INDIAN WELLS VALLEY GROUNDWATER BASIN

REVIEW DRAFT

GSP Annual Report

Water Year 2023

(October 1, 2022 to September 30, 2023)

December 2023

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Chapter 1 Executive Summary

The Indian Wells Valley Groundwater Authority (IWVGA) has prepared this Annual Report for the Indian Wells Valley Groundwater Basin (IWVGB or Basin), Basin 6-054, to be submitted to the California Department of Water Resources (DWR) in compliance with the Sustainable Groundwater Management Act (SGMA). This Annual Report presents required data for Water Year (WY) 2023 (October 1, 2022-September 30, 2023).

DWR has designated the IWVGB as a basin in critical overdraft. Overdraft in the IWVGB has been shown through several undesirable results, primarily the chronic lowering of groundwater levels, the degradation of water quality, and the reduction of groundwater in storage in the IWVGB. Consequently, under SGMA, the IWVGA must implement projects and management actions to mitigate and avoid undesirable results and reach sustainability by 2040. The sustainability goal is to manage and preserve the IWVGB groundwater resource as a sustainable water supply. To the greatest extent possible, the goal is to preserve the character of the community, preserve the quality of life of IWV residents, and sustain the mission at the U.S. Navy Naval Air Weapon Station (NAWS) China Lake.

The Groundwater Sustainability Plan (GSP) for the IWVGB (Stetson, 2020a) was adopted by the IWVGA Board of Directors on January 16, 2020 and submitted to DWR on January 31, 2020. DWR approved the IWV GSP in January 2022. The sustainable yield is estimated to be 7,650 acre-feet per year (AFY) based on measured groundwater levels and computer modeling, and the recommendation of the IWVGA Technical Advisory Committee (TAC). The GSP recommended projects and management actions to achieve Basin sustainability that are intended to culminate in managing the IWVGB within the sustainable yield without undesirable and unsustainable groundwater conditions in the IWVGB. Sustainable management criteria were established for determining undesirable results and measuring progress towards groundwater sustainability.

During WY 2023, no minimum thresholds were exceeded at the representative monitoring sites. The IWVGA continued developing and implementing projects and management actions proposed in the GSP and tracking sustainability using the sustainable management criteria. Significant achievements include the following:

- Improvements in collecting observation data
- Completion of the Imported Water Pipeline Alignment Study
- Initiation of Design of the Imported Water Interconnection Project
- Implementation of the Shallow Well Mitigation Program
- Revisions to the groundwater flow model that will incorporate new data that has been obtained
- Incorporation of Recommended Corrective Actions

These projects and management actions will ultimately reduce overdraft conditions in the Basin and reduce undesirable results.

During WY 2023, litigation continued along with adjudication actions. As a result, the current litigation has brought into question the accuracy of some self-reported groundwater production data due to inconsistencies with reported groundwater production and documented and stated water use.

During WY 2023, the Indian Wells Valley received approximately 8.27 inches of rain, classifying the year as a Wet year. In WY 2023, depth to groundwater (DTW) was measured at 147 wells in Fall 2022 and 151 wells in Spring 2023, a greater total number of data points than collected in WY 2022. Hydrographs have been developed for all wells in the monitoring program and are posted on the Data Management System (DMS) website (www.iwvgsp.com). Groundwater levels have historically declined in many parts of the IWVGB and continued during the period from Spring 2022 through Spring 2023.

Groundwater production during WY 2023 is estimated to be 19,150 AF and recycled water use is estimated to be 1,300 AF. Accordingly, total water use in the IWVGB in WY 2023 is estimated to be 20,450 AF.

This Annual Report provides an update on Basin conditions and Basin management activities organized into the following chapters:

- General information (including Basin location)
- Progress towards GSP implementation and sustainability
- Hydrologic conditions
- Groundwater elevation data (including contours and hydrographs)
- Groundwater storage data
- Water supply data (including groundwater extraction data)

- Other Data Collection and Basin Management Tasks

The IWVGA was made aware of a new DWR guidance document pertaining to Annual Reports, Periodic Evaluations, and Plan Amendments on October 30, 2023 (DWR, 2023a). After review of the guidance document, IWVGA Staff found that the current IWVGA GSP Annual Report format substantially and functionally complied with DWR's new guidance, due to being based on the Annual Report requirements provided in the GSP regulations (CCR, Title 23, Division 2. Chapter 1.5. Sections 351 and 356.2). Since the current IWVGA GSP Annual Report format substantially complies with DWR's new guidance, and also considering the short timeline before a draft Annual Report would be released to the public, it was decided that a reformat of the Annual Report was not necessary. However, in order to fully address the recommendations provided in the guidance document, two new subsections were added to this Annual Report: "Progress Made on Addressing Recommended Corrective Actions" and "Outreach and Engagement". DWR's Annual Report submittal spreadsheets are provided in Attachment A.

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Chapter 2 General Information

The IWVGB is located in the northwestern part of the Mojave Desert and underlies approximately 382,000 acres or approximately 600 square miles of land area in portions of the Counties of Kern, Inyo, and San Bernardino. The IWVGB is bordered on the west by the Sierra Nevada Mountain Range, on the north by the Coso Range, on the east by the Argus Range, and on the south by the El Paso Mountains. Intermittent surface water (following larger storm events) flows from the surrounding mountain ranges and drains to China Lake, a large normally dry lake, or playa, located in the central north-east part of the Basin.

The land overlying the IWVGB encompasses portions of Kern, Inyo, and San Bernardino Counties, with the majority (approximately 73%) being in Kern County. Approximately 79% of land overlying the IWVGB comprises of either the NAWS China Lake or public lands managed by the United States Bureau of Land Management (BLM). The City of Ridgecrest (Ridgecrest or City) is the only incorporated community in the Indian Wells Valley and covers an area of approximately 20 square miles with a population of approximately 29,000 people. The Indian Wells Valley Water District (IWVWD) serves potable water to approximately 35,800 people in Ridgecrest and certain areas outside of Ridgecrest's jurisdiction. Unincorporated communities in the Indian Wells Valley include the communities of Inyokern in Kern County and Pearsonville in Inyo County, along with other smaller communities. Additionally, there are communities outside of the Indian Wells Valley that are served by groundwater produced in the Basin, including Trona.

Kern County, Inyo County, San Bernardino County, Ridgecrest, and the IWVWD entered into a joint exercise of powers agreement to form the IWVGA and serve as General Members on the IWVGA Board of Directors, which governs the IWVGA as a whole. The U.S. Navy and BLM serve as Associate Members (non-voting) on the IWVGA Board of Directors. Figure 2-1 provides the location of the IWVGB and the extents of the IWVGA boundaries.

In its 2016 Bulletin 118 interim update, DWR identified the IWVGB as a critically overdrafted basin of medium priority[1]. As such, in compliance with SGMA, the associated groundwater sustainability agency

[1] The IWVGB has since been identified as a critically overdrafted basin of **high** priority as of the *Sustainable Groundwater Management Act 2018 Basin Prioritization: Process and Results*, published by DWR in January 2019.

(GSA) was required to submit a GSP by January 31, 2020 to achieve local sustainable management of groundwater resources. The IWVGA Board of Directors adopted Resolution No. 02-16 on December 8, 2016, to establish the IWVGA as the exclusive GSA for the entirety of the IWVGB. The GSP for the IWVGB (Stetson, 2020a) was adopted by the IWVGA Board of Directors on January 16, 2020 and was submitted to DWR on January 31, 2020. DWR approved the IWV GSP on January 13, 2022 and provided recommended corrective actions that are strongly recommended to be addressed prior to the first Periodic Evaluation due to DWR in January 2025.

The IWVGB serves as the sole supply of potable water for the Indian Wells Valley. Residents of the Indian Wells Valley are served groundwater through private domestic wells, small cooperative groups sharing wells, small mutual water companies, the Inyokern Community Services District (Inyokern CSD), and the IWVWD. The U.S. Navy produces and distributes groundwater for on-station water uses at the NAWS China Lake. Searles Valley Minerals Inc. produces groundwater from the IWVGB for use in its minerals recovery and processing operations in Searles Valley (located east of the IWVGB) and for potable use in the small communities of Trona, Westend, Argus, and Pioneer Point in the Searles Valley. In addition, a number of farms located in the Indian Wells Valley rely on the IWVGB's water supplies for their agricultural operations. Overdraft conditions in the IWVGB have existed since at least the 1960s (Dutcher and Moyle, 1973). Results of overdraft have manifested themselves through various undesirable results, primarily the chronic lowering of groundwater levels, degradation of water quality, and reduction of groundwater storage within the IWVGB.

Chapter 3 Progress Towards GSP Implementation and Sustainability

The IWVGB is characterized as a critically overdraft basin by DWR. The sustainable yield is estimated to be 7,650 AFY, while groundwater production has been and continues to be greater than the sustainable yield. This condition accounts for the occurrence of undesirable results for the following sustainability indicators:

- Chronic lowering of groundwater levels
- Reduction of groundwater in storage
- Degraded water quality
- Potential for land subsidence

After extensive public outreach and collaboration, the IWVGA Board of Directors adopted the IWVG GSP on January 16, 2020. In compliance with SGMA, the GSP provides Basin management strategies that are intended to culminate in managing the IWVGB within the sustainable yield and the absence of undesirable and unsustainable groundwater conditions in the IWVGB. The GSP recommends projects and management actions that are intended to achieve Basin sustainability while considering the unique geologic and hydrogeologic conditions of the IWVGB. Sustainable management criteria were established for measuring progress towards groundwater sustainability. Recommendations of the GSP are intended to provide for long-term sustainable groundwater management in the IWVGB within 20 years (WY 2040) of GSP implementation.

During WY 2023, the IWVGA continued developing projects and management actions proposed in the GSP and continued tracking sustainability using the proposed sustainable management criteria, discussed further in the subsections below. Significant progress was made toward implementing the Imported Water Project, implementing the Shallow Well Mitigation Program, and addressing DWR's Recommended Corrective Actions (RCAs) on the IWVGA GSP. In addition, the IWVGA continued significant data collection efforts to fill data gaps. These data collection efforts are documented in Chapter 7.

3.1 Projects and Management Actions

The following subsections document progress made towards implementation of projects and management actions proposed in the GSP. Additional information regarding projects and management actions can be found in the GSP.

3.1.1 Management Action 1: Annual Pumping Allocation Plan, Transient Pool, and Fallowing Program

During WY 2023, the IWVGA continued to implement Management Action 1 with the intent to fund an imported water supply and to provide economic incentives to reduce groundwater pumping.

On July 16, 2020, the IWVGA Board of Directors adopted Resolution Number 06-20 to adopt a report documenting the estimated sustainable yield of the IWVGB as 7,650 AFY. The purpose of determining the sustainable yield allotment is to determine the estimated volume of the sustainable yield available for the pumpers to produce without incurring Replenishment Fees in calendar year 2023. IWVWD continued to pay replenishment fees in WY 2023 based on the initial allotments presented in the 2020 report on the estimated sustainable yield of the Basin. Other producers subject to the replenishment fee, Mojave Pistachios and Searles Valley Minerals, did not pay the replenishment fee in WY 2023 and continue to not pay the fee. The nonpayment of fees by these major groundwater producers is one subject of current litigation. This litigation has impeded the implementation of the GSP and has called into the question of the accuracy of some self-reported groundwater production data.

The IWVGA has developed a Transient Pool Program to facilitate transitional reduced agricultural pumping to an interim acceptable and manageable level of basin overdraft until augmented supplies are available. In WY 2023, Transient Pool members produced groundwater within their allocations. One Transient Pool producer sold its ranch and transferred its full Transient Pool allocation to the new property owners.

Currently, there is no funding for the Fallowing Program, so it is not available at this time. The IWVGA is pursuing grant funding opportunities to fund fallowing projects.

3.1.2 Project 1: Develop Imported Water Supply

Due to overdraft conditions in the Indian Wells Valley and anticipated future water demands significantly in excess of the Basin sustainable yield, securing imported water supplies is a priority for the Basin. Conservation measures alone cannot bring the Basin into sustainability. The IWVGA has retained Capitol Core Group, Inc (Capitol Core) for the following general tasks:

- Identify and Procure Imported Water Supplies
- Develop and Secure Transfer Partners
- Identify and Secure Funding Sources

During WY 2022, Capitol Core identified potential permanent water supplies and actively pursued transfer deals with those water supply holders. In August 2022, the IWVGA executed a letter of intent between the IWVGA and a seller of water rights in the Dudley Ridge Water District. Proposals to finance the purchase of the water rights were received by the IWVGA in September 2022. In WY 2023, work continued on the permitting and transfer discussions with the relevant districts and regulatory authorities; however, ultimately, the transfer terms were not agreed upon. Capitol Core is continuously pursuing permanent water supplies and is in discussion with other entities for the sale and transfer of water rights.

Capitol Core continued discussions with Antelope Valley East Kern Water Agency (AVEK) concerning transfer agreements associated with the interconnection pipeline. The IWVGA is considering the option of joining AVEK with annexation into the AVEK service area.

In WY 2022, the IWVGA and the California Department of Water Resources (DWR) entered into an agreement for the award of $7.6 million in grant funding from the California Budget Act of 2021 Sustainable Groundwater Management Grant Program SGMA Implementation Round 1 grant solicitation (SGMA-IP). The grant funding is being used for the planning, design, environmental compliance, right-of-way acquisition, and other permitting and coordination with partnering agencies for the imported water interconnection project with AVEK.

In WY 2022, Provost and Pritchard Consulting Group (P&P) began the preparation of an Imported Water Pipeline Alignment Study to evaluate potential imported water pipeline routes and recommend a final alignment for design. The scope of work includes the following:

- Determine Capacity at Pipeline Inlet
- Determine Water Demands through 2070 for the Imported Water Pipeline
- Evaluate Potential Delivery and Connection Points
- Develop Preliminary Pipeline Alignments
- Analyze Alternative Pipeline Alignments
- Recommend a Preferred Pipeline Alignment

The Alignment Study was completed in WY 2023. It identified the three best alignments for the imported water pipeline, used a set of weighted screening criteria to identify the preferred alignment, and identified the AVEK tie-in point and the IWVWD connection point, among other tasks. In December 2022, the IWVGA Board of Directors approved the Central Alignment as defined in the Alignment Study as the preferred alignment to proceed with further Environmental Evaluation.

In February 2023, the IWVGA contracted with P&P for the Preliminary and Final Design of the imported water pipeline and to develop the appropriate California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) environmental documentation for the project. The IWVGA also contracted with OPC Services (since renamed Transystems) to provide Right-of-Way (ROW) services for the Project which includes a pipeline approximately 50.6 miles in length and up to 24-inches in diameter, three pump stations, two forebay tanks, and one regulating tank.

In August 2023, P&P submitted the draft Preliminary Design Report (PDR), the first major deliverable associated with the preliminary and final design services contract. The purpose of the PDR is to set forth the key assumptions and recommendations that will be incorporated into the final design of the pipeline and appurtenant facilities. The Final PDR was submitted early WY 2024. The 30% Design submittal, which will include 30% Design Drawings, Engineer's Opinion of Probable Construction Costs, and Construction Schedule, is projected to be completed by January 2024. The 60% Design submittal is projected to be completed in March 2024.

P&P completed a preliminary CEQA Initial Study in July 2023. An Administrative Draft Environmental Impact Report (EIR)/Environmental Assessment (EA) is anticipated to be completed in March 2024. A final EIR/EA is anticipated to be completed in WY 2024. Additionally, several geotechnical and biological monitoring and surveys were completed in WY 2023. IWVGA Staff have reviewed and approved drafts of the Noise & Groundborne Vibration Impact Analysis and Air Quality & Greenhouse Gas Impact Analysis Technical Studies. Coordination with California Department of Fish and Wildlife, United States Army Corps of Engineers, and State Water Resources Control Boards is ongoing and applications for permits have been submitted. Public scoping meetings for CEQA were held in Ridgecrest and California City on August 23, 2023 and August 24, 2023, respectively. The BLM held a NEPA 30-Day Scoping Period in WY 2024 which began on October 5, 2023 and ended on November 4, 2023. Additional public outreach and scoping meetings will take place in WY 2024.

In WY 2023, Transystems began ROW services and obtained 50 Right-of-Entry agreements from property owners for 48 parcels along the alignment to allow performance of biological/technical studies and geotechnical borings. Transystems is coordinating with California Fish and Wildlife and the County regarding ROW requirements for the project. A Right-of-Way Acquisition Plan will be completed in WY 2024.

In WY 2023, the Phase 1 Surface Percolation Replenishment Study Technical Memorandum was completed. The study identified locations for potential recharge basins for further investigation with the goal of ultimately assessing feasibility to develop a surface spreading project. The IWVGA staff and TAC concluded that surface percolation would not be feasible in the IWVGB due to the hydrogeology and depth to water. Consequently, a treated imported water project to deliver water directly to water users in the Indian Wells Valley was determined to be the most feasible imported water project.

3.1.3 Project 2: Optimize Recycled Water

The IWVGA Board of Directors adopted Resolution Number 02-20 on November 19, 2020, formally creating the Recycled Water Program. The IWVGA Board of Directors also approved an option agreement for purchase of recycled water from the City of Ridgecrest at the November 2020 meeting.

On July 11, 2022, Capital Core conducted a preliminary scoping meeting with Bureau of Reclamation (BOR) staff regarding the BOR's Title XVI programs which provide funding for planning, design, and

construction of water recycling and reuse projects. The preliminary scoping meeting determined that the IWVGA's recycled water project is eligible for funding under the Title XVI Reclaim and Reuse Program. In July 2022, the IWVGA Board of Directors authorized Staff to prepare a Title XVI Feasibility Study to submit to the Bureau of Reclamation (BOR) for funding under the Title XVI Reclaim and Reuse Program. The Feasibility Study was completed in WY 2023 and submitted to BOR in March 2023. It consists of the following:

- Project Description and Study Area
- Statement of Problem and Need
- Water Recycling Opportunity
- Description of Alternatives
- Economic Analysis of the Project
- Justification of the Recycling Project
- Environmental Considerations and Effects (NEPA)
- Legal and Institutional Requirements
- Research Needs for the BOR

BOR granted final approval of the Title XVI Feasibility Study in early WY 2024.

In January 2023, the IWVGA applied for funding through the DWR Urban Community Drought Relief Grant Program for Recycled Water Project planning costs. DWR did not award the IWVGA with grant funding for this project in part due to concerns that the overall cost per-acre foot of water produced was prohibitive. Due to a lack of funding for Recycled Water Project, as currently envisioned, the IWVGA Board of Directors directed Staff to halt work on the Project. In WY 2024, alternative uses for recycled water will continue to be considered.

3.1.4 Project 3: Conservation Efforts

Through Proposition 1 funding, the IWVGA completed a pilot water conservation program in early WY 2023 targeting groundwater users located in severely disadvantaged communities (SDAC). The program consisted of a rebate program for installation of water conservation devices, water audits and leak detection surveys, and the preparation of drought management and water conservation plans.

Water audit and leak detection surveys, initiated in WY 2022 and finalized in WY 2023, were performed for the following SDAC communities:

- Eastern Inyokern Mutual Water Company
- China Lake Acres Mutual Water Company
- Searles Domestic Water Company
- South Desert Mutual Water Company & West Valley Mutual Water Company

The reporting for these surveys was finalized in WY 2023. The water audit and leak detection survey for Inyokern Community Services District was completed in WY 2021.

During WY 2022, work began on developing Water Shortage Contingency Plans the following SDAC Communities:

- China Lake Acres Mutual Water Company
- Eastern Inyokern Mutual Water Company
- Inyokern Community Services District
- West Valley Mutual Water Company

The purpose of these plans is to provide strategies to protect the water supply during various events including a water shortage that would require mandatory conservation measures. These plans were completed in WY 2023.

The above-mentioned surveys and plans can be found on the DMS at the following site: www.iwvgsp.com.

Indirectly, the IWVGA extraction fees encourage and incentivize individual water saving and conservation practices. Additionally, the IWVWD has continued its conservations efforts for its customers, independent of the IWVGA, as described in IWVWD's 2020 Urban Water Management Plan. The IWVGA intends to cooperatively work with the IWVWD in WY 2024 to develop new conservation projects.

3.1.5 Project 4: Shallow Well Mitigation Program

Continued impacts at shallow wells (declining water levels and degraded water quality) are anticipated while management actions and GSP projects are being implemented due to poor or degraded water quality and overdraft conditions. Predictive modeling results and hydrographs of measured data indicate declining water levels suggest some shallow wells are likely to be impacted before sustainability is reached. The IWVGA continued development of the Shallow Well Mitigation Program in WY 2023. Funding for shallow well mitigation is through the adopted mitigation fee (Ordinance 03-20). The Shallow Well Mitigation Program is structured such that the IWVGA Board of Directors, along with appropriate technical Staff, conduct evaluations of submitted wells on a case-by-case basis to determine the appropriate mitigation measures and financial assistance. The Shallow Well Impact Report Form and Emergency Assistance Report Form can be found on the IWVGA website: https://iwvga.org/reports.

In WY 2023, the Water Resources Manager (WRM) evaluated applications to the IWVGA for shallow well mitigation funding. Based on the recommendations of the WRM and staff, the IWVGA Board has approved one application for partial funding to replace a well impacted by declining groundwater levels. One application was declined due to not meeting the criteria for funding. Two applications are currently being reviewed. Lastly, one application has been redirected to a more appropriate potential funding source.

In addition to implementing the Shallow Well Program to address individual well impacts, the IWVGA submitted an application to DWR under the Urban Community Drought Relief Grant Program to receive grant funding to consolidate small, vulnerable, well systems in disadvantaged areas into the IWVWD. DWR awarded the IWVGA $3,345,000 in June 2023. The grant agreement is anticipated to be finalized in early WY 2024. Implementation of this project would mitigate impacts to shallow wells and could reduce the number of applicants for the Shallow Well Program.

3.1.6 Project 5: Dust Control Mitigation Program

Implementation of the Fallowing Program and voluntary cessations of agricultural operations could potentially result in loss of vegetation and an increase in windblown dust and sand, due to the climate of the Indian Wells Valley which would require mitigation in order to eliminate undesirable results. Significant groundwater production reductions and cessation of agricultural operations have not yet

occurred. Additionally, the IWVGA does not have a funding source to implement the program at this time. Consequently, no work on this project was completed in WY 2023.

3.1.7 Project 6: Pumping Optimization Project

Evaluation of modeling results generated during development of the GSP for the proposed groundwater management and project scenarios showed that some current groundwater pumping may need to be redistributed in the IWVGB to reduce concentrated pumping centers that would lead to continuing localized declining groundwater levels and corresponding continuing impacts to shallow domestic wells.

Pumping throughout the Basin is influenced by the implementation of the other projects and management actions. This project will need to be evaluated after other projects and management actions are implemented and the basin impacts of said projects are evaluated. Consequently, no work on this project was completed in WY 2023.

3.2 Progress Towards Sustainable Management Criteria

As discussed previously, the IWVGA has identified four sustainability indicators with documented historical and/or current undesirable results in the IWVGB:

- Chronic lowering of groundwater levels
- Reduction of groundwater in storage
- Degraded water quality
- Potential for groundwater pumping related land subsidence

Quantifiable sustainable management criteria have been established for sustainability indicators with current or historical impacts to numerically define when undesirable results are occurring and to define achievable targets for reaching and maintaining sustainability. These sustainable management criteria include minimum thresholds, measurable objectives, and interim milestones. Development of these criteria relied upon information about the IWVGB developed in the hydrogeologic conceptual model, current and historical groundwater conditions, and the water budget. Additional information regarding the development of sustainable management criteria can be found in the GSP.

As an interim indicator of progress towards achieving sustainability, the applicable sustainability indicators are evaluated by the interim milestones at 5-year increments. The measurable objectives for

the applicable sustainability indicators are desired benchmarks to be reached by year 2040, although it is acceptable for conditions to be managed in the range between the minimum threshold and measurable objective (operating range). If conditions fall below the minimum threshold after year 2040, undesirable results are occurring and sustainability has not been reached.

The IWVGA selected representative monitoring sites to be used to specifically measure and monitor groundwater conditions caused by the sustainability indicators, and to evaluate the efficacy of proposed projects and management actions achieving sustainability. These sites were selected based on evaluation of the best available data. As more data become available through monitoring and data collection, the representative sites will be reevaluated for effectiveness at representing basin-wide conditions. This reevaluation process will occur prior to the five-year GSP update.

In general, the IWVGA anticipates the continuation of groundwater level declines until projects and management actions are fully implemented and the basin has stabilized. Sustainability is not required to be reached until 2040. The first interim milestones will be evaluated in 2025.

Sustainable management criteria established for the IWVGB can be monitored on the public data DMS at the following site: www.iwvgsp.com. A summary of data is provided in the subsections below.

3.2.1 Chronic Lowering of Groundwater Levels

Currently, ten representative monitoring sites have been selected in the IWV GSP[2] to monitor the chronic lowering of groundwater levels throughout the IWVGB. These wells were selected to have good spatial distribution throughout the IWVGB and across the pumping centers and good predictive ability to monitor the effectiveness of projects and management actions that will be implemented to limit the decline of groundwater levels. The ten well locations are shown in Figure 3-1.

Among the ten representative monitoring wells, three of them do not have established sustainable management criteria at this point in time. Sustainable management criteria will be established during the reevaluation process of all representative monitoring sites which will occur as part of the five-year GSP update. Representative monitoring sites and their respective sustainable management criteria can be found on the IWV DMS

[2] Section 4.4.2.6 (Representative Monitoring Sites) on the IWV GSP outlines how and why wells were selected as representative monitoring sites for the chronic lowering of groundwater levels.

(https://iwvgsp.com/GSP-Dashboard/map.php). At present, groundwater levels at six of the representative sites are above the measurable objectives, the target level in 2040 when sustainability is reached. Groundwater levels at one representative site is within the operating range between the measurable objective and the minimum threshold. Accordingly, undesirable results have not been observed.

Table 3-1: Representative Monitoring Sites for Chronic Lowering of Groundwater Levels

Monitoring Site	Screen Interval	Spring 2023 Measurement (ft msl) [1]	Minimum Thresholds (ft msl)	Measurable Objective (ft msl)	Note
USBR-01	1,750-1,770	2,668	2,659	2,664	Above measurable objective
USBR-03	1,850-1,870	2,165	-	-	Criteria not determined yet
USBR-04	1,190-1,200	2,130	2,110	2,125	Above measurable objective
USBR-05	850-870	2,159	2,151	2,156	Above measurable objective
USBR-06	330-350	2,170	2,166	2,171	Within operating range
MW 32	1,900-1,920	2,140	2,119	2,134	Above measurable objective
Kerr McGee	681-881	2,148	2,138	2,145	Above measurable objective
Sandquist Spa	135-191	2,170	2,162	2,167	Above measurable objective
Inyo	457-477	<2142/Dry	-	-	Criteria not determined yet
George Air Corridor	320-380	2,159	-	-	Criteria not determined yet

[1] *ft msl = feet mean sea level*

Except approximately 5 feet of water level decline at Inyo well, water level measurement at other representative monitoring sites fluctuated less than 1 foot in WY 2023, which indicates that the first interim milestones will be met in 2025 because groundwater level declines are anticipated to continue until projects and management actions are fully implemented. Groundwater elevation data are discussed more thoroughly in Chapter 5.

3.2.2 Reduction of Groundwater in Storage

Groundwater in storage will continue to be reduced until the IWVGB is operated within the sustainable yield. The 2025 interim milestone for change of groundwater in storage is a loss of approximately 82,000 AF since 2020. The cumulative change in storage from WY 2020 to WY 2023 is approximately 58,000 AF. According, no undesirable results has been observed. The annual change of groundwater in storage within the measured study area of the IWB Basin from Spring 2022 to Spring 2023 is estimated to be a loss of 12,370 AF in the IWV main basin and 5,513 AF in the El Paso Subarea based on changes to groundwater levels at 77 wells (see Table 5-1). Estimated change in groundwater storage is discussed in Chapter 5.3.

3.2.3 Degraded Water Quality

Currently, ten representative monitoring sites have been designated to monitor water quality, as represented by total dissolved solids (TDS) concentrations. These representative monitoring sites are shown in Figure 3-2. Groundwater water quality data was limited at the time of developing the GSP and establishing sustainable management criteria. Since the GSP adoption, water quality data has been collected to establish baseline conditions. Sustainable management criteria will be established during the reevaluation process of all representative monitoring sites which will occur prior to the next GSP Periodic Evaluation. The status of TDS concentrations at the current representative monitoring sites are summarized in Table 3-2 below.

Table 3-2: Representative Monitoring Sites for Degraded Water Quality

Well	Screen Interval	Fall 2022 / Most Recent Measurement (mg/l)	Minimum Thresholds (mg/l)	Measurable Objective (mg/l)	Note
AB 303-5	905-1,005	160	-	-	Criteria not determined yet

IWVWD Well 33	TD=1,020	280[1]	500	310	Below measurable objective
Owens Peak South 01		290[1]	500	300	Below measurable objective
IWVWD Well 30	TD=1,200	200[1]	500	240	Below measurable objective
Hometown Water Well 01		370[1]	500	370	At measurable objective
IWVWD Well 11	TD=620	580[1]	600	530	Within operating range
Sandquist Spa	135-191	340	-	-	Criteria not determined yet
West Valley Mutual 01		500[1]	600	500	At measurable objective
26S/38E-01M05	299-359	530	-	-	Criteria not determined yet
26S/39E-06P01		500[1]	-	-	Criteria not determined yet

[1] mg/L = milligram per liter. Measurement dates range from 2019 to 2021 due to monitoring schedule.

TDS concentrations at five of the representative sites are at or below the Measurable Objectives. TDS concentrations at one representative site are within the operating range between the Minimum Threshold and Measurable Objective. Four representative monitoring well sites do not have established sustainable management criteria due to lack of data at the time of selection. No undesirable results have been observed.

As discussed previously, the representative monitoring sites will be reevaluated for effectiveness at representing basin-wide conditions prior to the next GSP evaluation. Sustainable management criteria will be established for the remaining representative wells during the reevaluation process which will address DWR's recommended corrective action.

See Section 7.1 for additional data on TDS concentrations.

3.2.4 Land Subsidence Related to Groundwater Pumping

Due to implementation of projects and management actions that will result in stabilization of groundwater levels, land subsidence is not anticipated to occur. Accordingly, the Measurable Objective and interim milestones are set at the long-term historical rate of subsidence, 0.04 inches/year. (See the GSP for additional information.) No representative monitoring sites to measure land subsidence off of the NAWS China Lake have been selected at this time. The IWVGA intends to periodically monitor land subsidence conditions throughout the IWVGB as datasets become available and as necessary to ensure no undesirable groundwater conditions are occurring. Periodically and at least every five years, the IWVGA will request any available land subsidence data from the U.S. Navy at their Supersonic Naval Ordinance Research Track (SNORT) alignment. No land subsidence data was collected by the U.S. Navy during WY 2023.

The U.S. Geologic Survey (USGS) does not identify the IWVGB as a region which has experienced historical land subsidence due to groundwater production, peat loss, or oil production (USGS, 2021). Interferometric Synthetic Aperture Radar (InSAR) data measuring vertical displacement is available on the SGMA Data Viewer (DWR, 2023b). The data indicate the IWVGB (including El Paso) experienced a displacement between -0.1 and 0.1 feet in WY 2023. Accordingly, no significant land subsidence has occurred during WY 2022. No additional land subsidence data has been published in WY 2023.

3.3 Progress Made on Addressing Recommended Corrective Actions

In its GSP Assessment Staff Report for the IWV GSP, DWR provided seven RCAs to be considered by the IWVGA prior to the first Periodic Evaluation of the GSP. The following table documents each RCA and the current progress and plan to address DWR's recommendations.

Table 3-3: Recommended Corrective Actions Summary

Recommended Corrective Action Summary	Current Progress and Next Steps
RCA 1 ● Provide additional information on the required, ongoing communications elements required in the GSP Regulations.	● The Communication & Engagement Plan was amended in WY 2023.

Recommended Corrective Action Summary	Current Progress and Next Steps
• Address Communication & Engagement Plan.	• Ongoing communication with the public occurs regarding relevant and important GSP implementation topics.
RCA 2 • Investigate the hydraulic connectivity of the vertical and lateral relationships between the three hydrogeologic zones. • Provide a timeline and discuss the steps that will be taken to fill the data gap identified in the Plan related to groundwater monitoring. • Reassess the groundwater level and groundwater quality monitoring networks.	• Hydrogeologic zones have been investigated and data is being incorporated into the GSP model. • Data gaps are continuously being evaluated and filled. A comprehensive list and discussion of data gaps will be provided in the next GSP Plan Amendment. • The groundwater level and groundwater quality monitoring networks, particularly representative monitoring sites, were re-evaluated in WY 2024 and will be updated in the next GSP Plan Amendment.
RCA 3 • Update water budget • Revise climate change projections based on data obtained from addressing data gaps, as needed.	• GSP model is currently being updated with additional data. • Updated water budgets will be determined in WY 2024. • Climate change model runs will be performed in WY 2024.
RCA 4 • Update the Plan to include projects and management actions sufficient to eliminate perpetual overdraft currently projected beyond the fifty-year planning and implementation horizon. • Develop a contingency plan for if imported water is not secured. • Provide updates related to the negotiated details and implementation of the imported water project options.	• All Projects and Management Actions are currently being re-evaluated. • Additional modeling runs will be performed in WY 2024. • A contingency plan is being developed and will be provided in the next GSP Plan Amendment. • Updates on the imported water project are provided in each Annual Report.
RCA 5 • Identify and clarify groundwater conditions that would produce undesirable results. • Identify minimum thresholds to prevent conditions in the Basin from causing those undesirable results.	• Groundwater conditions and undesirable results will be re-evaluated and updated in the next GSP Plan Amendment. • Sustainable Management criteria, including minimum thresholds, will be established at sites not yet with criteria in WY 2024 after additional modeling runs are completed.
RCA 6 • Establish sustainable management criteria at all representative monitoring locations.	• Sustainable Management criteria will be established at sites not yet with criteria in WY

Recommended Corrective Action Summary	Current Progress and Next Steps
	2024 after additional modeling runs are completed.
RCA 7 ● Update the data management system to reflect correct, current, and complete information. ● Describe rationale for management area boundaries, if applicable.	● The DMS is continuously updated as new data is collected. ● Management areas have been evaluated with the El Paso management area to be proposed to DWR in the next GSP Plan Amendment.

3.4 Outreach and Engagement

A guidance document on communication and engagement (C&E Plan) was developed by the IWVGA in 2018 and revised in WY 2023. According to the C&E Plan, the IWVGA will use individual mailings and newsletters, website updates, potential use of social media, public notices and display advertisements in newspapers, focused workshops, board meetings, and provide hard copy materials along with CDs to public libraries as outreach methods to inform the public regarding important GSP implementation tasks.

The IWVGA conducts regular monthly Board meetings to support the implementation of projects and management actions that support Basin sustainability, and to receive input from the public. The IWVGA Policy Advisory Committee (PAC) meets regularly to advise the IWVGA on policy matters related to GSP implementation. The IWVGA Technical Advisory Committee (TAC) advises the IWVGA Board and IWVGA Water Resources Manager on technical matters, as needed.

In WY 2023, IWVGA staff began implementing some of the revisions to the C&E plan including developing Frequently Asked Questions (FAQ) sheets and other outreach materials. This work will continue into WY 2024.

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Chapter 4 Hydrologic Conditions

The California Code of Regulations (CCR) requires that GSP Annual Reports contain information on current and historical water year types (23 CCR § 356.2). DWR issues water year classifications for some areas of the state, including the Sacramento River and San Joaquin River basins. The DWR historical data set covers the period from WY 1931 to 2022; the classification for WY 2023 is still not yet available.

GSAs have the option to (1) develop their own water year types based on best available information (23 CCR Section 354.18d), or (2) use the data recently developed by DWR for the water budget. The suitability of the DWR water year type index will be assessed for future reports; at this time, a classification for the most recent water year is not yet available from DWR. A water year type index (Attachment B), based on local precipitation data in the IWVGB, was developed previously for the baseline groundwater model (GSP Appendix 3-H, Stetson 2020a) and the GSP Annual Reports for WYs 2019-2022 (Stetson, 2020b, 2021, 2022a, 2023). Use of that index is continued in this annual report.

The IWVGB water year type index is based on historical precipitation data from 1945-2023 at the China Lake NAF station and has five hydrologic categories. The categories are illustrated in the annual precipitation exceedance curve in Figure 4-1. The five types are Wet, Above Normal, Normal, Below Normal, and Dry. Table 4-1 shows the thresholds for determining water year type. The thresholds correspond to the vertical lines dividing the categories in Figure 4-1. WY 2023 was a Wet year, with 8.27 inches of rain at the index station. Table 4-2 and Attachment B lists the water year type since 2015 and the historical classifications of water year type since WY 1945, respectively. WY 2023 is a historical wet year, with only three years having higher amounts of rainfall since 1945. WY 1992, over thirty years ago, was the last time rainfall was more than WY 2023. The basin had been experiencing an historical drought (2012-2022) prior to the WY 2023 wet year. The precipitation in WY2023 broke this latest drought trend, with only 4% of years (1945-2023) having more precipitation than this Wet year that had 234% of the average rainfall (3.53 inches). Included in the annual total of 8.27 inches of rainfall is a very wet August 2023 with 4.33 inches of precipitation at the index station due to monsoon weather. A nearby precipitation gage at Trona (ID No. 49035) also experienced over four inches of rainfall during the month of August 2023. Even without this wet August, WY 2023 would have been close to Above Normal rainfall for the entire year.

Table 4-1: Percent Exceedance Ranges and Dividing Thresholds for Five Water Year Types

Year Type	Percent Exceedance Range (%)	Threshold Between Year Type (in/yr) [1]	Number of Years in Historical Record (WY 1945-2023)
Wet	0% - 10%	6.0	8
Above Normal	>10% - 33%	4.1	18
Normal	>33% - 67%	2.1	27
Below Normal	>67% - 90%	1.3	18
Dry	>90% - 100%	n/a	8
		Total years	***79***

1 Thresholds based on Percent Exceedance Ranges for 1945-2023 period.

Table 4-2: Water Year Types based on Precipitation at China Lake NAF Station (No. 041733)

WY	Annual Precipitation (in/yr)	Percentage of Average	Percent Exceedance Rank	Water Year Type
2015	3.67	104%	45%	N
2016	1.38	39%	87%	BN
2017	4.61	130%	26%	AN
2018	1.43	40%	86%	BN
2019	6.13	173%	8%	W
2020	5.57	158%	15%	AN
2021	0.58	16%	96%	D
2022	1.87	53%	73%	BN
2023	8.27	234%	4%	W

Notes: W = Wet, AN = Above Normal; N = Normal; BN = Below Normal; D = Dry.
Percentage of average and percent exceedance range calculated based on the 1945-2023 period of record.

Chapter 5 Groundwater Elevation Data

Since 1946, groundwater data have been collected in the IWVGB for studies conducted by the U.S. Navy, USGS, DWR, U.S. Bureau of Reclamation (USBR), and other agencies. In 1995, a groundwater monitoring program (GWMP) was established between Kern County Water Agency (KCWA) and the U.S. Navy collecting groundwater levels throughout the IWVGB during the wet (spring) and dry (fall) seasons from approximately 100 to 150 wells. Since 2020, the Indian Wells Valley Groundwater Authority (IWVGA) coordinates with KCWA and the Navy for the semi-annual monitoring collection of groundwater levels. Since WY 2022, the IWVGA's Water Resource Manager has been required to supply most of the field staff needed to measure groundwater levels. This additional support for KCWA and the Navy allowed for major improvements in collecting observation data during WY 2022 and has continued into WY 2023.

The GWMP included 176 monitoring sites during WY 2023 (See Attachment C for all wells in the GWMP). Depths to water (DTW) measurements were collected at 147 sites in Fall 2022 and 151 sites in Spring 2023. Three wells were added to the GWMP from Fall 2022 to Spring 2023 to fill data gaps and provide new groundwater levels[3] (Figure 5-2 shows these well locations). Attachment D contains measured DTW data, Land Surface Datum (LSD) and resulting groundwater elevations (feet, mean sea level) for WY 2023. These data were filed on DWR's SGMA portal and appended to DMS website (*iwvgsp.com)*. Groundwater elevation data were used to produce equipotential contour maps and hydrographs and are discussed below in this section of the annual report.

Due to the record snow and rainfall experienced in California during the winter months in WY 2023, DWR requested GSAs, including the IWVGA, to increase the frequency of groundwater level collection from the required biannual measurements. The purpose of this increase was to allow basins to better understand the response to groundwater levels associated with wet years and better understand the best time to capture the occurrence of seasonal high groundwater levels. Consequently, supplemental monitoring was conducted during may, August, and December 2023 to supplement the regular October and March bi-annual monitoring. All groundwater level data is posted on the DMS website (iwvgsp.com) and on DWR's SGMA data portal.

[3] New wells in the GWMP: 25S/39E-29N01, 26S/38E-17C01, 26S/39E-25K01, 26S/39E-27C01, 26S/39E-35B

5.1 Groundwater Elevation Contour Maps

KCWA's Geologist[4] produced Fall 2022 and Spring 2023 groundwater elevation and depth to water contours for this WY 2023 Annual Report. Figures 5-1 and 5-2 show the Fall 2022 and Spring 2023 groundwater elevation contours, respectively. Both figures also include the location of measured groundwater level monitoring wells used in the analysis, the groundwater basin boundary, and the watershed extents for Indian Wells Valley. Contours are dashed to show the uncertainty where there are limited data available.

The groundwater elevation contour maps show the general flow of groundwater from the surrounding mountains towards China Lake playa. Groundwater flows from Rose Valley in the northwest (about 2,250 feet, msl), the Sierra Mountain front fan deposits (about 2,190 feet, msl) along the west, the Argus Range Mountain front fan deposits from the east (about 2,180 feet, msl) and from the El Paso Subarea (2,800 feet, msl) in the southwest towards the playa at the center of the basin. Pumping centers form depressions near discharge areas in the northwest (about 2,170 feet, msl), southwest (about 2,150 feet, msl), and southeast (about 2,120 feet, msl). Groundwater mounding can also be observed near the wastewater treatment plant on the NAWS China Lake (2,190 feet, msl). There is a fault zone causing steep groundwater level contours from the El Paso Subarea towards the main IWVGB.

Figures 5-3 and 5-4 show contours of the depth to groundwater below land surface. These contours indicate the depth that would need to be drilled to intercept the groundwater table and produce water from a well. In general, depth to groundwater below land surface appears to be greatest in areas with the highest elevations along the Sierra Nevada and the El Paso Mountains. Depth to groundwater levels decrease at lower elevations at the playa and towards Salt Wells Valley.

5.2 Hydrographs

Hydrographs have been developed for all wells in the IWV Groundwater Monitoring Program (GWMP) and are posted on the DMS website (www.iwvgsp.com). Hydrographs for 14 selected well sites are provided in Attachment E (see also Figure 5-5), which include the designated representative monitoring wells for chronic lowering of groundwater specified in the GSP used to track Basin management. The

[4] Michelle Anderson, PG; Kern County Water Agency (KCWA) geologist.

selected wells include seven nested multi-level piezometers (note: data for nested multi-level piezometers appear on the same hydrograph), for a total of 30 groundwater level measurements. Groundwater level data collected by KCWA, the Navy, IWVWD and other agencies (Historical data collected in IWV from DWR, USGS, and USBR are also included on the hydrographs) were used to produce these hydrographs. Groundwater level data for the majority of the hydrographs begin in the late 1980s and early 1990s when the wells were installed, with the exception of the Inyo Well. The Inyo Well (27S/39E-07R01), located in the southwest of the IWV main basin has the longest period of record for groundwater level data in the basin dating back to 1946.

The hydrographs in Attachment E show historical changes of groundwater levels throughout the IWVGB. The most recent changes of groundwater levels at the 14 selected well locations shown on Figure 5-5 are summarized below.

- USBR-10 nested piezometers (Attachment E, page 1, upper graph)

These nested wells are located in the northwest near Ninemile Canyon Road (mountain front recharge) and south of Little Lake (Rose Valley subsurface flow). Historically there were four piezometers at USBR-10, but now only 3 of the piezometers are able to be measured[5]. Rising groundwater levels were observed at the three measured piezometers from Spring 2021 to Spring 2022. Groundwater levels in the shallow, shallow-mid and deep piezometers declined 2.88, 2.80, and 2.78 feet, respectively.

- USBR-6 nested piezometers (Attachment E, page 1, lower graph)

These nested wells are located on the Navy Base just inside the Navy fence line in the northwest adjacent to alfalfa fields, and near fan deposits from Sand Canyon. While the mid and deep piezometers saw a water level decline of 0.84 and 0.73 foot, respectively, the shallow piezometer saw an increase of 0.78 foot from Spring 2022 to Spring 2023.

- USBR-5 nested piezometers (Attachment E, page 2, upper graph)

These wells are located in the northwest at the base of Indian Wells Canyon (mountain front recharge) and approximately 0.5 mile from the agricultural pumping center. There was a water level decline in all three piezometers from Spring 2022 to Spring 2023 at 0.75 foot (shallow), 0.53 foot (mid) and 0.53 foot (deep).

- NR-2 nested piezometers (Attachment E, page 2, lower graph)

These wells are located in the northwest about one mile east of USBR-5 and near the agricultural pumping center. None of the three piezometers (shallow and deep) was measured during the Fall 2022 and Spring 2023 measuring events.

[5] Since Fall 2005 the mid-deep piezometer at USBR-10 has not been able to be measured (well collapsed, these data are posted for historical reference only).

- Sandquist Spa Well (Attachment E, page 3, upper graph)

This well is located on the Navy Base between the agricultural pumping centers and the playa (discharge area). The observed groundwater level decline was 0.71 foot from Spring 2022 to Spring 2023.

- Kerr McGee 17 (Attachment E, page 3, lower graph)

This well is located on the Navy Base east of Highway 395 about 3 miles southeast of NR-2 just inside the Navy fence line. From Spring 2021 to Spring 2022, groundwater level in this well declined 0.29 foot.

- MW-32 nested wells (Attachment E, page 4, upper graph)

These wells are located along Business Highway 395 to the east of Inyokern, in the vicinity of IWVWD pumping wells. From Spring 2022 to Spring 2023, water level rose 18.36 feet, 6.92 feet and 0.34 foot in the shallow, mid and deep piezometers, respectively.

- USBR-4 well (Attachment E, page 4, lower graph)

This well is also located along Business Highway 395, about 2 miles east of MW-32. A groundwater level increase of 9.65 feet was observed at this well from Spring 2022 to Spring 2023.

- 26S/39E-32L1 (Attachment E, page 5, upper graph)

This well is located about 2 miles south of the junction of U.S. Highway 395 and California State Route 178. Groundwater levels have shown a steady decline since monitoring began in 2007. Groundwater levels dropped 0.79 foot from Spring 2022 to Spring 2023 at this well.

- George Air Corridor Well (Attachment E, page 5, lower graph)

This well is located on the Navy Base in the southeast area on the basin. Groundwater levels have shown a steady decline since monitoring began in 1989. However, a slight water level increase (0.04 foot) was observed from March 2022 to March 2023.

- USBR-3 nested piezometers (Attachment E, page 6, upper graph)

This nested well is located to the west of Ridgecrest near the new IWVWD production wells. From Spring 2022 to Spring 2023, groundwater level increased 0.98 foot and 0.14 foot at the shallow and deep piezometers, respectively. At the mid piezometer, a water level decline of 1.64 feet was observed during that same one-year period.

- Inyo well (Attachment E, page 6, lower graph)

This well has the longest period of monitoring data, since 1946, and is located in the southwest area of the IWVWD new production wells. This well was deepened once and was dry during spring 2023 groundwater level measurements (425 feet depth). Groundwater levels have shown a steady decline since the early 1950s. This well is in poor condition and may be dry. Funding is being investigated for well replacement.

- AB303-05 well (Attachment E, page 7, upper graph)

This well is located in the El Paso subarea to the southwest of the main IWVGB where there isn't any significant pumping. Stable groundwater levels have been observed at this well since 2007, with a slight rise in recent years. Groundwater level declined 2.50 feet from Spring 2022 to Spring 2023 at this well.

- USBR-1 nested piezometers (Attachment E, page 7, lower graph)

This nested well is also located in the El Paso subarea of the IWVGB where there isn't any significant pumping, southwest of a fault that separates this subarea from the main IWV groundwater basin. Steady groundwater levels have been observed at all four piezometers since about 1995, with a slight rise in recent years. There was no water level measurement at the deep piezometer after May 2020. From Spring 2022 to Spring 2023, water level at the shallow piezometer increased 0.20 foot, while the shallow-mid piezometer saw a water level decline of 2.03 feet.

5.3 Estimated Change in Groundwater Storage

Groundwater levels have declined in many parts of the IWVGB during WY 2023. There are some areas that show little change, or even an increase in groundwater levels, primarily in the El Paso subarea, where there is little or no groundwater production. Two different methods were used to evaluate the changes in groundwater levels from Spring 2022 through Spring 2023: (1) map color coded comparison of measured groundwater level change, and (2) modified Thiessen polygon method using 77 monitoring wells distributed throughout the basin to estimate storage changes.

5.3.1 Groundwater Level Change from Spring 2022 to Spring 2023

Groundwater levels were measured at 134 wells during both Spring 2022 and Spring 2023. These measurements were compared to evaluate the annual groundwater level change across the basin. Figure 5-6 shows the annual groundwater elevation change from Spring 2022 to Spring 2023 (Attachment D) displayed as gradational colors on a map for each of these monitoring wells. This visual method of representing the available data on a map shows the distribution of lowered groundwater levels and where no change or an increase in groundwater levels occurred during the last year. Orange dots at 23 wells represent observations with a 1-foot to 6.3-foot drop in groundwater levels; and green dots at 57 wells display groundwater levels dropping up to 1 foot. The highest levels of groundwater elevation change observed (orange dots) appear to correlate with pumping and discharge areas. The largest decline in groundwater levels was observed at IWV-MW-02, located near the southwest pumping center.

From Spring 2022 to Spring 2023, there were a total of 6 monitoring wells that saw a water level drop of more than 1-foot (orange dots) to the southwest of Inyokern, where an increase or no change in groundwater levels were observed during previous 3-year period from Spring 2019 to Spring 2022. The cause of this drop in groundwater levels is not fully understood. These monitoring wells are located to the west of the surface expression of the Freeman fault (shown as a red NW/SE line on Figure 5-6). IWVWD pumps groundwater to the east of Freeman fault and at a distance from these wells located in the alluvial fans of the Sierra Nevada. Further investigation is warranted to determine what these WY 2023 dropping groundwater levels indicate.

An increase or no change in groundwater levels (no loss of groundwater storage) are observed in the wells shown as blue dots in Figure 5-6. This condition occurs mostly in El Paso Subarea where there is very limited pumping; and in the southeast near Ridgecrest where pumping was reduced when IWVWD moved its production further to the west.

5.3.2 Estimating Storage Change Using Modified Thiessen Polygon Method

Changes to groundwater in storage are estimated each year for the Annual Report and to be used for managing IWV's water resources. In this Section, changes to groundwater in storage for WY 2023 have been calculated for a portion of the aquifer where groundwater levels are measured for the GWMP. The distribution of measured data from GWMP monitoring wells are shown on the groundwater elevation and groundwater depth contour maps (Figures 5-1 through 5-4) and listed in Attachment D. This area (188,971 acres), where available groundwater level data exists and the major pumping occurs, represents about half of the total GSA Basin (381,746 acres). Groundwater modeling would be required to calculate how basin overdraft and the decline of groundwater in storage extends beyond this area to the edges of the GSA basin. Supplemental modeling using a partially updated GSP model is underway, but not complete for this Annual Report. Modeling methods will be reviewed for the 5-year GSP Report. Spring 2023 groundwater level measurements were compared with Spring 2022 measurements using a modified Thiessen Polygon Method.

5.3.2.1 Modified Thiessen Polygon Method

The Thiessen polygon method is a standard approach (Thiessen, 1911; Dunne et al., 1978) of averaging point rainfall values according to an areal distribution and can be applied to other datasets. This method

distributes data collected at discrete points to the basin area by forming polygons, with each polygon containing one station with measured data. Applying this method to a groundwater aquifer assumes that the groundwater level data at the monitoring well represents the average groundwater level throughout the area represented by that particular polygon. The volume of groundwater change within each polygon is the product of (1) area, (2) specific yield (Sy[6]), and (3) measured water level change during a given period of time. This calculation for each polygon is then summed up to calculate the total volume of groundwater change within the specified study area of the basin.

Modifications were made to the Thiessen Polygon Method based on comments received from the TAC to earlier annual reports (WY 2019 and WY 2020) using this method. These modifications were first used in the WY 2022 Annual Report and carried forward in this and subsequent Annual Reports. These modifications provide an estimate of changes to groundwater in storage within a subarea of the full basin with limitations. This estimate does not consider the changes in storage outside of the study area of the modified Thiessen Polygon Method where there aren't measurements, but it does provide an indication of whether the basin is gaining or losing groundwater in storage. It would require numerical modeling to estimate how the basin overdraft extends to the edges of the basin[7]. See the WY 2022 Annual Report for a thorough description of the modifications to the Thiessen Polygon Method used here and the limitations of the approach (Stetson, 2022).

The outer boundary of the study area for applying the modified Thiessen Polygon Method generally follows the extents of groundwater level contour maps developed by KCWA. Figure 5-7 shows the full extents of the GSA boundary and the study area where groundwater measurements exist. The study area was first discretized into Thiessen polygons using perpendicular bisectors and GIS. These polygons were then modified using Angster et al. (2020) surface rupture and fault maps. The resulting polygons and surface faults are shown on Figure 5-7. Attachment F summarizes the resulting areas for each of the 77 polygons developed for this analysis.

Monitoring wells used for this analysis were considered using the following criteria: (1) long and continuous spring water level record; (2) monitoring well's condition and access assuring that the

[6] Specific yield is the amount of groundwater that a unit volume of aquifer will yield when drained by gravity. This is related to the pore space where water occurs between the gravel/sand/silt/clay grains within the aquifer.
[7] These modeling analyses will be considered for the 5-year report.

groundwater level measurement will continue for the foreseeable future; (3) spatial distribution throughout the basin; (4) selecting the shallowest piezometer for nested monitoring wells. Based on these criteria, a total of 77 monitoring wells were selected for the Thiessen polygon discretization. These monitoring wells are shown on Figure 5-7 and labeled with name and database ID[8] in parentheses.

5.3.2.2 Estimated Changes to Groundwater in Storage: Spring 2016 to Spring 2023

Changes to groundwater in storage are estimated each year for the Annual Report and to be used for managing IWV's water resources. These changes over time are most notable in the areas of the basin where declining groundwater levels are being observed. Though measuring of groundwater levels had been interrupted for a couple of years, Spring 2022's comprehensive measurements showed a continuing decline in groundwater levels in the IWV basin and in groundwater in storage (Table 5-1). These changes in groundwater levels represent about half of the overall delineated GSA Boundary where there are available groundwater level data and the major pumping occurs.

Table 5-1: Estimated Annual Change to Groundwater in Storage, Spring 2022 to Spring 2023

	Polygon Area (acres)	Spring 2022 to Spring 2023 (AF)
IWV Main Basin	154,960	-12,370
El Paso Subarea	34,010	-5,513
Total Study Area	188,971	-17,883
Total GSA Basin	381,746	*n/a*
% of GSA Basin	*49.5%*	*not estimated*

The annual change of groundwater in storage within the measured study area of the IWB Basin from Spring 2022 to Spring 2023 is estimated to be a loss of 12,370 AF in the IWV main basin and a loss of 5,513 AF in the El Paso Subarea based on changes to groundwater levels at 77 wells. The change in

[8] The well database ID can be used to browse the IWV DMS website to view available groundwater data and reports (iwvgsp.com).

storage estimate will be expanded to account for the whole IWV GSA as data gaps are addressed and the model is updated for the 2025 GSP Plan Amendment.

Figure 5-8 provides a plot of the estimated groundwater storage change from WY 2016 to WY 2023 along with the recent estimated groundwater pumping. See Chapter 6.1 for the discussion of groundwater pumping. The modified Thiessen Polygon method estimates a continued decrease of groundwater in storage for the main IWV Basin, and although there was a decrease of groundwater in storage in the El Paso subarea in WY 2023, there has been an overall increase in groundwater storage in the El Paso subarea where there is very limited domestic pumping (and limited groundwater level data). Sustainable Management Criteria for monitoring loss of groundwater in storage is measured as a cumulative total since WY 2020 (see Table 5-2).

Table 5-2: WY 2020 to WY 2023 Estimated Groundwater Storage Change, Modified Thiessen Polygon Method

	Thiessen Area (acres)	Average Annual AFY			**WY 2023** (AF)	**4-Year Cumulative Change** (AF)
		WY 2020 (AF)	**WY 2021** (AF)	**WY 2022** (AF)		
IWV Main Basin	154,960	-15,883	-15,883	-15,883	-12,370	-60,019
El Paso Subarea	34,010	2,390	2,390	2,390	-5,513	1,657
Total	188,971	-13,492	-13,492	-13,492	-17,883	-58,359
Hydrologic Condition		AN	D	BN	W	

Note: Storage Change is based on the measured study area, approximately 49.5% of the 381,746 acres of the Total IWV Basin.

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Chapter 6 Water Supply Data

6.1 Groundwater Extraction Data

Groundwater from the IWVGB is the sole source of potable water in the Indian Wells Valley. Groundwater is produced from approximately 970 wells. Figure 6-1 provides the location of the production wells in the IWVGB[9]. Since 2018, the IWVGA has been actively engaged in efforts to determine annual groundwater production in the IWVGB and improve the accuracy of production estimates. These efforts are summarized below with the years the work was conducted in parenthesis.

- Baseline Pumping Conditions (2018-2019): The most recent available pumping data at the time (2018) were compiled from known and cooperative individual groundwater producers in order to develop the numerical flow model. Through stakeholder outreach efforts, major pumpers provided estimates to use for future conditions (2020 through 2070) that reflected their projected water demands. Prior studies were used to estimate pumping for years 1975-2017 for groundwater producers where little data were available nor provided by stakeholder outreach.

- Well Registration and Reporting (2018-Current): The IWVGA implemented well registration and well production reporting requirements in 2018 for the purpose of collecting volumetric pumping fees. All groundwater producers subject to the fees established by the IWVGA are required to register their groundwater production wells and report monthly groundwater production.

- Sustainable Yield Allocation (2020-Current): The IWVGA requested historical pumping records from all non-*de minimis* pumpers (excluding federal entities) for the purpose of allocating the sustainable yield of the IWVGB. This allocation is used to determine a pumping allotment that is not subject to the Basin Replenishment Fee.

- Flow Meter Requirements (2020): The IWVGA adopted Ordinance 01-20 requiring the installation and testing of IWVGA-approved flow and hour metering equipment on all non-de minimis and non-federal wells in the Basin, with the purpose of increasing accuracy of groundwater production records.

- Transient Pool (2020-Current): The IWVGA developed a Transient Pool program (see Section 3.1.1) which requires reporting of groundwater production to the IWVGA. This groundwater production is not subject to certain IWVGA established fees and is accounted for separately than other groundwater production.

[9] There is insufficient data by well to display the volume of each production well on Figure 6-1; however, the figure shows the location of wells by well use category.

- Legal Action and Settlements (2020 through Current): The IWVGA has taken legal action against non-compliant pumpers and has entered into settlements regarding the payment of fees and reporting of groundwater production.

- Pumping Verification (2023 through Current): In WY 2023, the IWVGA began a review and verification process of all production records for the years 2018 to current to update the numerical model production values. This task will continue into WY 2024.

Despite these efforts, data gaps in groundwater production within the IWVGB still exist. These gaps are partially due to inaccuracies of self-reporting, non-compliant groundwater producers who do not report production data, groundwater producers who have not installed water meters on their wells, and groundwater producers present in the IWVGB that are not subject to reporting (i.e. de minimis extractors). Additionally, current litigation has brought into question the accuracy of some self-reported groundwater production data due to inconsistencies with reported groundwater production and documented and stated water use.

The methods that groundwater producers use to report their production include the following:

- Water meters
- Electrical meters
- Estimates based on land use
- Estimates based on population served by groundwater production well

The best engineering estimate of WY 2023 pumping is derived from the combination of all pumping records and sources available to the IWVGA and is presented in the final column in Table 6-1, below. Attachment G provides a more detailed breakdown of pumping categories and the data source for each value. The IWVGA is continually working to improve its estimate of groundwater production in the IWVGB because these data are critical components of the water budget and essential for managing sustainability.

Table 6-1: IWVGB Groundwater Production Estimates

Water Use Sector	Estimated No Action Projections WY 2023 (AF)	WY 2023 Reported Pumping (incomplete) [3]	WY 2023 Total Estimated Pumping (AF) [4, 5]
Urban	7,050	4,300	5,620
Industrial	2,910	2,510	2,570
Agriculture	22,530[2]	7,700	8,110
Other – Federal [1]	2,040	1,380	1,380
Other – Domestic/ Mutuals/Co-Ops/ Community Services District	1,380	150	1,470
TOTAL	**35,910**	(incomplete)	**19,150**

1 Federal groundwater use is for NAWS China Lake and are provided by the U.S. Navy. Federal entities are not required to report monthly production to the IWVGA for the purpose of paying fees established by the IWVGA; however, though not required, the U.S Navy provided monthly production to the IWVGA for the Annual Report.

2 This value includes planned agricultural projections provided by pumpers and probably overestimates future agricultural groundwater production.

3 These values underestimate actual groundwater production in WY 2023 because not all non-de minimis groundwater producers submit data regularly to the IWVGA and because *De minimis* users (those that produce less than 2 acre-feet per year (AFY) or those that have four or fewer connections) are not required to report monthly production to the IWVGA for the purpose of paying fees established by the IWVGA.

4 See Attachment G for a more detailed table.

5 Actual pumping may be higher than estimated.

Table 6-2 below shows annual groundwater production estimates. Groundwater production within the IWVGB has been estimated to decrease since WY 2019 (the first year an Annual Report was prepared). This is due to the implementation of projects and management actions. The decrease in production that occurred in WY 2023 could also be due to the increased precipitation that year. In WY 2023, the estimated total groundwater production was 2.5 times the estimated sustainable yield of 7,650 indicating overdraft conditions have continued in the IWV.

Table 6-2: Total Estimated Pumping by Water Year

Water Year	Total Estimated Pumping (AF)
WY 2019	22,800
WY 2020	21,990
WY 2021	20,800
WY 2022	21,160
WY 2023	19,150

6.2 Surface Water Supply

Natural surface waters are not used as a drinking water supply source in the IWVGB. Approximately 2,540 acre-feet of recycled water was produced at the City of Ridgecrest's wastewater treatment plant during WY 2023 and was used for the following:

- Landscape irrigation (golf course)
- Agricultural irrigation (alfalfa)
- Partial maintenance of the Mojave Tui Chub habitat (environmental water)
- Discharge to evaporation/percolation ponds

Table 6-3 below provides the estimated breakdown of beneficial recycled water use in WY 2023.

Table 6-3: WY 2023 Recycled Water Use.

Recycled Water Use Sector	WY 2023 Estimated Use[1] (AF)
Urban[2]	270
Agriculture[3]	200
Other[4]	830
TOTAL	**1,300**

1 Data provided in email by the City of Ridgecrest to Stetson Engineers Inc on October 18, 2023.
2 Used for irrigation of golf course on NAWS China Lake.
3 Used for irrigation of alfalfa fields for beneficial re-use.
4 Recycled water not used for urban and agricultural irrigation is disposed of in evaporation/percolation ponds. Approximately 2,060 AF was discharged to the ponds in WY 2023. It is estimated approximately 60 percent of the recycled water discharged to the ponds evaporates, with the remaining 830 AF percolating to the groundwater (Provost and Pritchard Consulting Group, 2015). In addition, these ponds partially support the Mojave Tui Chub habitat on NAWS China Lake.

6.3 Total Water Use

Total water use in the IWVGB during WY 2023 is comprised of groundwater supplies and recycled water supplies. See Chapters 6.1 and 6.2 above for additional detail on these supplies.

Table 6-4: WY 2023 Estimated Total Water Use in the IWVGB.

Use Category	**WY 2023 Estimated Total Water Use** (AF)
Groundwater Production	19,150
Recycled Water	1,300
TOTAL	**20,450**

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Chapter 7 Other Data Collection and Basin Management Tasks

In WY 2023, the IWVGA has continued its data collection efforts and basin management tasks to improve Basin understanding and monitor groundwater sustainability, in addition to the regular groundwater level monitoring discussed in Chapter 5. These efforts help address the data gaps outlined in the GSP and are listed below:

- Data gaps associated with groundwater monitoring in the El Paso subarea
- Data gaps associated with streamflow and mountain front recharge
- Data gaps associated with the subsurface flow from Rose Valley into IWVGB
- Data gaps associated with the subsurface flow out of IWVGB to Salt Wells Valley
- Data gaps associated with groundwater dependent ecosystems (GDEs)
- Data gaps associated with aquifer properties

Summaries of key tasks are provided below.

7.1 Annual Groundwater Quality Sampling

Twenty-four groundwater quality samples were collected and sent to a laboratory for analysis in October 2022 from twenty monitoring wells and 4 domestic wells within the IWVGB. The purpose of this annual sampling was to obtain representative data to compare to the interim milestones for the sustainable management criteria, augment data in the existing water quality database, and address some data gaps for sustainable management of the IWVGB. Results from this sampling, provided in Attachment H, will be used to refine the existing IWVGB monitoring network (GSP § 354.34), validate the hydrogeologic conceptual model (HCM) (GSP § 354.14), and update the numerical groundwater model (GSP § 354.16) for the 2025 GSP Evaluation.

7.1.1 TDS Results

Salinity, represented by total dissolved solids (TDS), is one of two main groundwater quality constituents of concern in the IWVGB. The lowest observed TDS concentration collected in Fall 2022 was 160 mg/L at monitoring well AB303-05 (952-955 feet depth) and at monitoring well AB303-03 (497-500 feet depth) in the El Paso Subarea. The highest observed TDS concentration collected in Fall 2022 was 19,000 mg/L (572-575 feet depth) from the deep screen interval of monitoring well 26S/39E-05K01 near the southwest fence line on the Navy Base.

The areal distribution of TDS concentrations from the October 2022 sampling event are displayed on Figure 7-1. Five of the twenty-four wells sampled had TDS concentrations equal to or greater than 1,000 mg/L: 26S/39E-05L01(S) and 26S/39E-05K01(D) near the southwestern Navy fence line, 26S/40E-22E1 and -22E2 near Navy administration buildings, and 27S/40E-01K02 (George Air Corridor) east of Ridgecrest. TDS concentrations above the Secondary Maximum Contaminant Level (SMCL) (500 mg/L) were also present in the northwest, while lower TDS concentrations (<500 mg/L) occurred in the El Paso subarea and along the Sierra Nevada Mountain front. Results from the October 2022 water quality samples are consistent with historical data presented in the January 2020 GSP.

Historical TDS trends are plotted in Figure 7-2 for 11 wells with three or more TDS measurements. TDS results at IWVGB monitoring wells are summarized below.

- Monitoring well 25S/38E-03B is located in the northwest of IWV basin near U.S. Highway 395 by Pearsonville and is screened from 300 to 360 feet below ground surface (bgs). Five TDS samples have been collected from 2007 to 2022. The TDS concentration taken in Fall 2022 was 580 mg/L. This was a decrease of 10 mg/L from Fall 2021 (570 mg/L).

- Domestic well 25S/38E-14A is located in the northwest of IWV basin, southeast of well 03B. Four TDS samples have been collected from 2019 to 2022. TDS concentrations at 25S/38E-14A ranged from 400 mg/L (2020) to 450 mg/L (2021), and then decreased to 430 mg/L in October 2022.

- Domestic well 25S/38E-34A01 is also located in the northwest of IWV near U.S. Highway 395 directly south of 03B. This well is screened from 418.5 to 478.5 ft bgs. Five TDS samples have been collected from this well from 2006 to 2022 with TDS concentrations ranging from 260 mg/L (2006) to 530 mg/L (2019). TDS in 25S/38E-34A01 increased 70 mg/L from 2021 (450 mg/L) to 2022 (520 mg/L).

- Navy monitoring well 25S/39E-03R01 (Baker Range) is located on the northern range of the Navy base, and is screened from 65 to 165 ft bgs. Four TDS samples have been collected from this well from 2019 to 2022. TDS concentrations range from 660 mg/L (2019) to 590 mg/L (2021). TDS in the Baker Range well increased 20 mg/L from 2021 (590 mg/L) to 2022 (610 mg/L).

- Navy monitoring well 25S/39E-12R (Charley Tower) is located near the northern playa on NAWS China Lake. This well is screened from 60 to 140 ft bgs. Twenty-six TDS samples have been collected from this well from 1953 to 2022. TDS concentrations range from 650 mg/L (July 1978) to 780 mg/L (October 1961). The 2022 TDS concentration of 690 mg/L was a decrease of 30 mg/L from the previous year.

- Domestic well 26S/38E-01M05 is located north of Inyokern. This well is screened from 299 to 359 ft bgs. Water quality samples have been collected from this well during the last three annual sampling events and ranged from 520 mg/L (November 2020) to 570 mg/L (October 2021). The 2022 TDS concentration at 26S/38E-01M05 was measured at 530 mg/L showing a decrease in concentration of 40 mg/L from the previous year.

- Monitoring well 27S/38E-13A02 (AB303-01) is located in the southwest area of the IWVGB just south of Bowman Road and east of Red Rock Canyon Road. This well is screened from 232 to 272 ft bgs, 372 to 472 ft bgs, and 632 to 690 ft bgs. Two TDS samples were collected from this well in 2007 and 2021. TDS concentrations range from 300 mg/L (August 2007) to 340 mg/L (October 2021). The 2022 TDS sample was collected from the mid-level screen with a concentration of 300 mg/L.

- Navy monitoring well 27S/40E-01K02 (George Air Corridor) is east of Ridgecrest on Navy property. This well is screened from 320 to 380 ft bgs. Five TDS samples have been collected from this well from 1953 to 2022. TDS concentrations range from 1,000 mg/L (October 2022) to 1,510 mg/L (June 1972). The 2022 TDS concentration was measured at 1,000 mg/L showing a decrease in concentration of 200 mg/L from the previous year.

El Paso Subarea Monitoring Wells

- Monitoring well 27S/38E-09C01 (AB303-04) is located in the El Paso subarea of the IWVGB near Highway 14. This well is screened from 501 to 581 ft bgs. Four TDS samples have been collected from this well from 2007 to 2022. TDS concentrations range from 290 mg/L (November 2020) to 460 mg/L (August 2007). The current TDS concentration was measured at 290 mg/L,a decrease in concentration of 60 mg/L from 2021 to 2022.

- Monitoring well 27S/38E-21L01 (AB303-05) is located in the El Paso subarea and screened from 905 to 1,005 ft bgs. Five TDS samples have been collected from this well from 2007 to 2022. TDS

concentrations range from 160 mg/L (November 2020) to 510 mg/L (August 2007). The 2022 TDS concentration was measured at 160 mg/L, a decrease in concentration of 40 mg/L from 2021 to 2022.

7.1.2 Arsenic Results

Arsenic is the other defined contaminant of concern in the IWVGB. The maximum contaminate level for arsenic in drinking water is 10 µg/L. Figure 7-3 shows the areal distribution of arsenic in groundwater concentrations from October 2022. The lowest observed arsenic concentrations collected during October 2022 was 1.3 µg/L observed in wells AB303-01 (397-400 ft bgs) and AB303-04 (557-560 ft bgs). The highest observed arsenic concentration was 330 µg/L at Navy monitoring well 26S/40E-22E02 (557-600 ft bgs). These samples will provide a baseline for future arsenic samples collected.

7.2 Los Angeles Department of Water and Power Water Releases

In March 2023, the Los Angeles Department of Water and Power (LADWP) began releasing water from the Los Angeles Aqueduct into the Indian Wells Valley at the following locations: Freeman Wash, Bouder Draw, Indian Wells, Sage Canyon, and Bird Springs. Flow paths indicate that released water from Boulder Draw and Indian Wells Canyon flows into northern IWV stream channels, while water released from Freeman Wash, Sage Canyon and Bird Springs flows into the El Paso subarea. During the Spring 2023 water level measurement, seven (7) dataloggers at monitoring wells along potential flow paths were installed to measure groundwater level changes. In addition, water quality samples of the released water were collected. A report presenting the collected data will be released in WY 2024.

7.3 Rose Valley Subsurface Flow Monitoring and Evaluation

Permitting with the United States Bureau of Land Management (BLM), California State Lands (CSL), and Inyo County was completed during WY 2022 for drilling two new monitoring wells and evaluating a capped former sawmill well south of Little Lake. Drilling of RVS-MID was funded by a Cooperative Agreement with the U.S. Navy. The well was installed in Spring 2023. Since July 6, 2023, a datalogger has been installed in RVS-MID and two manual measurements have been taken. In WY 2023, permitting was pursued for an alternative well site for the second Rose Valley subsurface flow monitoring well. This well

is anticipated to be drilled in WY 2024. Groundwater levels from these wells will be used to fill a data gap for estimating subsurface flow from Rose Valley into Indian Wells Valley. In WY 2023, a draft report was prepared to summarize the results of a hydrogeologic analysis of the Rose Valley groundwater Basin and an estimate of the underflow from Rose Valley Groundwater Basin into the IWVGB. This report will be finalized in WY 2024.

7.4 El Paso Monitoring and Evaluation

On January 26, 2021, the IWVGA entered into an agreement with DWR for Technical Support Services to drill and construct one triple-nested monitoring well (EP-01) in the El Paso Subbasin. The well and monitoring equipment was installed in WY 2021. Beginning in 2021, the IWVGA has monitored EP-01 and maintained the data records consistent with other groundwater monitoring program wells; reporting EP-01 groundwater levels to the DMS as well as uploading this data to the DWR SGMA data portal. The IWVGA has continued to work with DWR to obtain telemetry equipment for this well in 2023. This monitoring well is important for filling in groundwater level data gaps in the El Paso Subbasin and defining hydrogeologic characteristics in the Basin.

In WY 2023, a draft report reviewing the hydrogeologic features and groundwater chemistry of the El Paso Subarea was prepared. This report will be finalized in WY 2024.

7.5 Brackish Water Investigation

Brackish water groundwater resources in the IWV have been the subject of ongoing study by the IWVWD and funding partners for several years with the goal of determining feasibility of developing brackish resources as an alternative water supply.

In WY 2023, work continued on preparing the first phase of the Feasibility Study to be submitted to DWR in WY 2024. Most of the brackish water in the IWVGB is believed to be underlying federal property at NAWS China Lake. To date, the U.S. Navy has not permitted drilling or sampling of brackish water on NAWS China Lake in conjunction with this Feasibility Study. Consequently, additional project phases are unlikely to be pursued.

7.6 Numerical Model

The numerical groundwater model developed for the Indian Wells Valley (IWV) Groundwater Sustainability Plan (GSP), GSP Model, is the primary tool used by the IWVGA TAC and Staff to quantify the occurrence and movement of groundwater, and to develop planning scenarios for managing the water resources of the IWVGB. In 2021, a Configuration Management Plan (CMP) was developed for determining the process of technical review of new data, making recommendations to the GA Board for model updates, and documenting any model revisions. A key component of this plan is the establishment of a Technical Modeling Group (TMG). At the end of 2022, the TMG prepared a list of groundwater model configuration items (CIs) that was recommended to the GA Board for model updates.

The TMG conducted 25 meetings to implement the Configuration Management Plan during WY 2023. These meetings are summarized in Attachment I. Tasks and subtasks completed in WY 2023 include:

- Task 1 Model Domain Boundary
  - Subtask 1a. Define base of model domain
  - Subtask 1b. Define aerial extent of groundwater basin boundary
- Task 2 Hydrogeologic Conceptual Model
  - Subtask 2a. Inclusion of faults
  - Subtask 2b. Hydrogeologic framework
  - Subtask 2c. Aquifer properties
- Task 3 Hydrologic Budget
  - Subtask 3a. Spatial distribution of mountain-front recharge
  - Subtask 3b. Spatial distribution of bare soil evaporation and evapotranspiration

This work will be used as part of the GSP Plan Amendment in 2025.

7.7 Data Management System

The IWVGA maintains a data management system (DMS) to support SGMA implementation. The SGMA regulations require having a DMS to support a GSA. This DMS consists of both a database part to store data and a public website to present data. Examples of stored data include monitoring data,

management criteria, and other supporting documentation. Server logs show the public have been accessing and using DMS. IWVGA has used the DMS website to help inform meetings and improve basin management.

As a software system, operation of the DMS requires periodic maintenance and updates. During WY 2023, IWVGSP spent funding and time to update databases, as well as update software. Database updates included the addition of new groundwater and surface water monitoring data. Other work included more review of existing entries for accuracy. Software updates included security updates and functionality improvements. Additional updates to the DMS will be made, as necessary, to address DWR's RCAs.

7.8 Precipitation Station and Stream Gage Data Collection

The IWVGA collects precipitation and stream flow data from precipitation stations and stream gages installed throughout the IWV. In 2020 IWVGA installed two precipitation stations and two stream gage stations to augment historical and current monitoring location data. During WY 2023, the IWVGA continued to operate these stations and gages, utilizing telemetry to transmit provisional data to the DMS. Various issues were encountered during WY 2023 including issues with flooding and issues with damage and theft of equipment. Data records are posted to the DMS annually concurrent with this Report, and presented in the summary reports in Attachment J.

Various data sets will be used to refine the existing IWV groundwater basin monitoring network (GSP § 354.34), validate the hydrogeologic conceptual model (HCM) (GSP § 354.14), and update the numerical groundwater model (GSP § 354.16) for the GSP Plan Amendment in 2025.

7.9 Groundwater Dependent Ecosystems

Three[10] groundwater dependent ecosystem (GDE) sites were identified by a Navy biologist based on vegetation type during WY 2022. The GDE monitoring program will evolve through the next few years as

[10] Nine potential groundwater dependent ecosystem (GDE) sites were investigated during August 11, 2021 and June/July 2022 field visits.

data are collected and more vegetation surveys are completed. In WY 2023, the U.S. Navy conducted biological surveys at GDE monitoring sites. A report on these surveys is anticipated for WY 2024.

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