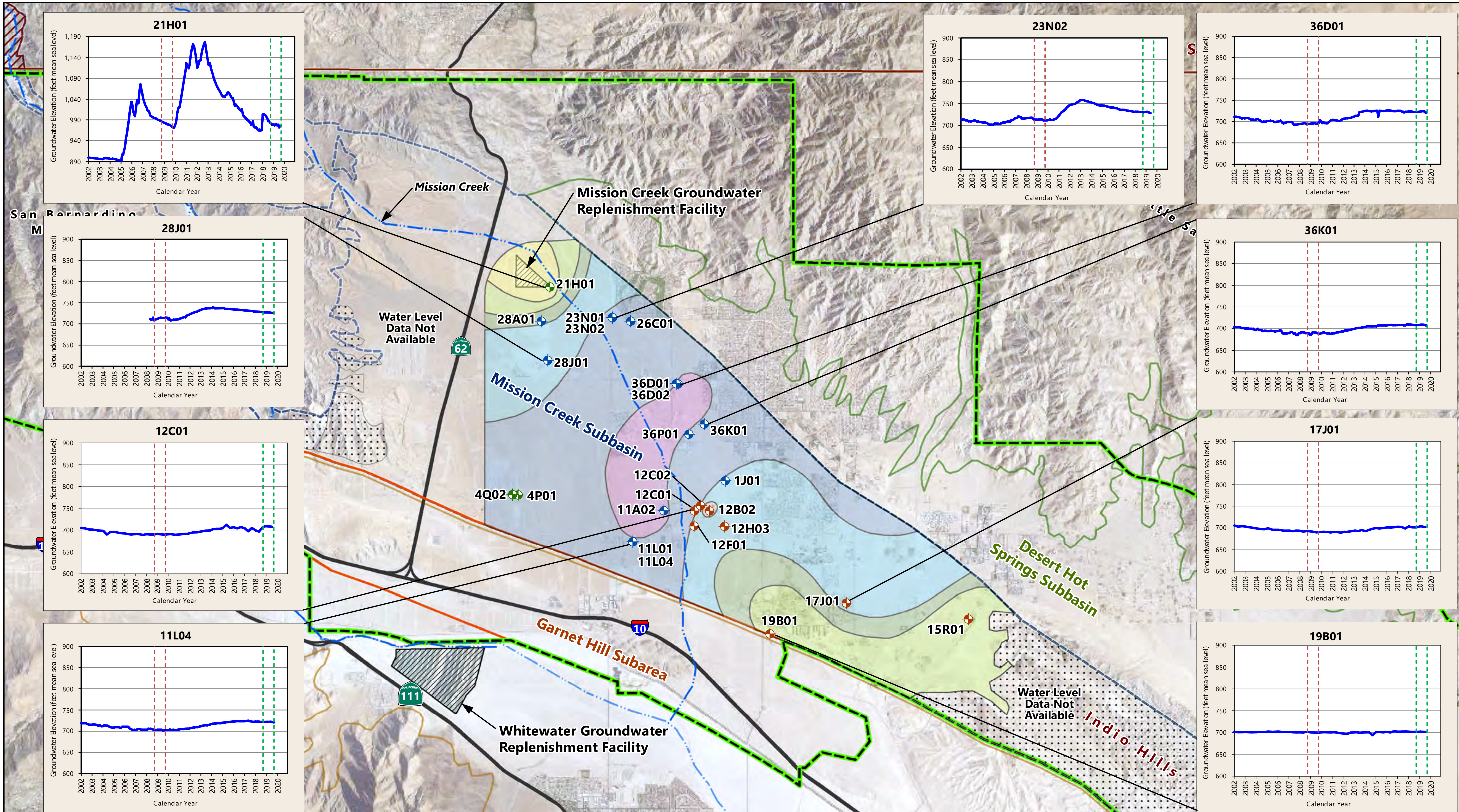
By: grr	Date: 11/22/2021	Project No.: CM19167351
wood.		Figure 4-8



Abbreviations:
AF = acre feet
msl = mean sea level
MC-GRF = Mission Creek Groundwater Replenishment Facility

HYDROGRAPHS OF WELLS WITH
GROUNDWATER REPLENISHMENT AT THE MC-GRF
Mission Creek Alternative Update
Coachella Valley, California

By: grr	Date: 11/22/2021	Project No.: CM19167351
wood.		Figure 4-9



Explanation

Monitoring Agency Well
- Coachella Valley Water District
- Mission Springs Water District
- Desert Water Agency
- Facility
- Planning Area
- Streams
- Highway/road
- Low permeability/non-water bearing sediments/bedrock
- Garnet Hill Subarea of Indio Subbasin
- Mission Creek Subbasin fringe area
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin
- Groundwater elevation
- Water years 2008 - 2019
- Water years 2018 - 2019

Change in Groundwater Elevation
- > 20 to 25 foot increase
- >15 to 20 foot increase
- > 10 to 15 foot increase
- > 5 to 10 foot increase
- > 0 to 5 foot increase
- > -5 to 0 foot decrease
- > -10 to -5 foot decrease
- > -15 to -10 foot decrease

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

0 4,000 8,000
Feet

TEN-YEAR CHANGE IN GROUNDWATER STORAGE WY 2008-2009 TO WY 2018-2019
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: pah/jrw	Date: 9/8/2021	Project No.: CM19167351
wood.		Figure 4-10

Date: 9/8/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternative)\Esri\Alternative Update\4-10_10Yr_change_wy2008-2019.mxd

Based on historical groundwater levels, the Agencies established the goal of managing the MCSB such that long-term average groundwater levels do not significantly decline to below 2009 conditions. The groundwater replenishment program successfully achieved this goal prior to the SGMA legislation.

Figure 4-10 shows groundwater level changes in the MCSB over the ten-year period from WY 2008-2009 to WY 2018-2019 (Wood, 2020). The figure is titled change in groundwater storage because change in groundwater levels across the subbasin represented by the monitoring wells is equivalent to change in groundwater storage for the area represented by the monitoring wells. Groundwater level changes ranged from a slight decrease (2.5 feet) near the MC-GRF to approximately 20 feet of increase in the central northern part of the MCSB, and about 1.5 feet of increase in the southeastern part of the MCSB (Wood, 2020). The figure shows that the 2013 Mission Creek/Garnet Hill Water Management Plan (MWH, 2013 [2013 MC/GH WMP]) and subsequent Alternative Plan have successfully achieved the goal of maintaining average groundwater levels above 2009 levels and consequently increasing and maintaining groundwater storage.

4.6 Groundwater Quality

This report section updates the water quality evaluation presented in the 2013 MC/GH WMP and includes a review of regional groundwater quality and known contaminant plumes in the Planning Area. The regional water quality review is based on the State Water Resources Control Board (SWRCB) database for water supply (SWRCB, 2021) and on information provided by the Agencies. For known contaminant plumes, the California Groundwater Ambient Monitoring and Assessment Program (GAMA),[8] and the SWRCB and California Department of Toxic Substances Control's databases of contaminated sites (GeoTracker[9] and EnviroStor[10], respectively) were reviewed for sites with contaminants that have impacted groundwater. The regional groundwater quality review and contaminated sites review are summarized below.

4.6.1 Regional Groundwater Quality

Water quality is summarized for selected parameters considered potential constituents of concern based on current or historical concentrations approaching or exceeding SWRCB primary California drinking water standards or maximum contaminant levels (MCLs) for drinking water in the Coachella Valley Groundwater Basin. These constituents include arsenic, fluoride, uranium, and nitrate. Although there is no current MCL for hexavalent chromium other than as a component of the MCL for total chromium, the SWRCB is in the process of evaluating the economic feasibility of setting an MCL for hexavalent chromium (SWRCB, 2020). Therefore, hexavalent chromium is included in this review. Total dissolved solids (TDS) were also considered a constituent of concern as described in greater detail below.

[8] https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/Default.asp
[9] https://geotracker.waterboards.ca.gov/
[10] https://www.envirostor.dtsc.ca.gov/public/

For regional groundwater quality, data used were from wells listed in the SWRCB drinking water database (SWRCB, 2021) for active and inactive permitted water sources that report to the state. This eliminates water quality data from environmental sites (discussed in Section 4.6.2) and non-drinking water monitoring wells. These data provide the best representation of the general water quality of the main aquifers used for drinking water supply. Data were from wells in the MCSB and one well located in the GHSA. Notably, none of the wells identified in the SWRCB database for water supply are in the Indio Hills. The only wells identified in the Indio Hills were monitoring wells associated with the Former Edom Hill Landfill[11] (location shown on **Figure 4-7** and discussed further in Section 4.6.2).

Total Dissolved Solids

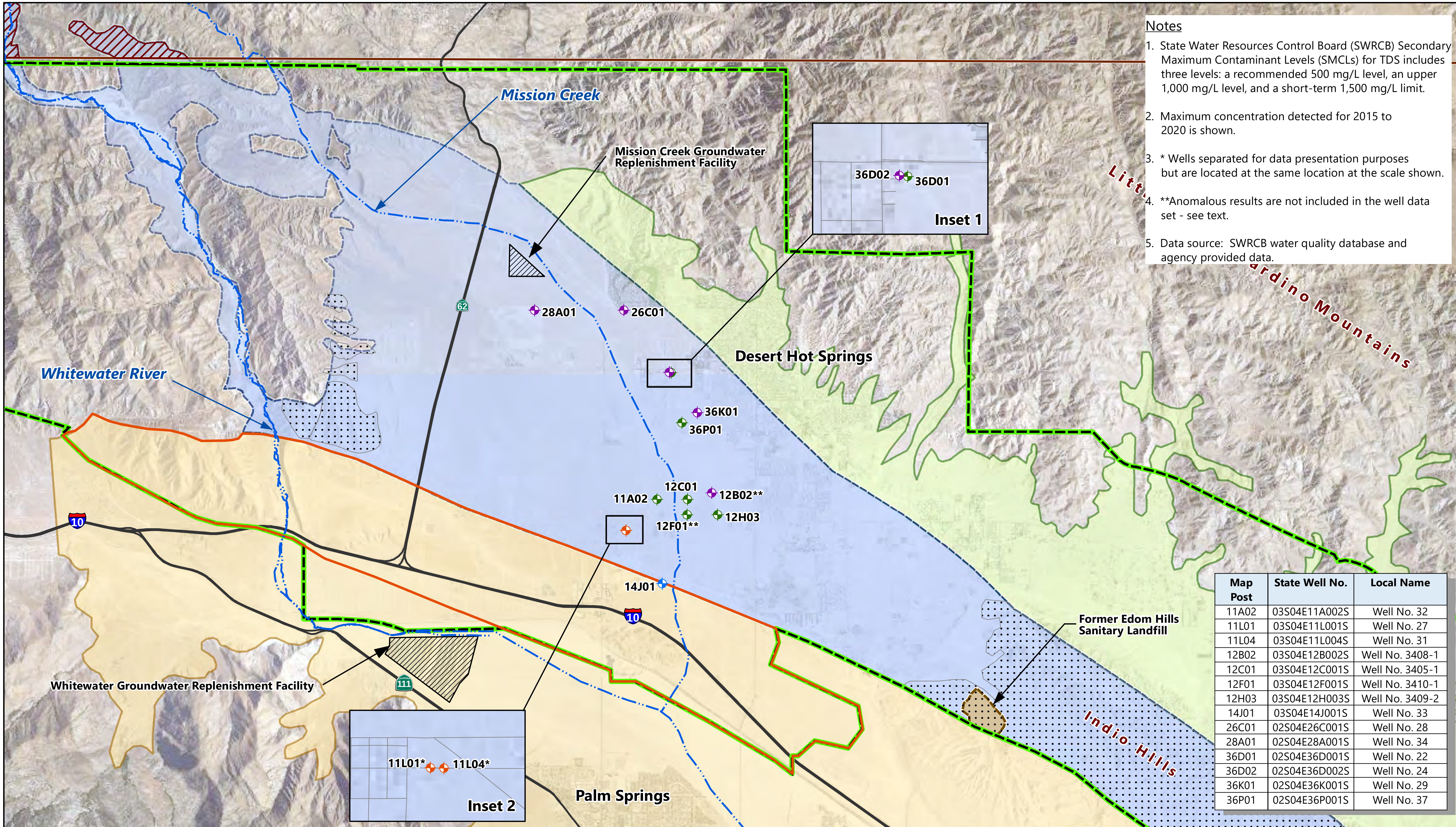
TDS are a measure of the combined amount of inorganic salts dissolved in water. No fixed Consumer Acceptance Contaminant Level has been established for TDS. Instead, TDS is regulated by Secondary Maximum Contaminant Levels (SMCLs), or Consumer Acceptance Contaminant Level Ranges for TDS, set by the SWRCB: a recommended 500 milligrams per liter (mg/L) level, an upper 1,000 mg/L level, and a short-term 1,500 mg/L limit. While primary MCLs are health-based standards, SMCLs, such as those for TDS, are based on aesthetic concerns (e.g., taste, color, and odor).

Sources of TDS in the Planning Area include return flows from agricultural and landscape irrigation, recharge of imported CRA water, percolation of wastewater from septic systems and wastewater treatment plants, and underflow of groundwater with elevated TDS from the DHSSB. The locations of wells with TDS data reported in the SWRCB drinking water database between 2015 and 2020 are shown on **Figure 4-11**. TDS concentrations ranged from 190 mg/L to 660 mg/L.[12] Data indicate that groundwater from wells 02S04E28A001S (28A01), 02S04E26C001S (26C01), 02S04E36K01S (36K01), 02S04E36D002S (36D02) and 03S04E12B002S (12B02) have TDS concentration between 500 mg/L and 1,000 mg/L. Except for well 12B02, these wells are located in the northern part of the MCSB and closer to the Mission Creek Fault than the other wells with TDS data. Wells 28A01 and 26C01 are located hydraulically downgradient of the MC-GRF at distances of approximately 0.5 miles and 1.5 miles, respectively.

Figure 4-12 shows TDS concentrations trends for selected wells during the period 1995 to 2020. Wells in the central part of the MCSB, including 03S04E12F001S (12F01) and 03S04E11L001S (11L01), indicate lower and more stable TDS concentrations in the range of 270 mg/L to 390 mg/L. Wells in the northern part of the MCSB and closer to the Mission Creek Fault (28A01, 26C01, and 36K01) generally indicate higher TDS concentrations with increasing concentration trends over time. Two of these wells (28A01 and 26C01) are wells located hydraulically downgradient of the MC-GRF. **Figure 4-12** also shows MWD annual average TDS concentrations in CRA water, the source of artificial recharge water to MC-GRF, at the nearest sample location (San Jacinto Tunnel West) derived from selected MWD annual reports (MWD, 2010, 2014, 2017, and 2020).

[11] Data for these monitoring wells were obtained from the GAMA, GeoTracker, and EnviroStor databases.

[12] Two results were removed from the data set based on clear inconsistency with historical trends and the most recent analyses conducted in 2020. These results include 570 mg/L for well 03S04E12F001 (12F01) in October 2019 and 670 mg/L for well 03S04E12B002S (12B02) in December 2019.



Notes
1. State Water Resources Control Board (SWRCB) Secondary Maximum Contaminant Levels (SMCLs) for TDS includes three levels: a recommended 500 mg/L level, an upper 1,000 mg/L level, and a short-term 1,500 mg/L limit.
2. Maximum concentration detected for 2015 to 2020 is shown.
3. * Wells separated for data presentation purposes but are located at the same location at the scale shown.
4. **Anomalous results are not included in the well data set - see text.
5. Data source: SWRCB water quality database and agency provided data.

Map Post	State Well No.	Local Name
11A02	03S04E11A002S	Well No. 32
11L01	03S04E11L001S	Well No. 27
11L04	03S04E11L004S	Well No. 31
12B02	03S04E12B002S	Well No. 3408-1
12C01	03S04E12C001S	Well No. 3405-1
12F01	03S04E12F001S	Well No. 3410-1
12H03	03S04E12H003S	Well No. 3409-2
14J01	03S04E14J001S	Well No. 33
26C01	02S04E26C001S	Well No. 28
28A01	02S04E28A001S	Well No. 34
36D01	02S04E36D001S	Well No. 22
36D02	02S04E36D002S	Well No. 24
36K01	02S04E36K001S	Well No. 29
36P01	02S04E36P001S	Well No. 37

Explanation
- Facility
- Former Edom Hill Sanitary Landfill
- Planning Area
- River/stream
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet HIll Subarea of Indio Subbasin
- Low permeability/non-water bearing sediments/bedrock
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin

Total Dissolved Solids (TDS), in milligrams per liter (mg/L)
- 190 -200
- 200 - 300
- 300 - 500
- 500 - 700

0 4,000 8,000
Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

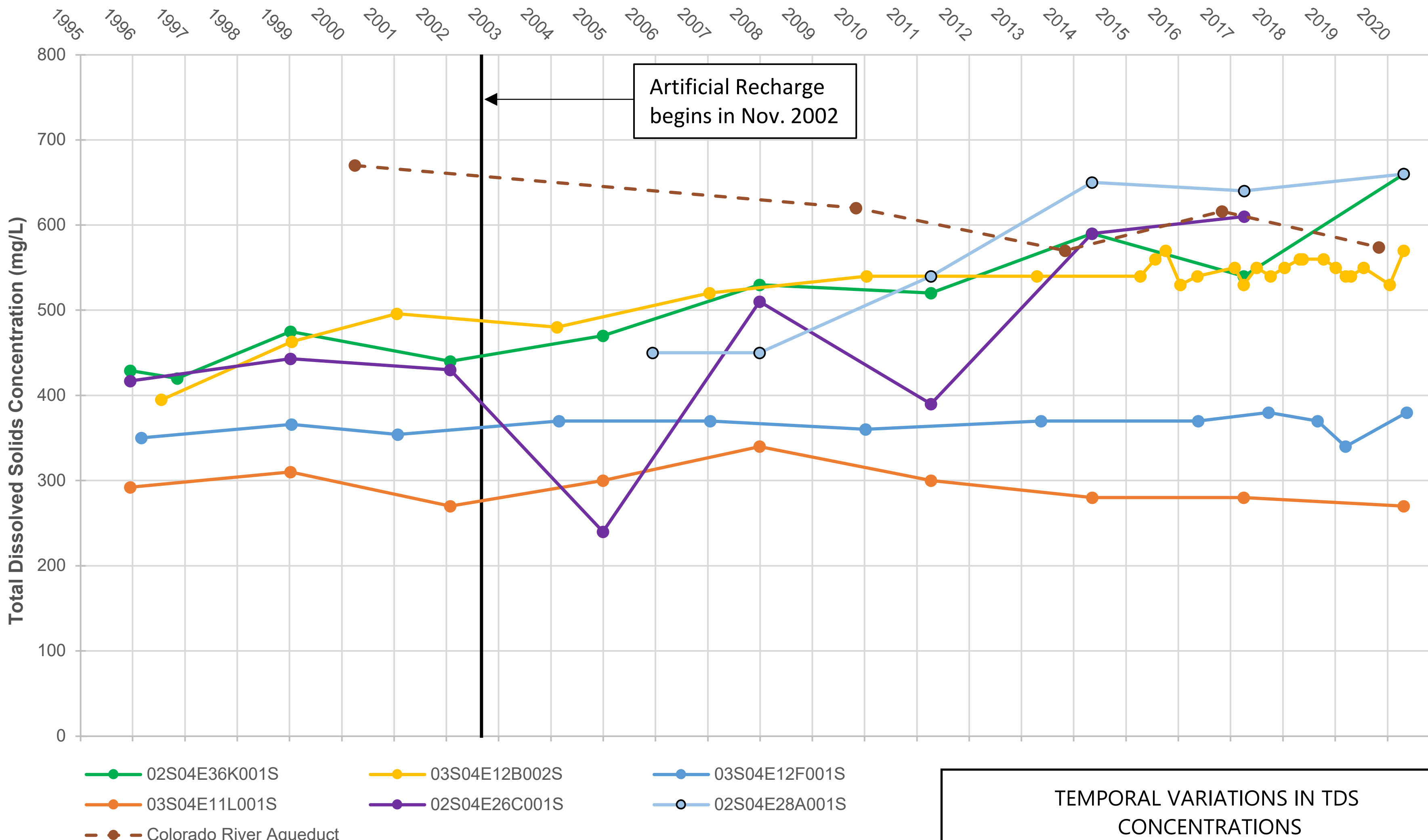
TDS CONCENTRATIONS IN GROUNDWATER
2015 - 2020
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: MWW | Date: 9/9/2021 | Project No.: CM19167351

wood.

Figure 4-11

Date: 9/9/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update\4-11_TDS in GW_2015-2020.mxd

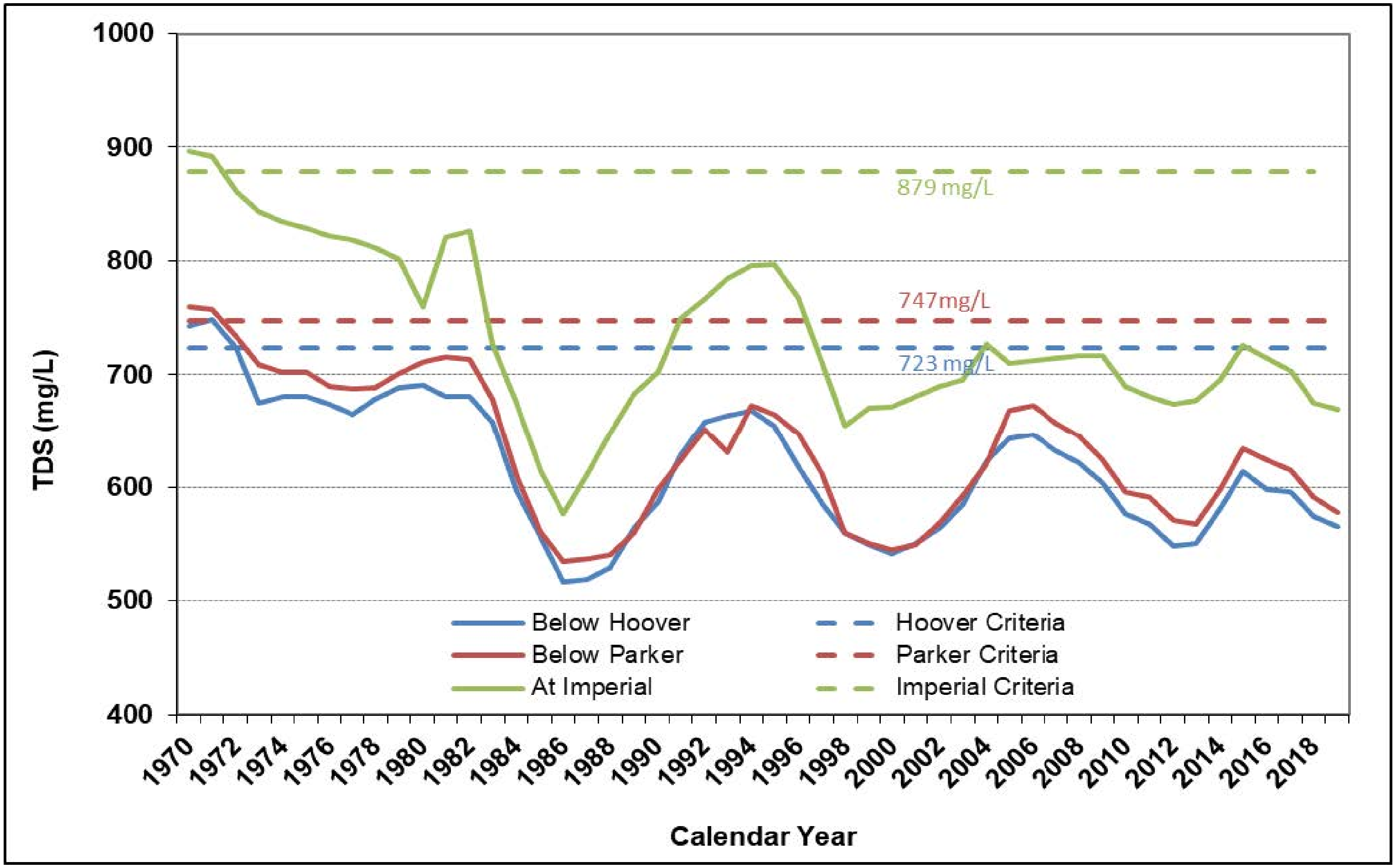


Abbreviations:
mg/L = milligrams per liter
TDS = Total Dissolved Solids

Note:
Plot does not show anomalous TDS results of 570 mg/L for well 03S04E12F001 in October 2019 and 670 mg/L for well

TEMPORAL VARIATIONS IN TDS CONCENTRATIONS
Mission Creek Alternative Update
Coachella Valley, California

By: djp	Date: 09/30/2021	Project No.: CM19167351
wood.		Figure 4-12



Abbreviations
mg/L = milligrams per liter
TDS = Total Dissolved Solids

Time concentration graph extracted from: Colorado River Basin Salinity Control Forum, 2020, 2020 Review of Water Quality Standards for Salinity, Colorado River System, October.

FLOW WEIGHTED AVERAGE ANNUAL TDS CONCENTRATIONS AT COLORADO RIVER NUMERIC CRITERIA STATIONS
Mission Creek Alternative Update
Coachella Valley, California

By: djp	Date: 11/22/2021	Project No.: CM19167351
wood.	Figure 4-13	

The average TDS for CRA water was 670 mg/L in 2000 (MWD, 2000), but has decreased in more recent years to as low as 570 mg/L.

As noted in the 2013 MC/GH WMP and shown on **Figure 4-12**, CRA water used for recharge in the MCSB generally has higher TDS concentrations than local groundwater. Use of CRA water involves salt loading to the MCSB and local increases in TDS concentrations. CVWD and DWA have investigated alternatives including direct importation and recharge of lower TDS SWP water at the MC-GRF. Direct importation of SWP, however, would require extensive construction for a conveyance pipeline from western Riverside County. The project would involve significant cost, technical constraints, environmental constraints/impacts, and would result in only limited benefits. In addition, direct importation of SWP water would most likely result in the loss of approximately 100,000 AFY of CRA water that results from the exchange of SWP water for CRA water from MWD Another alternative considered involves salt removal prior to recharge using reverse osmosis. This alternative has its own constraints including permitting, environmental, technical, and financial feasibility issues.

TDS (salinity) management of the Colorado River is ongoing though the Colorado River Basin Salinity Control Program (Program), a cooperative watershed effort among several federal agencies and seven states. The Program has established numeric criteria for salinity, adopted by the seven basin states and approved by the United States Environmental Protection Agency. **Figure 4-13** which was reproduced from the Colorado River Basin Salinity Control Forum (2020), shows the numeric criteria and the flow-weighted average annual TDS concentrations at three numeric criteria stations: Below Hoover, Below Parker, and at Imperial. Below Hoover is the farthest upstream of the stations and has the lowest average TDS. Imperial is the farthest downstream of the stations and has the highest average TDS. Below Parker station is the station most representative of CRA water quality as the intake to the CRA is located at Lake Havasu, created by the construction of Parker Dam. **Figure 4-13** shows that the flow weighted Average Annual TDS concentrations at the numeric criteria stations have decreased since the 1970s with increasing and decreasing trends occurring on a roughly 12- to 14-year cycle. TDS concentrations have been well below their numeric criteria for salinity since the mid-1980s as shown on **Figure 4-13**. The overall decreasing TDS concentrations reflect work accomplished by the Program, which has included construction of salinity control measures (e.g., preventing inflow to the river from saline springs and plugging of abandoned, flowing oil and gas wells), advancement of policies for effluent limitation (e.g., policies addressing discharges from fish hatcheries), and implementation of non-point source management plans (e.g., improved irrigation practices). Through these efforts, the Program has successfully controlled over 1.22 million tons of salt annually (Colorado River Basin Salinity Control Forum, 2020).

Beginning in 2002 (the first year of recharge at MC-GRF), Below Parker station has shown TDS concentrations ranging from about 560 mg/L to about 680 mg/L. Since 2016, the TDS concentration at Below Parker station has been on a downward trend and was about 590 mg/L in 2019. This decreasing concentration trend for TDS is consistent with concentrations shown for the CRA on **Figure 4-12** (note that data shown on **Figure 4-12** was based on sampling from the San Jacinto Tunnel West and **Figure 4-13** is from Below Parker station; variability is expected).

Nitrate

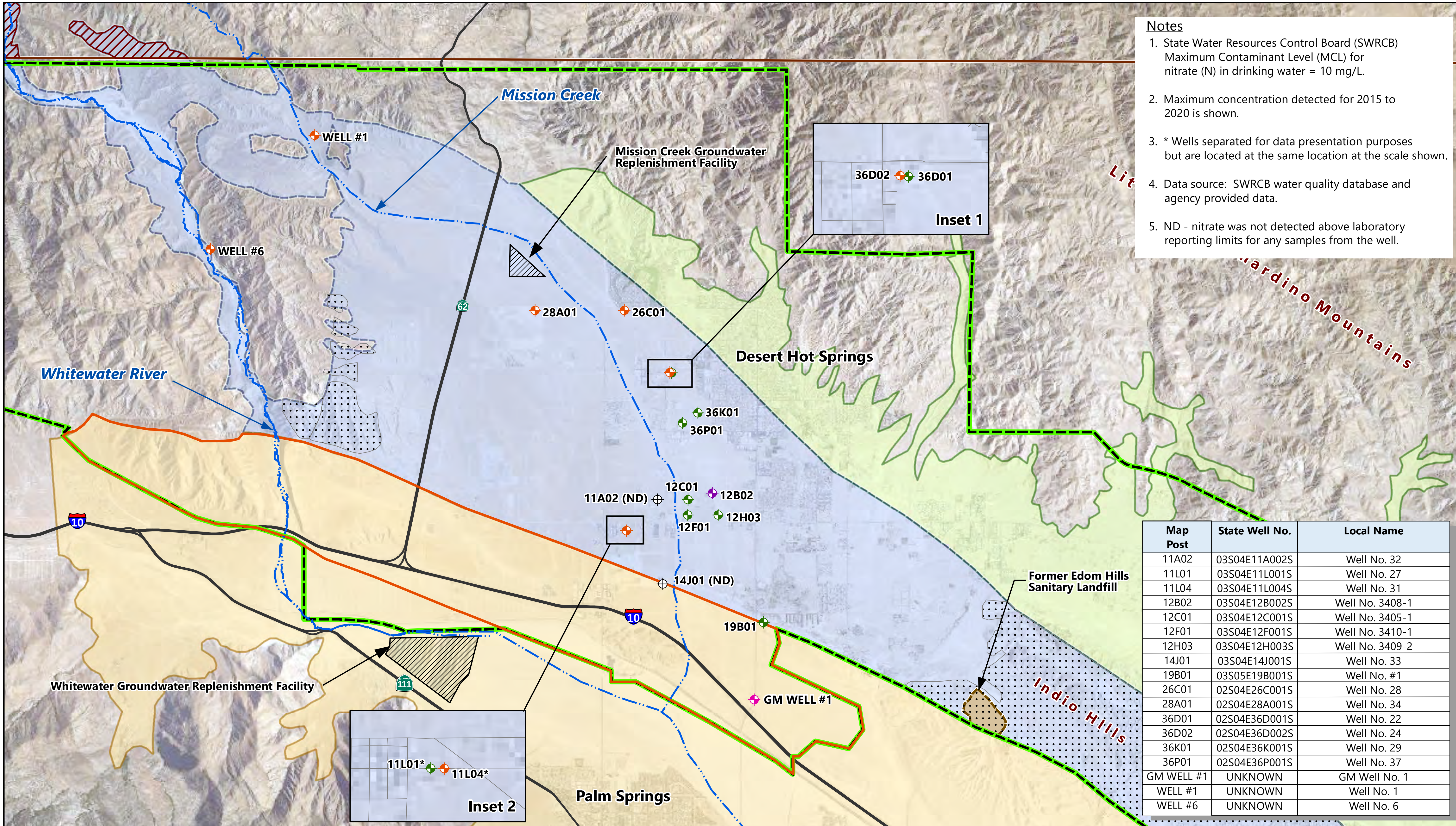
Nitrate in groundwater is usually associated with wastewater from septic tanks, disposal from wastewater treatment plants, or fertilizer application. The SWRCB MCL for nitrate is 10 mg/L when measured as nitrogen (N) and 45 mg/L when measured as nitrate. Nitrate as N is used for nitrate concentrations in this report. The locations of wells with nitrate data reported in the SWRCB drinking water database between 2015 and 2020 are shown on **Figure 4-14**. Concentrations ranged from 0.32 mg/L to 3.4 mg/L (nitrate as N) over this period, indicating that available results from the wells were all significantly below the MCL for nitrate. Data from two wells (03S04E11A02 and 03S04E14J01) were reported as non-detect for nitrate (N) at a reporting limit of 5 mg/L. These wells are qualified with non-detect on **Figure 4-14**.

Figure 4-15 shows nitrate concentration temporal variation plots for selected wells for the period 1995 to 2020. In general, nitrate concentrations appear to be relatively stable in the range of 0.5 to 1.5 mg/L nitrate (N) and well below the MCL. Well 26C01 indicates a general decreasing trend in nitrate since the MC-GRF began recharge in 2002. This well could be showing the influence of CRA water recharged at the MC-GRF based on average concentrations of nitrate in CRA water, which ranged from 0.23 mg/L to 0.33 mg/L from 2010 to 2020 (MWD, 2010, 2014, 2017, and 2020).

Arsenic

Arsenic is a naturally occurring groundwater quality constituent in the Planning Area with a SWRCB MCL of 10 micrograms per liter (µg/L). The locations of wells with arsenic data reported in the SWRCB drinking water database between 2015 and 2020 are shown on **Figure 4-16**. All but one well indicated non-detect for arsenic at the laboratory reporting limits ranging from 2 µg/L to 5 µg/L. These wells are qualified with non-detect on **Figure 4-16**. Only one well, 03S04E14J001S (14J01) indicated detectable concentrations of arsenic and all the detections for this well were at or below 2.7 µg/L.

Figure 4-17 is a temporal variation plot of arsenic concentrations for well 14J01 for the period 2006 to 2020. Over this period (detections ranging from 2.1 µg/L to 2.7 µg/L). The water quality for this well may be influenced by proximity to the Banning Fault. Arsenic concentrations in CRA water for the period of 2010 to 2020 ranged from 2.3 µg/L to 3.0 µg/L (MWD, 2010, 2014, 2017, and 2020).



Notes

1. State Water Resources Control Board (SWRCB) Maximum Contaminant Level (MCL) for nitrate (N) in drinking water = 10 mg/L.
2. Maximum concentration detected for 2015 to 2020 is shown.
3. * Wells separated for data presentation purposes but are located at the same location at the scale shown.
4. Data source: SWRCB water quality database and agency provided data.
5. ND - nitrate was not detected above laboratory reporting limits for any samples from the well.

Map Post	State Well No.	Local Name
11A02	03S04E11A002S	Well No. 32
11L01	03S04E11L001S	Well No. 27
11L04	03S04E11L004S	Well No. 31
12B02	03S04E12B002S	Well No. 3408-1
12C01	03S04E12C001S	Well No. 3405-1
12F01	03S04E12F001S	Well No. 3410-1
12H03	03S04E12H003S	Well No. 3409-2
14J01	03S04E14J001S	Well No. 33
19B01	03S05E19B001S	Well No. #1
26C01	02S04E26C001S	Well No. 28
28A01	02S04E28A001S	Well No. 34
36D01	02S04E36D001S	Well No. 22
36D02	02S04E36D002S	Well No. 24
36K01	02S04E36K001S	Well No. 29
36P01	02S04E36P001S	Well No. 37
GM WELL #1	UNKNOWN	GM Well No. 1
WELL #1	UNKNOWN	Well No. 1
WELL #6	UNKNOWN	Well No. 6

Explanation

- Facility
- Former Edom Hill Sanitary Landfill
- Planning Area
- River/stream
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet HIll Subarea of Indio Subbasin
- Low permeability/non-water bearing sediments/bedrock
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin

Nitrate (N), in milligrams per liter (mg/L)

- Non detect (ND)
- Less than or equal to 1
- 1 - 2
- 2 - 3
- 3 - 4

0 4,000 8,000
Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

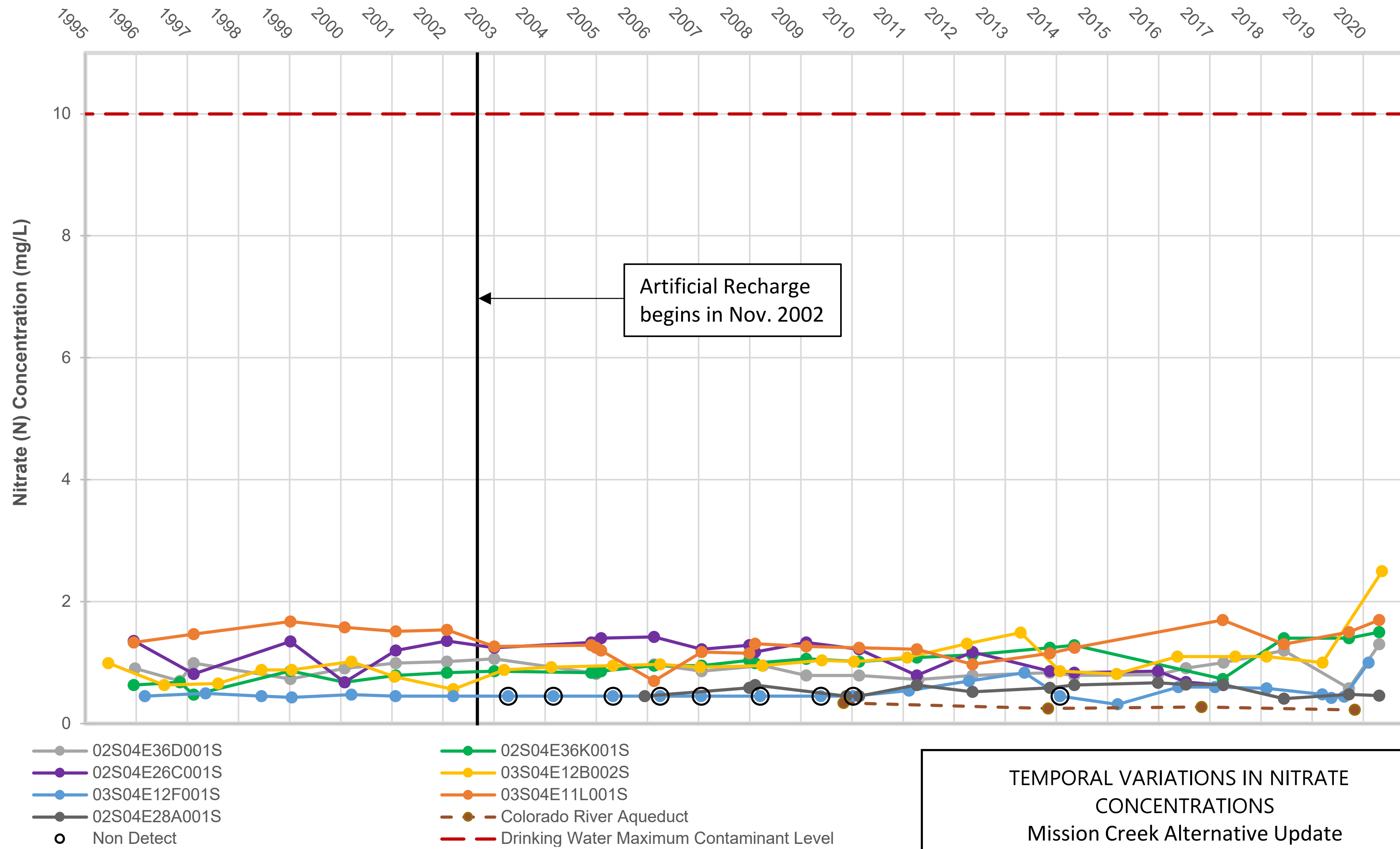
NITRATE CONCENTRATIONS IN GROUNDWATER
2015 - 2020
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: MWW | Date: 10/5/2021 | Project No.: CM19167351

wood.

Figure 4-14

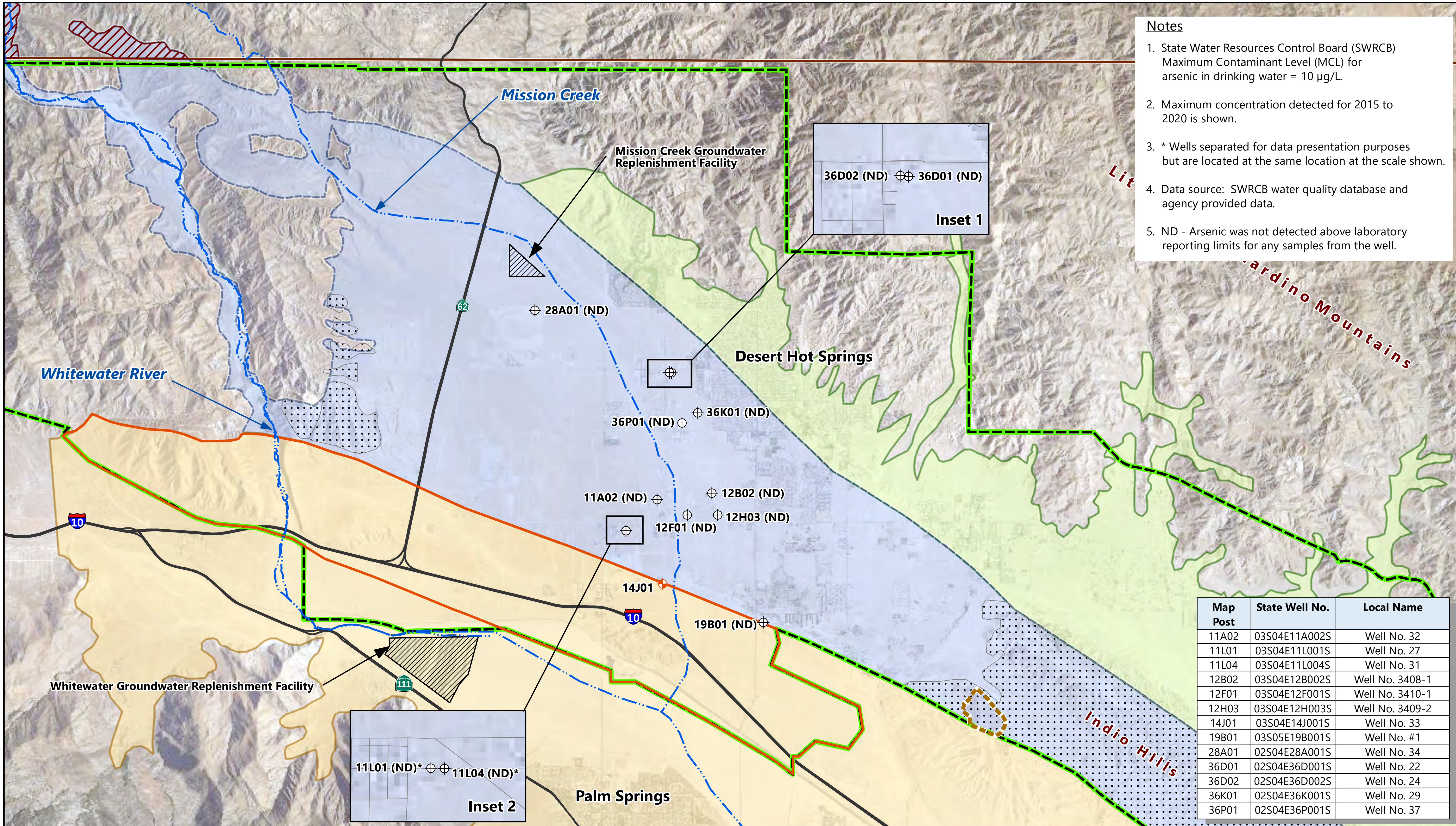
Date: 10/5/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update\4-14_NO3 in GW_2015-2020.mxd



Abbreviations:
mg/L = milligrams per liter
Nitrate (N) = Nitrate as Nitrogen
Note:
Open circles over a data point indicate not detected at the laboratory reporting limit.

TEMPORAL VARIATIONS IN NITRATE CONCENTRATIONS
Mission Creek Alternative Update
Coachella Valley, California

By: djp	Date: 08/24/2021	Project No.: CM19167351
wood.	Figure 4-15	



Notes

1. State Water Resources Control Board (SWRCB) Maximum Contaminant Level (MCL) for arsenic in drinking water = 10 µg/L.
2. Maximum concentration detected for 2015 to 2020 is shown.
3. * Wells separated for data presentation purposes but are located at the same location at the scale shown.
4. Data source: SWRCB water quality database and agency provided data.
5. ND - Arsenic was not detected above laboratory reporting limits for any samples from the well.

Map Post	State Well No.	Local Name
11A02	03S04E11A002S	Well No. 32
11L01	03S04E11L001S	Well No. 27
11L04	03S04E11L004S	Well No. 31
12B02	03S04E12B002S	Well No. 3408-1
12F01	03S04E12F001S	Well No. 3410-1
12H03	03S04E12H003S	Well No. 3409-2
14J01	03S04E14J001S	Well No. 33
19B01	03S05E19B001S	Well No. #1
28A01	02S04E28A001S	Well No. 34
36D01	02S04E36D001S	Well No. 22
36D02	02S04E36D002S	Well No. 24
36K01	02S04E36K001S	Well No. 29
36P01	02S04E36P001S	Well No. 37

Explanation

- Facility
- Planning Area
- River/stream
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet HIll Subarea of Indio Subbasin
- Low permeability/non-water bearing sediments/bedrock
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin

Arsenic in micrograms per liter (µg/L)

- Non detect (ND)
- 2 - 3

0 4,000 8,000
Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

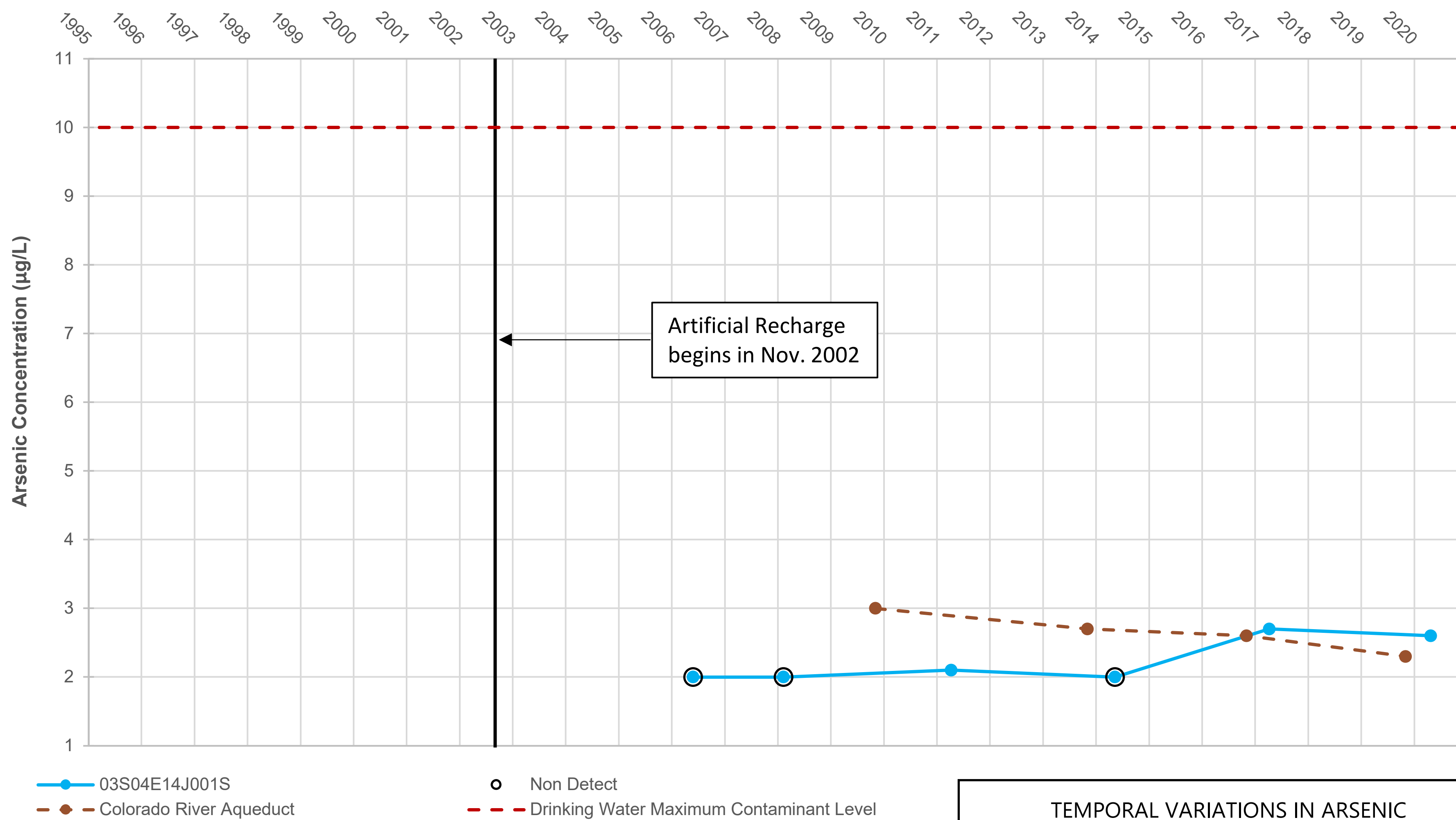
ARSENIC CONCENTRATIONS IN GROUNDWATER
2015 - 2019
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: MWW | Date: 10/5/2021 | Project No.: CM19167351

wood.

Figure 4-16

Date: 10/5/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update\4-16_Arsenic in GW_2015-2019.mxd



Abbreviation:
µg/L = micrograms per liter

Note:
Open circles over a data point indicate not detected at the laboratory reporting limit.

TEMPORAL VARIATIONS IN ARSENIC CONCENTRATIONS
Mission Creek Alternative Update
Coachella Valley, California

By: djp	Date: 08/24/2021	Project No.: CM19167351
wood.	Figure 4-17	

Fluoride

Fluoride is a naturally occurring groundwater quality constituent in the Planning Area with a SWRCB MCL of 2 mg/L. The locations of wells with fluoride data reported in the SWRCB drinking water database between 2015 and 2020 are shown on **Figure 4-18**. Concentrations ranged from 0.39 mg/L to 0.91 mg/L over this period.

Figure 4-19 is a temporal variation plot of fluoride concentrations for the period 1995 to 2020 for selected wells. Concentrations of fluoride have remained fairly stable over time. Fluoride concentrations in CRA water over the period of 2010 to 2020 were consistently 0.3 mg/L (MWD, 2010, 2014, 2017, and 2020), which is lower than the concentrations in the wells in the area.

Hexavalent Chromium

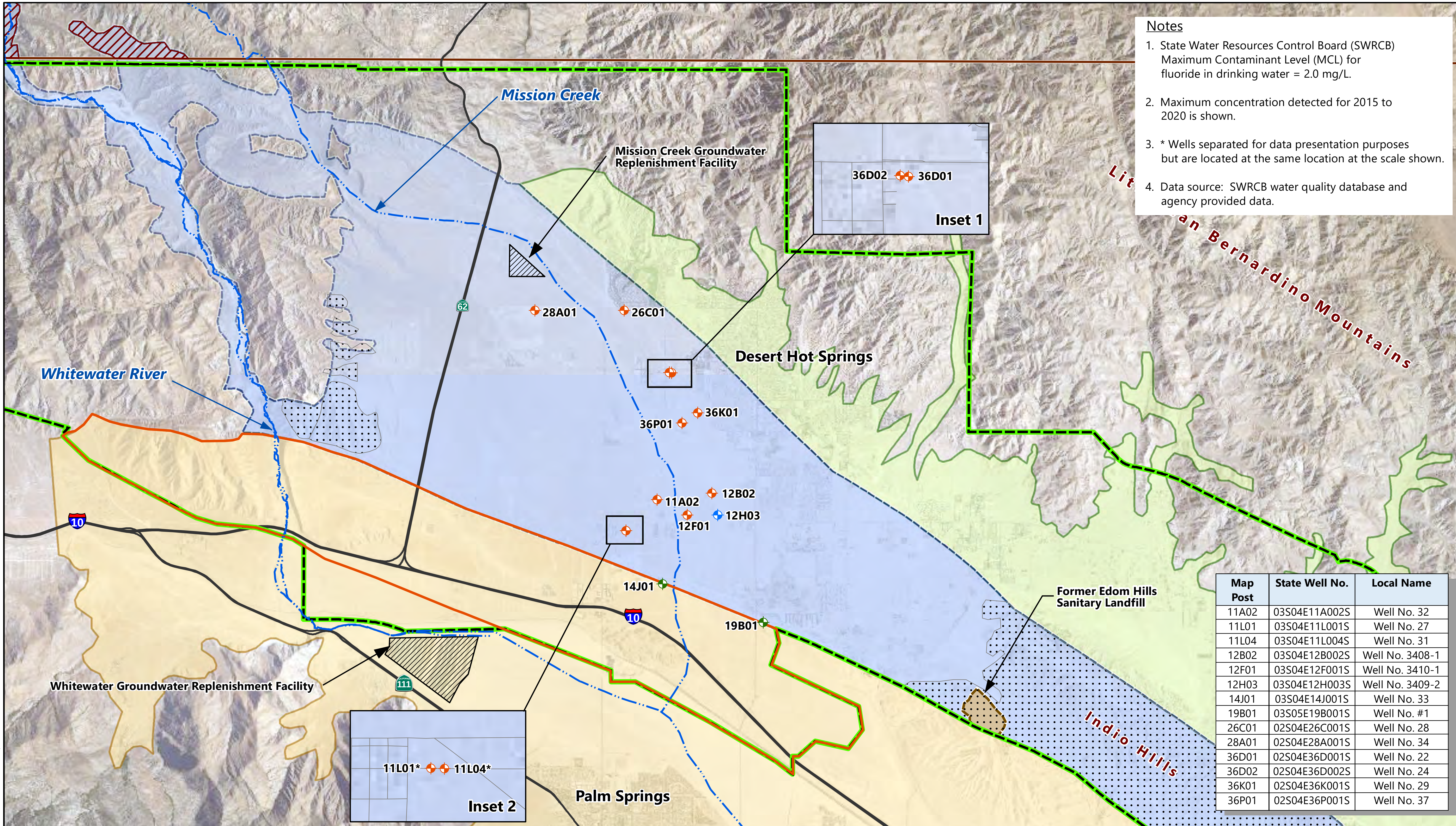
Chromium is a metal that occurs in the environment as soluble hexavalent chromium (chromium VI) and the less soluble trivalent chromium (chromium III). The SWRCB has set a MCL for total chromium (combined hexavalent chromium and trivalent chromium) at 50 µg/L. The locations of wells with hexavalent chromium concentration data reported in the SWRCB drinking water database between 2015 and 2020 are shown on **Figure 4-20**. Hexavalent chromium concentrations ranged from 1.2 µg/L to 24 µg/L over this period.

Figure 4-21 shows temporal variation plots of hexavalent chromium concentrations for the period 1995 to 2020 for selected wells. The data extends back to 2000 and very few wells were analyzed for hexavalent chromium between 2006 and 2012. The available data suggest that hexavalent chromium concentrations are relatively stable over time. The only clear trends based on the data are that the hexavalent chromium concentration in well 26C01 appears to be declining since December 2005 (possibly due to MC-GRF recharge) and that the hexavalent chromium concentration in water from well 14J01 near the Banning Fault appears to be increasing since 2006. Hexavalent chromium was not detected in CRA water at a laboratory reporting limit of 0.03 µg/L for the period of 2010 to 2020 (MWD, 2010, 2014, 2017, and 2020).

Uranium

Uranium is a naturally occurring radionuclide in the Planning Area with a SWRCB MCL of 20 picocuries per liter (pCi/L). GSi/water conducted an initial investigation of uranium sources in MSWD wells and observed that based on geomorphology, potential sources of uranium may include the Dry Morongo Creek and Big Morongo Creek watersheds and the southern base of the San Bernardino Mountains (GSi/water, 2011). The locations of wells with uranium activity data reported in the SWRCB drinking water database between 2015 and 2020 are shown on **Figure 4-22**. Uranium activity ranged from 1.9 pCi/L to 19 pCi/L for this period; all below the MCL. In general, concentrations appear to decrease southward as the distance from the Mission Creek Fault increases.

Figure 4-23 shows temporal variation plots of uranium activity from 1995 to 2020 for selected wells. In general, uranium activity appears to be stable over the long-term with the exception that well 28A01 and well 26C01 indicate a clear decreasing trend of uranium activity since about 2012. Wells 28A01 and 26C01 are located hydraulically downgradient of the MC-GRF (**Figure 4-23**). The timing of these decreasing trends relative to artificial recharge beginning in



Notes

1. State Water Resources Control Board (SWRCB) Maximum Contaminant Level (MCL) for fluoride in drinking water = 2.0 mg/L.
2. Maximum concentration detected for 2015 to 2020 is shown.
3. * Wells separated for data presentation purposes but are located at the same location at the scale shown.
4. Data source: SWRCB water quality database and agency provided data.

Map Post	State Well No.	Local Name
11A02	03S04E11A002S	Well No. 32
11L01	03S04E11L001S	Well No. 27
11L04	03S04E11L004S	Well No. 31
12B02	03S04E12B002S	Well No. 3408-1
12F01	03S04E12F001S	Well No. 3410-1
12H03	03S04E12H003S	Well No. 3409-2
14J01	03S04E14J001S	Well No. 33
19B01	03S05E19B001S	Well No. #1
26C01	02S04E26C001S	Well No. 28
28A01	02S04E28A001S	Well No. 34
36D01	02S04E36D001S	Well No. 22
36D02	02S04E36D002S	Well No. 24
36K01	02S04E36K001S	Well No. 29
36P01	02S04E36P001S	Well No. 37

Explanation

- Facility
- Former Edom Hill Sanitary Landfill
- Planning Area
- River/stream
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet HIll Subarea of Indio Subbasin
- Low permeability/non-water bearing sediments/bedrock
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin

Flouride, in milligrams per liter (mg/L)

- Less than or equal to 0.5
- 0.5 - 0.75
- 0.75 - 1

0 4,000 8,000
Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

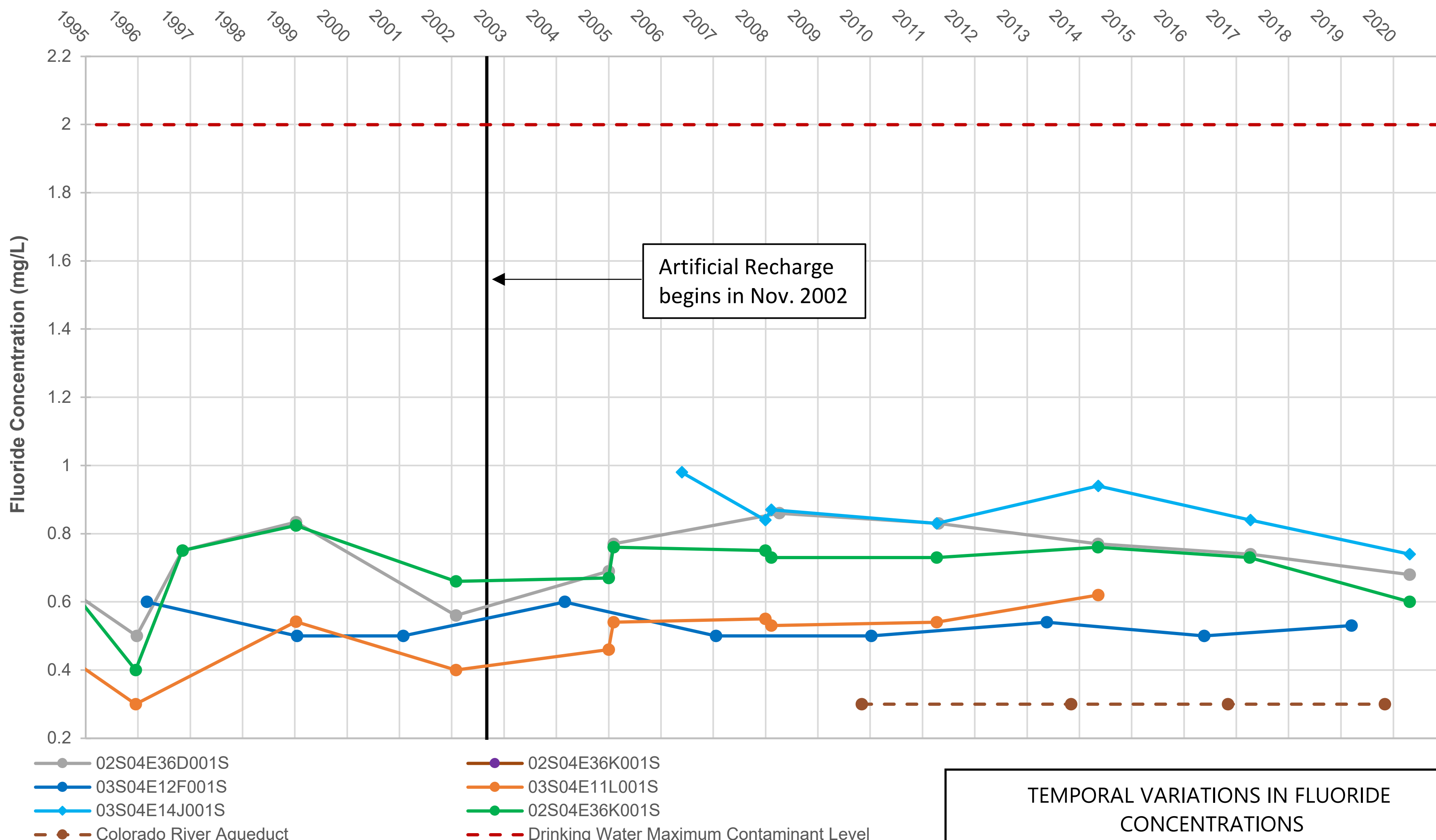
FLUORIDE CONCENTRATIONS IN GROUNDWATER
2015 - 2020
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: MWW | Date: 9/9/2021 | Project No.: CM19167351

wood.

Figure 4-18

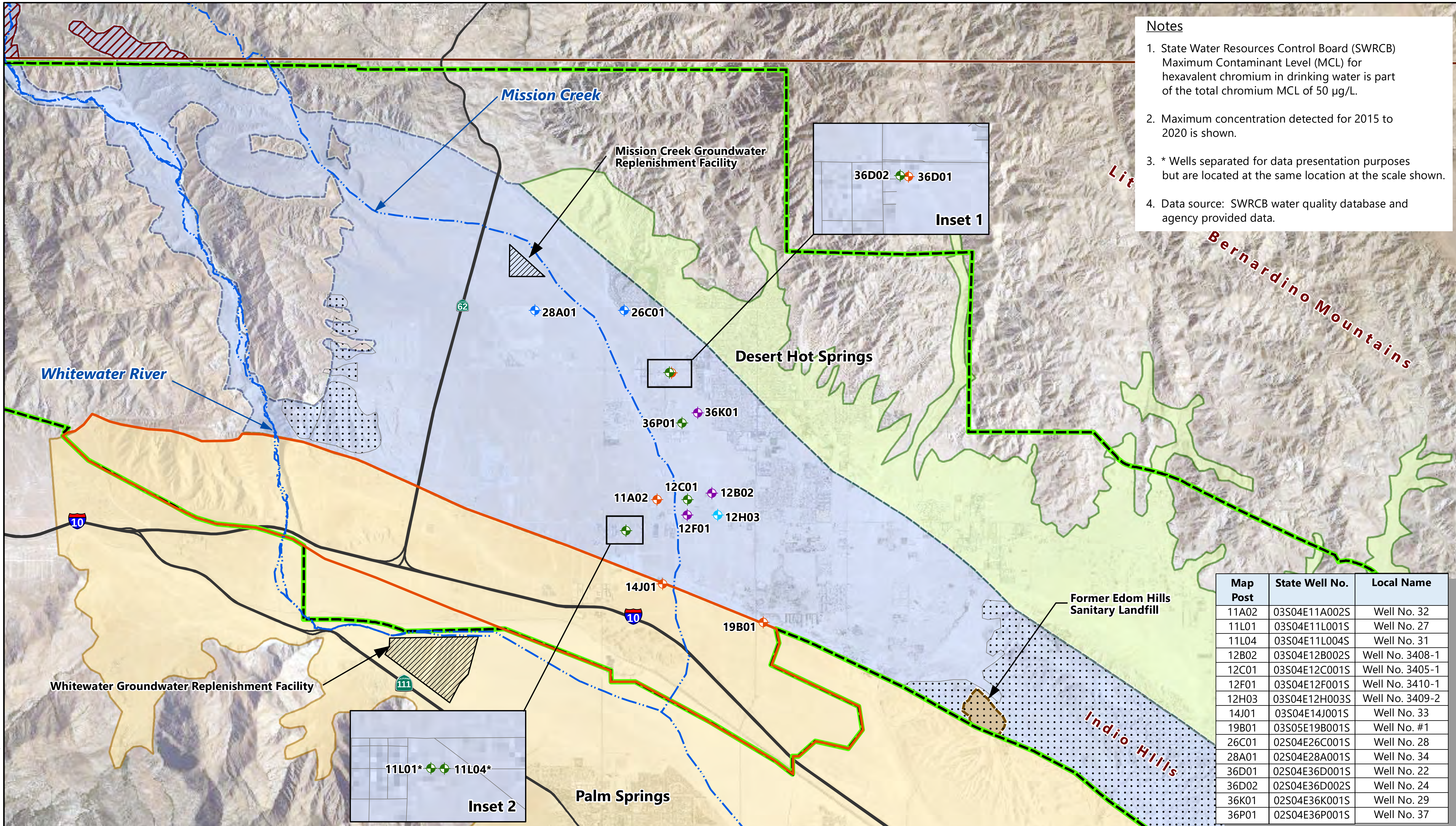
Date: 9/9/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternative)\Esri\Alternative Update\4-18_Fluoride in GW_2015-2020.mxd



Abbreviation:
mg/L = milligrams per liter

TEMPORAL VARIATIONS IN FLUORIDE CONCENTRATIONS
Mission Creek Alternative Update
Coachella Valley, California

By: djp	Date: 10/16/2021	Project No.: CM19167351
wood.		Figure 4-19



Notes

1. State Water Resources Control Board (SWRCB) Maximum Contaminant Level (MCL) for hexavalent chromium in drinking water is part of the total chromium MCL of 50 µg/L.
2. Maximum concentration detected for 2015 to 2020 is shown.
3. * Wells separated for data presentation purposes but are located at the same location at the scale shown.
4. Data source: SWRCB water quality database and agency provided data.

Map Post	State Well No.	Local Name
11A02	03S04E11A002S	Well No. 32
11L01	03S04E11L001S	Well No. 27
11L04	03S04E11L004S	Well No. 31
12B02	03S04E12B002S	Well No. 3408-1
12C01	03S04E12C001S	Well No. 3405-1
12F01	03S04E12F001S	Well No. 3410-1
12H03	03S04E12H003S	Well No. 3409-2
14J01	03S04E14J001S	Well No. 33
19B01	03S05E19B001S	Well No. #1
26C01	02S04E26C001S	Well No. 28
28A01	02S04E28A001S	Well No. 34
36D01	02S04E36D001S	Well No. 22
36D02	02S04E36D002S	Well No. 24
36K01	02S04E36K001S	Well No. 29
36P01	02S04E36P001S	Well No. 37

Explanation

- Facility
- Former Edom Hill Sanitary Landfill
- Planning Area
- River/stream
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet HIll Subarea of Indio Subbasin
- Low permeability/non-water bearing sediments/bedrock
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin

Hexavalent Chromium, in micrograms per liter (µg/L)

- Less than 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25

0 4,000 8,000
Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

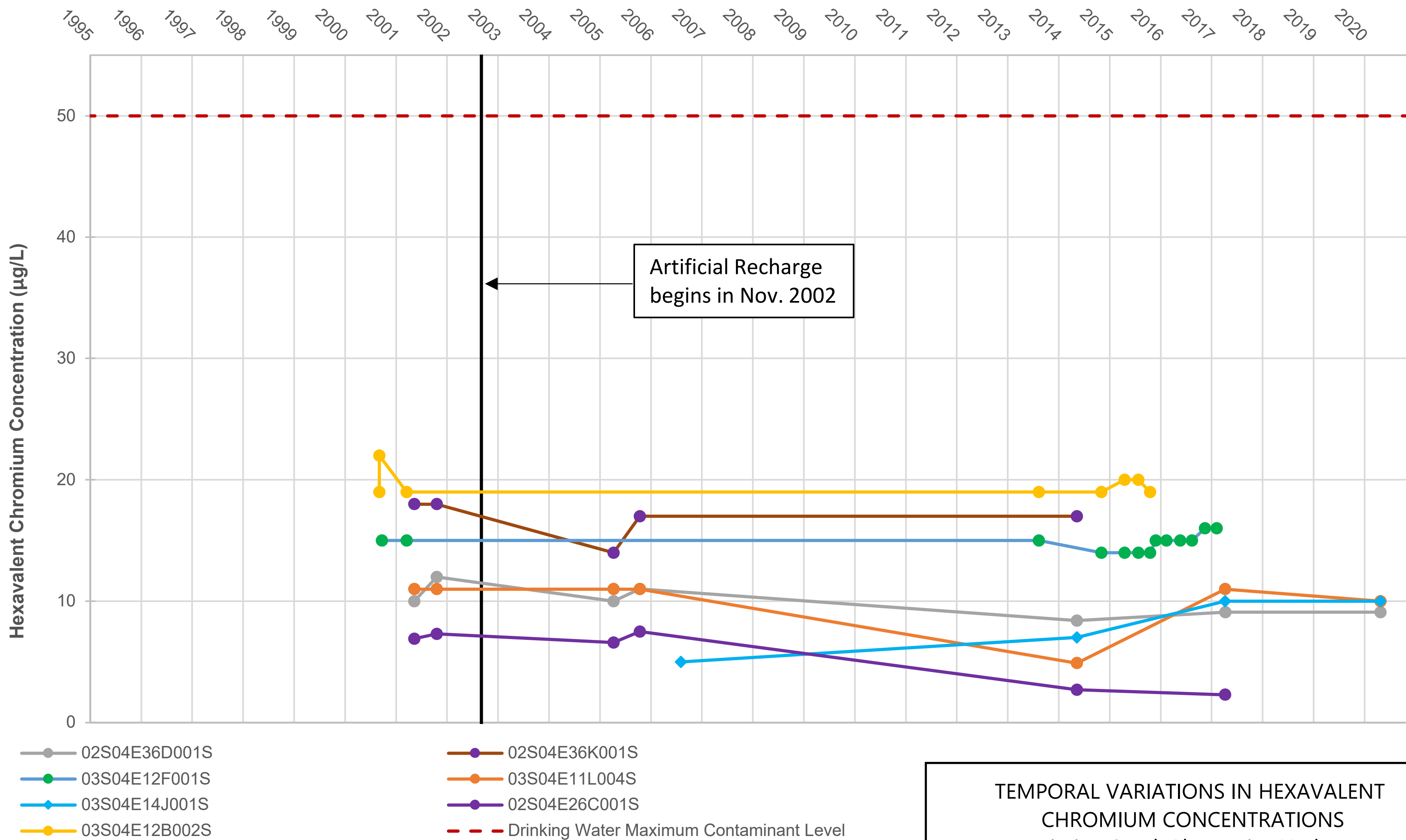
HEXAVALENT CHROMIUM CONCENTRATIONS IN GROUNDWATER
2015 - 2020
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: MWW | Date: 10/4/2021 | Project No.: CM19167351

wood.

Figure 4-20

Date: 10/4/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update\4-20_Cr6_in GW_2015-2020.mxd



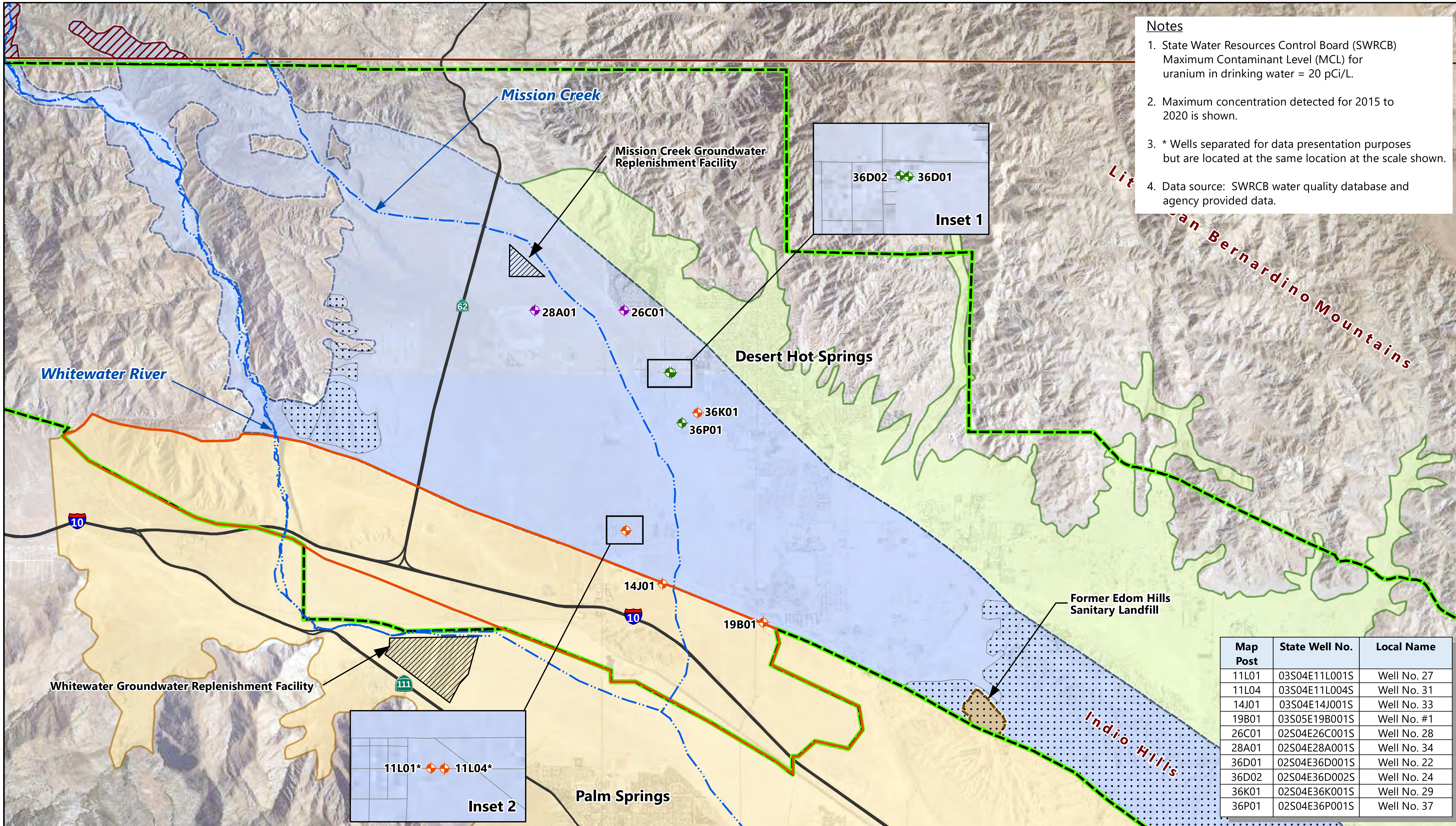
Abbreviation:
µg/L = micrograms per liter
Note: Maximum Contaminant Level is for total chromium.

TEMPORAL VARIATIONS IN HEXAVALENT CHROMIUM CONCENTRATIONS
Mission Creek Alternative Update
Coachella Valley, California

By: djp	Date: 08/24/2021	Project No.: CM19167351

wood.

Figure 4-21



Notes
1. State Water Resources Control Board (SWRCB) Maximum Contaminant Level (MCL) for uranium in drinking water = 20 pCi/L.
2. Maximum concentration detected for 2015 to 2020 is shown.
3. * Wells separated for data presentation purposes but are located at the same location at the scale shown.
4. Data source: SWRCB water quality database and agency provided data.

Map Post	State Well No.	Local Name
11L01	03S04E11L001S	Well No. 27
11L04	03S04E11L004S	Well No. 31
14J01	03S04E14J001S	Well No. 33
19B01	03S05E19B001S	Well No. #1
26C01	02S04E26C001S	Well No. 28
28A01	02S04E28A001S	Well No. 34
36D01	02S04E36D001S	Well No. 22
36D02	02S04E36D002S	Well No. 24
36K01	02S04E36K001S	Well No. 29
36P01	02S04E36P001S	Well No. 37

Explanation
- Facility
- Former Edom Hill Sanitary Landfill
- Planning Area
- River/stream
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet HIll Subarea of Indio Subbasin
- Low permeability/non-water bearing sediments/bedrock
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin

Uranium, in picocurie per liter (pCi/L)
- Less than or equal to 2
- 2 - 8
- 8 - 15
- 15 - 20

0 4,000 8,000
Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

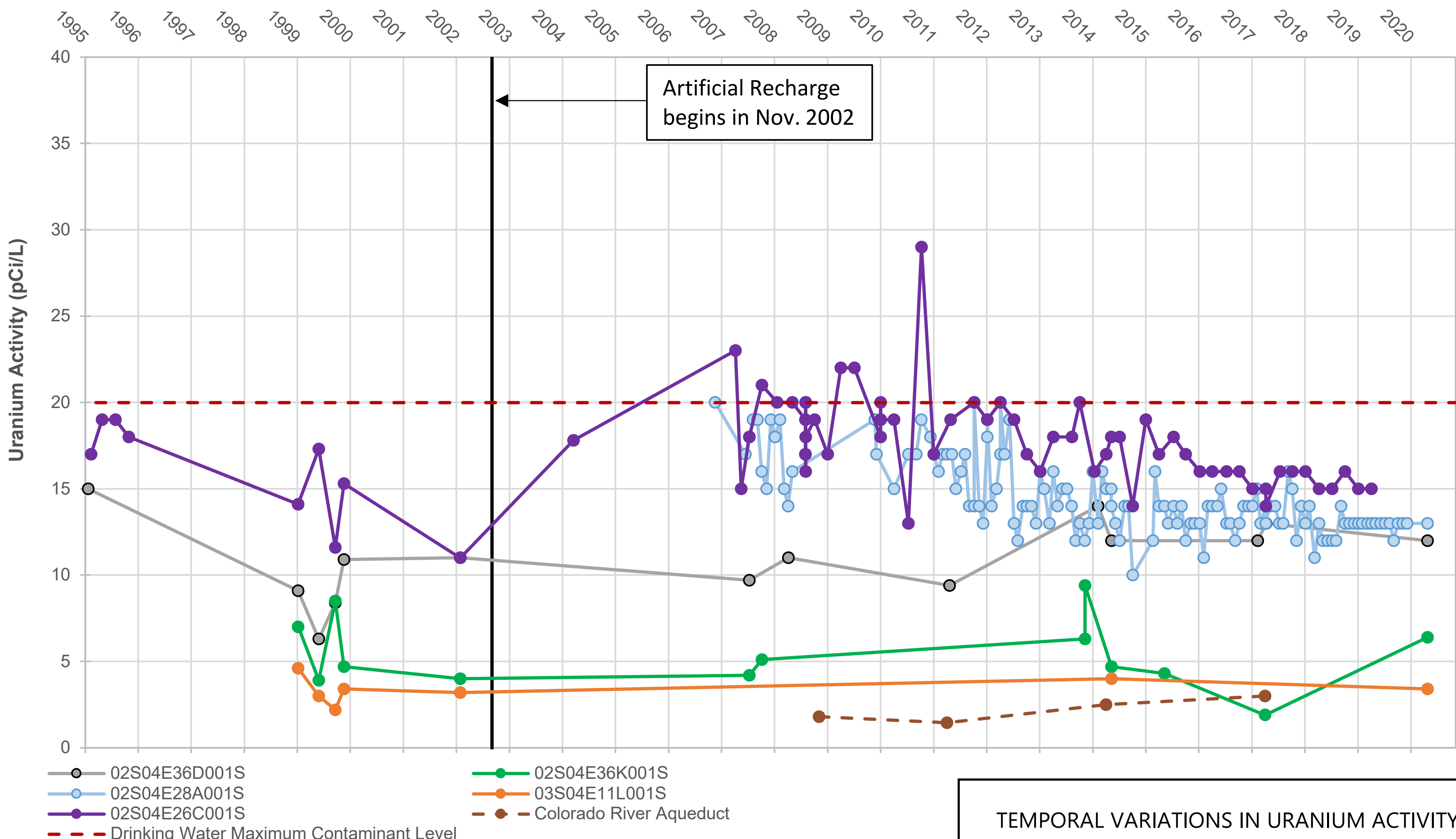
URANIUM ACTIVITY IN GROUNDWATER
2015 - 2020
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: MWW | Date: 9/10/2021 | Project No.: CM19167351

wood.

Figure 4-22

Date: 9/10/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update\4-22_Uranium_in GW_2015-2020.mxd



Abbreviation:
pCi/L = picocurie per liter

Note:
Plot does not show anomalous uranium activity result of 1 pCi/L for well 02S04E28A001 in January 2011.

TEMPORAL VARIATIONS IN URANIUM ACTIVITY
Mission Creek Alternative Update
Coachella Valley, California

By: djp	Date: 08/24/2021	Project No.: CM19167351
wood.		Figure 4-23

2002 and the location of these wells suggest that the trend may be related to groundwater recharge. Uranium activity in CRA water for the period of 2010 to 2020 ranged from 1.8 pCi/L to 3 pCi/L (MWD, 2010, 2014, 2017, and 2020).

4.6.2 Known Environmental Sites with Groundwater Impacts

Within the study area, only one site is identified on the GeoTracker or EnviroStor websites as an open regulatory site with environmental impacts to groundwater. This site is the former Edom Hill Class III landfill (GeoTracker Global ID L10009373801),[13] located in the Indio Hills within the MCSB as shown on **Figure 4-20**. Groundwater monitoring at this former facility has indicated the presence of volatile organic compounds and has also shown TDS concentrations exceeding 1,000 mg/L. The most recent monitoring of this facility indicated no constituents exceeding MCLs (RCDWR, 2020). Per- and poly-fluoroalkyl substances were sampled and analyzed in July and August 2019, and the results of these analyses indicated that perfluorooctanesulfonic acid exceeded the SWRCB Notification Level for drinking water in one monitoring well (RCDWR, 2019). The former landfill is in the lower permeability sediments of the Indio Hills where no groundwater production wells are known to exist. Groundwater impacts at the former landfill do not appear to be a threat to groundwater quality in the main MCSB. For this reason, groundwater quality results from the former landfill monitoring are not included in this summary of water quality.

4.7 Supply Risks and Uncertainties

The existing water supplies used in the Planning Area face risks and uncertainties that could affect long-term supply reliability. These risks and uncertainties include the extended drought in the southwestern United States and legal/regulatory decisions affecting vital contracts and water deliveries. In addition, climate change could impact both supplies and demands. Climate change is discussed in Section 7, Water Management Forecasting.

4.7.1 SWP Exchange

As described in Section 4.2.4, CDWR estimates the long-term average reliability of the SWP to be 58% declining to 52% by 2040 (CDWR, 2020a); while SWP final allocations have averaged 45% annually since the 2007 Wanger decision. This recent period of SWP allocation has included six critically dry years. Implementation of the DCF, described in Section 4.2.5, is likely to increase SWP supply reliability by addressing climate resiliency, environmental and habitat protection, and seismic risk. At this time, CVWD and DWA will continue participating in the DCF to minimize this supply risk.

4.7.2 Recycled Water

Recycled wastewater has not historically been used in the MCSB. The RWRF may add tertiary wastewater treatment for recycled water supply in the future. The amount of potential wastewater available for reuse in the future primarily depends on growth, along with MSWD's plans for construction of tertiary treatment and conveyance. However, the level of water conservation implemented in the future – particularly under the long-term conservation regulations anticipated from Assembly Bill 1668 (Friedman) and Senate Bill 606 (Hertzberg) –

[13] https://geotracker.waterboards.ca.gov/profile_report.asp?global_id=L10009373801

could reduce the amount of wastewater generated and available for reuse. Future waste discharge requirements will also dictate the level of treatment, and potentially volume of ongoing discharge, that would be required at the treatment plants. Thus, future growth, conservation, and water quality regulations will all dictate the amount of recycled water supply produced in the MCSB.

This Alternative Plan Update also acknowledges the financial challenges associated with development of the non-potable water treatment and distribution systems. Recycled water system construction in the MCSB is primarily dependent on availability of grant and loan funding for capital improvements. Despite this challenge, the GSAs will continue to pursue water reuse projects that reduce groundwater pumping and maximize use of local water.

4.8 Summary

The MCSB has both local groundwater (recharged by local surface water) and imported water (for use as groundwater replenishment) in its current water supply portfolio. This available water supply portfolio will be used to meet growing demands – municipal, agriculture, golf, and other demands as described in Section 3, Demand Projections, and to achieve groundwater sustainability. The water budgets described in Section 7, Water Management Forecasting, provide a deeper understanding of some of the demand and supply uncertainties and associated management actions that will help to meet growing demand and achieve groundwater sustainability. Section 8, Projects and Management Actions, summarizes the management actions and capital projects that are planned to maintain subbasin sustainability and meet future demands.

5.0 Groundwater Model Update

A three-dimensional groundwater flow model was developed to evaluate existing groundwater conditions in the Mission Creek Subbasin (MCSB) and to develop forecast scenarios for future water conditions. This report section summarizes the groundwater model (hereafter called the MCSB Model), and Section 7.0 summarizes the forecast scenarios. Additional more-detailed information about the groundwater model can be found in **Appendix A**.

5.1 Previous Modeling Efforts

Several analog and numerical groundwater flow models of the MCSB have been developed between 1974 and the present. These models were developed by the United States Geological Survey (USGS) and other parties to evaluate and quantify hydrogeologic conditions in the MCSB and surrounding area including consideration of natural mountain front and precipitation recharge, artificial recharge, return flows from water uses in the area, and groundwater occurrence and flow within the MCSB and between MCSB and adjacent subbasins. The most recent of the modeling efforts, part of the 2013 Mission Creek/Garnet Hill Water Management Plan (MWH, 2013 [2013 MC/GH WMP]), was performed by PSOMAS and was designed to evaluate four potential future management alternatives to maintain and stabilize groundwater levels in the MCSB (PSOMAS, 2013). As part of the overall planning effort, the Garnet Hill Subarea (GHSA) of the Indio Subbasin was included in the groundwater model.

5.2 Modeling Objectives

The objectives of the current modeling effort are to:

- Expand the 2013 PSOMAS model domain to include the Desert Hot Springs Subbasin (DHSSB) and expand the model to include the Indio Hills, as requested by the California Department of Water Resources.
- Extend the model simulation period from 1936 through 2009 to 1936 through 2019.
- Incorporate more robust estimates of the role that mountain front recharge plays in the hydrogeology of the area.
- Recalibrate the updated model to available groundwater elevation observations.
- Evaluate the inter-subbasin flows across faults.
- Coordinate with the Indio Subbasin modeling team (Todd Groundwater) regarding the amount of underflow across the Garnet Hill Fault.
- Develop a 50-year forecast model to estimate future groundwater conditions under various scenarios to attain sustainable groundwater management.

5.3 Data Sources for the Model Update

The MCSB Model was developed using historical raw data (i.e., no simulated data were used) from the 2013 PSOMAS groundwater model, as documented by PSOMAS (PSOMAS, 2013) and data provided by Coachella Valley Water District (CVWD), Desert Water Agency (DWA), and

Mission Springs Water District (MSWD), collectively, the Agencies. Previous Engineer's Reports by CVWD and DWA, as well as available stream runoff and precipitation records were also used as data sources. Most of the data provided by the Agencies did not extend back prior to 1978, so for the period prior to 1978, the data used were primarily from the 2013 PSOMAS model. If data reported by an agency were contradictory to the PSOMAS data set, the agency-provided data were used. If any agency records were missing after 1978, the PSOMAS data set was used. to fill in the gaps.

Data from the Agencies and the 2013 PSOMAS model included well construction, groundwater pumping, groundwater import and export, water quality, water level, geophysical logs, ecological data, water supply data, wastewater treatment plant (WWTP) data, and customer meter data. Data for the DHSSB were limited to water level and well construction data for a limited number of available wells and groundwater production data from literature sources.

Concurrent with the MCSB modeling effort, an update of the existing Indio Subbasin model (Fogg, 2000, 2010) was being conducted by Todd Groundwater (1997-2019 Indio Subbasin Model). The updated MCSB Model and the updated Indio Subbasin model both include the GHSA. At the request of the Agencies, the Wood and Todd Groundwater modeling teams agreed to coordinate efforts for representation of the GHSA in the two models.

During calibration of the two models, it became apparent that wells in the GHSA were responding to recharge events at the Whitewater River Groundwater Replenishment Facility (WWR-GRF) located in the main Indio Subbasin west of the Garnet Hill Fault. As a result, it was agreed that the most expeditious method to coordinate the Indio Subbasin and MCSB models would be for Wood to adopt the hydraulic parametrization of the GHSA from the 1997-2019 Indio Subbasin model into the MCSB Model, and to utilize the simulated groundwater flow across the Garnet Hill Fault as the western boundary condition for the MCSB Model. Using this methodology, the GHSA representations of both models yield nearly identical groundwater flow conditions where the two models overlap. The specific modifications made by Wood in coordinating hydraulic parameters and groundwater flux terms are discussed more fully in **Appendix A**.

5.4 Hydrogeologic Conceptual Model

A hydrogeologic conceptual model (conceptual model) is a simplified representation of the groundwater flow system, frequently in the form of a block diagram or cross section (Anderson & Woessner, 1992). The nature of the conceptual model determines the dimensions of the numerical model and the design of the model grid that is used to divide the groundwater system into discrete areas (nodes) for calculation purposes. The purpose of the conceptual model is to establish an initial understanding of the groundwater system and organize the associated field data so that the system can be analyzed more effectively. Conceptual models were developed for the previous modeling efforts (Fogg, 2000 and PSOMAS 2010, 2013) and formed the basis of the conceptual model presented here.

Four steps were completed in developing the conceptual model for the study area:
(1) description of the hydrogeologic setting, (2) delineation of the model domain and layering,

(3) estimation of the water budget, and (4) approximation of the flow system. The following paragraphs summarize this work.

Figure 5-1 is a representation of the conceptual model for the MCSB and shows the main components of the groundwater and hydrologic system for the MCSB.

5.4.1 Geologic Setting

The Coachella Valley is in the northwestern portion of a broad, tectonic depression known as the Salton Trough, which extends from the Gulf of California to the San Gorgonio Pass. The bedrock that is exposed on mountain ranges that flank and underlie the Salton Trough is largely composed of crystalline (igneous and metamorphic) rocks (CDWR, 1964).

The valley floor consists of much younger fine- and medium-grained alluvial sediments derived from the surrounding mountains that have filled the basin over millions of years. These sediments vary and range from well-indurated conglomerate, sandstones, shales, and siltstones to loose gravels, sands, silts, and interbedded clays.

5.4.2 Structural Geology and Faults

The Coachella Valley has been subdivided by faulting into multiple subbasins and subareas. **Figure 5-2** shows the major fault zones in the area. The major fault zones include:

- The Garnet Hill Fault, which separates the GHSA from the main Indio Subbasin.
- The Banning (San Andreas) Fault, which separates the MCSB from the GHSA.
- The Mission Creek Fault, which separates the MCSB from the DHSSB.

These fault zones are primarily southeast to northwest trending. The fault zones that cross the valley form partial barriers to groundwater flow and interrupt the overall flow of groundwater in the valley.

In addition to the major faults as described above, older unnamed faults have resulted in the apparent uplift of older semi-consolidated sediments and bedrock at the northern part of the GHSA and MCSB that effectively separates the active Whitewater River channel from the main part of the MCSB (Wood, 2020). This also potentially limits the hydraulic connection of the Whitewater River channel deposits and sediments in the GHSA.

5.4.3 Stratigraphy

The formations in the study area range in age from pre-Cambrian to Recent (actively being deposited). The geologic units or formations have been grouped in terms of their water-bearing capacity (CDWR, 1964). **Figure 5-2** shows the formations exposed in the MCSB, GHSA, and DHSSB.

The oldest formations in the area, which range from pre-Cambrian to Tertiary, are considered non-water bearing. They yield little or no water to wells and occur primarily as bedrock exposed in the mountains surrounding the MCSB and Coachella Valley and as bedrock underlying the alluvial sediments exposed on the valley floor and in some of the hills in and around the MCSB.

The semi-water bearing formations range in age from Tertiary to Quaternary, have low permeability and low water-yielding capabilities, and yield moderate quantities of water to wells.

As shown on **Figure 5-3a** through **Figure 5-d**, these formations are exposed in the hills in the southwest portion of the MCSB and underlie the relatively thin alluvial sediments in the Indio Hills. They are also mapped as exposed in some parts of the Indio Hills on larger scale geologic maps (e.g., CDWR, 1964 and 2016).

The water-bearing formations are of Quaternary (including Recent) age and comprise the main unconfined aquifer in the study area. These formations yield water readily to wells. The Quaternary deposits consist of active channel deposits, alluvial fan deposits, stream wash deposits, alluvial plain, and lake deposits (Q), and dune sand deposits (Qs). **Figure 5-2** shows that these units make up the majority of the formations exposed in the MCSB, GHSA, and DHSSB. As described above, the Quaternary deposits in the Indio Hills are thin and not of sufficient thickness to be part of the regional unconsolidated alluvial aquifer of main MCSB. The water bearing sediments in the Coachella Valley are very thick (up to 12,000 feet). Beneath the study area, the upper approximately 2,000 feet constitute the potable aquifer that is used as a water source (Sneed et al., 2014 and CDWR, 1964).

5.4.4 Hydrogeology

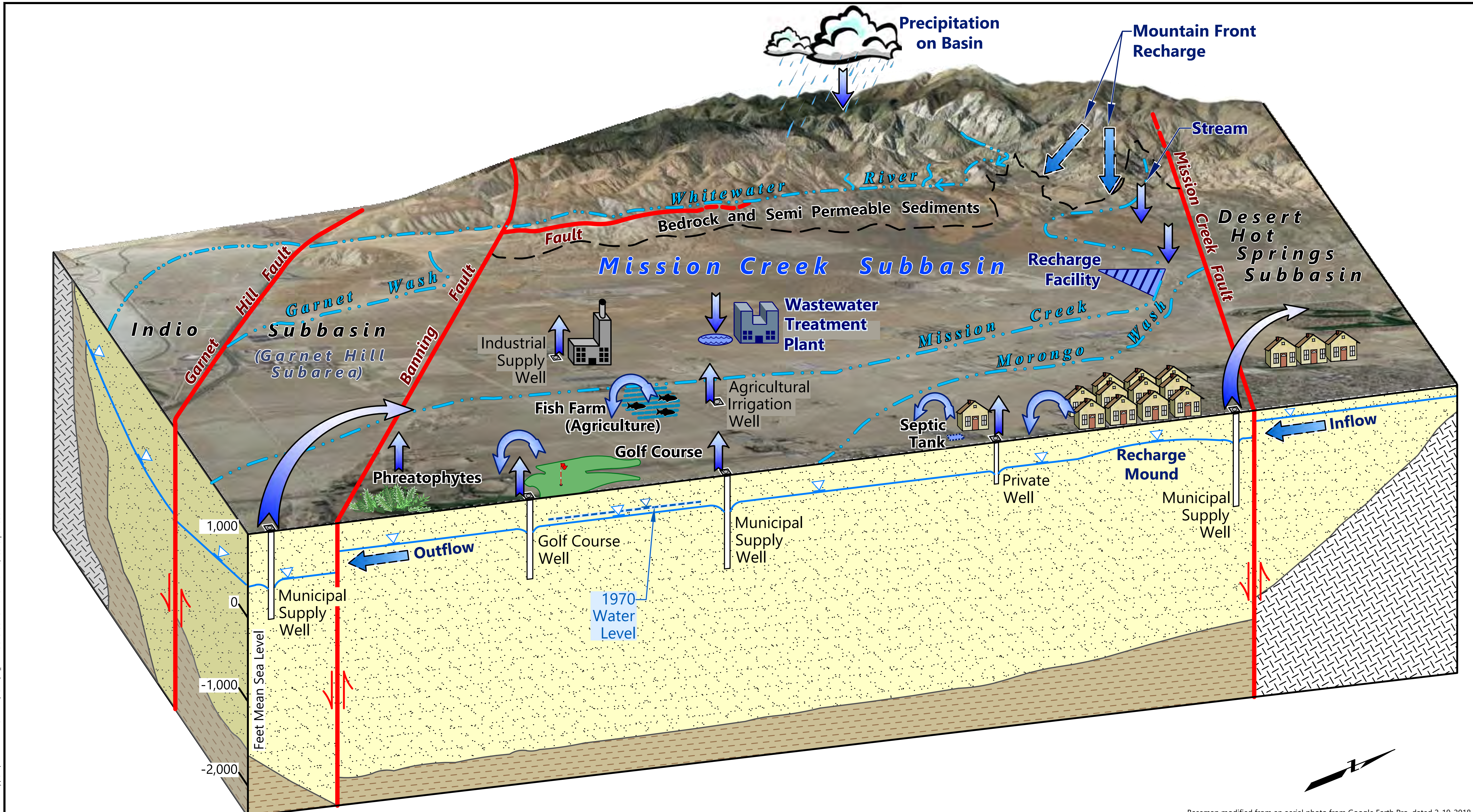
The main aquifer in the MCSB, the DHSSB, and the GHSA is a heterogenous alluvial deposit with sparse discontinuous lenticular clays. The aquifer in the western Coachella Valley, where the Planning Area is located, is predominantly under unconfined conditions (CDWR, 1964, Tyley, 1974).

5.4.4.1 Groundwater Elevations

Historically, groundwater levels in the MCSB aquifer decreased significantly as the overlying communities developed. Groundwater levels in portions of the MCSB declined almost 100 feet between 1936 and 2006. Between 2006 and 2019, however, groundwater levels stabilized and then recovered almost 20 feet as a result of conservation efforts and recharge of imported water at the Mission Creek Groundwater Replenishment Facility (MC-GRF). Between 2002 and 2012, water levels increased as much as 275 feet near the MC-GRF. **Figure 5-3a** through **Figure 5-3d** present groundwater contours for the MCSB, DHSSB, and GHSA for years 1936, 1993, 2009, and 2019.

The DHSSB aquifer has remained relatively undeveloped primarily due to elevated dissolved mineral content in the groundwater. As a result, groundwater levels in the subbasin have also remained relatively stable. Spatially sparse water level availability has made it difficult to estimate groundwater level changes over the DHSSB. This was not considered a data gap because the DHSSB was not the focus of the modeling effort, and the available information was adequate for the modeling objectives.

The GHSA aquifer also experienced some decline in groundwater levels prior to initiation of groundwater recharge activities. Groundwater levels in the GHSA declined about 20 feet between 1950 and 1965. Groundwater levels stabilized in the early 1970s with the start of recharge operation at the WWR-GRF in the main Indio Subbasin. Since the mid-1980s, groundwater levels in the GHSA have recovered over 60 feet.



Basemap modified from an aerial photo from Google Earth Pro, dated 2-19-2018.

Explanation

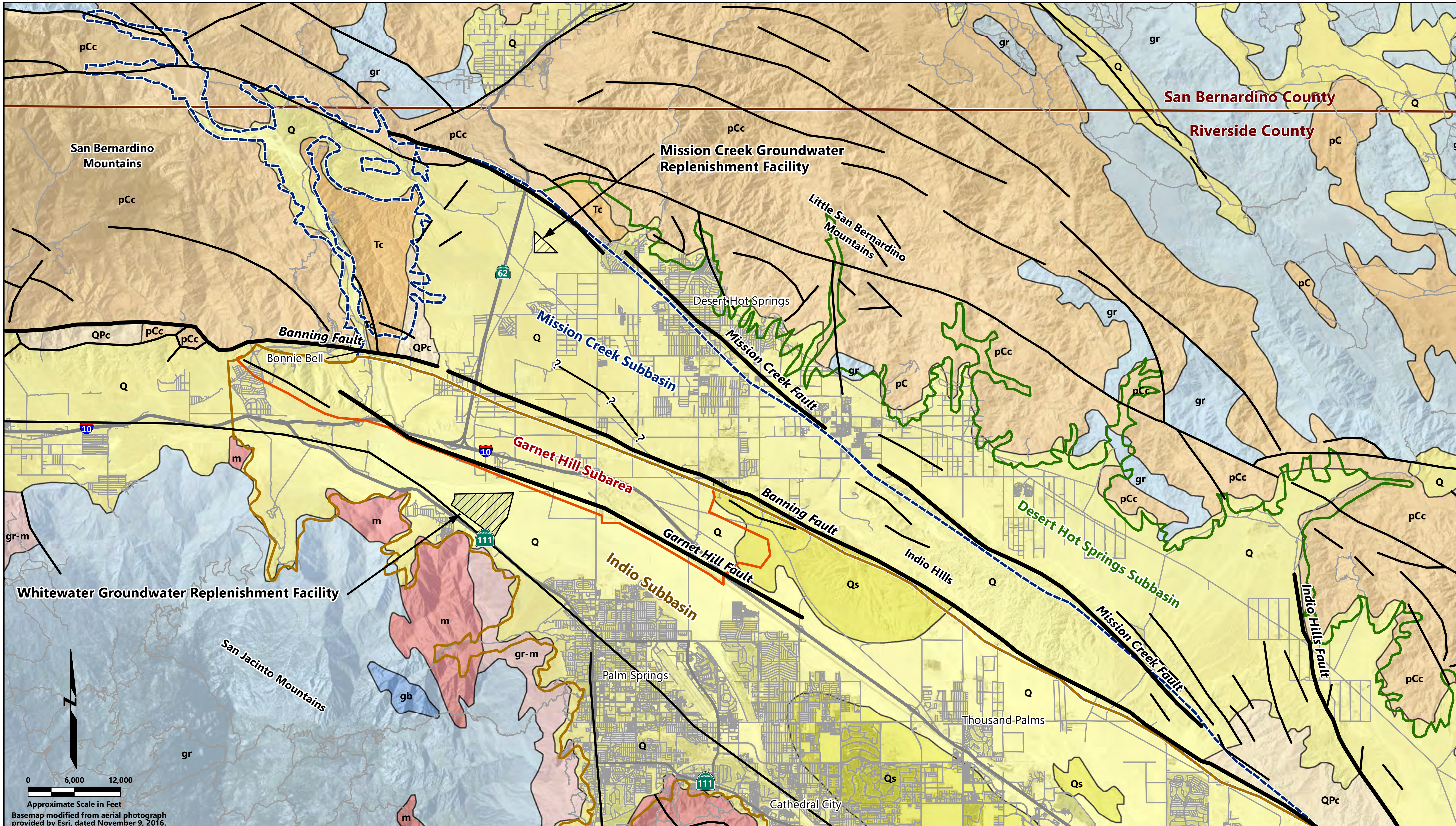
- Subsurface flow
- Return flow
- Recharge
- Discharge
- Import/ Export
- Groundwater surface
- Sand
- Semi-permeable Sediments
- Bedrock

Notes:

1. Land use features are shown for conceptual purposes and do not indicate land use activity in a specific portion of the subbasin.
2. Geology and structure conceptualized from GCI, 1979, and CDWR, 1964.
3. All locations are approximate.

HYDROGEOLOGIC CONCEPTUAL MODEL
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: pah	Date: 09/08/2021	Project No. CM19167351
wood.		Figure 5-1



Explanation

- Fault
- Facility
- Highway/road

Site Features

- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin
- Garnet Hill Subarea of Indio Subbasin

Geology

- **Qs**: dune sand (Quaternary)
- **Q**: alluvium (Quaternary)
- **QPc**: sandstone (Tertiary-Quaternary)
- **Tc**: sandstone conglomerate (Tertiary)
- **gb**: gabbro (Triassic)
- **gr**: diorite (Permian)
- **pC/pCc**: gneiss (Paleozoic)
- **gr-m**: plutonic rock (Early Proterozoic to Late Cretaceous)
- **m**: schist (Early Proterozoic to Cretaceous)

Sources:
1. USGS Open File Report 2005-1305, 2007.
2. Geotechnical Consultants, 1978.

Note:
Fault and groundwater basin boundary alignments differ due to different sources.

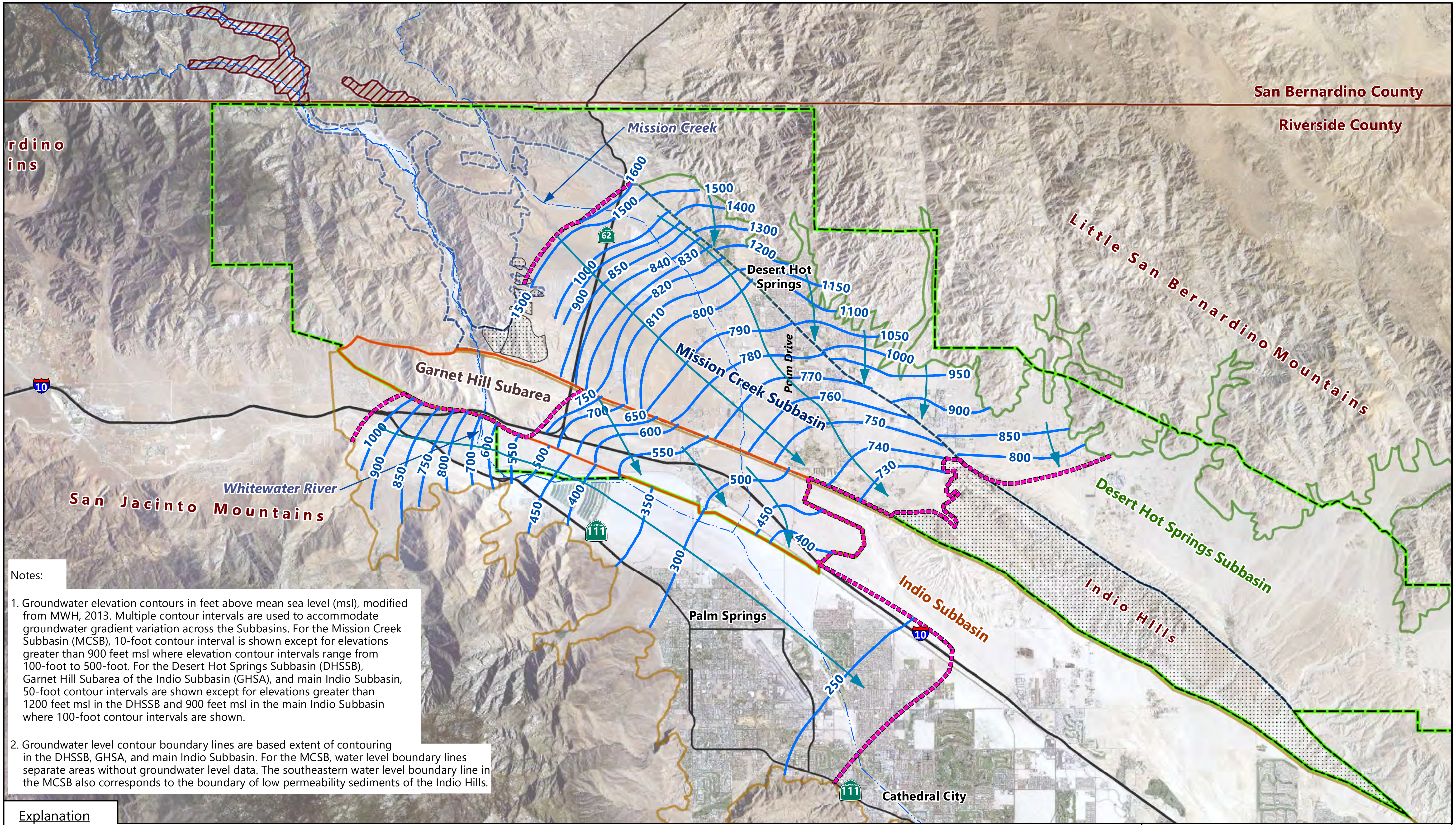
REGIONAL GEOLOGY IN THE
MISSION CREEK SUBBASIN AREA
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: pah | Date: 10/18/2021 | Project No.: CM19167351

wood.

Figure 5-2

Date: 10/18/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update\5-2_Regional_Geology.mxd



Notes:

1. Groundwater elevation contours in feet above mean sea level (msl), modified from MWH, 2013. Multiple contour intervals are used to accommodate groundwater gradient variation across the Subbasins. For the Mission Creek Subbasin (MCSB), 10-foot contour interval is shown except for elevations greater than 900 feet msl where elevation contour intervals range from 100-foot to 500-foot. For the Desert Hot Springs Subbasin (DHSSB), Garnet Hill Subarea of the Indio Subbasin (GHSA), and main Indio Subbasin, 50-foot contour intervals are shown except for elevations greater than 1200 feet msl in the DHSSB and 900 feet msl in the main Indio Subbasin where 100-foot contour intervals are shown.

2. Groundwater level contour boundary lines are based extent of contouring in the DHSSB, GHSA, and main Indio Subbasin. For the MCSB, water level boundary lines separate areas without groundwater level data. The southeastern water level boundary line in the MCSB also corresponds to the boundary of low permeability sediments of the Indio Hills.

Explanation

- Groundwater elevation contour (modified from MWH, 2013)
- Groundwater level contour boundary
- Groundwater flow direction
- Streams
- Highway/road
- Planning Area
- Mission Creek Subbasin fringe area
- Garnet HIll Subarea of Indio Subbasin
- Low permeability/non-water-bearing sediments/bedrock
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin

0 6,000 12,000
Approximate Scale in Feet

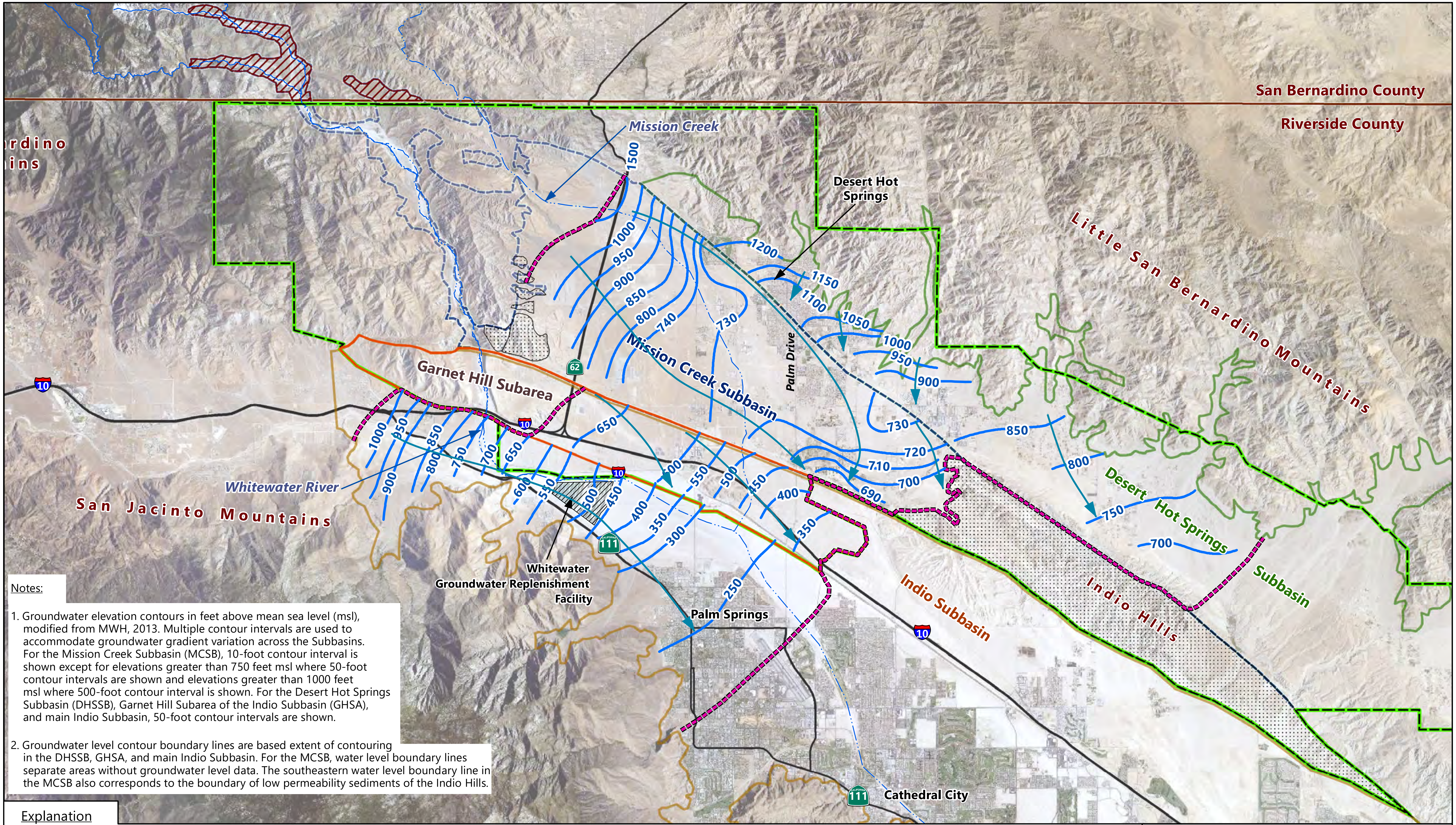
N

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

GROUNDWATER ELEVATION CONTOURS
1936
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: jrw/pah	Date: 9/8/2021	Project No.: CM19167351
wood.		Figure 5-3a

Date: 9/8/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update\5-3a_GW_Cont_1936.mxd



Notes:

1. Groundwater elevation contours in feet above mean sea level (msl), modified from MWH, 2013. Multiple contour intervals are used to accommodate groundwater gradient variation across the Subbasins. For the Mission Creek Subbasin (MCSB), 10-foot contour interval is shown except for elevations greater than 750 feet msl where 50-foot contour intervals are shown and elevations greater than 1000 feet msl where 500-foot contour interval is shown. For the Desert Hot Springs Subbasin (DHSSB), Garnet Hill Subarea of the Indio Subbasin (GHSA), and main Indio Subbasin, 50-foot contour intervals are shown.

2. Groundwater level contour boundary lines are based extent of contouring in the DHSSB, GHSA, and main Indio Subbasin. For the MCSB, water level boundary lines separate areas without groundwater level data. The southeastern water level boundary line in the MCSB also corresponds to the boundary of low permeability sediments of the Indio Hills.

Explanation

- Groundwater elevation contour (modified from MWH, 2013)
- Groundwater level contour boundary
- Groundwater flow direction
- Facility
- Planning Area
- Streams
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet HIll Subarea of Indio Subbasin
- Low permeability/non-water-bearing sediments/bedrock
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin

0 6,000 12,000

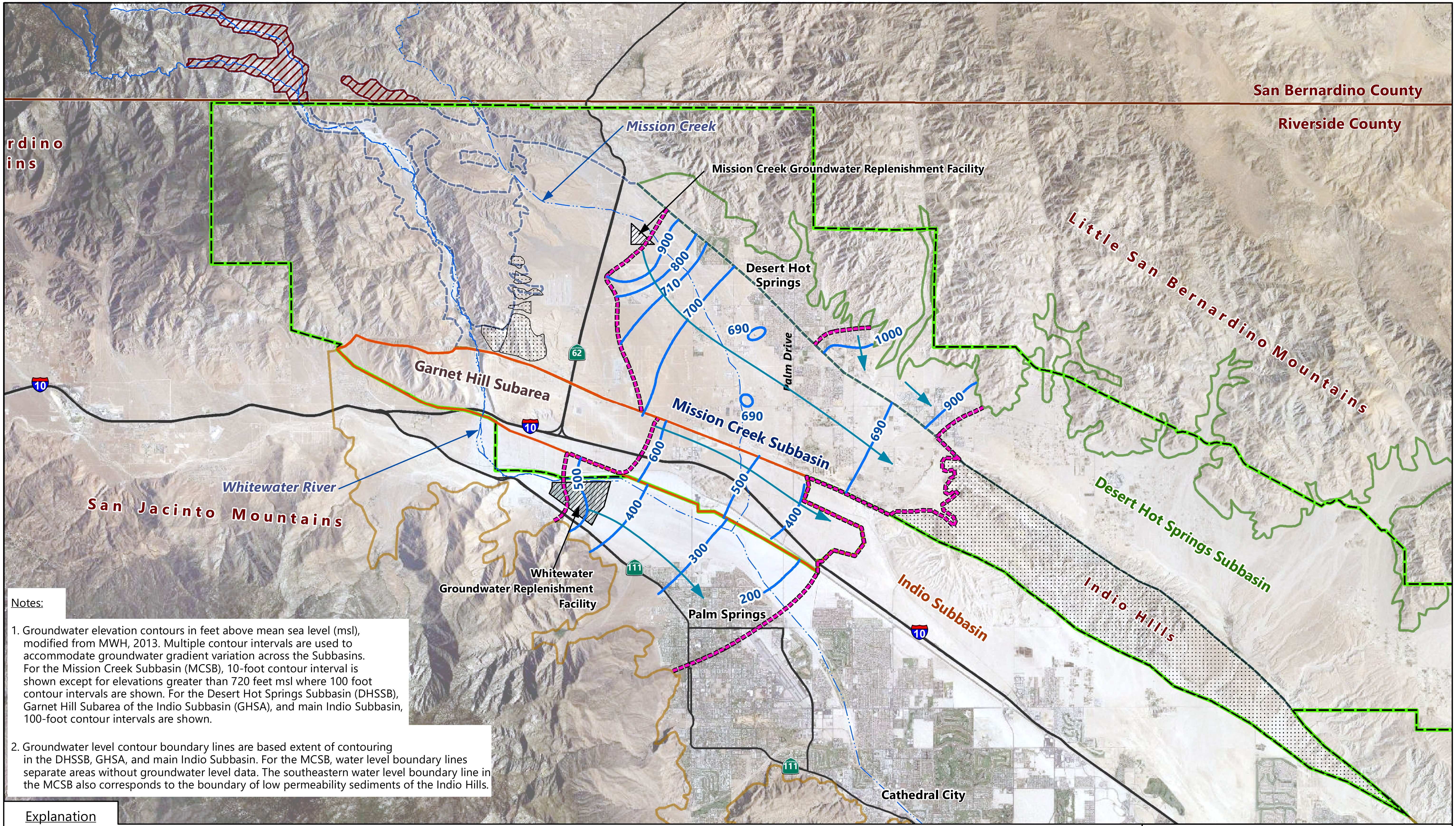
Approximate Scale in Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

GROUNDWATER ELEVATION CONTOURS
1992
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: jrw/pah	Date: 9/8/2021	Project No.: CM19167351
wood.		Figure 5-3b

Date: 9/8/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update\5-3b_GW_Cont_1992.mxd



Notes:

1. Groundwater elevation contours in feet above mean sea level (msl), modified from MWH, 2013. Multiple contour intervals are used to accommodate groundwater gradient variation across the Subbasins. For the Mission Creek Subbasin (MCSB), 10-foot contour interval is shown except for elevations greater than 720 feet msl where 100 foot contour intervals are shown. For the Desert Hot Springs Subbasin (DHSSB), Garnet Hill Subarea of the Indio Subbasin (GHSA), and main Indio Subbasin, 100-foot contour intervals are shown.

2. Groundwater level contour boundary lines are based extent of contouring in the DHSSB, GHSA, and main Indio Subbasin. For the MCSB, water level boundary lines separate areas without groundwater level data. The southeastern water level boundary line in the MCSB also corresponds to the boundary of low permeability sediments of the Indio Hills.

Explanation

- Groundwater elevation contour (modified from MWH, 2013)
- Groundwater level contour boundary
- Groundwater flow direction
- Facility
- Planning Area
- Streams
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet HIll Subarea of Indio Subbasin
- Low permeability/non-water-bearing sediments/bedrock
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin

0 6,000 12,000
Approximate Scale in Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

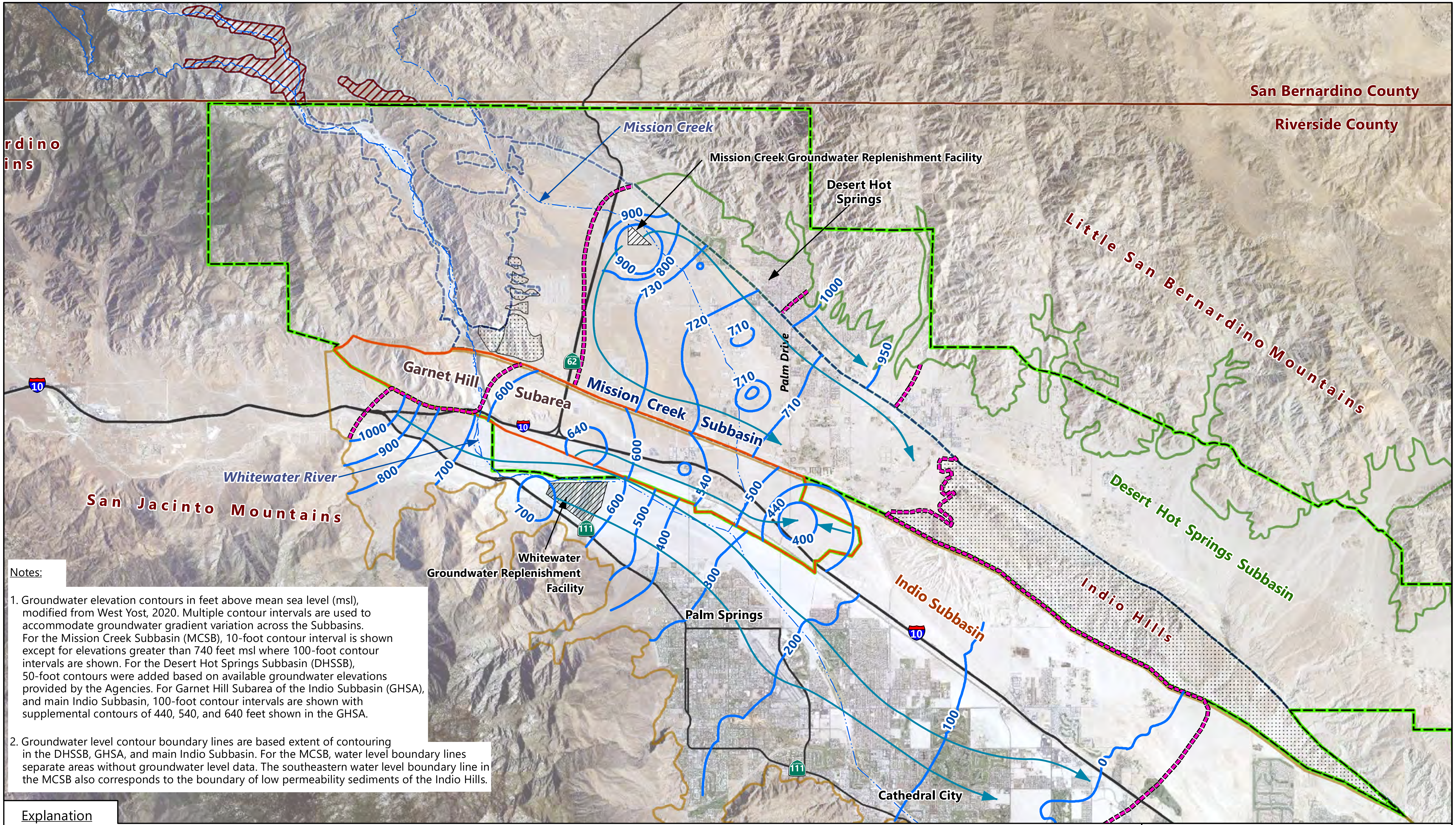
GROUNDWATER ELEVATION CONTOURS
2009
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: jrw/pah | Date: 9/30/2021 | Project No.: CM19167351

wood.

Figure 5-3c

Date: 9/30/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternative)\Esri\Alternative Update\5-3c_GW_Cont_2009.mxd



Notes:

1. Groundwater elevation contours in feet above mean sea level (msl), modified from West Yost, 2020. Multiple contour intervals are used to accommodate groundwater gradient variation across the Subbasins. For the Mission Creek Subbasin (MCSB), 10-foot contour interval is shown except for elevations greater than 740 feet msl where 100-foot contour intervals are shown. For the Desert Hot Springs Subbasin (DHSSB), 50-foot contours were added based on available groundwater elevations provided by the Agencies. For Garnet Hill Subarea of the Indio Subbasin (GHSA), and main Indio Subbasin, 100-foot contour intervals are shown with supplemental contours of 440, 540, and 640 feet shown in the GHSA.

2. Groundwater level contour boundary lines are based extent of contouring in the DHSSB, GHSA, and main Indio Subbasin. For the MCSB, water level boundary lines separate areas without groundwater level data. The southeastern water level boundary line in the MCSB also corresponds to the boundary of low permeability sediments of the Indio Hills.

Explanation

- Groundwater elevation contour (modified from West Yost, 2020)
- Groundwater flow direction
- Groundwater level contour boundary
- Facility
- Planning Area
- Streams
- Highway/road
- Low permeability/non-water-bearing sediments/bedrock
- Mission Creek Subbasin fringe area
- Garnet HIll Subarea of Indio Subbasin
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin

0 6,000 12,000
Approximate Scale in Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

GROUNDWATER ELEVATION CONTOURS
2019
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: jrw/pah | Date: 9/8/2021 | Project No.: CM19167351

wood.

Figure 5-3d

Date: 9/8/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update\5-3d_GW_Cont_2019.mxd

5.4.4.2 Groundwater Flow Direction

As shown on **Figure 5-3a** through **Figure 5-3d**, the general direction of groundwater flow in the MCSB and surrounding Coachella Valley is from northwest to southeast and is consistent in all subbasins. A series of fault zones constitute partial barriers to groundwater flow between subbasins. The Mission Creek Fault, which separates the MCSB from the DHSSB, is an effective flow barrier with a groundwater level differential across the fault of 150 to 200 feet (Swain, 1978). The Banning (San Andreas) Fault, which separates the MCSB from the GHSA, exhibits a groundwater level differential across the fault of 100 to 300 feet. Additionally, the Garnet Hill Fault, which separates the GHSA from the main Indio Subbasin, is an effective groundwater flow barrier, with a groundwater level differential across the fault of 100 to 200 feet.

5.4.5 Model Domain

The model update is based, in part, on a model domain originally developed for evaluation of groundwater flow beneath the entire Indio Subbasin (including the GHSA), extending from the San Bernardino Mountains to the Salton Sea (Fogg, 2000). This Alternative Plan Update's modeling effort is focused primarily on the western Coachella Valley (specifically the MCSB, GHSA and DHSSB) and extends from the San Bernardino Mountains to the southern end of the Indio Hills. **Figure 5-4** shows the model domain area.

5.4.6 Water Budget

The water budget describes the inflow and outflow to and from the hydrogeologic system. Inflow and outflow can occur from the hydraulic boundaries of the system, from various sources such as precipitation or recharge areas, and from exit points or sinks such as wells or drainage systems. The boundaries, sources, and sinks identified within the model domain are discussed below. Additional information regarding water budget components, including ranges in flows, is presented in the groundwater modeling summary report in **Appendix A**.

5.4.6.1 Inflows

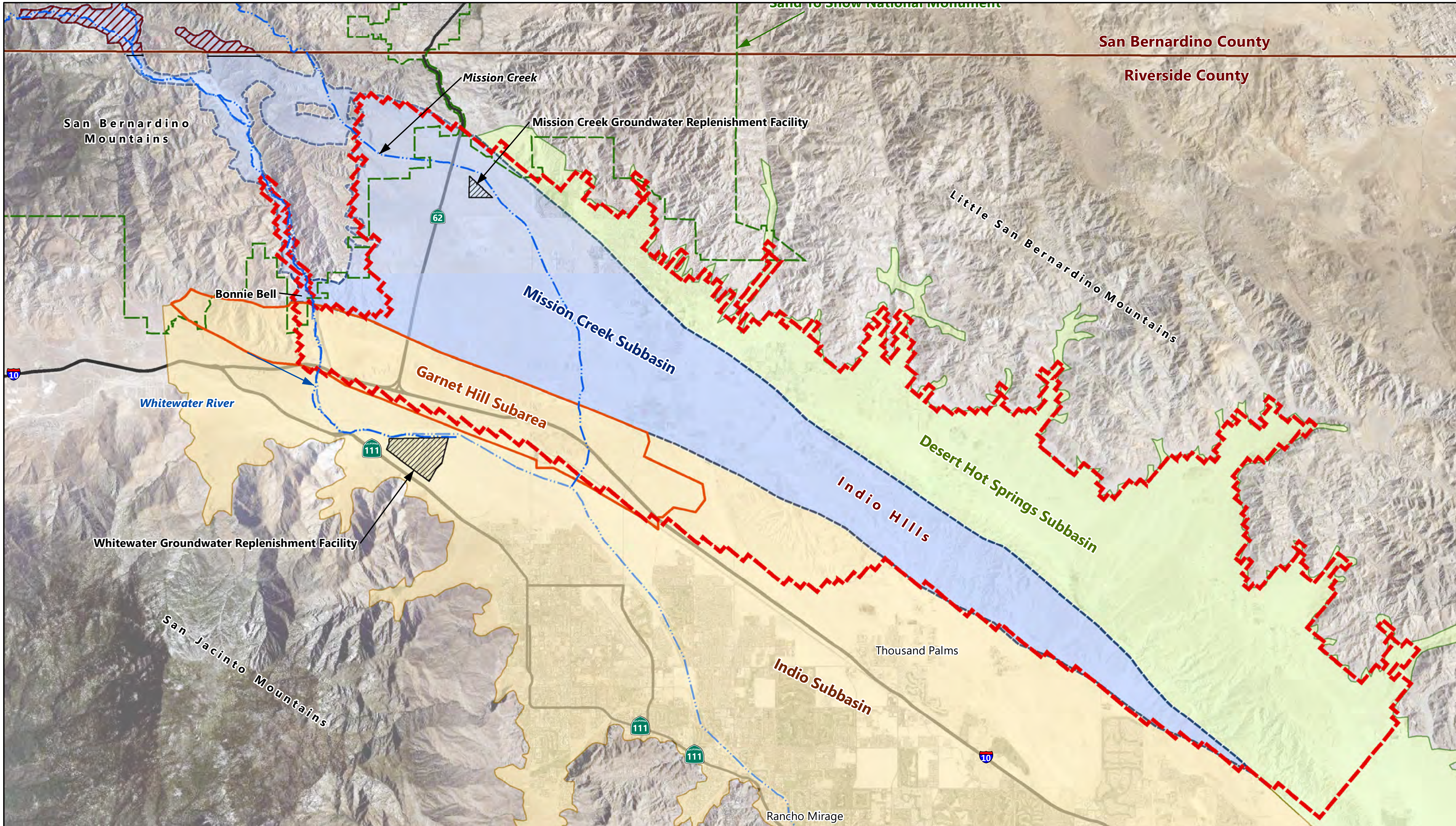
Several sources of water influence groundwater levels in the study area. They are described below.

- **Precipitation:** Long-term (1930-2019) average precipitation on the western Coachella Valley floor as measured at the Palm Springs International Airport (WRCC, 2020) is only about 5.4 inches per year and occurs primarily between November and May with occasional monsoonal rains in the summer months. Due to the high evaporation rate and low precipitation rate, direct groundwater recharge from precipitation is usually negligible on the valley floor.
- **Mountain Front Recharge (MFR):** MFR typically occurs where precipitation (including snow melt) on steep-sided bedrock mountains such as the San Jacinto, San Bernardino, and Little San Bernardino Mountains surrounding the MCSB area runs off, collects, and flows down intermittent streams, and ultimately discharges into alluvium at the base of the mountains. Although the MFR runoff flow can be highly variable and intermittent based on precipitation intensity and duration, it can be a significant source of groundwater recharge to mountain-bounded valleys like the Coachella Valley. However,

there may be a significant time lag between recharge at the mountain front and response in groundwater levels in the areas where pumping occurs.

- **Artificial Recharge:** Artificial recharge has taken place at the MC-GRF since its construction in 2002. Recharge volumes were calculated based on measured CRA deliveries from the MC-GRF turnout, and assuming a 2 percent (%) evaporative loss.[14] Recharge amounts have ranged from 0.2 acre-feet (AF) in 2016 to 33,209 AF in 2010.
- **Return Flows:** Return flow consists of the proportion of applied water that returns to the water cycle as recharge to groundwater after it has been used for its intended purpose (municipal, agricultural, industrial, and golf course). The types of return flows considered are:
  - **Applied Water Return Flow:** Applied water return flow includes return flow from municipal outdoor, agricultural, industrial, and golf course use.
  - **Septic Systems:** The number of septic systems was calculated from the difference between the total residences with municipal water accounts and the number of residences with municipal sewer accounts. Septic system return flow (i.e., percolation) has been decreasing since approximately 2005 because of ongoing water agency efforts to convert existing septic systems to sewer connections.
  - **Wastewater Treatment Plants (WWTPs):** The Horton and Desert Crest WWTP and the proposed Regional Water Reclamation Facility (RWRF) are located within the model domain. WWTP return flows were calculated based on daily flows reported by the treatment plants and assuming a 3% evaporative loss (K&SEC and Stantec, 2018). WWTP return flows have increased steadily since 2010 due to the conversion of septic systems to the regional sanitary sewer system and additional development in the subbasin.
- **Local Streams:** There are two streams that occasionally discharge into the study area at volumes significant enough to have warranted the placement and monitoring of stream gauges by the USGS: (1) the Whitewater River, which flows out of the San Bernardino Mountains through the northwestern portion of the GHSA; and (2) Mission Creek, which flows out of the San Bernardino Mountains into the northern portion of MCSB.
- **Inter-Subbasin Underflow:** Groundwater elevation differences between the various subbasins in the study area result in groundwater underflow across the faults separating the subbasins. Depending on the perspective, these can be inflows our outflows. From the perspective of the MCSB, groundwater underflow is inflow from DHSSB to the MCSB, Long-term average annual underflow has been estimated by several authors.

[14] Return flow calculations and evaporative loss estimates are documented in **Appendix B**, Computation of Non-Consumptive Return, in: Engineer's Report on Water Supply and Replenishment Assessment 2018-2019, prepared by Krieger & Stewart Engineering Consultants (K&SEC) and Stantec (K&SEC and Stantec, 2018) and in K&SCE and Stantec, 2017.



Explanation

- Approximate Active Model Boundary
- Facility
- Streams
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet Hill Subarea of Indio Subbasin
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin

0 6,000 12,000
Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

GROUNDWATER MODEL
ACTIVE MODEL DOMAIN
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: pah/jrw	Date: 4/26/2021	Project No.: IR18167160

wood.

Figure 5-4

Date: 9/8/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update_tb_Groundwater_Model_Domain.mxd

5.4.6.2 Outflows

Several groundwater sinks or outflows influence groundwater levels in the study area. These are described below.

- **Transpiration:** In the MCSB, approximately 1,120 acres of phreatophytes have been identified along the Banning Fault and Indio Hills. Phreatophytes are deep rooted plants that obtain significant portions of their water needs near the groundwater surface (mostly mesquite and tamarisk trees, also known as salt cedar, in the Planning Area). These phreatophytes consume shallow groundwater upwelling along the fault. Transpiration losses of applied water utilized for irrigation is accounted for as a reduction of return flow of pumped groundwater.
- **Local Pumping:** Groundwater pumping is the primary outflow from the study area. Groundwater pumping is primarily within the MCSB and GHSA, with lesser amounts within the DHSSB because of highly mineralized groundwater quality. Groundwater pumping has increased significantly over time, resulting in declining groundwater levels in the MCSB and GHSA. Pumping was determined from records provided by the Agencies. MCSB annual groundwater pumping ranged from 4,720 acre-feet per year (AFY) in 1978 to 17,280 AFY in 2006. In recent years (2015 to 2019), groundwater pumping ranged from 13,530 AFY in 2015 to 14,391 AFY in 2018. In addition, there is an estimated 500 AFY of unreported pumping by minimal pumpers that are not required to report production to the Agencies (Wood, 2020).

  No pumping information was provided by the Agencies for the DHSSB as the Agencies do not operate any production wells or groundwater replenishment programs in this subbasin. Pumping locations and volumes were based on a groundwater modeling study for the area (Mayer, 2007). Information from the study indicated relatively stable groundwater pumping in the subbasin from the early 1970s to the late 1990s (approximately 1,700 AFY). It is assumed that recent and future groundwater use will be similar to this long-term historical use.

  In the GHSA, pumping has historically been limited to just a few wells with metered pumping. Since 1990, metered pumping has been limited to two or fewer wells. Since 2008, metered pumping has been limited to one municipal production well and one private well.
- **Inter-Subbasin Underflow:** Groundwater elevation differences between the various subbasins in the study area result in some groundwater underflow across the faults separating the subbasins. From the perspective of the MCSB, groundwater underflow that is outflow is from MCSB to the GHSA of the Indio Subbasin either directly across the Banning Fault separating the two unconsolidated alluvial sediments in the subbasins or from the MCSB alluvial sediments into the consolidated sediments of the Indio Hills on the GHSA side of the Banning Fault (designated the Indio Hills West for the purposes of the MCSB Model). Groundwater underflow also flows out of the unconsolidated sediments of the main MCSB through the consolidated sediments of the Indio Hills

(designated the Indio Hills East for the purposed of the MCSB Model). Although the Indio Hills East is part of the MCSB, groundwater that flows into the Indio Hills East is considered outflow because it is no longer available as a groundwater resource for the main MCSB and groundwater is not extracted from the Indio Hills in the MCSB.

5.4.6.3 Water Balance

The net water balance for a subbasin equals the subbasin groundwater inflows minus the subbasin groundwater outflows for a given period of time. A positive water balance results in an increase in groundwater in storage and rising groundwater levels. A negative water balance results in a decrease in groundwater in storage and declining groundwater levels.

The subbasin water balance is a key component in developing the groundwater flow model for the MCSB and evaluating the sustainability of groundwater resources. The guidelines for numerical modeling for the Sustainable Groundwater Management Act (SGMA) compliance (CDWR, 2016a/b) recommend that the model be capable of meeting several objectives, including:

- Assessing how historical conditions concerning hydrology, water demand, and surface water supply availability or reliability have impacted the ability to operate the basin within sustainable yield.
- Assessing how annual changes in historical inflows, outflows, and changes in basin storage vary by water year type (hydrology) and water supply reliability.
- Evaluating how the surface and groundwater systems respond to the annual changes in the water budget inflows and outflows.
- Facilitating the estimate of sustainable yield for the basin.
- Evaluating future scenarios of water demand uncertainty associated with projected changes in local land use planning, population growth, and climate change.
- Informing development and quantification of sustainable management criteria, such as the sustainability goal, undesirable results, Minimum Thresholds, and Measurable Objectives.
- Optimizing proposed projects and management actions and evaluating the potential effects those activities have on achieving the sustainability goal for the basin during the 50-year planning and implementation horizon required under the SGMA.

To meet these objectives, the numerical model was developed using annual estimates of components of the water balance that are directly measured (imported surface water, pumping, artificial recharge, etc.) and annual estimates of components of the water balance that are not directly measured (natural MFR, transpiration, return flows, and inter-subbasin underflow). The methods used previously for calculating the water balance for the MCSB (Wood, 2020) were based on using the long-term average value for components of the water balance that are not directly measured (e.g., natural MFR, transpiration, inter-subbasin underflow). This approach attenuates wide fluctuations in water balance resulting from very wet or dry periods. Use of long-term averages for water balance values (i.e., the same value for every year in the simulation) makes the simulated change in storage less representative of the natural variation of flows into and out of the groundwater basin based on changing hydrologic conditions. Use of long-term averages, however, has utility in short-term estimates of water balance such as annual reporting where the focus is the annual water balance compared to the longer trend rather than a specific wet or dry year.

5.4.7 Flow System

The hydrogeologic and water budget information described above have been used to conceptualize the movement of groundwater through the model domain. The conceptual groundwater flow system has been described in several previous reports (CDWR, 1964; Tyley, 1974; Swain, 1978; GTI, 1979; Reichard, 1992; Fogg, 2000; GSi/water, 2005; Mayer, 2007; Catchings et al., 2009; PSOMAS, 2010 and 2013; and MWH, 2013) and is summarized below.

Potentiometric surface maps based on water levels measured in 1936, 1992, 2009, and 2019 (see **Figure 5-3a** through **Figure 5-3d**) indicate the general direction of groundwater flow beneath the western Coachella Valley has consistently been down the valley from northwest to southeast. In addition, there is a small component of inter-basin underflow from northeast to southwest across the faults, described above, which divide the Coachella Valley into multiple subbasins and subareas.

5.5 Model Selection

To meet the model objectives presented in Section 5.2, the groundwater flow model code used for the MCSB, and surrounding area must meet the following criteria:

- Be able to simulate three-dimensional groundwater flow within the model domain,
- Be well documented and verified against analytical solutions for specific flow scenarios,
- Be accepted by regulatory agencies,
- Be readily understandable and usable by others for simulation of future groundwater conditions, and
- Have a readily available technical support structure.

The model code MODFLOW2005-NWT meets these criteria and was used to develop the study area model. The model calculates values of potentiometric head (groundwater levels) and groundwater flow velocity at specific locations and at specific points in time. The calculated groundwater levels were compared to historical water level data in the model calibration process.

5.5.1 Code Assumptions and Limitations

There are certain model code assumptions and limitations that constrain the accuracy of the model simulations. The assumptions and limitations that may affect the modeling simulations are summarized in the groundwater modeling report in **Appendix A**. Key assumptions relate to unsaturated water flow in the vadose zone above the water table, groundwater flow in fractured bedrock surrounding the valley fill materials (alluvial units), and the use of a structured rectangular model grid to divide the model domain into nodes of various sizes and layers.

5.5.2 Graphic Pre/Post-Processor

To facilitate the preparation and evaluation of each model simulation, the graphics pre/post processor GWVistas™ Version 8.03 (GWV) by Environmental Simulations, Inc. was used. GWV is a Windows® program that utilizes a graphic user interface (GUI) to build and modify a database of model parameters. GWV was also utilized to post-process the model simulations and to create the figures presented in the modeling report (**Appendix A**). Wood also utilized some in-house utilities and Microsoft Excel spreadsheets for pre-processing and for post-processing simulation results.

5.6 Model Design

The following sections describe the numerical groundwater flow model for the study area.

5.6.1 Model Simulation Period and Stress Periods

MODFLOW simulates transient groundwater flow using multiple stress periods of variable duration. A stress period is defined as a period of time during which hydraulic stresses (groundwater pumping, for example) are held constant. The model was designed to simulate the 84-year period from pre-development (1936) conditions in the Coachella Valley area to present (2019). Because of a lack of data, the periods 1936 to 1940 and 1941 to 1944 were simulated using two five-year stress periods representing long-term average conditions. The period from 1946 to 1948 was simulated with a single three-year stress period based on 1945 estimated conditions.

The duration of the simulation stress periods was decreased in subsequent years because there were more data available to estimate pumping rates, recharge, and groundwater level elevations. The period from 1949 to 1989 was simulated using 41 annual stress periods. The period from 1990 through 2019 was simulated using 120 quarterly stress periods. The duration of the simulation stress periods was decreased in more recent times to take advantage of the additional data available for estimating pumping rates, recharge, and groundwater level elevations, and to reproduce the observed seasonal pumping and recharge activities more accurately in the subbasins.

5.6.2 Model Grid

The model domain is centered on the Coachella Valley from the San Bernardino Mountains to the Salton Sea. Since the study area of this modeling effort is focused on the MCSB, GHSA, and DHSSB in the western portion of the Coachella Valley, the model domain extending beyond this study area was deactivated.

The model grid consists of 280 rows, 113 columns, and 4 layers for a total of 126,560 model cells. The active study area consists of 18,172 model cells or less than 15% of the total number of model cells. The remaining 85% of the model cells were deactivated as they represent bedrock or the eastern Coachella Valley area outside of this study area. The model has a uniform cell size of approximately 1,000 feet by 1,000 feet. The active model area covers approximately 104,293 acres, or about 163 square miles.

5.6.3 Model Layers

To represent the various hydrogeologic units in the area that affect groundwater flow, the model was divided into four layers. The layers were selected based on hydrostratigraphic information (well logs, geologic cross sections, etc.) and to make the model compatible with modeling efforts by others for the adjacent Indio Subbasin.

Previous modeling efforts subdivided the alluvial sediments in the eastern portion of the Coachella Valley into four layers to represent an unconfined aquifer and confined aquifer separated by an aquitard. The aquitard was represented with two relatively thin layers. Due to layering constraints of earlier versions of MODFLOW, this four-layer scheme was extended into the western portion of the Coachella Valley even though there is no aquitard present. For consistency with previous modeling efforts and compatibility with modeling efforts by others for the Indio Subbasin, the four-layer scheme was maintained through the western portion of the Coachella Valley. Because the western Coachella Valley has unconfined groundwater conditions, it was assumed the initial hydraulic property distributions were the same in all model layers.

5.6.4 Hydraulic Parameters

To remain consistent with previous modeling efforts, model hydraulic parameters were assigned to the model grid using property zones, where the parameter values are consistent throughout each zone. The hydraulic property zones assigned to model layers outside of the GHSA were kept as consistent as possible with the 2013 PSOMAS model. For consistency with the current 1997-2019 Indio Subbasin model, the hydraulic property zones assigned to the GHSA were adopted from that model. The hydraulic property zones were only modified as necessary to improve the calibration of the model to historical water levels in wells. As such, the model contains no more complexity than is justified by the available data and the model objectives.

It should be noted that the hydraulic parameters for the Indio Hills area adopted from the 1997-2019 Indio Subbasin model are very similar to the hydraulic parameters used in the same model for other portions of the lower GHSA where less-consolidated alluvial sediments have been interpreted. This differs from the description (Tyley, 1974) of the Indio Hills as comprised of semi-consolidated, semi-water bearing formations and also from representation of the Indio Hills as a low-flow or no-flow region in some previous models (PSOMAS, 2010). The hydraulic parameters of the Indio Hills will be evaluated further during a future model update or refinement.

The range of final hydraulic properties, horizontal hydraulic conductivity (Kh), vertical hydraulic conductivity (Kv), storage, specific yield (Sy), and porosity used for the calibrated model are presented in the groundwater modeling report in **Appendix A**.

5.6.5 Boundary Conditions

The groundwater flow model must consider flows into and out of the model domain as well as conditions that affect groundwater flow within the model domain. There are a number of significant hydraulic boundaries (sources and sinks) within the model domain that must be considered in the study area numerical model. These boundary conditions are discussed below.

5.6.5.1 Initial Head (Groundwater Level) Distribution

The initial head distribution for the model was based on groundwater contour maps prepared in 1936 by the USGS Survey (Tyley, 1974) and others (MWH, 2013). The 1936 potentiometric surface map clearly shows the differences in groundwater level beneath the DHSSB, MCSB, GHSA, and main Indio Subbasin. It was assumed that the 1936 potentiometric surface was uniform across all model layers.

5.6.5.2 Flow Barriers (Fault Zones)

The MCSB, GHSA, and DHSSB, and main Indio Subbasin are separated by several faults including the Mission Creek Fault, Banning Fault, Garnet Hill Fault, and Indio Hills Fault. Groundwater flow across these fault zones were simulated using the Horizontal Flow Barrier (HFB) package of MODFLOW.

5.6.5.3 General Head Boundaries

The General Head Boundaries (GHB) package of MODFLOW was utilized to represent groundwater flow to or from aquifer areas outside of the active model domain. GHBs represent a constant water level over time for specific locations.

5.6.5.4 Evapotranspiration

Approximately 1,120 acres of phreatophytes (mostly mesquite and salt cedar) have been identified within the MCSB, along the juncture of the Banning Fault and Indio Hills. These phreatophytes consume shallow groundwater upwelling along the fault. Transpiration losses were simulated using the standard Evapotranspiration package of MODFLOW.

5.6.5.5 Mountain Front Recharge

As discussed above, MFR typically occurs where precipitation on steep-sided bedrock mountains runs off, collects, flows down intermittent streams, and ultimately discharges into alluvium at the base of the mountains. MFR for each of the 13 watersheds was estimated using the United States Geological Survey's Basin Characterization Model (BCM), which covers the entire state of California (Flint, 2020). The BCM provides estimates of runoff from watershed areas. BCM model estimates were compared with local runoff measured by stream gauges on the Whitewater River and Mission Creek and the BCM model-estimated runoff from the 13 watersheds were adjusted accordingly. Additional detail regarding the adjustments is presented in the groundwater modeling report in **Appendix A**.

5.6.5.6 Return Flow and Artificial Recharge

As previously discussed in Section 5.4.6, return flow from applied water for agricultural, industrial, municipal, and golf course uses provides a significant source of recharge to the regional aquifer system. Return flows from septic systems and WWTPs are also a significant source of recharge. The largest single source of recharge is from artificial recharge at the MC-GRF. A total of 45 unique return flow zones including one artificial recharge facility are represented within the model domain. Return flow estimates for these zones from 1936 to 1978 were derived from Tyley (1974) and PSOMAS (2013). Return flow estimates from 1978 to 2019 were calculated from water use data provided by the Agencies. In addition, metered deliveries of imported recharge water from 2002 through 2019 were provided by the Agencies. Aquifer recharge from all these sources was simulated in the model using the standard MODFLOW Recharge package.

5.6.5.7 Pumping Wells

As discussed in Section 5.4.6, groundwater pumping for agricultural, industrial, municipal, and golf course uses is one of the largest sinks in the regional aquifer system. A total of 94 wells have been identified within the study area. Most of these wells are located within the MCSB and DHSSB, with fewer wells pumping from the GHSA and DHSSB. Pumping wells were simulated using the Multi-Node Well (MNW) package of MODFLOW. Pumping rates for the period from 1936 to 1978 were based on prior modeling efforts (Tyley, 1974 and PSOMAS, 2013). Pumping rates for 1978 through 2019 are based on estimates and reported pumping by the Agencies or estimated from literature sources.

5.6.5.8 Garnet Hill Flux Boundary

The main Indio Subbasin was intentionally not included in this modeling effort, because it is being modeled for the Indio Subbasin Water Management Plan Update (Todd/W&C. 2021). As discussed in Section 5.3, the MCSB Model was made consistent with the 1997-2019 Indio Subbasin model by adopting the Indio Subbasin hydraulic properties in the GHSA (the overlap area of the two models). Likewise, the boundary flux (underflow) to and from the GHSA to the main Indio Subbasin across the Garnet Hill Fault was also extracted from the Indio Subbasin 1997-2019 model and used for this model. In addition, the Whitewater River recharge within the GHSA was also extracted from the 1997-2019 Indio Subbasin model.

To simulate the underflow in the MCSB Model, a flux boundary was set up using the Well package of MODFLOW. The flux boundary was set up immediately southwest of the Garnet Hill Fault using 332 wells in a series of six reaches (consistent with the Garnet Hill Fault reaches) in all model layers. Unlike the MNW package, the Well package does not reallocate pumping when a model layer goes dry; thus, allowing the Garnet Hill Fault flux to decrease as layers go dry. This provides a more realistic representation of flow across a fault. The flux for each Garnet Hill Fault reach from 1936 to 1997 was estimated using the simulated underflow from the PSOMAS model. The Garnet Hill Fault flux for each reach from 1997 through 2019 was based on underflow values extracted from the 1997-2019 Indio Subbasin model.

5.7 Calibration

Calibration of a groundwater flow model is a process through which the model parameters of hydraulic conductivity, aquifer storativity and other parameters are adjusted so that a suitable match is made between the model-estimated groundwater levels and flows and actual measured water levels and flows (known as model targets).

Calibration is accomplished by selecting a set of model parameters, boundary conditions, and stresses that produce simulated heads and fluxes that match field measurements within a pre-established range of error. Because of the many parameters involved in the calibration process, a unique solution (e.g., one set of parameters) cannot be achieved. A brief discussion of the calibration of the groundwater flow model for the study area is presented below.

5.7.1 Calibration Criteria

The quantitative fit of the MCSB Model to observed water level measurements was conducted through statistical analysis of the residuals, meaning the difference between observed and simulated water levels (or heads) at specified observation locations. In the case of transient calibration defined below, analysis of the residuals also includes variations over time. As discussed in the groundwater modeling report in **Appendix A**, there are several statistical values used to evaluate the model calibration and to adjust parameters to improve the model fit to historical data. Of these, the more important values are the residual mean, absolute residual mean, residual standard deviation, and root mean square error. The most used criteria are the normalized root mean square (NRMS), which is the root mean square error divided by the range in observations.

There is no industry standard for determining when a numerical model is "adequately" calibrated. A commonly used "rule of thumb" for acceptable calibration, however, is that the NRMS error should be less than 10% (Zheng and Neville, 1994).

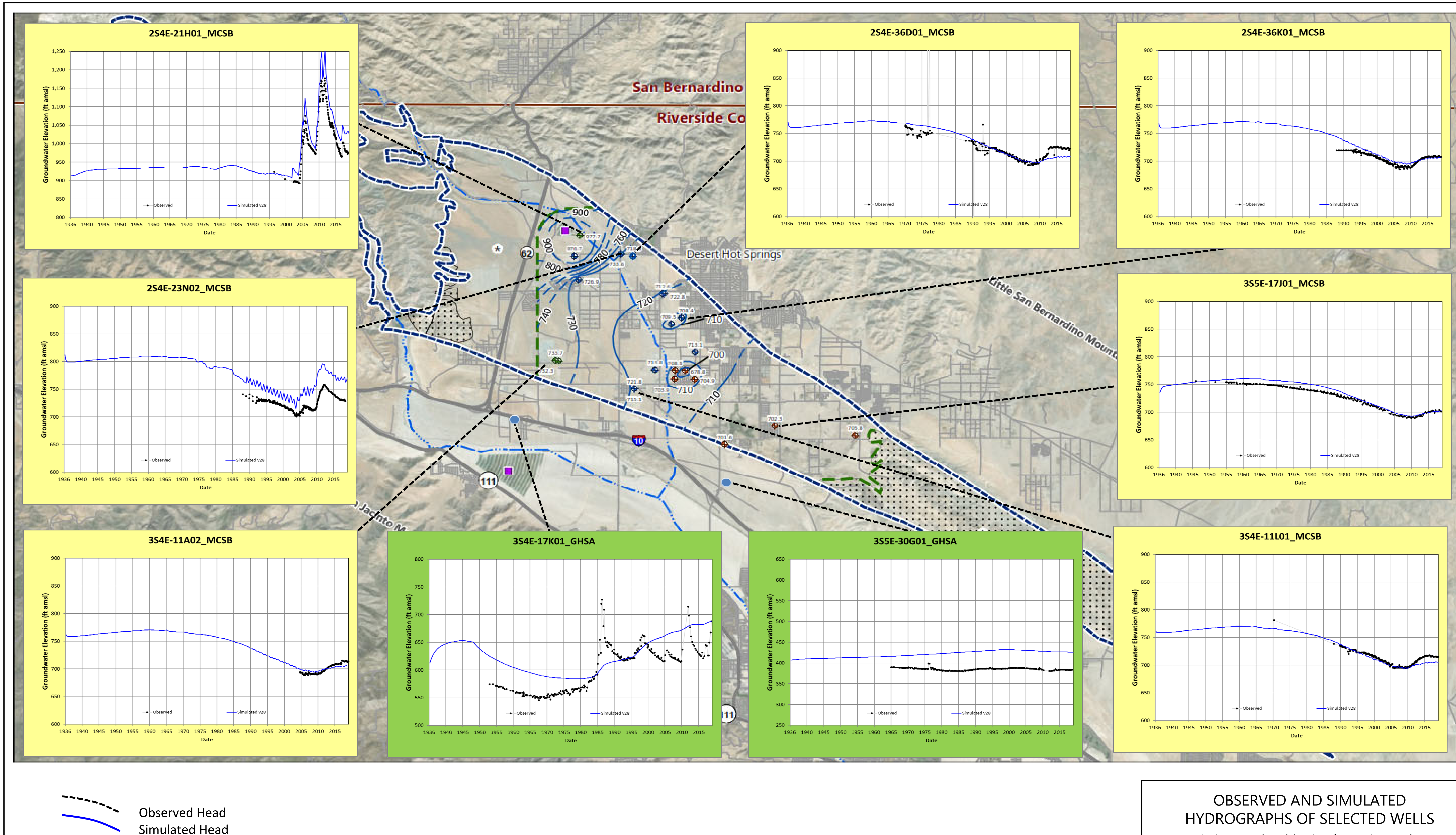
5.7.2 Transient Calibration

Transient calibration of a groundwater model is the matching of model simulation results to model targets over time (rather than for a single point in time). The MCSB Model was calibrated for the period 1936 through 2019. It was calibrated to 7,128 groundwater elevations in 58 wells and estimated underflow between subbasins. Calibration was accomplished using a process of manual trial-and-error and autocalibration using Parameter Estimation (PEST) software. A total of 28 model variant (with modifications of hydraulic parameters, boundary conditions, fault conductance, general head boundaries, flux boundaries, etc.) were evaluated during the calibration process. Multiple manual runs were made with each model variant, and several of the variants were further calibrated using PEST.

5.7.2.1 Calibration Results

As noted above, a model can be considered well calibrated when the NRMS error is 10% or less. Following the calibration process, the resulting NRMS error for the MCSB Model was 3.7%, meeting the calibration criteria. For the DHSSB, MCSB, and GHSA, the NRMS error was 5.5%, 2.3%, and 3.8%, respectively.

A comparison of observed and simulated heads on hydrographs provides a visual, qualitative measure of how well the model fits observations. A plot of hydrographs for selected wells across the model domain shows reasonably good fit for most wells (**Figure 5-5**). An attachment to the groundwater modeling report (**Appendix A, Attachment A1**) contains hydrographs of observed and simulated heads for all 58 observation wells used in the calibration process.



OBSERVED AND SIMULATED HYDROGRAPHS OF SELECTED WELLS

Mission Creek Subbasin Alternative Update

Coachella Valley, California

By: dmb	Date: 10/17/2021	Project No.: CM19167351
wood.	Figure	5-5

5.7.3 Model Calculated Water Balance

In addition to simulating groundwater elevations, the model was used to generate a summary of the inflows and outflows for various areas of the active model domain. That flow information was used to approximate the water balance for each subbasin and subarea.

The change in groundwater in storage for each subbasin and subarea can be calculated with Equation 1:

Total Inflows (AFY) – Total Outflows (AFY) = Change in Storage (AFY)

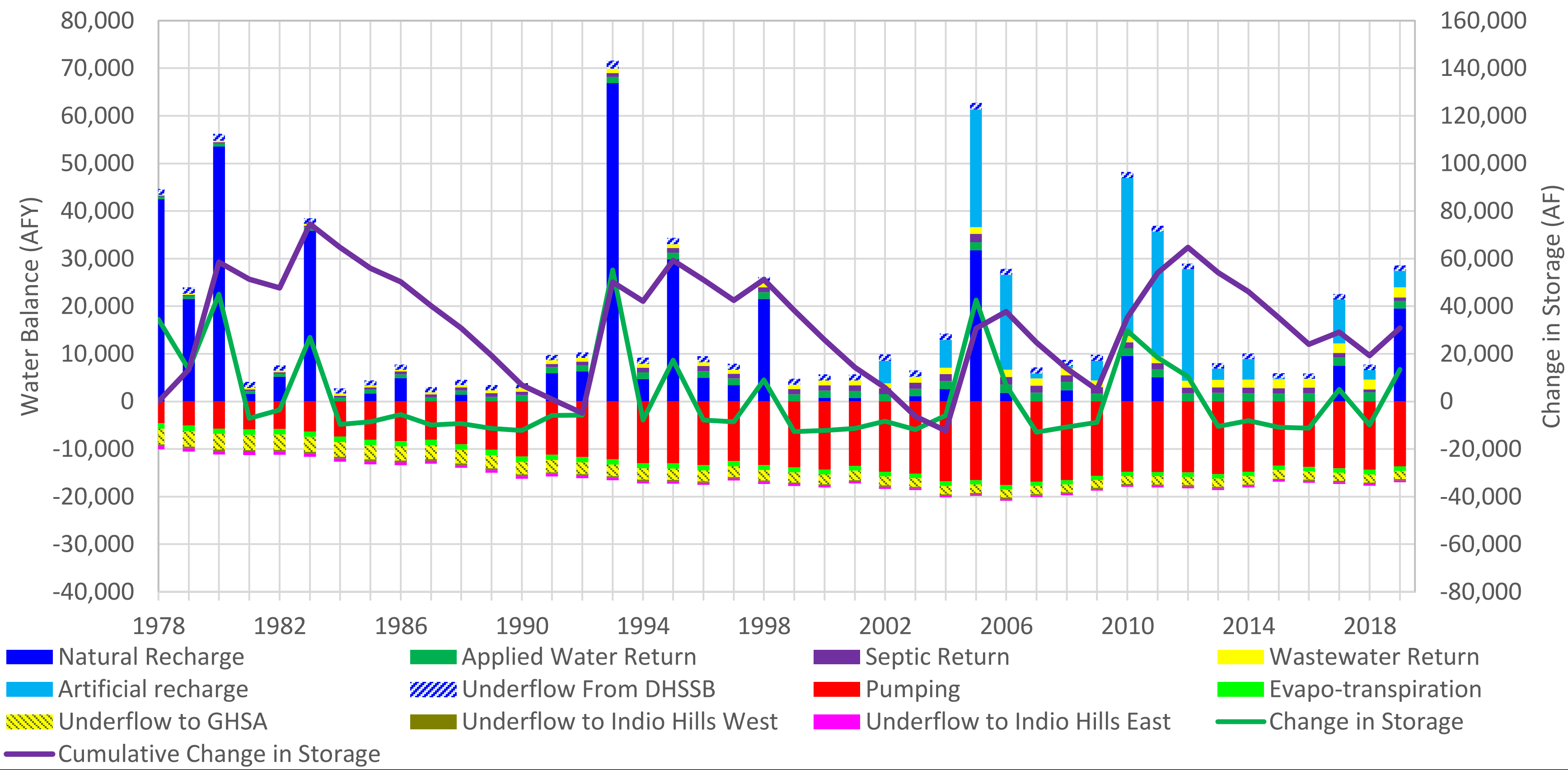
The simulated annual water balances for the 1978 through 2019 period for the MCSB, DHSSB and GHSA are described below. Note that the summary includes minimum, maximum, and average values for the components of inflow and outflow though the simulation period as well as the minimum, maximum, and average of the total annual inflows and outflows. The components are independent of each other, so the minimum (or maximum) for each component may occur in a different year than the minimum (or maximum) for other components. Consequently, the sum of the minimum (or maximum) values for all components will not equal the minimum (or maximum) value for total inflow in a single year.

5.7.3.1 Mission Creek Subbasin

The 1978 through 2019 simulated water balance for the MCSB is briefly discussed below and summarized on **Figure 5-6**. The following range and values are derived from Table A11 in **Appendix A** and unless otherwise mentioned, are for the period 1978 through 2019. Summary values shown are rounded to the nearest 10 AF or AFY.

Simulated Inflows

- **Natural Recharge** occurs primarily from MFR mostly from the Mission Creek watershed with minor inflows from the Chino Canyon, Garnet Wash, and Big Morongo Creek watersheds. Simulated natural recharge was between 10 and 66,880 AFY and averaged 9,400 AFY.
- **Groundwater Underflow** into the MCSB from DHSSB across the Mission Creek Fault was simulated to range from 1,060 to 1,700 AFY and averaged about 1,230 AFY. This inflow has groundwater quality implications because the DHSSB groundwater quality has higher total dissolved solid (TDS). An expanded evaluation of this groundwater underflow is provided at the end of this water balance summary for the MCSB.
- **Applied Water Return Flow** was calculated from groundwater production per agency records and subdivided into Agricultural, Industrial, Municipal, and Golf Course categories, each with its own return flow factor. Simulated applied water return flow ranged between 570 and 1,880 AFY and averaged about 1,330 AFY.
- **Septic Return Flow** was estimated based on Agency estimates of the number of households not connected to the municipal sewer systems. Simulated septic return flow ranged between 210 and 1,750 AFY and averaged about 930 AFY.



Abbreviations:

AF= Acre feet; AFY = Acre feet per year

DHSSB = Desert Hot Springs Subbasin

GHSA = Garnet Hill Subarea

Note: Water balance inflows and outflows derived from calibrated model.

1978 - 2019 SIMULATED WATER BALANCE FOR MISSION CREEK SUBBASIN

Mission Creek Subbasin Alternative Update

Coachella Valley, California

By: dmb	Date: 10/18/2021	Project No.: CM19167351
wood.	Figure 5-6	

- **Wastewater Return Flows** were estimated for the Horton WWTP and Desert Crest WWTP based on agency estimates and records. Simulated wastewater return flow ranged between 180 and 2,130 AFY and averaged about 1,030 AFY.
- **Artificial Recharge** was estimated based on agency-provided records of recharge at the MC-GRF. Between 2002 and 2019, simulated artificial recharge ranged between 0 and 33,210 AFY and averaged about 9,190 AFY.

Total Inflows are the sum of the various inflows described above. Simulated total inflows ranged between 2,740 and 71,590 AFY and averaged about 17,840 AFY.

Simulated Outflows

- **Pumping** was based primarily on agency-provided records. Simulated groundwater pumping ranged between 4,580 and 17,610 AFY and averaged about 12,190 AFY.
- **Evapotranspiration** from phreatophytes was simulated to between 880 and 1,140 AFY and averaged about 1,030 AFY.
- **Groundwater Underflow** from the MCSB to the GHSA across the Banning Fault was simulated as ranging from 1,630 to 3,300 AFY and averaged about 2,290 AFY.

  Groundwater underflow from the main MCSB to the Indio Hills East area of the MCSB was simulated as ranging from 290 to 680 AFY and averaged about 450 AFY.

  Groundwater underflow from the MCSB to the Indio Hills West area of the Indio Subbasin was simulated as ranging from 290 to 380 AFY and averaged about 330 AFY.

Total Outflows are the sum of the various outflows described above. Simulated total outflows ranged between 10,070 and 20,840 AFY and averaged about 16,290 AFY.

Simulated Change in Groundwater Storage

The change in groundwater storage in the MCSB can be calculated using Equation 1. For the period 1978 through 2019, total inflows minus total outflows ranged between negative 12,970 and positive 55,040 AFY and averaged about positive 1,560 AFY, as shown in **Table A12** (**Appendix A**) and by the green annual Change in Storage line on **Figure 5-6**. The MCSB has had a cumulative change in storage of about 25,040 AF since the start of artificial recharge in 2002.

The MCSB water budget is primarily dominated by imported water recharge and return flows from water use. As such, the modeled water budgets presented in this Section and Section 7, Water Management Forecasting, are a more appropriate tool for determining sustainability in this subbasin under the simulated forecast scenarios, and a sustainable yield was not calculated. Groundwater sustainability with regards to groundwater levels and storage will be evaluated at Key Wells based on the criteria presented in Section 6, Sustainable Management Criteria.

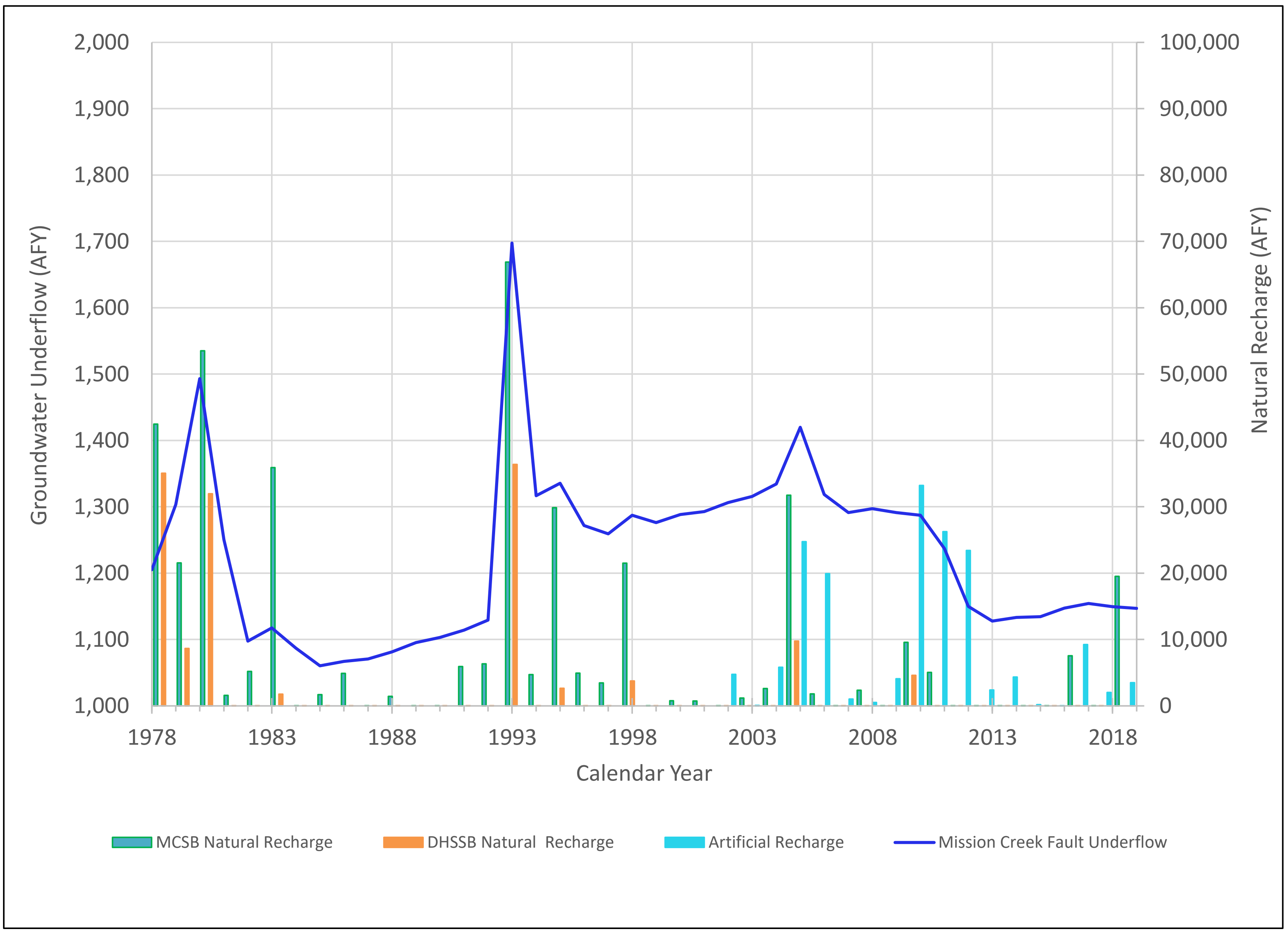
Underflow from Desert Hot Springs Subbasin to Mission Creek Subbasin

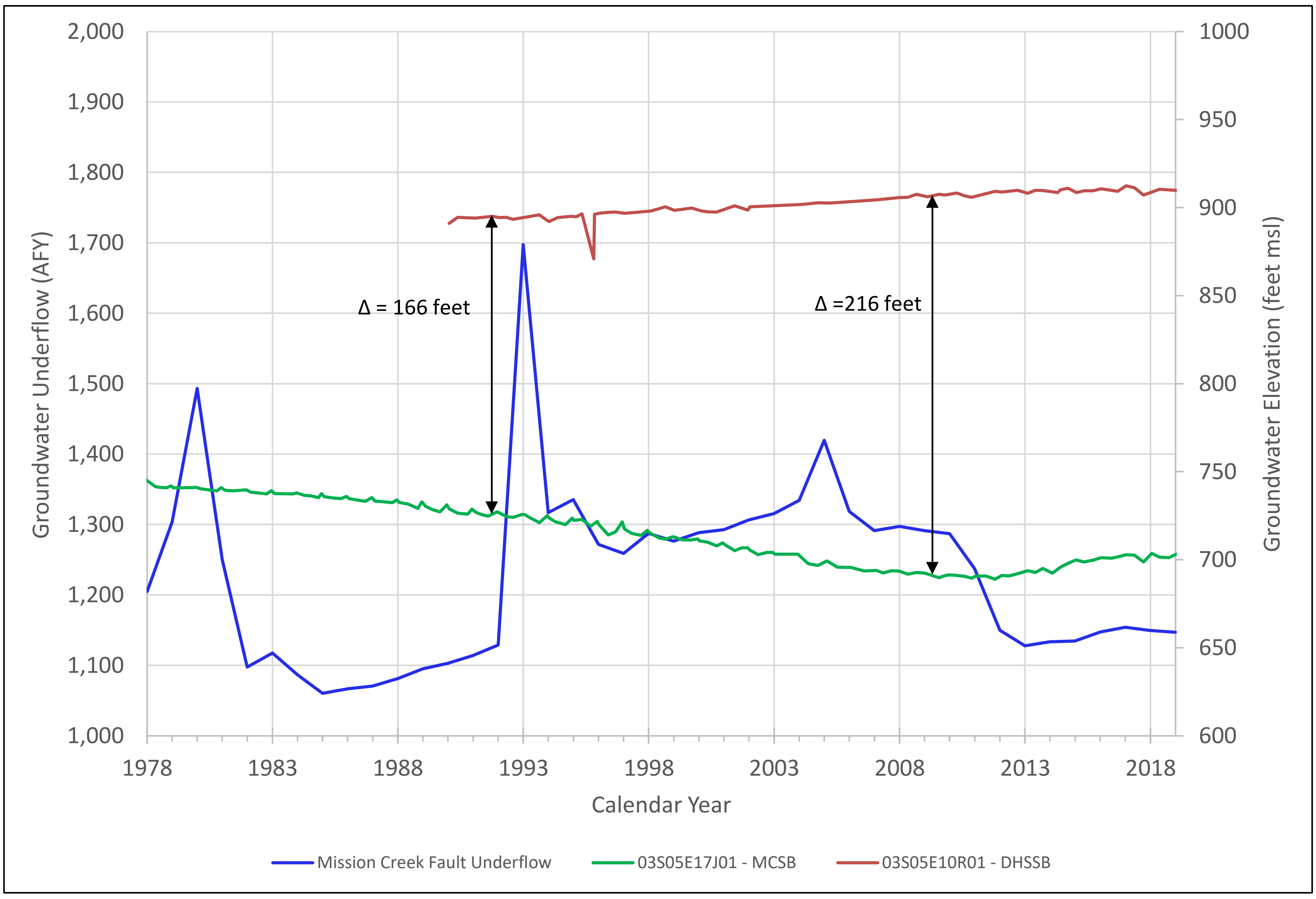
Conceptually, underflow from the DHSSB to the MCSB will increase with increasing water level difference across the Mission Creek Fault. The calibrated groundwater model was used to evaluate the relative magnitude of this underflow in comparison to natural and artificial recharge to the MCSB and how this underflow has changed in response to changes in recharge and water levels in both subbasins.

Underflow across the Mission Creek Fault is shown in **Appendix A, Table A10** and on **Figure 5-7**. The top chart on **Figure 5-7** shows the historical values of underflow from the DHSSB to the MCSB (shown as the dark blue line extending across the chart), natural recharge to the DHSSB (orange bars on the chart), natural recharge to the MCSB (green bars), and artificial recharge into the MCSB at the MC-GRF (blue bars). Note that on this chart, the scale for recharge is 100 times greater than the scale for groundwater underflow, illustrating that underflow from the DHSSB is a very small component of the total inflow to the MCSB. As shown on this chart, underflow across the Mission Creek Fault has been relatively stable except for brief periods when it increased abruptly in response to periods of relatively high natural recharge in both the MCSB and DHSSB. Because the DHSSB is a smaller subbasin with thinner alluvium, years with high natural recharge (e.g., 1980, 1993, and 2005) disproportionally impact groundwater levels in this subbasin and result in higher groundwater underflows across the Mission Creek Fault into the MCSB.

As also shown on this chart, artificial recharge at the MC-GRF appears to generally reduce underflow from the DHSSSB to the MCSB. Artificial recharge approaching 25,000 and 20,000 AF occurs in 2005 and 2006, respectively. Little to no impact of artificial recharge on groundwater underflow across the fault is apparent for these years; however, the start of this recharge corresponds to a high natural recharge year that may have offset the potential impact on groundwater underflow. Additional high-volume artificial recharge events occurred at the MC-GRF in three consecutive years beginning in 2010, ranging from approximately 33,000 AF in 2010 to approximately 26,000 AF in 2013. This period of increased artificial recharge corresponds to a steep decline in groundwater underflow across the fault. The lack of natural recharge in the region during the latter part of this period likely also contributed to the decline in groundwater underflow across the fault. From 2013 through 2019, groundwater underflow across the Mission Creek Fault has been relatively stable averaging approximately 1,140 AFY. This underflow is comparable to the average of approximately 1,090 AFY observed from 1985 to 1992 and is well below the average of approximately 1,310 AFY between 2000 and 2010.

The lower chart on **Figure 5-7** shows groundwater underflow across the Mission Creek Fault compared with groundwater levels on each side of the fault. Well 03S05E17J01 (17J01), located in the southeastern part of the MCSB, shows declining groundwater levels from 1975 through 2009, stable water levels from 2009 through 2011, and then increasing water levels beginning in 2012 due to groundwater replenishment at the MC-GRF (see the upper chart for artificial recharge). Well 03S05E10R01 (10R01), located in the DHSSB across the Mission Creek Fault from the southern MCSB area where 17J01 is located, shows groundwater levels increasing from 1990 to about 2017 and relatively stable water levels since then with a slight decline in 2019. The difference in groundwater levels across the fault in 1990 (1990 average) was approximately 166 feet, and the difference across the fault in 2009 (2009 average) was approximately 216 feet. Between rising groundwater levels on the DHSSB side of the fault and declining groundwater levels on the MCSB side of the fault, the net change in groundwater levels between 1990 and 2009 was about 50 feet.





Abbreviations:
AFY = acre feet per year
DHSSB = Desert Hot Springs Subbasin
MCSB = Mission Creek Subbasin
msl = mean sea level

UNDERFLOW FROM DESERT HOT SPRINGS SUBBASIN TO MISSION CREEK SUBBASIN
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: grr | Date: 11/22/2021 | Project No.: CM19167351

wood.

Figure 5-7

Together, the two charts show that even though the southeastern part of the MCSB continues to have a relatively high difference in groundwater levels across the fault, groundwater underflow across the fault declined as a result of lower natural recharge in the region due to recurring below normal precipitation conditions and due to artificial recharge at the MC-GRF.
A combination of artificial recharge efforts in the MCSB and low natural recharge in the DHSSB have significantly reduced groundwater underflow across the fault compared to much of the 1990s and 2000s. The implications of MCSB groundwater management on underflow across the Mission Creek Fault are further discussed in Section 7.

5.7.3.2 Desert Hot Springs Subbasin

The 1978 through 2019 simulated water balance for the DHSSB is briefly discussed below and summarized on **Figure 5-8**. The following range and values are derived from **Appendix A, Table A12** and unless otherwise mentioned, are for the period 1978 through 2019. Summary values shown are rounded to the nearest 10 AF or AFY.

Simulated Inflows

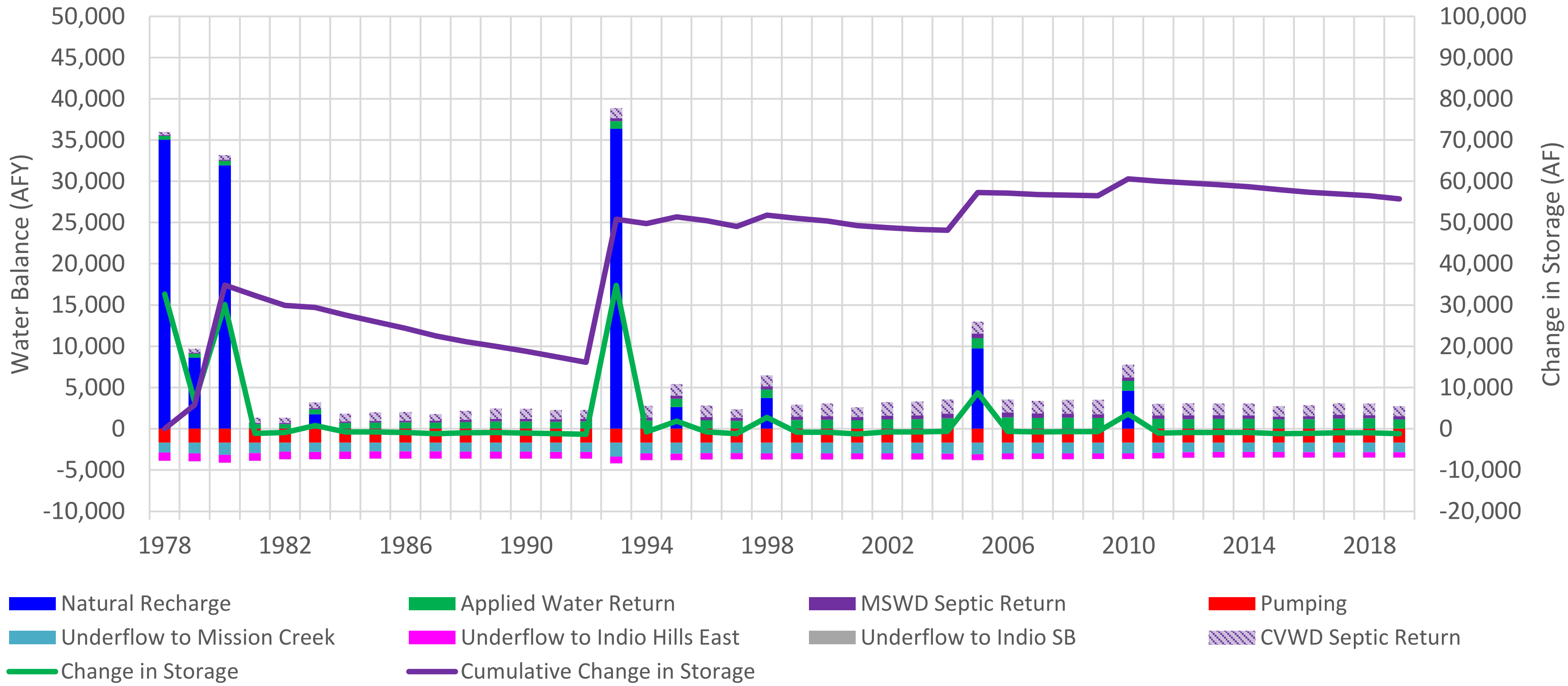
- **Natural Recharge** occurs primarily from MFR from several watersheds tributary to the DHSSB. Simulated natural recharge has ranged between near 0 and 36,380 AFY and averaged 3,220 AFY.
- **Applied Water Return Flow** was calculated from groundwater production per agency records and subdivided into Agricultural, Industrial, Municipal, and Golf Course categories, each with its own return flow factor. Simulated total applied water return flow ranged between 450 and 1,340 AFY and averaged about 970 AFY.
- **Septic Return Flow** was estimated based off agency estimates of the number of households not connected to the municipal sewer systems. Simulated septic return flow ranged between 510 and 2,260 AFY and averaged about 1,590 AFY.

Total Inflows are the summation of the various inflow components described above. Simulated total inflows ranged between 1,340 and 38,860 AFY and averaged about 5,780 AFY.

Simulated Outflows

- **Pumping** was based on literature results (Mayer, 2007) as pumping in this subbasin is by private parties and is limited. Simulated pumping was 1,690 AFY for all years except 1978 when it was 1,700 AFY. Pumping averaged about 1,690 AFY.
- **Groundwater Underflow** from the DHSSB to the MCSB across the Mission Creek Fault has been simulated as ranging between 1,060 and 1,700 AFY and averaged about 1,230 AFY. Groundwater underflow from the DHSSB to the Indio Hills portion of the MCSB across the Mission Creek Fault (also referred to as the Indio Hills East) was simulated to range from 640 and 970 AFY and averaged about 770 AFY.

Total Outflows are the summation of the various outflows described above. Simulated total outflows ranged between 3,800 and 4,180 AFY averaged about 3,690 AFY.



Abbreviations:

AF= Acre feet; AFY = Acre feet per year

CVWD = Coachella Valley Water District

MSWD = Mission Springs Water District

Note: Water balance inflows and outflows derived from calibrated model.

1978 - 2019 SIMULATED WATER BALANCE FOR DESERT HOT SPRINGS SUBBASIN

Mission Creek Subbasin Alternative Update

Coachella Valley, California

By: dmb	Date: 10/18/2021	Project No.: CM19167351
wood.		Figure 5-8

Simulated Change in Groundwater Storage

The change in groundwater storage in the DHSSB can be calculated with Equation 1. Between 1978 and 2019, total inflows minus total outflows ranged between negative 2,530 and positive 38,680 AFY and averaged about positive 2,090. Since the mid-2000s, the annual change in storage has been relatively stable at about negative 1,100 AFY. The cumulative change in storage from 1978 through 2019 is approximately positive 55,750 AF (**Figure 5-8** and **Appendix A, Table A12**).

5.7.3.3 Garnet Hill Subarea

The 1978 through 2019 simulated water balance for the GHSA is briefly discussed below and summarized on **Figure 5-9**. The following range and values are derived from **Appendix A, Table A13** and unless otherwise mentioned, are for the period 1978 through 2019. Summary values shown are rounded to the nearest 10 AF or AFY.

Simulated Inflows

- **Natural Recharge** occurs primarily from MFR from the Whitewater River watershed. Simulated natural recharge has ranged between 3,010 and 34,480 AFY and averaged 12,030 AFY.
- **Groundwater Underflow** into the GHSA from the MCSB across the Banning Fault has been simulated to range from 1,630 to 3,300 AFY and averaged about 2,290 AFY. These values include the Whitewater River recharge values derived from the 1997-2019 Indio Subbasin model.
- **Applied Water Return Flow** was calculated from groundwater production per agency records and subdivided into Agricultural, Industrial, Municipal, and Golf Course categories, each with its own return flow factor. Simulated total applied water return flow ranged between 10 and 140 AFY and averaged about 40 AFY.
- **Septic Return Flow** was estimated based off agency estimates of the number of households not connected to city sewer systems. Simulated septic return flow ranged between 20 and 410 AFY and averaged about 120 AFY.

Total Inflows are the sum of the various inflows described above. Simulated total inflows ranged between 4,820 and 37,970 AFY and averaged about 14,490 AFY.

Simulated Outflows

- **Pumping** was based primarily on agency-provided records. Simulated groundwater pumping ranged between 330 and 2,650 AFY and averaged about 600 AFY.
- **Groundwater Underflow** from the GHSA to the main Indio Subbasin across the Garnet Hill Fault has been estimated to range between 4,980 to 10,780 AFY and averaged about 7,790 AFY. Underflow from the GHSA to the West Indio Hills has been estimated to range between 320 to 870 AFY and averaged about 660 AFY between 1978 and 2019. Increased recharge at the WWR-GRF has occasionally reversed the direction of groundwater flow resulting in flow from the main Indio Subbasin to the GHSA.

Total Outflows are the sum of the various outflows described above. Simulated total outflows ranged between 4,450 and 12,230 AFY and averaged about 9,050 AFY.

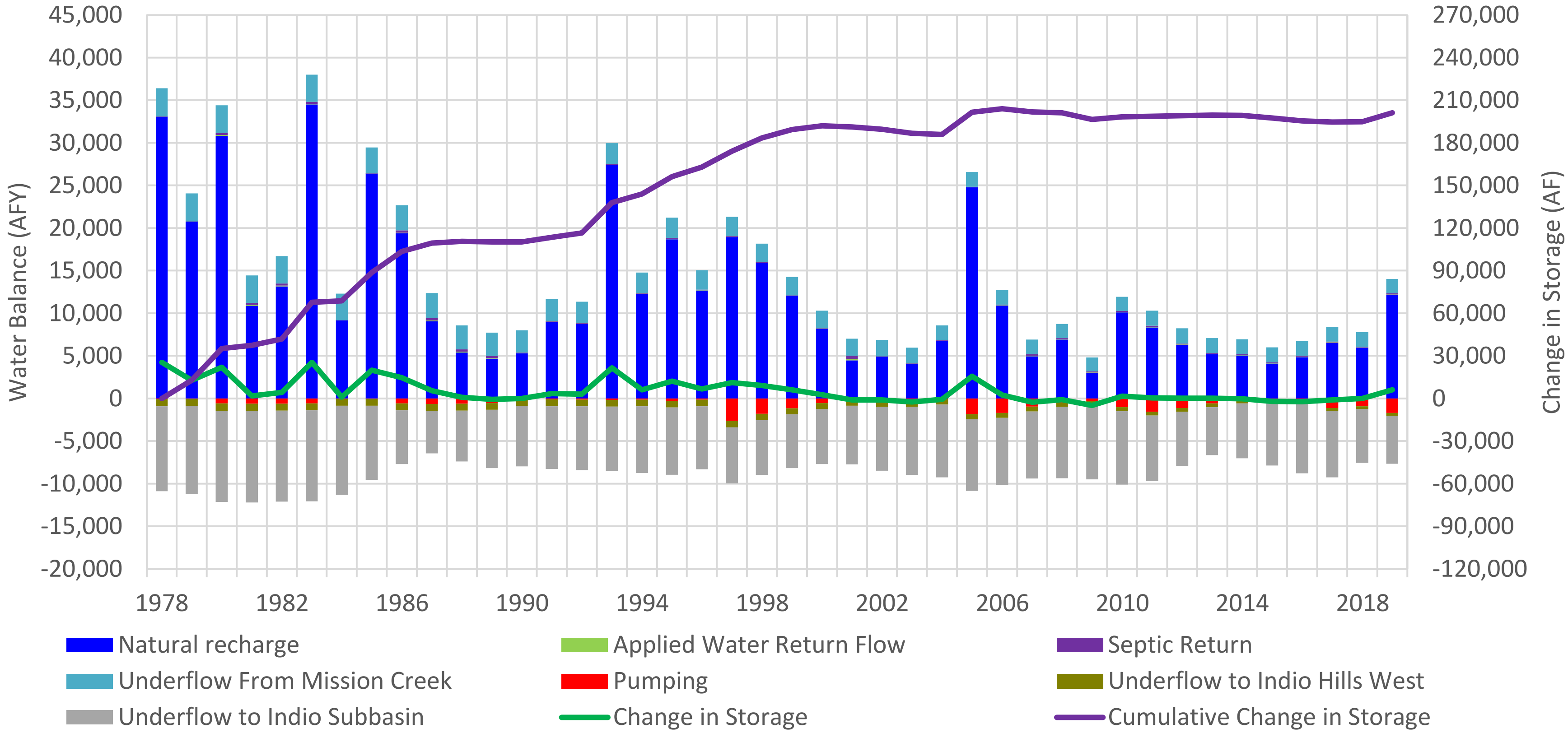
Simulated Change in Groundwater Storage

The simulated change in groundwater storage in the GHSA can be calculated with Equation 1. Between 1978 and 2019, total inflows minus total outflows ranged between negative 4,670 AFY and positive 25,880 AFY and averaged about positive 5,440 AFY (**Appendix A, Table A13**) as shown by the green annual Change in Storage line on the GHSA chart on **Figure 5-9**.

The GHSA had a net increase in annual storage from 1978 to 2006, mostly due to increases in MFR and underflow from the main Indio Subbasin due to recharge at the WWR-GRF. Since then, the GHSA had a net decrease in annual storage. The cumulative change in storage from 1978 to 2019 is approximately positive 202,820 AF, with most of that occurring before 2006 (**Figure 5-9** and **Appendix A, Table A13**).

5.8 Sensitivity Analysis

A sensitivity analysis was conducted to evaluate the sensitivity of the model to a change in the estimated hydraulic parameters. A total of 323 sensitivity runs were conducted and compared to the calibration model results to evaluate the change in calibration due to the change in the model parameter. The analysis showed that the Residual Sum of Squares (RSS) may be improved slightly (up to about 2%) by modifying some of the aquifer hydraulic conductivity and storativity values in selected areas and faults in the GHSA; however, those modifications would not improve model calibration to the NRMS error significantly (only up to about 0.025%) The model is relatively insensitive to changes in the other model parameters. Therefore, no revisions were incorporated into the model at this time.



Abbreviations:
AF= Acre feet; AFY = Acre feet per year

Note: Water balance inflows and outflows derived from calibrated model.

1978 - 2019 SIMULATED WATER BALANCE
FOR GARNET HILL SUBAREA
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: dmb	Date: 10/18/2021	Project No.: CM19167351

wood.

Figure 5-9

6.0 Sustainable Management Criteria

The Sustainable Groundwater Management Act (SGMA) defines sustainable groundwater management as the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results. Identifying and avoiding undesirable results is important to success in implementing this Alternative Plan Update and is consistent with the Water Management Objectives identified in the 2013 Mission Creek/Garnet Hill Water Management Plan (MWH, 2013 [2013 MC/GH WMP]) and summarized in the 2016 Bridge Document (Section 1.4.1.) The Agencies recognize that establishing metrics to avoid undesirable results and to maintain sustainability is a valuable tool in groundwater management. As such, this Alternative Plan Update has incorporated SGMA Sustainable Management Criteria to guide water resources management in the main Mission Creek Subbasin (MCSB). Sustainable Management Criteria for the Garnet Hill Subarea (GHSA) of the Indio Subbasin are being developed separately for the Indio Subbasin Water Management Plan Update (Todd/W&C, 2021).

Sustainable Management Criteria for the MCSB were developed based on available information developed for the Hydrogeologic Conceptual Model, the characterization of groundwater conditions, the groundwater balance (see Section 5 and **Appendix A**), discussion with the Agencies, and feedback solicited from the public.

The SGMA legislation includes defined terms related to Sustainable Management Criteria that will be used throughout this section as described below.

- **Management Area** – refers to an area within a basin for which the Plan may identify different Minimum Thresholds, Measurable Objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors.
- **Measurable Objective** – refers to a specific, quantifiable goal for the maintenance or improvement of specified groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the basin.[15]
- **Interim Milestone** – refers to a target value representing measurable groundwater conditions, in increments of five years, set by an Agency (or Agencies) as part of a Plan.
- **Minimum Threshold** – refers to a numeric value for each Sustainability Indicator used to define Undesirable Results.
- **Representative Monitoring Site** – refers to a monitoring site within a broader network of sites that typifies one or more conditions within the basin or an area of the basin.

[15] The SGMA uses the term "basin" to refer to a groundwater basin. However, this can also apply to a subbasin such as the MCSB.

- **Sustainability Indicator** – refers to any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results, as described in Water Code Section 10721(x).
- **Undesirable Result** – is not defined directly in the SGMA regulations. The California Department of Water Resources (CDWR) has described an Undesirable Result as occurring when conditions related to a Sustainability Indicator become significant and unreasonable. The threshold for a significant and unreasonable condition is defined by the GSAs and may be based on a single monitoring site, multiple monitoring sites, a Management Area, or the entire basin (CDWR, 2017).

Although SGMA allows for establishment of Management Areas within a basin or subbasin to develop area-specific Sustainable Management Criteria, Management Areas have not been established for the MCSB. In addition, no Interim Milestones are designated because the MCSB has been operating within the goal set in the MC/GH WMP for more than a decade.

6.1 Sustainability Goal

As identified in the 2016 Bridge Document, the sustainability goal for the MCSB was based on the mission statement of purpose for the 2013 MC-GH WMP:

> "The purpose of the 2013 Mission Creek and Garnet Hill WMP is to manage the water resources to meet demands reliably and protect water quality in a sustainable and cost-effective manner."

The following SGMA-specific sustainability goal for the MCSB[16] was developed as part of this Alternative Plan Update:

> *Maintain sustainable water resources to reliably meet demands for existing and future beneficial use in the Mission Creek Subbasin by managing the water resources cost effectively to avoid undesirable results*.

6.2 Sustainable Management Criteria Overview

In general, the process for developing the Sustainable Management Criteria starts with identifying the Sustainability Indicators relevant to the MCSB. As defined previously, Sustainability Indicators are any of the effects caused by groundwater conditions occurring throughout the subbasin that, when significant and unreasonable, cause undesirable results, as described in Water Code Section 107211(x). Using this definition, the four Sustainability Indicators relevant to the MCSB based on historical or current conditions include:

- **Chronic lowering of groundwater levels** – Historically, groundwater levels declined by up to approximately 60 feet in the MCSB between 1970 and 2009.
- **Reduction of groundwater storage** – As described in Section 4, groundwater storage in the MCSB was reduced as a result of declining groundwater levels between 1970 and 2009.

[16] The SGMA sustainability goal for the GHSA of the Indio Subbasin is included in the Alternative Plan Update for the Indio Subbasin.

- **Degraded water quality** – As described in Section 4.6, naturally occurring uranium activity historically exceeded drinking water regulatory thresholds in two municipal water supply wells that are no longer in use. Total dissolved solids (TDS) have been increasing in the subbasin over time due to groundwater use and return flow, fertilizer use, wastewater percolation, and recharge of higher TDS imported water. Nitrate concentrations have the potential to increase over time due to fertilizer use and wastewater percolation in the MCSB.
- **Land subsidence** – No evidence of subsidence in the MCSB has been documented. The subbasin is an alluvial basin with some fine-grained sediments at depth. Therefore, the potential for subsidence cannot be eliminated without gathering additional information.

SGMA allows for a Sustainability Indicator to not apply in a subbasin if there is evidence that the indicator does not exist and could not occur. In the MCSB, there is sufficient evidence to eliminate two of the Sustainability Indicators from further consideration:

- **Depletion of interconnected surface waters** – SGMA defines interconnected surface waters as water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. Although surface water flows occur in the upper reaches of the Whitewater River in the MCSB. This area consists almost entirely of government managed lands. In addition, the surface waters and groundwaters in this area are hydraulically isolated from the main MCSB. Because there are no interconnected surface waters in the MCSB that could be impacted by groundwater management activities, this Sustainability Indicator is not considered further.
- **Seawater intrusion** – There are no saltwater bodies in the vicinity of the MCSB. This Sustainability Indicator is not considered further.

Table 6-1 provides a summary of the Sustainable Management Criteria for each of the four relevant Sustainability Indicators. The rationale and background for these criteria are described in detail in the following subsections. Each subsection describes:

- The relevancy of the Sustainability Indicator to the MCSB,
- Significant and unreasonable conditions for the Sustainability Indicator,
- Minimum Thresholds developed for the Sustainability Indicator,
- Measurable Objectives established for the Sustainability Indicator, and
- Definition of Undesirable Results for the Sustainability Indicator.

Table 6-1: Sustainable Management Criteria Summary

Sustainability Indicator	Minimum Thresholds	Measurement	Measurable Objectives	Undesirable Result
Chronic lowering of groundwater levels	Set to one standard deviation of water levels in the well between 2002 and 2019 below the known or estimated 2009 water level of the well	Measured through nine Key Wells (see **Table 6-4** spatially distributed throughout the main MCSB	Set to 2009 groundwater elevations	Four Key Wells (~45%) each exceed their Minimum Threshold for three consecutive years
Reduction in groundwater storage	Set at the storage volume represented by the Average Minimum Threshold for groundwater levels in the nine Key Wells. (i.e., the average of the Minimum Thresholds in all nine Key Wells is 692 feet msl).	Comparison of average annual groundwater levels in Key Wells with the average of Key Well water level Minimum Thresholds (692 feet msl)	Set to 2009 subbasin groundwater storage	The average groundwater level in the Key Wells falls below the average Minimum Threshold for three consecutive years
Subsidence	To be evaluated based on results of USGS study (see Section 6.5)	To be evaluated based on results of USGS study. In the interim, review CDWR ground level vertical displacement data and use the groundwater minimum thresholds as a proxy for subsidence potential	To be evaluated based on USGS study (see Section 6.5)	To be evaluated based on USGS Study (see Section 6.5)
Degraded groundwater quality	For constituents of concern (COC) currently only nitrate and naturally occurring uranium, the Minimum Threshold will be no exceedances of California MCLs for drinking water. Exceedances only apply to drinking water supply wells that regularly test for the parameters. A minimum Threshold for TDS will be determined based on the findings of the CV-SNMP Update (in progress, see Section 6.6).	Groundwater quality data provided by the Agencies and downloaded annually from state and local sources	Same as the Minimum Threshold	For the COCs identified, the concentration/activity of the constituent shall not exceed the MCL. If there is an exceedance, the exceedance will be investigated. Undesirable results for TDS will be determined based on the findings of the CV-SNMP Update (in progress, see Section 6.6).

6.3 Lowering of Groundwater Levels

In the 1990s, the Agencies recognized that continued lowering of groundwater levels in the MCSB was not sustainable and, if continued, could have undesirable results ranging from increased energy costs for groundwater pumping to the need to deepen existing private and public wells. As a result, the Agencies developed and implemented plans to recharge imported water into the MCSB. Groundwater levels in the MCSB began to increase after an imported water recharge program began in 2002 at the MC-GRF.

The Agencies further understand that although groundwater level declines may not be avoidable during recurring below normal precipitation periods when imported water deliveries are reduced, they intend to manage the subbasin to maintain long-term average groundwater levels at or above 2009 conditions, which are generally considered to be the historically low groundwater levels throughout much of the MCSB. During the 2009 period of historically low groundwater levels, no incidents of groundwater production wells going dry or losing production capacity due to low groundwater levels were observed by or reported to the Agencies. In addition, no dry wells are identified in the MCSB in the CDWR "Reported Dry Water Sources" database that was initiated in 2014.[17]

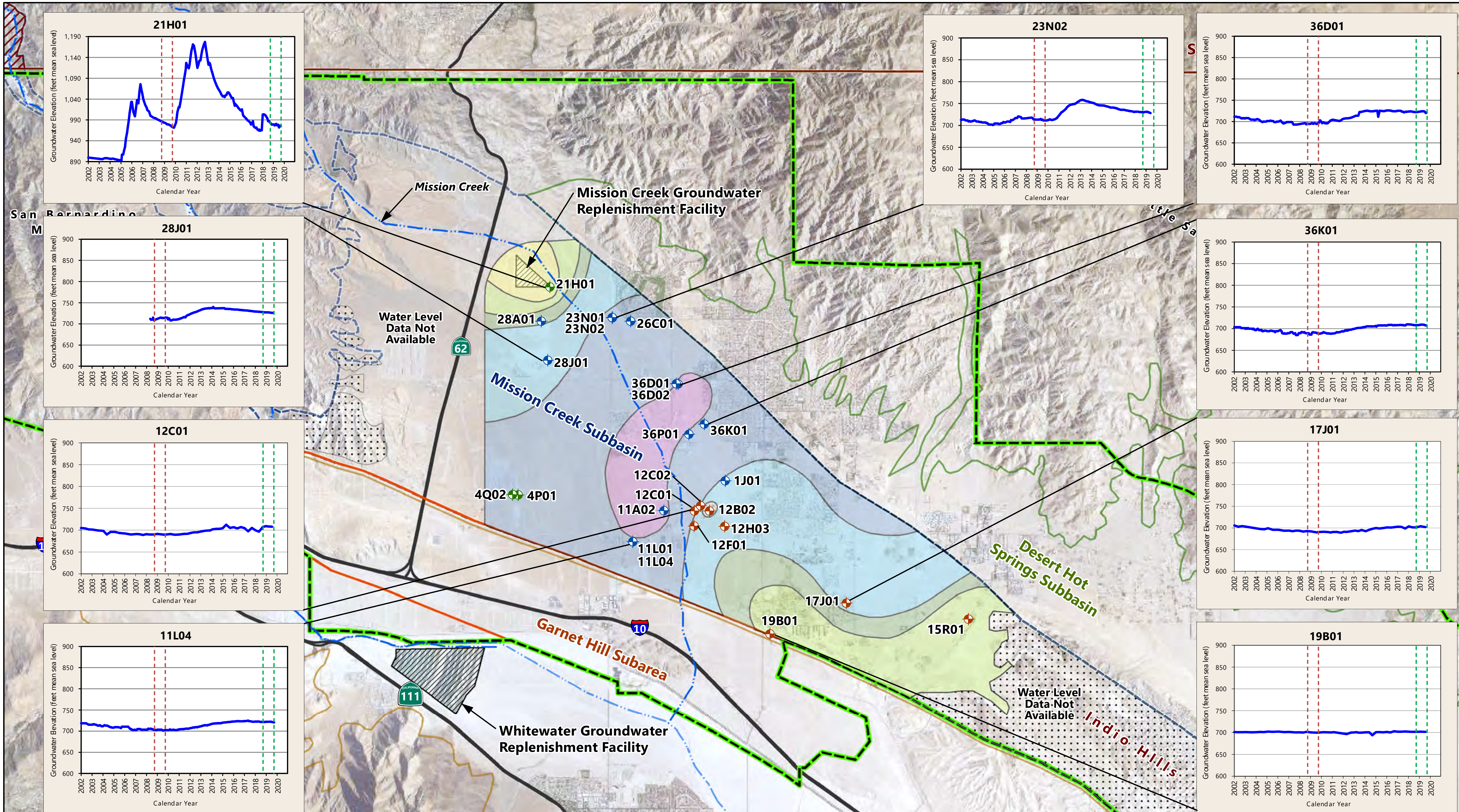
In 2013, the Agencies identified the need to maintain average groundwater water levels in the MCSB above 2009 levels and made this one of the objectives of the 2013 MC-GH WMP. The 2013 MC-GH WMP became the basis for the Alternative Plan for groundwater sustainability submitted to the CDWR in 2016.

In 2019, CDWR approved the Alternative Plan. In the staff report accompanying approval of the Alternative Update (CDWR, 2019a), CDWR recommended providing groundwater-level criteria from specific groundwater monitoring wells that will be used to demonstrate compliance with the 2009 groundwater levels threshold or describe in detail how 2009 groundwater levels are determined and how they can be quantitatively compared to water levels on an ongoing basis. This section provides groundwater-level criteria for specific monitoring wells that will be used to demonstrate compliance with the 2009 groundwater level threshold.

Currently, groundwater levels in the MCSB are above their 2009 levels in nearly all monitoring wells that have available groundwater level data for comparison. Exceptions include a monitoring well near the Mission Creek Groundwater Replenishment Facility (MC-GRF) where groundwater level mounding from high recharge volumes in 2005 and 2006 created elevated groundwater levels that were well above historical lows in this area. Mounding has since dissipated with time and lower recharge volumes. **Figure 6-1** shows groundwater level changes represented by individual well hydrographs in different areas of the MCSB over the ten-year period from water year (WY) 2008-2009 to WY 2018-2019. Changes in groundwater levels over an area representative of the subbasin are representative of groundwater storage changes in the subbasin; therefore, the figure is labeled "Change in Groundwater Storage." Groundwater level changes ranged from a slight decrease (2.5 feet) near the MC-GRF to an increase of approximately 20 feet in the central northern part of the MCSB, and about 1.5 feet of increase in the southeastern part of the MCSB (Wood, 2020). The data show that the objective to eliminate groundwater overdraft has successfully been achieved.

---

[17] https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#gwlevels



Explanation

Monitoring Agency Well
- Coachella Valley Water District
- Mission Springs Water District
- Desert Water Agency
- Facility
- Planning Area
- Streams
- Highway/road
- Low permeability/non-water bearing sediments/bedrock
- Garnet Hill Subarea of Indio Subbasin
- Mission Creek Subbasin fringe area
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin
- Groundwater elevation
- Water years 2008 - 2019
- Water years 2018 - 2019

Change in Groundwater Elevation
- > 20 to 25 foot increase
- >15 to 20 foot increase
- > 10 to 15 foot increase
- > 5 to 10 foot increase
- > 0 to 5 foot increase
- > -5 to 0 foot decrease
- > -10 to -5 foot decrease
- > -15 to -10 foot decrease

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

0 4,000 8,000
Feet

TEN-YEAR CHANGE IN GROUNDWATER STORAGE WY 2008-2009 TO WY 2018-2019
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: pah/jrw | Date: 9/8/2021 | Project No.: CM19167351

wood.

Figure 6-1

Date: 9/8/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternative)\Esri\Alternative Update\6-1_10Yr_change_wy2008-2019.mxd

6.3.1 Significant and Unreasonable Groundwater Level Conditions

Significant and unreasonable groundwater level conditions for the MCSB were selected based on discussions with the Agencies, review of hydrogeology, well pump settings, and historical records of impacts to beneficial users and neighboring subbasins resulting from lower groundwater levels. Significant and unreasonable groundwater levels in the MCSB are those that:

- Decrease significantly below the lowest observed historical groundwater levels for an extended period of time. In most cases, the lowest historical groundwater levels occurred in or around 2009. In the northern part of the subbasin, however, groundwater replenishment that began in 2002 resulted in groundwater elevations well above historical low groundwater elevation levels by 2009.
- Decrease to levels that significantly impact water supply well performance.
- Levels that contribute to significant and unreasonable conditions for other Sustainability Indicators.

6.3.2 Minimum Thresholds

Minimum Thresholds and Measurable Objectives for lowering of groundwater levels were established as described below. The information used for establishing the Measurable Objectives and Minimum Thresholds for the lowering of groundwater levels includes:

- Input from the Agencies on goals for management and potential issues resulting from declines in groundwater levels,
- Input on significant and unreasonable conditions received from the Agencies and solicited during public meetings,
- Historical groundwater elevation data from wells in the groundwater monitoring network, and
- Estimates of groundwater levels derived from the calibrated groundwater model (Section 5 of this report) for locations without measured 2009 groundwater level data.

The general steps for establishing the Minimum Thresholds and Measurable Objectives were:

1. Establish Representative Monitoring Sites for groundwater level Sustainability Criteria monitoring (referred to as Key Wells in this document). **Table 6-2** provides the rationale for selecting the Key Wells and **Figure 6-2** shows the locations of the nine Key Wells selected for the MCSB. Additional information about the groundwater level monitoring network is provided in **Appendix E, Monitoring Network**.
2. Establish the Measurable Objectives to maintain long-term average groundwater levels at or above 2009 groundwater levels. The 2009 groundwater levels were derived using hydrographs of water level data for seven of the nine Key Wells. The remaining two wells, 03S04E04P001S (4P01) and 03S05E15R001S (15R01), were selected to provide spatial coverage within the MCSB. Unlike the other Key Wells, these two wells have limited groundwater monitoring histories that do not extend back to 2009. Measurable Objectives for these two wells, therefore, were established based on the 2009 groundwater levels estimated by the calibrated groundwater model for the well

locations. As a result, the Measurable Objectives for these two Key Wells are considered provisional and subject to modification based on future additional monitoring data.

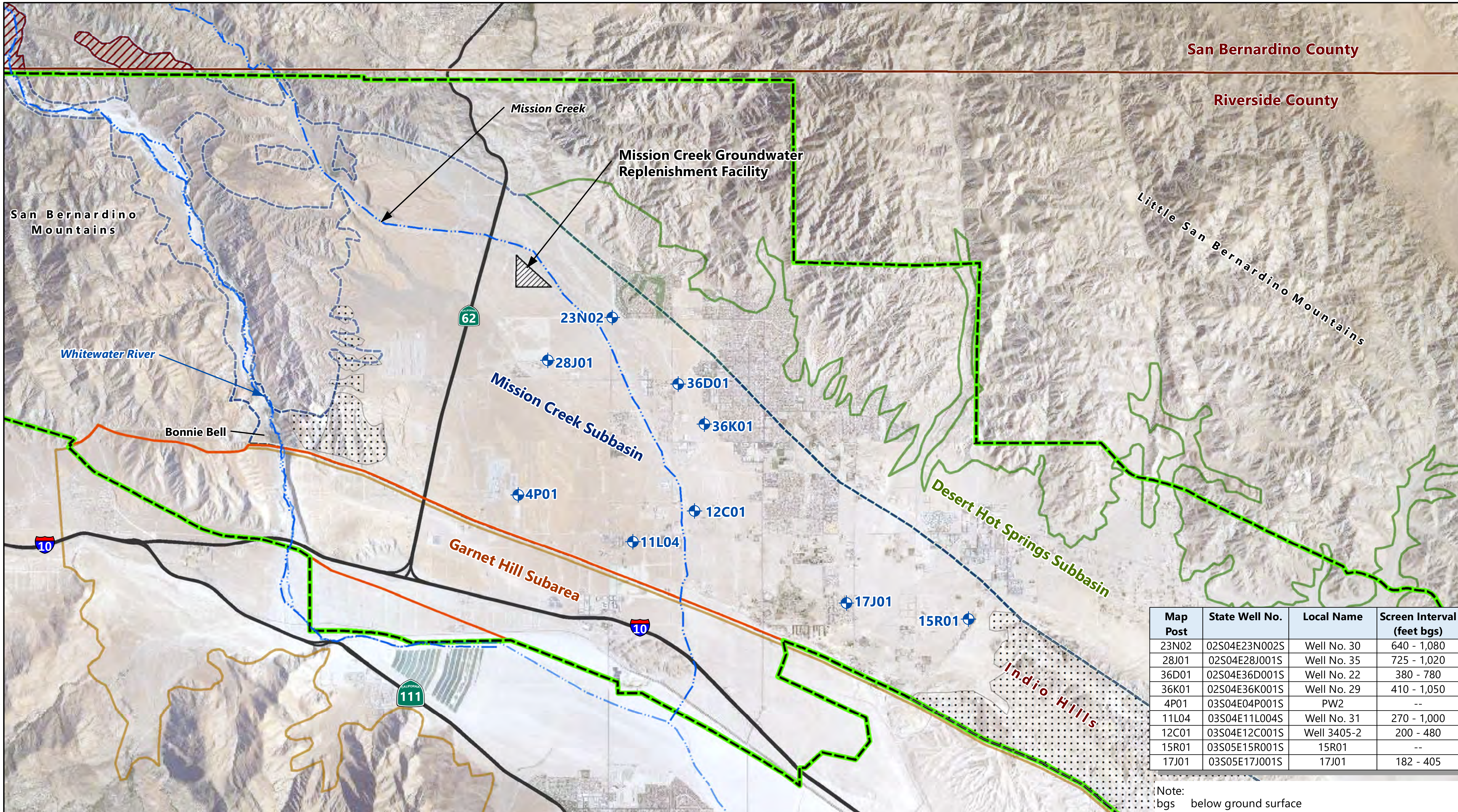
3. For each Key Well, establish a slightly lower groundwater elevation than the Measurable Objective (i.e., below the 2009 groundwater levels) to allow for Agency operational flexibility. This value represents the Minimum Threshold for each Key Well. Several potential options were considered for determining the magnitude of this operational flexibility. Groundwater level variability was considered an important factor as discussed in the next step.

4. Use groundwater level variability for each Key Well to determine its slightly lower Minimum Threshold. The variability was calculated using one standard deviation of the groundwater level measurements over the period from 2002 to 2019. This period represents the start of imported water recharge through the period evaluated for this Alternative Plan update (i.e., through the end of 2019). **Table 6-3** shows the historical groundwater level maximum, minimum, and standard deviation for each Key Well. Standard deviations ranged from 2.5 feet at well 04P01 to 16.3 feet in well 02S04E23N002 (23N02). The well with the greatest standard deviation, well 23N02, is located near the MC-GRF and has had relatively large groundwater fluctuations due the variable amounts and timing of groundwater recharge over the period considered. For each well other than well 4P01, the calculated standard deviation was subtracted from the Measurable Objective to establish the Minimum Threshold. For well 4P01, historical data were limited to 2017 through 2019 and were therefore, not sufficient to provide an estimate of historical variability. For this well, the average of the standard deviations for all the other Key Wells (7.9 feet) was used. **Table 6-4** presents the Measurable Objective and Minimum Threshold for each of the Key Wells. **Table 6-4** also includes the historical low groundwater elevation in each Key Well and indicates the depth of each Minimum Threshold below the historical low groundwater level for the well. The depths of the Minimum Thresholds below historical low groundwater levels range from 3 feet to 10 feet.[18]

   Measurable Objectives and Minimum Thresholds for wells 4P01 and 15R01 are provisional as described above in step 2. If groundwater levels drop below the provisional Minimum Threshold in either of these wells, the Measurable Objective and Minimum Threshold will be reevaluated as more data are collected at these wells. An example hydrograph showing the Measurable Objective and Minimum Threshold for Key Well 12C01 is shown on **Figure 6-3**. **Figure 6-4** shows the hydrograph for each Key Well along with its Measurable Objective and Minimum Threshold.

,

[18] This range is less than the range in depths below 2009 groundwater levels because Key Wells near the MC-GRF had historical low groundwater elevations prior to 2009 and these same wells had higher groundwater fluctuations due to proximity to the MC-GRF.



Map Post	State Well No.	Local Name	Screen Interval (feet bgs)
23N02	02S04E23N002S	Well No. 30	640 - 1,080
28J01	02S04E28J001S	Well No. 35	725 - 1,020
36D01	02S04E36D001S	Well No. 22	380 - 780
36K01	02S04E36K001S	Well No. 29	410 - 1,050
4P01	03S04E04P001S	PW2	--
11L04	03S04E11L004S	Well No. 31	270 - 1,000
12C01	03S04E12C001S	Well 3405-2	200 - 480
15R01	03S05E15R001S	15R01	--
17J01	03S05E17J001S	17J01	182 - 405

Note:
bgs below ground surface

Explanation

- Monitoring well (Key Well)
- Facility
- Planning Area
- Streams
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet Hill Subarea of Indio Subbasin
- Low permeability/non-water bearing sediments/bedrock
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin

0 4,000 8,000
Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

KEY WELLS FOR
SUSTAINABILITY INDICATOR MONITORING
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: pah/jrw | Date: 9/8/2021 | Project No.: CM19167351

wood.

Figure 6-2

Date: 9/8/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternative)\Esri\Alternative Update\6-2_Key_Well_Sustain_Mon.mxd

Table 6-2: Key Wells

Key Well	Local Name	Map Name	Rationale for Selection as a Key Well
02S04E23N002S	Well No. 30	23N02	Long monitoring history. Northern portion of northwestern subbasin
02S04E28J001S	Well No. 35	28J01	Spatial coverage of northwestern subbasin
02S04E36D001S	Well No. 22	36D01	Long monitoring history. North central portion of the subbasin
02S04E36K001S	Well No. 29	36K01	Long monitoring history. North central portion of subbasin
03S04E04P001S	PW2	4P01	Spatial coverage of south portion of northwestern subbasin
03S04E11L004S	Well No. 31	11L04	South central part of the main subbasin
03S04E12C001S	Well 3405-2	12C01	Long monitoring history. Near the center of the main subbasin
03S05E15R001S	Desert Springs Aquaculture Inc.	15R01	Southern end of the main subbasin
03S05E17J001S	Seven Palms	17J01	Long monitoring history. South central part of the main subbasin

Table 6-3: Key Wells - Water Level Statistics 2002 to 2019

Key Well	Local Name	Map Name	Minimum (feet msl)	Maximum (feet msl)	Average (feet msl)	Standard Deviation (feet msl)
02S04E23N002S	Well No. 30	23N02	701	758	725	16.3
02S04E28J001S	Well No. 35	28J01	708	740	725	9.2
02S04E36D001S	Well No. 22	36D01	693	726	710	11.5
02S04E36K001S	Well No. 29	36K01	685	710	699	7.3
03S04E04P001S	PW2	4P01	730	741	734	2.5
03S04E11L004S	Well No. 31	11L04	701	725	713	7.5
03S04E12C001S	Well 3405-2	12C01	689	712	698	6.7
03S05E15R001S	15R01	15R01	695	706	701	6.7
03S05E17J001S	17J01	17J01	689	706	697	3.7
Average Standard Deviation of Key Wells					7.9	

msl = Mean sea level.

Table 6-4: Key Wells – Groundwater Level Measurable Objectives and Minimum Thresholds

Key Well	Local Name	Map Name	Measurable Objective (MO)/ 2009 Levels[1] (feet msl)	Minimum Threshold (MT)[2] (feet msl)	Historical Low Groundwater Elevation (feet msl)[3]	MT Depth Below Historical Low Groundwater Level (feet)
02S04E23N002S	Well No. 30	23N02	711	695	701	6
02S04E28J001S	Well No. 35	28J01	710	700	708	8
02S04E36D001S	Well No. 22	36D01	695	683	693	10
02S04E36K001S	Well No. 29	36K01	686	679	685	6
03S04E04P001S[4]	PW2	4P01	727	719	727	8
03S04E11L004S	Well No. 31	11L04	701	694	701	7
03S04E12C001S	Well 3405-2	12C01	690	683	689	6
03S05E15R001S[4]	15R01	15R01	698	691	695	3
03S05E17J001S	17J01	17J01	690	686	689	3
		Average	701	692	699	6

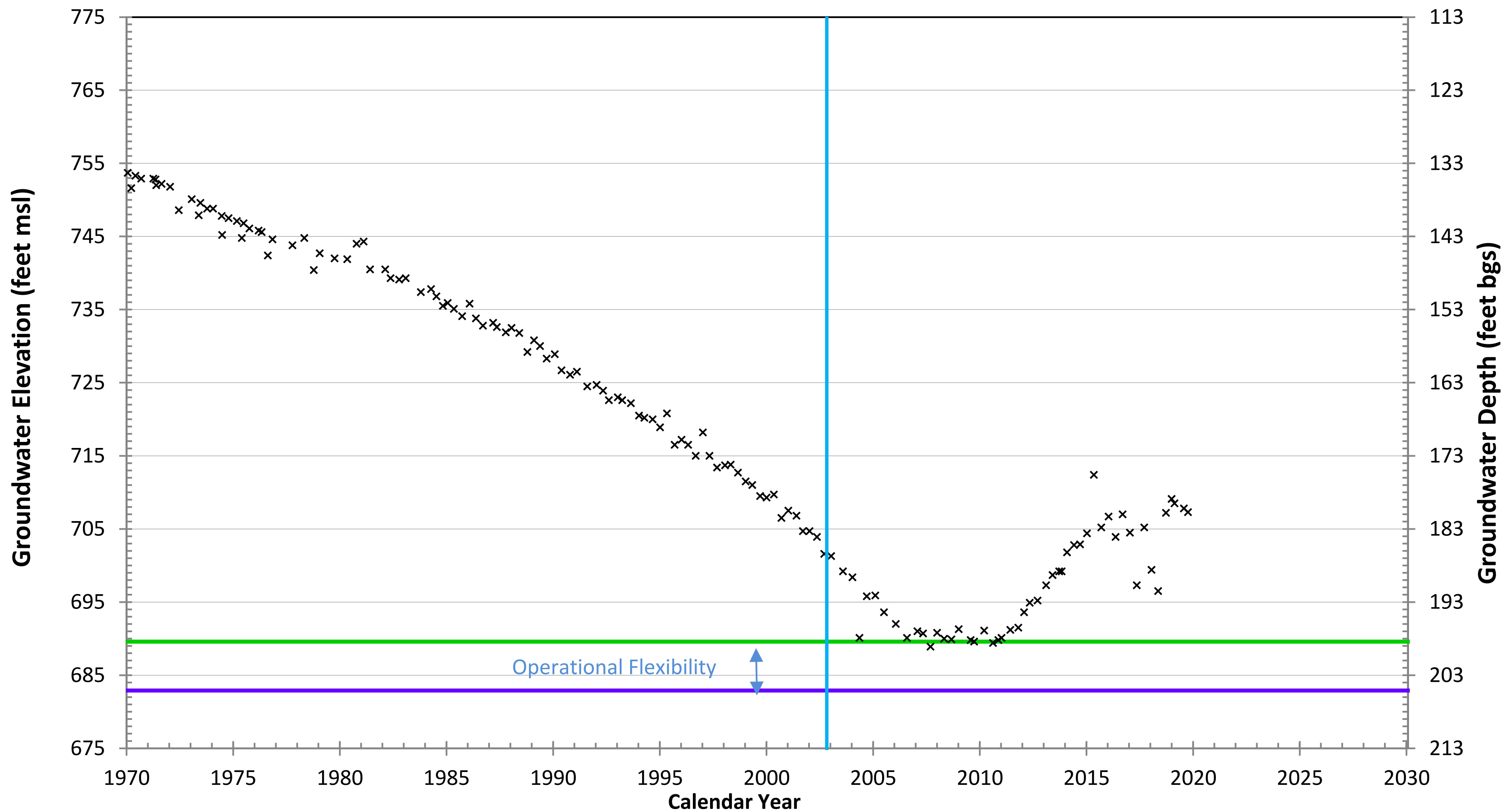
1. Measurable Objective (MO) is based on the minimum groundwater level at the well in 2009 or estimated groundwater level in 2009 (see note 3). Values are rounded to the nearest foot.

2. Minimum Threshold (MT) is based on the Measurable Objective minus the standard deviation of water levels at that well between 2002 and 2019 (see **Table 6-3**). Values are rounded to the nearest foot.

3. Historical low groundwater elevation based on available measured groundwater level data except for well PW2 that has a limited water level data. The historical low groundwater elevation for PW2 was estimated at the low 2009 level using the groundwater model.

4. Wells 4P01 and 15R01 have limited groundwater monitoring histories that do not extend back to 2009 water level conditions. The Measurable Objective for these wells was derived using groundwater model simulation fit to the available data and extracting the minimum simulated groundwater level in 2009. These Measurable Objectives are considered provisional and may be adjusted based on groundwater level response in these wells relative to other wells in the basin.

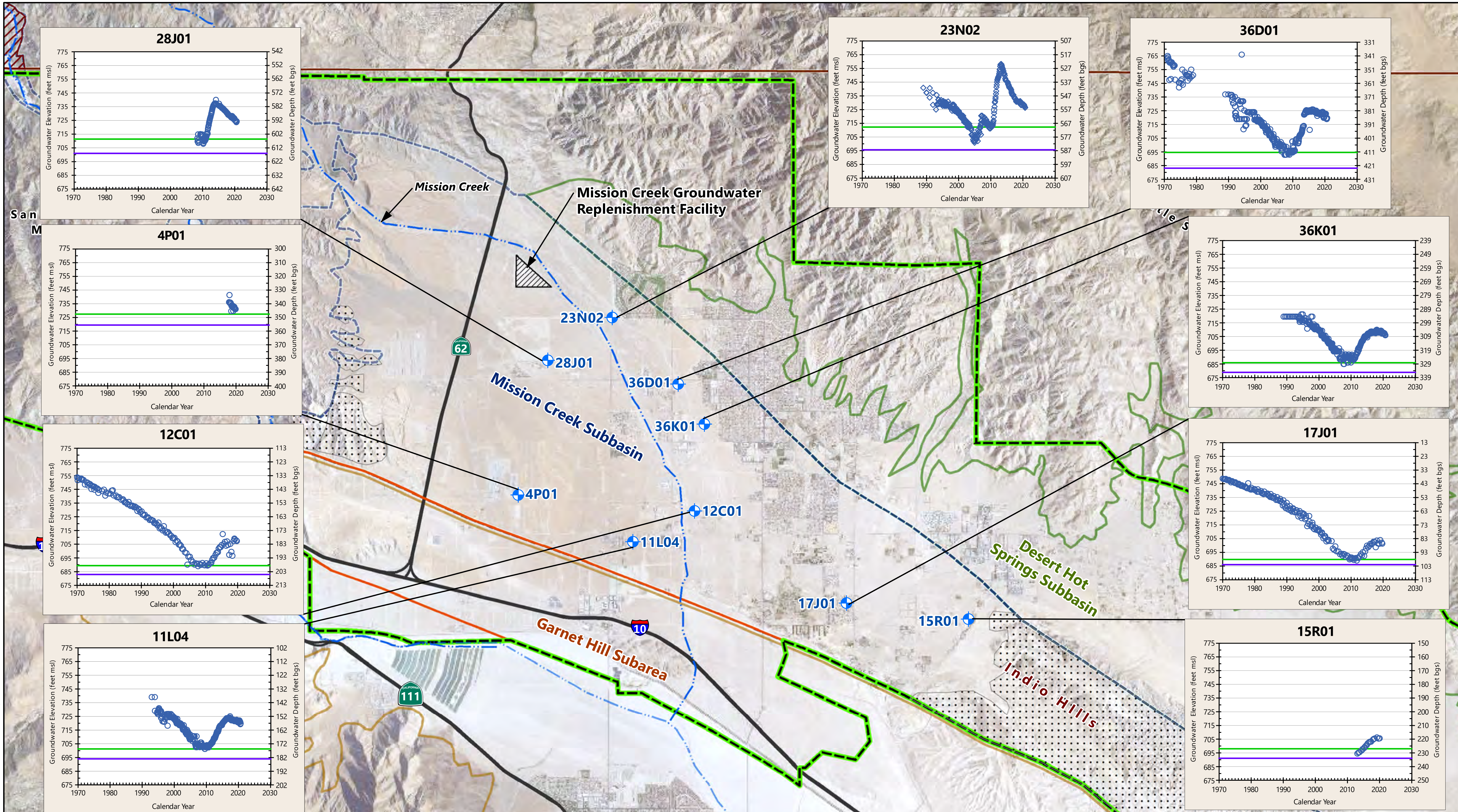
msl = mean sea level.



Abbreviations:
bgs = below ground surface
msl = mean sea level

MINIMUM THRESHOLD AND MEASURABLE OBJECTIVE
KEY WELL 12C01
Mission Creek Alternative Update
Coachella Valley, California

By: grr	Date: 10/18/2021	Project No.: CM19167351
wood.		Figure 6-3



Explanation

- Monitoring well (Key Well)
- Groundwater Replenishment Facility
- Planning Area
- Streams
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet Hill Subarea of Indio Subbasin
- Low permeability/non-water bearing sediments/bedrock
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin
- Groundwater elevation/depth
- Measurable objective
- Minimum threshold
- bgs Below ground surface
- msl Mean sea level

0 4,000 8,000
Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

KEY WELLS WITH MINIMUM THRESHOLDS AND MEASURABLE OBJECTIVES
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: pah/jrw	Date: 9/8/2021	Project No.: CM19167351
wood.		Figure 6-4

Date: 9/8/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update\6-4_Key_Well_Min_Mon.mxd

5. Verify that groundwater levels represented by the Minimum Threshold will not result in significant and unreasonable conditions by comparing Minimum Thresholds to pump settings and other sustainability indicators as described in the subsections below.

6.3.2.1 Minimum Thresholds Impact on Water Supply Wells

Minimum Threshold values for the MCSB were evaluated in relation to known well pump depth settings in the subbasin. Minimum Threshold values need to be above pump settings so that if Minimum Threshold values are reached, a well pump will still be below the water level in the well and able to operate. For the review, the Agencies agreed that 50 feet of water above the pump setting under static conditions was a conservative metric to use for screening potential impacts to pumping.

Coachella Valley Water District (CVWD) and Mission Springs Water District (MSWD) provided known or estimated pump depth settings for their municipal supply wells and Desert Water Agency (DWA) provided estimates of pump settings in two private wells in DWA's area. This information was compared to the Minimum Thresholds for the Key Wells. Based on this review, the Minimum Threshold for only one well approached but did not drop below a level that the Agencies identified as necessary for pump operation.

Construction data for private wells in the MCSB are limited in the MCSB. No well construction information was available for any wells termed "minimal pumpers." However, there are no recorded instances of well performance issues reported to the Agencies at the time of historical low groundwater levels in 2009 or subsequent years. Minimum Thresholds are slightly below the historical low groundwater levels (ranging from 3 to 10 feet below historical groundwater levels). No impact to private wells is anticipated based on these Minimum Thresholds.

6.3.2.2 Relationship Between Minimum Thresholds and Other Sustainability Indicators

The relationship between groundwater level Minimum Thresholds and other Sustainability Indicators is described below.

Change in Groundwater Storage

The MCSB consists of a single aquifer laterally and vertically. Groundwater levels are directly related to groundwater storage for the subbasin. Minimum Thresholds for water levels that are slightly below 2009 groundwater levels will not result in a significant change in storage compared to 2009 and the MCSB is of sufficient size that this level of storage will not limit groundwater use.

Degraded Groundwater Quality

A significant and unreasonable condition for degraded water quality is water that does not meet regulatory limits for constituents of concern in production wells due to groundwater management actions. No water quality constituents currently exceed regulatory thresholds within the MCSB in drinking water supply wells. In addition, setting the Minimum Threshold for groundwater levels slightly below 2009 groundwater levels is not anticipated to modify groundwater flow patterns within the MCSB significantly from 2009 groundwater conditions.

Conceptually, underflow from the Desert Hot Springs Subbasin (DHSSB) to the MCSB should increase with increasing water level difference across the Mission Creek Fault, resulting in groundwater degradation to the MCSB from higher TDS water in the DHSSB. However, groundwater model results described in Section 5.7.3.1 indicate that the variability in natural recharge in the DHSSB has a greater influence on groundwater underflow across the fault than local declining groundwater levels in the MCSB. In addition, groundwater recharge activities at the MC-GRF appear to have reduced groundwater underflow across the fault. As a result, from 2013 to 2019, groundwater underflow across the Mission Creek Fault has been relatively stable, averaging approximately 1,140 acre-feet per year (AFY). This underflow is comparable to the average of approximately 1,090 AFY observed from 1985 to 1992 when groundwater level differences across the fault were about 50 feet lower in the southern part of the MCSB.
The more recent groundwater underflow across the fault is also well below the average of approximately 1,310 AFY that occurred from 2000 and 2010, due primarily to years of high natural recharge at the beginning of this period. Based on this analysis, continued groundwater recharge at the MC-GRF and average groundwater levels in the MCSB at or near 2009 levels will not result in unusually high groundwater underflows across the fault compared with pre-2009 groundwater levels. In addition, it is noted here that the mountain front recharge to the MCSB varies from 10 to nearly 67,000 AFY and averages approximately 9,400 AFY, whereas underflow across the Mission Creek Fault ranges from 1,060 to 1,700 AFY and averages approximately 1,230 AFY. The Mission Creek Fault underflow is only a small component of recharge to the MCSB and any incremental increase in groundwater underflow due to groundwater level differences across the fault is a small fraction of the total underflow. Therefore, no significant and unreasonable groundwater quality impacts are anticipated with groundwater levels in the MCSB maintained at or slightly below 2009 groundwater levels.

Subsidence

A significant and unreasonable condition for subsidence is any measurable long-term inelastic subsidence that is caused by lowering of groundwater elevations and damages existing infrastructure. Subsidence may be caused by depressurization or dewatering of saturated sediments through lowering of groundwater levels. The groundwater level Minimum Thresholds are set slightly below historical low groundwater levels (10 feet or less). Because there was no evidence of subsidence during historical low groundwater levels, Minimum Threshold groundwater levels are not anticipated to result in significant and unreasonable subsidence if they were to occur.

6.3.2.3 Effect of Minimum Thresholds on Neighboring Subbasins/Subareas

The anticipated effect of groundwater level Minimum Thresholds on each of the neighboring subbasins is addressed below.

Desert Hot Springs Subbasin

DHSSB is separated from the MCSB by the Mission Creek Fault. Groundwater levels are more than 150 feet higher on the DHSSB side of the fault and no groundwater flows out of the MCSB into the DHSSB. Lowering groundwater in the MCSB to slightly below 2009 groundwater levels will have a slight impact on groundwater underflows across the Mission Creek Fault but as discussed above for groundwater quality, the impact of this additional underflow is minimal in context of the overall variability underflow, reduction in underflow due to recharge at the MC-GRF, and the quantity of this underflow compared to natural recharge.

Indio Subbasin

The MCSB is separated from the Indio Subbasin by the Banning Fault. Groundwater levels are more than 100 feet lower on the Indio Subbasin side of the fault and therefore groundwater flows from the MCSB to the Indio Subbasin. This flow primarily occurs via the GHSA of the Indio Subbasin. Conceptually, groundwater flow across the Banning Fault will decrease if the difference in groundwater levels across the fault decreases. Results of groundwater modeling indicate that the difference in flow from the MCSB to the GHSA resulting from decreasing water levels in the MCSB is relatively small compared with other inflows to the GHSA (see Section 5). Therefore, Minimum Thresholds for groundwater levels in the MCSB will have no significant effect on conditions in the GHSA.

6.3.2.4 Measurement of Minimum Thresholds

Groundwater levels will be monitored at each Key Well and documented as part of the SGMA annual report sustainable management criteria review. Key Well data and other monitoring data will be used to prepare contour maps to show groundwater levels in the MCSB where data are sufficient to contour.

6.3.3 Measurable Objectives

The Measurable Objectives for groundwater levels in the MCSB are set to maintain groundwater levels at or above conditions observed in 2009. The Measurable Objective for each Key Well is listed in **Table 6-4**. An example hydrograph showing the Measurable Objective and Minimum Threshold for Key Well 12C01 is shown on **Figure 6-3**. The Measurable Objectives for all the Key Wells are shown on **Figure 6-4**. Additional discussion of Measurable Objectives and Minimum Thresholds in context of the groundwater levels forecast using the calibrated groundwater model are provided in **Appendix B** and in Section 7.

6.3.4 Undesirable Results

The criteria for defining undesirable results of lowering groundwater levels are based on groundwater level Minimum Threshold exceedances. For the MCSB, the groundwater level undesirable result occurs when groundwater levels decline below the Minimum Threshold in at least four of nine (approximately 45%)[19] Key Wells over a consecutive three-year period. The four or more wells would need to maintain their levels below the Minimum Threshold for the three-year period, thus indicating Minimum Thresholds had been exceeded over a large consistent area for a sustained period. Groundwater level data will be compared with the Minimum Thresholds each year as part of the SGMA annual report submittal.

---

[19] As noted in **Table 6-4**, two of the Key Wells (4P01 and 15R01) have limited groundwater monitoring histories that do not extend back to 2009 groundwater level conditions. The Minimum Thresholds and Measurable Objectives for these wells are considered provisional and subject to change based on how groundwater levels in these wells compare with regional groundwater levels.

Groundwater levels exceeding the Minimum Thresholds would trigger actions and measures such as mandatory water conservation measures, purchase of water for import and recharge, increasing recharge of State Water Project (SWP) allocations at MC-GRF, and/or others as needed. Based on the current forecast of groundwater levels described in Section 7 and under the Planned Project and Management Actions described in Section 8, groundwater levels are not expected to approach Minimum Thresholds at any time during the planning horizon (through 2045).

6.4 Reduction in Groundwater Storage

The storage capacity of the MCSB has been estimated at 2,600,000 acre-feet (AF) (CDWR, 1964). The storage capacity is based on the thickness and lateral extent of alluvial sediments that extend to depths as great as 3,000 feet below ground surface in the MCSB (GCI, 1979). Available groundwater in storage, however, is limited by the level to which groundwater levels may be lowered without causing undesirable results. This level has been established as the Minimum Threshold groundwater levels discussed in Section 6.3.

6.4.1 Significant and Unreasonable Reduction in Groundwater Storage Conditions

Significant and unreasonable groundwater storage conditions were selected for the MCSB based on meetings and discussions with the Agencies, review of hydrogeology, and historical changes in storage. Significant and unreasonable reduction in groundwater storage in the MCSB is that which:

- Leads to long-term reduction in groundwater storage.
- Contributes to significant and unreasonable conditions for other Sustainability Indicators.

6.4.2 Minimum Thresholds

As previously mentioned, groundwater storage in the MCSB is related to regional groundwater levels. Because the MCSB is managed as one hydrogeologic unit both laterally and vertically, average groundwater levels may be used as a proxy for groundwater storage in the MCSB. This level has been established at the groundwater level Minimum Thresholds discussed above. If the groundwater level in the basin is maintained at or above the Minimum Threshold for the Key Wells, there will be sufficient groundwater in storage to meet the needs of beneficial uses and users in the MCSB without causing significant and unreasonable undesirable results. To provide operational flexibility, water levels in some Key Wells may drop below the Minimum Threshold while others stay above the Minimum Threshold and the overall average water level of all Key Wells is at or above the average of their Minimum Threshold levels. Therefore, the Minimum Threshold for groundwater storage Sustainable Management Criteria is to maintain the average groundwater elevation in the nine Key Wells at or above the average of the Minimum Threshold groundwater levels for the nine Key Wells (692 feet msl, as shown in **Table 6-4**).

6.4.2.1 Effect of Minimum Thresholds on Beneficial Uses and Users

Groundwater storage is related to regional groundwater levels and the effect of Minimum Thresholds on beneficial uses and users is the same as discussed for lowering groundwater levels.

6.4.2.2 Effect of Minimum Thresholds on Neighboring Subbasins/ Subareas

Groundwater storage is related to regional groundwater levels and the effect of Minimum Thresholds on neighboring subbasins/subareas is the same as discussed for lowering groundwater levels.

6.4.2.3 Relationship Between Minimum Thresholds and Other Sustainability Indicators

Groundwater storage is related to regional groundwater levels and the effect of Minimum Thresholds on other Sustainability Indicators is the same as discussed for lowering groundwater levels.

6.4.2.4 Measurement of Minimum Thresholds

At any time, water levels in one part of the MCSB may increase while water levels in other portions of the subbasin may decrease. Reduction in groundwater storage, therefore, should consider the subbasin as a whole. Any reduction in groundwater storage is related to groundwater levels at the Key Wells and because the Key Wells are spatially distributed in the MCSB, water level changes in all the Key Wells may be used to estimate the change in groundwater storage. Groundwater levels for the nine Key Wells will be averaged and compared with the average Minimum Threshold of 692 feet msl (**Table 6-4**), which is representative of groundwater levels that are slightly below the 2009 groundwater levels. By using the average, an overall reduction in groundwater storage for the subbasin can be considered and compared to the Minimum Threshold. Water level measurements and comparisons with the Minimum Thresholds will be presented in the SGMA Annual Reports.

6.4.3 Measurable Objectives

Available groundwater storage in the MCSB is fundamentally tied to groundwater levels in the MCSB. The Measurable Objective for groundwater storage is based on 2009 groundwater conditions as measured and compared to historical levels at the nine Key Wells.

6.4.4 Undesirable Results

The criteria for defining the groundwater storage reduction undesirable result are the volume of groundwater that can be withdrawn from the subbasin based on measurements from multiple areas without leading to undesirable results. For the MCSB, measured groundwater levels in the nine Key Wells will be used as a proxy representative for storage in the subbasin. The groundwater storage reduction undesirable result is groundwater levels in the nine Key Wells are measured below the average groundwater level Minimum Threshold of 692 feet msl for three consecutive years.

6.5 Land Subsidence

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. Although several different earth processes can cause subsidence, more than 80 percent of the subsidence in the United States is related to the withdrawal of groundwater (Galloway and others, 1999). Groundwater level related land subsidence occurs when groundwater is withdrawn from an aquifer and causes the loss of pore space and compaction of sediments, that in turn, results in the lowering of the ground surface overlying the aquifer. Compaction of sediments at depth is the primary cause of this type of land subsidence. Consequently, it is more likely to occur where compactible fine-grained sediments (clay, clayey silt, and silty clay mixtures) are present. Subsidence resulting from groundwater withdrawal can be elastic or inelastic. Inelastic subsidence is permanent. Elastic subsidence is the small, reversible lowering and rising of the ground surface resulting from groundwater level fluctuations. The Sustainable Management Criteria for subsidence only concerns inelastic (permanent) subsidence.

Land subsidence has the potential to cause damage to infrastructure which could result in hazards to public health and safety. Examples of infrastructure that have the potential to be impacted by subsidence include pipelines, bridges, private and public property, streets and highways, stormwater conveyance facilities, utility infrastructure, and groundwater wells.

Land subsidence may also result in a permanent loss of groundwater storage capacity if dewatering of an aquifer results in compression of sediments. Compaction of sediments permanently reduces the size and amount of pore spaces where water occurs in an aquifer, thus reducing overall aquifer storage capacity.

Neither subsidence nor impacts to structures potentially caused by subsidence have been identified historically in the MCSB. Geologic conditions of generally coarse-grained sediments and lack of thick, laterally extensive fine-grained sediments in the MCSB aquifer reduce the likelihood of subsidence.

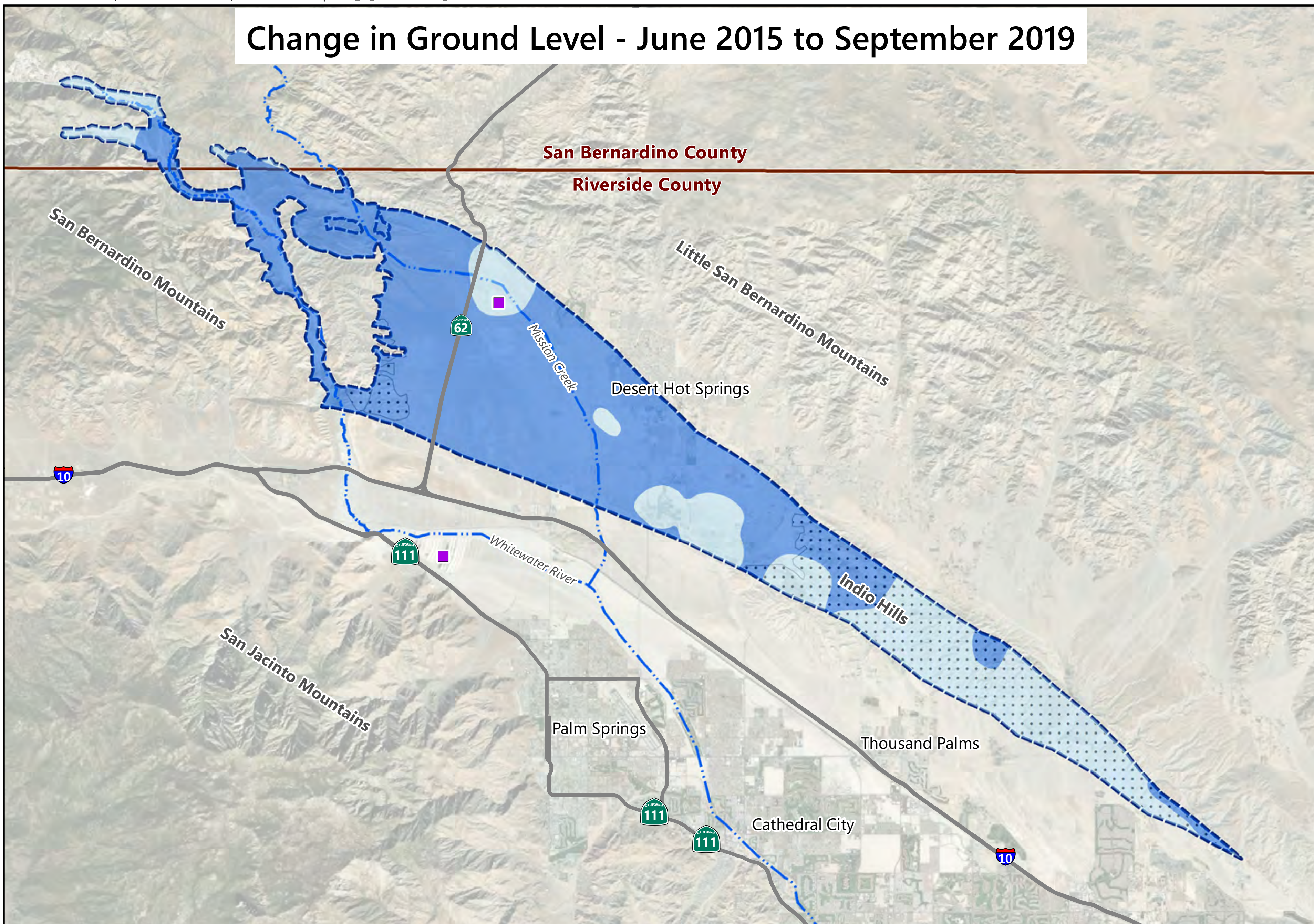
Figure 6-5 shows ground level displacement monitoring using Interferometric Synthetic Aperture Radar (InSAR) data available from CDWR for the full length of the approximately four-year monitoring period available for this technology (June 2015 to September 2019) and for the most recent annual record of vertical ground level displacement (October 2018 to September 2019). The light blue areas on the figure are areas where the ground surface elevation decreased during the monitoring period. Dark blue areas on the figure are areas where ground surface elevation increased during the monitoring period.

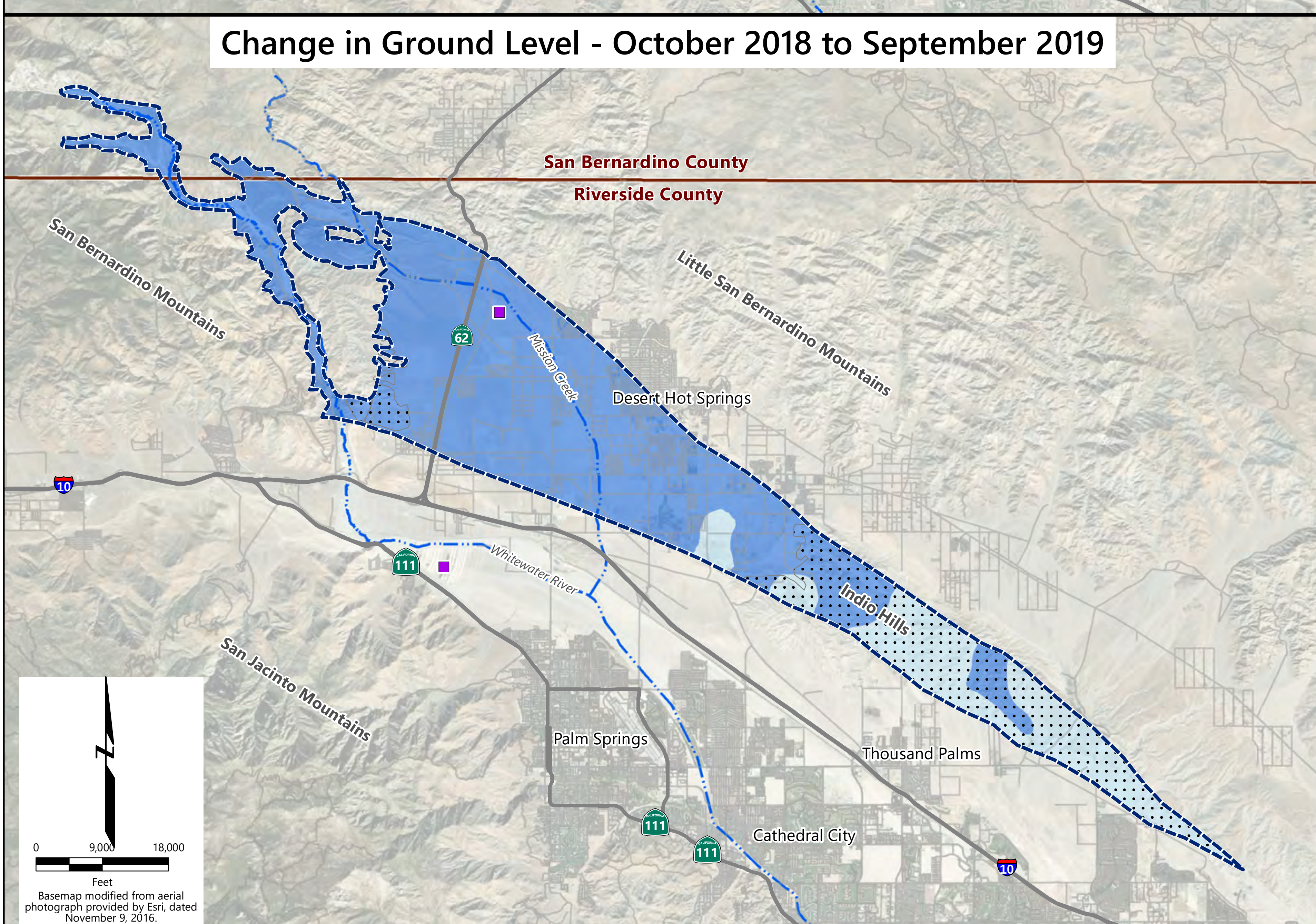
Based on the relatively small magnitude of downward vertical ground level change (less than 0.25 feet) and no clear trend of increasing vertical downward displacement over the period of monitoring, permanent land subsidence attributed to groundwater withdrawal is not apparent in the MCSB (Wood, 2021). This monitoring occurred over a period where groundwater levels were relatively stable and well above historical low groundwater levels. Subsidence is more likely to be observed, however, under conditions of continued lowering of groundwater levels below historical groundwater levels.

6.5.1 Significant and Unreasonable Subsidence Conditions

Significant and unreasonable subsidence conditions were defined for the MCSB based on discussions with the Agencies, review of hydrogeology, and historical change in storage. Significant and unreasonable subsidence in the MCSB is subsidence that results in any inelastic land subsidence that significantly impacts infrastructure and is caused by lowering of groundwater elevations occurring in the MCSB.

Date: 9/8/2021 Printed by: pat.herring
Path: Y:\CM19167351 (Mission Creek Alternate)\Esri\Alternative Update_tb_WY2015-2019_Subsidence.mxd





Explanation

- Groundwater Replenishment Facility
- Streams
- Highway/road
- Mission Creek Subbasin
- Low permeability/non-water bearing sediments/bedrock

Vertical Displacement (feet)

- -0.25 to 0
- 0 to 0.25

Source: Wood, 2021.

CHANGE IN GROUND LEVEL
2015 to 2019
Mission Creek Subbasin Alternative Update
Coachella, California

By: mww/pah | Date: 9/8/2021 | Project No.: CM19167351

wood.

Figure 6-5

6.5.2 Minimum Thresholds

Although InSAR data available from CDWR suggests that no subsidence has occurred in the MCSB, the resolution of the data is coarse, and the data are for a period of stable groundwater levels. A specific study on the potential for or measurement of subsidence has yet to be conducted in the MCSB.

To further consider the potential for subsidence, CVWD, in collaboration with the other Agencies, has engaged the United States Geological Survey (USGS) to study land subsidence in the MCSB. The USGS and CVWD have cooperatively investigated land subsidence in the Coachella Valley since 1996 but this work has focused on the Indio Subbasin. The proposed work will continue efforts in the Indio Subbasin but also include the MCSB. The objectives of the study in the MCSB are to:

1. Assess land-surface elevations during the period 2015–2021 using available InSAR or other survey data,
2. Develop a subsidence monitoring plan,
3. Detect and quantify land subsidence as stipulated in the monitoring plan, and
4. Evaluate the relation between changes in land-surface elevation and groundwater levels at selected sites.

This effort will include maps showing relative ground-elevation change over time for the period 2017 to 2023. Depending on the assessment of potential subsidence in the MCSB, the effort may also include the installation of ground level survey monuments in the unconsolidated sediments area of the MCSB and monitoring of these survey monuments beginning in 2022. The USGS will document the results of their evaluation by June 30, 2025, although preliminary data from the evaluation will be available earlier than the final publication. Additional information on the USGS subsidence assessment and monitoring program is provided in **Appendix E**.

The Agencies will await the findings of the USGS study to evaluate if subsidence has occurred in the MCSB and is likely to continue to occur.

Considering that the results of the USGS study will not be available until approximately 2025, the evaluation will be included in the next Alternative Plan Update, scheduled for January 1, 2027. In the meantime, groundwater levels will be considered as a proxy indicator of the potential for subsidence. Groundwater levels are well above historical lows, and subsidence is unlikely to occur if groundwater levels remain above historical low levels. Because subsidence was not observed or known to occur when groundwater levels in MCSB were at historical lows and considering that Minimum Thresholds for groundwater levels are only slightly (between 3 and 10 feet) lower than historic groundwater levels, subsidence is not anticipated even if Minimum Thresholds for groundwater levels are reached.

6.5.2.1 Effect of Minimum Thresholds on Beneficial Uses and Users

The subsidence Minimum Threshold is set to prevent any long-term inelastic subsidence that could harm infrastructure. Available information indicates that subsidence has not occurred in the MCSB. Therefore, there is no negative impact on any beneficial user.

6.5.2.2 Effect of Minimum Thresholds on Neighboring Subbasins/Subareas

The anticipated effect of subsidence Minimum Thresholds on the neighboring subbasins is discussed below.

Desert Hot Springs Subbasin

No evidence of subsidence has been reported in the DHSSB. The Minimum Thresholds for subsidence in the MCSB are not anticipated to impact the DHSSB.

Indio Subbasin

No evidence of subsidence has been reported in the GHSA of the Indio Subbasin. The Minimum Thresholds for subsidence in the MCSB are not anticipated to impact the GHSA.

6.5.2.3 Relationship Between Minimum Thresholds and Other Sustainability Indicators

Subsidence Minimum Thresholds have little or no impact on other Minimum Thresholds, as described below.

Chronic Lowering of Groundwater

Subsidence Minimum Thresholds will not result in significant and unreasonable lowering of groundwater levels.

Reduction in Groundwater Storage

Subsidence has the potential to reduce groundwater storage through compaction of aquifer materials. Compaction primarily occurs in fine-grained sediments which are limited in thickness and areal extent in the MCSB. Therefore, any loss of groundwater storage in the MCSB due to subsidence would be negligible.

Degraded Water Quality

The subsidence Minimum Thresholds will not change the groundwater flow directions or flow rates across groundwater barriers, and therefore, and will not result in a significant and unreasonable change in groundwater quality.

6.5.2.4 Measurement of Minimum Thresholds

If the USGS study determines that the MCSB unconsolidated sediments are susceptible to subsidence, the USGS will install survey monuments to monitor for subsidence with the monitoring beginning in 2022. In the interim, groundwater levels and CDWR InSAR data will be used as indicators to monitor for the potential that inelastic subsidence may occur (groundwater levels) or is occurring (CDWR InSAR data). Measurement of Minimum Thresholds for subsidence will be documented as part of the SGMA Annual Report.

6.5.3 Measurable Objectives

The Agencies will await the findings of the USGS work to evaluate Measurable Objectives for subsidence in the MCSB. In the interim, the Measurable Objective is set identical to the Minimum Threshold.

6.5.4 Undesirable Results

The Agencies will await the findings of the USGS work to define the undesirable results for subsidence in the MCSB. Based on the USGS schedule to complete the work, the definition of undesirable results will be included in the next Alternative Plan Update scheduled for January 1, 2027. In the interim, undesirable results for subsidence are most likely to occur with widespread and persistent lowering of groundwater levels below historical groundwater levels. Therefore, the undesirable result of lowering of groundwater levels will be used as the undesirable results for subsidence; that is when groundwater levels decline below the groundwater level Minimum Threshold in at least four of nine Key Wells over a consecutive three-year period.

6.6 Degraded Groundwater Quality

Groundwater quality conditions in the MCSB are described in Section 4.5. Arsenic, fluoride, uranium, and hexavalent chromium,[20] were assessed as potential constituents of concern (COCs) in the MCSB based on their natural occurrence at elevated concentrations in some parts of the Coachella Valley Groundwater Basin. Except for uranium, none of these COCs exceeded their respective California drinking water maximum contaminant levels (MCLs) in a water supply wells in the last five years. Of these naturally occurring constituents, only uranium is considered a COC in the MCSB based on concentrations historically observed in drinking water supply wells. Nitrate is also considered a COC based on ongoing sources for this constituent as described in Section 6.6.2.1. TDS was identified as a constituent that requires additional evaluation as described in Section 6.6.2.2.

6.6.1 Significant and Unreasonable Degraded Groundwater Quality

Significant and unreasonable degraded groundwater quality conditions were defined for the MCSB based on meetings and discussions with the Agencies, review of the Hydrogeologic Conceptual Model, and historical groundwater quality data. Significant and unreasonable changes in groundwater quality in the MCSB are increases in a chemical constituent that:

- Result in chemical constituent concentrations in a drinking water supply well above the constituent's established primary MCL.
- Result in exceedances of numeric objectives established in the Salt and Nutrient Management Plan for the Coachella Valley Groundwater Basin (CV-SNMP) Update (in progress).

[20] Although there is no current MCL for hexavalent chromium other than as a component of the MCL for total chromium, the California State Water Resources Control Board (SWRCB) is in the process of evaluating the economic feasibility of setting an MCL for hexavalent chromium (SWRCB, 2020). Hexavalent chromium was included in the review based on the potential for a future MCL for this constituent.

6.6.2 Minimum Thresholds

Minimum Thresholds for groundwater quality are separated into two different categories: COC constituents with primary MCLs and TDS that does not have a primary MCL but has three Secondary Maximum Contaminant Levels (SMCLs), or Consumer Acceptance Contaminant Level Ranges, set by the State Water Resources Control Board (SWRCB).

6.6.2.1 Constituents of Concern with Primary Maximum Contaminant Levels

Uranium is considered a COC because it has historically exceeded its MCL in a drinking water supply well in the MCSB. Nitrate is considered a COC based on ongoing sources for this constituent, including wastewater infiltration to the groundwater system (through septic systems and disposal of treated wastewater effluent), and fertilizer application at golf courses. Nitrate has not exceeded its MCL in any municipal supply well.

Table 6-5 summarizes the number of water supply wells sampled for COCs with primary MCLs, the number of exceedances for the MCL (none for all COCs) from 2015 to 2020, and the Minimum Thresholds for COCs based on their MCLs.

The monitoring network for COCs with primary MCLs will be the monitoring conducted by the Agencies for municipal water supply well reporting. It will be similar to the historical groundwater monitoring network described in Section 4.5 and augmented with the CV-SNMP groundwater monitoring of water supply wells. In addition, the reporting will include any additional sampling conducted for water supply wells or for contaminant plumes, should any contaminant plumes be identified during the annual review.

Table 6-5: Minimum Thresholds for Groundwater Quality – COCs with MCLs

Constituent of Concern (COC)	Maximum Contaminant Level (MCL)/ Minimum Threshold	Standard Units	Number of Wells Sampled for COC from 2015 - 2020	Number of Wells Exceeding MCL from 2015 - 2020
Uranium	20	pCi/L	10	0
Nitrate (N)	10	mg/L	17	0

mg/L = milligrams per liter.

Nitrate (N) = nitrate as nitrogen.

pCi/L = picocuries per liter.

6.6.2.2 Total Dissolved Solids

Sources of TDS in the MCSB include general groundwater for irrigation that is subject to evaporation, wastewater infiltration to the groundwater system (through septic systems and disposal of treated wastewater effluent), fertilizer application at golf courses, and recharge of Colorado River Aqueduct (CRA) water at the MC-GRF.

TDS has three SMCLs, or Consumer Acceptance Contaminant Level Ranges, set by the SWRCB: a recommended 500 milligrams per liter (mg/L) level, an upper 1,000 mg/L level, and a short-term 1,500 mg/L limit for rare circumstances. While primary MCLs are health-based standards, SMCLs, such as those for TDS, are based on aesthetic concerns (e.g., taste, color, and odor). TDS has exceeded the recommended 500 mg/L-level in some wells in the MCSB but has not exceeded the 1,000 mg/L upper level in any municipal supply well in the MCSB.

As suggested by CDWR Staff, to address groundwater quality degradation that could result from the accumulation of salt in the MCSB, the Agencies are working toward a Colorado River Basin Regional Water Quality Control Board (RWQCB) approved CV-SNMP. The objective of the CV-SNMP is to sustainably manage salt and nutrient loading in the Coachella Valley Groundwater Basin in a manner that protects its beneficial uses. When completed, the CV-SNMP will effectively provide the basis for groundwater quality Sustainable Management Criteria for TDS in the MCSB. Based on the CV-SNMP schedule, the Sustainable Management Criteria for TDS will likely be established as part of the next Alternative Plan Update scheduled for completion by January 1, 2027.

The CV-SNMP Agencies, which include CVWD, DWA, MSWD, Coachella Sanitary District, Indio Water Authority, Myoma Dunes Mutual Water Company, Valley Sanitary District, and City of Palm Springs, agreed to develop a workplan to define a scope that would be used to update the 2015 CV-SNMP. One specific requirement of the agreement with RWQCB was the need for a separate workplan to establish a monitoring network for TDS/nitrate with sufficient spatial and vertical coverage for the CV-SNMP evaluation and include a data gap analyses for the monitoring network.

The CV-SNMP Agencies prepared a monitoring program workplan entitled "*Groundwater Monitoring Program Workplan for the Coachella Valley Salt and Nutrient Management Plan Update* (GMP Workplan, West Yost, 2020). The RWQCB approved this workplan in February 2021. Within the MCSB alone, 22 wells are identified for the monitoring program, including wells screened in the shallow and deep portions of the MCSB aquifer system. Although the MCSB aquifer system is considered a single aquifer system, stratification of water quality is likely to occur based on the shallow sources for nutrients and TDS. The GMP Workplan is described in greater detail in **Appendix E**, with a copy of the workplan included as an attachment to the appendix.

CV-SNMP Agencies have also prepared a workplan titled "*Workplan to Develop the Coachella Valley Salt and Nutrient Management Plan*" (Workplan, West Yost, 2021) that was submitted to the RWQCB in September 2021 and approved in October 2021. This workplan outlines the steps and schedule to update the CV-SNMP. The CV-SNMP will include numeric objectives for TDS concentrations in groundwater. The numeric objectives are intended to demonstrate that beneficial uses are protected, quantify the magnitude of available assimilative capacity for salt loading, provide a technical basis for the RWQCB to allocate the use of assimilative capacity, and establish triggers for implementation measures at appropriate locations and times.

Elements of the CV-SNMP that will address CDWR recommendations on the Alternative Plan Update (CDWR, 2019b) include:

- Groundwater quality forecasting using groundwater quality information gathered to develop the CV-SNMP and using the calibrated groundwater flow model developed for the MCSB that includes the DHSSB and GHSA of the Indio Subbasin.
- TDS antidegradation analyses will be conducted using the selected CV-SNMP scenario. This scenario will include all sources of TDS including recharge of Colorado River. This antidegradation analysis will identify the potential extent of impacts to beneficial uses and will demonstrate that any water quality degradation allowed by the CV-SNMP provides maximum benefit to the people of California.

Steps for completion of the CV-SNMP include:

- Characterize nitrate/TDS loading to the Coachella Valley groundwater subbasins including MCSB.
- Characterize current groundwater quality.
- Delineate draft management zones and describe metrics to characterize beneficial use protection.
- Develop technical approach for forecasting nitrate/TDS concentrations in groundwater.
- Construct nitrate/TDS forecasting tools and evaluate baseline scenarios.
- Forecast nitrate/TDS concentrations for CV-SNMP scenarios.
- Characterize and compare the cost of baseline and CV-SNMP scenarios.
- Select a preferred CV-SNMP scenario, finalize management zones and beneficial uses, and set TDS objectives.
- Prepare the final CV-SNMP.

The CV-SNMP Development Workplan outlines the schedule for completion of the CV-SNMP:

- Characterization of nitrate/TDS loading to the Coachella Valley Groundwater Basin completed by the end of 2022.
- Delineation of draft management zones, development of forecasting tools, and forecast of nitrate/TDS completed by the middle of 2025.
- Selection of preferred CV-SNMP scenario, finalizing management zones and beneficial uses, setting TDS objectives, and preparation of the final CV-SNMP completed by the end of 2026.

6.6.2.3 Effect of Minimum Thresholds on Beneficial Uses and Users

For chemical constituents with MCLs, setting the MCL as the Minimum Threshold is protective of drinking water supply wells and consistent with the drinking water provisions of the DDW. The Minimum Thresholds will ensure an adequate groundwater supply for municipal and domestic uses.

For TDS loading, the CV-SNMP includes a process to demonstrate that beneficial uses are considered and protected.

6.6.2.4 Effect of Minimum Thresholds on Neighboring Subbasins/ Subareas

For each of the neighboring subbasins, the possible effects of groundwater quality in the MCSB degrading to Minimum Thresholds is discussed below.

Desert Hot Springs Subbasin

DHSSB is separated from the MCSB by the Mission Creek Fault. Groundwater levels are more than 100 feet higher on the DHSSB side of the fault and no groundwater flows from the DHSSB to the MCSB. Consequently, groundwater quality degrading to Minimum Thresholds in the MCSB would have no impact on the DHSSB.

Indio Subbasin

The MCSB is separated from the Indio Subbasin by the Banning Fault, groundwater levels are more than 100 feet lower on the Indio Subbasin side of the fault, and groundwater flows from the MCSB to the Indio Subbasin, primarily though the GHSA. Historically, no water quality constituents exceed MCLs in the MCSB near the Banning Fault and therefore, no adverse impacts to the Indio Subbasin groundwater quality have been identified.

6.6.2.5 Relationship Between Minimum Thresholds and Other Sustainability Indicators

The relationships between groundwater quality Minimum Thresholds and other Sustainability Indicators are described below.

Chronic Lowering of Groundwater

Groundwater quality Minimum Thresholds are not anticipated to have any impacts on chronic lowering of groundwater.

Reduction in Groundwater Storage

Groundwater quality Minimum Thresholds are not anticipated to have any impact on the reduction in groundwater storage

Subsidence

Nothing in the groundwater quality Minimum Thresholds promote conditions that could cause subsidence. Therefore, the groundwater quality Minimum Thresholds will not result in an exceedance of the subsidence Minimum Threshold.

6.6.2.6 Measurement of Minimum Thresholds

For constituents with MCLs, changes in groundwater quality and the relationship to Minimum Thresholds will be evaluated using water quality data from existing or new municipal supply wells and other drinking water supply wells. The evaluation will focus on the COCs identified above and their MCLs. If additional COCs are identified that exceed their MCLs, Minimum Thresholds and Measurable Objectives will be developed for these additional constituents.
For TDS, the CV-SNMP Update will include water quality objectives that will guide development of the Minimum Thresholds and Measurable Objectives for TDS levels. Measurement of groundwater quality Minimum Thresholds will be documented as part of the SGMA annual reporting.

6.6.3 Measurable Objectives

For constituents with MCLs, the Measurable Objectives are the same as the Minimum Thresholds. Measurable Objectives for TDS will be determined based on the results of the CV-SNMP.

6.6.4 Undesirable Results

Any groundwater quality degradation where concentrations exceed applicable MCLs in a water supply well is unacceptable. However, water supply wells can exceed applicable MCLs independent of any groundwater management activity, usually due to the natural occurrence of a constituent in some groundwater. The Agencies will investigate any exceedances of a Primary MCL. For TDS loading, undesirable results will be determined based on the findings of the of the CV-SNMP and included in future Alternative Plan Updates.

7.0 Water Management Forecasting

This section evaluates and compares the simulated effects of selected future water management scenarios on groundwater conditions in the MCSB. The water management scenarios were simulated using the updated groundwater flow model for the Mission Creek Subbasin (MCSB). The groundwater model is referred to as the MCSB Model and is described in Section 5 and **Appendix A** of this report.

The MCSB Model was prepared to evaluate the future sustainable use of groundwater within the MCSB in accordance with the 2014 Sustainable Groundwater Management Act (SGMA). In addition, the groundwater flow model will be used to support groundwater resources planning in the Garnet Hill Subarea (GHSA) of the Indio Subbasin. For SGMA compliance and reporting, however, the GHSA is part of the Indio Subbasin Water Management Plan Update (Todd/W&C, 2021. The Desert Hot Springs Subbasin (DHSSB) was also included in the model because it is adjacent to the MCSB and contributes subsurface flows to the MCSB water balance. Under SGMA, the DHSSB is considered a very low-priority basin and therefore does not have SGMA requirement. This Section focuses on selected water management scenarios and the effects these may have on the MCSB. Additional more-detailed information about the MCSB forecast model and other scenarios can be found in **Appendix B** of this report.

7.1 Introduction and Objective

The MCSB forecast model was developed using the water demand forecast provided in Section 3 and **Appendix C**, the imported water forecast provided in Section 4.2, and plans for wastewater recycled water use described in Section 4.3. In addition, information and assumptions were developed during discussions with the Coachella Valley Water District (CVWD), Desert Water Agency (DWA), and Mission Springs Water District (MSWD), collectively the Management Committee of the Agencies (Management Committee or the Agencies).

The objective of the MCSB forecast model was to evaluate the sustainable use of groundwater within the MCSB under several potential future hydrology and operational scenarios. Sustainability was evaluated using the 50-year forecasts by:

- Comparing groundwater elevations at selected “key” wells (Key Wells) within the MCSB to the Sustainable Management Criteria, Measurable Objective, and Minimum Threshold for each Key Well as described in Section 6; and
- Calculating the changes in groundwater storage in the MCSB.

7.2 Overview of MCSB Forecast Model Scenarios

This section provides a general overview of the MCSB water management forecast model scenarios, presents the nomenclature assigned to the forecast models, and describes how the assumed impacts of climate change are accounted for in the forecast scenarios. The scenarios described here and in **Appendix B** reflect water management projects already in progress or considered likely to occur on the schedules noted.

7.2.1 Scenario Descriptions

- Three water management forecast scenarios were simulated to evaluate the potential effects of projects that may be implemented to enhance water supplies in the MCSB. The following paragraphs present the nomenclature and general characteristics of these three scenarios. Additional details about these scenarios are included in **Appendix B**. The **Baseline** scenario provides a "benchmark" for comparison with other water management scenarios and includes the current understanding of the pumping demand based on population growth projections and conservation estimates described in Section 3. Population was projected through the 2045 planning horizon and held constant thereafter. The Baseline scenario includes increasing groundwater pumping to meet demands and a resulting proportional increase in the State Water Project (SWP) deliveries to the Mission Creek Groundwater Replenishment Facility (MC-GRF). The Baseline scenario also includes operation of the Regional Water Reclamation Facility (RWRF) in the GHSA, which is scheduled to begin construction by the end of 2021. This project will result in the conveyance of a portion of the wastewater treated for recharge or reuse in the MCSB to the RWRF in the GHSA. The Baseline scenario assumes that this conveyance out of MCSB is permanent and will grow as the population increases in the Planning Area. The Baseline scenario also includes longer-term programs that are within the control of the Agencies and have a high certainty of being implemented on schedule based on historical implementation of similar programs (e.g., MSWD planned septic to sewer conversions).
- The **Near-Term Projects** scenario includes the new projects factored into the Baseline scenario plus additional water management projects planned for implementation prior to 2035. Projects in the near-term category include the Lake Perris Seepage Recovery Project (described in Section 3) to augment the imported water supply starting in 2023, and construction of a pipeline to bring treated water from the RWRF back into the MCSB for use as recharge starting in 2028.
- The **Future Projects** scenario builds on the Near-Term Projects scenario with the addition of water management projects that are planned for implementation starting in 2035 and beyond. Projects in the future category include the Sites Reservoir (2035) and Delta Conveyance Facility (2045) projects that should result in increased reliability of SWP water deliveries.

7.2.2 Climate Change Assumptions

The SGMA guidance requires an evaluation of the potential impacts of climate change on proposed water management projects and water budgets for a groundwater basin/subbasin. The California Department of Water Resources (CDWR) climate change factors (CDWR, 2018) were initially considered for use as the basis for climate change assumptions. However, these factors resulted in only modest reductions in precipitation and SWP deliveries for the region. Based on recurring below normal precipitation conditions for more than 20 years in the

Coachella Valley region, the general understanding from the Agencies and other water management agencies in the Coachella Valley is that the region could be experiencing ongoing below normal average precipitation conditions with more recurring dry years. As such, the Indio Subbasin and MCSB technical teams and management committees agreed to use the recent observed below normal precipitation condition from 1995 through 2019 as the **Climate Change** scenario for the region. The assumption for this scenario is that climatic conditions of this 25-year period in the Coachella Valley is duplicated to provide the full 50-year hydrologic period. The period was implemented in a reverse order (i.e., 2019 to 1995) for the first 25-year portion of the forecast period, then forward order (i.e., 1995- 2019) for the second 25-year portion of the period. This results in a hydrologic period that starts and ends with multiple dry years. It was also assumed that climate change will impact the reliability of SWP deliveries as described in Section 4.2.4. The Technical Addendum to the 2019 SWP Delivery Capability Report (CDWR, 2020b) provides a "Future Conditions with Climate Change and 45 cm Sea Level Rise Scenario," which projects a further decrease in SWP deliveries over time. The 2019 SWP Delivery Capability Report estimates a future delivery reliability of 58 percent (%) declining to 52% by 2040 (CDWR, 2020a). However, based on the average SWP deliveries since the 2007 Wanger Decision, this Alternative Plan Update recognizes the significant potential reduction in reliability associated with Delta export litigation and climate change, if the Delta Conveyance Facility (DCF) Project is not constructed, and therefore, assumed a SWP delivery reliability of 45% through the planning horizon for all scenarios. In addition, as modeled by CDWR in its 2019 SWP Delivery Capability Report (CDWR, 2020), climate is anticipated to result a decrease of SWP deliveries of 1.5% by 2045.

7.2.3 Summary of Modeled Scenarios for Water Management Forecasting

Each of the three water management scenarios was simulated with and without climate change assumptions. This resulted in a total of six scenarios:

1) Baseline,
2) Near-Term Projects,
3) Future Projects,
4) Baseline with Climate Change,
5) Near-Term Projects with Climate Change, and
6) Future Projects with Climate Change.

The Wood Team and the Management Committee agreed the two scenarios that involve additional projects (Near-Term Projects and Future Projects) and climate change assumptions are reasonable and conservative and should be the focus of MCSB planning. The Baseline scenario is presented with and without climate change for comparison of the impact of the climate change assumptions. Therefore, the following discussion is focused on scenarios 1, 4, 5, and 6. Scenarios 2 and 3 are described in detail in **Appendix B**. Key hydrologic assumptions incorporated into all the scenarios are described below. Hydrologic assumptions specific to scenarios 1, 4, 5, and 6 are described in Section 7.4.

7.3 Common Assumptions

Several assumptions and hydrologic inputs are common to all the forecast scenarios. These are discussed in the following sections.

7.3.1 Model Domain and Simulation Period

The calibrated MCSB Model summarized above formed the hydrogeologic basis of the forecast model. There were no structural or hydrogeologic changes to the forecast model except for the addition or removal of scenario specific recharge areas or pumping wells.

As recommended by SGMA guidance documents, the forecast model simulates the 50-year period from 2020 to 2069 using 50 annual stress periods. Annual stress periods were used because the majority of available historical data and forecast estimates are annualized.

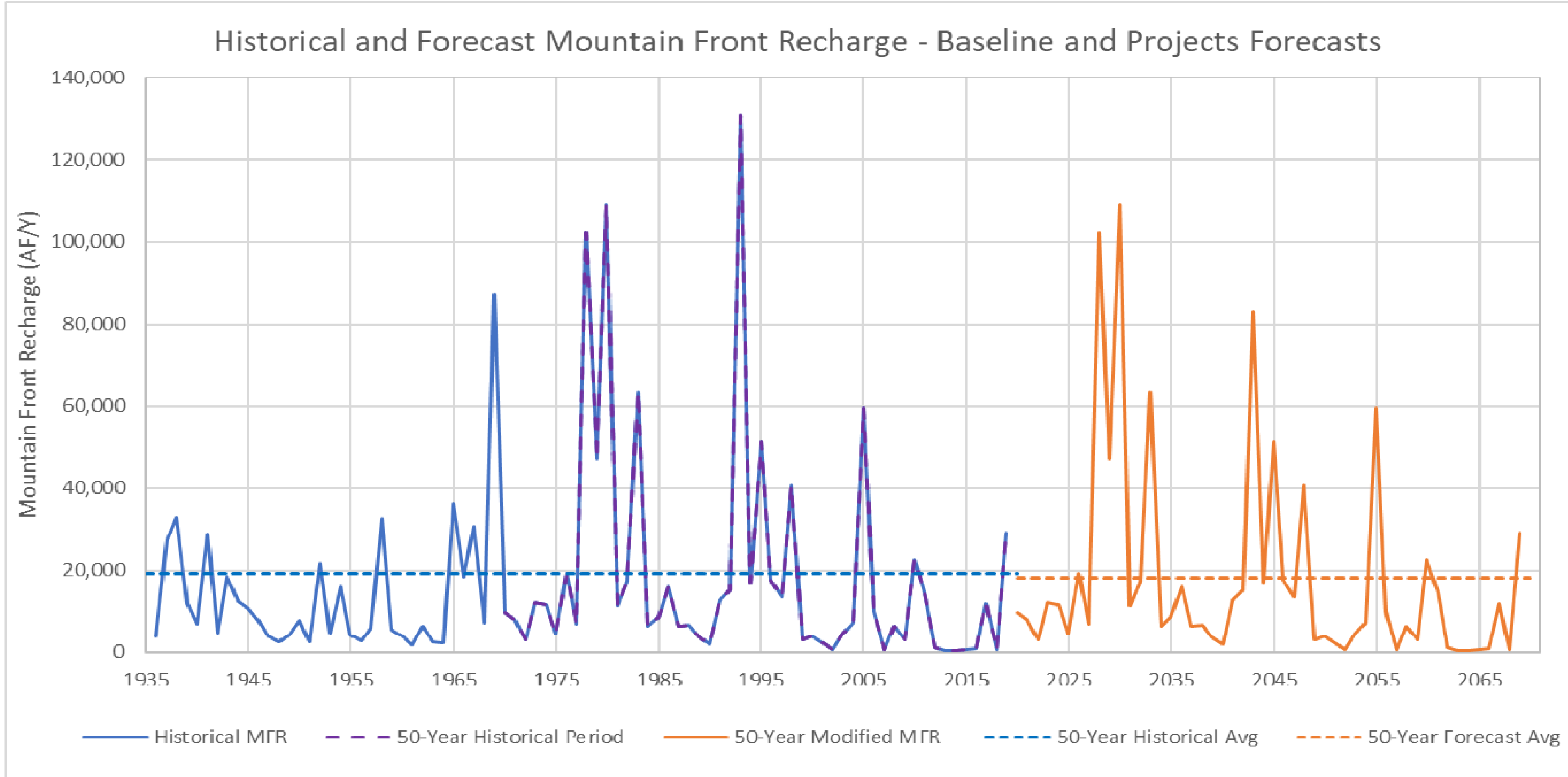
7.3.2 Mountain Front Recharge

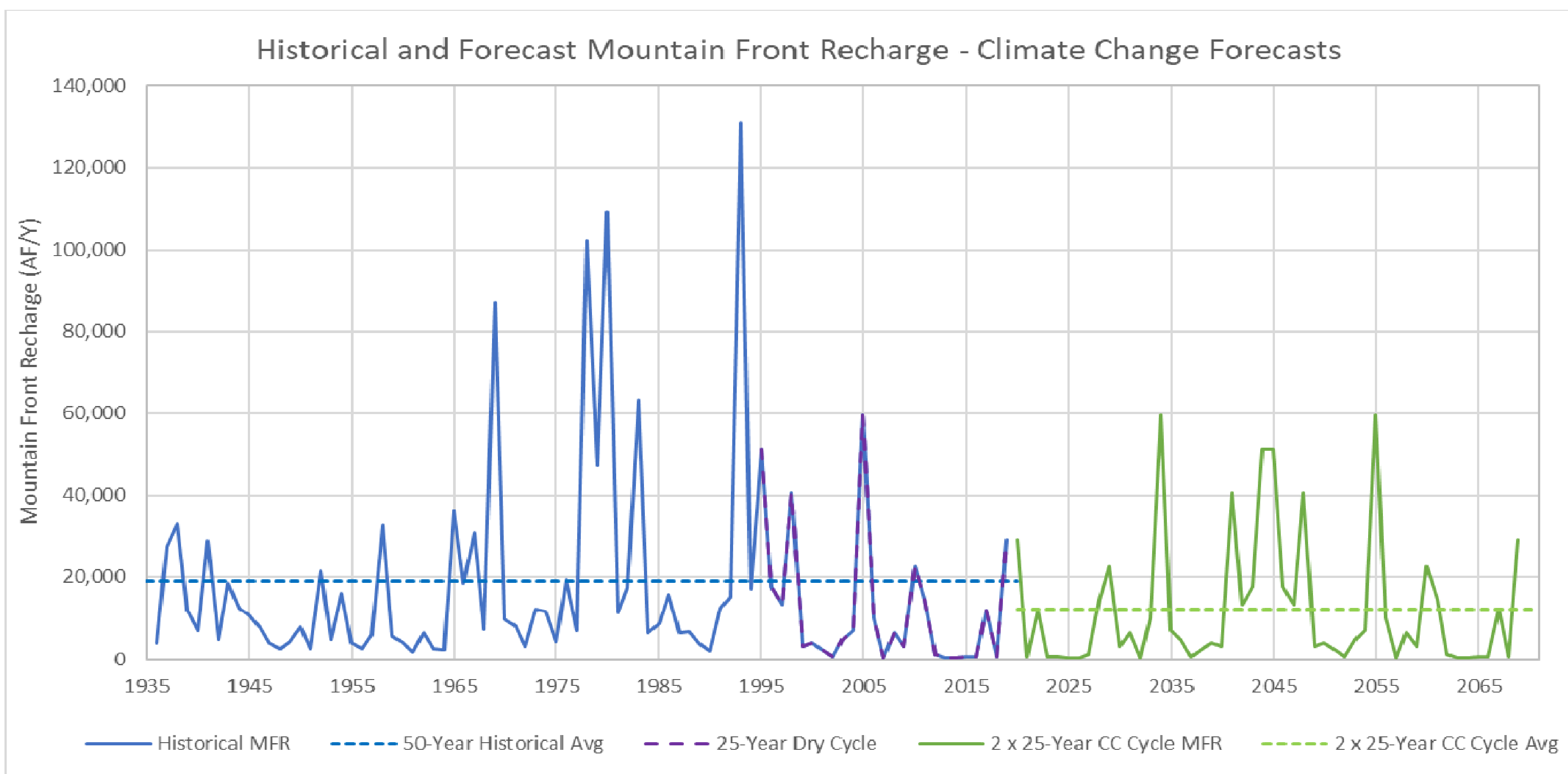
MFR within the model domain occurs from 13 watershed located in the San Bernardino and Little San Bernardino mountains (see Section 5). Between 1936 and 2019 (84 years), the period of record, MRF within the model domain ranged from 372 to 241,935 acre-feet per year (AFY) and averaged 19,145 AFY (**Figure 7-1**).

The SGMA guidance requires that forecast hydrology be based on at least 50 years of historical hydrology. All forecast scenarios utilize the historical MFR from 1970 through 2019 as the basis for MFR estimates. Note that 1993 (forecast year 2043) was an exceptionally wet year. It is unlikely that this exceptionally wet year will be repeated in the next 50 years; hence, the MFR for forecast year 2043 was decreased to bring the 50-year forecast average MFR to 21,390 AFY, closer to 19,145 AFY long-term, 84-year period of record average. Scenario-specific MFR is described for each scenario in Section 7.4.

7.3.3 State Water Project Deliveries for Aquifer Replenishment

Aquifer replenishment in the MCSB is conducted through surface water deliveries by exchanging SWP water, including Table A allocation (Table A) and other SWP water, for Colorado River Aqueduct (CRA) water. Table A amounts and Yuba River Accord Dry Year Water Purchase Program (Yuba Accord) amounts for delivery are common to each scenario and each Climate Change scenario after applying the climate change factor. The Table A amount is 194,100 AFY assuming 100% SWP delivery reliability and the Yuba Accord amount is 651 AFY, both to be proportioned between Indio Subbasin and the MCSB, as described below. As described previously, this Alternative Plan Update assumes 45% SWP reliability through the planning horizon.





Notes:
MFR = Mountain Front Recharge
CC = Climate Change

MOUNTAIN FRONT RECHARGE FORECASTS
Mission Creek Subbasin Alternative Update
Coachella Valley , California

By: dmb | Date: 09/30/2021 | Project No.: CM19167351

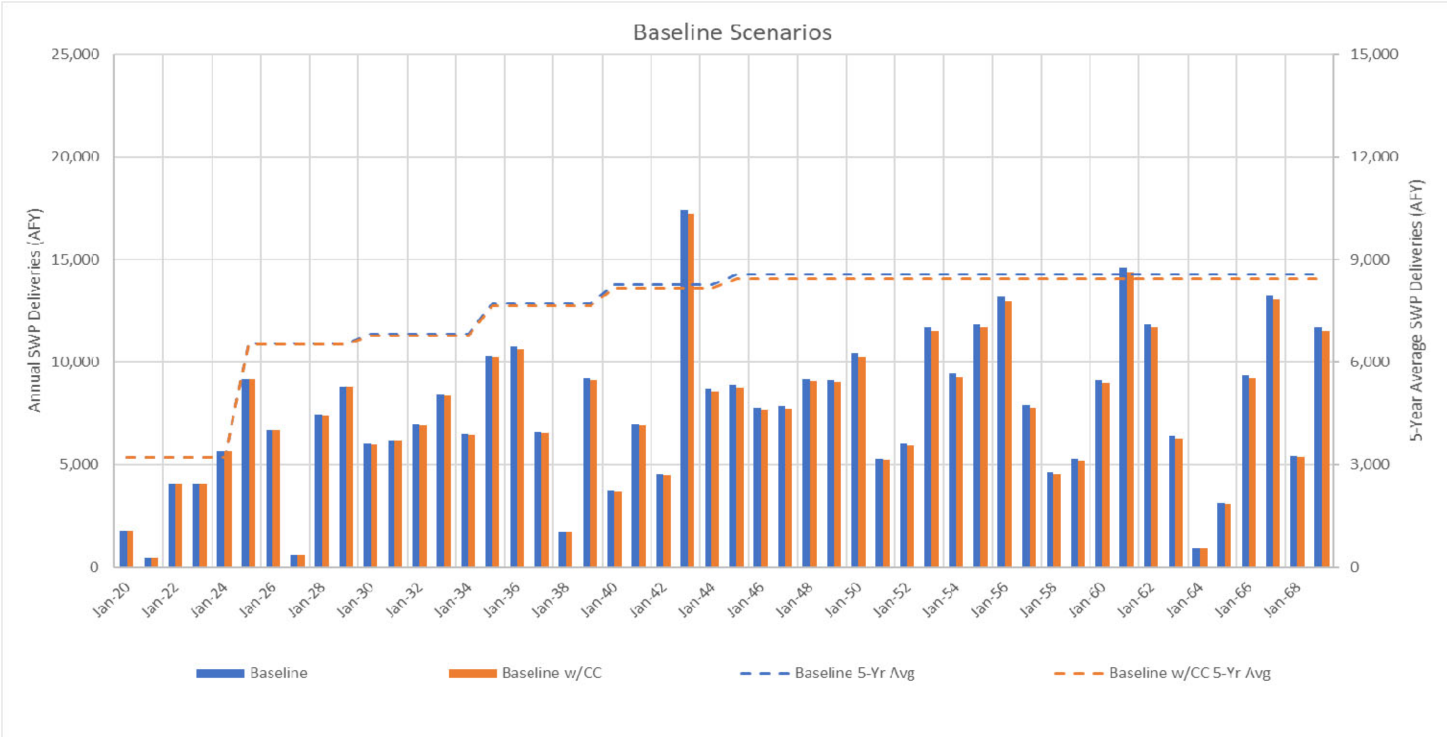
wood.

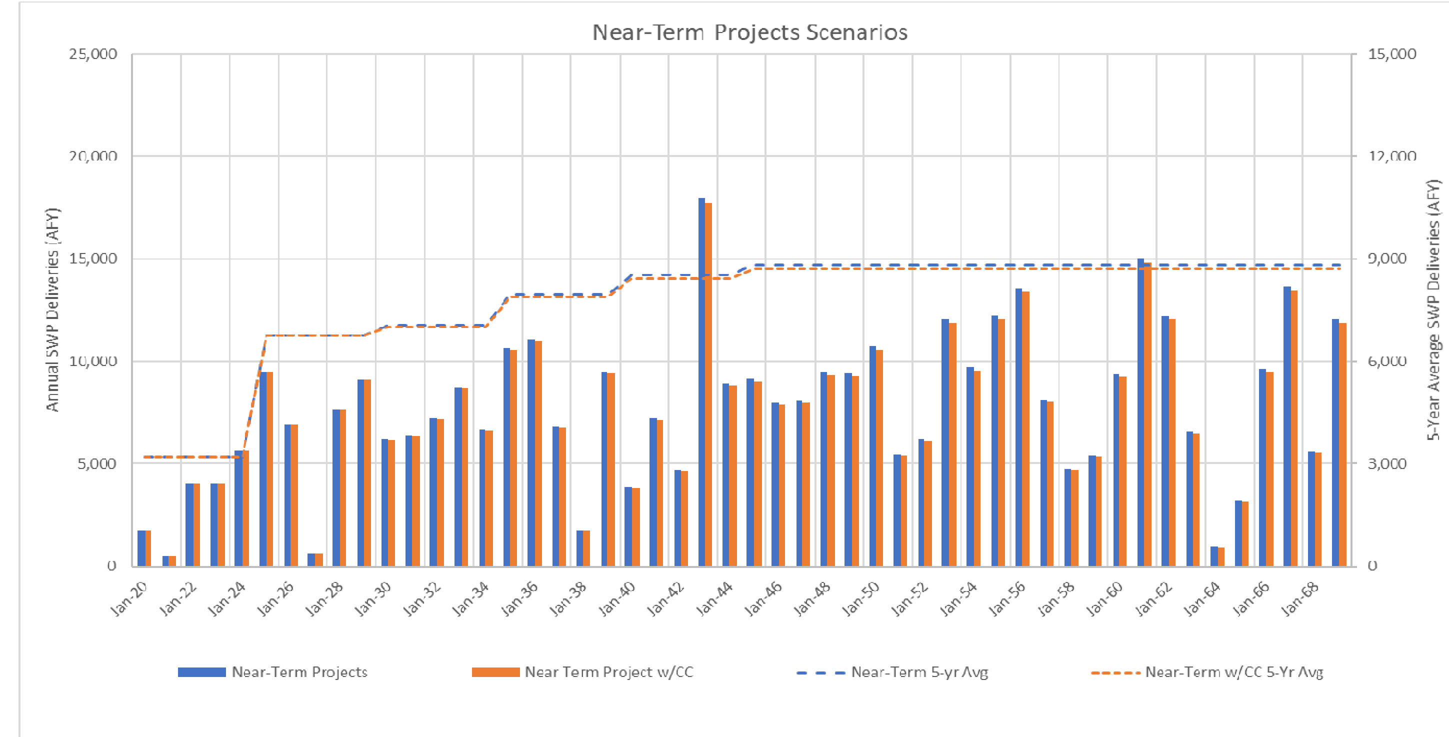
Figure 7-1

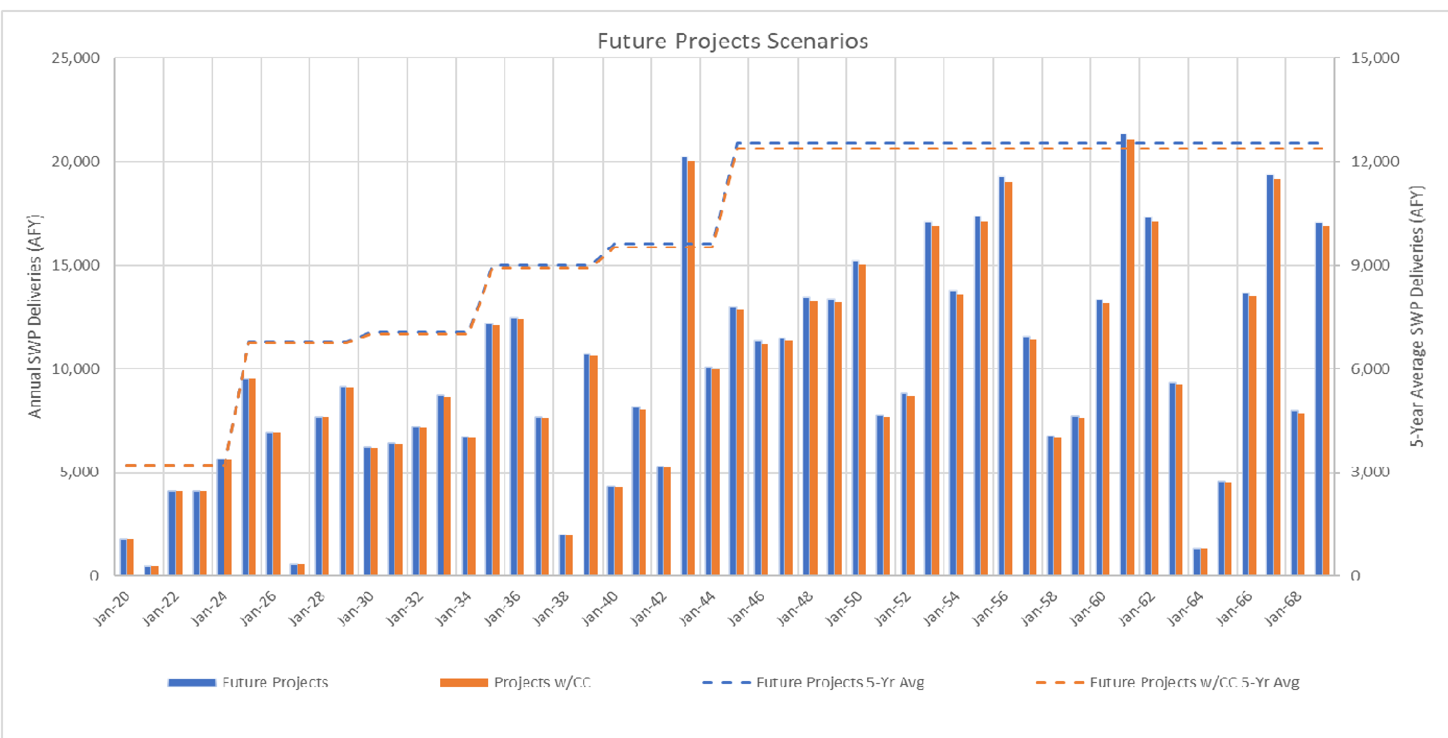
Table B4a in **Appendix B** shows the estimated Baseline SWP Table A and Yuba Accord deliveries for five-year projections starting in 2020 using the 45% delivery reliability. Supplies are then split between the two groundwater replenishment facilities in the West Whitewater River Management Area (in the Indio Subbasin) and the Mission Creek Management Area based on groundwater production in these two management areas. For 2020, the split is approximately 92% of the projected SWP water is delivered to the WWR-GRF and approximately 8% is delivered to the MC-GRF. Based on the demand projections, the percentage of recharge water delivered to the MC-GRF increases to approximately 9% in 2030 and increases again to approximately 10% in 2045. This process was used to estimate five-year projections for the MC-GRF from 2020 to 2045. Finally, the delivery is adjusting for "takes" on advance deliveries provide by Metropolitan Water District of Southern California (MWD) that are stored in the Coachella Valley and that maybe credited against future deliveries. These are referred to as Advanced Delivery Credits). The actual dates that Advanced Delivery Credits will be exercised is unknown. However, for the purpose of the model the Advanced Delivery Credit is deducted from the model from 2025 to 2035 to prevent double counting of the advanced deliveries. Similar SWP Table A five-year projections for the MC-GRF from 2020 to 2045 were developed for the Near-Term Projects scenario (**Table B4b** in **Appendix B**) and the Future Projects Scenario (**Table B4c** in **Appendix B**). Following 2045, SWP deliveries are assumed to be the same as 2045 through the end of the simulation in 2069.

The five-year projections were then annualized over the forecast period from 2020 through 2069 using a SWP factor developed for the Indio Subbasin Water Management Plan Update (Todd/W&C, 2021) to provide variability and is described in further detail in Appendix B. Application of the annual SWP factor to the five-year average delivery for each scenario, provided in **Tables B4a, B4b, and B4c** in **Appendix B,** results in a time-variant forecast of annual SWP deliveries that averages the same as the five-year projection for each scenario. **Table B5** in **Appendix B** provides the analog Table A reliability, calculated annual SWP factor, average annual delivery for the five-year period, and calculated annual SWP deliveries for each scenario. **Figure 7-2** shows a graphic of the five-year average deliveries and annual deliveries after applying the annual SWP factor.

SWP replenishment water for years 2020 through 2024 was tabulated separately based on known or reasonably estimated actual conditions and the contractual obligation to rebalance deliveries between the West Whitewater River Management Area and the Mission Creek Management Area. During the period 2000-2010, there were several years in which SWP deliveries to the MC-GRF were greater than obligations based on proportion of pumping. The MCSB Settlement Agreement required that SWP deliveries be rebalanced over a 20-year period beginning December 2004 and ending in December 2024. Currently, 8,096 acre-feet (AF) of replenishment water will need to be deducted from the MC-GRF replenishment allocation to achieve the rebalance obligation by December 2024.







Notes:
CC = Climate Change

FORECAST STATE WATER PROJECT DELIVERIES
FOR GROUNDWATER REPLENISHMENT
Mission Creek Subbasin Alternative Update
Coachella Valley , California

By: dmb	Date: 09/30/2021	Project No.: CM19167351
wood.		Figure 7-2

During the forecast period, actual SWP deliveries in 2020 were 1,768 AF and SWP deliveries for 2021 are estimated to be only 476 AF. These values were used as known or estimated without application of the Annual SWP factor. The smaller volumes of replenishment water delivered to the MC-GRF in 2020 and 2021 were recharged and not used to reduce the surplus in the balance obligation. It was assumed that projected SWP deliveries averaging 7,143 AFY (**Table B5** in **Appendix B**) will begin in 2022 that between 2022 and 2024, a corresponding total of 21,429 AF of replenishment water will be available to the MC-GRF. An additional 233 AFY is added to this total for two years of the Lake Perris Seepage starting in 2023 (466 AF). This brings the total to 21,895 AF. It was further assumed the volume needed for rebalance will be deducted at a rate of 2,699 AF each year for 2022 through 2024 (8,096 AF total deduction). The remaining balance of approximately 13,800 AF allocated to the three years 2022, 2023 and 2024.

This process of estimating the SWP supplies for replenishment based on the five-year projections was used for 2020 through 2045. SWP deliveries for years after 2045 are assumed to be identical to those of 2045 through the end of the simulation in 2069. Additional water supply assumptions under the Near-Term Projects and Future Projects scenarios result in additional SWP Table A supplies (**Tables B4b** and **B4c** in **Appendix B**). Changes in SWP Table A supplies as a result of climate change factors were also calculated (**Tables B4a, B4b,** and **B4c** in **Appendix B**). These differences are described where applicable for each scenario in Section 7.4.

7.3.4 Population Growth and Pumping Demand

There are no surface water supplies used to meet demands within the model domain (study area). All water supplies are from pumped groundwater. Hence, population growth will result in increased pumping demand. All forecast scenarios utilize the same assumptions regarding population growth and the associated groundwater pumping demand.

7.3.4.1 Population Growth

As described in Sections 2 and 3, Planning Area demographics are based on population information from the Southern California Association of Governments' (SCAG) regional growth forecast contained in the 2020 Regional Transportation Plan and Sustainable Communities Strategy (SCAG, 2020). The forecast includes population estimates for the base year 2016 and projections for years 2020, 2035, and 2045. SCAG used the Transportation Analysis Zones (TAZ), which are similar to the Census Block Groups, in their population projections.

The projected population for each TAZ polygon within the Planning Area was analyzed using graphical information system (GIS) methods to provide population estimates for the Planning Area of approximately 53,000 in 2020, 74,000 in 2035 and 88,000 in 2045 (Section 2, **Table 2-1**). These projections were linearly interpolated to provide an annual estimate of future population in the study area from 2020 through 2045.

7.3.4.2 Groundwater Pumping Demand

Municipal pumping, which accounts for about 75% of total pumping, is directly related to population. Historically, total pumping (municipal and private) in the Planning Area has ranged from a few thousand AFY in the 1950s to almost 20,000 AFY in 2006 (**Figure 7-3, bottom left**). Based on the demand projections in Section 3 and **Appendix C**, total municipal pumping demand was estimated to increase from about 10,700 AFY in 2018 to about 16,820 AFY by 2045 (**Figure 7-3, upper left; Table B6** in **Appendix B**). The increased pumping demand was distributed to existing well fields for each municipal planning area based on the population projections by TAZ polygons (**Figure 7-3, upper right**). Production for existing wells was allowed to increase to the historical high groundwater production for each well in the Planning Area to accommodate the increase in demand. Based on historical performance, the currently existing wells could accommodate the increase in municipal demand, so no additional wells were added to the model.

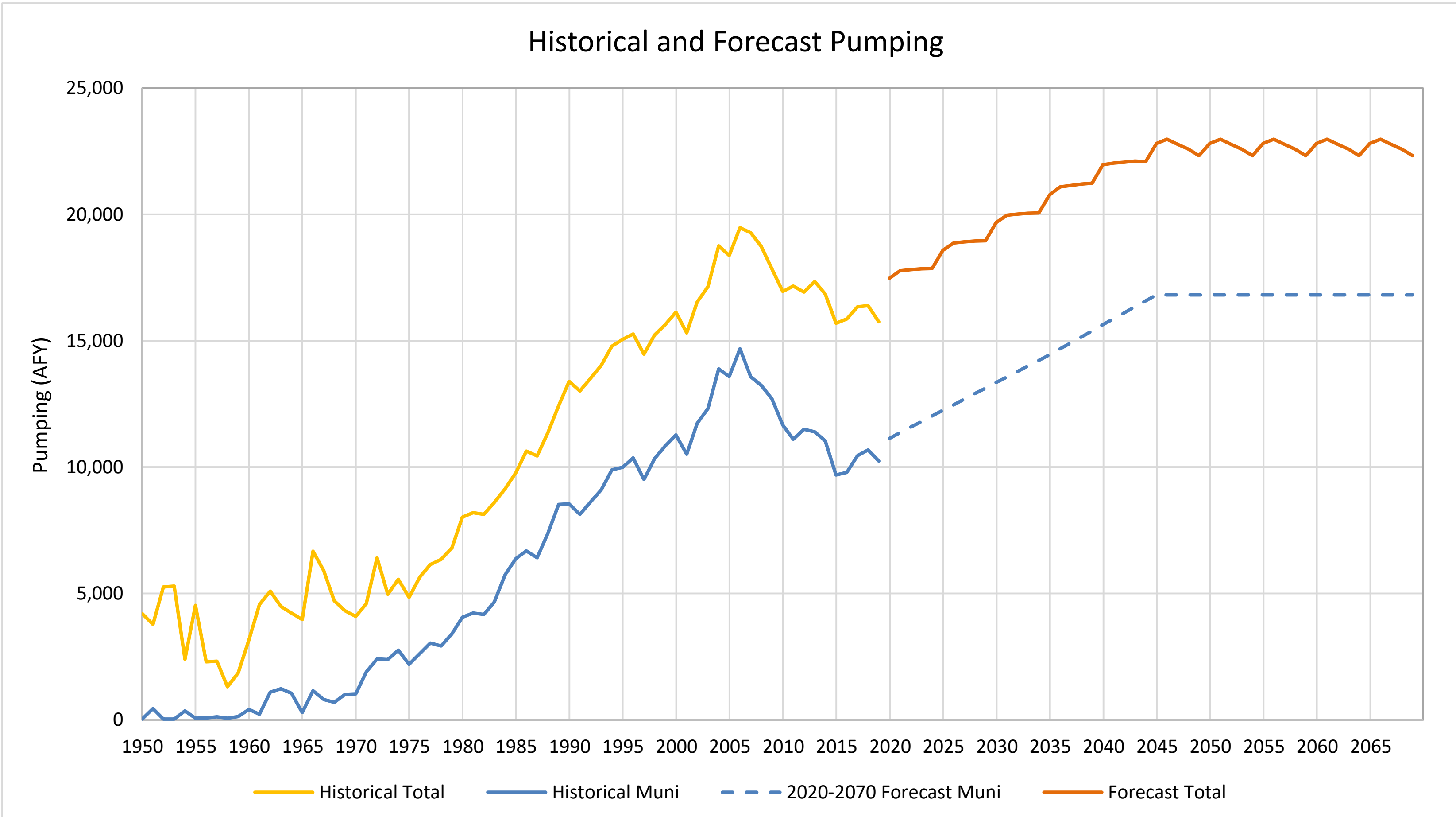
Metered private well production, consisting of pumping for golf courses, agricultural (primarily fish farms), industrial, and single domestic wells, was assumed to remain at the average 2015-2019 rate of 3,504 AFY through 2039. In 2040, the CPV Sentinel Energy Project is anticipated to be complete, and an average of 295 AFY will no longer be required for this industrial use. This results in metered private production declining to 3,209 AFY in 2040 and remaining at this level through the remainder of forecast simulation period.

Since the SCAG projections end in 2045, it was further assumed that all pumping demand would be held constant after 2045 (**Appendix B, Table B6**). Unmetered private well pumping assumed to be used primarily to meet domestic demands was estimated to decrease from 474 AFY in 2020 to 466 AFY in 2045 due to passive conservation assumptions. However, because the unmetered pumping estimates are based on highly uncertain assumptions, this pumping was rounded up to 500 AFY through the planning horizon for modeling purposes.

This pumping demand described above is common to all forecast scenarios.

7.3.5 Return Flow Recharge

Return flow consists of the proportion of pumped groundwater that returns to the water cycle as recharge to groundwater after it has been used for its intended purpose (municipal, agricultural, industrial, or golf course). The assumptions for the return flow calculations for the forecast model are the same as those used in the calibration model (**Table B7** in **Appendix B**) and are based on return flows estimated for the Coachella Valley Groundwater Basin as documented by K&SEC and Stantec (2018).



Note:
Pumping records compiled from various sources including Fogg, 2000, PSOMAS, 2010, and Agency records
Muni = municipal pumping

GROUNDWATER DEMAND
Mission Creek Subbasin Groundwater Model Update
Riverside County, California

By: dmb	Date: 10/18/2021	Project No.: CM19167351
wood.		Figure 7-3

7.3.5.1 Applied Water Return Flow

Applied water return flow includes return flow from municipal and private outdoor use of pumped groundwater including agricultural, industrial, and golf course irrigation. Because private metered production remains the same for the forecast period, the return flow for this use remains the same. Return flow for municipal outdoor use increases with increasing production through the planning horizon. Return flows for the Baseline scenario are provided in **Table B7** in **Appendix B**. Return flow from applied water has been estimated to be approximately 25%. Because applied water use is the same for all scenarios, applied water return flows are the same for all scenarios

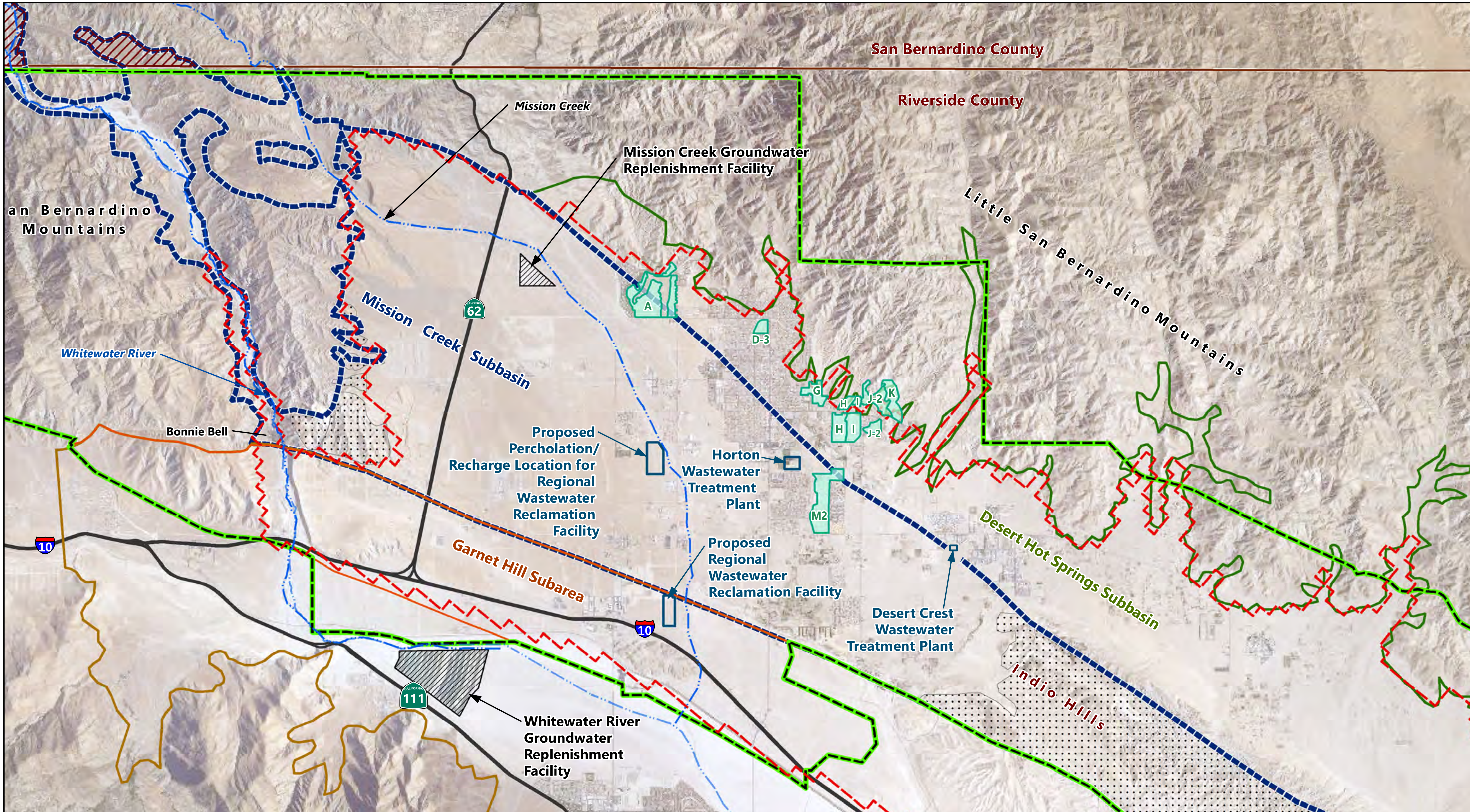
7.3.5.2 Septic and Treated Wastewater Return Flows

MSWD plans to continue to convert areas currently on septic systems to the municipal sewer system. The location of the areas to be converted (A, D3, M2, etc.) are shown on **Figure 7-4**. An estimated 2,331 parcels will be converted in the MCSB and DHSSB from 2022 to 2035 (**Figure 7-5**). The top chart on **Figure 7-5** depicts the timeline of the conversion of septic systems to municipal sewer connections for the conversion areas. The lower chart on **Figure 7-5** shows the decrease in septic system flows as systems are converted and the increase in sewer system flows as septic systems are converted, and as undeveloped parcels are developed over the build-out period. Septic to sewer conversions are incorporated into the Baseline return flow provided in **Table B7** of **Appendix B**. Total forecast return flows were calculated for each subbasin/subarea and are forecast to increase gradually from about 7,000 AFY to about 10,800 AFY by 2045 as a result of population growth. Forecast return flow volumes are the same for each scenario. However, the disposal locations for the treated wastewater differ between the Baseline, the Near-Term with Climate Change and Future Project with Climate Change scenarios, as discussed under each scenario. Additional information on return flows is provided in **Appendix B**.

7.3.6 Garnet Hill Fault Flux and Whitewater River Recharge

As discussed in **Appendix B**, Section B.1.1, Wood adopted the hydraulic properties from the 1997-2019 Indio Subbasin model into the MCSB Calibration model in the GHSA, where the models overlap. Wood also incorporated the simulated underflow between the GHSA and main Indio Subbasin across the Garnet Hill Fault and Whitewater River recharge into the into the GHSA portion of the MCSB Model. The processes for extracting the Garnet Hill Fault flux and Whitewater River recharge from the Indio Subbasin model and importing them into the MCSB Calibration model are discussed more fully in **Appendix A**, Section A.4.5.8.

As discussed in The Indio Subbasin Water Management Plan Update (Todd/W&C, 2021), the Indio Subbasin model was also used to perform multiple forecast scenarios, including scenarios similar to the six scenarios listed above in Section 7.2. Using the same processes as described in **Appendix A**, the Garnet Hill Fault flux and Whitewater River recharge were extracted from the Indio Subbasin model for each of the six forecast scenarios and incorporated into the MCSB forecast scenarios (**Figure B12** in **Appendix B**). This resulted in a consistent treatment of Whitewater River recharge and Garnet Hill Fault flux between the two models for all forecast scenarios. Although the Garnet Hill Fault flux varies between the scenarios, it has little influence on the MCSB and therefore is not discussed in this section. For a discussion of the Garnet Hill Fault flux for each scenario refer to **Appendix B**.



Explanation

- Wastewater Treatment and Reclamation facility
- A Septic to sewer conversion area
- Groundwater Replenishment Facility
- Planning Area
- Approximate Active Model Boundary
- Streams
- Highway/road
- Mission Creek Subbasin fringe area
- Garnet Hill Subarea of Indio Subbasin
- Low permeability/non-water bearing sediments/bedrock
- Desert Hot Springs Subbasin
- Indio Subbasin
- Mission Creek Subbasin

0 4,000 8,000
Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA. Water.CA.gov.

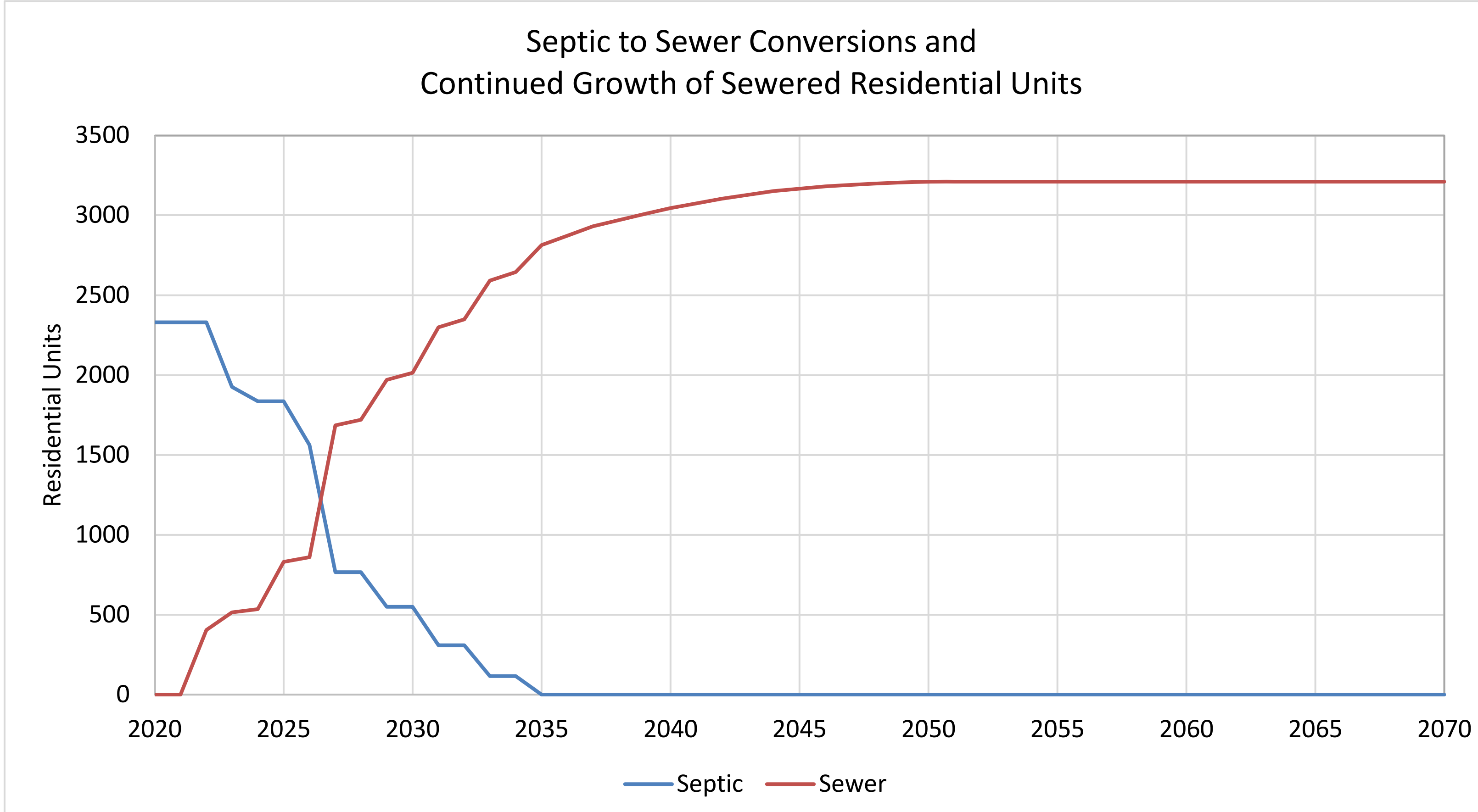
WASTEWATER TREATMENT AND RECLAMATION FACILITIES AND SEPTIC TO SEWER CONVERSION AREAS
Mission Creek Subbasin Alternative Update
Coachella Valley, California

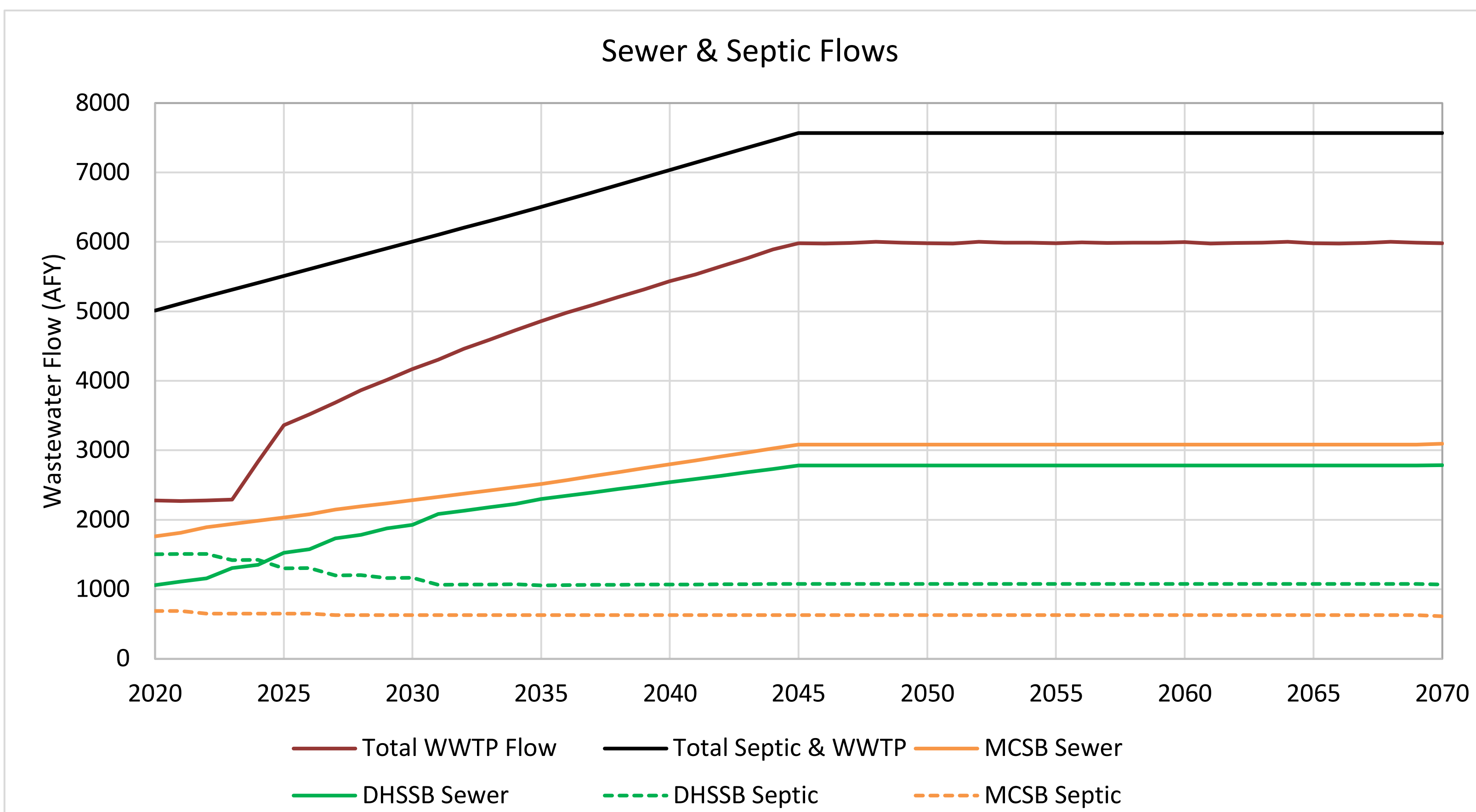
By: jrw/pah | Date: 9/22/2021 | Project No.: CM19167351

wood.

Figure 7-4

Date: 9/22/2021 Printed by: joanna.worker
Path: Y:\CM19167351 (Mission Creek Alternative)\Esri\Alternative Update_tb_WTR Facs_SepticSewer_Conv_Areas.mxd





PROJECTED SEPTIC TO SEWER CONVERSIONS
AND SEWER AND SEPTIC FLOWS
Mission Creek Groundwater Model Update
Riverside County, California

By: dmb	Date: 10/18/2021	Project No.: CM19167351
wood.	Figure 7-5	

7.4 Scenario Assumptions

The following sections discuss the specific assumptions unique to each of the forecast scenarios.

7.4.1 Scenario 1 – Baseline Scenario Assumptions

The Baseline scenario assumptions are discussed below.

7.4.1.1 Mountain Front Recharge

Estimated MFR for the Baseline scenario was assumed to be a repeat of the MFR estimated for the calibration model for the period 1970 through 2019 (**Figure 7-1, top; Table B3** in **Appendix B**). This 50-year period includes several drought intervals, several wet intervals, and is about 3,000 AFY greater than the long-term average hydrology. As described above in Section 7.3.2, the MFR for forecast year 2043 was decreased to 28.3% of historical (1993) MFR to bring the 50-year forecast average MFR close to the long-term average of 19,145 AFY (**Figure 7-1, bottom; Table B3** in **Appendix B**).

7.4.1.2 State Water Project Deliveries for Groundwater Replenishment

SWP deliveries for groundwater replenishment under the Baseline scenario are listed in **Table B4a** of **Appendix B**. Under the Baseline scenario, SWP deliveries are forecast to range from 6,540 to 8,565 AFY and average about 6,510 AFY from 2020 through 2044 and 8,565 AFY from 2045 through 2069 (**Figure 7-2**).

7.4.1.3 Wastewater Treatment Plant and Regional Water Reclamation Facility Return Flow

Figure 7-4 shows the location of the existing Horton and Desert Crest wastewater treatment plants (WWTPs), the proposed RWRF, and the proposed RWRF recharge location. **Figure B10** of **Appendix B**, top plot**,** shows MSWD projected total wastewater flows and flows to the individual WWTP/RWRF. This estimate closely matches the estimate of wastewater effluent based on the municipal sewered indoor use (**Table B7, Figure B10**, bottom plot in **Appendix B**). For purpose of modeling, indoor water use was used to estimate wastewater effluent to maintain the overall water balance of the model. All wastewater effluent has a 3% evaporation loss applied to calculate the return flow (See **Appendix A**). A summary of the WWTP/RWRF return flows assumptions are provided below.

- Desert Crest WWTP – Desert Crest WWTP will continue to operate at capacity levels, using the observed return flows from 2015-2019 (ranging from approximately 40.5 to 51 AFY) on a recuring cycle through the planning horizon (**Table B7**, Zone 35 in **Appendix B**). This return flow is the same for all scenarios.
- Horton WWTP – Horton WWTP will continue to operate at capacity until 2023 when the RWRF comes online. A portion of the Horton WWTP will be diverted to the RWRF beginning in 2023. Sewer flow to the Horton WWTP will then increase until it returns to its operating capacity of about 2,500 AFY in 2035 (**Table B7**, Zone 13 in **Appendix B**).
- RWRF – The RWRF comes online in 2023. A portion of the Horton WWTP is diverted to the facility for startup through 2027 and then the RWRF wastewater grows with population growth and septic to sewer conversions in the Planning Area (**Table B7**, Zone 44 in **Appendix B**). For the Baseline Scenario, all the wastewater treated at the

RWRF is percolated in ponds at the RWRF in the GHSA. The volume of this water in 2023 is approximately 330 AF and grows to approximately 3,250 AF by the end of the planning horizon in 2045. The wastewater percolation remains constant from 2045 through the simulation period ending in 2069 because assumed population growth and water demand are held constant.

7.4.2 Scenario 4 – Baseline with Climate Change Assumption

The Baseline with Climate Change scenario assumptions are identical to the Scenario 1, Baseline scenario assumptions discussed in Section 7.4.1 with differences discussed below.

7.4.2.1 Mountain Front Recharge

MFR for the Climate Change scenario utilizes a 25-year drought cycle based on data from 1995 through 2019 (**Figure 7-1**, bottom chart; **Table B8** in **Appendix B**). For the 50-year forecast period, this cycle was first simulated in reverse order (2019 to 1995) and then repeated in forward order (1995 to 2019). This resulted in four notably dry periods: the first occurring between 2023 and 2027, the second between 2035 and 2040, the third between 2049 and 2054, and the fourth between 2062 and 2066 (**Figure 7-1**, bottom chart). The resulting Climate Change scenario has a significantly lower average annual MFR of 12,740 AFY (**Table B8** in **Appendix B**) compared to 21,390 AFY for the Baseline scenario (**Table B3** in **Appendix B**). This dry cycle forecast of MFR more closely represents the recent historical conditions in the Coachella Valley and is more conservative than the CDWR climate change forecast. The Agencies considered the dry cycle MFR as the most appropriate scenario to use for planning purposes. This change in MFR is the same for all Climate Change scenarios.

7.4.2.2 State Water Project Deliveries for Groundwater Replenishment

As described in Section 7.3.3, the five-year estimates of SWP deliveries (**Table B4a** in **Appendix B**) were annualized using the annual SWP delivery reliability factors for the forecast period analog years of 1970 through 2019 (**Table B5** in **Appendix B**). SWP deliveries for the Baseline with Climate Change scenario were based on the annual SWP delivery reliability factors and an added climate change factor based on CDWR modeling (CDWR climate change factor). Under anticipated climate conditions, reliability is assumed to be reduced by an additional 1.5% as compared to Baseline by 2045, as modeled by CDWR in its 2019 SWP Delivery Capability Report (CDWR, 2020). The CDWR climate change factor is applied to each five-year delivery period starting at 0.3% in 2025 and increasing by 0.3% each year until 2045 when the CDWR climate change factor is 1.5% (**Table B4a** in **Appendix B**). The climate change scenarios average deliveries from **Table B4a** in **Appendix B** are used to calculate annual deliveries for these scenarios in **Table B5** in **Appendix B.** Consequently, CDWR climate change factors are incorporated into the annual delivery for the climate change scenario in **Table B5** in **Appendix B**. These deliveries are shown graphically on **Figure 7-2**.

7.4.3 Scenario 5 – Near-Term Projects with Climate Change Assumptions

The Near-Term Projects with Climate Change scenario assumptions are identical to those described in Section 7.4.4 for Scenario 4, Baseline with Climate Change, with differences as discussed below.

7.4.3.1 Additional State Water Project Supply

The Near-Term Projects with Climate Change scenario includes the Lake Perris Seepage supply beginning in 2023. The details of this project are provided in Section 4.2.6. This Lake Perris project is assumed to provide additional SWP water for groundwater replenishment at the MC-GRF with volumes estimated at 233 AFY starting in 2023, increasing to 242 AFY in 2030, and ultimately increasing to 265 AFY in 2045 and beyond (**Table B4b** in **Appendix B**).

7.4.3.2 Regional Water Reclamation Facility Return Flow Location

The RWRF is planned to begin construction before the end of 2021 and will be constructed in the GHSA (**Figure 7-4**). The RWRF will initially discharge treated water into evaporation/percolation ponds located at the facility and the Baseline Scenario maintains that condition though the simulation period. Under the Near-Term Projects with Climate Change scenario, it is assumed that the RWRF discharge will be transported via pipeline to the MCSB for percolation and/or groundwater recharge into new ponds at the RWRF disposal/recharge location (**Figure 7-4**). Intentional recharge of the treated effluent to replenish groundwater would involve different permitting and regulatory approval steps than would disposal of the treated effluent in evaporation/percolation ponds. From a water balance standpoint, however, this project will result in an increase in return flow to the MCSB regardless of whether the treated effluent is considered to be disposed of by percolation and evaporation or used for groundwater recharge. The proposed treated water pipeline and evaporation/percolation ponds are in the design phase and are scheduled to be completed by 2028. Hence it is assumed that under the Near-Term Project scenario, the discharge from the RWRF will shift to the MCSB in 2028.

7.4.4 Scenario 6 – Future Projects with Climate Change Scenario Assumptions

The Future Projects with Climate Change scenario assumptions are identical to those described in Section 7.4.3 for Scenario 5, Near-Term Projects with Climate Change, with the differences discussed below.

The Future Projects with Climate Change scenario includes the Sites Reservoir project and the Delta Conveyance Facility project. The details of these two projects are provided in Section 4.2. For the purposes of the model forecast, these two projects increase the SWP deliveries to the MC-GRF for groundwater replenishment. The Sites Reservoir project increases SWP deliveries starting in 2035 by approximately 1,050 AFY. In 2045, the increase in deliveries becomes approximately 1,120 AFY (**Table B4c** in **Appendix B**). The Delta Conveyance project increases SWP deliveries in 2042 by approximately 2,380 AFY.

7.5 Scenario Simulation Results

Forecast scenario groundwater elevations and water balances for the MCSB are discussed in the following sections.

7.5.1 Simulated Groundwater Levels

Hydrographs of observed 2009-2019 groundwater elevations and 2020-2069 forecast groundwater elevations were prepared for the nine Key Wells in the MCSB (**Figure 7-6** and **Appendix B, Attachment B1**). Because the calibration model does not exactly match physical water levels and the forecast starts at the end of the calibration model, the forecast water levels were modified as needed to match measured groundwater levels in the wells at the end of the calibration period (the end of 2019). Each hydrograph shows the Measurable Objective based on 2009 groundwater levels and the Minimum Threshold described in Section 6 of the Alternative Plan Update.

Simulated groundwater elevations are shown for the Baseline scenario and Baseline with Climate Change scenario (**Figure 7-6**). Also shown are hydrographs for the Near-Term Projects with Climate Change and Future Projects with Climate Change scenarios.

The hydrographs show that under Baseline conditions, groundwater levels in all the Key Wells fall below their Measurable Objectives. By the end of the planning horizon (2045), groundwater levels in five Key Wells fall below their Minimum Thresholds; these include wells 02S04E36K01 (36K01), 3S4E11L04 (11L04), 03S04E12C01 (12C01), 03S05E15R01 (15R01), and 03S05E17J01 (17J01). Groundwater levels in the remaining Key Wells stay above their Minimum Thresholds through the planning horizon of 2045.

Under the Baseline with Climate Change scenario, groundwater levels in all Key Wells fall below their Measurable Objectives during the planning horizon. Six of the Key Wells also fall below their Minimum Thresholds during the planning horizon (36K01, 11L04, 03S04E04P01 [4P01], 12C01, 15R01, and 17J01).

The hydrographs show that under the Near-Term Projects scenario, all the Key Wells stay above their Measurable Objectives through the forecast period. Under the Near-Term Projects with Climate Change scenario, all but three Key Wells (4P01, 15R01, and 17J01) also stay above their respective Measurable Objectives. All Key Wells stay above their Minimum Thresholds.

The hydrographs show that under the Future Projects scenario, all the Key Wells stay above their Measurable Objectives. Under the Future Projects with Climate Change scenario, the hydrographs show that all but three Key Wells (4P01, 15R01, and 17J01) will stay above their Measurable Objectives. Well 4P01 falls below its Measurable Objective in 2029 by 3.1 feet and then recovers above the Measurable Objective in 2041. Two wells that fall below their Measurable Objective (15R01 and 17J01) are in the southern part of the MCSB and only fall below their Measurable Objectives by 1.6 feet and 0.4 feet, respectively. Wells 4P01 and 15R01 have limited historical records and the Measurable Objectives for these wells are considered provisional (see Section 6.3.2). All wells remain above their Minimum Thresholds through the planning horizon.

The forecast hydrographs indicate that the Baseline scenario is not sustainable under normal nor climate change conditions. The Baseline scenarios are only shown for comparison purposes and are not a scenario that is planned for implementation. The Near-Term Projects and Future Projects are necessary to maintain groundwater elevations in the MCSB under climate change conditions.

7.5.2 Simulated Water Balance and Change in Storage

The simulated water balances and changes in storage for scenarios Baseline, Baseline with Climate Change, Near-Term Projects with Climate Change, and Future Projects with Climate Change for the MCSB are presented below. Simulated water balances and changes in storage for GHSA and DHSSB are described in **Appendix B**.

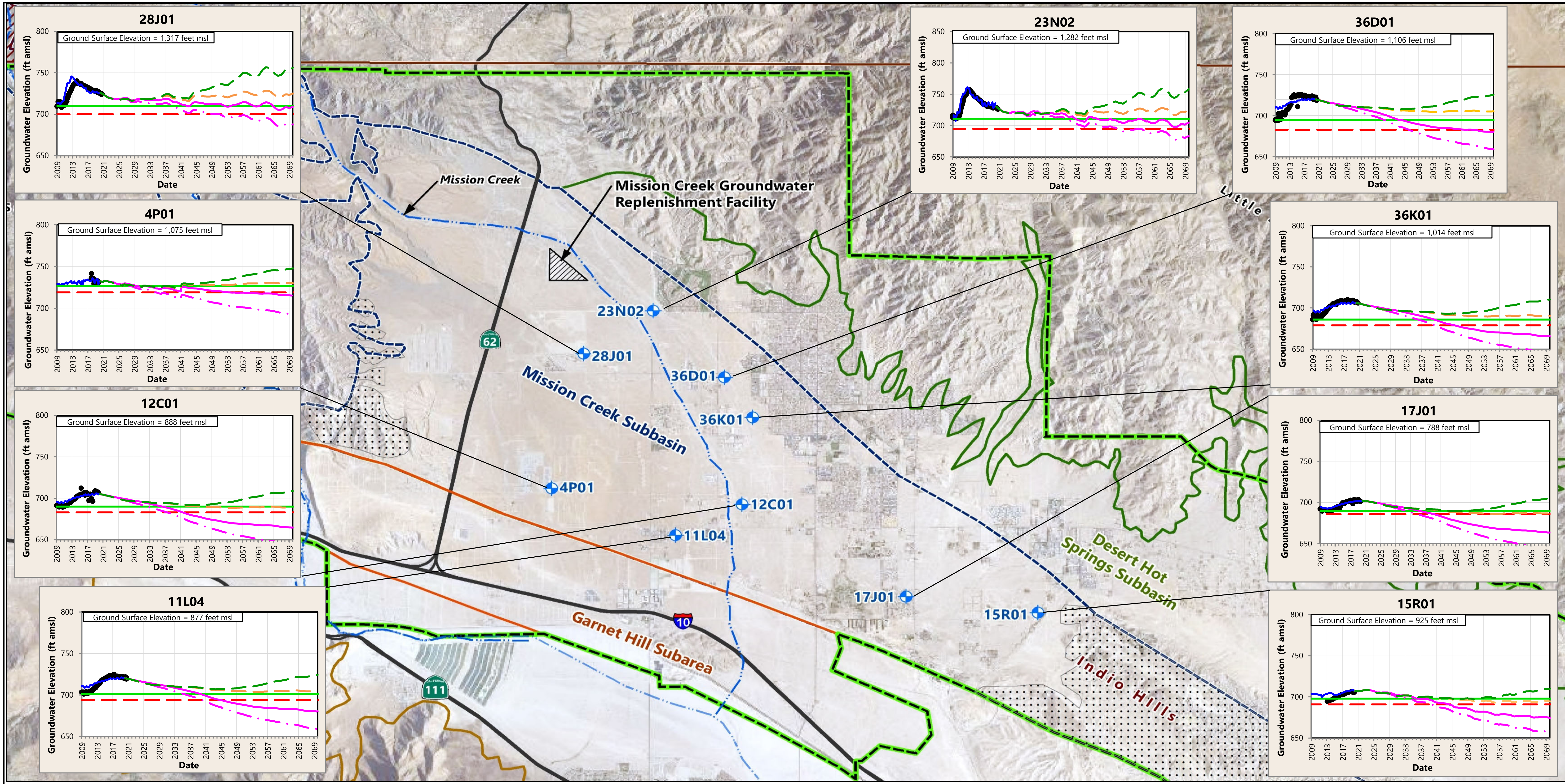
Water balance and change in storage simulated by the calibrated groundwater model includes storage for the entire subbasin/subarea. These areas are larger than the area developed for water supply and monitored by the Agencies. For example, in the MCSB, the northwestern portion of the subbasin comprises a relatively remote area without monitoring wells. This area is also where nearly all MFR into the subbasin occurs. Under extended drought conditions, MFR will decline along with groundwater levels in all subbasins. The reverse is true under wet conditions. This is part of the natural hydrogeologic cycle of the subbasin. Because this northwestern area is more than a mile upgradient from the nearest monitored area, there will be a significant time lag for the decrease or increase in recharge to impact groundwater levels in monitoring wells. Consequently, the simulated water balance and change in storage will not directly reflect groundwater levels in some portions of the MCSB under some hydrologic conditions. As described in Section 6.4.3, the Measurable Objective for groundwater in storage is based on 2009 groundwater conditions. Hence, the cumulative change in storage discussed below, which is relative to the 2009 conditions, is a useful measure in evaluating long term trends for groundwater storage and water balance.

The water balance (**Figure 7-7**and **Table B9** in **Appendix B**) shows that the long-term cumulative change in storage under the Baseline scenario is positive at 85,820 AF in 2045. Under the Baseline with Climate Change scenario, the cumulative change in storage becomes negative in the mid-2020s, decreasing to about -65,780 AF in 2040 and then rising to about -9,910 AF in 2045 (**Figure 7-8** and **Table B10** in **Appendix B**).

Under the Near-Term Projects with Climate Change scenario, the cumulative change in storage becomes negative in the mid-2020s, then rises to about 30,870 AF in 2045. Initiation of percolation of the RWRF treated wastewater in the MCSB in 2028 reduces the impacts of drought conditions through increased recharge from wastewater return flow (**Figure 7-9** and **Table B12** in **Appendix B**).

Under the Future Projects with Climate Change scenario, the cumulative change in storage becomes negative in the mid-2020s and increases to about 44,910 AF in 2045. Cumulative change in storage continues to increase as the RWRF discharge increases and more SWP water resulting from projects such as DCF and Sites is recharged at the MC-GRF (**Figure 7-10** and **Table B14** in **Appendix B**).

K:\CM19167351 (CVWD Alt update)\Final Report Figure\00 Appendix B\Appendix_B_Forecast_Figures_v30_02-11-22 Figure ES7, ES8, 7-6, 7-11, B13, and B32 v2



Monitoring well (Key Well)
Groundwater Replenishment Facility
Planning Area
Streams
Highway/road
Garnet Hill Subarea of Indio Subbasin
Lower permeability/non-water bearing sediments/bedrock
Desert Hot Springs Subbasin
Indio Subbasin
Mission Creek Subbasin
Observed
Simulated
Measurable Objective
Minimum Threshold
Baseline
Baseline w/CC
Near-term Projects w/CC
Future Projects w/CC

Note:
Ground surface elevation in feet above mean sea level.

0 4,000 8,000
Approximate Scale in Feet

Basemap modified from aerial photograph provided by Esri, dated November 9, 2016. GSA areas from SGMA.water.CA.gov.

FORECAST SIMULATION RESULTS FOR KEY WELLS WITH MEASURABLE OBJECTIVES AND MINIMUM THRESHOLDS
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: grr/pah	Date: 03/09/2022	Project No.: CM19167351
wood.	Figure	7-6

A direct comparison of the simulated MCSB cumulative change in storage curves for the Baseline scenario and the Baseline, Near-Term Projects, and Future Projects with Climate Change scenarios shows that positive and negative cumulative changes in storage occur over time. This is primarily driven by variations in assumed regional mountain front recharge. Under the assumed Baseline hydrology conditions, the MCSB starts out with a negative cumulative change in storage from 2022 through 2027, and then has a net positive cumulative change in storage from 2028 through 2069. This indicates that no additional management actions would be necessary to maintain groundwater storage sustainability (**Figure 7-11**). However, under the assumed drier climate change hydrology conditions, the Baseline with Climate Change scenario has a long-term negative cumulative change in storage starting in 2025 and is therefore not sustainable. The Near-Term Projects and Future Projects with Climate Change scenarios also start out with negative cumulative changes in storage but begin a positive trend in the early 2040s and the cumulative change in storage remains positive through the planning horizon. This indicates that under assumed drier hydrology conditions the Near-Term Projects are necessary to maintain groundwater sustainability and that the Future Projects will provide an increase in groundwater in storage and a buffer for dry periods.

7.5.3 Underflow from DHSSB to MCSB

Underflow from DHSSB to MCSB is discussed below to address the CDWR recommendation to provide reasoning and evidence that maintaining groundwater above the 2009 levels is expected to reduce water quality impacts of groundwater with higher total dissolved solids flowing into the MCSB from the DHSSB (CDWR, 2019a). Section 5.7.3.1 provides a comparison of underflow prior to 2009 conditions and recent conditions using the groundwater model and draws the conclusion that no significant and unreasonable groundwater quality impacts are anticipated with groundwater levels in the MCSB maintained at or above 2009 groundwater levels. This subsection reviews the projected underflow from the DHSSB to the MCSB for the forecast scenarios considered for planning purposes through the planning horizon (2045). Mission Creek Fault underflows are compared to the average underflow from 1978 through 2001, which was about 1,220 AFY. This period was selected because it is prior to artificial recharge that began in 2002, which could affect the underflow.

The water balance for the Baseline scenario (**Table B21**) shows that simulated 2020 to 2045 underflow from DHSSB to MCSB ranges between approximately 1,150 and 1,840 and averages approximately 1,360 AFY, about 140 AFY more than the 1978 through 2001 average of about 1,220 AFY. The Baseline with Climate Change scenario (**Table B22**) shows that simulated 2020 to 2045 underflow from DHSSB to MCSB ranges between approximately 1,130 and 1,230 AFY and averages approximately 1,160 AFY, about 60 AF less than the 1978 through 2001 average of about 1,220 AFY.

The Near-Term Projects with Climate Change scenario (**Table B24**) shows that simulated 2020 to 2045 underflow from DHSSB to MCSB ranges between approximately 1,050 and 1,170 AFY and averages about 1,120 AFY, about 100 AFY less than the 1978 through 2001 average of about 1,220 AFY.

The Future Projects with Climate Change scenario (**Table B26**) shows that simulated 2020 to 2045 AFY underflow from DHSSB to MCSB ranges between approximately 1,030 and 1,170 AFY and averages about 1,110 AFY, about 110 AFY less than the 1978 through 2001 average of about 1,220 AFY.

The water balance results show that except for the Baseline scenario, the simulated underflow from DHSSB to MCSB is less than the 1978 through 2001 average underflow. Under the Near-Term Project and Future Project scenarios recharge of increased SWP deliveries at the MC-GRF results in increasing groundwater levels in the MCSB, reducing the groundwater elevation difference between DHSSB and MCSB, and thus reducing underflow from DHSSB to MCSB.

7.6 Summary and Conclusions

To evaluate selected water management options the calibrated 1936-2019 MCSB model was modified to simulate the 50-year period 2020 through 2069. Forecasts of future population growth were utilized to estimate future groundwater pumping demand and WWTP effluent. Forecasts of MFR were prepared based on 50 years of historical MFR from 1970 through 2019 and a 25-year drought cycle from 1995-2019.

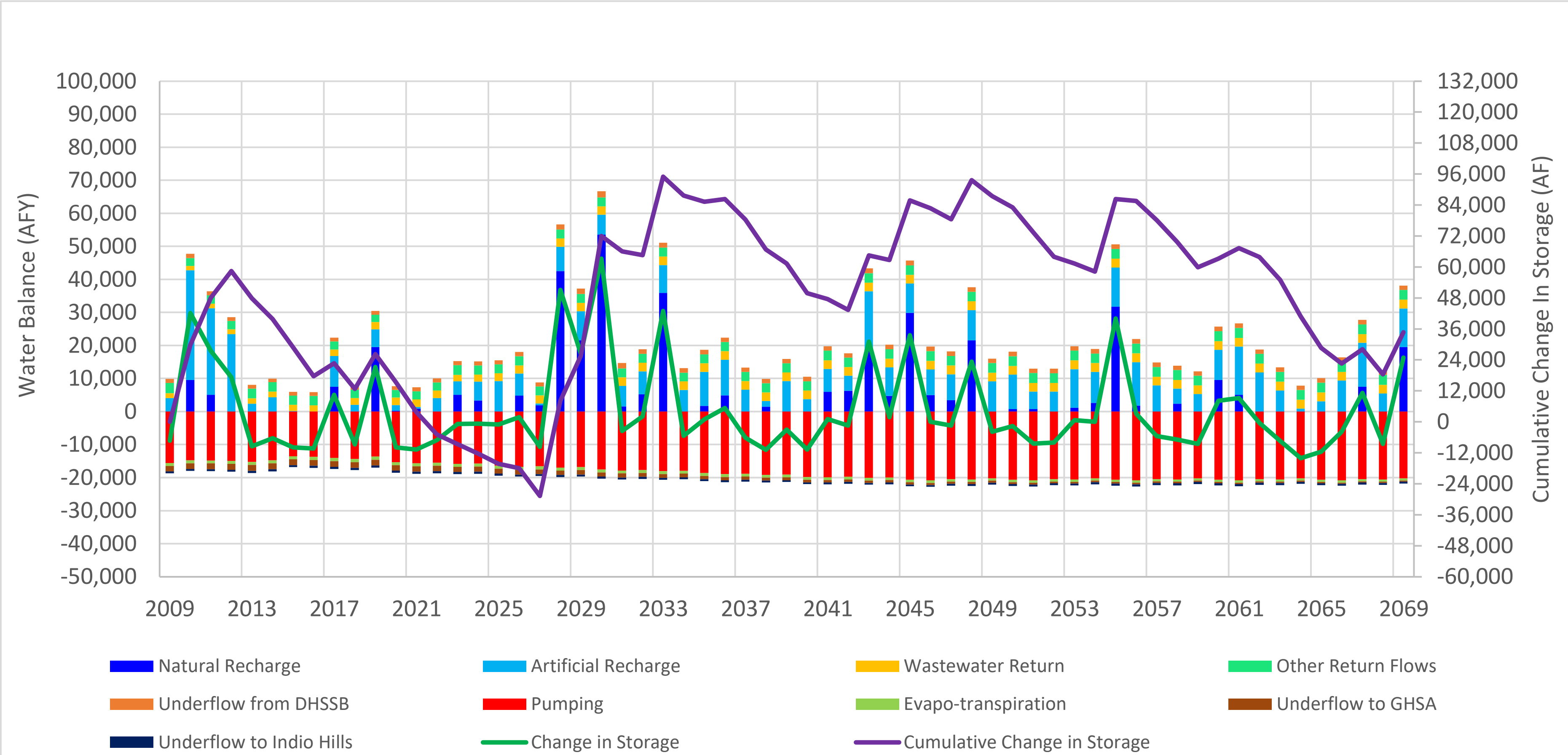
Six forecast scenarios were developed and simulated to evaluate selected water management options. The first three scenarios assume a continuation of long-term historical hydrology and build on one another with additional water management projects. The second three scenarios assume drier climate change conditions and build on one another.

1. Baseline,
2. Near-Term Projects,
3. Future Projects,
4. Baseline with Climate Change,
5. Near-Term Projects with Climate Change, and
6. Future Projects with Climate Change.

The Baseline Forecast provides a useful and necessary benchmark while the forecasts with climate change represent a potential future with a “new normal” of ongoing below normal precipitation conditions Therefore, scenarios 1, 4, 5, and 6 are discussed in this section of the report. These scenarios are also described in **Appendix B** along with scenarios 2 and 3, which do not include assumed climate change. The forecasts were evaluated using simulated hydrographs for nine Key Wells in the MCSB and simulated water balances. Under the Baseline scenario, groundwater levels in all of the nine Key Wells fall below their respective Measurable Objective through the planning horizon of 2045. Groundwater levels in five Key Wells fall below their Minimum Threshold. The long-term cumulative water balance remains positive. Under the Baseline with Climate Change scenario, all wells fall below their respective Measurable Objectives, and six wells fall below their Minimum Threshold during the planning horizon. The long-term cumulative water balance is negative. Consequently, the assumptions used for the Baseline scenario and the Baseline with Climate Change Scenario result in unsustainable conditions. The Baseline scenarios are only shown for comparison purposes and are not a scenario that is planned for implementation.

Under the Near-Term Projects with Climate Change scenario, three Key Wells fall below their respective Measurable Objectives, and all Key Wells stay above their Minimum Thresholds through the planning horizon of 2045. The long-term cumulative water balance is slightly positive. The Near-Term Projects with Climate Change scenario conditions are sustainable.

Under the Future Projects with Climate Change scenario, three Key Wells fall below their respective Measurable Objectives, and all Key Wells stay above their Minimum Thresholds through the planning horizon of 2045. Well 4P01 falls below its Measurable Objective in 2029 by 3.1 feet and then rebounds in 2041. Two wells that fall below their Measurable Objective (15R01 and 17J01) are in the southern part of the MCSB and only fall below their Measurable Objectives by 1.6 feet and 0.4 feet, respectively. Wells 4P01 and 15R01 have limited historical records and the Measurable Objectives for these wells are considered provisional. The long-term cumulative water balance is positive. The Future Projects with Climate Change scenario conditions are sustainable and show increases in groundwater in storage compared to the Near-Term Projects with Climate Change scenario.



Abbreviations:

AF= Acre feet; AFY = Acre feet per year

DHSSB = Desert Hot Springs Subbasin

GHSA = Garnet Hill Subarea

Note: 2009-2019 Water balance inflows and outflows derived from calibrated model.

2009 - 2069 SIMULATED

WATER BALANCE FOR MISSION CREEK SUBBASIN

BASELINE SCENARIO

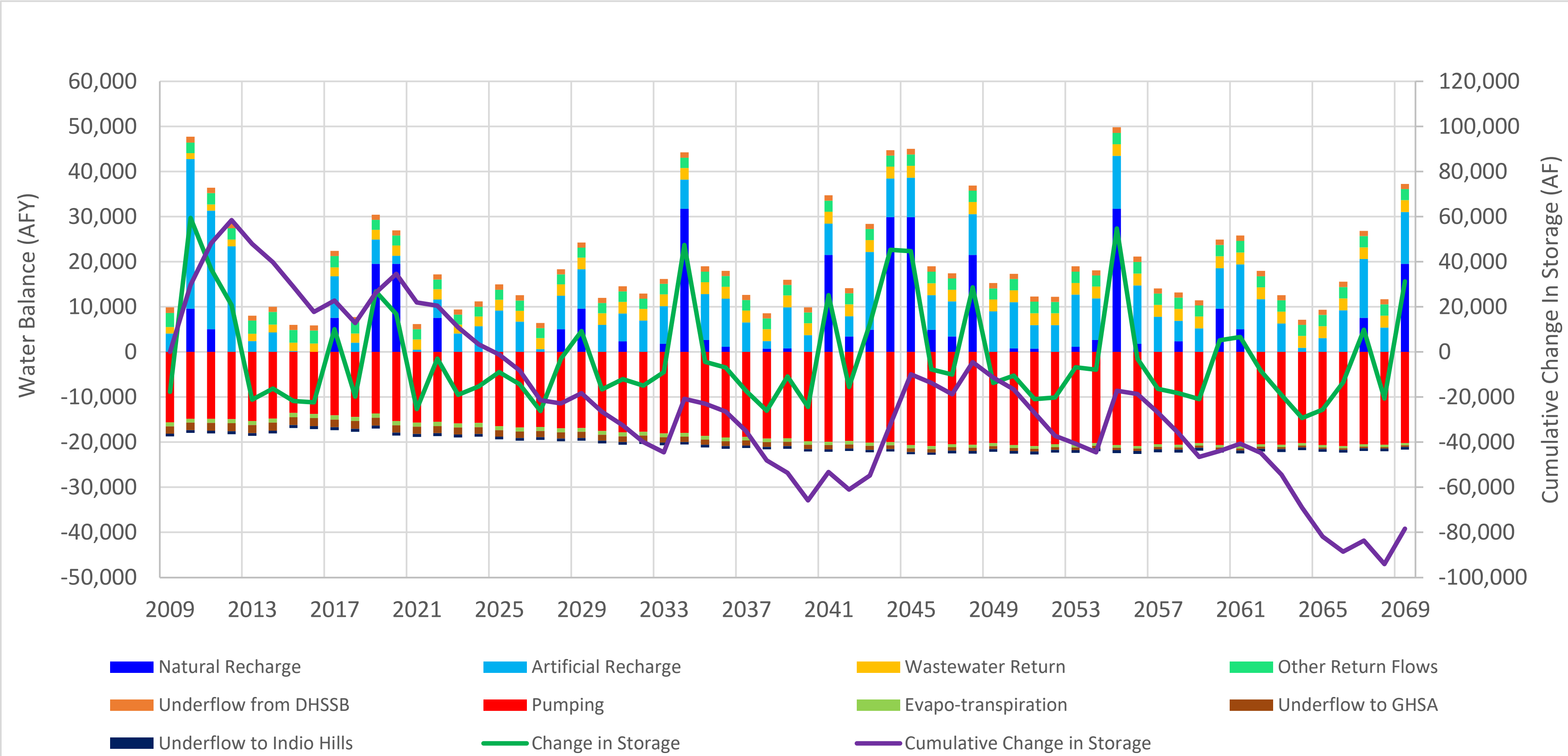
Mission Creek Subbasin Alternative Update

Coachella Valley, California

By: dmb	Date: 02/14/2022	Project No.: CM19167351

wood.

Figure 7-7

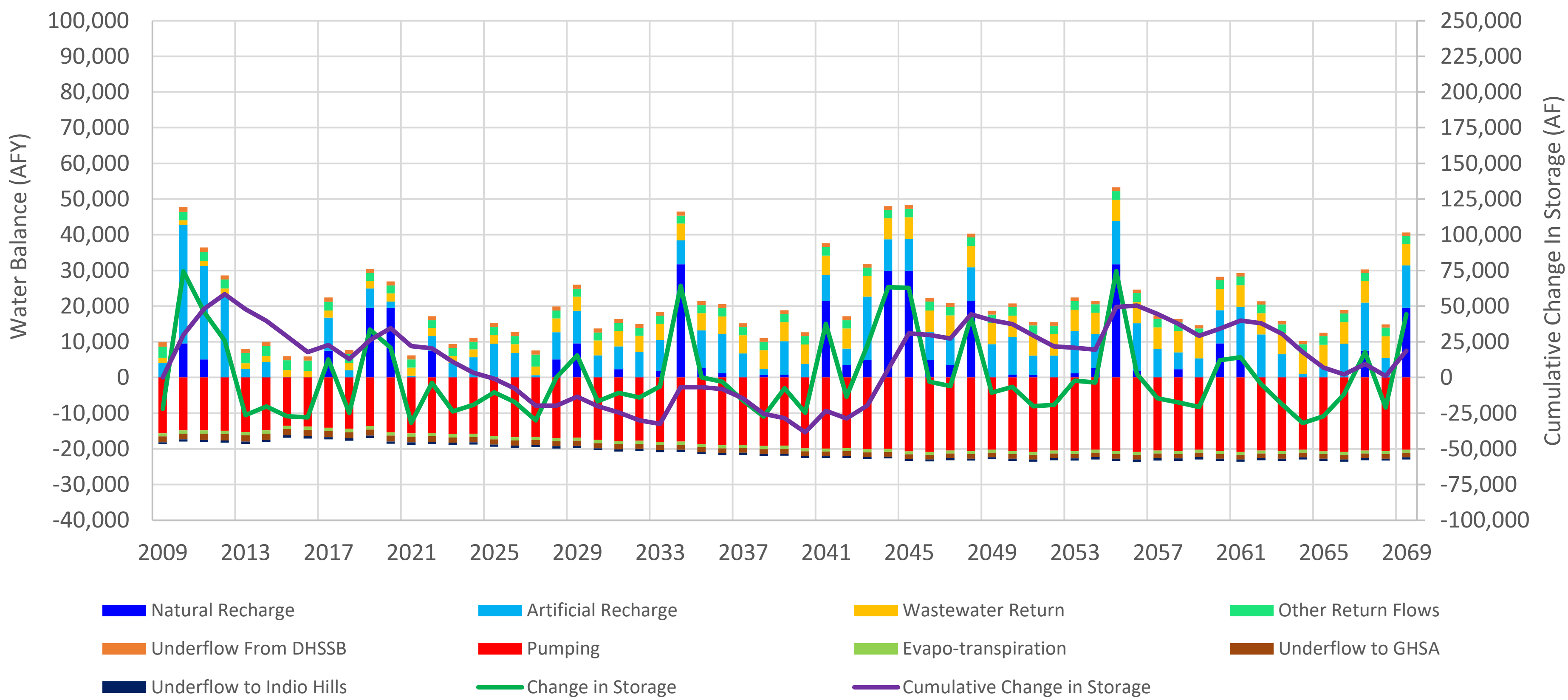


Abbreviations:
AF= Acre feet; AFY = Acre feet per year
DHSSB = Desert Hot Springs Subbasin
GHSA = Garnet Hill Subarea

Note: 2009-2019 Water balance inflows and outflows derived from calibrated model.

2009 - 2069 SIMULATED
WATER BALANCE FOR MISSION CREEK SUBBASIN
BASELINE W/CC SCENARIO
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: dmb	Date: 02/14/2022	Project No.: CM19167351
wood.		Figure 7-8

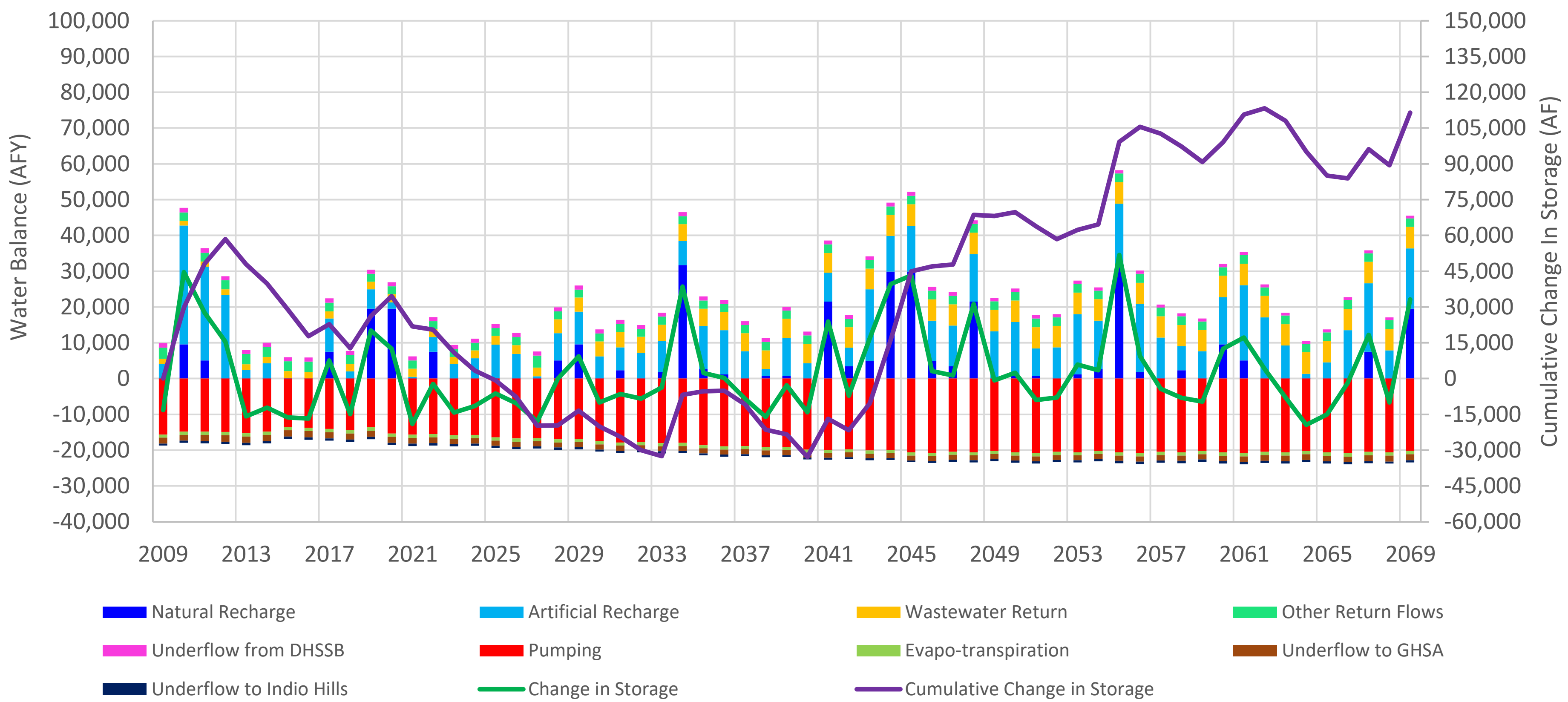


Abbreviations:
AF= Acre feet; AFY = Acre feet per year
DHSSB = Desert Hot Springs Subbasin
GHSA = Garnet Hill Subarea

Note: 2009-2019 Water balance inflows and outflows derived from calibrated model.

2009 - 2069 SIMULATED
WATER BALANCE FOR MISSION CREEK SUBBASIN
NEAR-TERM W/CC SCENARIO
Mission Creek Subbasin Alternative Update
Coachella Valley, California

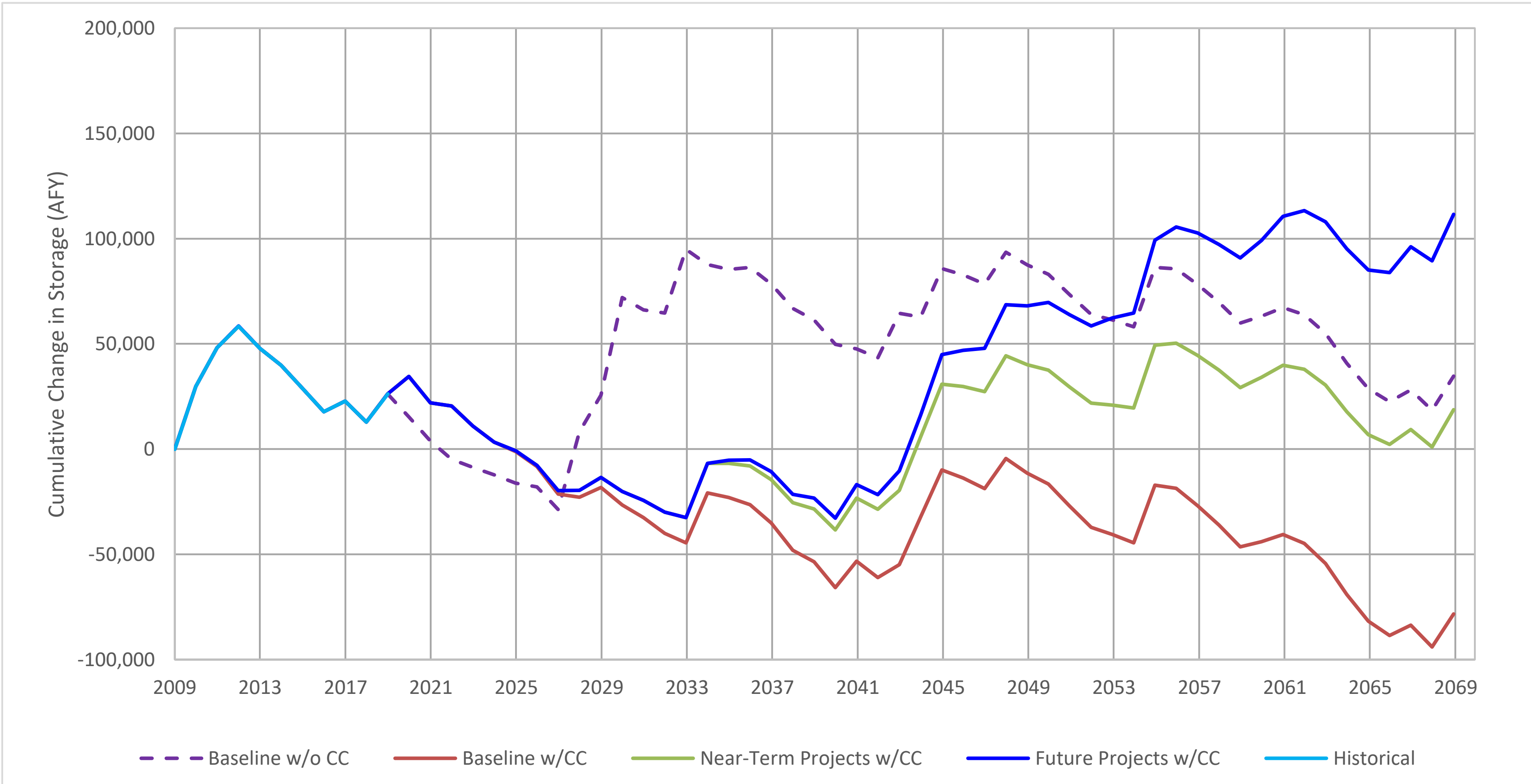
By: dmb	Date: 02/14/2022	Project No.: CM19167351
wood.		Figure 7-9



Abbreviations:
AF= Acre feet; AFY = Acre feet per year
DHSSB = Desert Hot Springs Subbasin
GHSA = Garnet Hill Subarea

Note: 2009-2019 Water balance inflows and outflows derived from calibrated model.

2009 - 2069 SIMULATED WATER BALANCE FOR MISSION CREEK SUBBASIN FUTURE PROJECTS W/CC SCENARIO Mission Creek Subbasin Alternative Update Coachella Valley, California		
By: dmb	Date: 02/14/2022	Project No.: CM19167351
wood.		Figure 7-10



Abbreviations:
AFY = Acre feet per year
MCSB = Mission Creek Subbasin
w/o CC = with out Climate Change
w/CC = with Climate Change

Note: 2009-2019 Cumulative Change in Storage derived from calibrated model.

COMPARISON OF SIMULATED MCSB
CUMULATIVE CHANGE IN STORAGE
Mission Creek Subbasin Alternative Update
Coachella Valley, California

By: dmb	Date: 02/14/2022	Project No.: CM19167351
wood.	Figure	7-11

8.0 Projects and Management Actions

8.1 Introduction

This section of the Alternative Plan Update identifies the Projects and Management Actions (PMAs) that are currently being implemented to effectively manage the groundwater resources of the Planning Area. In addition, this section describes future PMAs that will continue to provide sustainable groundwater management in the Mission Creek Subbasin (MCSB). This section reviews previous and ongoing PMAs and provides information on planned PMAs.

As discussed throughout this Alternative Plan Update, PMAs previously developed and implemented by the Agencies, described in the 2013 Mission Creek/Garnet Hill Water Management Plan (MWH, 2013 [2013 MC/GH WMP]), resulted in groundwater sustainability for the MCSB as follows:

1. Groundwater recharge beginning in 2002 has reversed lowering of groundwater levels and associated depletion of groundwater storage that began in the MCSB in the 1970s. Groundwater levels throughout most of the MCSB and at all the designated Key Wells have been above 2009 groundwater levels for more than a decade, and
2. Parties are addressing salt loading in the MCSB through development of an updated Coachella Valley Salt and Nutrient Management Plan (CV-SNMP).

As described in Section 7, ongoing PMAs and implementation of planned PMAs will allow for sustainability as future demands increase, even under an assumption of climate change conditions that result in lower natural recharge and constraints on artificial recharge. To that end, this Alternative Plan Update section provides an overview of the adaptive management processes of the Management Committee and the ongoing and planned PMAs.

8.2 Adaptive Management

An adaptive management strategy for groundwater management and PMA implementation has been employed by the Agencies to maintain sustainability of the MCSB. Since the 2013 MC/GH WMP, population growth projections have decreased with a corresponding reduction in the projected urban development and water demands in the MCSB. At the same time, the reliability of imported water supply from the State Water Project (SWP) has declined due to a combination of drought, climate change, and legal and environmental restrictions in the Sacramento-San Joaquin Delta (Delta). The Agencies need flexibility to manage the uncertainties associated with shifting forecasted water demands and anticipated conservation legislation, climate change, and supply constraints. Adaptive management provides the flexibility needed to maintain a balanced MCSB and avoid significant and unreasonable undesirable results when conditions change. This Alternative Plan Update incorporates a flexible and adaptive approach to water resources management so the Agencies can adjust the implementation strategy as needed.

Adaptive management is the process of making water management decisions on an incremental basis in response to actual data that have been gathered. Adaptive management is used to balance the risk of over-investment in water supplies and infrastructure with the risk of unanticipated shortages due to inadequate action. Adaptive management involves five steps: monitoring, reporting, evaluating, adjusting, and implementing (see **Figure 8-1** below).

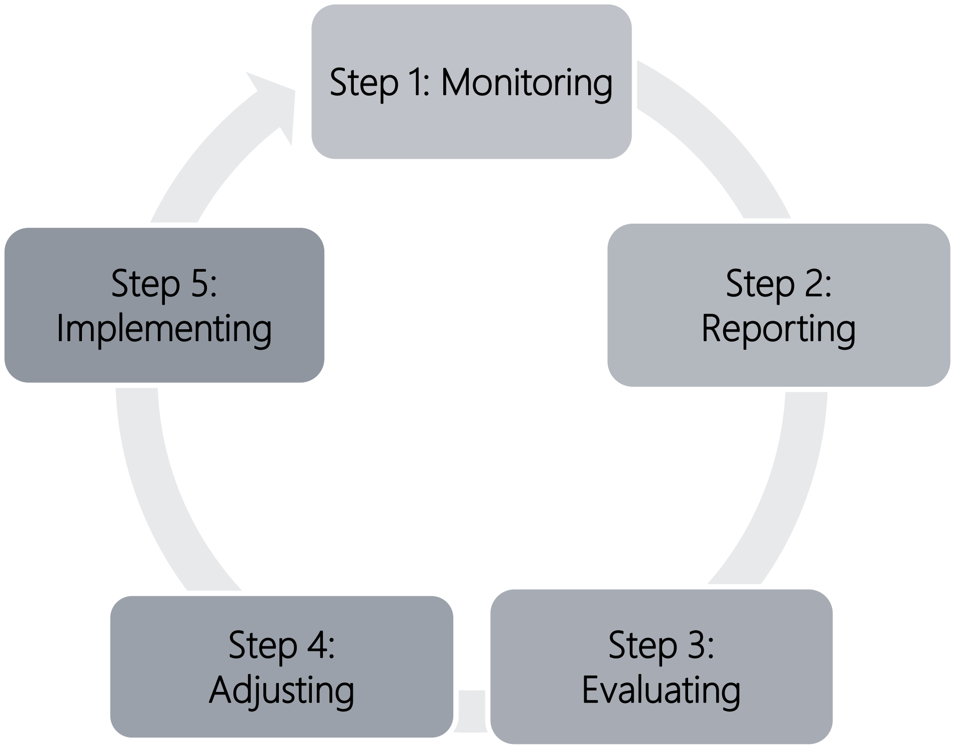


Figure 8-1: Adaptive Management Cycle for PMA Implementation

Following is a description of each step in the adaptive management cycle using compliance with the Sustainable Groundwater Management Act (SGMA) as an example:

1. **Step 1: Monitoring**. The Agencies will continue their ongoing monitoring programs as outlined in **Appendix E**, Monitoring Program, to assess groundwater levels; climate and streamflow; groundwater production; subsidence; and water quality.
2. **Step 2: Reporting**. The Agencies will use the monitoring data to track conditions for the applicable sustainability indicators discussed in Section 6, Sustainable Management Criteria. These conditions will be reported in the SGMA Annual Report (Project SGMA-4).
3. **Step 3: Evaluating**. If any Minimum Threshold approaches exceedance, the Agencies will conduct an evaluation to determine whether there is a change in conditions that is locally driven, such as a change in local land use or pumping patterns, or a change in conditions that is long-term and/or regional. The evaluation will include steps such as analyzing pumping, imported water recharge, well logs, land use changes, well permit records, or climate/precipitation data to determine whether any recent changes occurred that may have affected monitoring results. This evaluation can be incorporated in the SGMA Annual Report.

4. **Step 4: Adjusting**. If a long-term regional trend may cause undesirable results, the Agencies may adjust the PMAs that are being implemented to manage the MCSB. The Agencies will select the relevant PMAs within their respective jurisdiction. Regional programs also may be developed and implemented with the agreement of the Agencies. Any changes to PMAs will be captured within the SGMA Annual Report or the Five-Year Alternative Plan Update described in Sections 8.7.4 and 8.7.5, respectively.
5. **Step 5**: **Implementing**. Following selection of new or refined PMAs, monitoring and management practices will be implemented to reflect the new activities. PMAs to be implemented will be reviewed during SGMA Annual Reports and Five-Year Alternative Plan Updates and adjusted as needed.
6. **Return to Step 1: Monitoring.** Ongoing monitoring data will be used to assess the results of PMA implementation and any changes to conditions. If monitoring indicates sustainable conditions have been restored (i.e., conditions are above the minimum threshold), implementation of the PMAs may be scaled back and monitoring continued. If the exceedance is not addressed, the Agencies will identify and implement additional PMAs to avoid undesirable results.

This adaptive management approach allows the Agencies to adapt to changing conditions and accelerate existing PMAs, add PMAs, or delay or defer PMAs as needed.

8.3 Project Review

The Agencies have reviewed the list of projects identified in the 2013 MC/GH WMP and 2016 Bridge Document, which were adopted as the Alternative Plan. This list of projects is included and updated with each SGMA Annual Report.

For this Alternative Plan Update, Agencies reviewed the PMA lists from the 2013 MC/GH WMP and the 2021 SGMA Annual Report (Wood, 2021) and divided the PMA list into the following categories:

- Active Projects, which are further defined as:
    - Ongoing Projects that are currently underway or that Agencies anticipate implementing on a continual basis, and
    - Planned Projects for future implementation.
- Completed Projects are those that are fully completed;
- Deferred Projects are those that may not be currently needed or are not currently economically feasible; and
- Removed Projects are those that were incorporated into other Active projects or are no longer being pursued.

Collectively, the Active Projects will facilitate maintaining the sustainability of the MCSB now and over a range of potential future conditions. Therefore, the focus of this section is the Active

Projects as detailed in Sections 8.4 through 8.8. The remaining project categories are described in **Appendix F**.

8.3.1 Project Identification

This Alternative Plan Update modifies the project identification numbering system used in the 2013 MC/GH WMP, 2016 Bridge Document, and SGMA Annual Reports. The new numbering system uses similar categories, (i.e., conservation, water supply), but now incorporates a more descriptive letter combination, listed below, followed by a sequential number (e.g., WC-1 is the first water conservation project).

- WC: Water Conservation
- WS: Water Supply
- WQ: Water Quality Protection, including CV-SNMP activities
- SGMA: SGMA Implementation
- WELL: Well Management

A cross-reference table of the prior identification numbers and the current identification for Active Projects is provided in **Table G-1** of **Appendix G**.

8.4 Water Conservation

Active water conservation activities have supported the water management achievements in the Planning Area and are important to continue moving forward. The ongoing and future water conservation projects are:

- Project WC-1: Continue to implement urban water conservation and education programs,
- Project WC-2: Track water conservation effectiveness through the Regional Urban Water Management Plan (RUWMP),
- Project WC-3: Regional conservation study, and
- Project WC-4: Implement Water Shortage Contingency Plans.

The descriptions for Project WC-1 and Project WC-2 are combined as they are interrelated while Project WC-3 and Project WC-4 are standalone descriptions.

8.4.1 Project WC-1: Continue to implement urban water conservation and education programs and Project WC-2: Track water conservation effectiveness through the RUWMP

Coachella Valley Water District (CVWD), Desert Water Agency (DWA), and Mission Springs Water District (MSWD) were participants (along with Coachella Water Authority [CWA], Indio Water Authority [IWA], and Myomas Dunes Water Company) in the 2020 Coachella Valley RUWMP that provides detailed descriptions of each of the Agencies' water conservation programs (2020 CVRUWMP [WSC, 2021]). The effectiveness of the water conservation efforts is documented in the Water Conservation Act of 2009 Senate Bill X7-7 (SB X7-7) compliance for each agency. In

SB X7-7, the State set a goal of reducing urban water use by 20% by the year 2020. Each retail urban water supplier was required to determine its water use during a baseline period and establish water use targets for the years 2015 and 2020 to help the State achieve the 20% reduction. All the Agencies exceeded the 20% reduction from their baseline water use by achieving savings of 36% for CVWD, 32% for DWA, and 35% for MSWD.

As described in the 2020 CVRUWMP, the Agencies continue to implement demand management measures (DMMs) to maintain these savings and to encourage additional conservation, such as:

- Water waste and landscape ordinances;
- Metering;
- Conservation pricing including water budget-based tiered billing;
- Public education and outreach including conservation kits, workshops/seminars on water use efficiency, water audits, and water waste patrols;
- Programs to assess and manage distribution system losses;
- Landscape conservation and incentive programs including irrigation system upgrades, grass replacement, drought tolerant landscape installations, and conservation demonstration gardens;
- Rebate programs for high efficiency appliances including toilets, washers, and dishwashers; and
- Staff support for water conservation activities.

The Agencies collaborate on regional conservation messaging through CV Water Counts (www.CVWaterCounts.com), originally funded with California Department of Water Resources (CDWR) Proposition 84 funding and currently sustained by local water agencies. The group has a web and social media presence in addition to an ongoing advertising campaign. The Agencies will continue to implement DMMs and will track effectiveness of water conservation efforts during the update of the RUWMP. Project WC-2 will also include tracking new conservation standards that are currently under development and will include updates to conservation programs, if needed, to implement those standards.

8.4.2 Project WC-3: Regional conservation study

As a supplement to existing Projects WC-1 and WC-2, the Agencies have initiated planning to conduct a study specific to the unique climate, soil, and occupancy conditions of the Coachella Valley. Project WC-3: Regional conservation study, will take an econometric approach to estimating water savings for various rebate programs and may be used to evaluate incentive amounts for residents and businesses.

The study will likely focus on outdoor irrigation to determine the water savings per square foot if grass were replaced by alternative landscape such as artificial turf or desertscape. The water savings study will analyze information from ongoing programs and may include:

- Analysis of historical grass replacement rebate data from the Agencies from 2014-present including consideration of square foot grass replaced and water usage before and after the replacement;
- Validation of low-water use landscape maintenance by surveying customers and spot checking grass replacement sites;
- Consideration of customers that removed grass without receiving a rebate and/or replaced grass with private patios, side yards, and/or backyards;
- Potential for additional grass replacement among existing customers (i.e., percent saturation achieved by existing conservation programs);
- A similar review of water efficient devices; and
- Preparation of a report to document analysis.

The Agencies are seeking grant funding for this study. Once completed, the study can support more competitive water conservation implementation grant applications such as those funded by the United States Bureau of Reclamation and CDWR. Additional grant funding for implementation would support expansion of water conservation programs to serve more customers, result in increased water savings, and reduce groundwater pumping.

8.4.3 Project WC-4: Implement Water Shortage Contingency Plans

The 2020 RUWMP that was recently completed and adopted includes standalone Water Shortage Contingency Plans (WSCP) for each of the Agencies. The WSCPs contain Annual Water Supply and Demand Assessment procedures, defines six standard shortage levels from 10% shortage up to greater than 50% shortage, and identifies shortage response actions including demand reduction actions and mandatory use restrictions and supply augmentation as well as communication protocols for implementing the WSCP. The WSCPs are another tool to be implemented by the Agencies if needed.

8.5 Water Supply

Imported water is critical to groundwater sustainability in the MCSB. CVWD and DWA continue to invest in long-term, statewide water projects and are working with Metropolitan Water District of Southern California (MWD) and the CDWR to improve the reliability of SWP water and acquire additional supplies. Ongoing and future water supply projects are listed below and described in the sections that follow.

- Project WS-1: Continue existing imported water replenishment programs,
- Project WS-2: Recycled water for reuse in the MCSB,
- Project WS-3: SWP-Delta Conveyance Facility (DCF),
- Project WS-4: SWP Lake Perris Dam Seepage Recovery Project, and
- Project WS-5: SWP- Sites Reservoir Delivery.

SWP supplies to the region are expected to increase by approximately 14,300 AF by 2035, along with increased SWP reliability of 26,500 acre-feet per year (AFY) following construction of the DCF by 2040 for a grand total of 40,800 AFY of SWP supply increase to the region. A portion of these supplies and increased SWP reliability will be provided to the MCSB.

8.5.1 Project WS-1: Continue existing imported water replenishment program

CVWD and DWA both have authority to operate imported water replenishment in the Coachella Valley. Imported water replenishment operations will deliver as much imported water to the Coachella Valley as possible given the constraints of SWP contract and delivery and MWD Colorado River Aqueduct (CRA) operations. As opportunities arise, CVWD and DWA will consider making imported water purchases from programs such as the Yuba River Accord Dry Year Water Purchase Program (Yuba Accord).

CVWD and DWA intend to continue regular recharge activities at the Mission Creek Groundwater Replenishment Facility (MC-GRF) to maintain sustainable groundwater levels. Between calendar years 2002 and 2019, CVWD and DWA have replenished 165,276 AF of SWP Exchange Water at the MC-GRF.

CVWD, DWA, and MSWD periodically review local and imported water supply availability and needs as part of the routine Management Committee activities per the 2004 Settlement Agreement. This review will now be conducted in coordination with preparation of the SGMA Annual Report described in Section 8.7.4. CVWD and DWA are pursuing acquisition of additional imported water supplies as needed and described in Section 8.5.3 through Section 8.5.5.

8.5.2 Project WS-2: Recycled water for reuse in MCSB

Project WS-2 will be to plan, design and construct tertiary treatment at MSWD's Regional Water Reclamation Facility (RWRF) where the recycled water can be used for groundwater recharge or for non-potable reuse for irrigation of parks, golf courses, schools, resorts, homeowner's associations, agricultural uses, etc. Project WS-2 is directly related to Project WQ-1: Convert from septic to sewer in MSWD area and Project WQ-2: Construct RWRF which is scheduled to begin construction in 2021. Implementation of Projects WQ-1 and WQ-2, detailed in Section 8.6, will result in construction of wastewater treatment and evaporation/percolation ponds in the Garnet Hill Subarea of the Indio Subbasin (GHSA).

MSWD initiated planning work for Project WS-2 as described in the Recycled Water Program Development Feasibility Study: Technical Memorandum No. 2 (TM-2) (Hazen, 2018). TM-2 documents the regulatory requirements to implement groundwater recharge which is considered a Groundwater Replenishment Reuse Project (GRRP). The GRRP regulations were adopted on June 30, 2014 by the State Water Resources Control Board, Division of Drinking Water (SWRCB-DDW), which are found in Title 22 Code of Regulations, Division 4. Environmental Health, Chapter 3. Water Recycling Criteria, Article 5.1 Indirect Potable Reuse: Groundwater Replenishment - Surface Application.

Implementation of a GRRP project will require additional treatment to achieve the virus, *Giardia*, and *Cryptosporidium* log reduction values identified in the regulations and diluent water will need to be blended with recycled water to meet the prescribed recycled water concentration.

A GRRP project will also require, at a minimum, assessment of diluent water characteristics, as well as groundwater modeling and tracer tests to assess retention time to the nearest downgradient well.

As detailed in Section 8.6.2, the RWRF (Project WQ-2) is anticipated to start receiving flow in 2022 and is projected to reach 1.50 million gallons per day (mgd) treatment capacity by approximately 2030. The proposed recharge facilities in Project WS-2 are planned for an 80-acre site in the MCSB owned by MSWD on 14th Avenue, approximately 1,500 feet west of Indian Canyon Drive. The available recharge capacity of the 80-acre site amounts to approximately 78 mgd utilizing an infiltration rate of 3 feet per day (Hazen, 2018). In addition to treatment facilities, the GRRP will require conveyance infrastructure from GHSA to MCSB, recharge ponds, and monitoring wells.

TM-2 also identifies both existing developments and proposed developments totaling 1,085 acres of potential recycled water irrigation area that were estimated to require up to 6,949 AFY of average annual recycled water demand. Recycled water for non-potable irrigation uses will require tertiary treatment including filtration as well as disinfection. In addition to treatment facilities, non-potable reuse will require conveyance infrastructure from GHSA to MCSB, recycled water distribution infrastructure and connections to individual customers.

As described in Section 7, recharge of treated effluent in the MCSB could be important to groundwater sustainability by returning treated wastewater that would otherwise be evaporated/percolated in the GHSA. Project WS-2 may be implemented in phases with the need for initiation of additional planning in the near future. Project WS-2 also has the advantage of being a water supply project that could be implemented locally.

8.5.3 Project WS-3: SWP – Delta Conveyance Facility

The DCF project is led by CDWR to improve SWP reliability. The DCF will modernize SWP conveyance facilities in the Delta for increased future deliveries related to projected long-term reliability. Existing natural channels currently used for SWP conveyance are vulnerable to earthquakes, sea level rise, and pumping restrictions. The DCF will construct and operate a new tunnel to bypass these vulnerable natural channels. The new facilities will convey water from the north Delta to the south Delta operating in coordination with the existing south Delta pumping facilities. The planning process for the proposed DCF is moving forward, and a Draft Environmental Impact Report is anticipated for public review in mid-2022.

CVWD and DWA have approved a 2-year agreement to advance their share of funding for DCF planning and design costs. The Agreement in Principle for the DCF was approved in 2020 as outlined in **Table 4-5**. As detailed in Section 4.2.5, SWP contractors estimate that SWP Table A deliveries will increase by 500,000 AFY after the DCF is built, restoring an average of SWP supply of 26,500 AFY above current conditions to CVWD and DWA by 2040.

8.5.4 Project WS-4: SWP – Lake Perris Dam Seepage Recovery Project

The Lake Perris Dam Seepage Recovery Project is led by CDWR. This project will collect and distribute SWP water seeping under Lake Perris Dam for delivery to MWD in addition to its current allocated Table A water. The project consists of installing an integrated recovery well system downgradient from the face of Lake Perris Dam that would include up to six (6) new seepage recovery wells and a conveyance pipeline connecting the wells to MWD's CRA. The project is proceeding as planned, and the Draft Environmental Impact Report was released in May 2021 for public comments.

MWD has partnered with CVWD and DWA and signed an agreement with CDWR in 2021 to fund the environmental analysis, planning, and preliminary design of the project. CVWD and DWA will need an additional agreement (or amendment to the existing Exchange Agreement) to exchange a proportion of the recovered seepage water for Colorado River water delivered by MWD through the CRA to the Whitewater River Groundwater Replenishment Facility (WWR-GRF) and the MC-GRF (MWD, 2020) As described in Section 4.2.6, the project is anticipated to deliver approximately 7,500 AFY to the region in 2023, of which 2,753 AFY is estimated to be the combined CVWD and DWA portion.

8.5.5 Project WS-5: SWP – Sites Reservoir Delivery

The Sites Project Authority is developing the Sites Reservoir Delivery project to capture and store excess water from snowmelt and winter runoff from the Sacramento River for use during dry periods. The Sites Reservoir will be in the Sacramento Valley. The project is considered "off-stream," i.e., it will not dam or impede the Sacramento River or other streams. The Sites Reservoir will operate in conjunction with other California reservoirs to increase water supply reliability and resiliency. Project implementation will increase water storage capacity in Northern California by up to 15%. Water supply and storage capacity will be made available to water purveyors throughout California who want to purchase water supply from the Sites Reservoir Project. The project is in the early planning and permitting stages. The Sites Project Authority is currently negotiating agreements to secure funding and financing for design, construction, and operation of the project (Sites Project Authority, 2020).

In 2019, CVWD and DWA entered into an agreement with the Sites Project Authority for the next phase of planning for the Sites Reservoir (Sites Project Authority 2019; 2020). CVWD and DWA are participating members at 10,000 AFY (5.2%) and 6,500 AFY (3.4%) levels, respectively. Assuming a 30% conveyance loss, CVWD and DWA anticipate a total delivery of 11,550 AFY of Sites Reservoir water beginning in 2035.

8.6 Water Quality Protection

There is a broad suite of active water quality protection programs that are implemented by local agencies, as well as collaboratively in the Planning Area. These include:

- Project WQ-1: Convert from septic to sewer in MSWD area,
- Project WQ-2: Construct RWRF with nitrogen removal,
- Project WQ-3: Track water quality regulatory actions,
- Project WQ-4: Well source assessment and protection coordination,
- Project WQ-5: Engage in planning processes to protect water quality,
- Project WQ-6: Educate public on groundwater quality issues,

- Project WQ-7: Implement CV-SNMP Development Workplan,
- Project WQ-8: Implement CV-SNMP Groundwater Monitoring Program Workplan,
- Project WQ-9: Install water quality monitoring wells, and
- Project WQ-10: Evaluate occurrence and risk of uranium migration.

The water quality protection projects are described below.

8.6.1 Project WQ-1: Convert from septic to sewer in MSWD area

Project WQ-1 is MSWD's ongoing Groundwater Quality Protection Program to convert residences from septic to community sewers and wastewater treatment facilities. MSWD Assessment District (AD) 15 and AD-18 will support septic to sewer conversions by providing local funding to match with grant funding opportunities. MSWD has completed sewering in five previous ADs to date. Design for planned conversions in AD-15 are expected to be constructed in 2022 with other completed designs planned for construction in 2023 and 2024. MSWD has other conversions in design to be constructed in future years.

8.6.2 Project WQ-2: Construct RWRF with nitrogen removal

In anticipation of meeting future treatment and recharge needs, MSWD has completed design of the RWRF (Project WQ-2), which will treat wastewater flows to secondary levels including nitrification and denitrification. Located in the GHSA, the RWRF will divert some wastewater flows from existing wastewater treatment plants in the MCSB that are at capacity. The RWRF will have an initial capacity of 1.5 mgd with construction to begin in 2021. The RWRF will start receiving flow in 2022 and is projected to reach 1.50 mgd treatment capacity by approximately 2030. RWRF has the potential to be expanded to a buildout capacity of 3.00 mgd. Wastewater flows will be from existing sewered customers and from the septic to sewer conversions in the DHSSB, MCSB, and GHSA.

Treated wastewater will be discharged to evaporation/percolation ponds in the GHSA and will show measurable reduction in nitrogen in the effluent water quality samples in comparison to the existing septic system dischargers. The benefits of a treated RWRF effluent rather than septic discharges are reduced contributions of nitrates and ammonia to the aquifer, which results in improved groundwater quality.

As described in Section 8.5.2, upon completion of the RWRF construction, treated effluent from Project WQ-2 can be conveyed and reused in Project WS-2 with construction of additional treatment, recycled water distribution systems, and groundwater recharge facilities.

8.6.3 Project WQ-3: Track water quality regulatory actions

SWRCB-DDW and United States Environmental Protection Agency (USEPA) periodically update drinking water constituent lists for potential regulation. These updated lists need to be tracked and shared as they could affect the ability of CVWD, DWA, and MSWD to comply with drinking water regulations. This PMA continues the ongoing effort to track potential regulatory actions of SWRCB-DDW and USEPA and to share information during Management Committee meetings.

As water quality can vary across the Planning Area, each agency will evaluate its data to assess the impact of regulations within its boundaries.

8.6.4 Project WQ-4: Well source assessment and protection coordination

Project WQ-4 is necessary because of the potential for contaminating activities to impact both individual wells and managed and natural recharge areas. Potential contaminating activities can include spills, landfills, and underground tank leaks which are regulated by Riverside County Department of Environmental Health (RCDEH), the Colorado River Basin Regional Water Quality Control Board (RWQCB), and/or California Department of Toxic Substance Control. The Agencies will continue to coordinate as necessary with the appropriate regulatory agencies that are responsible for monitoring and regulating potentially contaminating activities, especially if the activity occurs within well capture zones and/or principal recharge zones. Information gathered can be shared during Management Committee meetings and appropriate follow-up actions discussed and pursued.

8.6.5 Project WQ-5: Engage in planning processes to protect water quality

Project WQ-5 will be the responsibility of each agency and is necessary to assess development proposals, during the entitlement process, for potential water quality and other impacts. Agencies are notified of new projects in the incorporated cities of Desert Hot Springs and Palm Springs and unincorporated Riverside County through receipt of the notice of preparation of environmental documents, requests for water supply assessments for larger developments, and other means. Agencies can review and comment on the documents and identify water quality and other potential impacts to the MCSB. As discussed in Section 3, the information gathered annually regarding upcoming development projects in the City of Desert Hot Springs (City of DHS) will also facilitate identification of projects that could impact water quality.

8.6.6 Project WQ-6: Educate public on groundwater quality issues

Project WQ-6 to provide public education on groundwater quality is ongoing through participation in the Groundwater Guardian program, a community educational program developed by the non-profit Groundwater Foundation. Other ongoing planning activities such as the CV-SNMP, Coachella Valley Integrated Regional Water Management Plan, and CV Water Counts provide opportunities for additional public education regarding groundwater quality.

8.6.7 Project WQ-7: Implement CV-SNMP Development Workplan

In 2015, the CV-SNMP was developed for the Coachella Valley Groundwater Basin in accordance with the Recycled Water Policy. The CV-SNMP was prepared to manage salts and nutrients on a Subbasin-wide basis, while encouraging recycled water use. However, the RWQCB found the 2015 CV-SNMP insufficient and made recommendations for improvements in 2020. In 2020 and 2021, the CV-SNMP partners – which include CVWD, Coachella Sanitary District, City of Palm Springs, CWA, DWA, IWA, MSWD, Myoma Dunes Mutual Water Company, and Valley Sanitary District – prepared a CV-SNMP Development Workplan (Development Workplan), which is the focus of this project and a CV-SNMP Groundwater Monitoring Program Workplan (Monitoring Workplan), which is Project WQ-8, to guide revisions to the plan.

The CV-SNMP agencies submitted a draft Development Workplan to the RWQCB in April 2021 that was discussed at a September 2021 meeting with the RWQCB. The goal of the Development Workplan is to outline the steps necessary to resolve the challenges identified by the RWQCB in their 2015 CV-SNMP review comments and to comply with the Recycled Water Policy. The Development Workplan also defines the approach to be used to update the CV-SNMP in a collaborative manner that addresses management of salts and nutrients from all sources, including importation of Colorado River water, in order to protect beneficial uses. The Development Workplan includes a Groundwater Monitoring Program Workplan (West Yost, 2020) to define the updated SNMP monitoring network, including wells needed to address network gaps, which will be used to monitor the spatial and vertical distribution of salts and nutrients in the Basin. **Appendix E** provides a summary of water quality monitoring for the CV-SNMP.

CVWD, DWA, and MSWD, along with the other CV-SNMP Agencies, will implement the Development Workplan that includes conducting public outreach and creating a technical advisory committee, characterizing current groundwater quality and salt loading, developing nitrogen/total dissolved solids (N/TDS) forecasting methodologies, completing forecasting for multiple scenarios, selecting a preferred scenario, establishing management zones, and recommending TDS objectives. The implementation schedule for the Development Workplan concludes with a final CV-SNMP submitted to the RWQCB in October 2026.

The CV-SNMP update may require implementation of mitigation for N/TDS loading, which will be evaluated during implementation of the Development Workplan.

8.6.8 Project WQ-8: Implement CV-SNMP Groundwater Monitoring Program Workplan

With the other CV-SNMP Agencies, CVWD, DWA, and MSWD are implementing the Monitoring Workplan approved by the RWQCB in February 2021. The Monitoring Workplan outlines an expanded groundwater monitoring program to sufficiently determine whether concentrations of N/TDS in groundwater are consistent with water quality objectives. The Monitoring Workplan covers all subbasins within the Coachella Valley Groundwater Basin, including MCSB; includes sampling from the deep, shallow, and perched zones of the aquifer; focuses on critical areas near large water reclamation plants, Groundwater Replenishment Facilities (GRFs), and other potential sources of salt and nutrient loading; and emphasizes areas near production wells. The Monitoring Workplan establishes the monitoring network, sampling frequency, and reporting of monitoring results, and identifies data gaps to be filled in the monitoring network. Monitoring data and progress toward filling data gaps will be reported to the RWQCB and to the State Water Resource Control Board’s Groundwater Ambient Monitoring and Assessment (GAMA) system annually starting in 2022. **Appendix E**, which describes the monitoring program for the Alternative Plan Update, includes the Monitoring Workplan as an attachment.

8.6.9 Project WQ-9: Install water quality monitoring wells

The CV-SNMP Monitoring Workplan identified locations in the MCSB, DHSSB, and GHSA at which monitoring wells will be constructed and sampled to address data gaps. Wells will be constructed in accordance with the schedule provided in the Monitoring Workplan to support water quality data collection. **Appendix E**, which describes the monitoring program for the Alternative Plan Update, includes the Monitoring Workplan as an attachment.

8.6.10 Project WQ-10: Evaluate occurrence and risk of uranium migration

As detailed in Section 4.6.1, uranium is a naturally occurring radionuclide in the Planning Area with a SWRCB maximum contaminant level (MCL) in drinking water of 20 picocuries per liter. In general, uranium activity appears to be stable over the long-term and below the MCL. A study by GSi/water (2011) indicates the potential source of the uranium is subsurface alluvial materials derived from the Dry Morongo Creek and Big Morongo Creek watersheds. Other sources considered include shallow bedrock, rising fluids along the Mission Creek Fault, and anthropogenic sources.

MSWD plans to initiate a study in the near term to further evaluate the potential sources and migration risk of uranium. The study is also intended to evaluate whether the uranium source is associated with specific alluvial sediments so that future wells can be designed to avoid those sediments if necessary.

8.7 SGMA Implementation

SGMA implementation will require continuing a range of monitoring, data management and reporting activities that have been an integral part of water management since the preparation of the 2013 MC/GH WMP. The SGMA Implementation projects are:

- Project SGMA-1: Continue existing subbasin Management Committee structure,
- Project SGMA-2: Conduct subsidence evaluation,
- Project SGMA-3: Maintain and manage water related data,
- Project SGMA-4: SGMA Annual Report,
- Project SGMA-5: Five-Year Alternative Plan Updates, and
- Project SGMA-6: Pursue funding opportunities.

The projects below are either required by SGMA or otherwise support meeting SGMA requirements.

8.7.1 Project SGMA-1: Continue existing subbasin Management Committee structure

This project was initiated during the preparation of the 2013 MC/GH WMP and satisfies CDWR’s guidelines for a groundwater management planning committee. The Management Committee is a requirement of the 2004 Settlement Agreement and occurs quarterly between GMs and staff throughout the year. In addition, staff have periodic coordination meetings for items like plan update, annual reports, or other relevant topics that may come up and will meet at least once per year to specifically discuss the annual report. The Management Committee has met frequently during the preparation of this Alternative Plan Update and will continue to meet quarterly and collaborate on water management activities during implementation of this Alternative Plan Update.

8.7.2 Project SGMA-2: Conduct subsidence evaluation

There has been no historical evidence of subsidence occurring in the MCSB and current monitoring of ground levels using Interferometric Synthetic Aperture Radar (InSAR) data available through CDWR do not show subsidence over the period 2015 to 2019. To further evaluate the potential for subsidence, the Agencies have engaged the United States Geological Survey (USGS) to conduct a more detailed evaluation of the potential for subsidence in the MCSB. If this initial evaluation identifies subsidence as a potential issue, the USGS will develop a subsidence monitoring workplan for the MCSB and conduct ground surface monitoring. Information collected from this project will be summarized in the SGMA Annual Report prepared as part of Project SGMA-4 and be considered in the next Alternative Plan Update scheduled to be submitted by January 1, 2027.

8.7.3 Project SGMA-3: Maintain and manage water related data

Each agency maintains a broad range of groundwater information such as groundwater pumping, water levels, and water quality. Project SGMA-3 continues the Agencies' current practice of compiling, combining, and validating this information. The data will be used to evaluate groundwater management needs such as trends relative to sustainable management criteria including water levels, basin storage, subsidence, and water quality to be reported in Project SGMA-4: SGMA Annual Report and Project SGMA-5: Five-Year Alternative Plan Updates.

8.7.4 Project SGMA-4: SGMA Annual Report

The Management Committee will prepare and submit the SGMA Annual Report to CDWR by the April 1 deadline of each year. The SGMA Annual Report is a comprehensive evaluation of water data that have been collected by each agency, per Project SGMA-3: Maintain and manage water related data. Each SGMA Annual Report will evaluate data for the prior water year period covering October 1 through September 30. The SGMA Annual Reports have been prepared since 2017 and follow this general structure:

1. Introduction
2. Coachella Valley Groundwater Basin Setting
3. Groundwater Elevation Data
4. Groundwater Extraction
5. Surface Water
6. Total Water Use
7. Groundwater Balance and Change in Groundwater Storage
8. Description of Progress of Implementing Projects
9. References

Data to be presented include groundwater elevation contour maps, hydrographs of key wells, precipitation, groundwater extraction by water use sector, surface, and imported water supply, and change in groundwater storage. Future SGMA Annual Reports will include a new section on

Sustainable Management Criteria with subsections describing the state of the subbasin in relation to the four relevant sustainability indicators: groundwater levels, groundwater storage, subsidence, and groundwater quality and need for and progress toward implementing the Alternative Plan Update PMAs.

8.7.5 Project SGMA-5: Five-Year Alternative Plan Updates

The 2013 MC/GH WMP identified the need for periodic review and update of the water management plan. As required by SGMA, this Alternative Plan Update will be reviewed every five years to assess changing conditions in the MCSB that may warrant modification of the plan or management objectives.

The Alternative Plan Updates will evaluate groundwater conditions and the status of projects and managements actions to determine whether the Sustainable Management Criteria and management objectives are meeting the sustainability goals of the MCSB. In addition to meeting SGMA requirements, the Agencies identified some other key areas requiring periodic review including evaluation of demand projections, imported water supply reliability, and update of the groundwater model and model forecasts.

8.7.6 Project SGMA-6: Pursue funding opportunities

The development of this Alternative Plan Update was funded, in part, through a Proposition 68 Sustainable Groundwater Management Grant. Costs of overall Plan implementation are expected to be shared by the groundwater sustainability agencies (GSAs) through the 2009 Memorandum of Understanding among CVWD, DWA, and MSWD, to prepare the 2013 MC/GH WMP and develop a groundwater model of the MCSB and GHSA, individual agency contributions, and/or new cost-sharing agreements yet to be developed. However, there will be a need to seek funding opportunities to support Plan projects and management actions and ongoing implementation.

Outside grants will be sought to reduce the cost of implementation to participating agencies and the communities of the MCSB. Financing options under consideration include loans and grants for projects and management actions, as well as monitoring network improvements and other planning/feasibility analysis needed to support Plan implementation. Funding through grants or loans has varying levels of certainty and may be available for some implementation activities (including capital projects). The potential sources of loans and grants include:

- Sustainable Groundwater Management Grant Program administered by CDWR.
  The Round 2 solicitation, anticipated in 2022, includes approximately $77 million of grant funding for implementation projects that address drought and groundwater challenges, prevent or clean up contaminated groundwater, support supply reliability, and support water banking, exchange, or reclamation.
- Technical Support Services for Groundwater Sustainability Plans administered by CDWR. Technical Support Services provides funding for field activities (monitoring well installation, geologic logging, etc.), modeling, and mapping to provide education, data, and tools to GSAs.

- Clean Water State Revolving Fund and Drinking Water State Revolving Fund loan programs administered by SWRCB. The loan programs provide low-interest loans (typically ½ of the General Obligation Bond Rate) for drinking water treatment and infrastructure, water recycling, wastewater treatment, and sewer collection projects. Applications are submitted continually and are considered for a fundable list, approved by the SWRCB for each fiscal year.
- Water Recycling Funding Program – Planning and Construction Grants from SWRCB. The Planning grants (for facilities planning) are available and can fund 50% of eligible costs, up to $150,000. Construction grants for recycled water have been periodically exhausted but are typically restored with water bond funding.
- Infrastructure State Revolving Fund Loan Program administered by the California Infrastructure and Economic Development Bank (I-Bank), which are low interest loans of up to $25 million per applicant and considered on a rolling basis.
- Title XVI Water Recycling and Reclamation / Water Infrastructure Improvements for the Nation Program – Construction Grants administered by the United States Bureau of Reclamation (USBR). USBR administers a recycled water funding program that provides grants up to 25% of project costs or $20 million, whichever is less. A Title XVI Feasibility Study must be submitted to and approved by USBR to be eligible. USBR solicits grants annually.
- WaterSMART Title XVI Water Recycling and Reclamation Program – Feasibility Study Grants administered by USBR. USBR has previously funded grants of up to $150,000 for preparation of Title XVI Feasibility Studies. It is possible future rounds may be available.
- Integrated Regional Water Management (IRWM) implementation grants administered by CDWR. The Coachella Valley IRWM Region can pursue grant funding through the IRWM Implementation Grant Program. The Coachella Valley IRWM Region falls within the Colorado River Funding Area (Funding Area). The Colorado River Funding Area was allocated $22.5 million in funding through Proposition 1. Of that, roughly $7.9 million was awarded to the Funding Area during the Round 1 solicitation. The remaining funding is anticipated to be distributed during the Round 2 solicitation, which is expected in late 2021.
- Proposition 68 grant programs administered by various state agencies. Grant programs funded through Proposition 68, which was passed by California voters in 2018, and administered by various state agencies are expected to be applicable to fund SGMA implementation activities. These grant programs are expected to be competitive, where $74 million has been set aside for Groundwater Sustainability statewide.

Other types of funding that are not loan or grants that agencies may pursue are further described in Section 8.10.2 and include revenue bonds and SGMA fees as is under consideration by CVWD as described in Project WELL-3 in Section 8.8.3.

8.8 Well Management

Well management activities will facilitate maintaining water quality in the MCSB in addition to improving data collection regarding well locations and pumping. The well management projects are:

- Project WELL-1: Well construction, abandonment, and destruction management;
- Project WELL-2: Subbasin well inventory; and
- Project WELL-3: Expand groundwater production reporting.

These projects are described below.

8.8.1 Project WELL-1: Well construction, abandonment, and destruction management

This project is an important management tool as RCDEH has regulatory authority over well construction and destruction. RCDEH has a permitting process for new or replacement wells in the MCSB which are encompassed in Riverside County Ordinance 682.4. In addition, both the Riverside County General Plan and the City of DHS General Plan include policies related to wellhead protection and sustainable groundwater pumping. The Agencies will continue to work with RCDEH so that any new wells are constructed to current standards, artesian flow management policies are followed, and any existing wells that could be negatively impacting groundwater quality are retrofit, properly capped, or destroyed. In addition, this coordination will allow for opportunities to communicate with permitting agencies regarding groundwater levels to help ensure that future wells are screened below minimum thresholds.

8.8.2 Project WELL-2: Subbasin well inventory

The MCSB has a well inventory that has been compiled by CVWD and DWA to implement the Replenishment Assessment Charge (RAC) Programs for assessable groundwater production. CVWD levies and collects the RAC from groundwater producers that benefit from the Groundwater Replenishment Programs (GRPs) and extract more than 25 AFY within the CVWD MCSB Area of Benefit (AOB). DWA levies and collects the RAC from groundwater producers that benefit from the GRPs and extract more than 10 AFY within DWA's MCSB AOB. However, data on minimal pumpers who do not meet these criteria are incomplete. It is unclear how many wells producing less than the RAC criteria exist, and approximations of unreported production are best estimates.

The Agencies may develop a well inventory for the MCSB that will identify and compile information about all production wells located in the MCSB. CVWD is evaluating this effort, with DWA participating at its discretion. The well inventory would involve development of a well registry. The well inventory would support any expansion or refinement of the monitoring network, allow improvement of groundwater extraction estimates, and improve the understanding of how private wells may affect MCSB conditions and how MCSB management may affect private wells. Compilation of the well inventory may include the following:

- Review and organize data management systems to incorporate well inventory component;

- Gather water well drillers' reports with well construction information;
- Coordinate with well owners to identify wells and obtain relevant information on location, construction, use, status, and monitoring, if any;
- Conduct as-needed field visits to verify well location, use, and status; and
- Input well inventory information into the data management system.

The Agencies will collaborate with CDWR, local agencies, water users, landowners, and leaseholders to identify and locate wells and compile information on construction, status, and use.

8.8.3 Project WELL-3: Expand groundwater production reporting

SGMA (Section 10725.8) authorizes GSAs to require that the use of every groundwater extraction facility (production well) be measured with a water-measuring device (meter) except for de minimis extractors (domestic users extracting 2 AFY or less). As described in Section 8.8.2, both CVWD and DWA already require metering and extraction reporting by groundwater producers pumping more than 25 and 10 AFY, respectively, based on their respective water management authorities. CVWD and DWA separately author an Engineer's Report on Water Supply and Replenishment Assessment annually to assess the groundwater supply conditions and the need for continued replenishment within their AOBs, to provide a description of the current GRF operations, and to recommend adjustments to the RAC that is levied on groundwater production (see CVWDs website: https://cvwd.org/Archive.aspx?AMID=43 and DWA's website: https://dwa.org/about-us/documents/library/).

CVWD and DWA may consider expansion of groundwater extraction reporting to include groundwater pumpers that produce less than the current assessment threshold but more than the de minimis threshold established by SGMA. CVWD is evaluating this effort with a Cost of Service Study for a SGMA fee within its AOB; DWA may require reporting within their service areas at their discretion.

8.9 Summary of Active Projects

The sections above provide the Active PMAs that could be selected and implemented by the Agencies, depending on the outcomes of the monitoring programs and adaptive management process. **Table 8-1** includes a concise summary of the Active PMAs that can be used for tracking in SGMA Annual Reports.

8.10 Plan Evaluation and Implementation

This Alternative Plan Update describes the planning process for the Agencies to achieve a reliable and sustainable water supply while sustainably managing groundwater resources. This section provides an evaluation of how implementation of this Alternative Plan Update will achieve the dual goals of meeting projected demands and maintaining groundwater sustainability. This section also outlines the Alternative Plan Update implementation activities necessary to support those goals.

8.10.1 Plan Evaluation

This Alternative Plan Update includes analysis of the range of uncertainties facing the Agencies in planning for a balance of future water demands and supplies. Section 3, Demand Projections, and Section 4, Water Resources, both address potential future conditions that are outside of the Agencies' control, including increased municipal demands, climate change, and regulatory changes. The planning process considered those uncertainties in the development of forecast scenarios described in Section 7, which analyzed a range of potential future conditions given those uncertainties and compares the results with the Sustainable Management Criteria for water levels described in Section 6. Section 8.2 lays out an adaptive management process by which the Agencies can identify and select PMAs for implementation based on MCSB conditions. The PMAs are packaged in the modeling scenarios, and as described in Section 7, the scenarios associated with a Baseline scenario were modeled under historical long-term hydrology and climate change hydrology to show the difference between these two assumptions. Additional scenarios were modeled under the climate change assumption, the more conservative of the two assumptions, and included Near-term Projects and Future Projects scenarios. The climate change hydrology assumption was considered a reasonable assumption given the last 20 years of climatic conditions and was used as the working assumption for future conditions that provides a level of conservatism to the findings.

The Baseline scenarios are not considered in the plan evaluation because Baseline conditions are not part of the plan and are only provided to show potential conditions without the Alternative Plan Update projects and management actions. Under the Near-term Projects with Climate Change scenario, in which recycled water is brought back to the MCSB for recharge or re-use and Lake Perris Seepage Recovery water is added to the replenishment water beginning in 2023, water levels remain above Minimum Thresholds in all Key Wells through the end of the planning horizon (2045). Under this scenario, three Key Wells fall below 2009 conditions (Measurable Objective) before the end of the planning horizon. Under the Future Projects with Climate Change scenario, where new reliability of SWP is added beginning in 2035 (Sites Reservoir) and again in 2040 (DCF), three Key Wells fall slightly below their Measurable Objectives by the end of the planning horizon. One well falls below its Measurable Objective in 2029 by 3.1 feet and then rebounds above the Measurable Objective in 2041. The remaining two wells that fall below their Measurable Objective are in the southern part of the MCSB and only fall below their Measurable Objectives by 1.6 feet and 0.4 feet, respectively. Both wells have limited historical records and the Measurable Objectives for these wells are considered provisional. All wells remain above their Minimum Thresholds through the planning horizon.

Table 8-1: Summary of Active Projects

Project No.	Ongoing/Planned	Project/Program	Project/Program Description
Water Conservation (WC)			
WC-1	Ongoing	Continue to implement urban water conservation and education programs	Agencies will continue education and outreach to encourage water use efficiency by urban water users, indoor and outdoor incentive programs, ordinances and conservation pricing, water loss management, and conservation staff support.
WC-2	Ongoing	Track water conservation effectiveness through the Urban Water Management Plans (UWMPs)	CVWD, DWA and MSWD will track the effectiveness of their urban water conservation programs and the progress towards achieving their water conservation goals in UWMP prepared at 5-year intervals.
WC-3	Planned	Regional water savings study	Agencies are planning to conduct a regional conservation study specific to the conditions of Coachella Valley.
WC-4	As-needed	Implement Water Shortage Contingency Plan	Agencies will implement adopted WSCPs as needed to respond to water supply/demand imbalances.
Water Supply (WS) Including Reliability and New Supply Development			
WS-1	Ongoing	Continue existing imported water replenishment program	CVWD and DWA to continue annual recharge activities at the MC-GRF with SWP Exchange water.
WS-2	Planned	Recycled water for reuse in MCSB	Percolating and/or reusing treated RWRF effluent in the MCSB.
WS-3	Planned	State Water Project (SWP) – Delta Conveyance Facility	CVWD/DWA to continue participation in DCF, a SWP project to improve SWP reliability.
WS-4	Planned	SWP – Lake Perris Dam Seepage Recovery Project	CVWD/DWA to continue participation in Lake Perris Dam Seepage Recovery to pump seepage from the lake into a MWD collection pipeline discharging into MWD's Colorado River Aqueduct

Project No.	Ongoing/Planned	Project/Program	Project/Program Description
WS-5	Planned	SWP – Sites Reservoir Delivery	CVWD/DWA to continue participation in Sites Reservoir, a SWP project to capture and store stormwater flows from the Sacramento River for release in dry years.
Water Quality Protection (WQ)			
WQ-1	Ongoing	Convert from septic to sewer in MSWD area	Continue septic to sewer conversions within MSWD service area as a part of wastewater management (based on available funding).
WQ-2	Construction completion in 2022	Construct Regional Water Reclamation Facility (RWRF) with nitrogen removal	Complete MSWD RWRF construction in 2022 to meet treatment needs and allow for additional septic to sewer conversions.
WQ-3	Ongoing	Track water quality regulatory actions	Agencies to continue ongoing effort to track potential regulatory actions of SWRCB-DDW and USEPA that could affect ability to comply with drinking water regulations.
WQ-4	Ongoing	Well source assessment and protection coordination	Agencies to coordinate with the appropriate local, state, and federal regulatory agencies regarding potentially contaminating activities within well capture zones and principal recharge zones.
WQ-5	Ongoing	Engage in planning processes to protect water quality	Review and comment on proposed land developments, environmental documents and land use plans developed by local planning agencies.
WQ-6	Ongoing	Educate public on groundwater quality issues	Continue to support the Groundwater Guardian program, a community educational program developed by the non-profit Groundwater Foundation.

Project No.	Ongoing/Planned	Project/Program	Project/Program Description
WQ: Salt and Nutrient Management Planning			
WQ-7	Ongoing	Participate in Implementation of CV-SNMP Development Workplan	Implement CV-SNMP Development Workplan, when approved by the RWQCB, to update the CV-SNMP in accordance with the 2018 Recycled Water Policy and RWQCB findings
WQ-8	Ongoing	Implement CV-SNMP Groundwater Monitoring Program Workplan	Implement CV-SNMP Groundwater Monitoring Program Workplan which has been as approved by the RWQCB.
WQ-9	Ongoing	Install water quality monitoring wells	Install wells to address water quality data gaps as described in the CV-SNMP Groundwater Monitoring Program Workplan
SGMA Implementation (SGMA)			
SGMA-1	Ongoing	Continue existing subbasin management committee structure	Existing Mission Creek and Garnet Hill Management Committee formed by the 2004 Settlement Agreement satisfies CDWR's requirements for groundwater management planning committees.
SGMA-2	Ongoing	Conduct subsidence evaluation	The Agencies to continue working with USGS on a multi-phase subsidence monitoring program.
SGMA-3	Ongoing	Maintain and manage water related data	Agencies to maintain existing agency-specific data management systems to be combined annually to prepare SGMA Annual Reports.
SGMA-4	Ongoing	SGMA Annual Report	Assemble, process, and evaluate water data for the MCSB Annual Report for SGMA compliance for each water year.
SGMA-5	Ongoing	Five-Year Alternative Plan Updates	Review SGMA requirements such as Sustainable Management Criteria and progress towards achieving sustainability, and review/update demand projections and available water supplies; groundwater model and calibration and forecasts.

Project No.	Ongoing/Planned	Project/Program	Project/Program Description
SGMA-6	Ongoing	Pursue funding opportunities	Agencies will identify and pursue funding opportunities for projects and management actions as applications become available.
Well Management (WELL)			
WELL-1	Ongoing	Well construction, abandonment, and destruction management	Agencies to continue cooperative efforts with RCDEH regarding well management programs
WELL-2	Ongoing	Subbasin Well Inventory	Continue developing well inventory that may include coordination with well owners and compiling well information such as well drillers report into data management system.
WELL-3	Ongoing	Expand Groundwater Production Reporting	Consider expansion of requirements for reporting of groundwater extraction to any pumpers that extracts more than the de minimis user threshold of 2 AFY or less established by SGMA

The conclusion from the forecast modeling is that the Agencies can maintain sustainable groundwater levels in the MCSB under assumed drier climate change conditions through the planning period (2045) by continuing the ongoing PMAs and implementing the planned Near-term and Future PMAs. In fact, the Near-term Projects are the only PMAs required to maintain sustainability, but Future Projects may address additional demands past 2045. Because groundwater levels in the MCSB also drive sustainability criteria for change in groundwater storage and subsidence, these two sustainability indicators also indicate sustainability through the planning period and model forecast period.

Groundwater quality will be evaluated on an ongoing basis. The Agencies continue to support the efforts to update the CV-SNMP by implementing the CV-SNMP Development Workplan which includes development of recommended numeric objectives for TDS concentration in groundwater that are both protective of beneficial uses while also providing maximum benefit of groundwater. This Alternative Plan Update demonstrates that there is no substantial increase in inflow of elevated TDS groundwater from the DHSSB into the MCSB across the Mission Creek Fault due to lower groundwater levels in the MCSB. As documented in Section 5, the groundwater model results indicate that the variability in natural recharge in the DHSSB has a greater influence on groundwater underflow across the fault than local declining groundwater levels in the MCSB and rising groundwater levels in the DHSSB. In addition, groundwater recharge activities at the MC-GRF appear to have reduced groundwater underflow across the fault. Based on this analysis, continued groundwater recharge at the MC-GRF and average groundwater levels in the MCSB at or near 2009 levels will not result in unusually high groundwater underflows across the fault compared with pre-2009 groundwater conditions.

MCSB conditions will be evaluated using the monitoring data as outlined in **Appendix E**, Monitoring Program, and as compared to the sustainability objectives and thresholds established in Section 6, Sustainable Management Criteria. Each of these components of the planning process is essential to a water management plan that meets projected demands and maintains groundwater sustainability.

8.10.2 Implementation

Implementation of this Alternative Plan Update will follow the processes described in the sections that follow.

8.10.2.1 Legal Authority

As detailed in Section 1.4.4, the Management Committee will implement the provisions of SGMA and this Alternative Plan Update under legal authority established in the California Water Code. Specifically, for MSWD, Water Code §30000-33901; for CVWD, Water Code §30000-33901 with specific reference in §31630-31639; and for DWA, Water Code Appendix Chapter 100. CVWD and DWA, as GSAs, are granted powers and authorities to manage the MCSB under State Water Code §10725-10726.9.

8.10.2.2 Permitting and Regulatory Processes

The permitting and regulatory processes for each project and management action are specific to each project and will be detailed during project implementation. Updates to permitting and regulatory processes will be provided in the Five-Year Alternative Plan Updates as details are developed.

8.10.2.3 Timetable

The timetables for implementation of the active projects and management actions are specific to each project as described for each project. Updates to implementation timetables will be provided in Five-Year Alternative Plan Updates.

8.10.2.4 Implementation Costs

The implementation of the projects and management actions in this Alternative Plan Update will require significant capital and operating investments to achieve the goals of the plan. Some projects and management actions such as the water conservation programs and monitoring necessary to prepare the SGMA Annual Report are ongoing and incorporated into the Agencies' annual budgets. The individual projects may be implemented by a single agency or by multiple agencies and implementation costs will be established and updated as projects near construction. The Management Committee meetings provide a venue for implementation discussions, of which capital and operating cost and financing and funding strategies, described below, are critical to implementation.

8.10.2.5 Financing and Funding Strategies

A variety of financing options are available to the Agencies as summarized below.

- Water and sewer rates – water purveyor charges to water customers for the purchase of water for urban or agricultural use and sewer rates for collection, treatment, and disposal of wastewater
- Replenishment assessments – charges for replenishment programs to groundwater pumpers based on their annual production
- Developer fees – charges applied to new development on a per-connection basis to cover the capital cost of water/wastewater system construction
- Supplemental water supply fee - charges applied to new development to cover the capital cost of developing and securing supplemental water supplies
- Groundwater sustainability fees – charges for groundwater extraction and to administer groundwater sustainability programs
- Assessment districts – charges applied to property tax bills to recover the capital cost of utility construction for both existing and new development
- Property taxes – charges applied to property tax bills of landowners to recover bonded indebtedness such as the SWP capital costs and other authorized bonds
- Grants – state or federal money provided for specific water management programs, usually awarded on a competitive basis
- Bonds – voter-authorized (general obligation) or water agency-authorized (revenue) funding for capital facilities

The specific financing mechanisms that will be applied to each project will be determined by the governing bodies of the participating agencies. A combination of funding sources will likely be used to meet the needs of the water users.

Opportunities may exist for joint agency participation in project implementation. Several guiding principles may be applied to joint project implementation:

1. Generally, each agency is responsible for implementation of projects that benefit its customers. However, projects that provide benefits to multiple agencies may be jointly funded if all participants agree.
2. Objectively quantifiable benefits should guide cost allocation of jointly funded projects.
3. Opportunities for external funding will be pursued when feasible.

8.10.2.6 Stakeholder Engagement

Stakeholder engagement was an important part of the development of the initial 2013 GH/MC WMP, has continued through the preparation of this Alternative Plan Update, and will continue during implementation of this Alternative Plan Update. Stakeholder engagement has included activities such as maintenance of an outreach e-mail list, development of a website, and promotion and facilitation of public meetings as detailed in the Communication and Engagement Plan, found in **Appendix D**. The public meetings provide the opportunity for the public to help guide the development and implementation of the plan, including the status of projects and provide a forum for resolution of issues, if they arise.

Stakeholder engagement activities that are planned to continue include:

- Maintaining the website http://www.missioncreeksubbasinsgma.org/.
- E-mail announcements:
  - When SGMA Annual Reports are available,
  - When SGMA-related presentations to Agency Boards are made, and
  - When Five-Year Alternative Plan Updates are under development.
- Public presentations regarding Annual Reports (e.g., during Agency Board Meetings)

CVWD, DWA, and MSWD also conduct public outreach for a range of other water management activities including the recent development of the 2020 RUWMP and water conservation programs. Other ongoing water management efforts in the region includes the CV-SNMP and the activities of the Coachella Valley Regional Water Management Group. In an effort to retain stakeholder engagement without overloading stakeholders, the public outreach activities of this Alternative Plan Update could be coordinated with other ongoing agency-specific or regional water management outreach.

9.0 References

Anderson, M. P., and W. W. Woessner, 1992. Applied Groundwater Modeling – Simulation of Flow and Advective Transport, Academic Press.

Cabot's Museum, 2020. The Water. Available at: https://www.cabotsmuseum.org/the-water/.

Catchings, R. D., M. J. Rymer, M. R. Goldman, and G. Gandhok, 2009. San Andreas Fault Geometry at Desert Hot Springs, California, and Its Effects on Earthquake Hazards and Groundwater, Bulletin of the Seismological Society of America, Vol. 99, No. 4, pp. 2190–2207, August.

California Code of Regulations (CCR), 2016. Approved Groundwater Sustainability Plan Emergency Regulations: California Code of Regulations, Title 23. Waters, Division 2. Department Of Water Resources, Chapter 1.5. Groundwater Management, Subchapter 2. Groundwater Sustainability Plans, Article 1. Introductory Provisions, §§ 350-359.4; 42 pp.

California Department of Water Resources (CDWR). 1964. Coachella Valley Investigation, California Department of Water Resources, Bulletin 109.

CDWR, 1979. Coachella Valley area well standards investigation: Los Angeles, California Department of Water Resources, Southern District,

CDWR, 1999. California Irrigation Management Information System (CIMIS) Reference Evapotranspiration Map, prepared by David W. Jones, map scale 1:1,805,000.

CDWR, 2003. California's Groundwater, Bulletin 118, Available at: https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118

CDWR, 2004. Amendment No. 19 to Water Supply Contract between the State of California Department of Water Resources and Coachella Valley Water District (Tulare Lake Basin Water Storage District transfer) dated February 23, 2004.

CDWR, 2007a. Amendment No. 20 to Water Supply Contract between the State of California Department of Water Resources and Coachella Valley Water District (Tulare Lake Basin Water Storage District transfer) dated May 9, 2007.

CDWR, 2007b. Amendment No. 19 to Water Supply Contract between the State of California Department of Water Resources and Desert Water Agency (Tulare Lake Basin Water Storage District transfer) dated May 9, 2007.

CDWR, 2007c. Amendment No. 21 to Water Supply Contract between the State of California Department of Water Resources and Coachella Valley Water District (Berrenda Mesa Water District transfer) dated September 26, 2007.

CDWR, 2007d. Amendment No. 20 to Water Supply Contract between the State of California Department of Water Resources and Desert Water Agency (Berrenda Mesa Water District transfer) dated September 26, 2007.

CDWR, 2016. Best Management Practices for the Sustainable Management of Groundwater – Modeling BMP, December.

CDWR, 2016a. Approved Groundwater Sustainability Plan Emergency Regulations; August.

CDWR, 2016b. Groundwater Sustainability Agencies. Available at: https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Groundwater-Sustainable-Agencies.

CDWR, 2018. Bulletin 132-18 and Notices to Contractors. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/State-Water-Project/Management/Bulletin-132/Bulletin-132/Files/Bulletin132-18.pdf.

CDWR, 2019a. Sustainable Groundwater Management Program Alternative Assessment Staff Report, Coachella Valley – Mission Creek (Basin No. 7-021.02), July 17. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Alternatives/Files/ExistingPlans/MissionCreek/03_Mission_Creek_Staff_Report.pdf.

CDWR, 2019b. Statement of Findings Regarding the Approval of the Mission Creek Subbasin Alternative, July 17. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Alternatives/Files/ExistingPlans/MissionCreek/02_Mission_Creek_Statement_of_Findings.pdf.

CDWR, 2019c. Alternative Assessment Summary, Mission Creek Subbasin, July. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Alternatives/Files/ExistingPlans/MissionCreek/04_Mission_Creek_Assessment_Summary.pdf.

CDWR, 2020a. Final State Water Project Delivery Capability Report 2019. August 26, 2020. Available at: https://data.cnra.ca.gov/dataset/state-water-project-delivery-capability-report-dcr-2019.

CDWR, 2020b. Technical Addendum to Final State Water Project Delivery Capability Report 2019. August 26, 2020. Available at: https://data.cnra.ca.gov/dataset/state-water-project-delivery-capability-report-dcr-2019.

CDWR and State Water Resources Control Board (SWRCB), 2018. Making Conservation a California Way of Life: Primer of 2018 Legislation on Water Conservation and Drought Planning Senate Bill 606 (Hertzberg) and Assembly Bill 1668 (Friedman). November. Sacramento, California. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Water-Use-And-Efficiency/Make-Water-C Efficiency/Make-Water-Conservation-A-California-Way-of-Life/Files/PDFs/Final-WCL-Primer.pdf.

California Senate, 2016. Oversight Hearing on State Implementation of the Sustainable Groundwater Management Act – Background Brief. Senate Natural Resources and Water Committee. Assembly Water Parks and Wildlife Committee. February 23, 2016. Available at https://sntr.senate.ca.gov/sites/sntr.senate.ca.gov/files/2_23_16_sgma_background.pdf

California Water Code (CWC), 2016. §§ 10720-10736: 2014 Sustainable Groundwater Management Act [And Related Statutory Provisions from SB1168 (Pavley), AB1739 (Dickinson), and SB1319 (Pavley) as Chaptered], California, 2015 Amendments (effective January 1, 2016); Available at: https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=WAT&division=6.&title=&part=2.74.&chapter=1.&article=.

City of Desert Hot Springs General Plan, 2007.

City of Desert Hot Springs General Plan Update, 2020. Available at: https://www.cityofdhs.org/planning-documents.

Coachella Valley Association of Governments (CVAG), 2016. Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP), 2007 with Final Major Amendment, August 2016, available at: https://cvmshcp.org/, website accessed January 2021.

Coachella Valley Conservation Commission (CVCC), 2019. Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) 2019 Annual Report. Available at: https://www.cvmshcp.org/Annual%20Reports/cvmshcp-annualreport-2019.pdf

CVCC, 2020. Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) Website Fact Sheet. Available at: https://www.cvmshcp.org/doc/Fact%20Sheet%20CVMSHCP.pdf

Coachella Valley Water District (CVWD) archive documents. Available at: https://cvwd.org/Archive.aspx?AMID=43

CVWD, 2014. Letter to Mr. Tom Kirk Coachella Valley Conservation Commission from Mr. Steve Bigley, CVWD, Draft Report "Factors Contributing to Persistence and Declines of the Mesquite Dune Hummock Community in the Coachella Valley, January 9.

CVWD, 2015. Notice of Election to become a Groundwater Sustainability Agency; Submitted to California Department of Water Resources, November 6. Available at: https://sgma.water.ca.gov/portal/service/alternativedocument/download/387.

CVWD, 2019. Amended and Restated Agreement Between the Metropolitan Water District of Southern California, Coachella Valley Water District, and Desert Water Agency for the Exchange and Advance Delivery of Water.

CVWD and Desert Water Agency (DWA). 2014. Mission Creek Water Management Agreement. Dated as of July 15, 2014.P

Colorado River Basin Salinity Control Forum, 2020. 2020 Review of Water Quality Standards for Salinity, Colorado River System. October. Available: https://coloradoriversalinity.org/docs/2020%20REVIEW%20-%20Final%20w%20appendices.pdf

Desert Water Agency (DWA), 2016. Engineer's Report – Groundwater Replenishment and Assessment Program for the Whitewater River, Mission Creek, and Garnet Hill Subbasins 2016/17.

EnviroLogic Resources, Inc., 2019. Technical Memorandum, Monitoring Well Installations & Water Levels Evaluation, prepared for Mission Springs Water District, Desert Hot Springs, Riverside County, California, September 6.

Environmental Solutions, Inc., 2017. Groundwater Vistas Version 7 Users Guide.

Flint, L. E., A. L. Flint, and M. A. Stern, 2020. The Basin Characterization Model – A Regional Water Balance Code, U.S. Geological Survey Techniques and Methods.

Fogg, G. E., G. T. O'Neill, E. M. LaBolle, and D. J. Ringel, 2000. Groundwater Flow Model of Coachella Valley, California: An Overview Prepared for Coachella Valley Water District, November.

Galloway, D., Jones, D. R., and Ingebritsen, S.E., 1999. Land Subsidence in the United States, United States Geological Survey Circular 1182.

Gsi/water, 2005. Ground Water Input to the Alluvial Basin of the Mission Springs Water District Riverside County, California, Prepared for Mission Springs Water District, January.

Geotechnical Consultants, Inc, 1979. Hydrogeologic Investigation Mission Creek Subbasin within the Desert Hot Springs County Water District, prepared by Geotechnical Consultants, Inc., prepared for Desert Water Agency, November.

Hazen, 2018. Recycled Water Program Development Feasibility Study: Technical Memorandum No. 2 prepared for Mission Springs Water District, March.

Krieger & Stewart Engineering Consultants (K&SEC), 2018. Engineer's Report Groundwater Replenishment and Assessment Program for the Whitewater River, Mission Creek, and Garnet Hill Subbasins 2018/2019 prepared for Desert Water Agency, May.

K&SEC, 2019-2020. Engineer's Report on Water Supply and Replenishment Assessment for the Mission Creek Subbasin Area of Benefit, West Whitewater River Subbasin Area of Benefit, and East Whitewater River Subbasin Area of Benefit 2019-2020, prepared for Desert Water Agency, May. Available at https://dwa.org/about-us/documents/library/

K&SEC and Stantec, 2016. Engineer's Report on Water Supply and Replenishment Assessment for the Mission Creek Subbasin Area of Benefit, West Whitewater River Subbasin Area of Benefit, and East Whitewater River Subbasin Area of Benefit 2016-2017, prepared for Coachella Valley Water District, April. Available at https://dwa.org/wp-content/uploads/bsk-pdf-manager/groundwater-replenishment-assessment-report/2016/12/2016-2017-Groundwater-Replenishment-Report-All-Basins.pdf

K&SEC and Stantec, 2017. Engineer's Report on Water Supply and Replenishment Assessment for the Mission Creek Subbasin Area of Benefit, West Whitewater River Subbasin Area of Benefit, and East Whitewater River Subbasin Area of Benefit 2017-2018, prepared for Coachella Valley Water District, April. Available at http://www.cvwd.org/ArchiveCenter/ViewFile/Item/574

K&SEC and Stantec, 2018. Engineer's Report on Water Supply and Replenishment Assessment for the Mission Creek Subbasin Area of Benefit, West Whitewater River Subbasin Area of Benefit, and East Whitewater River Subbasin Area of Benefit 2018-2019, prepared for Coachella Valley Water District, April.

Mayer, A., May, W., Lukkarila, C., and Diehl, J., 2007. Estimation of Fault-zone conductance by calibration of a regional groundwater flow model: Desert Hot Springs, California, Hydrogeology Journal 15: 1093-1106.

Metropolitan Water District (MWD), 2010. Annual Report for the Fiscal Year July 1, 2009 to June 30, 2010. Available at https://www.mwdh2o.com/media/18930/151_annual_report_2010.pdf.

MWD, 2014. Annual Report for the Fiscal Year July 1, 2013 to June 30, 2014. Available at: https://www.mwdh2o.com/media/18934/151_annual_report_2014.pdf.

MWD, 2017. Annual Report for the Fiscal Year July 1, 2016 to June 30, 2017. Available at: https://www.mwdh2o.com/media/18938/2017_annualreport.pdf.

MWD, 2020a. Annual Report for the Fiscal Year July 1, 2019 to June 30, 2020. Available at: – https://www.mwdh2o.com/media/20099/2020_annualreport.pdf.

MWD. 2020b. Summary of Lake Perris Seepage Recovery Project Sharing Agreement Terms, DRAFT – As of November 26, 2019.

Mission Springs Water District, 2016. Amended Notice of Election to become a Groundwater Sustainability Agency; Submitted to California Department of Water Resources, 49 Pp. Available at: https://sgma.water.ca.gov/portal/service/alternativedocument/download/389.

Montgomery Watson Harza (MWH), 2013. Mission Creek / Garnet Hill Water Management Plan 2010 Update, Final Report. Prepared for: Coachella Valley Water District, Desert Water Agency, Mission Springs Water District. Jan 2013. Available at: *http://www.cvwd.org/ArchiveCenter/ViewFile/Item/320*

Psomas, 2010. Technical Memorandum Conceptual Groundwater Model of the Mission Creek and Garnet Hill Subbasins, Riverside County, California – Draft, prepared for Coachella Valley Water District, June.

Psomas, 2013. Groundwater Flow Model of the Mission Creek and Carnet Hill Subbasins and Palm Springs Subarea, Riverside County, California, prepared for Coachella Valley Water District, Desert Water Agency, Mission Springs Water District, January, in: MWH, 2013, Mission Creek/Garnet Hill Water Management Plan Final Report, prepared for Coachella Valley Water District, Desert Water Agency, Mission Springs Water District, January.

Riverside County, 2012. Riverside County General Plan – Western Coachella Valley Area Plan. Available at https://planning.rctlma.org/Portals/0/genplan/general_plan_2013/3%20Area%20Plan%20Volume%202/Western%20Coachella%20Valley%20AP.pdf

Riverside County, 2019. Riverside County General Plan – 2019 Amendments. Available at https://planning.rctlma.org/General-Plan-Zoning/General-Plan

Riverside County Department of Waste Resources (RCDWR), 2019, PFAS Water Quality Sampling and Analysis, Edom Hill Landfill (L1000937381), September 19. Available at: https://documents.geotracker.waterboards.ca.gov/esi/uploads/geo_report/7102168202/L10009373801.PDF

RCDWR, 2020, Transmittal Letter – Annual Compliance Monitoring Report, Edom Hill Sanitary Landfill, 70-100 Varner Road, Cathedral City, California, February 14. Available at: https://documents.geotracker.waterboards.ca.gov/esi/uploads/geo_report/8507044911/L10009373801.PDF

Sites Project Authority. 2019. 2019 Reservoir Project Agreement, Dated as of April 1, 2019.

Sites Project Authority. 2020. First Amendment to 2019 Reservoir Project Agreement, Dated as of January 1, 2020.

Sneed, M., Brandt, J. T., and Solt, M., 2014. Land subsidence, groundwater levels, and geology in the Coachella Valley, California, 1993– 2010, U.S. Geological Survey Scientific Investigations Report 2014–5075, https://doi.org/10.3133/sir20145075, 62 pp., 2014.

Southern California Association of Governments (SCAG). 2020. Demographics & Growth Forecast, Connect SoCal (2020 – 2045 Regional Transportation Plan/Sustainable Communities Strategy), May 2020. Retrieved from SCAG: http://www.scag.ca.gov/

Southern California Association of Governments. 2020a. Demographics & Growth Forecast, Connect SoCal (2020 – 2045 Regional Transportation Plan/Sustainable Communities Strategy), May 2020. Retrieved from SCAG: http://www.scag.ca.gov/

Southern California Association of Governments, 2020b. 6/11/2020 Draft SCAG TAZ Population Summary

Stantec, 2016. SGMA Alternative Groundwater Sustainability Plan – Bridge Document for the Mission Creek Subbasin. Prepared for: Coachella Valley Water District, Desert Water Agency, Mission Springs Water District. December 2016. Prepared by MWH (now part of Stantec).

Stantec, 2018a. Mission Creek Subbasin Annual Report for Water Year 2016-2017. Prepared for: Coachella Valley Water District, Desert Water Agency, Mission Springs Water District. March.

Stantec, 2018b. Indio Subbasin Annual Report for Water Year 2016-2017. Prepared for: Coachella Valley Water District, Coachella Water Authority, Desert Water Agency, and Indio Water Authority, March.

Stantec, 2019. Mission Creek Subbasin Annual Report for Water Year 2017-2018. Prepared for: Coachella Valley Water District, Desert Water Agency, Mission Springs Water District. March.

State Water Resources Control Board, Division of Drinking Water (SWRCB-DDW), 2014. Title 22 Code of Regulations, Division 4. Environmental Health, Chapter 3. Water Recycling Criteria, Article 5.1 Indirect Potable Reuse: Groundwater Replenishment- Surface Application.

SWRCB, 2020. White Paper discussion on: Economic Feasibility Analyses in consideration of a Hexavalent Chromium MCL, February. https://www.waterboards.ca.gov/drinking_water/programs/documents/cr6econwp.pdf, website accessed April 23, 2021.

SWRCB, 2021. EDT Library and Water Quality Analyses Data and Download Page https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/EDTlibrary.html, site accessed April 9, 2021.

Swain, L.A, 1978. Predicted Water-Level and Water-Quality Effects of Artificial Recharge in the Upper Coachella Valley, California, Using a Finite-Element Digital Model, U.S. Geological Survey Water-Resources Investigations 77-29.

Todd Groundwater, 2020. Indio Subbasin Annual Report for Water year 2018-2019, Prepared in cooperation with Woodard and Curran for: Coachella Valley Water District, Coachella Water Authority, Desert Water Agency, and Indio Water Authority, February.

Todd Groundwater, 2021. Personal communication with Daniel Craig, July 30, 2021 (Todd, 2021).

Todd Groundwater and Woodard and Curran (Todd/W&C). 2021. Indio Subbasin Water Management Plan Update. Prepared for: Indio Subbasin Groundwater Sustainability Agencies (CVWD, Coachella Water Authority and Sanitary District, DWA, and Indio Water Authority), November.

Tyley, S.J., 1974. Analog Model Study of the Ground-Water Basin of the Upper Coachella Valley, California, Geologic Survey Water-Supply Paper 2027.

University of California Riverside, Center for Conservation Biology (UCR-CCB). 2020. Assessment of the Status of Honey Mesquite Stands in the Coachella Valley Multiple Species Habitat Conservation Plan Area and Factors Affecting Persistence. Prepared for the Coachella Valley Conservation Commission. October.

USBR, 1986. 1986 Agreement Between the United States of America and the State of California for Coordinated Operation of the Central Valley Project and the State Water Project.

USBR. 2018. 2018 Addendum to the Coordinated Operation Agreement, Central Valley Project/State Water Project.

U.S. Fish and Wildlife Service, 2020. (website). Water Project Biological Opinions. Available: https://www.fws.gov/sfbaydelta/cvp-swp/index.htm

United States Geological Survey (USGS), 1974. Analog Model Study of the Ground-Water Basin of the Upper Coachella Valley, California, Geological Survey Water-Supply Paper 2027.

USGS, 1980. Potential for Using the Upper Coachella Valley Ground-Water Basin, California, for Storage of Artificially Recharged Water, Open-File Report 80-599.

USGS, 2007. Preliminary Integrated Geologic Map Databases for the United States; Western States, California, Nevada, Arizona, Washington, Oregon, Idaho, and Utah, version 1.3, USGS Open File Report 2005-1305, updated December 2007.

West Yost, 2020. Groundwater Monitoring Program Workplan, Coachella Valley Salt and Nutrient Management Plan Update, prepared for the Coachella Valley SNMP Agencies, December 23.

West Yost, 2021. Workplan to Develop the Coachella Valley Salt and Nutrient Management Plan, prepared for the Coachella Valley SNMP Agencies, September 2.

Wildermuth Environmental, Inc., 2019. 2019 -2020 Engineer's Report on Water Supply and Replenishment Assessment, prepared for the Coachella Valley Water District, April.

Wildermuth Environmental, Inc., 2020. 2020-2021 Engineer's Report on Water Supply and Replenishment Assessment, prepared for the Coachella Valley Water District, April.

Wood, 2019. Mission Creek Subbasin Annual Report for Water Year 2017-2019. Prepared for: Coachella Valley Water District, Desert Water Agency, Mission Springs Water District. March 18, 2019

Wood, 2020. Mission Creek Subbasin Annual Report for Water Year 2018-2019. Prepared for: Coachella Valley Water District, Desert Water Agency, Mission Springs Water District. February 24, 2020.

Wood, 2021. Mission Creek Subbasin Annual Report for Water Year 2019-2020. Prepared for: Coachella Valley Water District, Desert Water Agency, Mission Springs Water District. February 2021.

Western Regional Climate Center, 2020. Monthly Precipitation Totals, Palm Spring, CA, https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca6635

WSC, 2021. 2020 Coachella Valley Regional Urban Water Management Plan for CVWD, Coachella Water Authority, DWA, Indio Water Authority, MSWD, and Myoma Dunes Mutual Water Company. June.

Zheng and Neville, 1994. Practical Modeling of Pump-and-Treat Systems Using MODFLOW, PATH3d and MT3D, Short Course Notes.