# CHAPTER 3
# SUSTAINABLE MANAGEMENT CRITERIA

This chapter of the Groundwater Sustainability Plan (GSP, Plan) provides a discussion of the sustainability goal (Section 3.1), undesirable results (Section 3.2), minimum thresholds (Section 3.3), and the measurable objectives to avoid undesirable results (Section 3.4) applicable to the Borrego Springs Groundwater Subbasin (Subbasin, Plan Area).[1] Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators[2] defined by the Sustainable Groundwater Management Act (SGMA) are caused by groundwater conditions occurring in one of the Subbasin's three management areas, or throughout the Subbasin. This chapter describes the criteria by which the Groundwater Sustainability Agency (GSA, Agency) defines undesirable results within the Subbasin, and identifies what constitutes sustainable groundwater management for the Subbasin, including the process by which the GSA establishes minimum thresholds[3] and measurable objectives[4] for each applicable sustainability indicator (Title 23 California Code of Regulations [CCR] Section 354.22). Accordingly, the following Sections 3.2, 3.3, and 3.4 are subdivided to address each groundwater sustainability indicator. Undesirable results can vary for each management area of the Subbasin, and the beneficial uses and users supported by the Subbasin's aquifers. Section 3.5 provides a description of the monitoring network to measure each applicable sustainability indicator.

The GSA will periodically evaluate this GSP, assess changing conditions in the Subbasin that may warrant modification of the Plan or management objectives, and may adjust components accordingly. The GSA will focus its evaluation on determining whether the actions under the Plan are meeting the Plan's management objectives and whether those objectives are meeting the sustainability goal in the Subbasin.

## 3.1 SUSTAINABILITY GOAL

### 3.1.1 Standards for Establishing the Sustainability Goal

A sustainability goal means the existence and implementation of one or more GSP's "that achieve sustainable groundwater management by identifying and causing the implementation of measures

1 A basin is a groundwater basin *or subbasin* [emphasis added] identified and defined in Bulletin 118 or as modified pursuant to a basin boundary modification approved by the Department of Water Resources (CWC Section 10721). In the context of this GSP, the word "basin" means the Borrego Springs Subbasin, unless otherwise specified.

2 A sustainability indicator refers to "any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results" (Title 23 CCR Section 351(ah)).

3 A minimum threshold means "a numeric value for each sustainability indicator used to define undesirable results" (Title 23 CCR Section 351(t)).

4 A measurable objective means "specific, quantifiable goals 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" (Title 23 CCR Section 351(s)).

targeted to ensure the . . . basin is operated within its sustainable yield[5]" (California Water Code [CWC] Section 10721(u))." "Sustainable groundwater management" means the "management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results" (CWC Section 10721(v)). Undesirable results include chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply, significant and unreasonable reduction of groundwater storage, significant and unreasonable degraded water quality, and depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water (CWC Section 10721(x)).

The California Department of Water Resources (DWR) SGMA GSP regulations (Title 23 CCR Section 350, et seq.) provide supplemental information about the sustainability goal. For example, the regulations state: "Each Agency shall establish in its Plan a sustainability goal for the basin that culminates in the absence of undesirable results within 20 years of the applicable statutory deadline. The Plan shall include a description of the sustainability goal, including:

- information from the basin setting used to establish the sustainability goal,
- a discussion of the measures that will be implemented to ensure that the basin will be operated within its sustainable yield, and
- an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation and is likely to be maintained through the planning and implementation horizon" (Title 23 CCR Section 354.24).

### 3.1.2 Background

The Borrego Springs community overlying the Subbasin relies on local groundwater resources as the sole source of municipal drinking water, domestic supply, and agricultural irrigation. Recreational water use in the Subbasin is entirely supported by groundwater. Groundwater also supports other beneficial uses, as described in Chapter 2, Plan Area and Basin Setting, of this GSP, including those set forth in the *Water Quality Control Plan for the Colorado River Basin* (Basin Plan). The current rate of groundwater production from the Subbasin is not sustainable and, if not moderated, threatens to impact the beneficial uses and users of groundwater in the Plan Area. Impacts to beneficial uses and users may include decreased well production rate, increased pumping costs, dry wells, and/or increasingly poor water quality. Without action, groundwater could become much more challenging and expensive to access and potentially insufficient in quantity and quality to support beneficial uses. The community of Borrego Springs is a small and

5 "Sustainable yield" means the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result [CWC Section 10721(w)].

severely disadvantaged community (DWR 2018a).[6] The continued overdraft of the basin at its present rate of pumping could cause severe economic hardship for the community.

Annual natural recharge to the Subbasin is small compared to the volume of groundwater available in storage. Since inception of large-scale pumping in the Subbasin in the 1940s, an imbalance of groundwater extraction exceeding recharge has occurred. In other words, annual groundwater extraction from the Subbasin has exceeded recharge over multiple decades resulting in a depletion or "mining" of the groundwater resource. According to the results of the Borrego Valley Hydrologic Model (BVHM) described in Sections ~~2.2.2.2 and~~ 2.2.3, Water Budget, the cumulative volume of storage lost from the Subbasin between 1945 and 2016 is approximately 520,000 acre-feet (AF), which is a sum of the annual differences between Subbasin inflows and outflows. The storage capacity of the Borrego Valley Groundwater Basin (which includes the Ocotillo Wells Subbasin), based on stable groundwater levels before groundwater development began, is estimated to have been about 5,500,000 AF (USGS 1982). Based upon subsequent study by Dr. David Huntley, the majority of readily available water to existing well users in the Borrego Valley exists in the upper and middle aquifers. The amount of groundwater within these two aquifers within the Subbasin was estimated to be approximately 2,131,000 AF in 1945 and 1,900,500 AF in 1979 (Huntley 1993). The remaining water located within the lower aquifer is more difficult and costly to extract due to its low specific yield (estimated to be approximately 3%), its depth, and low specific capacity (estimated to be 5 gallons per minute/foot of drawdown or less) (County of San Diego 2010). Furthermore, as groundwater levels continue to drop in the Subbasin, an increasing percentage of water will be pumped from the lower aquifer, which has a lower yield, but is also likely to yield lower quality water (elevated total dissolved solids (TDS), sulfates, and arsenic), as discussed in Section 2.2.2.4. The BVHM estimates that total storage loss from water year 1980 through water year 2016 is 334,293 AF. Therefore, as of 2016, the volume of groundwater in storage within the upper and middle aquifers of the Subbasin is approximately 1,566,207 AF.

Outright depletion (dewatering) of a groundwater resource is a serious condition for a community that is totally reliant on groundwater supply. Depletion also means that the groundwater resource has been effectively permanently removed, from storage without the ability to recover under current climate conditions and pumping volumes. In order to begin to bring the Subbasin back into balance, it is estimated that approximately ~~74%~~75% of the maximum baseline pumping in the Subbasin, on average, will need to be reduced over the GSP implementation period and through the planning an implementation horizon.

6 Severely disadvantaged communities are those census geographies with an annual median household income that is less than 60 percent of the Statewide annual median household income. The statewide median household income for 2012–2016 (the current dataset) is $63,783; therefore, the calculated severely disadvantaged community threshold is $38,270.

### 3.1.3 Sustainability Goal

The GSA's sustainability goal is to ensure that by 2040, and thereafter within the planning and implementation horizon of this GSP (50 years), the Subbasin is operated within its sustainable yield and does not exhibit undesirable results.

Meeting this goal requires achieving a balance of water demand with available water supply, while protecting water quality, by the end of the GSP implementation timeframe, carrying through the SGMA planning and implementation horizon. A good analogy is a prudent financial routine of "balancing the books" whereby the totals of debit (groundwater withdrawal) and credits (recharge) are brought into agreement to determine the profit or loss (change in groundwater storage) made during a period of time (annually or over a longer period of time such as a hydrologic cycle). Central to achieving this goal is a strong understanding of the local setting of the Subbasin described in Chapter 2. The Subbasin is totally groundwater dependent with no immediately viable alternative sources of water supply such as imported water, recycled water or groundwater from adjacent basins/subbasins (USBR 2015; Dudek 2018; BWD 2000, 2002).

Conditions within the Subbasin will be considered sustainable when the following sustainability goals are met:

- Long-term, aggregate groundwater use is less than or equal to the Subbasin's estimated sustainable yield, as defined by SGMA (Section 2.2.3.~~5~~6, Sustainable Yield Estimate);
- The rate of groundwater level change within the Subbasin, averaged across indicator wells in the previous reporting period, is generally stable or increasing when compared to the contemporary groundwater level trend (i.e., 10-year trend 2010–2020 or trend based on available data) (Section 2.2.2.1, Groundwater Elevation Data);
- Groundwater levels are maintained at elevations necessary to avoid undesirable results. Lowering of groundwater levels potentially leading to significant and unreasonable depletions of available water supply for beneficial use could occur if groundwater levels fall below the top of screened intervals for key municipal water wells, or result in the loss of water availability for domestic well users (Section 2.2.2.1, Groundwater Elevation Data);
- Groundwater quality, as measured in municipal and domestic water wells, generally exhibits a stable and/or improving trend for identified contaminants of concern: arsenic, nitrate, sulfate, and TDS (Section 2.2.2.4, Groundwater Quality); and
- Groundwater quality is suitable for existing and future beneficial uses (Section 2.2.2.4, Groundwater Quality).

### 3.1.4 Sustainability Strategy

To ensure the Subbasin meets its sustainability goal by 2040, the GSA has proposed several projects and management actions (PMAs) detailed in Chapter 4, Projects and Management Actions, to address undesirable results. The PMAs expected to be implemented are: (1) Water Trading Program, (2) Water Conservation Program, (3) Pumping Reduction Program, (4) Voluntary Fallowing of Agricultural Land, (5) Water Quality Optimization, and (6) Intra-Subbasin Water Transfers. The overarching sustainability goal as well as the absence of undesirable results are expected to be achieved by 2040 through implementation of the PMAs. The sustainability goals will be maintained through proactive monitoring and management by the GSA as described in this and the following chapters.

Table 3-1 summarizes whether each of the six undesirable~~s~~ results has occurred, is occurring, or is expected to occur in the future in the Subbasin without GSP implementation, and shows the PMAs that have been developed to address each of the undesirable results presently occurring. The community of Borrego Springs has been acutely aware of its water problems for over 25 years, and the major drought period from 2012 through 2016 led to further heightened public awareness. Because supply augmentation through local and/or imported surface water is not a feasible option for the Subbasin at this time, the only tool available to the GSA to achieve groundwater sustainability is through demand reduction. The Borrego Water District (BWD) already implements a water conservation (shortage) policy, some golf courses have already implemented technologies and landscape practices that save water, and agricultural users have implemented increasingly efficient irrigation systems over the years. It is important to continue to implement and strengthen water conservation practices, as proposed in the water conservation PMA, because opportunity remains for further water savings, particularly with regard to the outdoor water use of BWD customers.

Considering the water conservation already achieved, and the diminishing returns in the volume of water that can be saved through conservation alone, the most critical PMAs to realize the pumping/water use reductions needed to achieve the GSP's sustainability goal are the voluntary fallowing of agricultural land, and the pumping reduction program. The pumping reduction program caps water use at the beginning of the implementation period (a total pumping allowance of ~~21,936~~22,600 acre-feet per year (AFY)) and gradually reduces the cap to a level that matches the sustainable yield of the Subbasin (5,700 AFY) by 2040. Because agriculture accounts for approximately 70% of groundwater used in the Subbasin, such a drastic reduction cannot be achieved without continuing the permanent fallowing of agricultural land. The Water Trading Program is a PMA expected to replace the existing water credit program that assigned a water allocation for fallowing of primarily agricultural land based on crop or turf type and allowed for water credits to be transferred to new development to offset water demand. The water trading PMA ties into the pumping reduction program and voluntary fallowing of agricultural land by preserving the economic value of water as its availability is capped and reduced over time, and by providing for flexibility in the types of economic development or redevelopment that can occur, where consistent with water availability, general plan and zoning designations, and land use regulations.

**Table 3-1**
**Summary of Undesirable Results Applicable to the Plan Area**

| Sustainability Indicator | Historical (Pre-2015) | Existing Conditions | Future Conditions Without GSP Implementation | PMAs Iimplemented to Mmeet the GSP's Ssustainability Ggoal |
|---|---|---|---|---|
| Chronic Lowering of Groundwater Levels | Significant and Unreasonable ✓ | Significant and Unreasonable✓ | Significant and Unreasonable✓ | Water Trading Program, Water Conservation, Pumping Reduction Program, Voluntary Fallowing of Agricultural Land Intra-Subbasin Water Transfers |
| Reduction of Groundwater Storage | Significant and Unreasonable ✓ | Significant and Unreasonable✓ | Significant and Unreasonable✓ | |
| Seawater Intrusion | Not Applicable | Not Applicable | Not Applicable | Not Applicable |
| Degraded Water Quality | ✓Not Significant | ✓Not Significant | ✓Significant and Unreasonable | Pumping Reduction Program, Voluntary Fallowing of Agricultural Land, Water Quality Optimization, Intra-Subbasin Water Transfers |
| Land Subsidence | Not Significant | Not Significant | Not Significant | Not Applicable |
| Depletions of Interconnected Surface Water | Significant and Unreasonable ✓ | Not Applicable* | Not Applicable* | Not Applicable |

**Notes:** GSP = Groundwater Sustainability Plan; PMA = Projects and Management Action.
* See following Sections 3.2.6 and 3.2.7.

## 3.2 UNDESIRABLE RESULTS

### Standards for the Description of Undesirable Results

According to GSP Regulations, the GSP's description of undesirable results is to include the following:

1. The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.
2. The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.

3. Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results (Title 23 CCR Section 354.26(b)).

Under SGMA, undesirable results occur when the effects caused by groundwater conditions occurring throughout the basin cause significant and unreasonable impacts to any of the six sustainability indicators. That is, the “significant and unreasonable occurrence of any of the six sustainability indicators constitutes an undesirable result” (DWR, Draft Sustainable Management Criteria, Best Management Practice, Section 4, p. 5). These sustainability indicators are:

- Chronic lowering of groundwater levels
- Reduction of groundwater storage
- Seawater intrusion
- Degraded water quality
- Land subsidence
- Depletions of interconnected surface water

**Application of Standards in the Borrego Subbasin**

Each of the sustainability indicators for the Subbasin is discussed as follows, in the context of undesirable results.

## 3.2.1 Chronic Lowering of Groundwater Levels – Undesirable Results

Chronic lowering of groundwater levels in the Subbasin’s aquifers has historically occurred and is ongoing due to groundwater production for agricultural, municipal, recreational and domestic use that exceeds the long-term sustainable yield of the Subbasin and the absence of any viable alternative source of water supply. The existing beneficial uses and users of Subbasin water are described in Section 2.1.5.14, Beneficial Uses and Users. The beneficial uses for groundwater for the Anza Borrego Hydrologic Unit are defined in the Basin Plan as Municipal and Domestic Supply (MUN), Industrial Service Supply (IND), and Agriculture Supply (AGR) as described in Section 2.1.2, (Water Resources Monitoring and Management Programs). SGMA requires that all beneficial uses and users of groundwater, including groundwater dependent ecosystems (GDEs), be considered in GSPs (CWC Section 10723.2). The honey mesquite bosque in the vicinity of the Borrego Sink is the primary GDE identified within the Plan Area that has historically been affected by pumping as described in Section 2.2.2.67, Groundwater Identification of Interconnected Surface WaterGroundwater Dependent Ecosystems Connections.

Undesirable results associated with chronic (i.e., persistent and long-term) lowering of groundwater levels are most directly indicated by loss of access to adequate water resources for support of current and/or potential future beneficial uses and users. As discussed in Section 2.2.2.1, Groundwater Elevation Data, the rate of groundwater level decline within the Subbasin is variable across the Plan Area, generally decreasing in magnitude from north to south. The North Management Area (NMA) exhibits the steepest groundwater level declines since 1945 (average rate of 1.95 feet per year) due to pumping for primarily agricultural uses; the Central Management Area (CMA) exhibits substantial but somewhat less severe declines (average rate of 1.33 feet per year) due to pumping for primarily municipal, domestic and recreational uses; and the South Management Area (SMA) has up until 2014 exhibited minimal if any decline, though the resumption of groundwater pumping to support recreation at Rams Hill Golf Club resulted in a localized decline in groundwater levels, as shown by MW-3 in Figure 2.2-13F. Domestic users of groundwater, including customers of the BWD, are predominantly supplied groundwater produced from wells located within CMA, and to a lesser degree the SMA and NMA. Failure to address and reverse the current rate of groundwater level decline could put domestic, agricultural, recreational and water supply availability for other beneficial uses at risk.

Groundwater level declines indicating a significant and unreasonable depletion of supply, if continued over the SGMA planning and implementation horizon, can occur in several ways in the Subbasin. Depletions leading to a complete dewatering of the Subbasin's upper aquifer in the CMA would be considered significant and unreasonable because beneficial users rely on this aquifer for water supply. Groundwater level declines would be significant and unreasonable if they are sufficient in magnitude to lower the rate of production of pre-existing groundwater extraction wells below that needed to meet the minimum required to support the overlying beneficial use(s), and that alternative means of obtaining sufficient groundwater resources are not technically or financially feasible. To the extent lowering groundwater levels impact *de -minimis*[7] pumpers, significant and unreasonable impacts to those pumpers could be avoided. For example, alternative means of obtaining water for *de -minimis* and domestic pumpers who can no longer pump may include connection to the municipal water system (i.e., BWD), groundwater well maintenance or rehabilitation (e.g., well pump lowering), or for some beneficial users, well redevelopment or deepening. However, use of these alternative means of supply, by themselves, do not necessarily offset undesirable results for lowering groundwater levels in the context of the Subbasin as a whole (as opposed to individual uses or users), because the ultimate source of supply remains groundwater pumped from the Subbasin, even if from another location.

Undertaking an evaluation for one particular use or user depends on the overlying beneficial use(s), the location within the Subbasin, and the characteristics of the well(s) currently in use. Should a groundwater level decline cause the production rate of pre-existing groundwater wells to be

7 SGMA defines a de -minimis extractor as "a person who extracts, for domestic purposes, two acre-feet or less (of groundwater) per year."

insufficient for the applicable beneficial use, an undesirable result may be avoided for that particular user through the alternative means shown in Table 3-2. Table 3-2 acknowledges that certain beneficial users have greater flexibility and financial capacity to address lowering groundwater levels than others. For example, the BWD, as the municipal water system, has the ability to manage production from multiple extraction wells across its service area, normally distributes the cost for well maintenance and development to its pool of customers, and can obtain grants for such work, if available. In contrast, domestic and *de -minimis* users can have geographic and financial constraints that may make well redevelopment and/or new well construction infeasible. Given the considerations previously outlined, domestic well users who are not in close proximity to existing BWD water service lines have the greatest sensitivity to and are consequently the most likely to experience the adverse effects of continued declining groundwater levels.

**Table 3-2**
**Means of Addressing Decreasing Well Production by Use**

| | Municipal Uses | Agricultural Uses | Recreational Uses | Domestic/*De -Minimis* Uses |
|---|---|---|---|---|
| Connection to Municipal Water System | N/A | | ✓ | * |
| Well Maintenance (e.g., brushing and bailing, pump lowering, repair or replacement) | ✓ | ✓ | ✓ | ✓ |
| Well Redevelopment/Deepening | ✓ | ✓ | ✓ | * |
| Well Abandonment/New Well Development | ✓ | ✓ | ✓ | * |

**Notes:** N/A = not applicable.
* Domestic and *de -minimis* users may have geographic, financial, and technical constraints that limit the ability to modify or deepen wells. Furthermore, based on Borrego Water District's (BWD's) water supply pipeline distribution system, some – but not all – domestic and *de -minimis* users can be hooked into the BWD system.

The upper aquifer currently hosts the most accessible (i.e., shallowest) and highest-yielding wells within the Subbasin as a whole. Figure 3.2-1 shows the extent of the upper aquifer, and a representation of the percentage of the aquifer that remains saturated, based on the update of the BVHM discussed in Section 2.2.3, Water Budget. Also shown is the saturated thickness, in feet of the aquifer. The upper aquifer does not occur in the southern fringe of the CMA, nor in the southwestern portion of the SMA; in these areas, the middle or lower aquifers begin near the ground surface. The water table has dropped below the base of this aquifer in some parts of the Subbasin, particularly within the southwestern half of the CMA, which overlies the more developed portion of Borrego Springs that is served by the BWD with wells located in the CMA (Figure 3.2-1).

Up to 200 feet of the upper aquifer remains saturated in the east central part of the CMA, and roughly 50 feet, on average, of the upper aquifer remains saturated within portions of the SMA and CMA. Figure 3.2-2 and Figure 3.2-3 show the same information for the middle, and lower aquifers, respectively. Groundwater level declines, based on the percentage of the aquifer thickness that is saturated, have begun to drop below the top of the middle aquifer in the southwestern part of the NMA, and the western part of the CMA. Groundwater levels have also dropped below the top of the lower aquifer along the western fringes of the CMA, and SMA, where the upper aquifer boundary is much closer to the ground surface.

Because many of the domestic groundwater users not connected to BWD rely on continued access to the upper aquifer or upper portions of the middle aquifer, an important objective in this GSP is that access to the upper aquifer or upper middle aquifer be maintained, as much is practicable, in areas with *de minimis* and other domestic wells not currently served by municipal supply (Figure 3.2-1 and Figure 3.2-2). The lower aquifer is an important source of water supply to irrigation wells, municipal wells and some domestic wells mostly in the SMA. The lower aquifer is the thickest aquifer underlying the Plan Area (Figure 3.2-3). Figure 3.2-4 shows a map of township and range sections where well completion reports indicate domestic wells occur, along with an estimate of the average remaining water column, based on statistics gathered by DWR on well depths, and the results of the BVHM regarding depth to water as of September 2016.

The groundwater levels simulated by the BVHM were attached to township and range sections by averaging the groundwater levels of the overlapping model grid cells. Also shown in Figure 3.2-4 is BWD's water distribution system, because the feasibility of connecting domestic well users to the municipal water system, if needed, is related to the distance from BWD's existing infrastructure. Overall, there are 77 domestic wells in DWR's well completion report database. As shown Figure 3.2-4, four of the township and range sections have water levels estimated to be below the bottom of the well in the section. Furthermore, the difference between the average well depth and the average groundwater level is less than 50 feet in seven township and range sections, representing 20 domestic wells, which indicates a high likelihood that some may lack access to adequate water in existing wells. With groundwater levels expected to continue to decline early in the GSP implementation period, domestic users are currently experiencing undesirable results, which will be alleviated by 2040. The majority of the wells in this situation are close to the BWD water distribution system.

The undesirable results of chronic lowering of groundwater levels is expected to continue to occur absent management action to counteract the current trend, until the Subbasin water budget is brought into balance. BWD has had to abandon and re-drill wells in the past and expects to continue to do so within the GSP's implementation timeframe to continue to provide adequate groundwater access. For example, BWD well ID1-10 is being replaced and relocated in 2019 due to declining groundwater levels and production rate loss. The exact number of agricultural and domestic wells that have been abandoned and re-drilled deeper and/or relocated due to production rate loss from declining groundwater levels is not known. However, anecdotal information and field observations have confirmed that inactive wells exist throughout the Plan Area.

As discussed in Section 3.3, Minimum Thresholds, this GSP establishes thresholds for each Subbasin management area that would generally indicate the occurrence (or absence) of an undesirable result. These thresholds relate to known elevations that current and future groundwater levels can be compared against, such as the subsurface boundaries between the upper, middle and lower aquifers, and the prevailing elevations of the perforated intervals of groundwater wells in use, where known. The pumping reduction plan, the voluntary fallowing of agricultural land, and other PMAs described in this GSP are intended to limit production to meet all present beneficial uses and users of groundwater including the existing footprint of water intensive agriculture in the Subbasin. The proposed PMAs to mitigate potential effects to beneficial use and users are discussed in Chapter 4, Projects and Management Actions.

### 3.2.2 Reduction of Groundwater Storage – Undesirable Results

Reduction of groundwater storage in the Plan Area has the potential to impact the beneficial uses and users of groundwater in the Subbasin by limiting the volume of groundwater available for agricultural, municipal, recreational, industrial, and domestic use. In essence, the undesirable results of reductions in groundwater in storage are the same as those previously described for chronic lowering of groundwater levels, because within this Subbasin, these impacts go hand-in-hand. Continuing the current rate of loss of groundwater in storage could also impact other sustainability indicators, namely groundwater quality.

The primary cause of groundwater conditions in the Plan Area that would lead to reduction in groundwater storage is the ongoing groundwater production in excess of the estimated long-term sustainable yield of the Subbasin. Significant and unreasonable impacts with respect to groundwater in storage are indicated by a long-term deficit in the groundwater budget, which is described in Section 2.2.3, Water Budget. The usable quantity of groundwater in storage is large compared to average annual natural recharge to the Subbasin. On average, the Subbasin lost approximately 7,300 AFY from storage for the period between 1945 and 2015. Over the last 10 years, the Subbasin lost 13,137 AFY, based on the BVHM model results as described in Section 2.2.3. It is estimated from the BVHM that the cumulative volume of stored water lost from the Subbasin between 1945 and 2016 was approximately 520,000 AF. This volume is the cumulative difference between Subbasin inflows (e.g., natural recharge) and outflows (e.g., pumping) calculated by the BVHM over the 71-year timeframe.

An important concept relevant to the Subbasin is the high variability and the decadal periodicity of wet versus dry periods in the climatic record. A clear example of the variability inherent in the recharge values is that the 20-year period from 1955 to 1974 was one of the 'driest' on record and it immediately preceded one of the 'wettest' periods from 1975 to 1994 (ENSI 2018). The average annual recharge rates for these two periods of 'dry' and 'wet' precipitation were 3,975 and 11,907 AFY, respectively (ENSI 2018). The long-term groundwater supply highly depends on 'wet' years with high recharge rates; however, these occur on a decadal scale and may not coincide with the 20-year GSP implementation period.

Reduction in groundwater storage is significant and unreasonable if it is sufficient in magnitude to lower the rate of production of pre-existing groundwater wells below that needed to meet the minimum required to support the overlying beneficial use(s), and where means of obtaining sufficient groundwater or imported resources are not technically or financially feasible for the well owner to absorb, either independently or with assistance from the GSA, or other available assistance/grant program(s). Additionally, historical reductions in groundwater storage have desiccated GDEs (honey mesquite ~~bosque~~) in the Subbasin prior to the effective date of SGMA, January 1, 2015 (USGS 1982, 2015; County of San Diego 2009). GDEs are discussed in more detail in Section 3.2.6, Depletions of Interconnected Surface Water.

Under the fixed pumping reduction plan described in Chapter 4 of this GSP, which would ramp down existing levels of pumping to meet the sustainable yield by 2040, it is estimated that an additional 72,000 AF of water would be removed from storage for the period 2020 through 2040. This estimate assumes that the historical climate from 1960 through 2010 repeats for the 50-year planning horizon from 2020 to 2070. Depending on the actual timing and magnitude of pumping reductions and the location and magnitude of future groundwater recharge, the amount of groundwater removed from storage will vary. The implementation of pumping reductions will limit water supply availability such that the present extent of water-intensive agriculture in the Subbasin will be substantially reduced (i.e., the existing trend of agricultural land fallowing will need to be maintained and likely accelerated). The proposed PMAs to mitigate potential effects to beneficial use and users are discussed in Chapter 4.

### 3.2.3 Seawater Intrusion – Undesirable Results

Undesirable results from seawater intrusion are not considered to be applicable to the Subbasin due to geographic isolation from the ocean. The Subbasin is more than 50 miles from the Pacific Ocean and more than 130 miles from the Gulf of California. As a result, this GSP does not establish criteria for seawater intrusion (Title 23 CCR Section 354.26(d)).

### 3.2.4 Degraded Water Quality – Undesirable Results

In general, the groundwater quality in the Subbasin meets California drinking water maximum contaminant levels (MCLs) without the need for treatment. As documented in Section 2.2.2.4, Groundwater Quality, naturally occurring poor water quality has been identified in specific areas: near the margins of the Subbasin where unconsolidated sediments are in contact with fractured bedrock; in parts of the SMA where certain wells that tap the lower aquifer have concentrations of arsenic above the drinking water MCL; and near the Borrego Sink where elevated sulfate and TDS are likely associated with dissolution of evaporites from the dry lake. Historical groundwater quality impairment for nitrates is noted for select portions of the Plan Area predominantly in the upper aquifer of the NMA underling the agricultural areas and near high density septic point sources. The source of nitrates is likely associated with either fertilizer applications or septic return flows. In desert environments artificial irrigation of the previously undisturbed desert floor can result in leaching of built up soil nitrate deposits (Walvoord et al. 2003). As discussed in Section 2.2.2.4, several potable wells in the Plan Area have been abandoned because of elevated nitrate above the drinking water MCL.

Degradation of groundwater quality in the upper aquifer has occurred as recharge to the aquifer has mobilized natural and anthropogenic sources of nitrate. The groundwater impacted by nitrate has the potential to migrate laterally as a result of pumping. One strategy successfully implemented to produce potable water in several areas of the Subbasin is to only screen the deeper sediments of the middle and lower aquifer to avoid nitrate that is likely concentrated in the upper aquifer. It should be noted that abandoned wells have the potential to provide a migration pathway of nitrate contaminants from the upper aquifer to the middle and lower aquifers. Hence, proactive abandonment of inactive wells will be considered by the GSA in order to preserve the existing potable water quality, especially where poor water quality has been identified.

Naturally occurring arsenic above the drinking water MCL has been detected in a subset of wells primarily screened in the lower aquifer of the SMA. Arsenic has not been detected at elevated concentrations in the NMA or CMA; however, semi-annual monitoring will track arsenic trends over time.

Degraded water quality is significant and unreasonable if the magnitude of degradation at pre-existing groundwater wells precludes the use of groundwater for existing beneficial use(s), including through migration of contaminant plumes that impair water supplies, where alternative means of treating or otherwise obtaining sufficient alternative groundwater resources are not technically or financially feasible. At a minimum, for municipal and domestic wells, water quality must meet potable drinking water standards specified in Title 17 ~~CCR~~ and Title 22 of the CCR. For irrigation wells, water quality should generally be suitable for agriculture use. The majority of groundwater pumped in the Plan Area is used for recreational and agricultural irrigation and thus does not have to meet potable drinking water standards to be put to beneficial use~~-~~. The Basin Plan has not established numerical objectives for groundwater quality in the Plan Area but recognizes that in most cases irrigation return flows return to the aquifer with an increase in mineral concentrations such as TDS and nitrate (Colorado River RWQCB 2017). The Basin Plan objective is to minimize quantities of contaminants reaching the aquifer by establishing stormwater and irrigation/fertilizer use best management practices.

Alternative means of obtaining water may consist of connection to the municipal water system (i.e., BWD), wellhead treatment, or for some beneficial users, well abandonment and new well development. Table 3-3 evaluates potential alternative means for addressing degraded water quality for each beneficial user type.

In summary, degradation of groundwater quality in the Plan Area has occurred for certain constituents (e.g., nitrate, sulfate, arsenic) and locally within the certain aquifers. However, groundwater quality has continued to be suitable for beneficial use throughout the Plan Area, when considering reasonable adaptation strategies such as screening wells in the lower and/or middle aquifer or selective well abandonment. However, undesirable results related to groundwater quality may become significant and unreasonable if conditions worsen to the point where beneficial uses are impaired (e.g., if adaptation strategies or required treatment methods becomes technically and/or financially infeasible). Continued reduction of groundwater in storage and chronic lowering of groundwater levels are intricately linked to undesirable effects on groundwater quality because these conditions increasingly limit the effectiveness of existing mitigation strategies. Therefore, significant and unreasonable impacts on groundwater quality are a potential outcome in the future if groundwater overdraft is not halted.

The proposed PMAs, including the Groundwater Quality Optimization Program are discussed in Chapter 4.

**Table 3-3**
**Means of Addressing Degraded Water Quality**

| | Municipal Uses | Agricultural Uses | Recreational Uses | Domestic/*De -Minimis* Uses |
|---|---|---|---|---|
| Connection to Municipal Water System | N/A | | ✓ | ✓ |
| Wellhead Treatment | ✓ | ✓ | ✓ | * |
| Blending Sources | ✓ | ✓ | ✓ | * |
| Well Abandonment/New Well Construction | ✓ | ✓ | ✓ | * |

**Notes:** N/A = not applicable.
* Depending on water quality degradation, wellhead treatment for domestic/*de -minimis* uses may not be financially feasible in a severely disadvantaged community. Furthermore, domestic and *de -minimis* users may not have the flexibility, nor the technical or financial means to blend sources or drill new wells.

The proposed PMAs, including the Groundwater Quality Optimization Program are discussed in Chapter 4.

## 3.2.5 Land Subsidence – Undesirable Results

The undesirable result of land subsidence includes an irreversible reduction in groundwater storage, and differential settlement of the land surface that substantially interferes with surface land uses. The U.S. Geological Survey (USGS) evaluated subsidence in the Plan Area using geophysical and remote sensing techniques, including Global Positioning System (GPS) surveys, continuous GPS data collection, and interferometric synthetic aperture radar (InSAR) remote sensing techniques.

The USGS report indicates that GPS surveys are within the expected range of uncertainty, and that there has not been significant land-surface elevation change during the 41-year period from 1969 to 2009 (USGS 2015). The minor amount of subsidence that has occurred when compared to over a hundred feet

~~of groundwater level decline in the northern parts of the Plan Area indicate that the subsurface strata may be less sensitive to land subsidence due to its coarse-grained nature. USGS (2015) also reported subsidence rates based on InSAR method, as described in Chapter 2 for the period from 2003 to 2007, in which the maximum rate of subsidence of 3.75 millimeters per year (or 0.15 inches per year) occurred in the NMA. This is not anticipated to cause undesirable results because the area lacks linear infrastructure that is most sensitive to small subsidence rates, such as canals or high hazard pipelines.~~

~~Given the low sensitivity of subsurface strata to land subsidence in response to historical groundwater level declines, along with the lack of infrastructure in the Plan Area that is most sensitive to subsidence,~~ As discussed in Section 2.2.2.5, Land Subsidence, the degree of land subsidence occurring in the Plan Area is minimal, has not substantially interfered with surface land uses in the past, and is not anticipated to substantially interfere with surface land uses in the foreseeable future, including ~~subsidence is also not expected to become an undesirable result~~ within the GSP's planning and implementation horizon. Therefore, this GSP does not propose minimum thresholds or measurable objectives specific to this sustainability indicator. If during the GSP implementation timeline, it becomes evident that minimum thresholds and measurable objectives for lowering of groundwater levels and groundwater in storage are not being met, the degree to which land subsidence may become an undesirable result will be re-evaluated.

### 3.2.6 Depletions of Interconnected Surface Water – Undesirable Results

Under SGMA, depletions of surface waters interconnected with water in the Subbasin that have significant and adverse impacts on beneficial uses of surface waters constitute an undesirable result (CWC Section 10721(x)(6)). ~~This form of undesirable result had been ongoing since the 1940s in the Subbasin due to specific ecological impacts associated with lowering groundwater levels and associated depletion of surface water, including the loss of riparian habitats, and desiccation of GDEs such as the honey mesquite bosque located in the vicinity of the Borrego Sink, a~~As described in Section 2.2.2.6, ~~Groundwater~~ Identification of Interconnected Surface Water, surface waters have been disconnected from the underlying Subbasin aquifer for many decades. Though pre-development groundwater conditions supported a flowing spring east of the Borrego Sink (Old Borrego Spring), the spring became dry early in the Subbasin's history due to groundwater decline that cannot be feasibly reversed under current or expected future conditions. Furthermore, for the reasons described in Section 2.2.2.6 and Appendix D4, pumping within the Subbasin has no significant nexus to the seeps and/or springs that contribute flow to mapped creeks that enter the margins of the Subbasin such as Coyote Creek and Borrego Palm Creek. ~~Connections. Potential GDEs mapped along the margins of the Plan Area are disconnected from the Subbasin's groundwater aquifer for the reasons described in Section 2.2.2.6, are fed by surface water flow from outside the Subbasin, and thus are not considered to have a significant nexus to the water table within the Subbasin.~~ Therefore, there are no undesirable results as defined in SGMA currently occurring, or expected to occur, as a result of depletion of interconnected surface water. Therefore, this GSP does not propose minimum thresholds or measurable objectives related to this sustainability indicator.

## 3.2.7 Groundwater Dependent Ecosystems – Undesirable Results

Appendix D4 provides a complete review of available pertinent spatial datasets, historical data (e.g., stream flow and groundwater levels), satellite-derived vegetation metrics, and geology to develop a robust hydrogeological conceptual model to evaluate nexus of mapped GDEs with regional groundwater levels within the Subbasin. As described in Section 2.2.2.7, Identification of Groundwater Dependent Ecosystems, and Appendix D4, because of the long-term imbalance of pumping with available natural recharge, an irreversible impact has likely occurred on the honey mesquite community from a decline in groundwater levels, an impact which, based on the best available science, was completed and likely became permanent sometime prior to 1985. The comprehensive assessment revealed potential GDEs identified within the Subbasin no longer have direct reliance on groundwater emerging from aquifers or on groundwater occurring near the ground surface, and instead are sustained by periodic stormwater flows, soil moisture, and potentially perched groundwater where present. These findings indicate that based on best available data, undesirable results on GDEs occurred prior to 1985 and are not presently occurring or anticipated to occur in the future.~~The only vegetation mapped in the basin as a potential GDE is found in and around the Borrego Sink wash (Figure 2.2-19; the Natural Communities Commonly Associated with Groundwater (NCCAG) dataset). The honey mesquite bosque, shown as purple in Figure 2.2-19 north of the Borrego Sink, is considered a pre-2015 impact, because groundwater levels declined many decades ago to a level no longer supporting a viable mesquite bosque habitat. Natural discharge – as determined from the BVHM – attributable to evapotranspiration "was approximately 6,500 acre-feet per year (AFY) prior to development, but has been virtually zero in the last several decades (1990–2010), because the groundwater levels in the basin dropped below the reach of the mesquite in the Subbasin" (USGS 2015). The green area in Figure 2.2-19 depicts the pre-pumping mapped historical extent of phreatophytes in the Subbasin by USGS (USGS 2015). The pink area depicts the mapped pre-January 1, 2015, extent of potential GDEs (SANGIS 2017), and the orange and light blue areas depict the extent of vegetation and wetland communities mapped in the NCCAG dataset (DWR 2018b). The honey mesquite experienced prolonged adverse impacts including desiccation, inability to regenerate and habitat loss well prior to 2015.~~

~~Pumping in the Subbasin has resulted in a groundwater level decline of about 44 feet over the last 65 years in the vicinity of the Borrego Sink. The average rate of decline over this 65-year period is approximately 0.67 feet per year. Because of the long-term imbalance of pumping with available natural recharge, an irreversible impact has occurred to the honey mesquite bosque. As discussed in Section 2.2.2.6~~7~~, the remaining phreatophytes in the Subbasin are supported by periodic storm runoff, percolating surface water (i.e., above the static groundwater level), and/or locally perched~~

layers of groundwater. Given groundwater levels underlying this area of the Subbasin now exceed 55 feet below ground surface, as measured at monitoring well MW-5, and that the estimated rooting depth of the habitat is a maximum of 15.3 feet (USGS 2015), it is unfeasible that any PMA developed by the GSA will result in recovery of the honey mesquite GDE. To restore the honey mesquite GDE, groundwater levels would have to rise by 30 to 40 feet over the course of the GSP implementation period. This is not possible even with cessation of all groundwater use in the basin. And, any such complete cessation of groundwater use would result in other significant and unreasonable impacts and undesirable results to groundwater users in the basin.

The GSA does not consider depletions of interconnected surface water as a current or future undesirable result, because this is a permanent impact that occurred early in the history of the Subbasin. As a result of the long-term trend of declining groundwater levels, the pumping wells in the Subbasin do not draw water that would otherwise support the remaining areas mapped by DWR as NCCAGs. Remaining NCCAGs are now supported by percolating surface water, and and potentially, locally perched layers of groundwater not accessed by pumping wells (Appendix D4). Therefore, this GSP does not propose minimum thresholds or measurable objectives related to this sustainability indicator.

## 3.3 MINIMUM THRESHOLDS

A minimum threshold refe–rs to a numeric value for each sustainability indicator used to define undesirable results (Title 23 CCR Section 351(t)). A GSP must establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results (Title 23 CCR Section 354.28(a)).

A GSA may establish a representative minimum threshold for groundwater elevation (GWE) to serve as the value for multiple sustainability indicators, where the GSA can demonstrate the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence (Title 23 CCR Section 354.28(d)). Minimum thresholds are not required for sustainability indicators that are not present and not likely to occur in the Subbasin (Title 23 CCR Section 354.28(e)).

Per Title 23 CCR Section 354.28(b), the description of minimum thresholds shall include the following:

1. The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by uncertainty in the understanding of the basin setting.

2. The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.
3. How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.
4. How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.
5. How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.
6. How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in [the GSP Regulations].

The following sections address minimum thresholds for each of SGMA's sustainability indicators.

## 3.3.1 Chronic Lowering of Groundwater Levels – Minimum Thresholds

### 3.3.1.1 Minimum Threshold Justification

The GSP regulations provide that the "minimum threshold for chronic lowering of groundwater levels shall be the groundwater level indicating a depletion of supply at a given location that may lead to undesirable results" (Title 23 CCR Section 354.28(c)(2)).

Chronic lowering of groundwater levels in the Subbasin, as discussed in Section 3.2.1, Chronic Lowering of Groundwater Levels – Undesirable Results, cause significant and unreasonable declines if they are sufficient in magnitude to lower the rate of production of pre-existing groundwater wells below that necessary to meet the minimum required to support the overlying beneficial use(s), where alternative means of obtaining sufficient groundwater resources are not technically or financially feasible. In addition, GWEs will be managed under the minimum thresholds to ensure the several aquifers in the Subbasin are not depleted in a manner to cause significant and unreasonable impacts to other sustainability indicators. At the same time, the GSA is mindful that groundwater levels are anticipated to fall below 2015 levels before they are stabilized by the end of the GSP implementation period. Thus, the minimum thresholds have been designed with that circumstance in mind.

Maintaining groundwater levels above saturated screen intervals for pre-existing municipal wells during an anticipated multi-year drought circumstance was selected as the minimum desired threshold for GWEs that would be protective of beneficial uses in the Subbasin. This minimum threshold in most cases would also be protective of non-potable irrigation beneficial uses.

Explained as follows, these minimum thresholds are also intended to protect against significant and unreasonable impacts to groundwater storage volumes, and water quality and the beneficial uses of interconnected surface water. The development of the minimum thresholds for chronic lowering of groundwater levels included review of the hydrogeologic conceptual model, climate, current and historical groundwater conditions including groundwater level trends and groundwater quality, land subsidence data, groundwater interconnected surface water connections and the water budget as discussed in various sections of Chapter 2.

The minimum thresholds for chronic lowering of groundwater levels are based principally on the documented screen intervals of key municipal water wells and domestic/*de -minimis* wells located in the Subbasin. Municipal wells are listed in Table 3-4 along with minimum thresholds corresponding to the top screened interval. Key indicator wells are also shown in Figure 3.3-1. Minimum thresholds are not considered applicable for BWD wells that require replacement, or are not relied upon for a significant source of supply. These wells are as follows: (1) Well ID1-10 well is planned for replacement in 2019; (2) the Wilcox well is an emergency back-up well with no power supply (diesel generator only); (3) ID1-16 will continue to be used but is planned to be replaced during the GSP implementation period; (4) ID4-18 is proposed for replacement in the future; and (5) ID1-8 is seldom used by the districtBWD, and is not anticipated to continue to serve BWD customers over the entire SGMA implementation period. Although the aforementioned wells are not key municipal wells and thus do not have an accompanying minimum threshold, they are included in Table 3-4 for informational purposes. Table 3-4 also lists the year drilled, well depth, blank casing intervals and a recent static depth to groundwater, surface elevation, GWE, aquifers screened, and management area for the BWD wells.

# Table 3-4
## Borrego Water District Well Screened Intervals and Key Municipal Well Minimum Thresholds

| Well | Year Drilled | Well Depth (feet) | Screen Intervals (feet; bgs) | Minimum Threshold / Top of Well Screen (feet; bgs) | Depth to Groundwater (feet; bgs)* | Surface Elevation / Groundwater Elevation (feet MSL)* | Aquifer | Management Area | Existing Minimum Threshold Exceedance |
|---|---|---|---|---|---|---|---|---|---|
| *Improvement District (ID) No. 1* | | | | | | | | | |
| ID1-8 | 1972 | 830 | 72–240<br>260–830 | 72 | 77.76 | 526.69 / 448.93 | Middle/ Lower | SMA | N/A |
| ID1-10 | 1972 | 392 | 162–372 | N/A | 204.2 | 595.14 / 390.94 | Middle | CMA | N/A |
| ID1-12 | 1984 | 580 | 248–568 | 248 | 146.14 | 533.2 / 387.06 | Middle/ Lower | CMA | No |
| ID1-16 | 1989 | 550 | 160–540 | N/A | 231.77 | 620.15 / 388.38 | Middle/ Lower | CMA | N/A |
| Wilcox | 1981 | 502 | 252–502 | N/A | 309.78 | 702.13 / 392.35 | Lower | CMA | N/A |
| *Improvement District (ID) No. 4* | | | | | | | | | |
| ID4-4 | 1979 | 802 | 470–500<br>532–570<br>586–786 | 470 | 290.88 | 598.11 / 307.23 | Middle/ Lower | NMA | No |
| ID4-11 | 1995 | 770 | 450–750 | 450 | 223.2 | 613.72 / 390.52 | Middle/ Lower | NMA/CMA | No |
| ID4-18 | 1982 | 570 | 240–300<br>310–385<br>395–405<br>425–440<br>460–475<br>490–560 | N/A | 315.31 | 690.96 / 375.65 | Upper/ Middle | NMA | N/A |
| *Improvement District (ID) No. 5* | | | | | | | | | |
| ID5-5 | 2000 | 700 | 400–700 | 400 | 182.1 | 576.8 / 394.7 | Middle/ Lower | CMA | No |

**Notes:** bgs = below ground surface; MSL = above mean sea level; SMA = South Management Area; N/A = not applicable; CMA = Central Management Area; NMA = North Management Area.
* Fall 2018 measured value, except ID4-11 and Wilcox, which are Spring 2018 measurements (due to active pumping or lack of access at time of Fall 2018 visit).

In Section 3.4, Measurable Objectives, this GSP establishes measurable objectives and interim milestones at the same locations as the minimum thresholds as required by the GSP Regulations (Title 23 CCR Sections 351(g) and 354.30) based on the assumption that the historical climate from 1960 through 2010 repeats for the period 2020 through 2070. A linear reduction in pumping from current levels to a target of 5,700 AFY between 2020 and 2040 was applied in the BVHM to forecast change in Subbasin groundwater storage (Figure 3.3-2). Figure 3.3-2 shows the cumulative change in storage for the entire Borrego Basin for several model runs including the cumulative change in storage from the original USGS model run (1945 through 2010) and the cumulative change in storage for the model update (2011 through 2016). In addition, the model was run to address six different future scenarios. Future scenarios can be divided into two groups:

1. Pumping remains the same as current levels, and
2. A linear reduction in pumping from current levels to a target of 5,700 AFY between 2020 and 2040. Three potential climate scenarios were run for each of the scenarios:
    a. Historical climate from 1960 through 2010 was repeated for the period 2020 through 2070,
    b. California DWR change factors for projected climate conditions in 2030 were applied to the historical period from 1960 through 2010 following the procedures outlined in the DWR climate guidance for GSPs, and
    c. DWR change factors for projected climate conditions in 2070 were applied to the historical period from 1960 through 2010 following the procedures outlined in the DWR climate guidance for GSPs (DWR 2018c).

Applying DWR climate change factors for projected climate conditions in 2030 and 2070 result in an estimated 79,000 AF and 87,000 AF of groundwater removed from storage or an increase of 9.7% and 20.8%, respectively as compared to assuming a repeat of the historical climate scenario. The results indicate that 5,700 AFY of sustainable yield appears to be an acceptable target for sustainable annual withdrawals from the Subbasin, and that changes in future climate conditions are just as likely as not to produce a small impact on storage in the Subbasin when compared to changes in pumping and historical climate variability.

Because water years in which significant natural recharge occurs are infrequent and unpredictable, identifying the degree of climate variability in the Subbasin is a more informative and consequential factor in understanding future conditions than the application of DWR climate change factors to a repeat of historical climate. Although Figure 3.3-2 shows that the difference between a repeat of past climate and the application of DWR climate change factors is notable, the range in future outcomes produced by climate variability is much more significant. Therefore, the GSA evaluated the potential future variability in recharge to the Subbasin over the 20-year implementation period based on the effect of time-varying recharge using a Monte Carlo

Simulation (MCS) uncertainty analysis (ENSI 2018). The BVHM recharge values produced over the model period from 1945 to 2010 served as the basis of the analysis. All of the simulations are based on the target pumping rate of 5,700 AFY being achieved in year 20 of GSP implementation. The MCS uncertainty analysis selected 20-year periods at random from the historical time series from 1945 to 2010. Alternatively, annual data could be randomly selected based on the distribution of values, but this was not done because review of the recharge values shows that there is periodicity within the time series (i.e., decadal dry, wet, and normal climatic periods).

The MCS uncertainty analysis provides for a series of 'what if' analyses where a 20-year SGMA attainment period could occur for any historical 20-year period modeled by the BVHM and thus examine the potential variability in the water balance as exhibited by the model. A total of 53 20-year periods from 1945 to 2016 are evaluated using the MCS uncertainty analysis. Figure 3.3-3 shows the MCS uncertainty analysis simulations in terms of the average and percentiles. Shown are the 20th through 80th percentiles. The 20th percentile line on Figure 3.3-3 indicates the value of the cumulative change in storage. The 20th percentile line represents a result which is higher than 20% of the simulations and lower than 80% of the simulations.

Since the simulations are looking at different time periods, the values translate to rate of occurrence. For example, values below the 20th percentile occur 20% of the time. The change in groundwater in storage, and corresponding change in groundwater level, associated with the 20th percentile was selected as the proposed minimum threshold for the Subbasin meaning that based on 53 20-year periods evaluated, values below the minimum threshold occur 20% of the time and values above the threshold occur 80% of the time. The uncertainty analysis demonstrates that variability in the historical climate and associated recharge is a critical factor to establish minimum thresholds.

In addition to minimum thresholds for BWD key indicator wells, the GSA has set minimum thresholds for key indicator wells throughout the Subbasin which are intended to be protective of beneficial uses and users of groundwater (Table 3-5). As previously mentioned, the climate in the Subbasin is both highly variable and has a decadal periodicity (ENSI 2018). A MCS uncertainty analysis was performed to estimate the effects of reaching a pumping target of 5,700 AFY through incremental reductions by 2040 under a wide range of potential climate scenarios (ENSI 2018). The minimum threshold is based on the estimated degree of groundwater level decline that would occur in each indicator well if the 20th percentile scenario for groundwater recharge were to be realized. It should be noted that the minimum thresholds in Table 3-5 were determined based on groundwater reductions occurring uniformly across all production wells in the BVHM and do not account for differential reductions that may be possible between and across different sectors and/or groundwater management areas.

The GSA will evaluate the minimum thresholds, interim milestones, and measurable objectives at least every 5 years based on the preceding GSP implementation period climate and actual realized pumping reductions to determine the likelihood that the Plan will attain sustainability goals. The

GSA will adjust the rate of pumping reduction, revisit minimum thresholds, and/or evaluate additional PMAs if the minimum thresholds in Table 3-4 or Table 3-5 are exceeded or if the interim milestones in Table 3-7 are not being achieved. Furthermore, key wells could be added or replaced for the purpose of minimum threshold compliance monitoring as new data become available.

As described in Section 3.5, the GSP establishes a monitoring network in the Subbasin of 50 monitoring sites; however, only those representative sites listed in Table 3-4, Key Municipal Well Minimum Thresholds, and Table 3-5, Key Indicator Wells in Each Management Area, will be used to monitor compliance with the sustainability indicators for each management area, per Title 23 CCR Section 354.36(a). The thresholds in Table 3-4 are intended to establish groundwater level thresholds for municipal water system, whereas those in Table 3-5 are intended to be representative of Subbasin management areas, and reflect domestic, recreational and agricultural beneficial users not connected to the BWD system.

**Table 3-5**
**Minimum Thresholds for Key Indicator Wells in Each Management Area**

| Management Area | Representative Monitoring Point Well ID | 2018 Observed Groundwater Elevation (feet MSL) | Minimum Threshold<br>Maximum allowable decline in groundwater levels as measured at the beginning of GSP Implementation through 2040 |
|---|---|---|---|
| NMA | MW-1 | 377.91 | -39 |
| | ID4-3 | 381.4 | -42 |
| | SWID 010S006E09N001S | 375.05 | -46 |
| | ID4-18 | 377.94 | -44 |
| CMA | ID4-1 | 393.88 | -33 |
| | Airport 2 | 407.51 | -25 |
| | ID1-16 | 389.75 | -33 |
| SMA | MW-5A | 409.61 | -14 |
| | MW-5B | 409.6 | |
| | MW-3 | 454.38 | -12 |
| | Air Ranch | 465.47 | -9 |
| | ~~ID1~~RH1-1 | 468.13 | -9 |

**Notes:** MSL = above mean sea level; GSP = Groundwater Sustainability Plan; NMA = North Management Area; CMA = Central Management Area; SMA = South Management Area.

### 3.3.1.2 Relationship between the Established Minimum Thresholds and Sustainability Indicator(s)

a. Relationship between the established minimum thresholds and the Chronic Lowering of Groundwater Sustainability Indicator

The wells described in Table 3-4 and Table 3-5 are in locations that reflect a wide cross section of Subbasin conditions. These locations are representative of overall Subbasin conditions and conditions in each management area because they are spatially distributed throughout the Subbasin both vertically (across aquifers), and laterally. The GSA has determined that use of the minimum elevation thresholds at each of the listed monitoring site locations will help avoid the undesirable results of chronic lowering of groundwater levels because it will minimize the chance that access to adequate water resources for beneficial users within the Subbasin will be compromised.

b. Relationship between the established minimum thresholds and the three other sustainability indicators applicable to the Borrego Subbasin

In addition, and as described more fully as follows, use of GWEs at the cross section of wells outlined in Table 3-4 and Table 3-5, are also appropriate minimum thresholds for the following sustainability indicators: groundwater storage, and groundwater quality degradation and, and depletion of interconnected surface waters. As established in Chapter 2, there are no regionally extensive aquitards, so lowering groundwater levels can reasonably be considered a proxy for decreases in groundwater in storage. Furthermore, the mechanism by which the GSA intends to address undesirable results is an incremental pumping reduction plan to reach the sustainable yield of 5,700 AFY by 2040. This measure would also minimize the degree of overdraft. The relationship between the chronic lowering of groundwater levels and water quality is not direct, but deeper groundwater may be the source of elevated arsenic concentrations in the SMA. Chronic lowering of groundwater levels may, therefore, result in the need to treat groundwater for municipal and domestic uses.

### 3.3.1.3 Minimum Threshold Impacts to Adjacent Basins

As described in the hydrogeologic conceptual model in Section 2.2.1, Hydrogeologic Conceptual Model, subsurface outflow from the Subbasin is minor (estimated at 511 AFY in the southern end of the BVHM model domain). The Coyote Creek fault is interpreted to act as a boundary to groundwater flow between the Subbasin and the Ocotillo-Clark Valley Groundwater Basin (USGS 2015). The adjacent Ocotillo-Clark Valley Groundwater Basin and Ocotillo Wells Subbasin are both "very low" priority basins not required to prepare GSPs. As such, they are not expected to develop descriptive undesirable results or quantitative minimum thresholds and measurable objectives. Thus, the minimum threshold of GWE selected to prevent chronic lowering of groundwater levels and to avoid triggering the other three two applicable sustainability indicators in the Subbasin are not expected to cause undesirable results in adjacent basins or adversely affect the ability of adjacent basins to achieve sustainability goals.

### 3.3.1.4 Minimum Threshold Impact on Beneficial Uses

Beneficial uses and users of groundwater in the Subbasin are discussed in Section 2.1.~~5.1~~4, Beneficial Uses and Users, and generally include three primary sets of pumpers: agriculture, municipal and recreation. Other Subbasin pumpers include small water systems and *de ~~-~~minimis* users. The minimum thresholds developed represent points in the Subbasin that, if exceeded, may cause undesirable results (Title 23 CCR Section 354.28(a)). It is expected that, if GWEs fall below the established minimum thresholds, water supplies available to beneficial uses and users in the Subbasin will be limited or challenging to produce, and significant and unreasonable water quality and other adverse impacts to sustainability indicators may occur.

As a result, the PMA Section of the GSP (Chapter 4) describes the GSA's plan to establish: (1) Baseline Pumping Allocations for each non-*de ~~-~~minimis* pumper of groundwater in the Subbasin, and (2) a ramp down schedule using a linear reduction in pumping to reach the planning sustainability target of 5,700 AFY. Once implemented, the latter is expected to require an approximate 19% reduction in pumping every 5 years from the Baseline Pumping Allocation of ~~21~~22,~~963~~00 AFY for a total estimated reduction of about ~~74%~~75%. Baseline Pumping Allocations were determined based on the maximum water use by individual (non-*de ~~-~~minimis*) pumpers over the 5-year baseline period of January 1, 2010, to January 1, 2015. The Baseline Pumping Allocation also includes ~~allocations for water credits issued in conjunction with the County/BWD program for sites fallowed prior to adoption of the GSP,~~ municipal water use previously reduced through end use efficiency and conservation efforts, and recreation use curtailed prior to GSP adoption. The estimated water use by sector is ~~71.6~~70% for agriculture, 18~~.5~~% for recreation, ~~9.7~~12% for municipal, and less than ~~0.3~~1% for other users based on the total Baseline Pumping Allocation.[8] Agricultural water use occurs over approximately 2,624 acres (according to updated estimates by the GSA in 2018), municipal water use includes 2,059 residential and commercial connections, and recreational water use includes six golf courses with approximately over 400 acres of irrigated turf.

As described in Chapter 4, the GSA proposes to develop water trading, water conservation and efficiency, land fallowing, and pumping reduction programs to mitigate the impacts of mandated pumping reductions. These programs will be designed to maximize beneficial uses while recognizing the finite availability of groundwater resources in the Subbasin. The proposed aggregate pumping allowance at each 5-year milestone and for achieving Subbasin sustainability is presented in Table 3-6.

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[8] Water credits are currently not included in the Baseline Pumping Allocation but may be converted to Baseline Pumping Allocation during GSP implementation.

**Table 3-6**
**Proposed Aggregate Pumping**

| Year | Baseline Pumping Allocation (AFY) | Percent Reduced | Pumping Allowance (Percent) | Pumping Allowance (AFY) |
|---|---|---|---|---|
| 0 | 221,9386001 | 0.0% | 100% | 22,600121,938 |
| 5 | | 18.59% | 81.5% | 18,37617,879 |
| 10 | | 37.1% | 63.0% | 14,15113,819 |
| 15 | | 55.6% | 44.5% | 9,9259,760 |
| 20 | | 74.175% | 256.0% | 5,7005,700 |

**Notes:** AFY = acre-feet per year.

### 3.3.1.5 Comparison between Minimum Threshold and Relevant State, Federal, or Local Standards

The GSA is not aware of any other state, federal, or local standards specific to addressing the lowering of groundwater levels in the Subbasin. As part of the implementation of PMAs, additional biological analysis may be required in some circumstances and may have relevance to future iterations of the minimum thresholds. The California Environmental Quality Act (Guidelines Appendix G) has a requirement to examine whether a program or project would "substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)." However, the management criteria established in this GSP merely clarify the meaning of this requirement in the local context of the Subbasin, and are not conflicting or inconsistent.

With regard to local standards, there are no quantitative standards that define or limit specific GWEs or amount of allowable groundwater level decline. As further described in Chapter 2, when the County prepares a general plan (including community plan) update process, the GSP will be a key consideration with respect to related goals and policies. The implementation of this GSP and the County's general plan update process are separate but related processes. Future general plan and community plan updates should consider the sustainability goals of this GSP. This GSP may be referred to by reference within future general plan and community plan updates.

### 3.3.1.6 Minimum Threshold Measurement Method

The static groundwater level will be measured at each identified minimum threshold well (key indicator wells) at least two times per year to evaluate groundwater level elevation trends at anticipated seasonal low and seasonal high groundwater conditions. All measurements will comply with the Sampling and Analysis Plan and Quality Assurance Project Plan (Appendix E1) and will be entered in to the GSA's data management system. The monitoring network is described in further detail in Section 3.5, Monitoring Network.

## 3.3.2 Reduction of Groundwater Storage – Minimum Thresholds

### 3.3.2.1 Minimum Threshold Justification

Reduction of groundwater in storage in the Subbasin as discussed in Section 3.2.2, Reduction of Groundwater Storage – Undesirable Results, is significant and unreasonable if it is sufficient in magnitude to lower the rate of production of active groundwater wells below the minimum required to support the overlying beneficial use(s), where an alternative means of obtaining sufficient groundwater resources is not technically or financially feasible. As discussed in Section 3.3.1, Chronic Lowering of Groundwater Levels – Minimum Thresholds, domestic wells are generally located in areas that have a groundwater level substantially above the average depth of wells, with some exceptions shown in Figure 3.2-4. Furthermore, in most cases it would be technically and financially feasible to connect domestic and *de -minimis* users to the municipal water system, should they experience a significant loss in production rate attributable to groundwater level declines.

As discussed in Section 2.2.3.~~7~~8, Surface Water Available for Groundwater Recharge or In-Lieu Use, neither imported nor recycled water is economically viable for alternative water supply. Stormwater capture and infiltration has limited potential in the Subbasin due to the arid environment and infrequent availability of stormwater runoff. The usable quantity of groundwater in storage is large compared to average annual natural recharge to the Subbasin. On average, the Subbasin lost approximately 7,300 AFY from storage for the period between 1945 and 2015. Over the last 10 years, the Subbasin lost approximately 13,137 AFY, based on the BVHM model results as described in Section 2.2.3, Water Budget. The long-term deficits in the groundwater budget resulted in an estimated 520,000 AF of water removed from storage from 1945 to 2016.

In order to reach the current target sustainability of 5,700 AFY, a linear pumping reduction is proposed to bring the basin into sustainability by 2040. The estimated pumping reduction over the applicable period is ~~74%~~75% from the Baseline Pumping Allocation. The Baseline Pumping Allocation is based on maximum annual groundwater extraction by each non-*de -minimis* pumper in the Subbasin during the period from January 1, 2010, to January 1, 2015. Hence, some pumping reductions, such as those for municipal end-use efficiency and water credits sites, have already been realized.

BVHM simulations that include a target pumping rate of 5,700 AFY in 2040, linear reduction in pumping, and an assumption that the historical climate from 1960 through 2010 was repeated for the period 2020 through 2070 to simulate future conditions, indicate a net deficit of 72,000 AF for groundwater in storage over the 20-year Plan implementation period. As discussed in Section 3.3.1.1, the change in groundwater in storage associated with the 20th percentile was selected as the proposed minimum threshold for the Subbasin meaning that based on fifty-three 20-year periods evaluated, values below the minimum threshold occur 20% of the time and values above the threshold occur 80% of the time (Figure 3.3-3).

The overdraft 'curve' that assumes a 5,700 AFY average annual recharge is approximately equal to the 55th percentile of the MCS analysis, meaning target sustainability occurs in 45% of the simulations. The GSA will evaluate the interim milestones and measurable objective at least every 5 years based on the preceding GSP implementation period climate and realized pumping reductions to determine the likelihood that the Plan will attain sustainability goals. If necessary, the GSA will adjust the rate of pumping reduction or evaluate additional PMAs if the minimum threshold is exceeded or the interim milestone is not being achieved.

#### 3.3.2.2 Relationship between Minimum Threshold and Sustainability Indicator(s)

The minimum threshold for reduction of groundwater storage is related to the other applicable sustainability indicators, including chronic lowering of groundwater levels and degraded groundwater quality. The minimum threshold for reduction in groundwater storage, which will be directly correlated with the minimum threshold for chronic lowering of groundwater levels, will protect against losses of groundwater in storage sufficient to lower the rate of production of pre-existing groundwater wells below the minimum required to support the overlying beneficial use(s), as further described in Section 3.2.2.1, Minimum Threshold Justification.

#### 3.3.2.3 Minimum Threshold Impacts to Adjacent Basins

As described in Section 3.3.1.3, Chronic Lowering of Groundwater Levels – Minimum Threshold, the minimum threshold selected for reduction of storage avoids causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.

#### 3.3.2.4 Minimum Threshold Impact on Beneficial Uses

The minimum thresholds developed will limit the availability of water supply to beneficial uses and users in the Subbasin as discussed in Section 3.3.1.4, Chronic Lowering of Groundwater Levels – Minimum Threshold. The minimum threshold impact on beneficial uses for both chronic lowering of groundwater level and reduction of groundwater storage is the same.

#### 3.3.2.5 Comparison between Minimum Threshold and Relevant State, Federal, or Local Standards

The comparison between minimum threshold and relevant state, federal, or local standards is generally the same as previously discussed for Section 3.3.1.4, Chronic Lowering of Groundwater Levels – Minimum Threshold. The only difference is that San Diego County currently has cumulative analysis and mitigation standards for permitting discretionary projects with water demands in the Borrego Valley Exemption area, in which adequate water availability must be determined in consideration of surrounding uses and users. It is anticipated these standards will be updated to ensure consistency with the ~~superseded by this~~ GSP. ~~and will be equally or more protective of groundwater in storage.~~

### 3.3.2.6 Minimum Threshold Measurement Method

Reduction in groundwater storage is not a parameter that can be directly measured; rather, change in storage will be regularly estimated based on either the Subbasin water budget or monitoring results derived from analysis of GWEs and aquifer properties as discussed in Section 3.5.2, Monitoring Protocols for Data Collection and Monitoring. To monitor the changes in storage to the Subbasin, the generalized water budget equation is as follows:

**Sum of inflows – Sum of outflows = Change in storage**

The water budget is an accounting framework used to quantify all inflows and outflows from the Subbasin over a given period of time, with the difference equating to the change in storage. The BVHM is used to estimate the water budget. The simulated water budget included water inputs from underflow, infiltrating rainfall, applied irrigation, and infiltrating surface water flows in creeks (i.e., losing streams); the water outputs included evapotranspiration, pumping, and subsurface flow out of the Subbasin. The water budget developed using the USGS model is an important tool to manage water resources and will be updated at least every 5 years to document progress toward achieving Subbasin sustainability.

On at least an annual basis, change in groundwater storage will be estimated based on change in GWEs. This involves documenting change in measured GWEs at all monitoring program wells in the Subbasin over a given period of time. The GWE change is then multiplied by the overlying Subbasin area and estimated specific yield of the aquifer sediments to determine the change in groundwater storage. Changes in storage in the Subbasin are determined from the generalized GWE and aquifer properties equation:

***Overlying Area x ($GWE_{t0}$ – $GWE_{t1}$) x Specific Yield = Change in Storage***

Groundwater elevation surfaces will be created from measured GWE data using a geographic information system (GIS) for specific time periods (e.g., Spring 2020 and Spring 2021). Each surface represents a specific elevation of the groundwater table. The difference between the two surfaces multiplied by the surface area of the Subbasin represents the change in saturated volume of aquifer material between the two periods. This difference will be calculated using GIS and multiplied by the specific yield to estimate the change in groundwater storage. The reduction in groundwater storage will be calculated annually and reported by the GSA to document progress toward the sustainability goal.

Monitoring parameters for this sustainability indicator/minimum threshold include routine groundwater level measurements. Additionally, the hydrogeologic properties of the aquifer will be updated as additional pump test data becomes available.

## 3.3.3 Seawater Intrusion – Minimum Thresholds

As described in Section 3.2.3, Seawater Intrusion – Undesirable Results, seawater intrusion is not an applicable undesirable result in the Subbasin and a minimum threshold is not warranted.

## 3.3.4 Degraded Water Quality – Minimum Thresholds

Degraded water quality in the Subbasin, as discussed in Section 3.2.4, Degraded Water Quality – Undesirable Results, is significant and unreasonable if it is sufficient in magnitude to affect use of pre-existing groundwater wells such that the water quality precludes the use of groundwater to support the overlying beneficial use(s), and that alternative means of obtaining sufficient groundwater resources are not technically or financially feasible. For municipal and domestic wells, this means water quality that meets potable drinking water standards specified in Title 22 of the CCR. For irrigation wells, water quality should generally be suitable for agriculture use. As indicated in the Basin Plan, irrigation return flows and septic recharge returns to the aquifer with an increase in mineral concentrations such as TDS and nitrate. The Basin Plan objective is to minimize quantities of contaminants reaching the aquifer by establishing stormwater best management practices. A PMA to optimize water quality is discussed in Chapter 4.

### 3.3.4.1 Minimum Threshold Justification

The minimum threshold for degraded water quality is protective of existing and potential beneficial uses and users in the Subbasin. Alternative means of addressing degraded water quality such as wellhead treatment may also be technically and financially achievable.

### 3.3.4.2 Relationship between Minimum Threshold and Sustainability Indicator(s)

Degraded water quality is related to the sustainability indicators: chronic lowering of groundwater levels and reduction in groundwater storage. As groundwater levels decline and storage decreases there exists the potential for increased concentration of constituents of concern (COCs) as a result of poorer water quality identified in parts of the lower aquifer. Additionally, poor water quality associated with irrigation return flow and septic recharge that has percolated to the aquifer has the potential to migrate laterally as a result of pumping. Degraded water quality is not a predictor of other sustainability indicators. Rather, it is a potential response. As such, it is sufficient to establish the minimum threshold for degraded water quality in isolation from the other sustainability indicators.

#### 3.3.4.3 Minimum Threshold Impacts to Adjacent Basins

As described in Section 3.3.1.3, Chronic Lowering of Groundwater Levels – Minimum Threshold, the minimum threshold selected for degraded water quality is protective of causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.

#### 3.3.4.4 Minimum Threshold Impact on Beneficial Uses

The minimum threshold for degraded water quality maintains existing and potential future beneficial uses.

#### 3.3.4.5 Comparison between Minimum Threshold and Relevant State, Federal, or Local Standards

The minimum threshold for degraded water quality is compliant with potable drinking water standards specified in Title 22 of the CCR and water quality objectives established in the Basin Plan.

Section 13241, Division 7 of the CWC, specifies that, "[e]ach regional board shall establish such water quality objectives in water quality control plans as in its judgement will ensure the reasonable protection of beneficial uses and the prevention of nuisance; however, it is recognized that it may be possible for the quality of water to be changed to some degree without unreasonably affecting beneficial uses..." The GSA is mindful that the Basin Plan indicates that investigative studies will be conducted to develop groundwater objectives and implementation plans for the Borrego Subarea.

#### 3.3.4.6 Minimum Threshold Measurement Method

Groundwater quality will be monitored on a semi-annual basis at key, representative monitoring and extraction wells (shown in Table 3-4 and Table 3-5) located in each of the three management areas: NMA, CMA, and SMA. All measurements will comply with the *Sampling and Analysis Plan and Quality Assurance Project Plan* (Appendix E1) and be recorded in the GSA's data management system. The monitoring network and monitoring protocols are described in Section 3.5, Monitoring Network, and Section 3.5.2, Monitoring Protocols for Data Collection and Monitoring. Groundwater quality trends will be evaluated semi-annually using the Mann-Kendall test to assess whether or not the historical dataset exhibits a trend with a selected significance level of 0.05 or confidence interval of 95%. Water quality results will be compared to background water quality objectives discussed in Section 3.4.4, Degraded Water Quality – Measurable Objectives, and potable drinking water standards specified in Title 22 of the CCR.

### 3.3.5 Land Subsidence – Minimum Thresholds

As explained in Section 3.2.5, Land Subsidence – Undesirable Results, land subsidence is not presently an applicable undesirable result in the Subbasin and a minimum threshold is not presently warranted.

### 3.3.6 Depletions of Interconnected Surface Water – Minimum Thresholds

As described in Section 3.2.6, Depletions of Interconnected Surface Water, ~~the impact of groundwater pumping within the Subbasin to GDEs occurred prior to 2015~~there are no ~~undesireable~~undesirable results occurring within the Subbasin associated with depletion of interconnected surface water, and thus a minimum threshold is not being proposed by the GSA.

### 3.3.7 Groundwater Dependent Ecosystems – Minimum Thresholds

As described in Section 3.2.7, Groundwater Dependent Ecosystems, the impact of groundwater pumping within the Subbasin to GDEs occurred prior to 2015, and thus, a minimum threshold is not being proposed by the GSA.

## 3.4 MEASURABLE OBJECTIVES

**Standards for Establishing Measurable Objectives**

Under Chapter 6 of SGMA, a GSP is to include "measurable objectives, as well as interim milestones in increments of 5 years, to achieve the sustainability goal in the basin within 20 years of implementation of the plan" (CWC Section 10727.2(b)(1)). In addition, the plan is to describe "how the Plan helps meet each objective and how each objective is intended to achieve the sustainability goal for the basin for the long-term beneficial uses" (CWC Section 10727.2(b)(2)). The GSP Regulations define "measurable objectives" as "specific, quantifiable goals 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" (Title 23 CCR Section 351(s)).

Per GSP Regulations (Title 23 CCR Section 354.30):

a. Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.

b. Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.

c. Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.

d. An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence. Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.

The measurable objectives developed for each of the applicable sustainability indicators in this GSP are based on the current understanding of the Plan Area and basin setting as discussed in detail in Chapter 2. In particular, evaluation of the water budget as described in Section 2.2.3, Water Budget, concluded that the sustainable yield of the Subbasin is approximately 5,700 AFY and a ~~74%~~75% curtailment of pumping from the Baseline Pumping Allocation would be required to achieve the target sustainability goal. As discussed in Section 3.3.1, Chronic Lowering of Groundwater Levels – Minimum Threshold, a linear reduction in pumping from current levels to a target of 5,700 AFY between 2020 and 2040 was applied in the BVHM to forecast change in Subbasin groundwater storage and groundwater levels at each of the BWD wells and for key indicator wells in the Subbasin. Use of the BVHM to develop measurable objectives for chronic lowering of groundwater levels and reduction of groundwater in storage is discussed in the following sections. Additionally, the basis for establishing the measurable objective for degraded water quality and depletions of interconnected surface water are also described.

## 3.4.1 Chronic Lowering of Groundwater Levels – Measurable Objectives

A reasonable margin of operational flexibility under adverse conditions was factored in when developing minimum thresholds and measurable objectives for chronic lowering of groundwater levels. The minimum threshold is based on a statistical evaluation of historical climate and the probability of reoccurrence as discussed in Section 3.3.1, Chronic Lowering of Groundwater Levels – Minimum Threshold. The minimum threshold for chronic lowering of groundwater levels is based on the 20th percentile, meaning 20% of the time groundwater recharge is greater than the 53 20-year historical periods evaluated. For municipal wells, the minimum threshold is equivalent to the top of the well screen.

The reduction of groundwater in storage 'curve' that assumes a 5,700 AFY average annual recharge is approximately equal to the 55th percentile meaning target sustainability occurs for 45% of the simulations using historical climate.

The measurable objective for chronic lowering of groundwater levels is based on the average annual recharge. Table 3-7 presents observed groundwater levels, observed groundwater level trends, interim milestones and measurable objectives by Subbasin management area for key indicator wells, as well as key municipal wells. The difference between minimum thresholds, measurable objectives, and the current groundwater table level is visually depicted in Figure 23.4-1 for the key municipal wells. The methodology used to establish interim milestones assumes a consistent pumping reduction applied uniformly across all pumping wells in the Subbasin, and approximates average conditions based on the BVHM. Therefore, the GSA will evaluate progress toward meeting interim milestones based on average conditions by management area.

**Table 3-7**
**Measurable Objectives for Groundwater Levels**

| Representative Monitoring Point Well ID | 2018 Observed Groundwater Elevation (feet MSL) | Observed Groundwater Level Trend (feet per year) | 2020 Interim Milestone (feet MSL) | 2025 Interim Milestone (feet MSL) | 2030 Interim Milestone (feet MSL) | 2035 Interim Milestone (feet MSL) | Measurable Objective Value (feet MSL) |
|---|---|---|---|---|---|---|---|
| *North Management Area* | | | | | | | |
| MW-1 | 377.91 | -2.14 | 373 | 367 | 364 | 363 | 363 |
| ID4-3 | 381.4 | -2.09 | 377 | 371 | 369 | 368 | 368 |
| SWID 010S006E09N001S | 375.05 | -2.48 | 370 | 367 | 366 | 365 | 365 |
| ID4-18 | 377.94 | -2.31 | 373 | 369 | 367 | 367 | 367 |
| *Central Management Area* | | | | | | | |
| ID4-1 | 393.88 | -1.39 | 391 | 381 | 375 | 370 | 370 |
| Airport 2 | 407.51 | -1.67 | 404 | 394 | 387 | 382 | 382 |
| ID1-16 | 389.75 | -0.95 | 388 | 384 | 376 | 370 | 370 |
| *South Management Area* | | | | | | | |
| MW-5A | 409.61 | -0.74 | 408 | 400 | 393 | 387 | 384 |
| MW-5B | 409.6 | -0.74 | 408 | 400 | 393 | 387 | 384 |
| MW-3 | 454.38 | -5.84 | 443 | 440 | 437 | 434 | 433 |
| Air Ranch | 465.47 | -0.50 | 464 | 462 | 460 | 458 | 458 |
| ~~ID1-1 (~~RH-1~~)~~ | 468.13 | -0.94 | 466 | 463 | 460 | 457 | 456 |
| *BWD Key Municipal Indicator Wells* | | | | | | | |
| ID4-4 | 305.33 | -2.73 | 300 | 291 | 285 | 284 | 284 |
| ID4-11 | 390.52 | -2.29 | 386 | 366 | 358 | 355 | 355 |
| ID1-12 | 386.81 | -1.51 | 384 | 377 | 370 | 369 | 368 |
| ID5-5 | 394.7 | -0.85 | 393 | 384 | 378 | 377 | 377 |

**Notes:** MSL = above mean sea level; BWD = Borrego Water District.

Methodologies: The 2020 interim milestone is based on the spring 2018 observed groundwater elevation subtracted from the absolute value of the contemporary observed groundwater level trend multiplied by 2 years. The 2025, 2030, 2035 and measurable objective are based on the results of the BVHM estimates of change in groundwater in storage and corresponding change in groundwater head at each model node with linear fixed reduction to the estimated sustainable yield target of 5,700 acre-feet per year and the applied 2030 DWR climate change factors. In cases where there was a groundwater level increase between 2035 and 2040, the measurable objective was held at 2035 levels. Note SWID 010S006E09N001S has a limited groundwater level record and was determined by subtracting Spring 2018 measurement from the Spring 2017 measurement.

The interim milestones define the planned pathway to sustainability and are meant to track progress toward achieving sustainability.

The GSA recognizes that climate change enhances the probability, magnitude, and periodicity of extreme precipitation events and that recharge over the 20-year GSP implementation period is an estimation. As such, the interim milestones for chronic lowering of groundwater levels will be closely monitored to determine whether the Subbasin is on track to achieve its sustainability goals. The GSA will annually review actual Subbasin groundwater extraction, historical and contemporary groundwater level trends, changes in groundwater storage, and climatic condition (i.e., dry, normal, wet year/period) to determine whether metrics indicate the Subbasin is on track to achieve its sustainability goals.

The GSA will provide at a minimum a 5-year outlook for proposed pumping reductions and annually review the pumping allowance in terms of achieving sustainability goals. The GSA may amend the pumping allowance to achieve and maintain the sustainability goals. The intent of the 5-year outlook is to provide clear direction to the groundwater extractors regarding the availability of water supply over the next 5-year period. The GSA will provide 5-year outlooks for the start of GSP implementation and for each of the 5-year milestones. If the GSA amends the pumping allowance in any given year, they will provide a minimum 5-year outlook that will be reevaluated at the next 5-year milestone.

## 3.4.2 Reduction of Groundwater in Storage – Measurable Objectives

The reduction of groundwater in storage measurable objective was developed using the same methodology as chronic lowering of groundwater levels. The estimated reduction of groundwater in storage simulated using the BVHM was used to establish the interim milestones and measurable objective, as described in Section 3.4.1, Chronic Lowering of Groundwater Levels – Measurable Objective. The reduction of groundwater in storage measurable objectives are listed in Table 3-8 for the BVHM model domain.

**Table 3-8**
**Reduction of Groundwater in Storage Interim Milestones and Measurable Objectives**

| Year | Percent Pumping Reduced | Pumping Allowance (percent) | Pumping Allowance (acre-feet per year) | Cumulative Reduction of Groundwater in Storage (acre-feet) |
|---|---|---|---|---|
| 0 (Baseline) | 0.0% | 100% | 22,600~~121,938~~[a] | 0 |
| 5 (Interim Milestone) | 19~~8.5~~% | 81~~.5~~% | 18,376~~17,879~~ | 43,500 |

**Table 3-8**
**Reduction of Groundwater in Storage Interim Milestones and Measurable Objectives**

| Year | Percent Pumping Reduced | Pumping Allowance (percent) | Pumping Allowance (acre-feet per year) | Cumulative Reduction of Groundwater in Storage (acre-feet) |
|---|---|---|---|---|
| 10 (Interim Milestone) | 37.1% | 63.0% | 14,15113,819 | 73,000 |
| 15 (Interim Milestone) | 56%55.6% | 44.5% | 9,9259,760 | 76,600 |
| 20 (Measurable Objective) | 75%74.1% | 25%26.0% | 5,7005,700 | 72,000 |

**Notes:**
a. The Baseline Pumping Allocation currently does not include Water Credits that may be converted to Baseline Pumping Allocation during GSP implementation.

## 3.4.3 Seawater Intrusion

As explained in Section 3.2.3, Seawater Intrusion – Undesirable Results, seawater intrusion is not an applicable undesirable result in the Subbasin and a measurable objective is not warranted.

## 3.4.4 Degraded Water Quality – Measurable Objectives

Extraction wells in the Subbasin are generally screened in the upper, middle, or lower aquifers or cross-screened in multiple aquifers. These principal aquifers are discussed in Section 2.2.1.3, Principal Aquifers and Aquitards. Many extraction wells have long well screens intercepting multiple aquifers. Wellhead concentrations represent the average water quality of the formations producing flow to the well and in most cases do not represent the water quality of a specific aquifer or zone. As discussed Section 2.2.2.4, Groundwater Quality, the primary COCs identified in the Subbasin include arsenic, fluoride, nitrate, sulfate, and TDS.

As discussed in Section 3.3.4, Degraded Water Quality – Undesirable Results, the minimum threshold for degraded water quality is based on intended beneficial uses. For domestic or municipal supply (MUN), the minimum water quality means water quality that meets potable drinking water standards specified in Title 22 of the CCR. For irrigation wells, minimum water quality should generally be suitable for agriculture use. To develop a measurable objective for degraded water quality, the Basin Plan water quality objectives have been considered. The Regional Water Quality Control Board (RWQCB), Colorado River Region Basin Plan recognizes that, "[e]stablishment of numerical objectives for groundwater involves complex considerations since the quality of groundwater varies significantly with depth of well perforations, existing water levels, geology, hydrology and several other factors" (Colorado River RWQCB 2017). The Basin Plan does not have specific water quality objectives for groundwater. Groundwater quality suitability for agricultural use is industry and crop-specific, but can be gaged through conformance with generally accepted threshold limits for irrigation used by State Water Resources Control Board, and/or through continued engagement with growers within the Subbasin. If groundwater quality destined for irrigation is measured as meeting Title 22 standards, it would also be suitable for irrigation, as drinking water quality objectives are stricter than those that would make groundwater suitable for irrigation use.

Since the aforementioned standards are minimum thresholds, the GSA's measurable objective is for groundwater quality for the identified COCs within municipal and domestic wells exhibit stable or ~~increasing~~ improving trend, as measured at each 5-year evaluation. For irrigation wells, the measurable objective is the same as the minimum threshold (i.e., that water quality be of suitable quality for agricultural use).

### 3.4.5 Land Subsidence Measurable Objectives

As explained in Section 3.2.5, Land Subsidence – Undesirable Results, land subsidence is not presently an applicable undesirable result in the Subbasin and a measurable objective is not warranted at this time.

### 3.4.6 Depletions of Interconnected Surface Water – Measurable Objectives

As discussed in Section 3.3.6, Depletions of Interconnected Surface Water – Minimum Thresholds, there is not sufficient information at this time to establish a minimum threshold or measurable objective for depletions of interconnected surface water. Based on information provided by the DWR and best available data, actions implementable by the GSA such as pumping reductions and PMAs do not ~~appear to~~ have a substantial nexus with mitigating depletions of interconnected surface water. Specifically, a pre-SGMA impacted GDE associated with the honey mesquite ~~bosque~~ located in the vicinity of the Borrego Sink and potential GDEs located along the fringes of the Subbasin.

### 3.4.7 Groundwater Dependent Ecosystems – Measurable Objectives

As described in Section 3.2.7, the impact of groundwater pumping within the Subbasin to GDEs occurred prior to 2015, and thus, a minimum threshold is not being proposed by the GSA.

## 3.5 MONITORING NETWORK

**Standards for Establishment of Monitoring Networks**

Under SGMA, a GSP is to contain information regarding:

1. The monitoring and management of groundwater levels within the basin;
2. The monitoring and management of groundwater quality, groundwater quality degradation;

3. The type of monitoring sites, type of measurements, and the frequency of monitoring for each location monitoring groundwater levels, groundwater quality, subsidence, streamflow, precipitation, and evaporation, including a summary of monitoring information such as well depth, screened intervals, and aquifer zones monitored, and a summary of the type of well relied on for the information, including public, irrigation, domestic, industrial, and monitoring wells; and
4. Monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater extraction in the basin (CWC Section 10727.2).

According to GSP Regulations, the GSP is also to include descriptions of:

- How the monitoring network is capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and yield representative information about groundwater conditions as necessary to evaluate Plan implementation
- Monitoring network objectives including explanation of how the network will be developed and implemented to monitor:
  - Groundwater and related surface conditions
  - Interconnection of surface water and groundwater
- How implementation of the monitoring network objectives demonstrate progress toward achieving the measurable objectives, monitor impacts to beneficial uses or users of groundwater, monitor changes in groundwater conditions, and quantify annual changes in water budget components
- How the monitoring network is designed to accomplish the following for each sustainability indicator:
  - Chronic Lowering of Groundwater Levels. Demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features
  - Reduction of Groundwater Storage. Estimate the change in annual groundwater in storage
  - Seawater Intrusion. Monitor seawater intrusion
  - Degraded Water Quality. Determine groundwater quality trends
  - Land Subsidence. Identify the rate and extent of land subsidence
  - Depletions of Interconnected Surface Water. Calculate depletions of surface water caused by groundwater extractions
- How the monitoring plan provides adequate coverage of the sustainability indicators

- The density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends
- The scientific rational (or reason) for site selection
- Consistency with data and reporting standards
- For each well, the corresponding sustainability indicator, minimum threshold, measurable objective, and interim milestone
- The location and type of each monitoring site on a map (Title 23 CCR Section 354.34).

**Monitoring Network**

The overall objective of the monitoring network in the Borrego Springs Subbasin is to track and monitor parameters to demonstrate progress toward meeting the sustainability goals, including the minimum thresholds and measurable objectives defined in Section 3.3 and Section 3.4, respectively. In 2017, the GSA developed a *Sampling and Analysis Plan and Quality Assurance Project Plan* (SAP/QAPP), and in August 2018, the GSA developed a *Groundwater Extraction Metering Plan* (both included in Appendix E). The metering plan will be a mandatory component of GSP implementation for non-*de minimis* users. The monitoring network is described in Chapter 2, Section 2.2.2.2, and the monitoring plan is described below in terms of each applicable sustainability indicator, including monitoring protocols and monitoring plan assessment and improvement. The monitoring plan described below will be re-evaluated periodically to address findings of the data and compliance criteria presented in this GSP. It is expected that data collected throughout implementation of this GSP may be used to validate and update the BVHM.

The monitoring plan was prepared pursuant to the DWR's *Best Management Practices for Sustainable Management of Groundwater, Monitoring Networks, and Identification of Data Gaps (BMP)* (DWR 2016), and considers relevant data and studies performed to date for the Subbasin. Consistent with the recommendations of the BMP, the monitoring plan includes monitoring objectives and recommendations for collecting data that demonstrate short- and long-term trends in groundwater, and progress toward achieving measurable objectives. The monitoring plan is also designed to monitor impacts to beneficial uses of groundwater, and to quantify annual changes in water budget components. Monitoring objectives, previous studies and ongoing monitoring programs, data quality objectives, and monitoring scope are described in detail below.

## 3.5.1 Description of Monitoring Network

The monitoring network is designed to collect sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and provide representative information about Subbasin-wide groundwater conditions as necessary to evaluate Plan implementation. The most critical sustainability criteria to be monitored directly for the Subbasin are chronic lowering of groundwater levels and degraded water quality at the key indicator wells listed in Table 3-4 and Table 3-5 (Figure 3.3-1). Direct measurement of groundwater levels across the wider monitoring network described in Chapter 2 (Table 2.2-4) will be used to calculate and evaluate reductions in groundwater storage. No direct measurements of seawater intrusion, land subsidence, and depletions of interconnected surface water are proposed at this time.

The scope of monitoring is subdivided below consistent with the sustainability indicators.

### 3.5.1.1 Chronic Lowering of Groundwater Levels – Monitoring Network

As a critically overdrafted basin, groundwater levels in the Subbasin are the most obvious and important metric for basin sustainability, closely followed by water quality conditions. In addition, the effect of chronic lowering of groundwater levels will also be observed within each of the other sustainability indicators. The groundwater level-monitoring network currently consists of 50 wells, including 23 dedicated monitoring wells and 27 extraction wells. Of the 50 wells in the network, 46 are monitored for water levels, 30 are monitored for water quality, and 19 are monitored for production, as explained in Section 2.2.2, Current and Historical Groundwater Conditions, and shown on Figure 2.2-12. The Subbasin monitoring density for GWE is currently approximately 48 wells per 100 square miles (Plan Area is approximately 98 square miles). While there is no definitive rule for the density of groundwater monitoring points needed in a basin, for comparison the monitoring well density recommended by CASGEM Groundwater Elevation Monitoring Guidelines ranges from 1 to 10 wells per 100 square miles (DWR 2010). Per GSP Regulation Section 354.2(a), the key indicator wells identified in Table 3-4 and Table 3-5 are proposed as the representative monitoring sites for the chronic lowering of groundwater sustainability indicator.

Wells were selected for monitoring based on a combination of factors, including geographic location, screen interval relative to the three principal aquifers, accessibility, well condition, and continuity of historical data. The groundwater level monitoring program incorporates all feasible wells in the Subbasin at this time; however, the network is expected to be further refined as access is gained to additional wells or new wells are drilled in the Subbasin. The GSA has recently inspected several private wells to determine potential to include into the monitoring network and is working with private property owners to gain access for long-term monitoring. In addition to tracking groundwater levels at key indicator wells in the Subbasin, collected data will also be used to update groundwater level elevation contour and direction of groundwater flow maps.

Groundwater production is currently recorded monthly for 11 active BWD wells and 12 golf course wells. Additionally, many private pumpers record groundwater production at monthly or annual intervals. Upon Plan adoption, all non-*de minimis* groundwater extractors will be required to record monthly groundwater production and report to the GSA on an annual basis. The GSA secured Proposition 1 grant funding to install a limited number of flow meters at wells and is currently working with private well owners to get flow meters installed. ~~It is expected that~~ Tthe property owner (or third-party contractor acceptable to the GSA) would monitor/read the meter on a monthly basis. A third-party contractor acceptable to the GSA would inspect and read the meter on a semi-annual basis to verify the accuracy of data including meter calibration. On behalf of the property owner, the third-party contractor would provide an annual statement to the GSA with verification of the total extraction in gallons from each well and verification that each flow meter is calibrated to within factory acceptable limits. The GSA will keep data confidential to the maximum extent allowed by law (California Govt. Code 6254(e)). The mandatory requirements~~approach~~ for well metering are~~is~~ detailed further in the *Groundwater Extraction Metering Plan* provided as Appendix E2.

The current groundwater level monitoring network is capable of collecting data of sufficient accuracy and quantity to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions.

The entire groundwater monitoring network is shown in Figure 2.2-12, whereas the key indicator wells used to track progress towards interim milestones and measurable objectives are shown in Figure 3.3-1 and Figure 3.4-1.

- Short-term trends are tracked by pressure transducers currently installed and maintained in 17 wells that record groundwater levels at intervals of 15 minutes to 1 hour (sub-daily).
- Seasonal trends are tracked by semi-annual GWE monitoring of 46 wells in the spring and fall.
- Long-term trends are tracked by analysis of data from key indicator wells monitored semi-annually in each of the management areas with historical data dating back to the mid-1950s.

The groundwater level network is sufficiently representative of groundwater conditions in the Subbasin necessary to update the BVHM and track sustainability metrics discussed in the previous sections. As discussed in Section 2.2.1.3, Principal Aquifers and Aquitards, the groundwater system has been subdivided into three principal aquifers consisting of the upper, middle and lower aquifers. Most wells are cross-screened in more than one aquifer and aquifer-specific groundwater levels are limited. As described in Section 2.2.2.1, ~~Geology and Geologic Structure~~Groundwater Elevation Data, review of existing GWE data within the Plan Area suggests that although three distinct aquifers are delineated in varying thickness across the Subbasin, the effect of well screen lengths and intervals is potentially negligible with respect to measured depths to groundwater (i.e., potentiometric surface).

Therefore, although the GSA may not be able to obtain data from groundwater monitoring wells screened solely in each of the three aquifer units in each of the three management areas, these data gaps are not considered significant with regard to groundwater levels, given all the other available data points. As such, for the purposes of the GSP, the need for wells screened solely in each vertical aquifer unit independently does not appear to be necessary to achieve adequate spatial representation of GWEs in the Subbasin.

#### 3.5.1.2 Reduction of Groundwater in Storage Monitoring Network

Reduction in groundwater storage is not a parameter that can be directly measured; rather, change in storage will be estimated based on the Subbasin water budget every 5 years and monitoring results derived from analysis of GWE changes annually (aquifer properties will be refined if there are additional pump tests performed within the Subbasin). The wider monitoring network shown in Table 2.2-4 will be used to update groundwater level elevation contour and direction of groundwater flow maps. Based on the availability of sufficient aquifer properties and GWE data, monitoring of groundwater levels in the Subbasin is a sufficient surrogate for evaluating reduction of groundwater in storage (Title 23 CCR Section 354.36(b)). The method for measurement of estimating annual reduction of groundwater in storage is described in Section 3.3.2.6, Minimum Threshold Measurement Method.

#### 3.5.1.3 Degraded Water Quality Monitoring Network

The monitoring network currently includes sampling of 30 wells on a semi-annual basis to determine and track groundwater quality trends. Wells are monitored for potential COCs that were previously identified in part by the USGS and DWR, and a review of the historical data by the GSA. The COCs include arsenic, fluoride, nitrate, sulfate and TDS. Additionally, in Fall 2017, general minerals were analyzed to establish baseline water quality and for comparison of water quality type for all wells monitored. Radionuclides were also analyzed to determine baseline conditions but are not currently considered a COC.

~~Five a~~Additional wells are proposed to be added to the monitoring network ~~in Fall 2018~~ to further evaluate both groundwater levels and groundwater quality in the CMA to better track trends in this more developed area of the Subbasin. Additionally, the GSA continues to work with private landowners to expand the monitoring network.

#### 3.5.1.4 Seawater Intrusion Monitoring Network

As explained in Section 3.2.3, Seawater Intrusion – Undesirable Results, seawater intrusion is not an applicable undesirable result in the Subbasin and monitoring is not warranted.

#### 3.5.1.5 Land Subsidence Monitoring Network

As explained in Section 3.2.5, Land Subsidence – Undesirable Results, land subsidence is not an applicable undesirable result in the Subbasin and monitoring is not warranted. If during the GSP implementation timeline, it becomes evident that minimum thresholds and measurable objectives for lowering of groundwater levels and groundwater in storage are not being met, the degree to which land subsidence may become an undesirable result will be re-evaluated.

#### 3.5.1.6 Depletions of Interconnected Surface Water Monitoring Network

As explained in Section 3.2.6, Depletions of Interconnected Surface Waters – Undesirable Results, the impact of groundwater pumping within the Subbasin to GDEs occurred prior to 2015, is neither currently nor expected to become an undesirable result, and thus monitoring is not warranted.

### 3.5.2 Monitoring Protocols for Data Collection and Monitoring

**Standards for Establishing Monitoring Protocols**

"Under SGMA, the GSP must contain monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic surface subsidence for basins for which subsidence has been identified as a potential problem, and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater extraction in the basin. The CWC Section 10727.2(f). According to GSP Regulations, "Each Plan shall include monitoring protocols adopted by the Agency for data collection and management, as follows:

a. Monitoring protocols shall be developed according to best management practices.
b. The Agency may rely on monitoring protocols included as part of the best management practices developed by the Department, or may adopt similar monitoring protocols that will yield comparable data.
c. Monitoring protocols shall be reviewed at least every five years as part of the periodic evaluation of the Plan, and modified as necessary" (Title 23 CCR Section 352.2).

**Protocols in the Borrego Subbasin**

The protocols for data collection and monitoring are detailed in the SAP/QAPP (Appendix E1). The SAP/QAPP will be updated periodically to address findings of the data and compliance criteria presented in this GSP. The SAP provides a sampling and analysis plan that includes sampling objectives, potential COCs, monitoring frequency, methods for GWE and quality monitoring, and sample handling. The QAPP defines roles and responsibilities, quality objectives and criteria, special training, documentation and records, field and laboratory analytical methods, field and laboratory quality control, assessments and response actions, data reduction, review, verification and validation, data evaluation roles and responsibilities, and data reporting. Technical standards, data collection methods and quality assurance are described in detail in the SAP/QAPP to ensure comparable data and methodologies (Appendix E1).

### 3.5.3 Representative Monitoring

**Standards for Representative Monitoring**

The GSP Regulations provide that a GSA may designate a subset of monitoring sites as representative of conditions in the basin as follows:

1. Representative monitoring sites may be designated by the Agency as the point at which sustainability indicators are monitored, and for which quantitative values for minimum thresholds, measurable objectives, and interim milestones are defined.
2. Groundwater elevations may be used as a proxy for monitoring other sustainability indicators if the Agency demonstrates the following:
   a. (1) Significant correlation exists between groundwater elevations and the sustainability indicators for which groundwater elevation measurements serve as a proxy.
   b. (2) Measurable objectives established for groundwater elevation shall include a reasonable margin of operational flexibility taking into consideration the basin setting to avoid undesirable results for the sustainability indicators for which groundwater elevation measurements serve as a proxy.
3. The designation of a representative monitoring site shall be supported by adequate evidence demonstrating that the site reflects general conditions in the area (Title 23 CCR Section 354.36).

GWEs and water quality are the primary indicators to be directly measured and are the only sustainability indicators for which representative monitoring points are warranted at this time. GWEs are also a proxy for evaluation of storage as previously described in Section 3.5.1.2. Measurement of other sustainability indicators (i.e., seawater intrusion, subsidence, and depletion of interconnected surface water) is not currently warranted as described in Section 3.5.1.

Representative monitoring points have been selected in each of the three management areas. Multiple representative monitoring points are warranted within each management area to address the diversity of land uses, proximity to pumping centers and recharge areas, elevation differences, etc. As such, selected representative monitoring points are anticipated to be updated as the Subbasin pumping centers evolve or other pertinent data are obtained over the GSP implementation period. Representative monitoring points are presented in Table 3-9 and plotted on Figure 3.3-1.

**Table 3-9**
**Representative Monitoring Points**

| Management Area | Well ID | Rationale |
|---|---|---|
| North Management Area | MW-1 | Dedicated monitoring well downgradient of agricultural pumping center, screened in the lower-middle/lower aquifers |
| | ID4-3 | Proximal and cross-gradient of agricultural pumping center and golf course (De Anza). No log or well completion information is available. |
| | SWID 010S006E09N001S | Proximal to agricultural pumping center and suspected nitrate source areas, screened in the middle and lower aquifer |
| | ID4-18 | Proximal and cross-gradient of agricultural pumping center and screened in the upper/upper-middle aquifers |
| | ID4-4 | Key Municipal Water Well |
| Central Management Area | ID4-1 | Located in central portion of community of Borrego Springs with predominantly drinking water beneficial use. No log or well completion information is available. |
| | Airport 2 | Representative of eastern portion of CMA, screened in the middle and lower aquifer |
| | ID1-16 | Representative of southwestern portion of CMA, screened in the middle and lower aquifers |
| | ID4-11 | Key Municipal Water Well |
| | ID1-12 | Key Municipal Water Well |
| | ID5-5 | Key Municipal Water Well |
| South Management Area | MW-5A | Effective well pair to evaluate vertical differences (groundwater levels and water quality), located near Borrego Sink, screened in the middle/lower aquifers |
| | MW-5B | Effective well pair to evaluate vertical differences (groundwater levels and water quality), located near Borrego Sink, screened in the upper/middle aquifers |
| | MW-3 | Dedicated monitoring well representative of pumping effects near golf course (Rams Hill) screened in the middle/upper-lower aquifers. |
| | Air Ranch Well 4 | Representative of conditions in southeast SMA, screened in the lower aquifer |

**Notes:** CMA = Central Management Area; SMA = South Management Area.

## 3.5.4 Assessment and Improvement of Monitoring Network

### Standards for Assessment and Improvement of Monitoring Network

Section 354.38 of the GSP Regulations provide that a GSA should continue to assess and improve the monitoring network throughout the planning and implementation horizon, as follows:

1. Each Agency shall review the monitoring network and include an evaluation in the Plan and each 5-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.
2. Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes

monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.

3. If the monitoring network contains data gaps, the Plan shall include a description of the following:
   a. The location and reason for data gaps in the monitoring network.
   b. Local issues and circumstances that limit or prevent monitoring.
4. Each Agency shall describe steps that will be taken to fill data gaps before the next ~~five~~ 5-year assessment, including the location and purpose of newly added or installed monitoring sites.
5. Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:
   a. Minimum threshold exceedances.
   b. Highly variable spatial or temporal conditions.
   c. Adverse impacts to beneficial uses and users of groundwater.

#### 3.5.4.1 Review and Evaluation of the Monitoring Network

The Subbasin monitoring network will be reviewed and evaluated for effectiveness annually and for each 5-year assessment. The review and evaluation will address uncertainty and data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin, and will consider localized effects that may not be represented throughout the respective management area. The evaluation is described in more detail in Section 5.4.5, Monitoring Network, of the GSP.

#### 3.5.4.2 Identification of Data Gaps

**Groundwater Elevation**

Identification of data gaps for GWEs must consider vertical and lateral representation of the Subbasin and management areas. For vertical control, as discussed in Section 2.2.2, Current and Historical Groundwater Conditions, review of existing GWE data within the Plan Area suggests that although three distinct aquifers are delineated in varying thickness across the Subbasin, the effect of well screen lengths and intervals is potentially negligible with respect to measured depths to groundwater (i.e., potentiometric surface). Multicompletion wells or well clusters screened at discrete intervals in the upper, middle and lower aquifers would be required to determine potentiometric surface by aquifer unit. However, the average potentiometric surface measured at wells that are screened over one or more aquifer units appears to sufficiently represent groundwater conditions in the Subbasin with respect to monitoring the applicable sustainability indicators.

Laterally, the pattern of existing overlying land uses and beneficial uses of groundwater are well represented by the management areas, which the monitoring network covers. As conditions may change throughout GSP implementation, representation of overlying land uses and beneficial groundwater uses will be evaluated annually along with the network's reliability (i.e., access). Each monitoring well will be tracked and the need for alternative or additional monitoring wells will be evaluated as part of the annual and 5-year review processes, as described in Section 5.4.5, Monitoring Network, of the GSP.

As described in Section 3.5.1.1, based on the nature of the Subbasin and review of historical data, semi-annual monitoring is an appropriate monitoring frequency to continue to track seasonal trends and addresses the minimum standards of the monitoring network.

**Groundwater Quality**

As discussed in Section 2.2.2.4, Groundwater Quality, there are both anthropogenic and natural sources of the COCs in the Subbasin. All COCs are found in differing concentrations in the upper, middle, and lower aquifers. Extraction wells in the Subbasin are generally screened in the upper, middle, or lower aquifers or cross-screened in multiple aquifers. As such, water quality samples collected at the wellhead represent an average concentration of the formations screened and do not represent depth-discrete or aquifer specific conditions. Multicompletion wells or depth discrete water quality samples would be required to better characterize water quality by aquifer zone and depth in the Subbasin. For example, water quality results indicate that there is elevated arsenic detected at concentrations above drinking water standards in the lower aquifer of the SMA. As the occurrence of wells screened in discrete aquifer zones is limited, especially for the lower aquifer in the NMA and CMA, it is uncertain if elevated arsenic occurs at depth in these areas of the Subbasin. Additionally, there is limited contemporary data available for private wells located in the NMA and CMA to laterally and vertically delineate nitrate and TDS concentrations in the upper aquifer.

**Regulatory Data Gaps**

SGMA requires that the Plan consider relevant state, federal, and local standards. As such, pertinent regulatory agencies are considered stakeholders. Summaries of data gaps associated with relevant agencies are provided below:

- RWQCB – The Colorado River RWQCB has not established water quality objectives for the Region, and acknowledges that "[e]stablishment of numerical objectives for groundwater involves complex considerations since the quality of groundwater varies significantly with depth of well perforations, existing water levels, geology, hydrology and several other factors" (Colorado River RWQCB 2017).

**Borrego Valley Hydrologic Model**

SGMA requires that the GSA identify data gaps and uncertainty associated with key water budget components and model forecasts, and develop an understanding of how these gaps and uncertainty may affect implementation of proposed projects and water management actions.

As explained in the *Update to U.S. Geological Survey Borrego Valley Hydrologic Model for the Borrego Valley Sustainability Agency* (contained in Appendix D1), the sensitivity analysis conducted by the USGS indicated the greatest uncertainty in the numerical model was in agricultural pumping, streamflow leakage, and storage. As new data are collected and an improved understanding of the basin is developed over time, through either additional characterization, monitoring efforts, or both, the predictive accuracy of the BVHM could be improved, as needed, at annual updates and the 5-year review process. This is because new data could allow for a refinement of the underlying model assumptions (aquifer properties, stratigraphy, boundary conditions, etc.) and/or a more robust calibration due to a larger database of calibration targets (groundwater levels, surface water flows, a more robust climatic dataset, etc.).

To improve the accuracy of the BVHM in simulating actual conditions and provide greater confidence in predictive simulations, the GSA intends to obtain additional data and further study the hydrogeology of the basin:

- Collect actual agricultural pumping data via existing or installation of new flow meters at farm wells. The pumping data may be incorporated in the numerical model to calibrate the Farm Process Package to more accurately estimate the water demands for the various crops and golf courses being irrigated.
- Collect periodic manual streamflow measurements at major drainages that convey most of the surface water runoff to the valley, either from perennial flows or flash flows from major precipitation events. Collection of this information can be used to further verify the accuracy of the Basin Characterization Model used in the BVHM, and ultimately to provide a more accurate estimate of stream leakage.

Additional data gaps noted within this GSP, which would improve the accuracy of the BVHM, but may not be necessary to adequately apply sustainable management criteria include:

- Conduct aquifer tests at wells with screen intervals isolated to only the upper aquifer or the middle aquifer to obtain site-specific estimates of hydraulic conductivity and specific yield for each aquifer unit. This information may be used to enhance the calibration of the model to these hydraulic properties and our understanding of storage in the Subbasin.

- Evaluate subsurface inflow and outflow along the Coyote Creek fault. Currently, the Coyote Creek fault is interpreted to act as a boundary to groundwater flow between the Subbasin and the Ocotillo-Clark Valley Groundwater Basin. However, supplemental analysis of boundary conditions may be warranted to estimate a value of underflow to substantiate the working assumption regarding the negligible effect on the Subbasin water balance across this portion of the Subbasin boundary.

#### 3.5.4.3 Description of Steps to Fill Data Gaps

The process for addressing identified data gaps is for the GSA to evaluate the potential significance of the data gaps, anticipated duration, costs, and overall benefit to the effectiveness of the GSP. Initial tasks to address existing data gaps include the following:

- If the Colorado River RWQCB develops interim water quality measurable objectives, the GSA will coordinate for determination of defensible water quality objectives.
- The GSA will evaluate opportunities for gathering additional data on existing or new monitoring wells screened in the upper aquifer of the NMA to determine the nature and extent of nitrate concentrations in the upper aquifer underlying areas of historical agricultural fertilizer application.
- The GSA will evaluate opportunities for gathering additional data on existing or new monitoring wells screened in the lower aquifer of the NMA and CMA to determine if poor water quality occurs with depth in the Subbasin, such as the elevated arsenic detected in the lower aquifer of the SMA.

#### 3.5.4.4 Description of Monitoring Frequency and Density of Sites

Based on Subbasin conditions, as described in GSP Chapter 2; Section 3.5.1.1, Chronic Lowering of Groundwater Levels Monitoring Network; and the monitoring plan (described above), semi-annual monitoring of water quality and water elevations is considered adequate to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and yield representative data to compare to measurable objectives and minimum thresholds.

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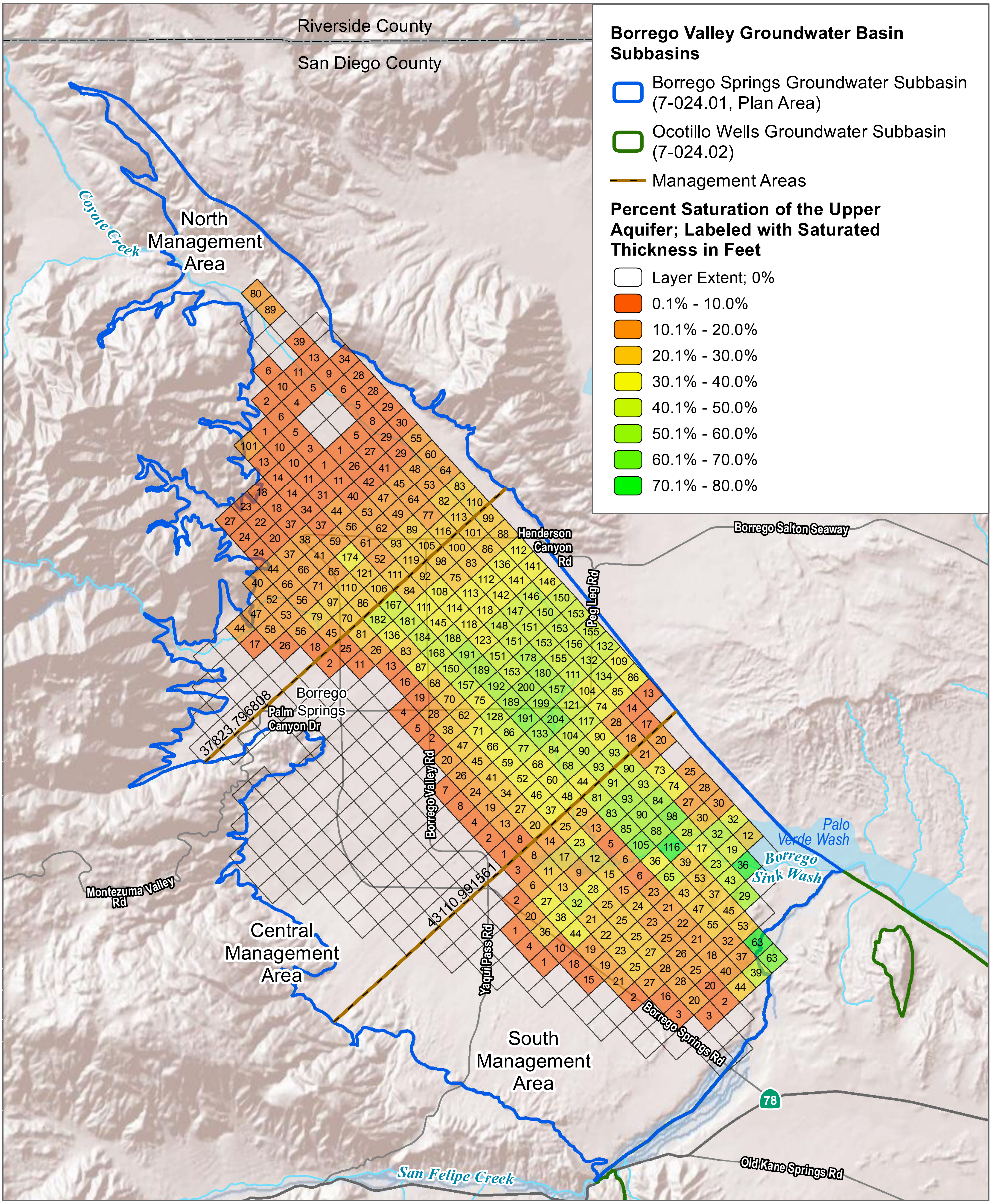


August 2019

DATUM: NAD 1983. DATA SOURCE: DWR 2015, USGS 2015

DUDEK

0 1 2 Miles

Figure 3.2-1
Model Upper Aquifer Saturated Thickness - September 2016

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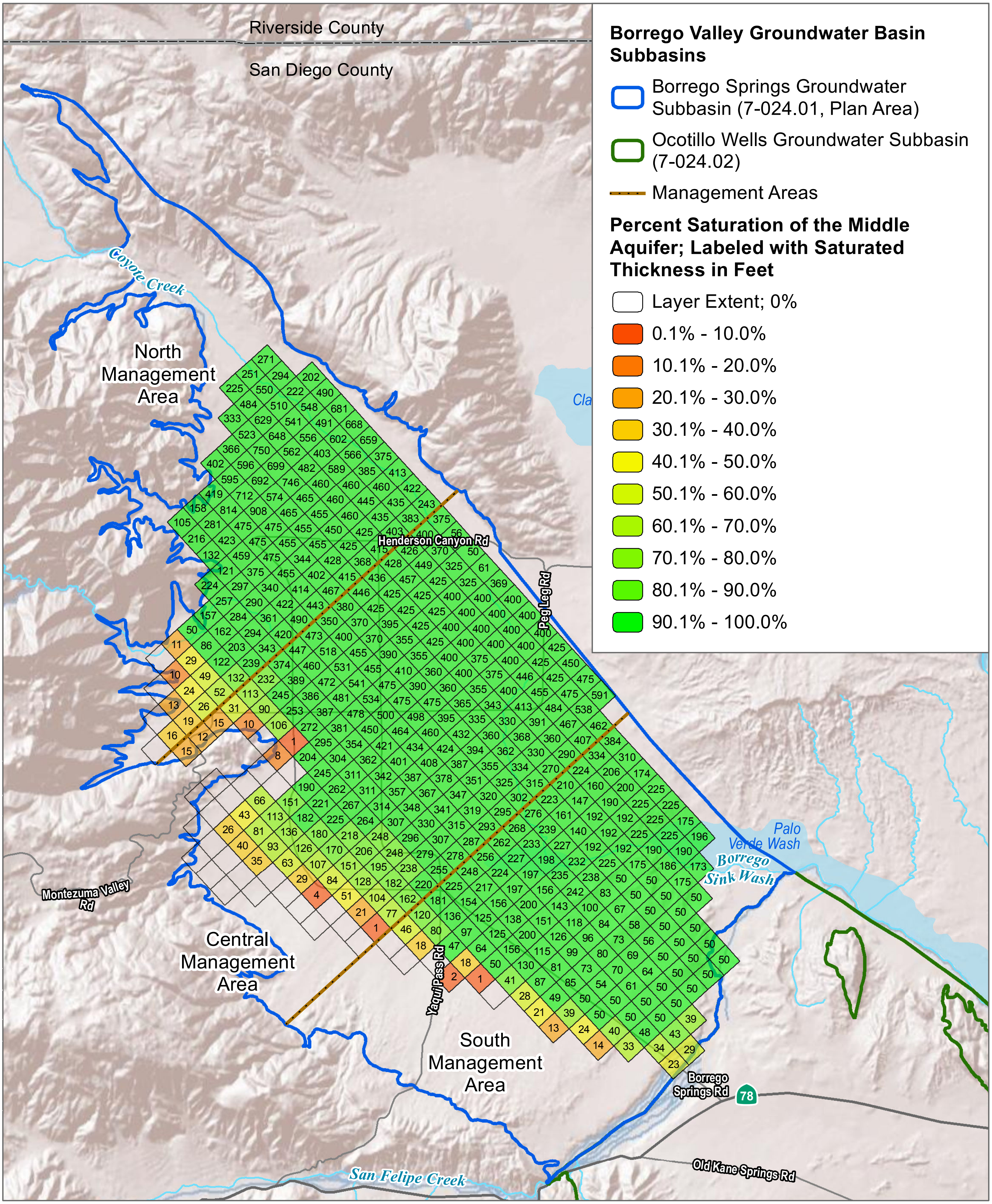


August 2019

DATUM: NAD 1983. DATA SOURCE: DWR 2015, USGS 2015

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Figure 3.2-2

Model Middle Aquifer Saturated Thickness - September 2016

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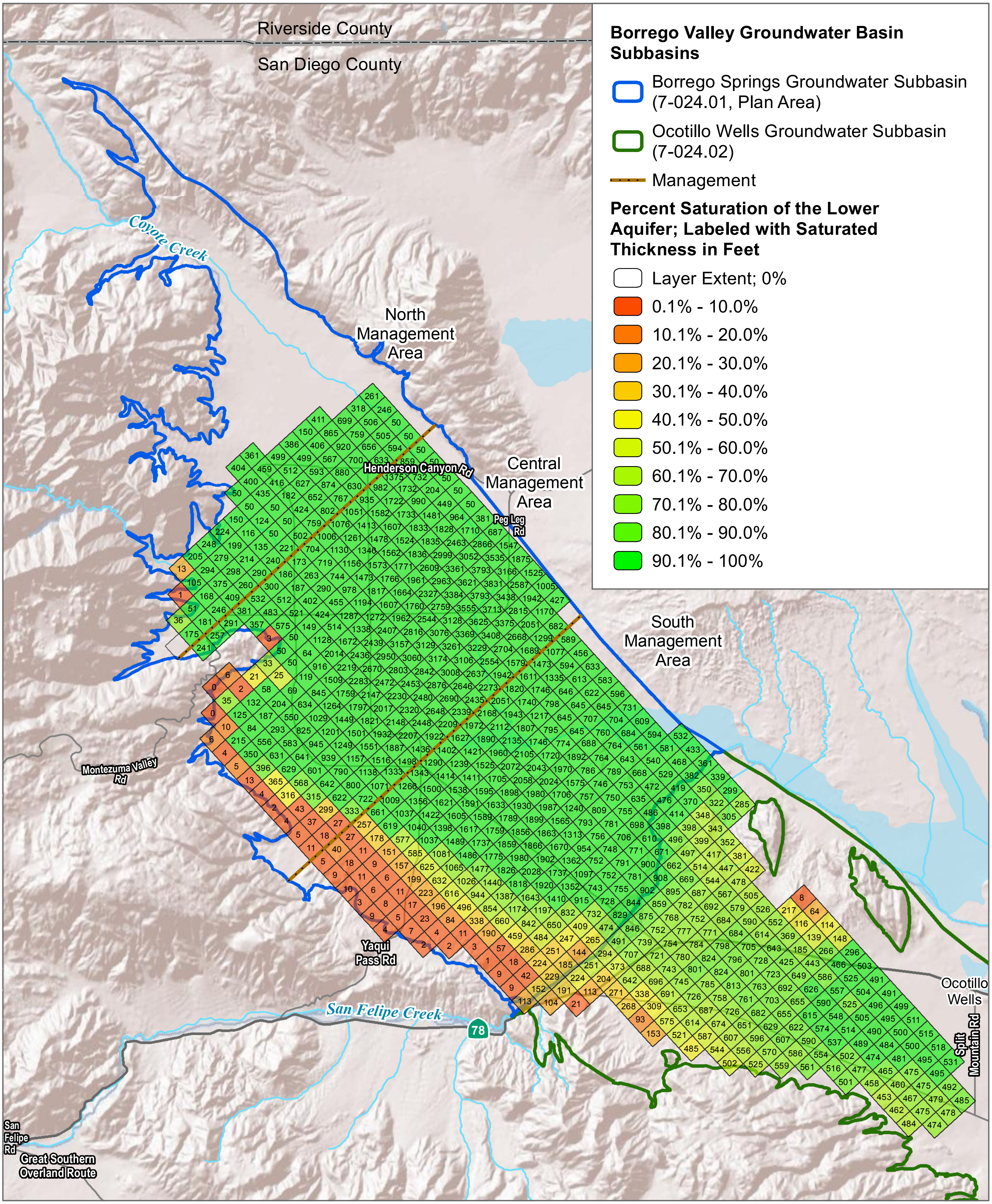


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DATUM: NAD 1983. DATA SOURCE: DWR 2015, USGS 2015

DUDEK

0 1.25 2.5 Miles

Figure 3.2-3
Model Lower Aquifer Saturated Thickness - September 2016

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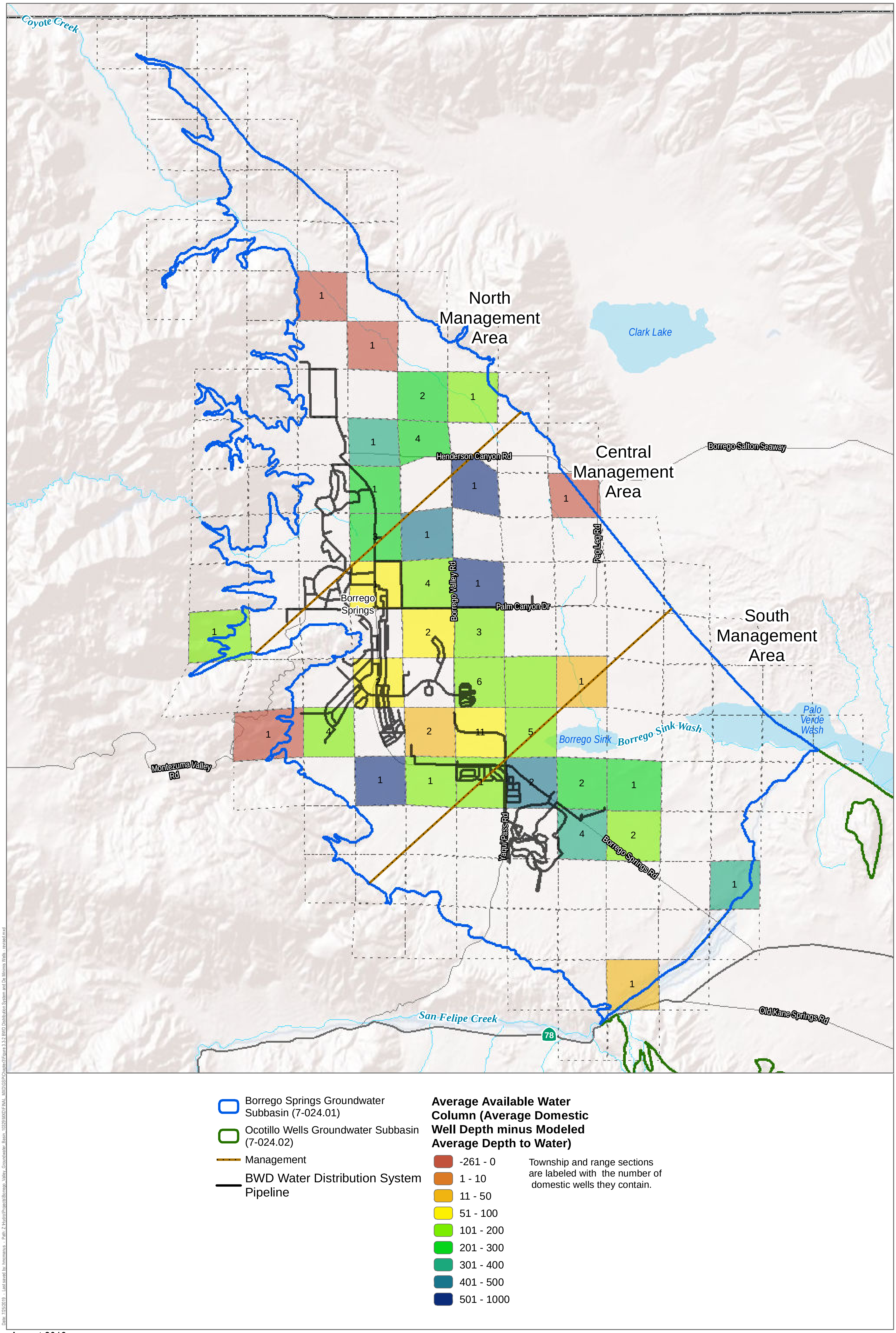


August 2019

DATUM: NAD 1983. DATA SOURCE: SanGIS 2017, BWD, DWR 2018

DUDEK 0 0.75 1.5 Miles

Figure 3.2-4

BWD Distribution System and De Minimis Users

Groundwater Sustainability Plan for the Borrego Springs Groundwater Subbasin

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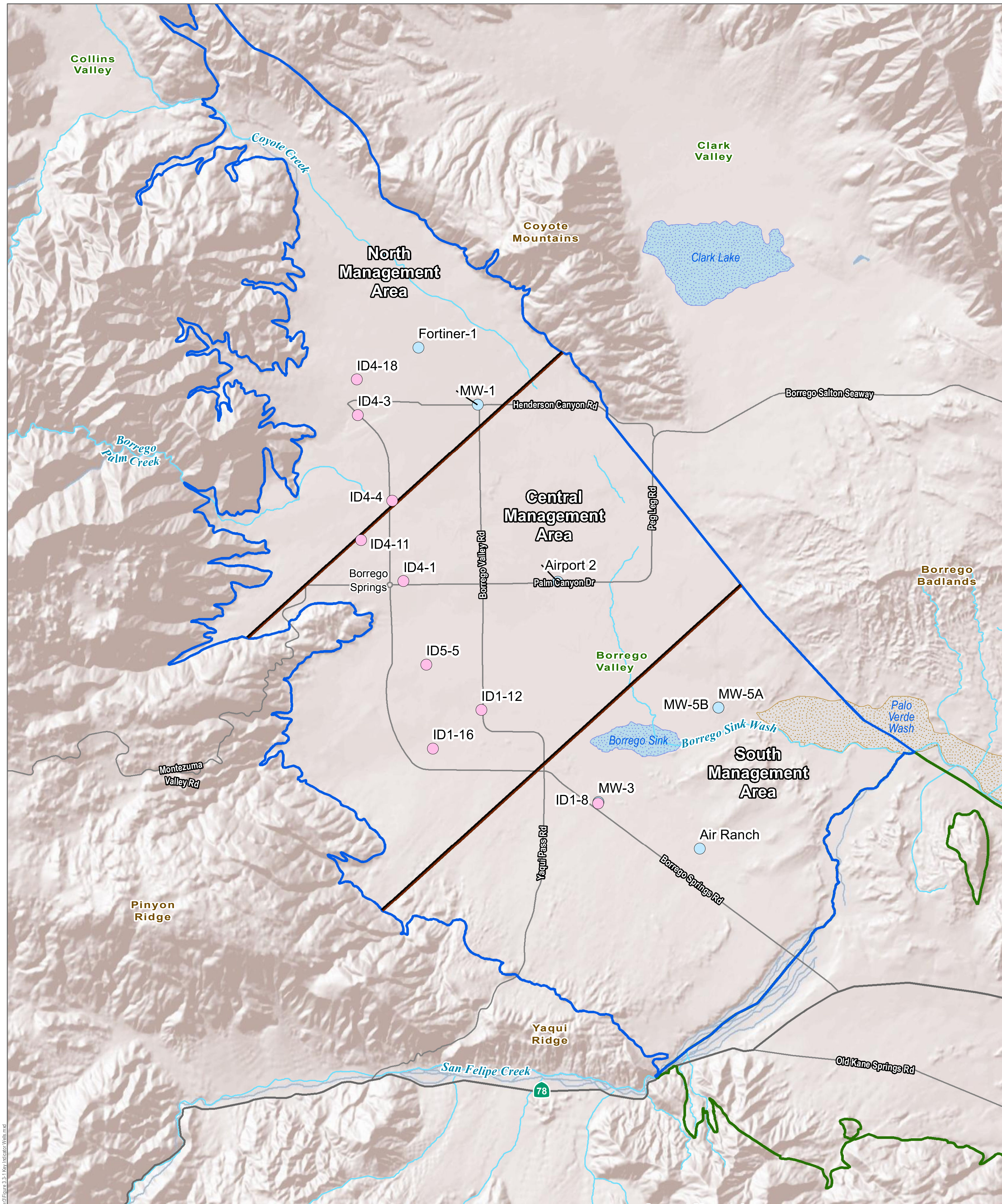


**Key Indicator Wells**

- BWD Well
- Other Well

**Borrego Valley Groundwater Basin Subbasins**

- Borrego Springs Groundwater Subbasin (7-024.01, Plan Area)
- Ocotillo Wells Groundwater Subbasin (7-024.02)
- Management Area Divisions

**Surface Water Features**

- Major Flow Paths
- Dry Lake
- Wash

August 2019

DATUM: NAD 1983.

DUDEK

0 0.75 1.5 Miles

Figure 3.3-1

Key Indicator Wells

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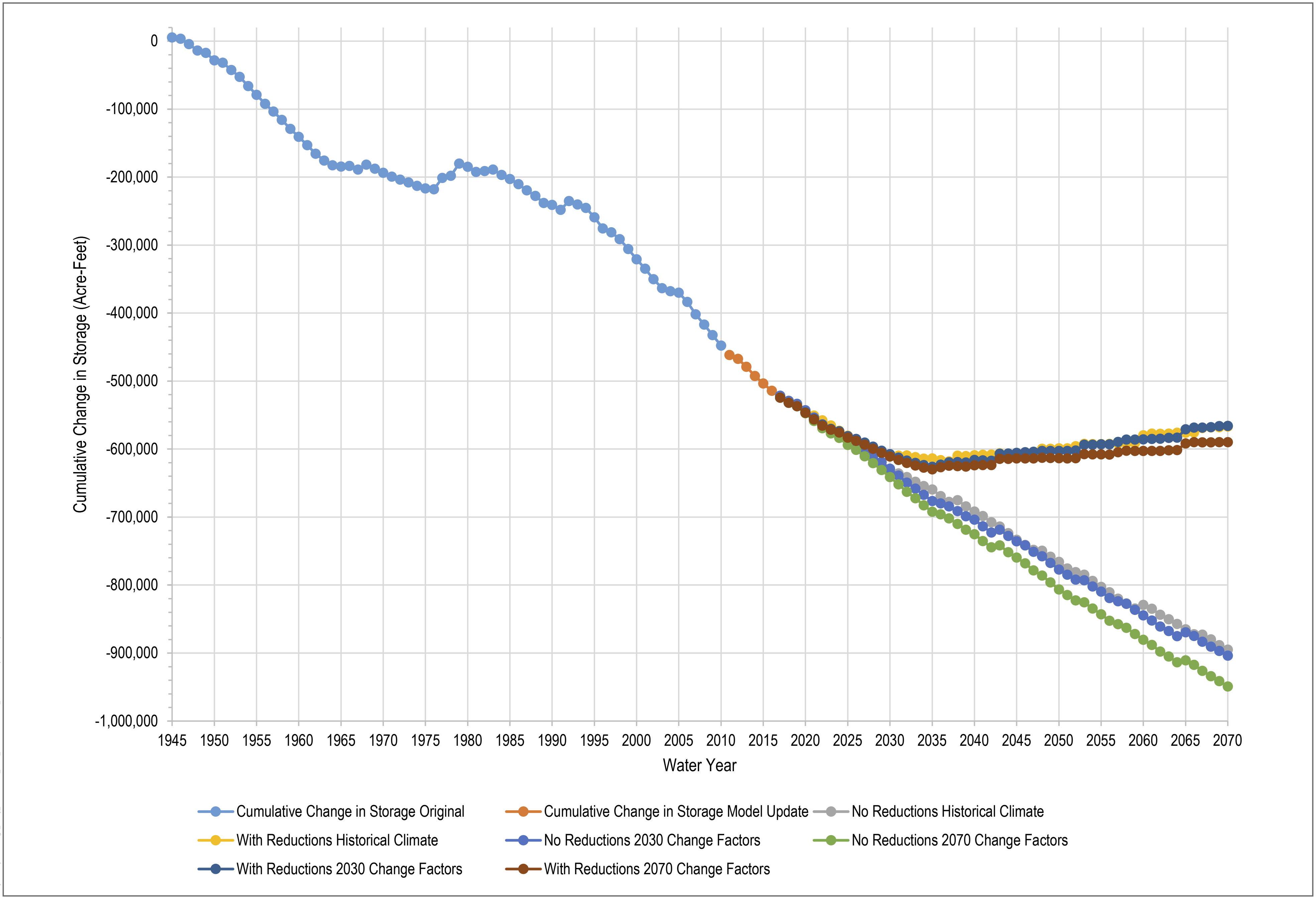


**FIGURE 3.3-2**

BVHM Model Runs Addressing Future Climate and Pumping Reductions

Groundwater Sustainability Plan for the Borrego Springs Groundwater Subbasin

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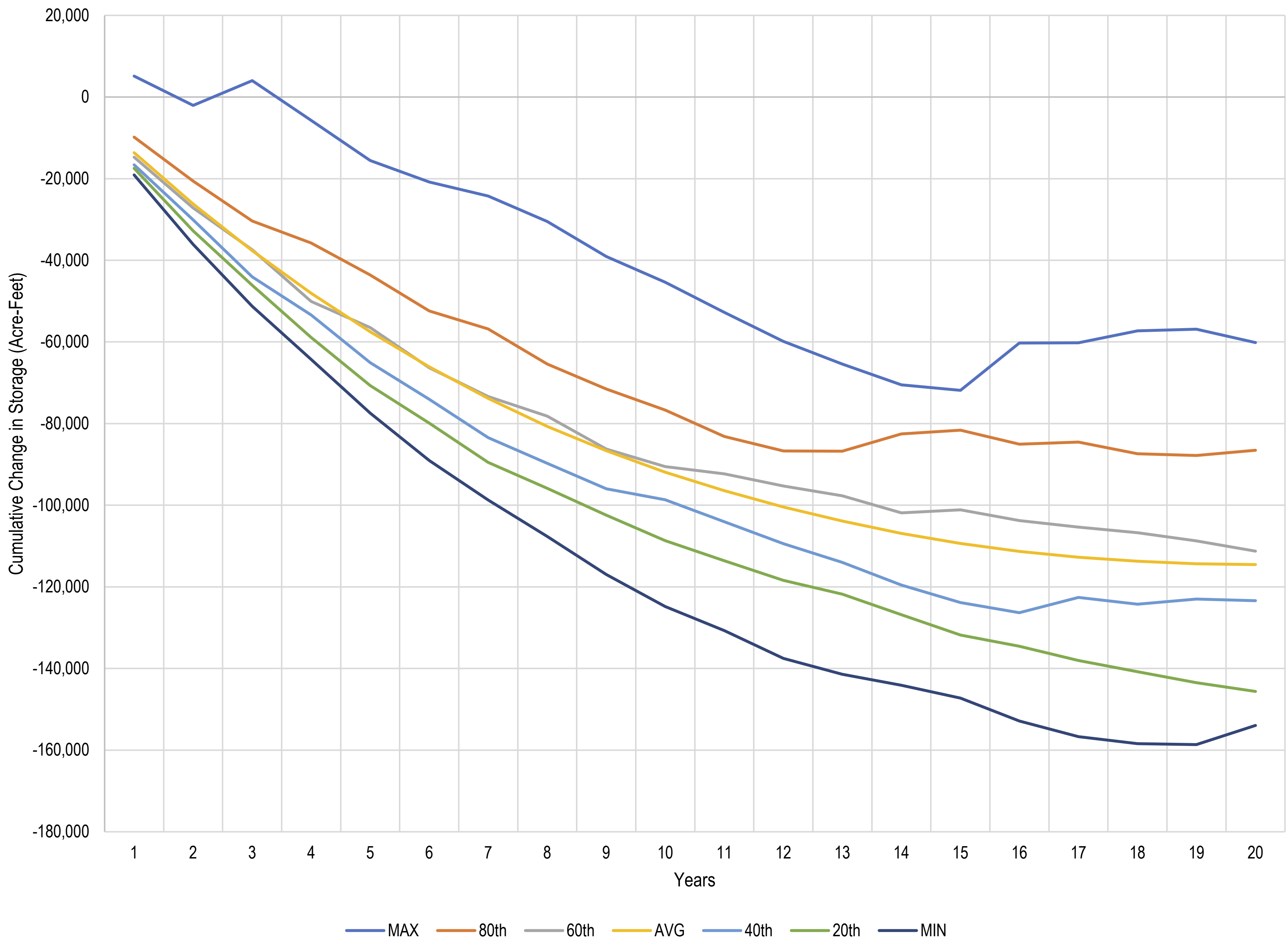


SOURCE: ENSI 2018

**FIGURE 3.3-3**

Monte Carlo Simulation Time Varying Recharge 1945 to 2010 and Forcasted Cumulative Overdraft

Groundwater Sustainability Plan for the Borrego Springs Groundwater Subbasin

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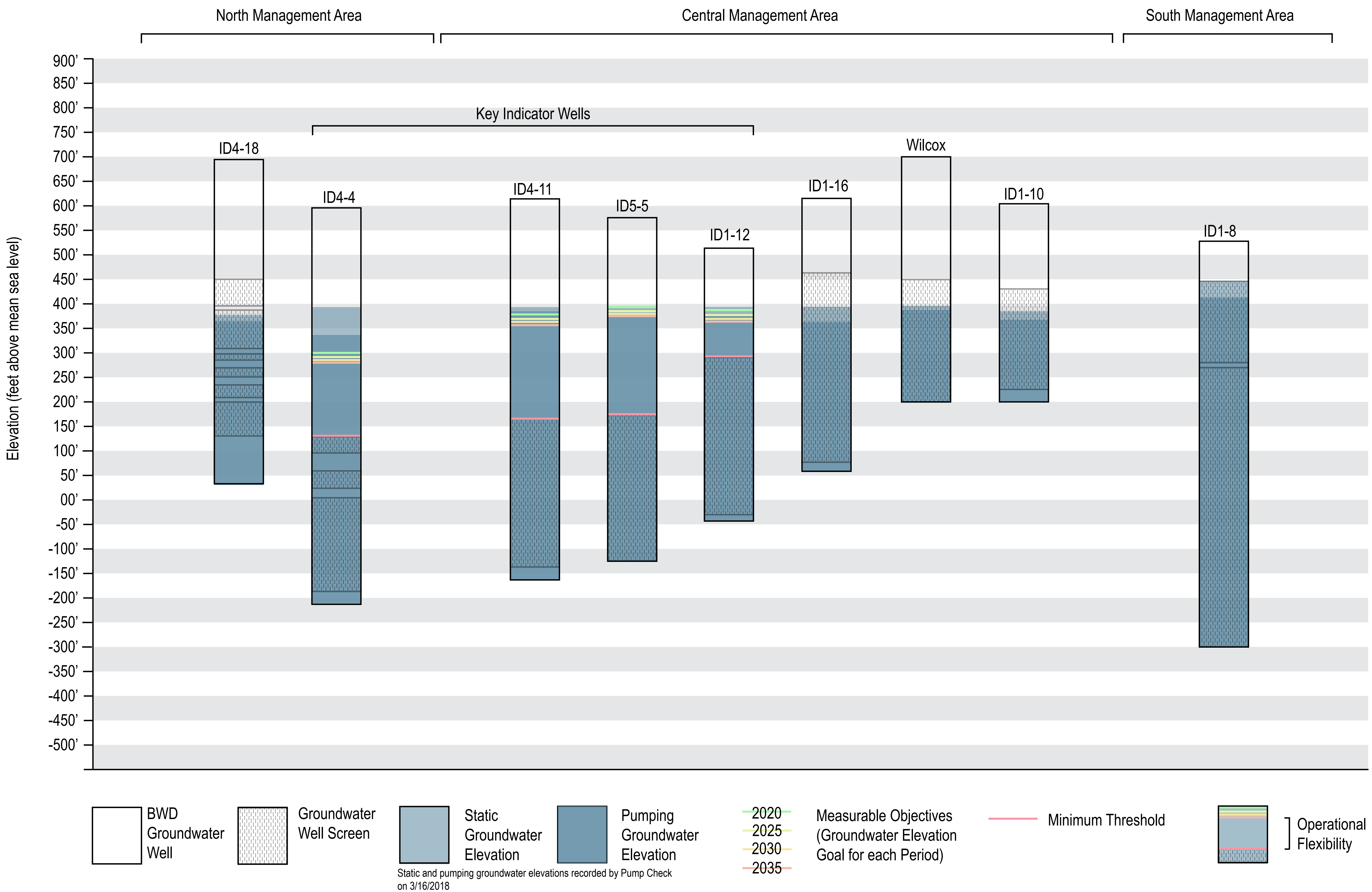


SOURCE: Pump Check 2018

**FIGURE 3.4-1**

BWD Municipal Well Screens Relative to 2018 Groundwater Elevations

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