

INDIAN WELLS VALLEY GROUNDWATER BASIN

FINAL DRAFT

GSP Annual Report

Water Year 2023

(October 1, 2022 to September 30, 2023)

March 2024

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Contents

Chapter 1 Executive Summary	1
Chapter 2 General Information.....	5
Chapter 3 Progress Towards GSP Implementation and Sustainability	7
3.1 Projects and Management Actions.....	7
3.1.1 Management Action 1: Annual Pumping Allocation Plan, Transient Pool, and Fallowing Program 8	
3.1.2 Project 1: Develop Imported Water Supply.....	8
3.1.3 Project 2: Optimize Recycled Water	11
3.1.4 Project 3: Conservation Efforts	12
3.1.5 Project 4: Shallow Well Mitigation Program.....	13
3.1.6 Project 5: Dust Control Mitigation Program	14
3.1.7 Project 6: Pumping Optimization Project	14
3.2 Progress Towards Sustainable Management Criteria.....	14
3.2.1 Chronic Lowering of Groundwater Levels.....	15
3.2.2 Reduction of Groundwater in Storage.....	17
3.2.3 Degraded Water Quality	17
3.2.4 Land Subsidence Related to Groundwater Pumping	19
3.3 Progress Made on Addressing Recommended Corrective Actions	19
3.4 Outreach and Engagement	21
Chapter 4 Hydrologic Conditions	23
Chapter 5 Groundwater Elevation Data.....	25
5.1 Groundwater Elevation Contour Maps.....	26
5.2 Hydrographs.....	26
5.3 Estimated Change in Groundwater Storage	29

5.3.1	Groundwater Level Change from Spring 2022 to Spring 2023	29
5.3.2	Estimating Storage Change Using Modified Thiessen Polygon Method.....	30
Chapter 6 Water Supply Data		35
6.1	Groundwater Extraction Data	35
6.2	Surface Water Supply.....	38
6.3	Total Water Use	39
Chapter 7 Other Data Collection and Basin Management Tasks.....		41
7.1	Annual Groundwater Quality Sampling	41
7.1.1	TDS Results.....	41
7.1.2	Arsenic Results	43
7.2	Los Angeles Department of Water and Power Water Releases	44
7.3	Rose Valley Subsurface Flow Monitoring and Evaluation.....	44
7.4	El Paso Monitoring and Evaluation	45
7.5	Brackish Water Investigation	45
7.6	Numerical Model	45
7.7	Data Management System.....	46
7.8	Precipitation Station and Stream Gage Data Collection	47
7.9	Groundwater Dependent Ecosystems	47
Chapter 8 References.....		49

List of Tables

Table 3-1: Representative Monitoring Sites for Chronic Lowering of Groundwater Levels	16
Table 3-2: Representative Monitoring Sites for Degraded Water Quality	18
Table 3-3: Recommended Corrective Actions Summary	20
Table 4-1: Percent Exceedance Ranges and Dividing Thresholds for Five Water Year Types	24
Table 4-2: Water Year Types based on Precipitation at China Lake NAF Station (No. 041733)	24
Table 5-1: Estimated Annual Change to Groundwater in Storage, Spring 2022 to Spring 2023	32
Table 5-2: WY 2020 to WY 2023 Estimated Groundwater Storage Change, Modified Thiessen Polygon Method	33
Table 6-1: IWVGB Groundwater Production Estimates	37
Table 6-2: Total Estimated Pumping by Water Year	38
Table 6-3: WY 2023 Recycled Water Use	38
Table 6-4: WY 2023 Estimated Total Water Use in the IWVGB.	39

List of Figures

Figure 2-1	Indian Wells Valley Groundwater Basin and Indian Wells Valley Groundwater Authority Boundaries
Figure 3-1	Chronic lowering of Groundwater Levels Representative Monitoring Sites
Figure 3-2	Water Quality Degradation Representative Monitoring Sites
Figure 4-1	Annual Precipitation Exceedance in IWVGB at Index Station China Lake NAF
Figure 5-1	Estimated Fall 2022 Groundwater Elevation Contours
Figure 5-2	Estimated Spring 2023 Groundwater Elevation Contours
Figure 5-3	Estimated Fall 2022 Groundwater Depth Contours
Figure 5-4	Estimated Spring 2023 Groundwater Depth Contours
Figure 5-5	Monitoring Wells with Hydrographs in Attachment E
Figure 5-6	Annual Groundwater Level Change WY 2023
Figure 5-7	Modified Thiessen Polygon Method Estimating Changes to Groundwater in Storage
Figure 5-8	Estimated Groundwater Storage Change WY 2016-2023
Figure 6-1	Pumping Well Location Map
Figure 7-1	Groundwater Quality – TDS, Fall 2022

Figure 7-2 Historical TDS Concentrations

Figure 7-3 Groundwater Quality – Arsenic, Fall 2022

List of Attachments

Attachment A DWR Annual Report Submittal Tables

Attachment B Historical Water Year Types Based on Precipitation at China Lake NAF (No. 041733)

Attachment C Groundwater Monitoring Program Updates

Attachment D WY 2023 Groundwater Level Data

Attachment E Hydrographs for Select Monitoring Wells

Attachment F Storage Change Estimate Using Thiessen Polygon Method

Attachment G Estimated WY 2023 Groundwater Production

Attachment H WY 2023 Water Quality Data

Attachment I IWV Model Configuration Item List

Attachment J WY 2022 Precipitation and Stream Gage Data

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 (IWWVD) 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 IWWVD 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 priority¹. As such, in compliance with SGMA, the associated groundwater sustainability agency (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,

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.

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 IWWVD has continued its conservations efforts for its customers, independent of the IWVGA, as described in IWWVD's 2020 Urban Water Management Plan. The IWVGA intends to cooperatively work with the IWWVD 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 IWWVD. 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 GSP² 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

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.

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 (<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. - Address Communication & Engagement Plan.	- The Communication & Engagement Plan was amended in WY 2023. - 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 2024 after additional modeling runs are completed.

Recommended Corrective Action Summary	Current Progress and Next Steps
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 levels³ (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 Geologist⁴ 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.iwvgs.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 selected wells include seven nested multi-level piezometers (note: data for nested multi-level

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

piezometers appear on the same hydrograph), for a total of 30 groundwater level measurements. Groundwater level data collected by KCWA, the Navy, IWWVD 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 Nine Mile 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 measured⁵. 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.
- Sandquist Spa Well (Attachment E, page 3, upper graph)

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).

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 IWWVD 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 IWWVD 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 IWWVD 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 117 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 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 and red dots at 17 wells represent observations with a 1-foot to 6.3-foot drop in groundwater levels; and yellow and light orange dots at 51 wells display groundwater levels dropping up to 1 foot. The highest levels of groundwater elevation change observed (red dots) typically 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 (red and orange dots) to the southwest of Inyokern, where an increase or no change in groundwater levels were observed during the 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 green and blue dots in Figure 5-6. This condition seems to occur mostly outside of the Inyokern area. The cause of these increases to the groundwater levels in these areas is not fully understood .

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 basin⁷. 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 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 ID⁸ in parentheses.

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.

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

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 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
<i>Hydrologic Condition</i>		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 IWVGB⁹. 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 IWW.

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, Boulder 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 by the IWVWD.

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

Three¹⁰ 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 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.

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

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FIGURES

FIGURE 2-1

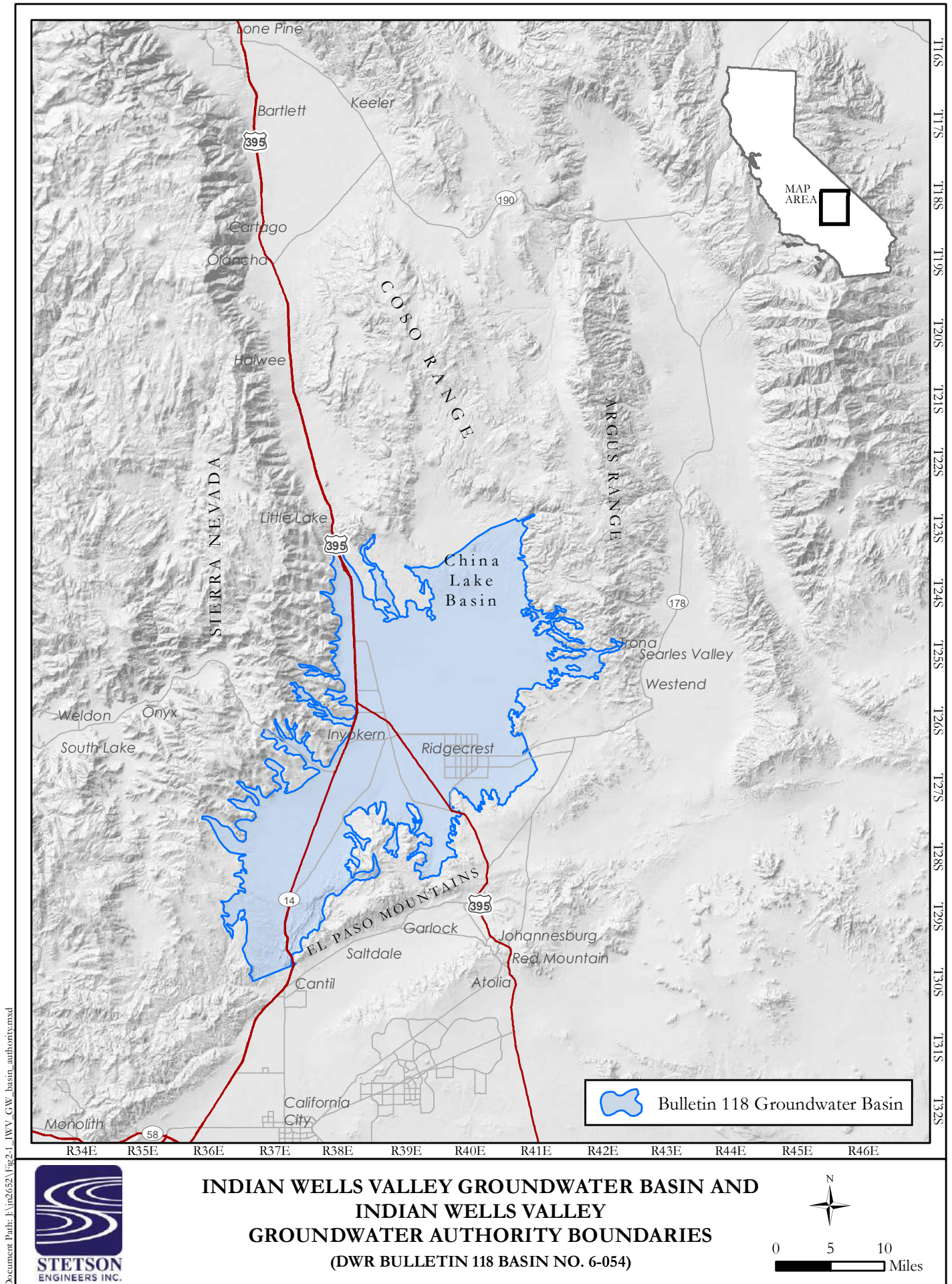
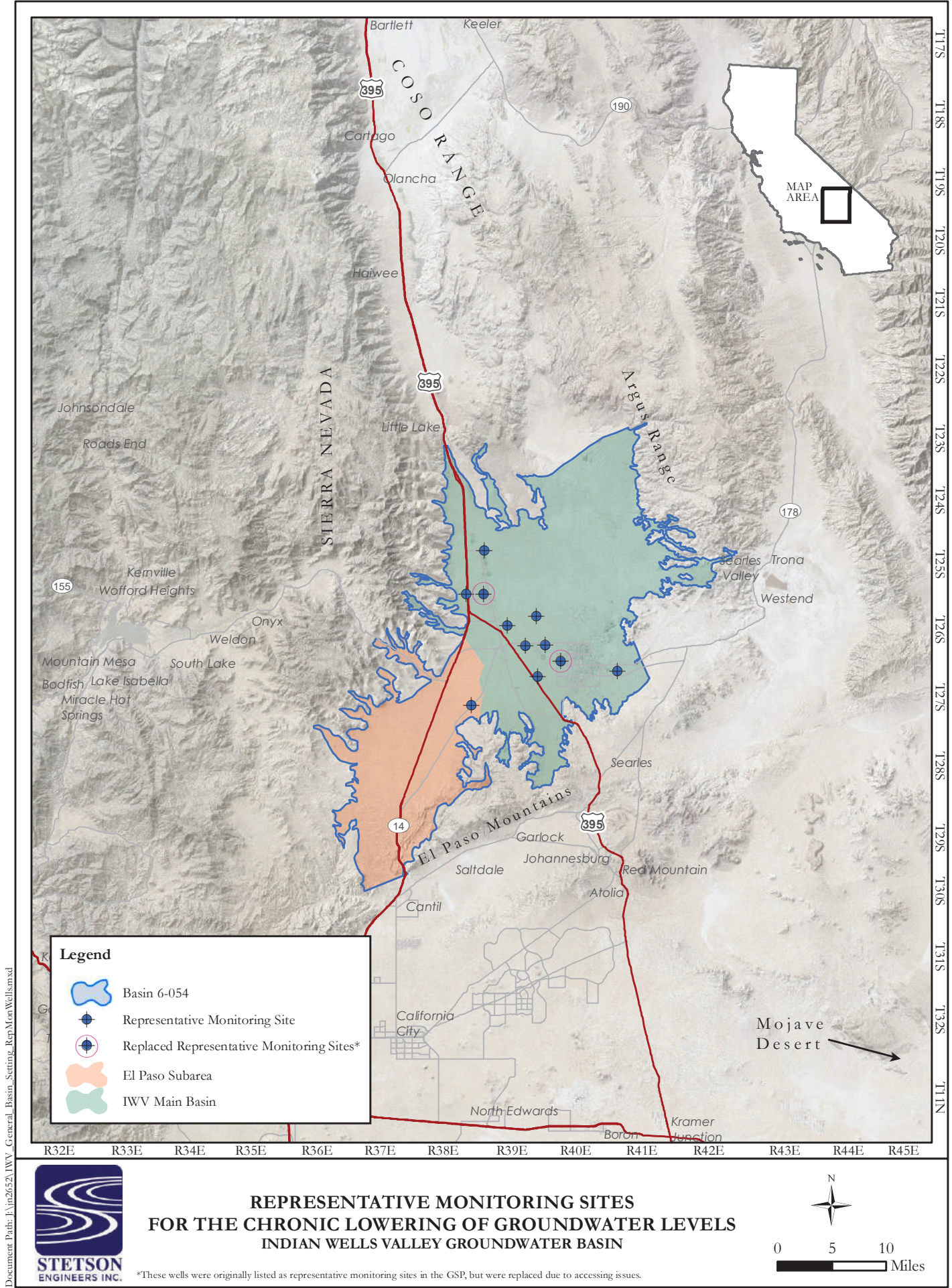
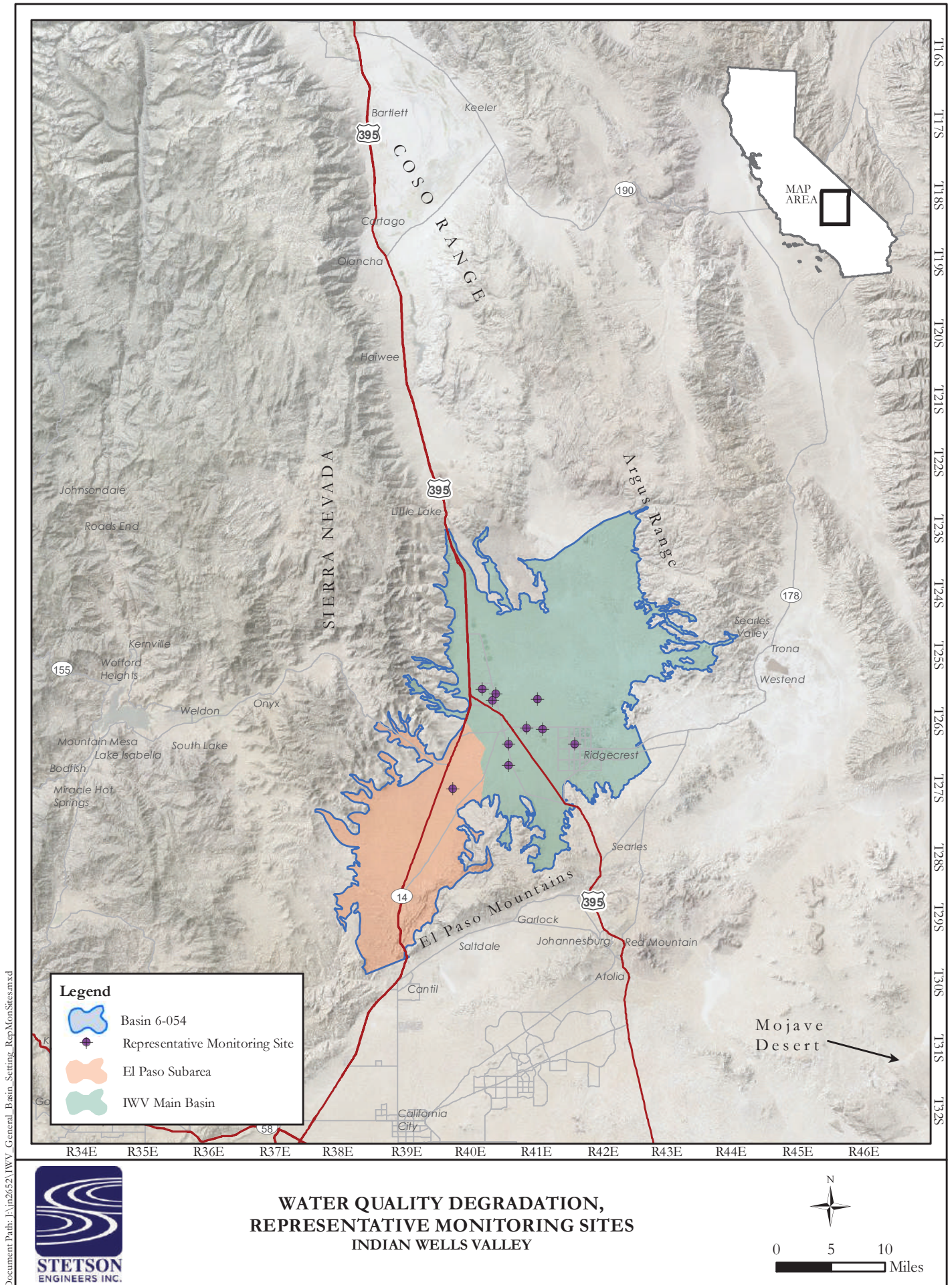


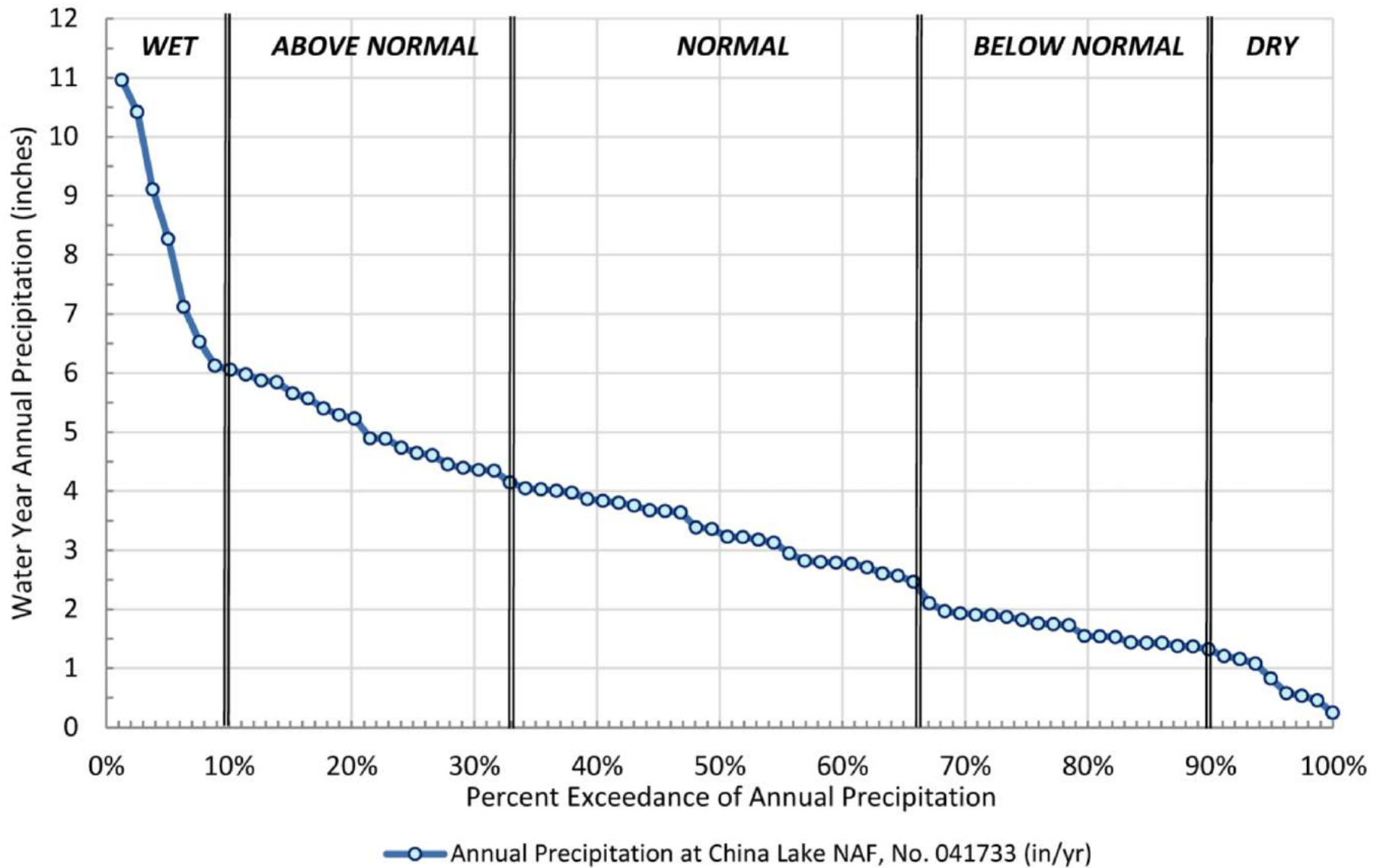
FIGURE 3-1



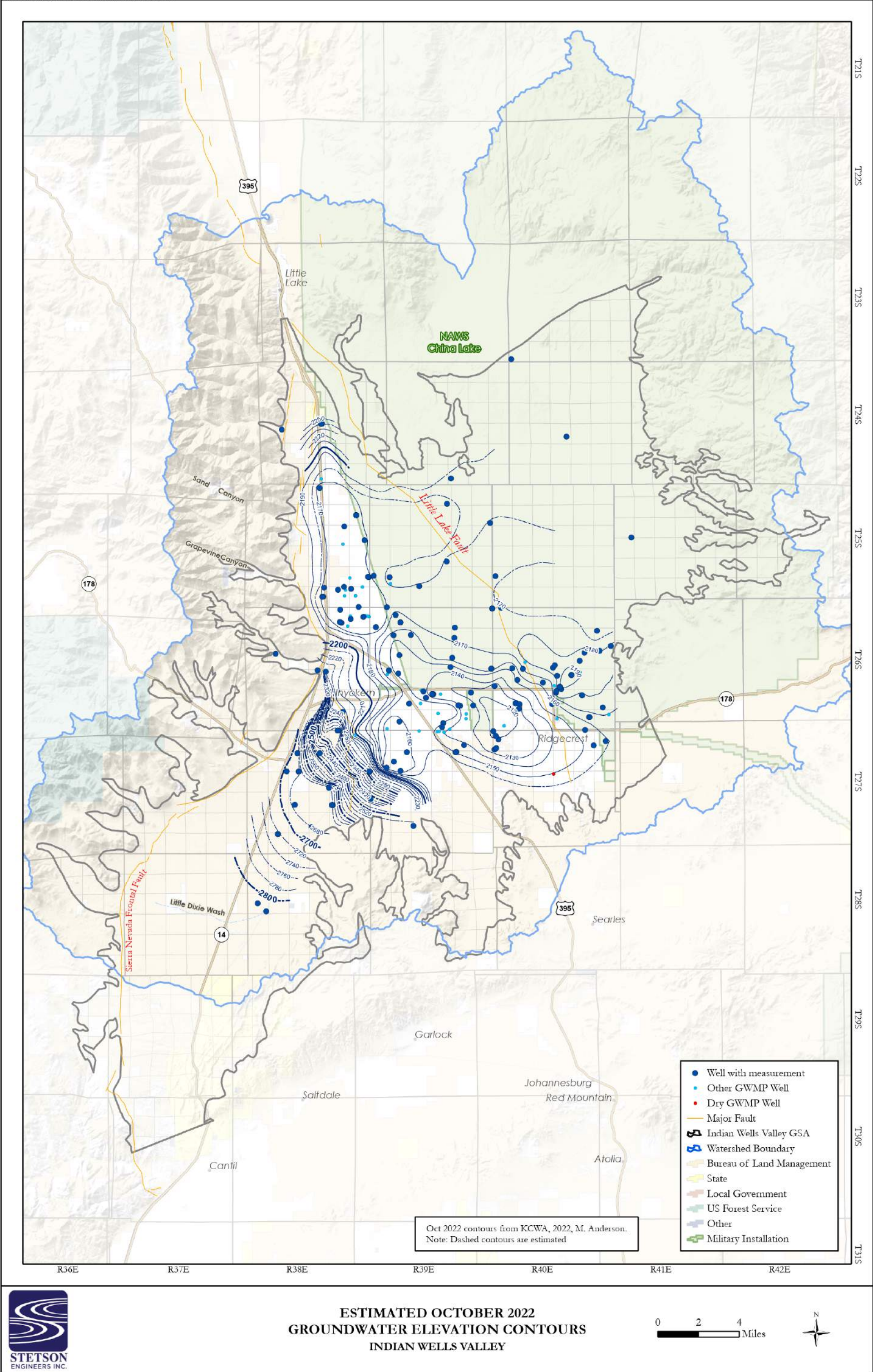
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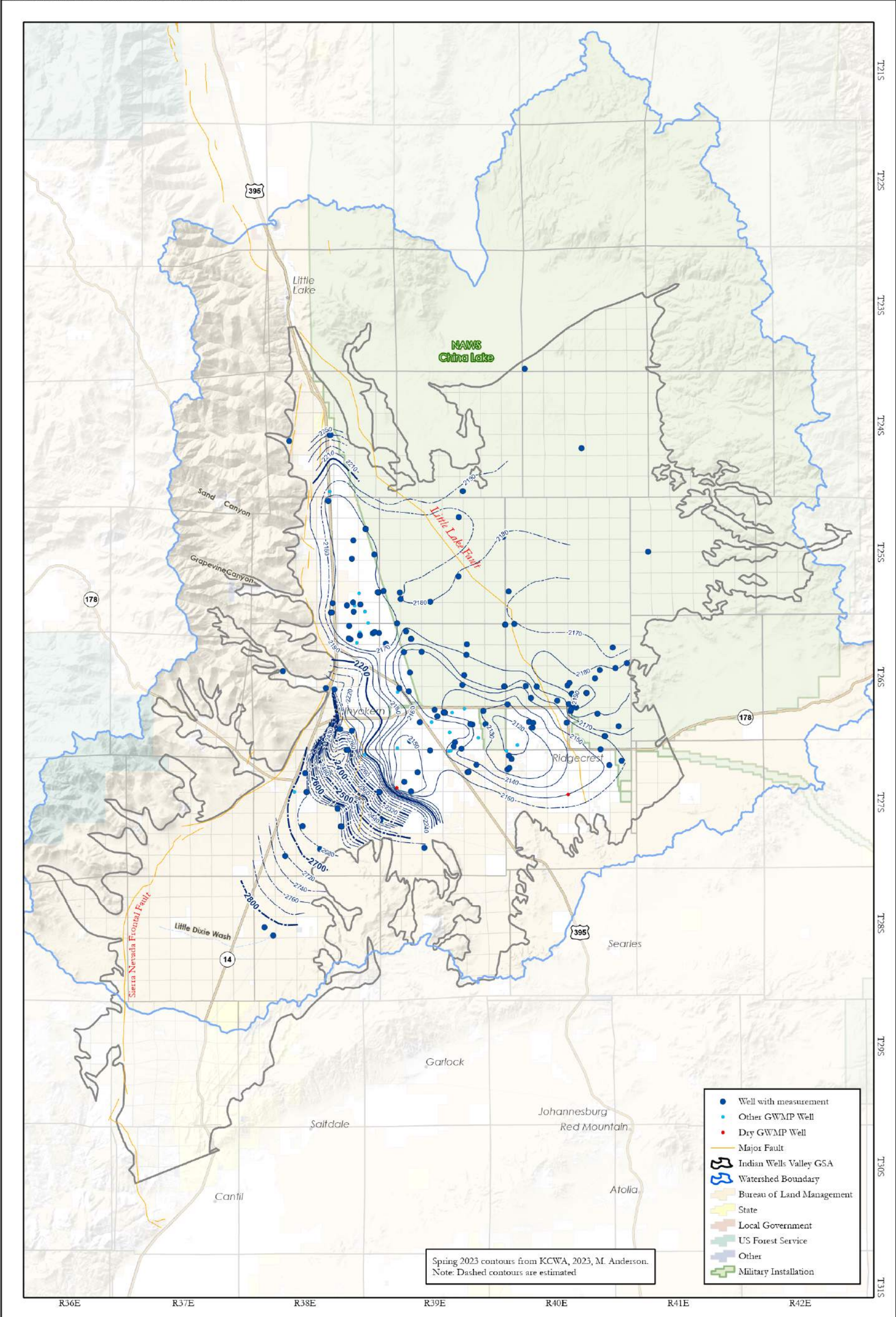
FIGURE 3-2

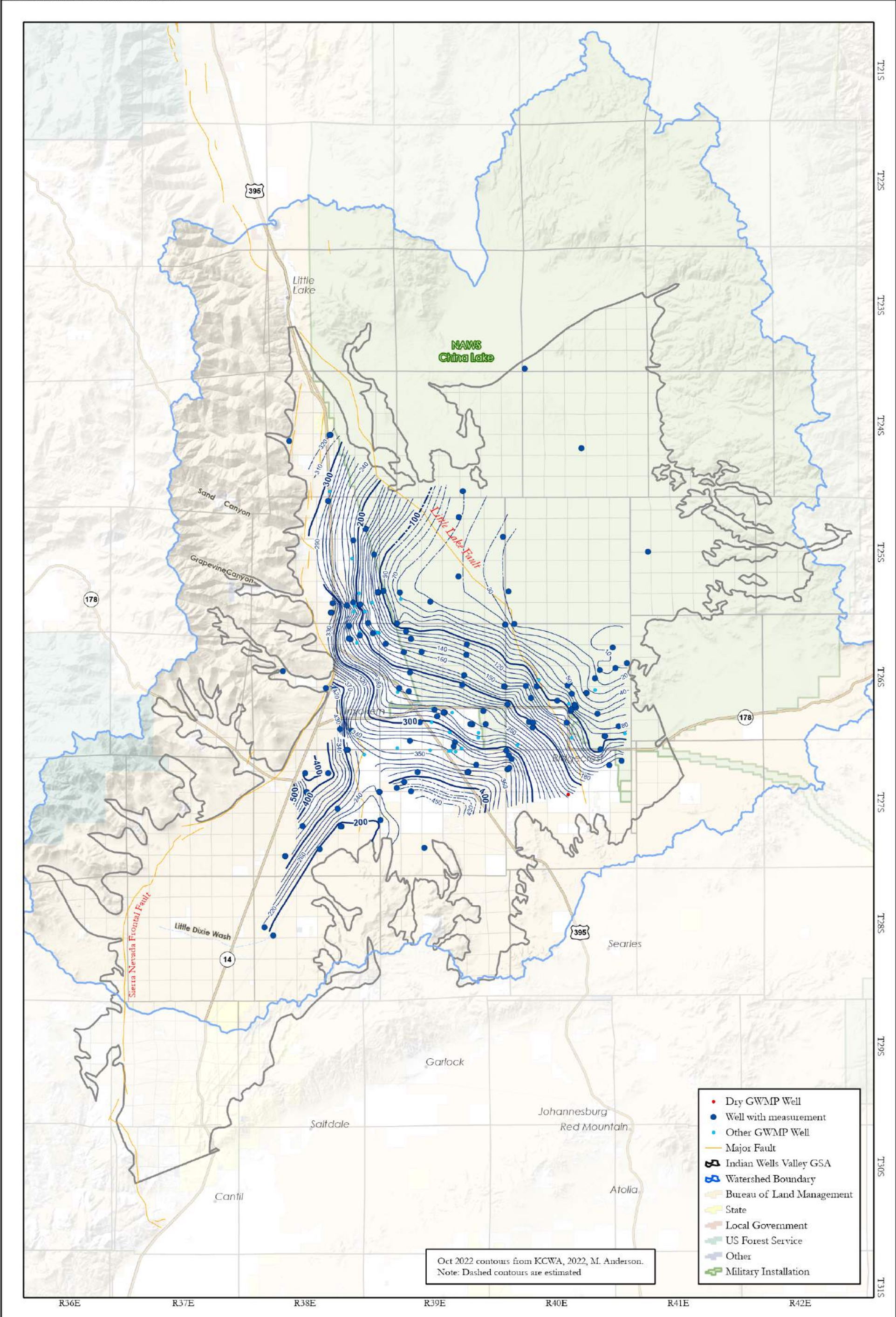




ANNUAL PRECIPITATION EXCEEDANCE IN IWWGB
HYDROLOGIC INDEX WATER YEARS 1945-2023
INDIAN WELLS VALLEY, CA







**ESTIMATED FALL 2022
GROUNDWATER DEPTH CONTOURS
INDIAN WELLS VALLEY**

0 2 4 Miles



FIGURE 5-3

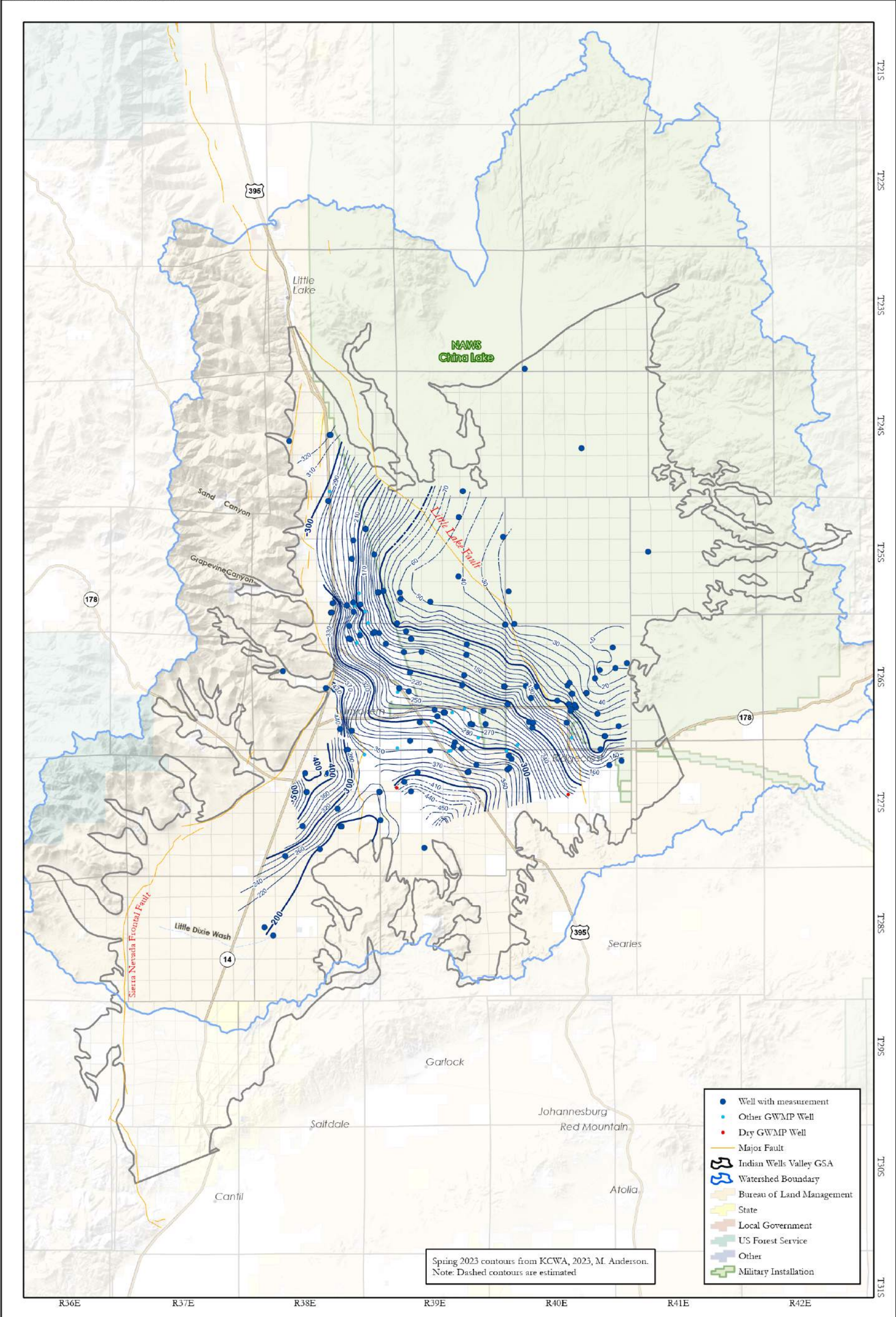
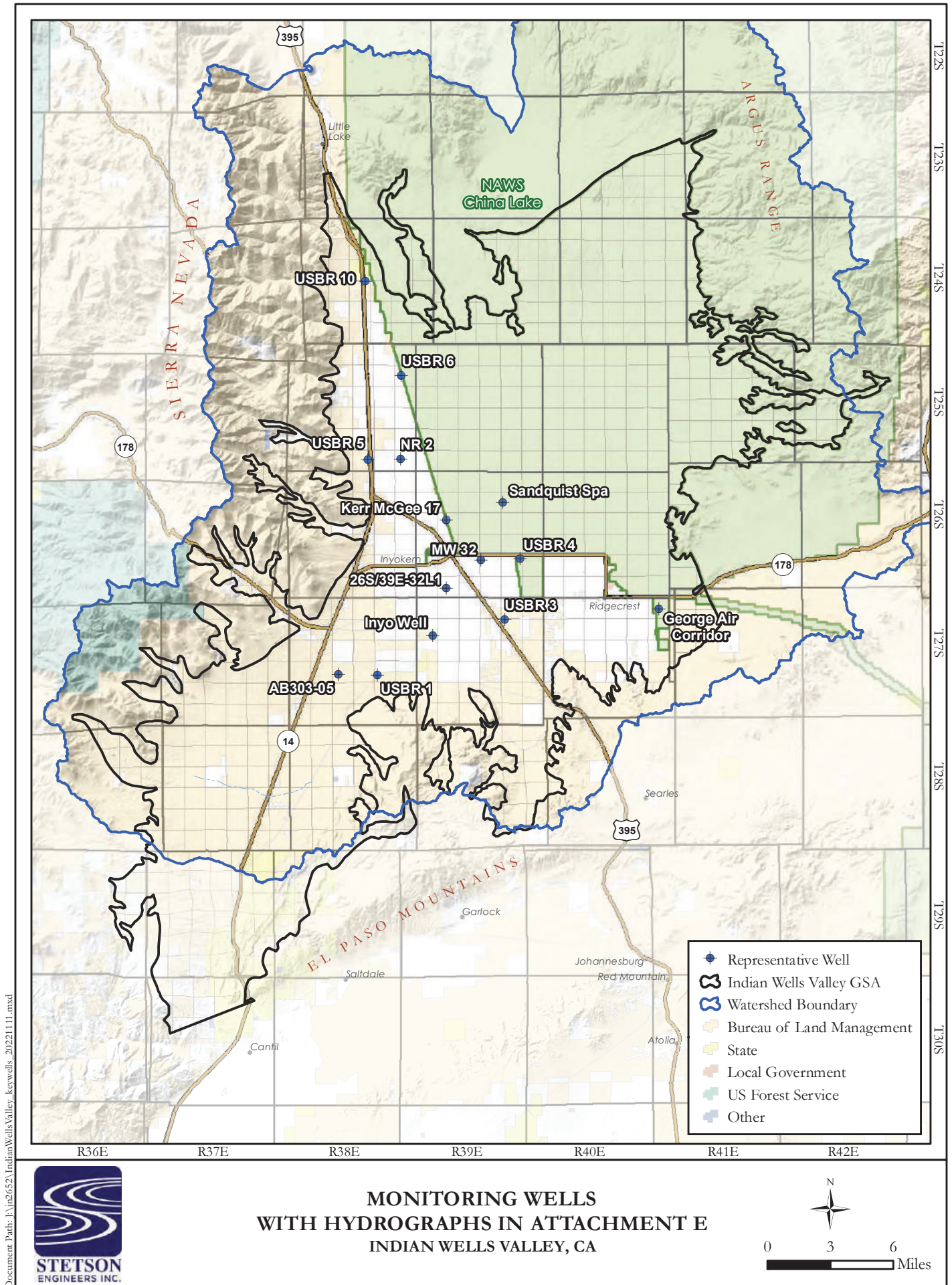
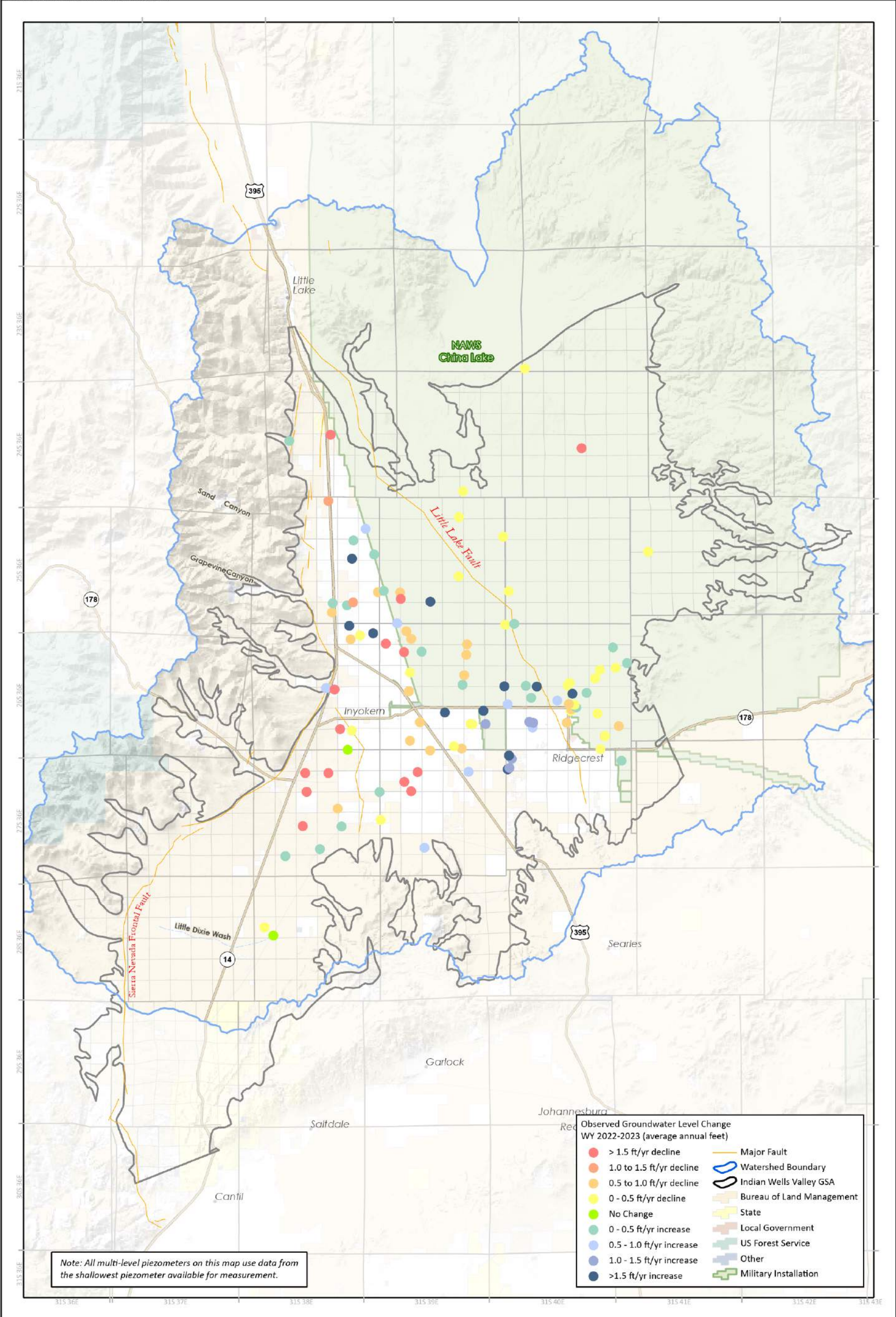
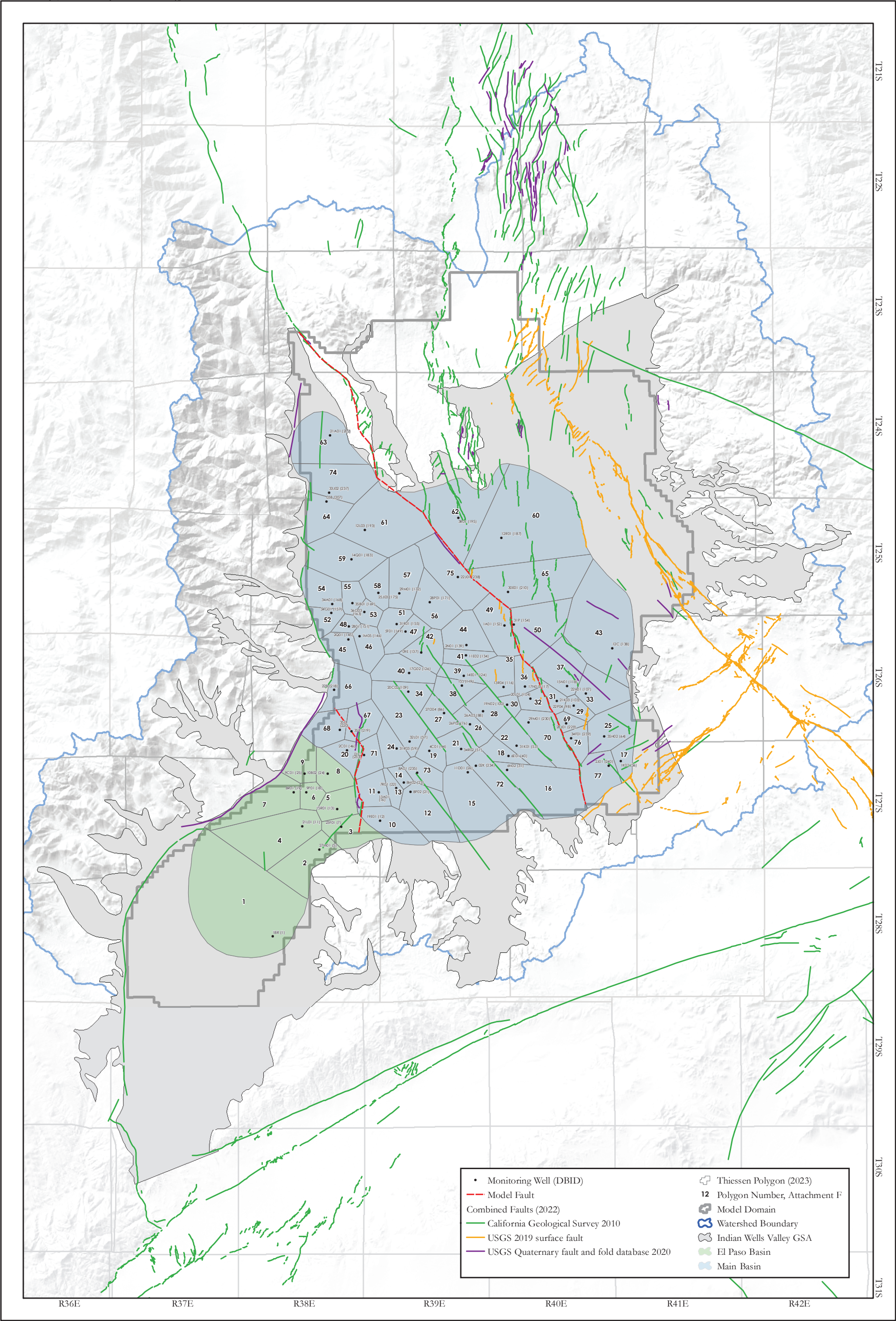


FIGURE 5-5







DBID: Database ID used in Data
Management System (DMS) website invgsp.com

**MODIFIED THIESSEN POLYGON METHOD
ESTIMATING CHANGES TO GROUNDWATER IN STORAGE
INDIAN WELLS VALLEY, CA**

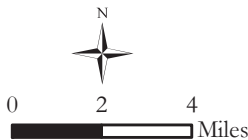
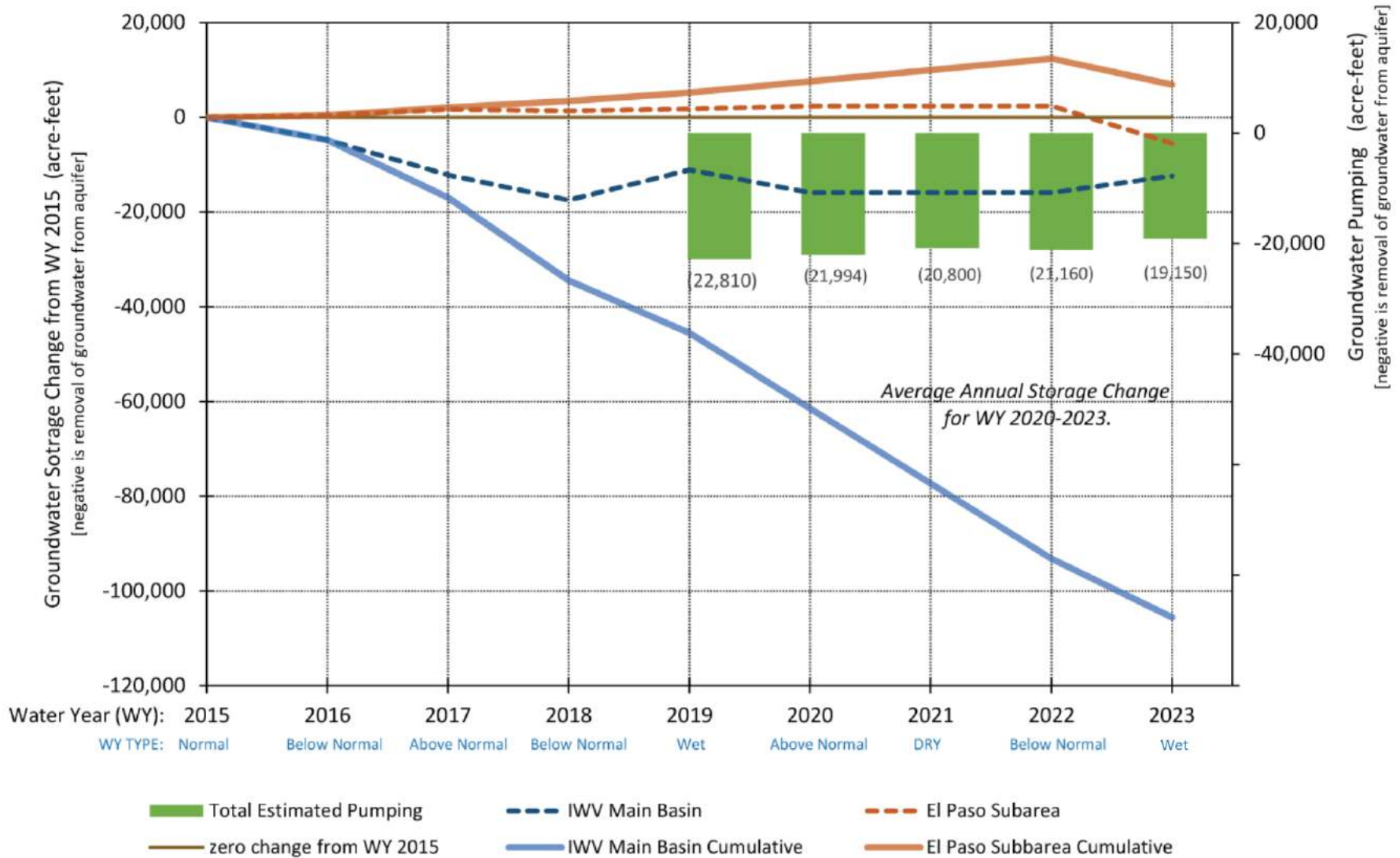
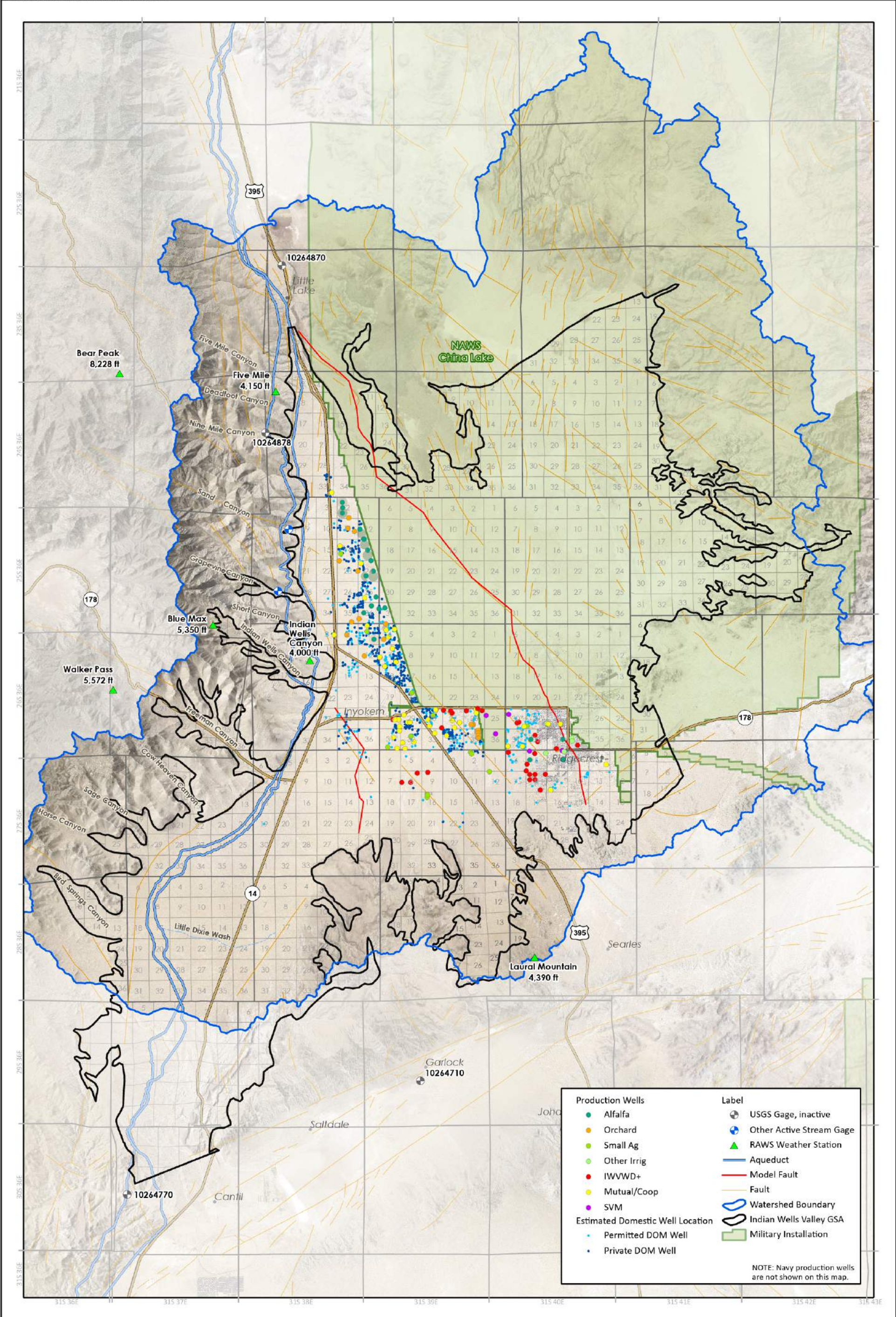


FIGURE 5-7



**ESTIMATED GROUNDWATER STORAGE CHANGE WY 2016-2023
WITH RECENT GROUNDWATER PUMPING
INDIAN WELLS VALLEY, CA**

Note: Groundwater storage change is estimated based on the Thiessen polygon method for measured area of basin (see IWV Annual Report).



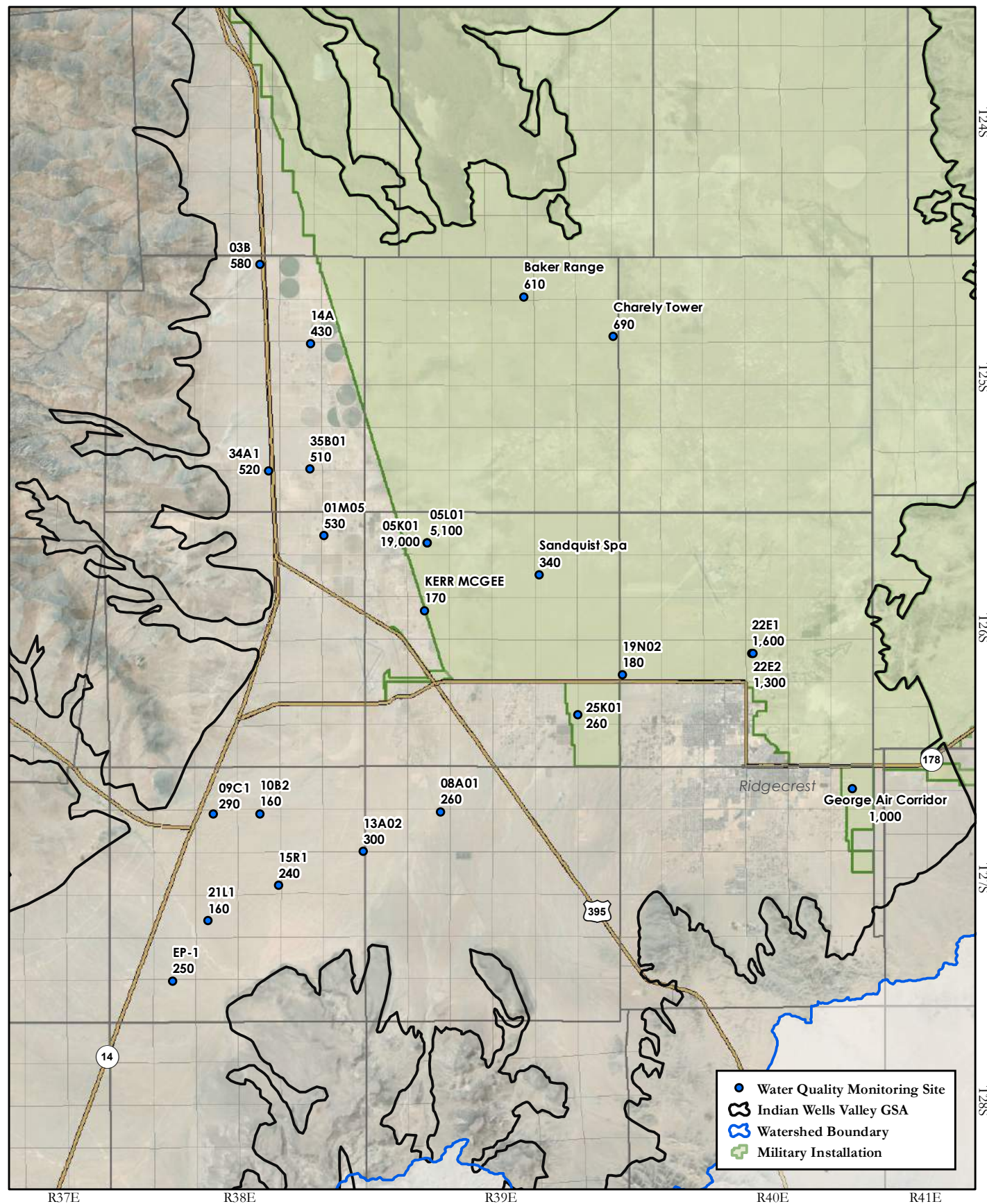
PUMPING WELL LOCATION MAP
INDIAN WELLS VALLEY, CA

0 2 4
Miles



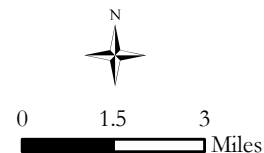
FIGURE 6-1

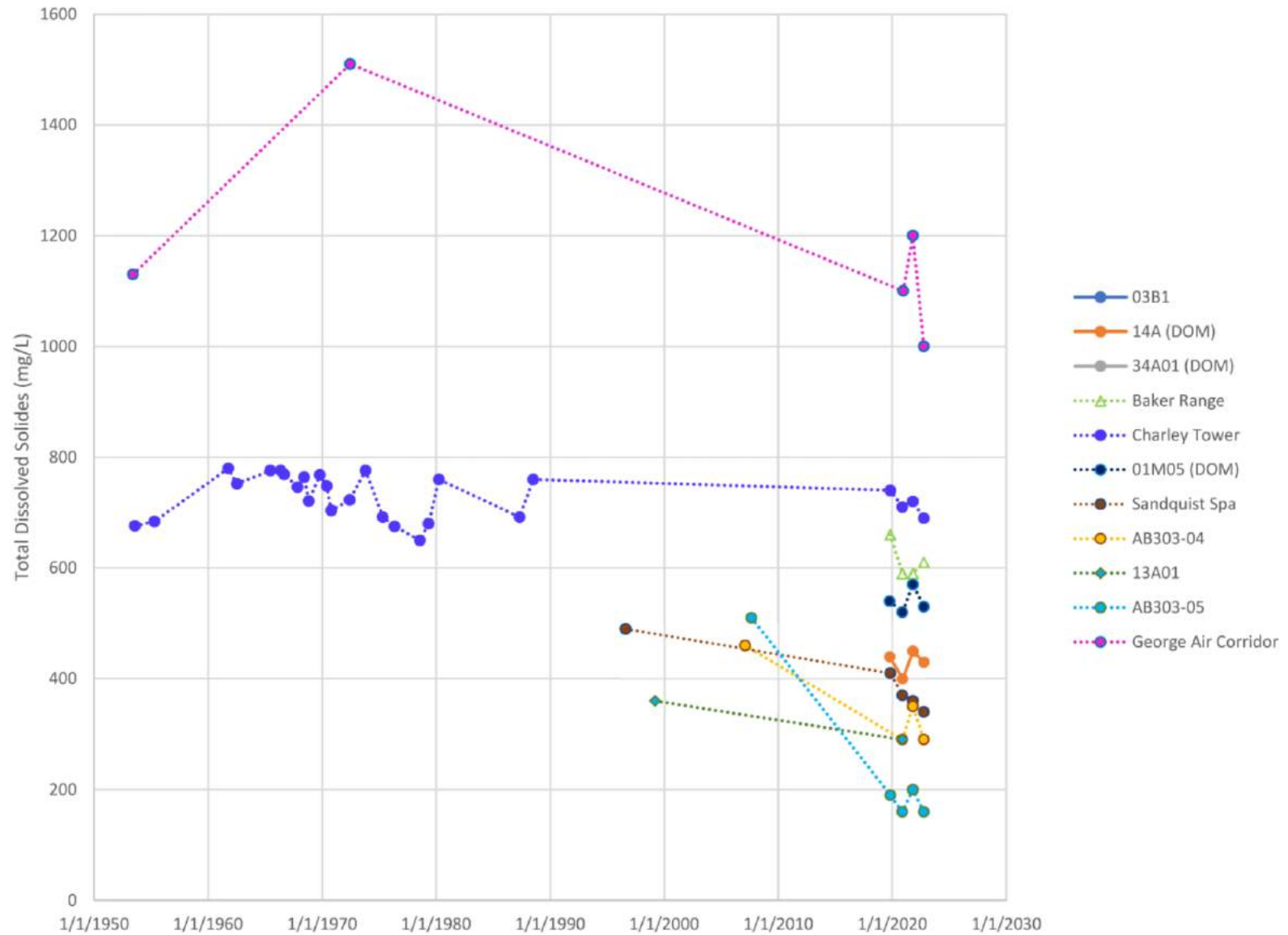
FIGURE 7-1

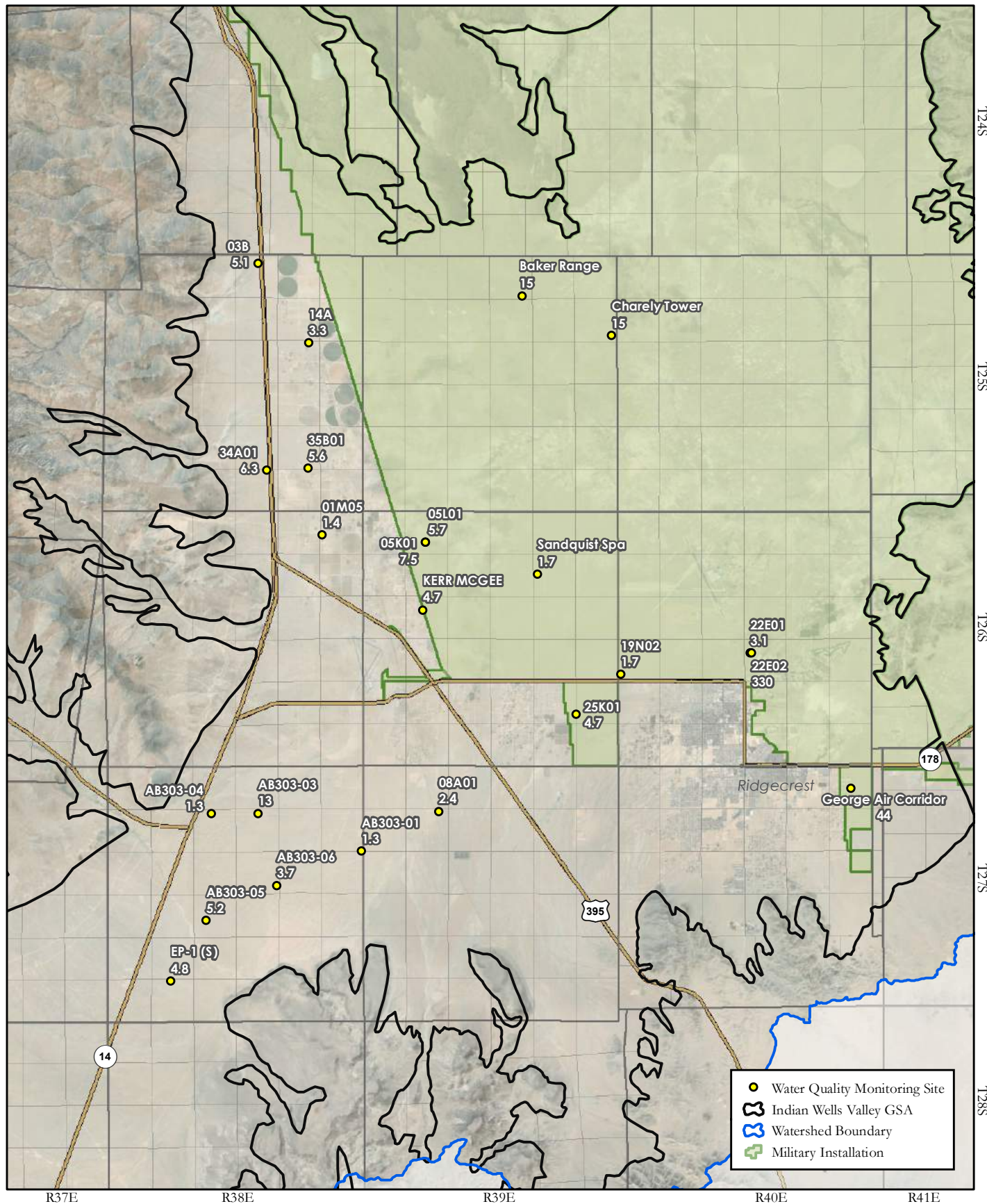


GROUNDWATER QUALITY - TDS
OCTOBER 2022
INDIAN WELLS VALLEY, CA

TDS concentrations are in (mg/L)

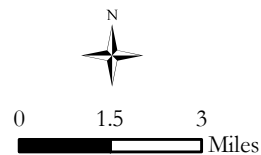






GROUNDWATER QUALITY - ARSENIC
OCTOBER 2022
INDIAN WELLS VALLEY, CA

Arsenic concentrations are in (µg/L)



ATTACHMENTS

Attachment A

DWR Annual Report Submittal Tables

PART A: GROUNDWATER EXTRACTIONS										
Basin Number	Water Year	Total Groundwater Extractions (AF)	Water Use Sector Urban (AF)	Water Use Sector Industrial (AF)	Water Use Sector Agricultural (AF)	Water Use Sector Managed Wetlands (AF)	Water Use Sector Managed Recharge (AF)	Water Use Sector Native Vegetation (AF)	Water Use Sector Other (AF)	Water Use Sector Other Description
6-054	2023 (Oct. 2022 - Sept. 2023)	19150	5620	2570	8110	0	0	0	2850	Other includes Federal Use: (1,380 AF) and Domestic/Mutual/Co-Ops: (1,470 AF)

PART B: GROUNDWATER MODEL ACCURACY DESCRIPTION					
Groundwater Model Accuracy Description	Other Method(s) Volume (AF)	Other Method(s) Description	Other Method(s) Type	Other Method(s) Accuracy (%)	Other Method(s) Accuracy Description
	19150	Compilation of data from multiple sources and self-reported data (estimated using various methods) acquired through stakeholder outreach efforts and reporting efforts.			Accuracy is unknown due to data compiled from multiple sources and multiple methods including water meters, electrical meters, population estimates, and land use estimates.

PART C: SURFACE WATER SUPPLY											
Basin Number	Water Year	Methods Used To Determine	Water Source Type Central Valley Project (AF)	Water Source Type State Water Project (AF)	Water Source Type Colorado River Project (AF)	Water Source Type Local Supplies (AF)	Water Source Type Local Imported Supplies (AF)	Water Source Type Recycled Water (AF)	Water Source Type Desalination (AF)	Water Source Type Other (AF)	Water Source Type Other Description
6-054	2023 (Oct. 2022 - Sept. 2023)	Methods include meters and estimates based on total treatment plant influent.	0	0	0	0	0	1300	0	0	

PART D: TOTAL WATER USE															
Total Water Use (AF)	Methods Used To Determine	Water Source Type Groundwater (AF)	Water Source Type Surface Water (AF)	Water Source Type Recycled Water (AF)	Water Source Type Reused Water (AF)	Water Source Type Other (AF)	Water Source Type Other Description	Water Use Sector Urban (AF)	Water Use Sector Industrial (AF)	Water Use Sector Agricultural (AF)	Water Use Sector Managed Wetlands (AF)	Water Use Sector Managed Recharge (AF)	Water Use Sector Native Vegetation (AF)	Water Use Sector Other (AF)	Water Use Sector Other Description
20450		19150	0	1300	0	0		5890	2570	8310	0	0	0	3680	Other includes Federal Use: (1,380 AF), Domestic/Mutual/Co-Ops: (1,470 AF), and recycled water percolation/habitat support (830 AF).

Attachment B

Historical Water Year Types Based on
Precipitation at China Lake NAF
(No. 041733)

Annual Precipitation at China Lake NAF, No. 041733			Annual Precipitation at China Lake NAF, No. 041733		
WY	(in/yr)	Water Year Type	WY	(in/yr)	Water Year Type
1945	4.90	AN	1985	2.79	N
1946	2.77	N	1986	4.15	AN
1947	3.81	N	1987	2.82	N
1948	1.97	BN	1988	5.40	AN
1949	1.21	D	1989	1.37	BN
1950	1.90	BN	1990	1.43	BN
1951	0.25	D	1991	3.84	N
1952	4.89	AN	1992	9.11	W
1953	1.75	BN	1993	7.12	W
1954	2.80	N	1994	1.08	D
1955	1.93	BN	1995	5.23	AN
1956	1.73	BN	1996	1.91	BN
1957	2.10	N	1997	2.71	N
1958	4.45	AN	1998	6.06	W
1959	2.47	N	1999	1.53	BN
1960	3.13	N	2000	1.76	BN
1961	1.82	BN	2001	4.36	AN
1962	3.87	N	2002	0.54	D
1963	4.03	N	2003	4.35	AN
1964	1.54	BN	2004	3.22	N
1965	4.74	AN	2005	5.88	AN
1966	5.85	AN	2006	2.61	N
1967	2.57	N	2007	0.46	D
1968	4.65	AN	2008	3.18	N
1969	5.29	AN	2009	1.16	D
1970	3.68	N	2010	3.36	N
1971	2.95	N	2011	3.98	N
1972	1.55	BN	2012	1.32	BN
1973	3.76	N	2013	0.83	D
1974	5.98	AN	2014	1.44	BN
1975	3.39	N	2015	3.67	N
1976	3.64	N	2016	1.38	BN
1977	4.01	N	2017	4.61	AN
1978	10.96	W	2018	1.43	BN
1979	6.53	W	2019	6.13	W
1980	5.66	AN	2020	5.57	AN
1981	3.23	N	2021	0.58	D
1982	4.40	AN	2022	1.87	BN
1983	10.42	W	2023	8.27	W
1984	4.05	N			

Attachment C

Groundwater Monitoring Program Updates



TECHNICAL NOTE

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November 2023

GROUNDWATER MONITORING PROGRAM UPDATES

Groundwater levels have been measured in IWW groundwater basin since the 1920's. Starting in 1989, the Kern County Water Agency (KCWA), the Naval Air Weapons Station (NAWS), and multiple other entities (USGS, BLM, USBR, and IWWVD) collected depth to water (DTW) measurements within the basin. In 1995, the IWW Cooperative Groundwater Management Group was formed to coordinate monitoring and management efforts of groundwater level data across IWW. The management of this program was taken over by the Indian Wells Valley Groundwater Authority (IWWGA) in 2018.

At the time the program was taken over by the IWWGA, KCWA measured 198 DTW levels in 171 groundwater wells and 9 multi-level groundwater wells (27 piezometers)¹. Wells monitored consists of private and public water production wells and monitoring wells. These data provide a strong foundation for understanding the trends and state of water resources within the Basin.

Since 2018, updates have been made to the monitoring program to assure that the GWMP is representative of current basin monitoring. Depth to water is measured at accessible monitoring wells during Spring (March) and Fall (October) to observe seasonal changes in groundwater levels. The existing WY 2023 program contains 176 monitoring wells throughout the basin including 10 multi-level monitoring wells (30 piezometers), 47 domestic wells, and 60 wells on the Navy base. The wells in the existing WY 2023 GWMP have varying supporting data, with limited well log and construction data. Table 1 summarizes existing wells monitored for groundwater levels by different areas within the IWWGB.

The Water Resource Manager continues an ongoing effort to fill in data gaps and update the monitoring wells included in the GWMP. Table 2 and Table 3 detail wells added to and removed from the GWMP, respectively. Figure 1 shows the current GWMP and changes made since the Water Year 2022 Indian Wells Valley GSP Annual Report.

- Removal of 5 Wells from the GWMP – Five wells were removed from the GWMP during the WY 2023 review. Wells removed from the GWMP are listed below.
 1. **25S/38E-35A (Domestic)** – Well 35A is a domestic well monitored by KCWA. KCWA has encountered issues accessing this well dating back to 2002. Both KCWA and the

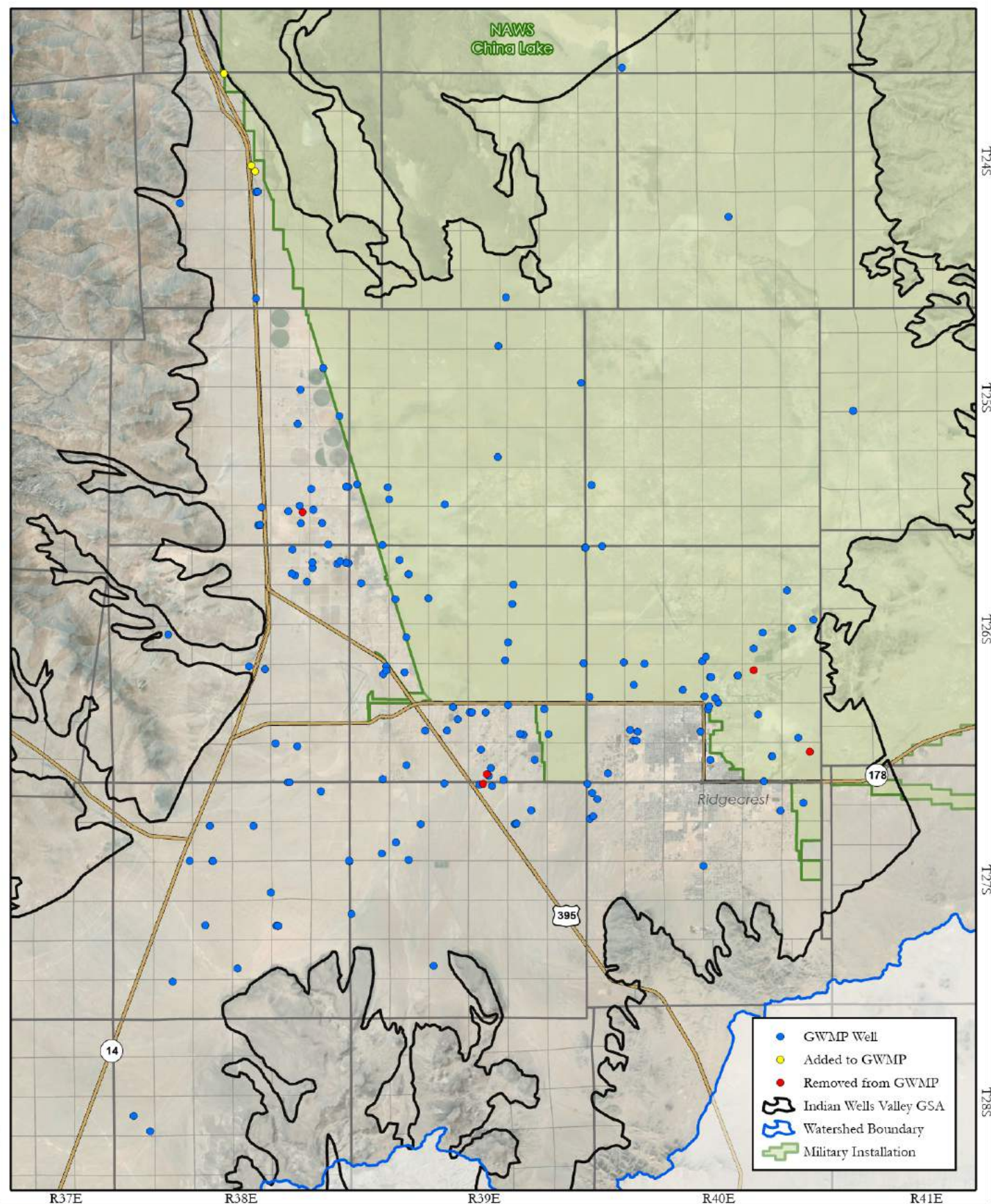
¹ These wells are described in Section 3.6 of the Groundwater Sustainability Plan (GSP, 2020).

IWVGA have been unable to re-establish contact with the owner of this well, and as a result DTW measurements have been discontinued. The last DTW measurement at this well was in October 2018.

2. **26S/39E-34P04 (Domestic)** – Well 34P04 is a domestic well monitored by KCWA. KCWA has been locked out of this well since 2019. Both KCWA and the IWVGA have been unable to reestablish contact with the owner of this well, and as a result DTW measurements have been discontinued. The last DTW measurement at this well was in October 2018.
 3. **26S/40E-23C01 (Navy)** – Well 23C01 is a monitoring well monitored located on NAWS China Lake and monitored by Navy personnel. Well 23C01 has been dry since 2006, and as such, Navy personnel have requested measurements at this well be discontinued.
 4. **26S/40E-36A01 (Navy)** – Well 36A01 is a monitoring well monitored located on NAWS China Lake and monitored by Navy personnel. Well 36A01 has been dry since 2010, and as such, Navy personnel have requested it be measurements at this well be discontinued.
 5. **27S/39E-03C02 (Domestic)** – Well 03C02 is a domestic well monitored by KCWA. KCWA has encountered issues accessing this well dating back to 2014. Both KCWA and the IWVGA have been unable to re-establish contact with the owner of this well, and as a result DTW measurements have been discontinued. The last DTW measurement at this well was in March 2019.
- Addition of 3 Wells to the GWMP – Three wells were added to the GWMP since WY 2022. Wells were added to fill data gaps and provide new groundwater levels. Wells added to the GWMP are detailed below.
 1. **24S/38E-16J (Sawmill Well 1)** – Well Sawmill Well 1 was added to the GWMP in Spring 2023. This well was an existing monitoring well added to fill groundwater level data gaps in the northern basin. A Solinst levellogger has been installed in this well. Groundwater level data and DTW levels in this well will be collected biannually by the IWVGA.
 2. **24S/38E-16 (Sawmill Well 4)** – Sawmill Well 4 was a monitoring well added to the GWMP in Spring 2023. This well was an existing monitoring well added to fill groundwater level data gaps in the northern basin. Groundwater level data and DTW levels in this well will be collected biannually by the IWVGA.
 3. **24S/38E-04D01 (RVS-Mid)** – RVS-Mid was drilled in 2023 in the northern basin area to monitor Rose Valley subflow. A Solinst levellogger has been installed in this well. DTW levels in this well will be collected biannually by the IWVGA.

In WY 2023, 9 domestic wells and 11 monitoring, stock, cathode, or irrigation wells were unable to be accessed in both Fall 2022 and Spring 2023. The IWVGA, with assistance from KCWA, are investigating the possibility of re-establishing access to these wells. In Fall 2022 and Spring 2023, the IWVGA has 1) been unable to contact current well owners; or 2) property ownership has changed, and the IWVGA is attempting to contact new well owners. Changes and updates to the GWMP will continue as new wells are added or removed from the program.

FIGURE X-X



WY 2023

GROUNDWATER MONITORING PROGRAM UPDATES

INDIAN WELLS VALLEY, CA

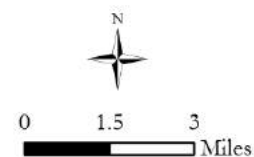


Table 1: Indian Wells Valley Groundwater Monitoring Program (GWMP)

Blue Text indicates a column count

176

60

DBID	State ID	Alternate Well Name	Latitude (NAD83)	Longitude (NAD83)	Well Type	NAVY
1	28S/38E-18R	Black Hills Well	35.49364	-117.92094	Stock	
2	28S/38E-18F01		35.49928	-117.92844	Stock	
5	27S/38E-27M01	USNS-03	35.55387	-117.88132	MW	
6	27S/39E-28L01	Rock Quarry	35.55472	-117.79253	Dom	
7	27S/38E-23F01	USBR 1-S	35.56959	-117.86289	MW	
8	27S/38E-23F02	USBR 1-SM	35.56968	-117.86369	MW	
10	27S/38E-23F04	USBR 1-D	35.56968	-117.86369	MW	
11	27S/38E-21L01	AB303-05	35.56985	-117.89592	MW	
12	27S/39E-19E01	IWV MW #3	35.57400	-117.82969	Stock	
13	27S/38E-15R01	AB303-06	35.58195	-117.86617	MW	
15	27S/40E-15D01	Bucket Well	35.59143	-117.67011	Dom	
16	27S/38E-13A01	Sea Bee Well	35.59345	-117.83060	MW	
17	27S/38E-09Q02	AB303-02	35.59362	-117.89262	MW	
18	27S/38E-09P01	Father Crowley	35.59363	-117.89246	MW	
19	27S/38E-08R01		35.59367	-117.90300	MW	
20	27S/38E-13A02	AB303-01	35.59369	-117.83070	MW	
21	27S/39E-08P02	IWV MW # 2	35.59393	-117.80371	MW	
22	27S/39E-07R01	Inyo	35.59634	-117.81589	MW	
23	27S/39E-08M02	IWV MW #1	35.60045	-117.80947	MW	
24	27S/38E-10B02	AB303-03	35.60662	-117.87407	MW	
25	27S/38E-09C01	AB303-04	35.60665	-117.89378	MW	
26	27S/39E-11D01	USBR 3-S	35.60731	-117.75485	MW	
27	27S/39E-11D02	USBR 3-M	35.60718	-117.75563	MW	
28	27S/39E-11D03	USBR 3-D	35.60718	-117.75563	MW	
30	27S/40E-06D01	Dist. Well 12	35.62198	-117.72253	MW	
31	27S/40E-06N02		35.60898	-117.72155	Dom	
32	27S/40E-06N01		35.60996	-117.72005	Dom	
36	27S/40E-01K02	George Air Corridor	35.61470	-117.62469	MW	
37	27S/40E-06F01		35.61629	-117.71810	Dom	
40	27S/40E-06E01		35.61855	-117.72040	Dom	
41	27S/39E-03B01		35.62127	-117.76580	Dom	
43	27S/39E-03C01		35.62174	-117.77157	Dom	
44	27S/39E-04C01		35.62224	-117.78752	Dom	
46	27S/38E-02C01	USBR 2-S	35.62280	-117.85761	Stock	
47	27S/38E-02C02	USBR 2-M	35.62274	-117.85841	Stock	
48	27S/38E-02C03	USBR 2-D	35.62274	-117.85841	Stock	
50	26S/40E-35Q02	S.E. Line	35.62274	-117.64257	Stock	✓
51	26S/39E-34R02		35.62351	-117.76068	Dom	
53	26S/40E-31K01		35.62580	-117.71330	Dom	
56	26S/39E-34K03		35.62791	-117.76635	Dom	
57	26S/39E-32L01		35.62902	-117.80461	Dom	

Table 1: Indian Wells Valley Groundwater Monitoring Program (GWMP)

Blue Text indicates a column count

176			60			
DBID	State ID	Alternate Well Name	Latitude (NAD83)	Longitude (NAD83)	Well Type	NAVY
58	26S/39E-35G01		35.63079	-117.74730	Irr	
59	26S/39E-31R03	Donna Sue Water Co.	35.62389	-117.81543	Dom	
63	26S/40E-35H01	Satellite Lake 1 (west)	35.63191	-117.63896	Stock	✓
64	26S/40E-35H02	Satellite Lake 2 (east)	35.63191	-117.63869	Stock	✓
72	26S/40E-29N01		35.63792	-117.70175	Dom	
73	26S/40E-29P01		35.63791	-117.70032	Dom	
75	26S/39E-26P01		35.64024	-117.75147	Irr	
76	26S/39E-26P02		35.64052	-117.75313	Irr	
77	26S/39E-29J02		35.64181	-117.79611	Dom	
78	26S/39E-28L02		35.64182	-117.78619	Dom	
80	26S/39E-28G02		35.64601	-117.78135	Dom	
82	26S/40E-26F01		35.64746	-117.64508	Stock	✓
84	26S/39E-27D02	MW 32-SM	35.64852	-117.77493	MW	
85	26S/39E-27D03	MW 32-DM	35.64857	-117.77591	MW	
86	26S/39E-27D04	MW 32-D	35.64857	-117.77591	MW	
87	26S/40E-27D02		35.64941	-117.66785	Stock	✓
88	26S/39E-26A03	USBR 4-SM	35.64966	-117.74213	MW	
90	26S/39E-28B03		35.65050	-117.78352	Dom	
92	26S/40E-27D01		35.65052	-117.66730	Stock	✓
94	26S/39E-20L		35.66560	-117.81374	Stock	
95	26S/40E-22P02	PW Substation 3	35.65191	-117.66313	Stock	✓
97	26S/40E-22P03	PW Substation 1	35.65357	-117.66452	MW	✓
98	26S/40E-22P04	PW Substation 2	35.65357	-117.66452	MW	✓
100	26S/40E-19N02		35.65413	-117.72147	MW	✓
101	26S/40E-22N01		35.65423	-117.66940	Stock	✓
103	26S/40E-21K03		35.65663	-117.67924	Stock	✓
104	26S/40E-20L01		35.65857	-117.70147	Stock	✓
105	26S/40E-22H01		35.66190	-117.65424	Stock	✓
106	26S/40E-22H02		35.66190	-117.65424	Stock	✓
107	26S/40E-22H03		35.66190	-117.65424	Stock	✓
108	26S/39E-20N01	ICSD MW #2	35.66274	-117.81508	MW	
109	26S/39E-20C02		35.66337	-117.80541	Dom	
112	26S/39E-20N02	ICSD MW #3	35.66413	-117.81369	MW	
114	26S/38E-22D		35.66566	-117.87597	MW	
115	26S/39E-13R03	USNS-01	35.66663	-117.72424	Stock	✓
116	26S/39E-13R04		35.66663	-117.72424	MW	✓
117	26S/40E-17N01		35.66690	-117.70591	Stock	✓
118	26S/40E-15N01		35.66718	-117.67035	Stock	✓
119	26S/39E-15J		35.66774	-117.75980	Stock	✓
120	26S/40E-15N02		35.66885	-117.66869	Stock	✓
122	26S/40E-14L01		35.67190	-117.64702	Stock	✓

Table 1: Indian Wells Valley Groundwater Monitoring Program (GWMP)

Blue Text indicates a column count

176			60			
DBID	State ID	Alternate Well Name	Latitude (NAD83)	Longitude (NAD83)	Well Type	NAVY
124	26S/39E-14E01		35.67440	-117.75841	Stock	✓
126	26S/39E-17G02	Kerr McGee	35.67635	-117.80452	MW	✓
127	26S/40E-14B01		35.67774	-117.64285	Stock	✓
129	26S/40E-13C02		35.67913	-117.62952	MW	✓
131	26S/40E-12R01	Chub Med	35.68246	-117.61980	Stock	✓
134	26S/39E-11E02	Sandquist Spa	35.68857	-117.75647	MW	✓
136	26S/39E-08F		35.69051	-117.80952	Stock	✓
137	26S/39E-09E		35.69079	-117.79452	Stock	✓
138	26S/40E-12C		35.69329	-117.63174	Stock	✓
139	26S/39E-02N01		35.69579	-117.75591	Stock	✓
140	26S/39E-06P01		35.69639	-117.82502	Dom	
141	26S/38E-02R01		35.69703	-117.84962	MW	
144	26S/38E-02Q02		35.69941	-117.85503	Dom	
145	26S/38E-02Q01		35.70000	-117.85645	Dom	
146	26S/38E-01M05		35.70215	-117.84707	Dom	
147	26S/38E-01G02		35.70363	-117.83580	Dom	
148	26S/38E-01H03		35.70384	-117.83079	Dom	
149	26S/39E-05F01	Well 23	35.70496	-117.80758	Unk	✓
151	26S/38E-02B01		35.70886	-117.85615	Dom	
152	26S/39E-01A01		35.70940	-117.72341	Stock	✓
153	26S/39E-01A02		35.70940	-117.72313	Stock	✓
154	25S/40E-31P		35.70996	-117.71563	Stock	✓
155	25S/39E-31R01		35.71051	-117.81536	MW	✓
156	25S/38E-36P		35.71076	-117.83996	Dom	
157	25S/38E-34G01	USBR 5-S	35.71813	-117.87090	MW	
158	25S/38E-34G02	USBR 5-M	35.71801	-117.87175	MW	
159	25S/38E-34G03	USBR 05-D	35.71801	-117.87175	Mun	
160	25S/38E-35H		35.71860	-117.85238	Dom	
161	25S/38E-36G01	NR-2 (Shallow)	35.71868	-117.84271	MW	
162	25S/38E-36G02	NR-2 (Middle)	35.71868	-117.84271	MW	
163	25S/38E-36G03	NR-2 (Deep)	35.71868	-117.84271	MW	
165	25S/38E-35C		35.72307	-117.85805	Dom	
166	25S/38E-36D		35.72366	-117.84667	Dom	
168	25S/38E-34A01		35.72453	-117.87024	Dom	
169	25S/38E-35B01		35.72509	-117.85286	MW	
171	25S/39E-28P01	Baker 4-NE	35.72551	-117.78701	Stock	✓
172	25S/39E-29M01		35.73190	-117.81286	Stock	✓
173	25S/38E-25J01	NR 1-S	35.73218	-117.83175	Stock	
174	25S/38E-25J02	NR 1-M	35.73208	-117.83087	Stock	
175	25S/38E-25J03	NR 1-D	35.73218	-117.83175	MW	
176	25S/39E-30E01		35.73301	-117.82675	Stock	✓

Table 1: Indian Wells Valley Groundwater Monitoring Program (GWMP)

Blue Text indicates a column count

176		60				
DBID	State ID	Alternate Well Name	Latitude (NAD83)	Longitude (NAD83)	Well Type	NAVY
183	25S/38E-14Q01		35.75542	-117.85372	Dom	
184	25S/38E-13J01		35.75829	-117.83480	Stock	✓
187	25S/39E-12R01	Charely Tower; Well 22	35.77039	-117.72496	Dom	✓
191	25S/38E-12L01	USBR 6-S	35.77607	-117.84203	MW	✓
192	25S/38E-12L02	USBR 6-M	35.77607	-117.84203	MW	✓
193	25S/38E-12L03	USBR 6-D	35.77607	-117.84203	MW	✓
195	25S/39E-03R01	Baker Range	35.78412	-117.76257	MW	✓
199	24S/39E-34D01	Baker-North	35.80213	-117.75901	MW	✓
202	24S/38E-21A01	USBR 10-S	35.84143	-117.87176	MW	
203	24S/38E-21A02	USBR 10-SM	35.84134	-117.87258	MW	
205	24S/38E-21A04	USBR 10-D	35.84134	-117.87258	MW	
208	25S/38E-25M		35.73135	-117.84767	Dom	
210	25S/40E-30E01	TTBK MW14	35.73254	-117.72033	MW	✓
211	25S/41E-18R01	TTBK MW12	35.75969	-117.60148	MW	✓
212	26S/38E-01E03		35.70417	-117.84716	Dom	
215	26S/38E-01H05		35.70406	-117.83200	Dom	
216	26S/38E-01H06		35.70453	-117.83447	Dom	
218	26S/38E-22B		35.66466	-117.86875	Dom	
219	26S/38E-35B		35.63608	-117.85408	Dom	
220	26S/38E-35D		35.63714	-117.86398	Unk	
223	26S/39E-27C01		35.64849	-117.76864	Unk	
224	26S/39E-34C01		35.63472	-117.77080	Dom	
227	26S/39E-34Q01		35.62502	-117.76733	Dom	
229	26S/40E-28J01	Hospital	35.64121	-117.67128	Mun	
230	26S/40E-29M01		35.64186	-117.70314	Dom	
231	26S/40E-29M02		35.64125	-117.69973	Dom	
233	27S/38E-01C		35.61944	-117.84342	Dom	
234	27S/39E-02K	Asphalt Construction Co.	35.61218	-117.74813	Ind/DC	
235	27S/39E-08A01		35.60721	-117.79818	MW	
237	24S/38E-33J02		35.80190	-117.87258	MW	
238	25S/39E-22J01	S. Baker Ranch	35.74300	-117.76290	MW	✓
239	26S/40E-34F01	City of Ridgecrest	35.63070	-117.66690	Cath	
240	27S/40E-02J01	DMP Cemetery	35.61176	-117.63510	Irr	
241	26S/40E-17Q01	S. Hangar 5; 96030-1	35.66638	-117.69659	MW	✓
244	24S/40E-21K02	TTIWV-MW15	35.83168	-117.65779	MW	✓
245	26S/40E-25P	MK22-MW10	35.63875	-117.62699	MW	✓
246	23S/40E-31N	E. Airport Lake Well	35.887	-117.706	MW	✓
247	24S/38E-19H	Ninemile Well	35.83719	-117.90704	MW	
248	25S/38E-14A01		35.76809	-117.85244	Dom	
249	26S/39E-05L01		35.69973	-117.80355	MW	✓
250	26S/39E-05K01		35.69973	-117.80339	MW	✓

Table 1: Indian Wells Valley Groundwater Monitoring Program (GWMP)

Blue Text indicates a column count

176

60

DBID	State ID	Alternate Well Name	Latitude (NAD83)	Longitude (NAD83)	Well Type	NAVY
251	26S/40E-22E01	CB Camp Well #1	35.66135	-117.66687	MW	✓
254	25S/39E-29N01		35.72744	-117.81227	MW	✓
255	26S/40E-22E02	CB Camp Well #2	35.66132	-117.66633	MW	✓
301	27S/38E-32C01	EP-01 S	35.54904	-117.91071	MW	
302	27S/38E-32C02	EP-01 M	35.54904	-117.91071	MW	
303	27S/38E-32C03	EP-01 D	35.54904	-117.91071	MW	

Table 2: Wells Added to Indian Wells Valley GWMP

Well additions that occurred from Fall 2022 to Spring 2023

Blue Text indicates a column count

3

DBID	State ID	Alternative Well Name	Latitude (NAD83)	Longitude (NAD83)	Well Type	Notes
308	24S/38E-16J	Sawmill Well 1	35.84887	-117.87292	MW	Added to fill groundwater level data gaps in the northern basin
309	24S/38E-16	Sawmill Well 4	35.85113	-117.87469	MW	Added to fill groundwater level data gaps in the northern basin
311	24S/38E-04D01	RVS-Mid	35.88517	-117.88699	MW	Drilled in WY 2023 to monitoring Rose Valley Subflow

Table 3: Wells Removed from Indian Wells Valley GWMP

Measurements discontinued & removed from GWMP in WY 2023

Blue Text indicates a column count

5

DBID	State ID	Alternative Well Name	Latitude (NAD83)	Longitude (NAD83)	Well Type	Date First Measured	Date Last Measured	Notes
164	25S/38E-35A		35.72272	-117.85156	Dom	4/16/1998	10/15/2018	Access issues dating back to 2002.
52	26S/39E-34P04		35.62565	-117.76819	Dom	3/23/2010	10/16/2018	Locked out of this well since 2019.
113	26S/40E-23C01		35.66385	-117.64702	Stock	3/23/1995	10/17/2017	Well has been dry since 2006.
66	26S/40E-36A01		35.63357	-117.62174	Stock	3/13/1989	10/15/2018	Well has been dry since 2010.
45	27S/39E-03C02		35.62206	-117.76995	Dom	10/11/2011	3/12/2019	Access issues dating back to 2014.

Attachment D

WY 2023 Groundwater Level Data

						Fall 2022			Spring 2023		
182		33				142			149		
DBID	State ID	Alternate Well Name	CASGEM	(NAD83)	(NAD83)	Date	(ft, bgs)	(ft, amsl)	Date	(ft, bgs)	(ft, amsl)
1	28S/38E-18R	Black Hills Well	X	35.49364	-117.92094	10/3/2022	197.70	2819.30	3/7/2023	193.80	2819.90
2	28S/38E-18F01			35.49928	-117.92844	10/3/2022	213.22	2813.55	3/7/2023	214.50	2815.15
5	27S/38E-27M01	USNS-03	X	35.55387	-117.88132	10/3/2022	193.60	2679.59	3/8/2023	196.28	2680.61
6	27S/39E-28L01	Rock Quarry		35.55472	-117.79253	10/3/2022	287.60	2532.40	3/7/2023	287.70	2532.30
7	27S/38E-23F01	USBR 1-S	X	35.56959	-117.86289	10/4/2022	182.24	2668.26	3/8/2023	185.61	2668.35
8	27S/38E-23F02	USBR 1-SM	X	35.56968	-117.86369	10/4/2022	179.85	2670.65	3/8/2023	185.27	2668.61
10	27S/38E-23F04	USBR 1-D		35.56968	-117.86369	10/4/2022	182.25	2668.25	3/8/2023	185.27	2668.44
11	27S/38E-21L01	AB303-05	X	35.56985	-117.89592	10/3/2022	358.78	2665.38	3/9/2023	360.60	2665.27
12	27S/39E-19E01	IWV MW #3		35.57400	-117.82969	10/3/2022	204.00	2435.49	3/7/2023	207.60	2434.89
13	27S/38E-15R01	AB303-06		35.58195	-117.86617	10/3/2022	273.32	2658.67	3/7/2023	277.30	2658.29
15	27S/40E-15D01	Bucket Well		35.59143	-117.67011				3/7/2023		Dry
16	27S/38E-13A01	Sea Bee Well		35.59345	-117.83060	10/4/2022	224.93	2429.06	3/8/2023	227.49	2428.95
17	27S/38E-09Q02	AB303-02		35.59362	-117.89262	10/3/2022	419.20	2685.80	3/9/2023	422.54	2686.06
18	27S/38E-09P01	Father Crowley		35.59363	-117.89246	10/3/2022	417.80	2694.32	3/9/2023	423.83	2691.29
19	27S/38E-08R01			35.59367	-117.90300	10/3/2022	505.80	2697.54			
20	27S/38E-13A02	AB303-01		35.59369	-117.83070	10/3/2022	223.31	2426.69	3/8/2023	226.81	2425.69
21	27S/39E-08P02	IWV MW # 2		35.59393	-117.80371	10/3/2022	440.80	2140.16	3/7/2023	445.30	2138.66
22	27S/39E-07R01	Inyo		35.59634	-117.81589	10/3/2022	425.80	2138.30	3/8/2023		Dry
23	27S/39E-08M02	IWV MW #1		35.60045	-117.80947	10/3/2022	415.60	2137.83	3/7/2023	418.40	2136.03
24	27S/38E-10B02	AB303-03		35.60662	-117.87407	10/4/2022	427.84	2467.16	3/7/2023	429.00	2469.60
25	27S/38E-09C01	AB303-04		35.60665	-117.89378	10/3/2022	282.85	2787.15	3/7/2023	385.30	2688.50
26	27S/39E-11D01	USBR 3-S	X	35.60731	-117.75485	10/4/2022	371.91	2138.49	3/8/2023	371.60	2141.76
27	27S/39E-11D02	USBR 3-M	X	35.60718	-117.75563	10/4/2022	363.56	2146.84	3/8/2023	366.46	2146.86
28	27S/39E-11D03	USBR 3-D	X	35.60718	-117.75563	10/4/2022	346.72	2163.68	3/8/2023	347.98	2165.13
30	27S/40E-06D01	Dist. Well 12		35.62198	-117.72253	10/4/2022	284.55	2122.45			
31	27S/40E-06N02			35.60898	-117.72155	10/4/2022	352.00	2121.73	3/7/2023	348.80	2124.93
32	27S/40E-06N01			35.60996	-117.72005	10/4/2022	350.10	2121.49	3/7/2023	348.70	2122.89
36	27S/40E-01K02	George Air Corridor	X	35.61470	-117.62469	10/3/2022	163.51	2159.13	3/9/2023	164.76	2159.38
37	27S/40E-06F01			35.61629	-117.71810	10/4/2022	318.70	2120.86	3/9/2023	318.29	2122.27
40	27S/40E-06E01			35.61855	-117.72040	10/4/2022	313.90	2118.99	3/7/2023	311.30	2121.59
41	27S/39E-03B01			35.62127	-117.76580						
43	27S/39E-03C01			35.62174	-117.77157						
44	27S/39E-04C01			35.62224	-117.78752				3/7/2023	351.70	2149.40
45	27S/39E-03C02			35.62206	-117.76995						
46	27S/38E-02C01	USBR 2-S	X	35.62280	-117.85761	10/3/2022	281.76	2373.19	3/7/2023	284.30	2373.19
47	27S/38E-02C02	USBR 2-M	X	35.62274	-117.85841	10/3/2022	273.82	2381.13	3/7/2023	276.10	2381.23
48	27S/38E-02C03	USBR 2-D	X	35.62274	-117.85841	10/3/2022	281.87	2373.08	3/7/2023	283.90	2373.38
50	26S/40E-35Q02	S.E. Line		35.62274	-117.64257	10/4/2022	94.63	2158.20	3/7/2023	98.32	2158.01
51	26S/39E-34R02			35.62351	-117.76068				3/9/2023	324.50	2127.21
52	26S/39E-34P04			35.62565	-117.76819						
53	26S/40E-31K01			35.62580	-117.71330						
56	26S/39E-34K03			35.62791	-117.76635	10/4/2022	329.50	2146.12	3/7/2023	329.80	2146.82
57	26S/39E-32L01			35.62902	-117.80461	10/3/2022	342.60	2149.44	3/7/2023	346.00	2147.04
58	26S/39E-35G01			35.63089	-117.74645						
59	26S/39E-31R03			35.62389	-117.81543						
63	26S/40E-35H01	Satellite Lake 1 (west)		35.63191	-117.63896	10/4/2022	90.73	2161.62	3/7/2023	92.14	2161.41
64	26S/40E-35H02	Satellite Lake 2 (east)		35.63191	-117.63869	10/4/2022	98.52	2153.51	3/7/2023	100.89	2153.54
66	26S/40E-36A01			35.63357	-117.62174						
72	26S/40E-29N01			35.63792	-117.70175						
73	26S/40E-29P01			35.63791	-117.70032	10/4/2022	208.10	2122.59	3/8/2023	198.50	2133.19

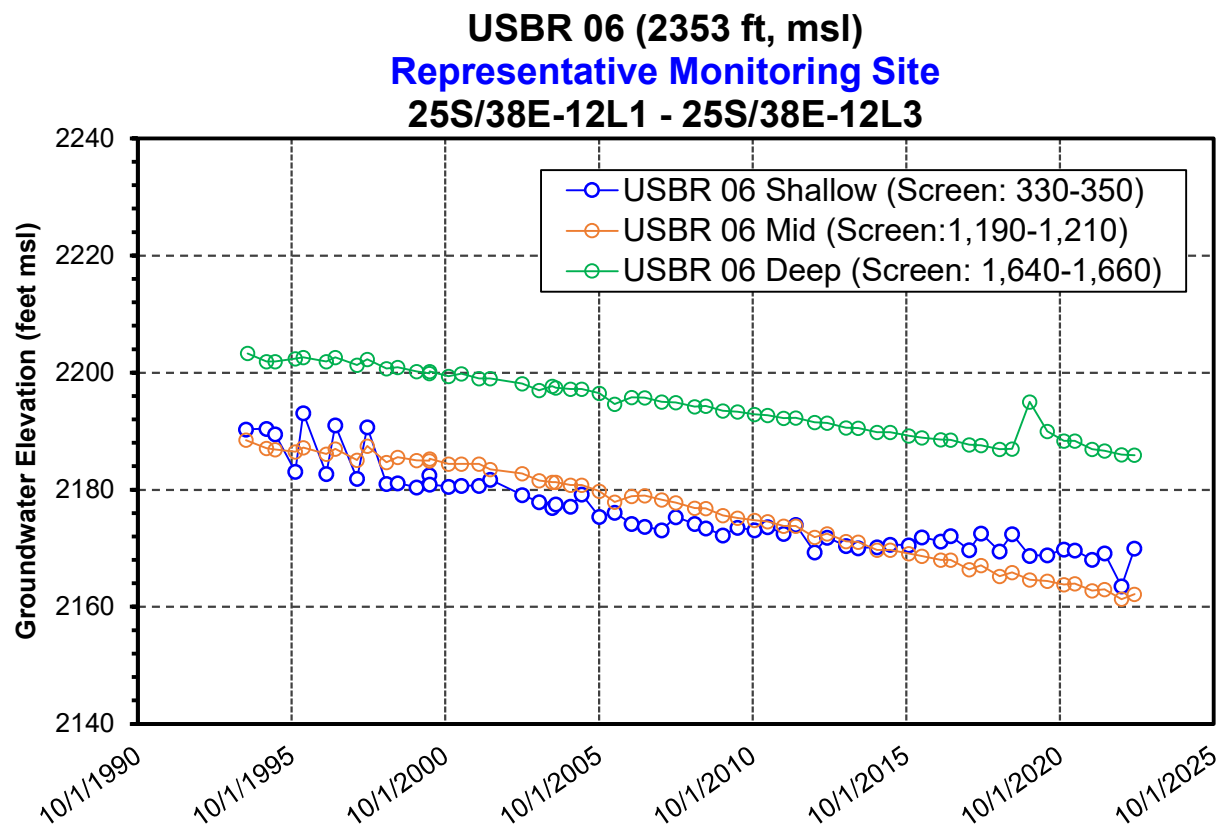
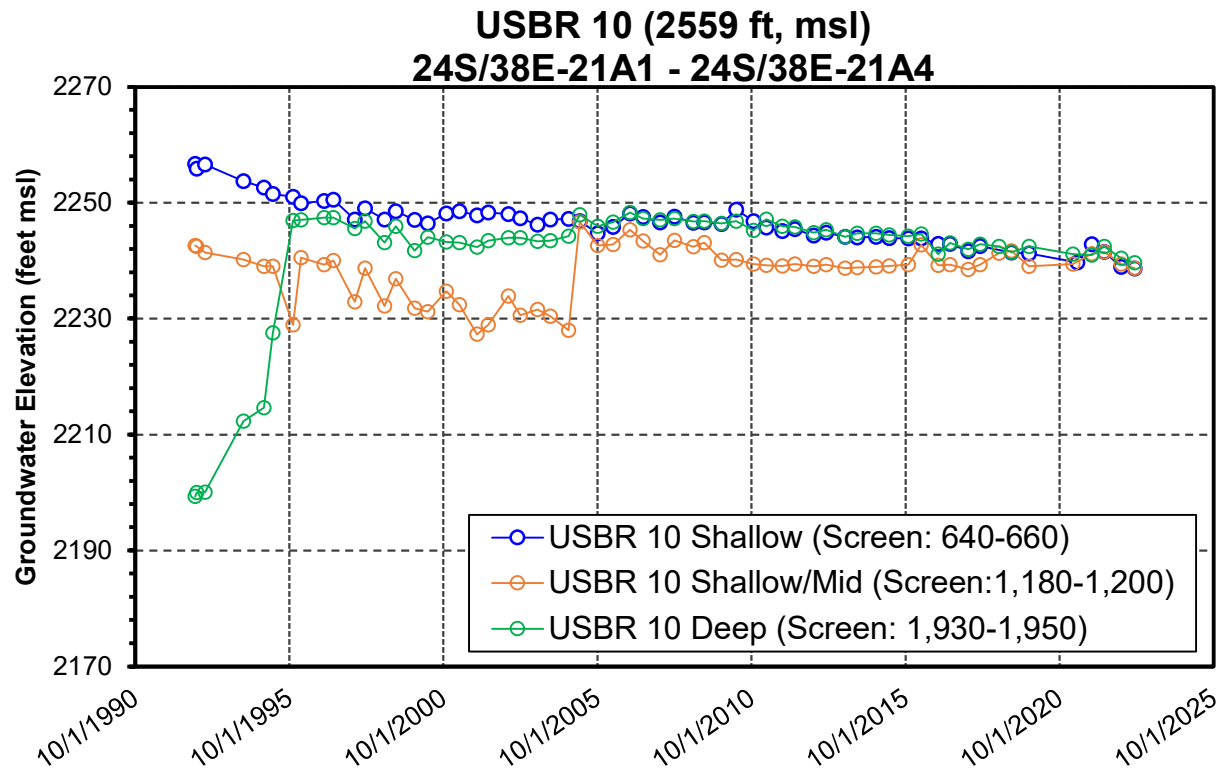
75	26S/39E-26P01			35.64024	-117.75147	10/3/2022	266.70	2136.63	3/7/2023	264.10	2140.23
76	26S/39E-26P02			35.64052	-117.75313	10/3/2022	269.60	2136.66	3/7/2023	267.30	2139.96
77	26S/39E-29J02			35.64181	-117.79611	10/3/2022	304.70	2124.30	3/7/2023	304.10	2124.90
78	26S/39E-28L02			35.64182	-117.78619						
80	26S/39E-28G02			35.64601	-117.78135	10/4/2022	286.40	2146.62	3/7/2023	287.20	2146.82
82	26S/40E-26F01			35.64746	-117.64508	10/4/2022	59.37	2173.43	3/7/2023	62.68	2173.12
84	26S/39E-27D02	MW 32-SM	X	35.64852	-117.77493	10/4/2022	301.22	2117.31	3/7/2023	280.51	2141.06
85	26S/39E-27D03	MW 32-DM	X	35.64857	-117.77591	10/4/2022	291.88	2126.65	3/7/2023	280.73	2140.84
86	26S/39E-27D04	MW 32-D	X	35.64857	-117.77591	10/4/2022	280.57	2137.96	3/7/2023	280.76	2140.42
87	26S/40E-27D02			35.64941	-117.66785	10/4/2022	45.92	2220.83	3/7/2023	46.98	2220.67
88	26S/39E-26A03	USBR 4	X	35.64966	-117.74213	10/3/2022	252.25	2124.84	3/9/2023	248.55	2130.39
90	26S/39E-28B03			35.65050	-117.78352	10/3/2022	250.30	2176.35	3/7/2023	251.20	2176.45
92	26S/40E-27D01			35.65052	-117.66730	10/4/2022	72.22	2195.82	3/7/2023	71.52	2195.52
94	26S/39E-20L			35.66560	-117.81374	10/3/2022	241.10	2186.89	3/7/2023	242.70	2187.19
95	26S/40E-22P02	PW Substation 3		35.65191	-117.66313	10/4/2022	65.64	2201.58	3/7/2023	69.32	2201.60
97	26S/40E-22P03	PW Substation 1		35.65357	-117.66452	10/4/2022	113.38	2145.50	3/7/2023	112.40	2147.48
98	26S/40E-22P04	PW Substation 2		35.65357	-117.66452	10/4/2022	53.37	2205.38	3/7/2023	53.83	2205.92
100	26S/40E-19N02			35.65413	-117.72147	10/3/2022	209.00	2128.43	3/7/2023	208.92	2129.51
101	26S/40E-22N01			35.65423	-117.66940				3/7/2023	92.98	2171.38
103	26S/40E-21K03			35.65663	-117.67924	10/4/2022	100.28	2166.51	3/7/2023	102.06	2167.53
104	26S/40E-20L01			35.65857	-117.70147	10/4/2022	145.92	2150.93	3/7/2023	149.71	2150.74
105	26S/40E-22H01			35.66190	-117.65424	10/4/2022	33.03	2195.12	3/7/2023	35.51	2195.54
106	26S/40E-22H02			35.66190	-117.65424	10/4/2022	33.01	2195.37	3/7/2023	36.12	2195.56
107	26S/40E-22H03			35.66190	-117.65424	10/4/2022	33.06	2194.68	3/7/2023	35.65	2195.09
108	26S/39E-20N01	ICSD MW #2		35.66274	-117.81508						
109	26S/39E-20C02			35.66337	-117.80541	10/3/2022	241.50	2149.36	3/7/2023	242.30	2149.56
112	26S/39E-20N02	ICSD MW #3		35.66413	-117.81369						
113	26S/40E-23C01			35.66385	-117.64702						
114	26S/38E-22D			35.66566	-117.87597	10/3/2022	57.50	2790.75	3/7/2023	58.30	2790.95
115	26S/39E-13R03	USNS-01		35.66663	-117.72424	10/4/2022	152.74	2166.61	3/7/2023	154.25	2166.40
116	26S/39E-13R04			35.66663	-117.72424	10/4/2022	197.63	2122.18	3/7/2023	193.71	2127.60
117	26S/40E-17N01			35.66690	-117.70591	10/4/2022	142.82	2152.26	3/7/2023	144.62	2152.26
118	26S/40E-15N01			35.66718	-117.67035	10/4/2022	58.20	2186.58	3/7/2023	60.94	2186.44
119	26S/39E-15J			35.66774	-117.75980	10/4/2022	203.80	2143.99	3/6/2023	210.45	2144.34
120	26S/40E-15N02			35.66885	-117.66869	10/4/2022	51.23	2185.14	3/7/2023	54.43	2185.14
121	26S/40E-17J01			35.67107	-117.69480						
122	26S/40E-14L01			35.67190	-117.64702	10/4/2022	21.72	2183.95	3/7/2023	23.11	2185.46
124	26S/39E-14E01			35.67440	-117.75841	10/4/2022	170.39	2164.94	3/6/2023	171.75	2164.58
126	26S/39E-17G02	Kerr McGee		35.67635	-117.80452	10/3/2022	210.10	2146.44	3/6/2023	209.95	2148.09
127	26S/40E-14B01			35.67774	-117.64285	10/4/2022	9.68	2181.37	3/7/2023	10.64	2182.41
129	26S/40E-13C02			35.67913	-117.62952	10/4/2022	10.07	2178.29	3/7/2023	10.74	2178.62
131	26S/40E-12R01	Chub Med		35.68246	-117.61980	10/4/2022	2.77	2182.56	3/7/2023	4.88	2182.35
134	26S/39E-11E02	Sandquist Spa	X	35.68857	-117.75647	10/3/2022	136.51	2170.79	3/6/2023	138.05	2170.25
136	26S/39E-08F			35.69051	-117.80952	10/4/2022	168.40	2150.92	3/6/2023	169.96	2150.36
137	26S/39E-09E			35.69079	-117.79452	10/4/2022	173.13	2139.38	3/6/2023	172.60	2142.41
138	26S/40E-12C			35.69329	-117.63174	10/4/2022	5.48	2160.65	3/6/2023	6.92	2160.71
139	26S/39E-02N01			35.69579	-117.75591	10/3/2022	114.40	2172.23	3/6/2023	115.65	2171.98
140	26S/39E-06P01			35.69639	-117.82502	10/3/2022	163.00	2157.00	3/7/2023	164.40	2157.00
141	26S/38E-02R01			35.69703	-117.84962						
144	26S/38E-02Q02			35.69941	-117.85503	10/3/2022	275.00	2134.50	3/7/2023	253.00	2158.60
145	26S/38E-02Q01			35.70000	-117.85645	10/3/2022	255.80	2153.44	3/7/2023	254.30	2155.94
146	26S/38E-01M05			35.70215	-117.84707	10/5/2022	215.41	2158.02	3/7/2023	214.40	2160.03
147	26S/38E-01G02			35.70363	-117.83580	10/3/2022	180.70	2157.81	3/7/2023	179.50	2160.01
148	26S/38E-01H03			35.70384	-117.83079				3/7/2023	184.00	2135.82
149	26S/39E-05F01			35.70496	-117.80758	10/4/2022	113.62	2163.98	3/6/2023	113.32	2164.28
151	26S/38E-02B01			35.70886	-117.85615	10/3/2022	215.10	2157.76	3/7/2023	214.90	2159.16

152	26S/39E-01A01			35.70940	-117.72341	10/3/2022	42.12	2175.52	3/6/2023	43.90	2175.34
153	26S/39E-01A02			35.70940	-117.72313	10/3/2022	43.16	2174.77	3/6/2023	45.83	2174.60
154	25S/40E-31P			35.70996	-117.71563	10/3/2022	18.93	2172.81	3/6/2023	21.05	2172.99
155	25S/39E-31R01			35.71051	-117.81536	10/4/2022	92.13	2169.72	3/6/2023	94.64	2169.71
156	25S/38E-36P			35.71076	-117.83996	10/3/2022	170.20	2158.80			
157	25S/38E-34G01	USBR 5-S	X	35.71813	-117.87090	10/3/2022	361.02	2159.40	3/7/2023	363.94	2159.06
158	25S/38E-34G02	USBR 5-M	X	35.71801	-117.87175	10/3/2022	368.52	2151.90	3/7/2023	371.05	2151.75
159	25S/38E-34G03	USBR 05-D	X	35.71801	-117.87175	10/3/2022	372.17	2148.25	3/7/2023	372.26	2150.29
160	25S/38E-35H			35.71860	-117.85238				3/7/2023	199.40	2158.36
161	25S/38E-36G01	NR-2 (Shallow)	X	35.71868	-117.84271						
162	25S/38E-36G02	NR-2 (Middle)	X	35.71868	-117.84271						
163	25S/38E-36G03	NR-2 (Deep)	X	35.71868	-117.84271						
164	25S/38E-35A			35.72272	-117.85156						
165	25S/38E-35C			35.72307	-117.85805	10/3/2022	265.00	2158.52	3/7/2023	264.50	2160.02
166	25S/38E-36D			35.72366	-117.84667	10/3/2022	187.00	2156.72	3/7/2023	184.70	2159.52
168	25S/38E-34A01			35.72453	-117.87024	10/3/2022	364.83	2163.95	3/7/2023	364.00	2165.78
169	25S/38E-35B01			35.72509	-117.85286	10/4/2022	239.09	2157.15	3/7/2023	239.94	2158.16
170	25S/38E-36B01	WELL 27		35.72496	-117.83675						
171	25S/39E-28P01	Baker 4-NE		35.72551	-117.78701	10/4/2022	54.08	2174.96	3/6/2023	50.48	2179.56
172	25S/39E-29M01			35.73190	-117.81286	10/4/2022	49.56	2182.74	3/6/2023	60.76	2172.54
173	25S/38E-25J01	NR 1-S		35.73218	-117.83175	10/3/2022	114.60	2162.35	3/7/2023	117.30	2162.45
174	25S/38E-25J02	NR 1-M		35.73208	-117.83087	10/3/2022	117.40	2158.30	3/7/2023	120.70	2157.80
175	25S/38E-25J03	NR 1-D		35.73218	-117.83175	10/3/2022	134.70	2141.00	3/7/2023	136.10	2142.40
176	25S/39E-30E01			35.73301	-117.82675	10/4/2022	54.48	2194.13	3/6/2023	55.55	2195.26
183	25S/38E-14Q01			35.75542	-117.85372				3/7/2023	227.50	2165.00
184	25S/38E-13J01			35.75829	-117.83480	10/4/2022	127.96	2164.01	3/6/2023	129.69	2166.08
187	25S/39E-12R01	Charely Tower; Well 22		35.77039	-117.72496	10/3/2022	25.01	2177.36	3/6/2023	26.13	2177.24
191	25S/38E-12L01	USBR 6-S	X	35.77607	-117.84203	10/4/2022	189.41	2163.51	3/6/2023	184.75	2169.96
192	25S/38E-12L02	USBR 6-M	X	35.77607	-117.84203	10/4/2022	191.59	2161.33	3/6/2023	192.22	2162.16
193	25S/38E-12L03	USBR 6-D	X	35.77607	-117.84203	10/4/2022	166.95	2185.97	3/6/2023	168.09	2185.91
195	25S/39E-03R01	Baker Range	X	35.78412	-117.76257	10/3/2022	51.42	2174.85	3/6/2023	52.68	2174.59
199	24S/39E-34D01	Baker-North		35.80213	-117.75901	10/3/2022	47.42	2179.61	3/6/2023	49.21	2179.42
202	24S/38E-21A01	USBR 10-S	X	35.84143	-117.87176	10/3/2022	320.49	2238.90	3/9/2023	325.68	2238.63
203	24S/38E-21A02	USBR 10-SM	X	35.84134	-117.87258	10/3/2022	319.95	2239.44	3/9/2023	325.50	2238.70
205	24S/38E-21A04	USBR 10-D	X	35.84134	-117.87258	10/3/2022	318.96	2240.43	3/9/2023	324.28	2239.65
207	25S/38E-03B			35.79546	-117.87382	10/4/2022	291.46	2164.89	3/8/2023	293.58	2164.37
208	25S/38E-25M			35.73135	-117.84767						
210	25S/40E-30E01	TTBK MW14	X	35.73254	-117.72033	10/3/2022	14.89	2176.15	3/6/2023	18.25	2176.00
211	25S/41E-18R01	TTBK MW12	X	35.75969	-117.60148	10/3/2022	22.16	1981.06	3/6/2023	25.35	1981.12
212	26S/38E-01E03			35.70417	-117.84716						
215	26S/38E-01H05			35.70406	-117.83200						
216	26S/38E-01H06			35.70453	-117.83447				3/7/2023	172.00	2148.20
218	26S/38E-22B	Ostrich Ranch		35.66466	-117.86875	10/3/2022	432.20	2234.08	3/7/2023	434.00	2233.28
219	26S/38E-35B			35.63608	-117.85408	10/3/2022	343.40	2231.15	3/7/2023	343.00	2231.55
220	26S/38E-35D			35.63714	-117.86398	10/3/2022	449.20	2236.03	3/7/2023	451.10	2235.53
223	26S/39E-27C01			35.64849	-117.76864						
224	26S/39E-34C01			35.63472	-117.77080						
227	26S/39E-34Q01			35.62502	-117.76733	10/4/2022	338.61	2134.49	3/8/2023	338.10	2134.90
229	26S/40E-28J01	Hospital		35.64121	-117.67128	10/3/2022	136.60	2154.32	3/7/2023	136.10	2155.82
230	26S/40E-29M01			35.64186	-117.70314	10/4/2022	207.60	2123.04	3/8/2023	206.80	2124.84
231	26S/40E-29M02			35.64125	-117.69973	10/4/2022	197.60	2127.04	3/8/2023	196.20	2129.44
233	27S/38E-01C			35.61944	-117.84342						
234	27S/39E-02K	Asphalt Construction Co.		35.61218	-117.74813	10/4/2022	316.60	2141.82	3/8/2023	316.40	2142.02
235	27S/39E-08A01			35.60721	-117.79818	10/4/2022	396.68	2137.51	3/8/2023	398.85	2136.64
237	24S/38E-33J02			35.80190	-117.87258						
238	25S/39E-22J01	S. Baker Ranch		35.74300	-117.76290	10/4/2022	42.53	2176.24	3/6/2023	43.73	2176.04

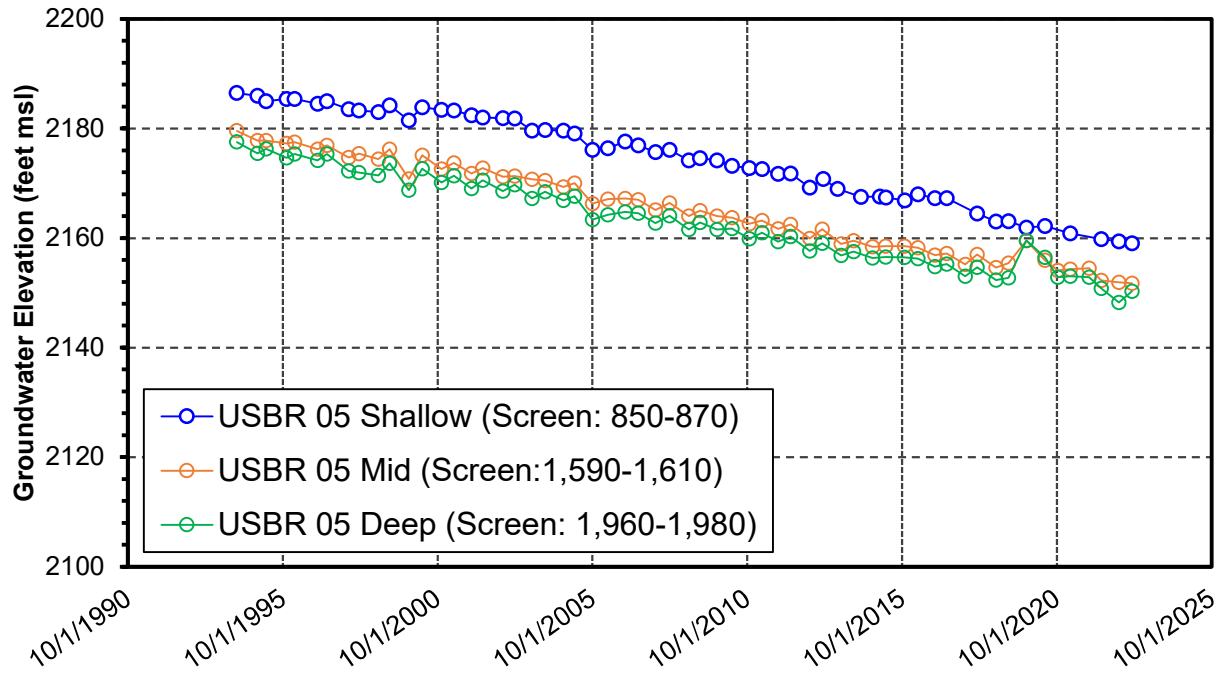
239	26S/40E-34F01	City of Ridgecrest		35.63070	-117.66690						
240	27S/40E-02J01	DMP Cemetery		35.61176	-117.63510	10/3/2022	154.50	2150.55	3/7/2023	155.00	2150.55
241	26S/40E-17Q01	S. Hangar 5; 96030-1	X	35.66638	-117.69659	10/4/2022	144.46	2132.64	3/7/2023	143.31	2136.04
244	24S/40E-21K02	TTIWV-MW15		35.83168	-117.65779	10/3/2022	50.58	2192.42	3/6/2023	52.68	2188.62
245	26S/40E-25P	MK22-MW10		35.63875	-117.62699	10/4/2022	87.05	2155.65	3/7/2023	89.52	2155.15
246	23S/40E-31N	E. Airport Lake Well		35.88700	-117.70600	10/3/2022	105.97	2192.13	3/6/2023	109.47	2191.96
247	24S/38E-19H	Ninemile Well		35.83719	-117.90704	10/4/2022	14.09	2957.16	3/7/2023	8.06	2963.21
248	25S/38E-14A01			35.76809	-117.85244	10/3/2022	234.91	2140.09	3/8/2023	232.00	2162.10
249	26S/39E-05L01			35.69973	-117.80355	10/3/2022	131.38	2162.48	3/6/2023	133.18	2162.54
250	26S/39E-05K01			35.69973	-117.80339	10/3/2022	129.39	2164.36	3/6/2023	131.37	2164.13
251	26S/40E-22E01	CB Camp Well #1		35.66135	-117.66687	10/3/2022	98.87	2144.81	3/7/2023	101.51	2144.95
254	25S/39E-29N01			35.72740	-117.81212				3/6/2023	66.89	2174.21
255	26S/40E-22E02	CB Camp Well #2		35.66132	-117.66633				3/7/2023	92.46	2154.19
301	27S/38E-32C01	EP-01 S		35.54904	-117.91071	10/4/2022	272.82	2689.84	3/8/2023	275.13	2689.99
302	27S/38E-32C02	EP-01 M		35.54904	-117.91071	10/4/2022	279.38	2683.28	3/8/2023	281.61	2683.41
303	27S/38E-32C03	EP-01 D		35.54904	-117.91071	10/4/2022	273.88	2688.78	3/8/2023	275.83	2689.04
304	26S/39E-35B01			35.63444	-117.74635						
305	26S/38E-17C01	Indian Wells Canyon		35.67749	-117.91262	10/5/2022	79.36	3389.14	3/7/2023	81.19	3386.63
306	26S/39E-27C01			35.65120	-117.78538						
307	26S/39E-25K01			35.64041	-117.74023	10/4/2022	267.74	2120.96	3/9/2023	265.07	2123.93
		Lumbermill Well #4							3/9/2023	343.64	
	25S/40E-32	TTBKMW05							3/6/2023	13.3	

Attachment E

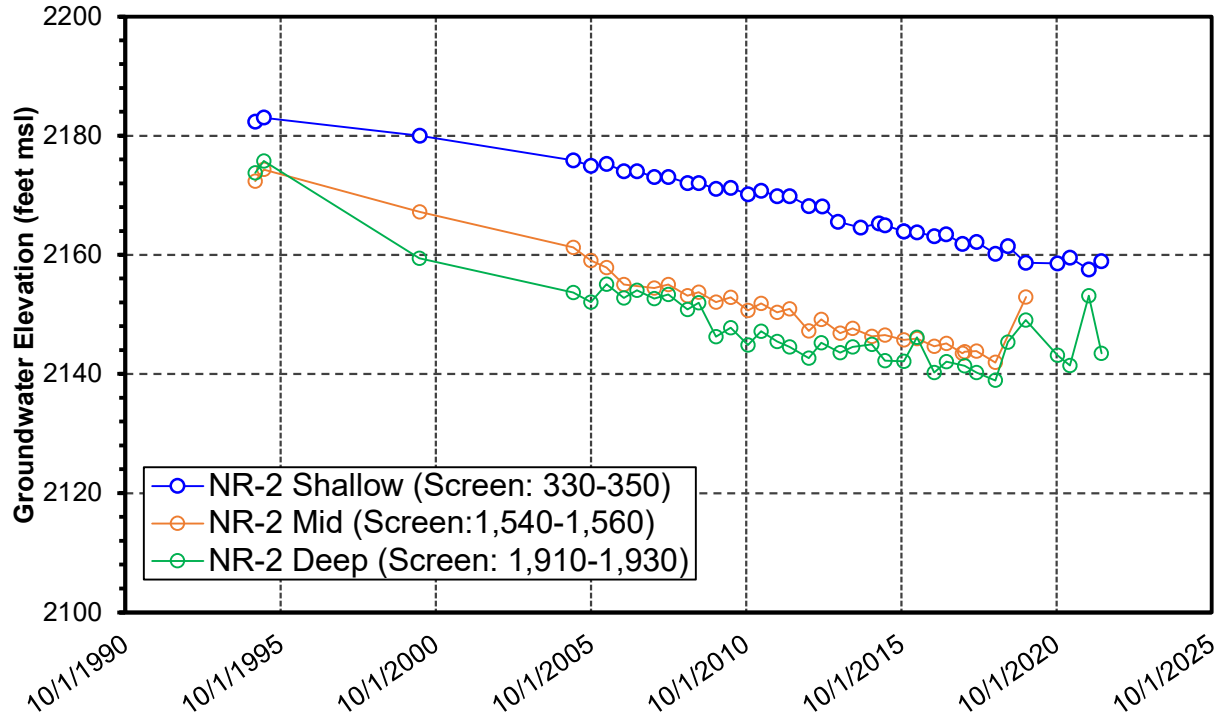
Hydrographs for Select Monitoring Wells



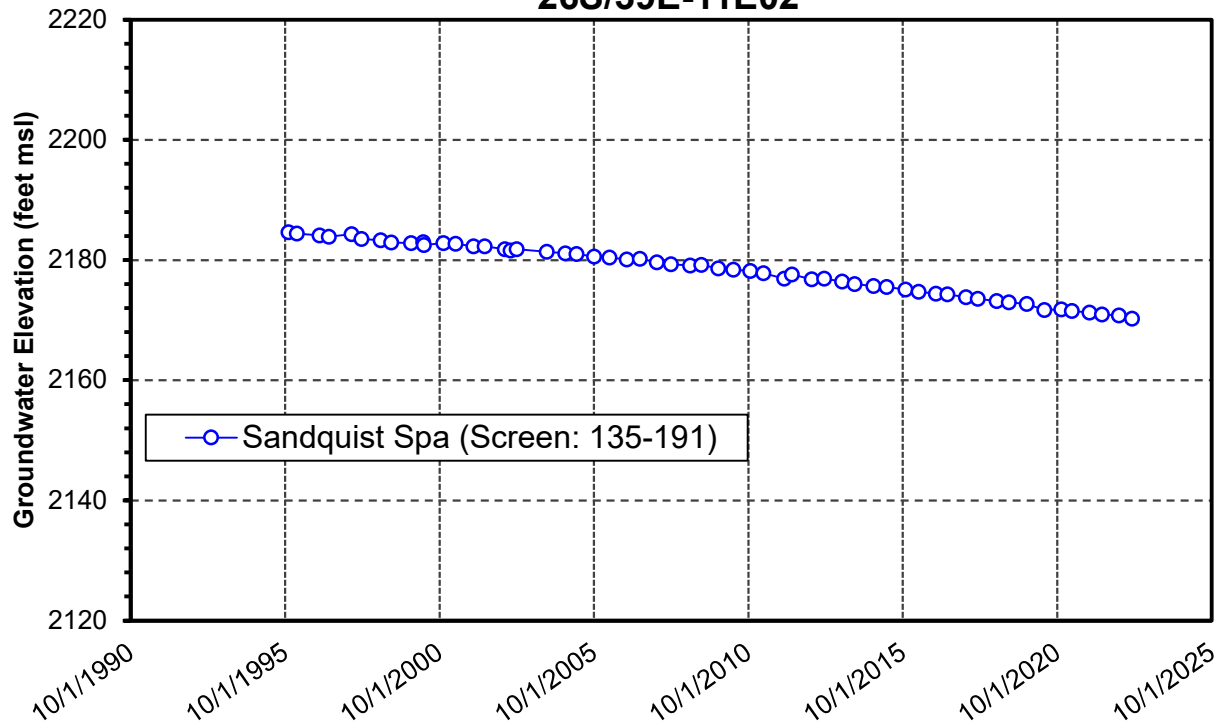
USBR 05 (2520 ft, msl)
Representative Monitoring Site
25S/38E-34G1 - 25S/38E-34G3



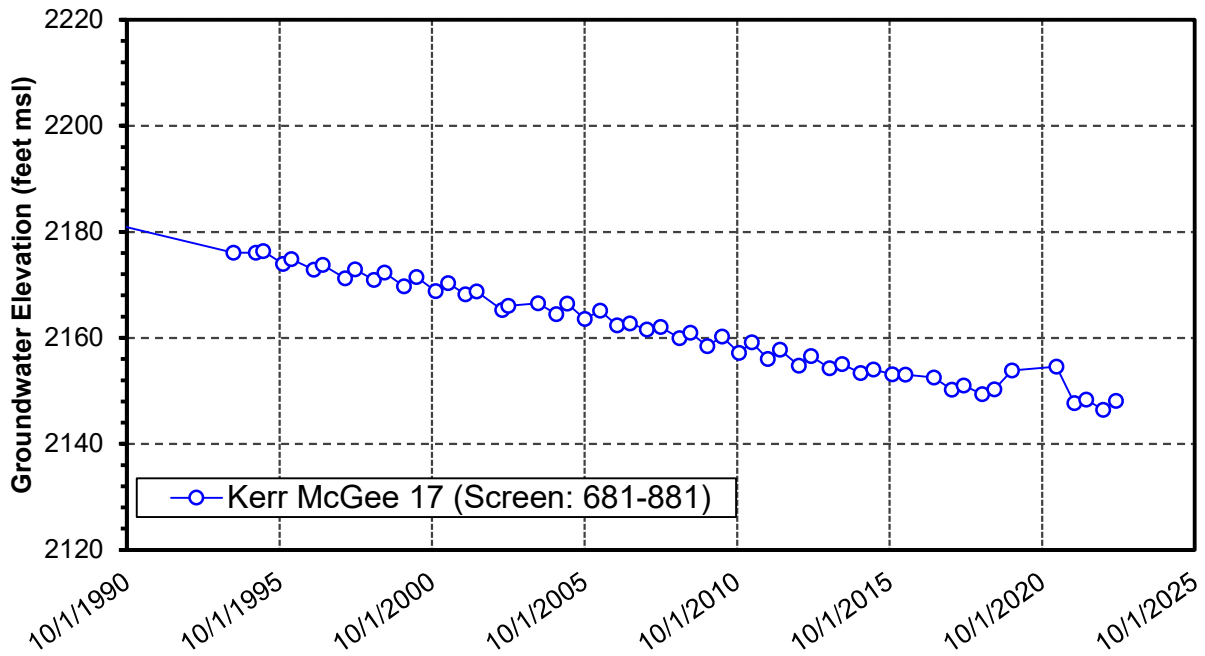
NR-2 (2315 ft, msl)
25S/38E-36G1 - 25S/38E-36G3



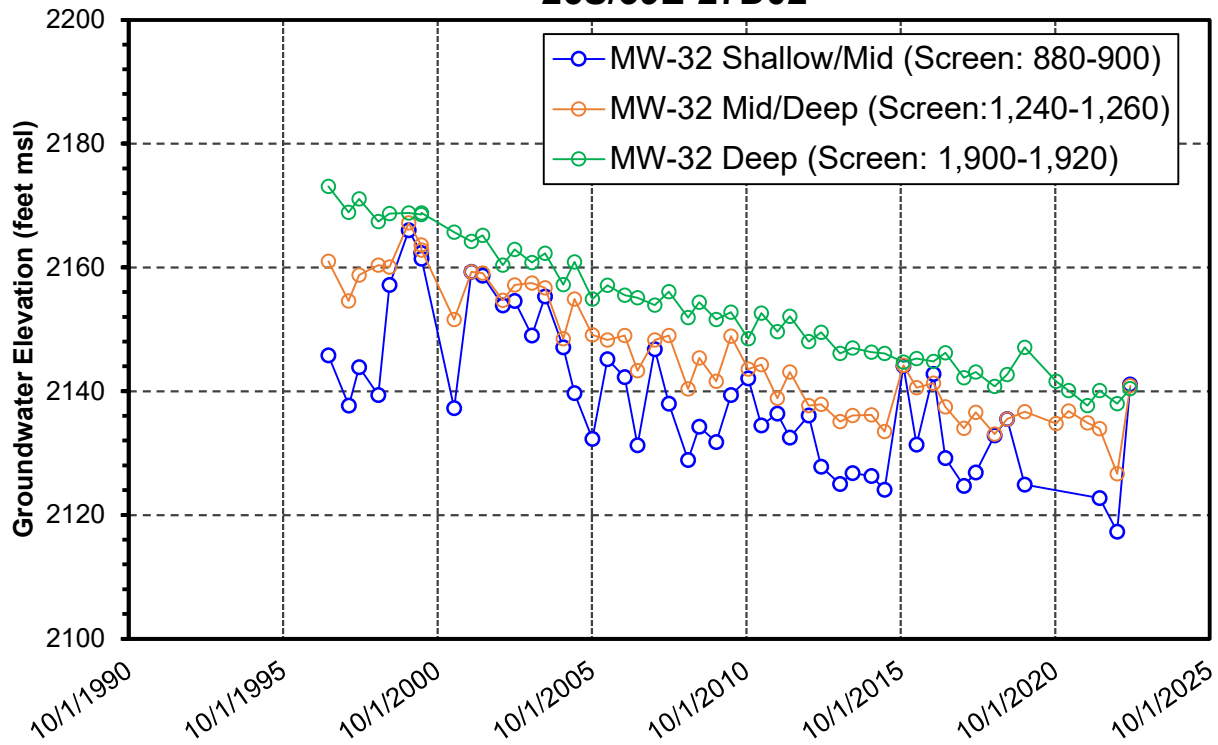
Sandquist Spa (2307 ft, msl)
Representative Monitoring Site
26S/39E-11E02



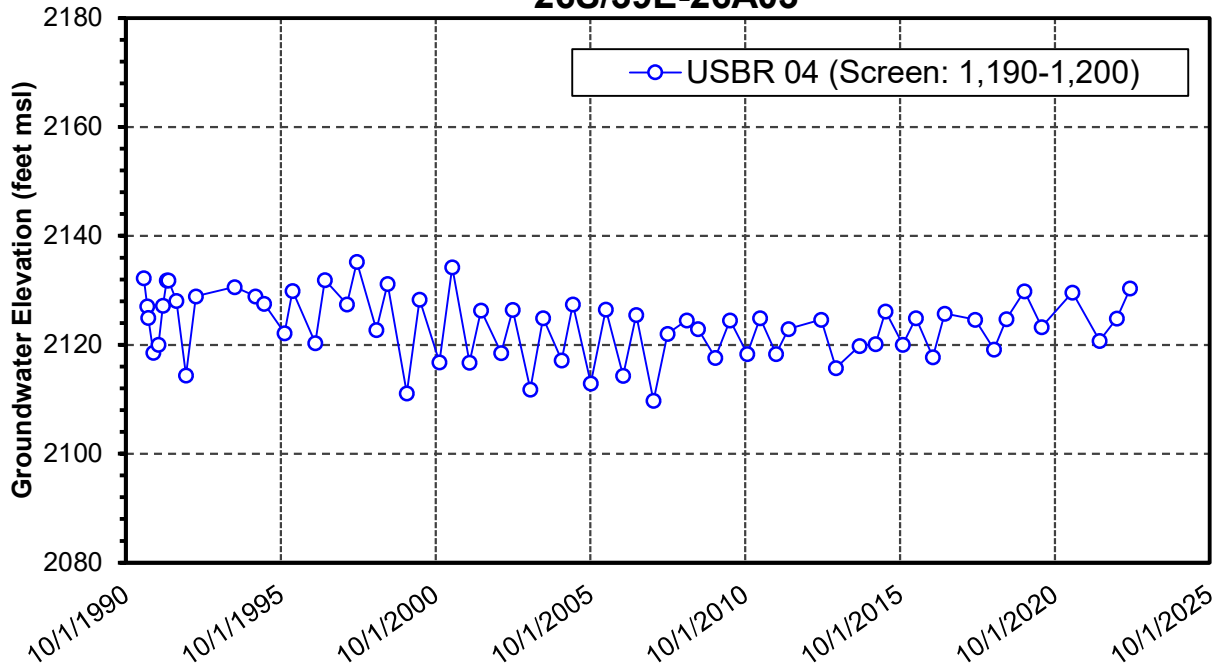
Kerr McGee 17 (2357 ft, msl)
Representative Monitoring Site
26S/39E-17G02



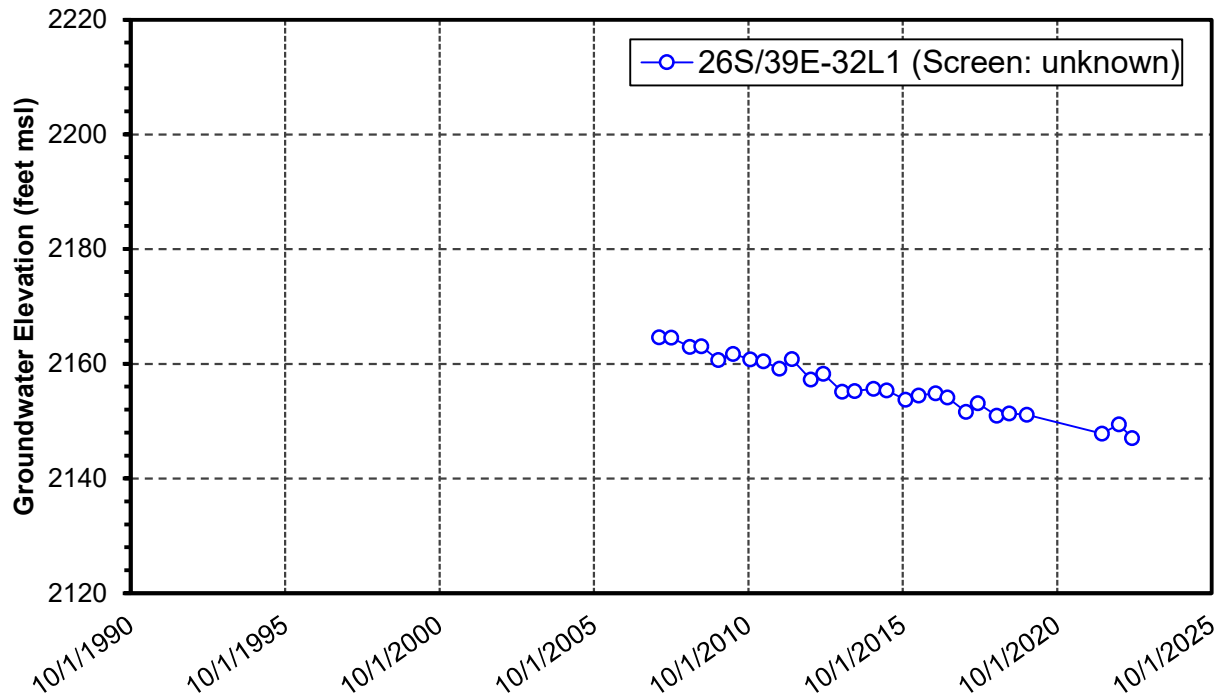
MW-32 (2419 ft, msl)
Representative Monitoring Site
26S/39E-27D02



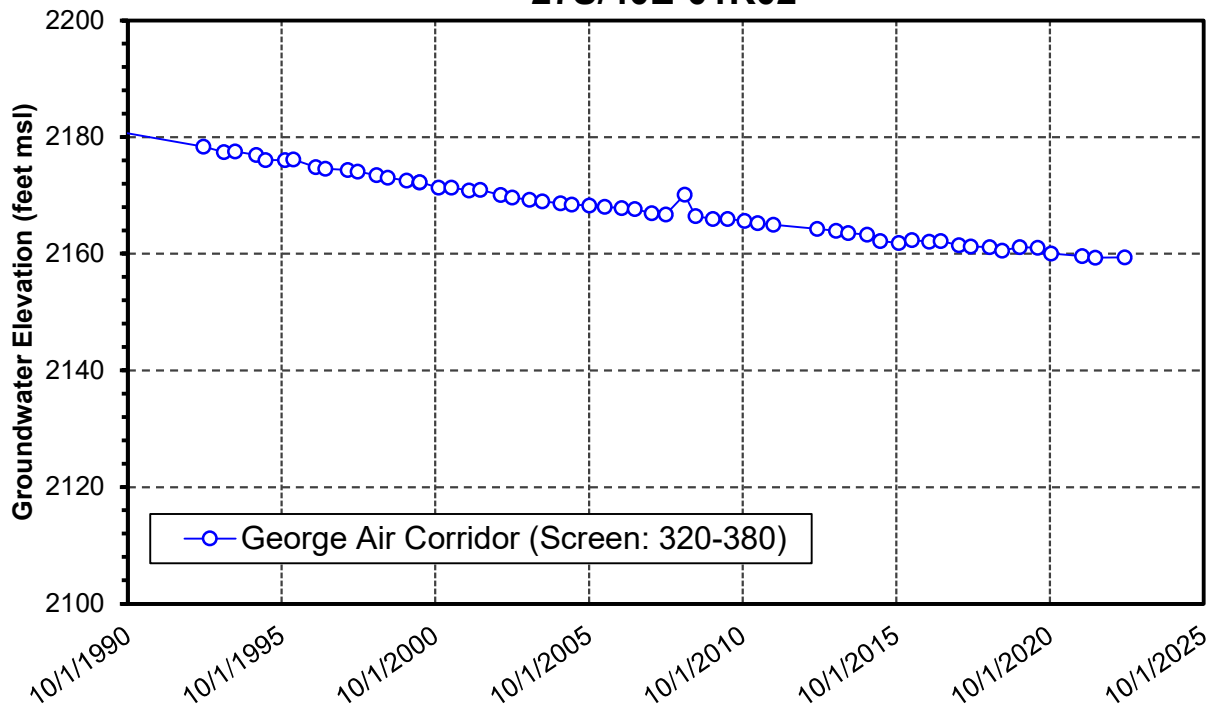
USBR 04 (2377 ft, msl)
Representative Monitoring Site
26S/39E-26A03



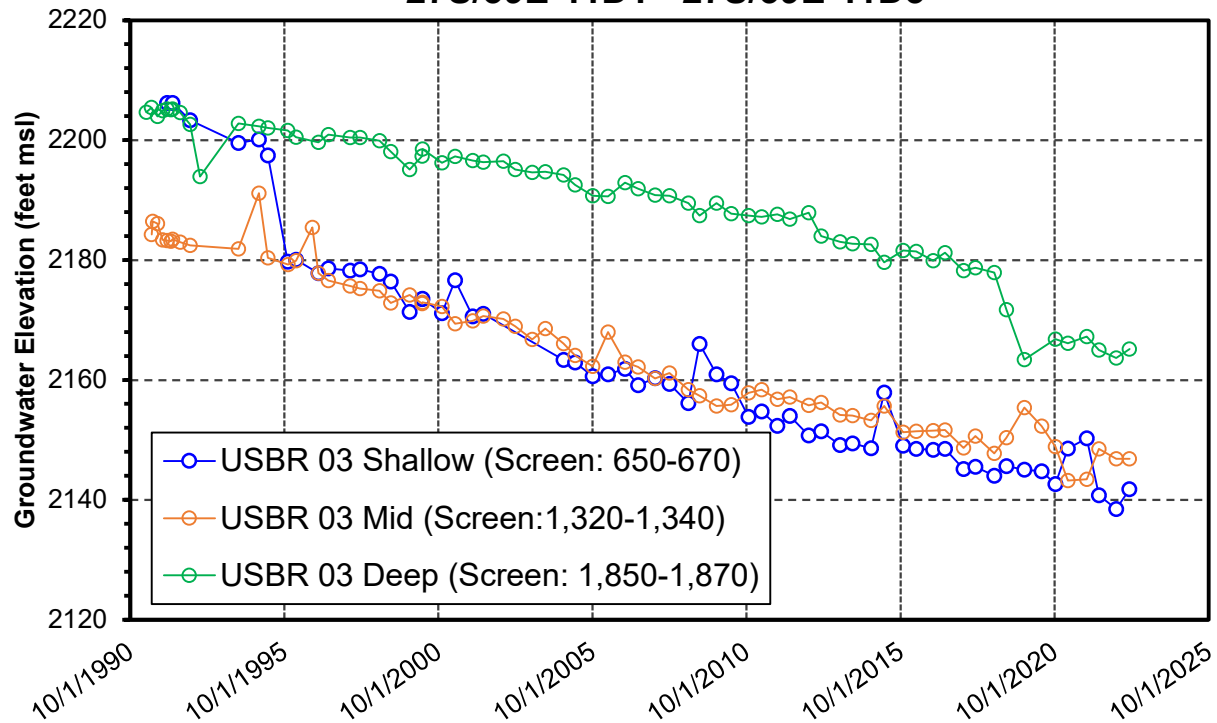
26S/39E-32L1 (2492 ft, msl)



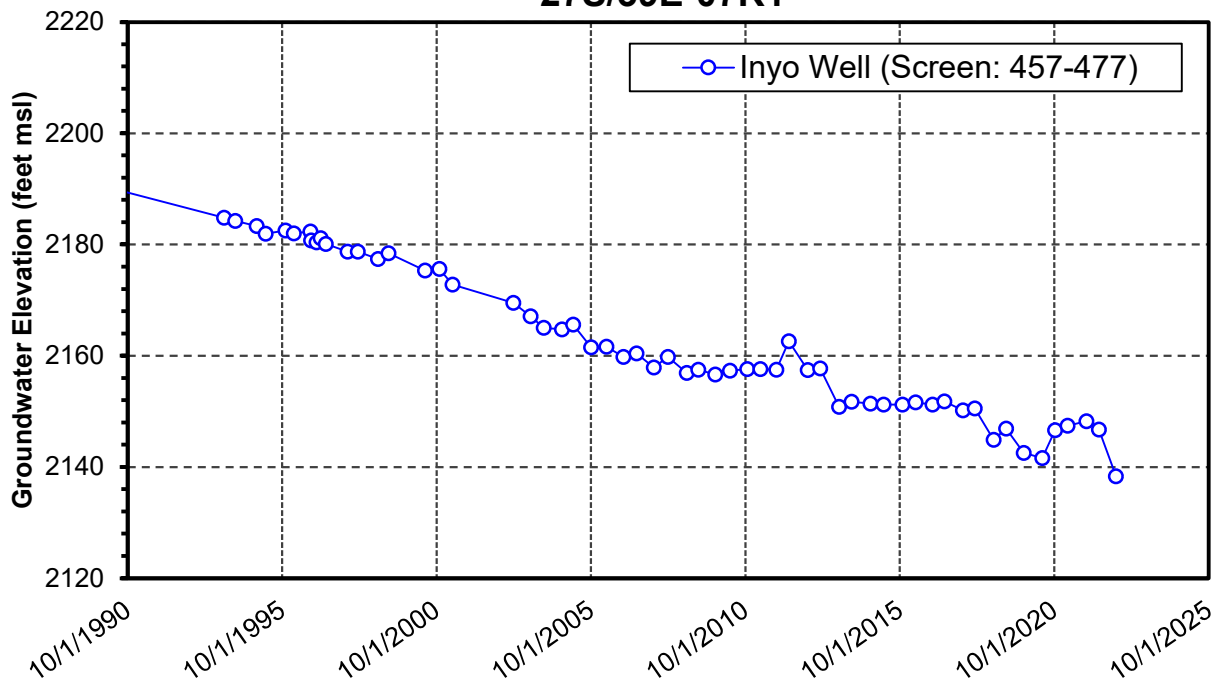
George Air Corridor (2322.64 ft, msl) Representative Monitoring Site 27S/40E-01K02

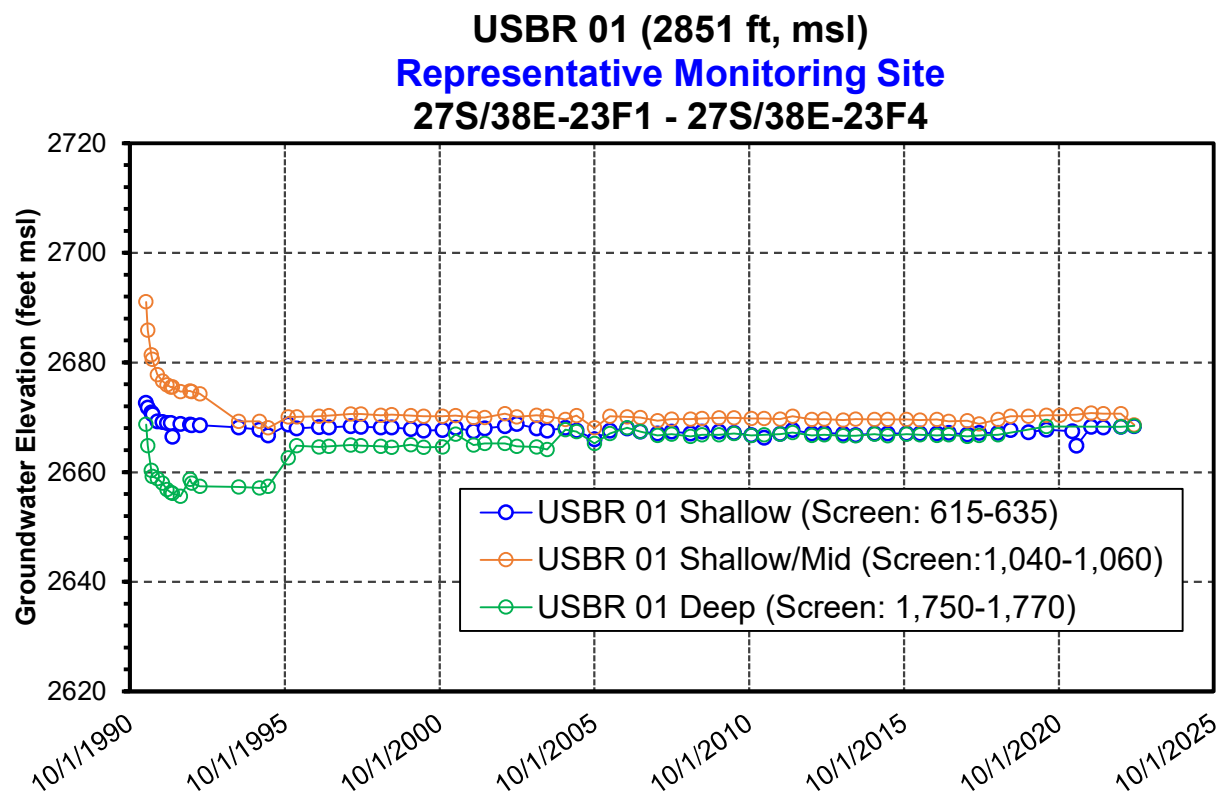
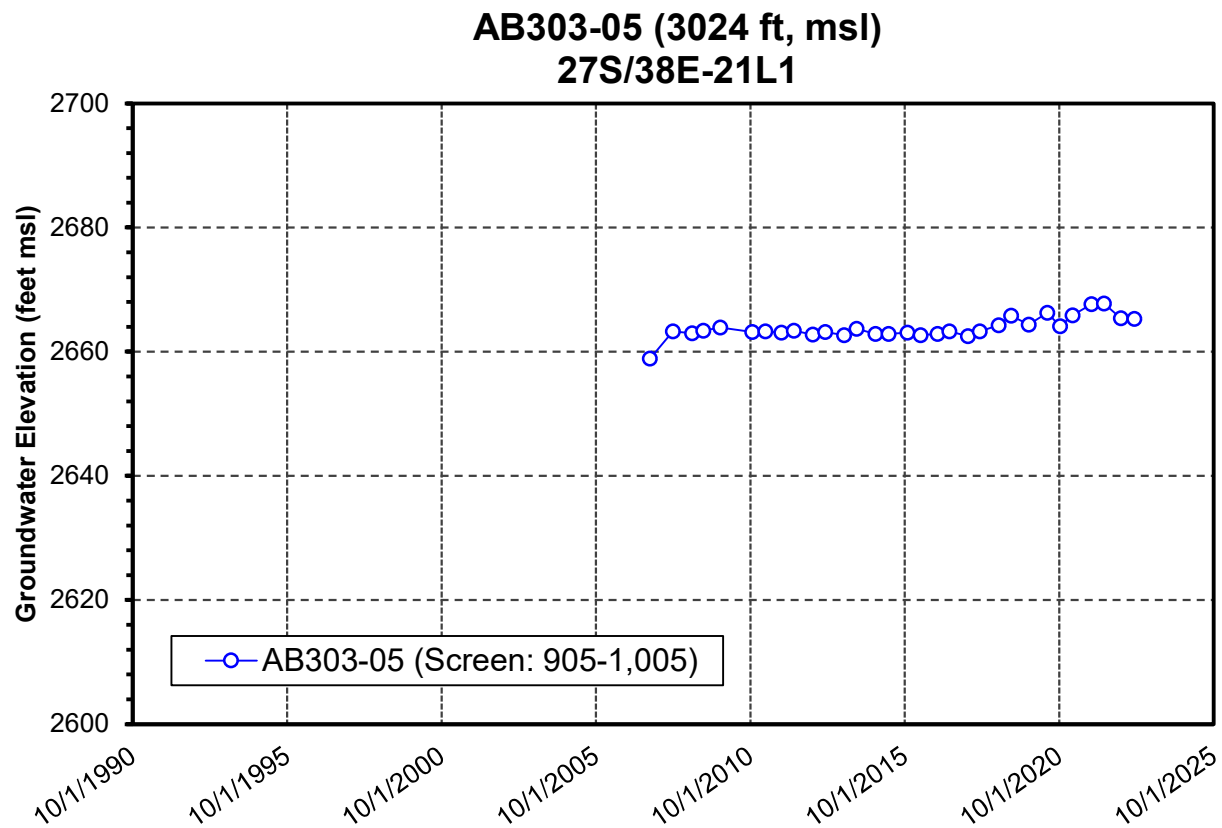


USBR 03 (2510 ft, msl)
Representative Monitoring Site
27S/39E-11D1 - 27S/39E-11D3



Inyo Well (2564 ft, msl)
Representative Monitoring Site
27S/39E-07R1





Attachment F

Storage Change Estimate Using Thiessen Polygon Method

INDIAN WELLS VALLEY GROUNDWATER BASIN
ESTIMATED GROUNDWATER STORAGE CHANGE

Note: This Storage Change Calculation is for Measured Areas of the IWV Basin

State ID		Basin	Specific	Surface Area	2015	2016	2017	2018	2019	2022	2023	2015-2016	2016-2017	2017-2018	2018-2019	2019-2022	2022-2023	WY 2016	WY 2017	WY 2018	WY 2019	2020 to 2022	WY 2023	4-Yr Cumm
Polygon	T/R-S	Common Name	Area	Yield	(acres)							2016	2017	2018	2019	2022	2023	2016	2017	2018	2019	3-year Avg	Anl	
1	28S/38E-18R	Black Hills Well	EP	0.21	14,609	2,820	2,820	2,820	2,821	2,820	2,820	0.1	0.2	0.6	-0.4	-0.3	0.0	307	614	1,841	-1,227	-918	-306	0
2	27S/38E-27M01	USNS-03	EP	0.21	2,987	2,679	2,679	2,679	2,679	2,680	2,681	-0.1	0.2	-0.2	1.2	0.6	0.2	-63	126	-126	753	376	125	138
3	27S/38E-23F01	USBR 1-S	EP	0.08	1,967	2,667	2,667	2,667	2,667	2,668	2,668	0.0	0.1	0.0	0.5	0.5	0.2	0	16	0	79	77	26	32
4	27S/38E-21L01	AB303-05	EP	0.21	5,344	2,663	2,663	2,663	2,663	2,666	2,668	-0.2	0.6	0.0	2.5	2.0	-2.5	-225	673	0	2,806	2,245	748	-2,806
5	27S/38E-15R01	AB303-06	EP	0.21	1,497	2,659	2,658	2,658	2,659	2,659	2,658	-0.6	-0.1	0.6	0.6	-0.2	-0.8	-189	-31	189	189	-63	-21	-251
6	27S/38E-09P01	Father Crowley	EP	0.21	849	2,694	2,694	2,695	2,695	2,694	2,697	0.3	0.2	0.1	-0.7	2.5	-5.2	54	36	18	-125	446	149	-933
7	27S/38E-08R01		EP	0.21	3,525	2,697	2,697	2,697	2,697	2,696	2,701	0.3	0.0	0.0	-1.0	4.3	0.2	222	0	0	-740	3,183	1,061	170
8	27S/38E-10B02	AB303-03	EP	0.21	1,588	2,469	2,470	2,470	2,469	2,469	2,473	0.5	0.6	-1.0	-0.1	3.4	-3.1	167	200	-333	-33	1,134	378	-1,034
9	27S/38E-09C01	AB303-04	EP	0.21	1,645	2,689	2,689	2,689	2,689	2,689	2,691	0.4	0.1	-0.6	0.2	2.0	-2.4	138	35	-207	69	691	230	-829
10	27S/39E-19E01	IWV MW #3	IWV	0.08	2,275	2,436	2,435	2,436	2,435	2,435	2,435	-0.2	0.1	-0.4	0.2	-0.4	-0.1	-36	18	-73	36	-72	-24	-18
11	27S/38E-13A01	Sea Bee Well	IWV	0.08	1,517	2,430	2,430	2,430	2,430	2,429	2,429	0.0	-0.2	-0.2	0.2	-0.9	0.1	0	-24	-24	24	-107	-36	11
12	27S/39E-08P02	IWV MW # 2	IWV	0.21	3,341	2,150	2,149	2,149	2,147	2,146	2,145	-0.8	-0.2	-1.5	-1.0	-1.2	-6.3	-561	-140	-1,053	-702	-845	-282	-4,420
13	27S/39E-07R01	Inyo	IWV	0.21	631	2,151	2,152	2,152	2,151	2,147	2,147	0.4	0.2	-1.3	-3.6	-0.2	-1.5	53	27	-172	-477	-27	-9	-199
14	27S/39E-08M02	IWV MW #1	IWV	0.21	468	2,148	2,147	2,146	2,146	2,144	2,140	-0.7	-0.7	-0.7	-1.9	-3.4	-4.4	-69	-69	-69	-187	-334	-111	-433
15	27S/39E-11D01	USBR 3-S	IWV	0.08	5,027	2,158	2,149	2,149	2,146	2,146	2,141	1.8	-0.2	-2.5	-7.0	-4.8	1.0	724	-80	-1,005	-2,815	-1,947	-649	394
16	27S/40E-06N02		IWV	0.08	4,727	2,119	2,121	2,119	2,122	2,121	2,123	2.1	-1.6	2.7	-1.4	2.6	1.8	794	-605	1,021	-530	997	332	666
17	27S/40E-01K02	George Air Corr.	IWV	0.21	1,001	2,162	2,162	2,162	2,161	2,161	2,159	0.2	-0.2	-0.9	-0.7	-1.2	0.0	42	-42	-189	-147	-253	-84	8
18	27S/40E-06E01		IWV	0.08	975	2,114	2,116	2,115	2,115	2,116	2,119	1.7	-1.1	0.9	0.4	3.6	2.1	133	-86	70	31	279	93	166
19	27S/39E-04C01		IWV	0.21	1,116	2,158	2,157	2,157	2,157	2,154	2,150	-0.7	-0.5	-0.2	-2.4	-4.3	-0.5	-164	-117	-47	-563	-1,003	-334	-122
20	27S/38E-02C01	USBR 2-S	IWV	0.21	1,109	2,373	2,373	2,373	2,372	2,372	2,373	-0.2	0.5	-1.0	0.0	1.1	0.0	-47	117	-233	0	256	85	-1
21	26S/39E-34R02		IWV	0.21	1,379	2,136	2,135	2,134	2,133	2,132	2,128	-0.8	-1.1	-1.1	-1.1	-3.7	-0.7	-232	-319	-319	-319	-1,074	-358	-200
22	26S/40E-31K01		IWV	0.21	1,791	2,113	2,115	2,114	2,115	2,118	2,119	2.2	-0.7	0.4	2.9	1.4	0.0	828	-263	151	1,091	530	177	1
23	26S/39E-32L01		IWV	0.21	3,171	2,155	2,154	2,154	2,153	2,151	2,148	-0.9	-0.3	-1.0	-1.8	-3.5	-0.8	-599	-200	-666	-1,199	-2,338	-779	-526
24	26S/39E-31R03		IWV	0.21	1,376	2,144	2,144	2,144	2,142	2,141	2,138	-0.5	-0.4	-1.2	-1.4	-3.1	-1.1	-130	-130	-347	-404	-893	-298	-315
25	26S/40E-35H02	Satellite Lake2(e)	IWV	0.21	2,609	2,155	2,154	2,154	2,153	2,153	2,154	-0.4	-0.3	-0.7	-0.3	0.8	-0.4	-219	-164	-384	-164	449	150	-225
26	26S/39E-26P02		IWV	0.18	1,070	2,146	2,146	2,145	2,144	2,143	2,140	-0.6	-0.6	-0.9	-1.4	-2.7	-0.2	-116	-116	-173	-270	-514	-171	-44
27	26S/39E-27D04	MW 32-D	IWV	0.18	1,459	2,146	2,145	2,146	2,143	2,143	2,140	-0.8	0.9	-3.1	-0.4	-2.6	0.3	-210	236	-814	-105	-684	-228	89
28	26S/39E-26A03	USBR 4	IWV	0.18	1,694	2,126	2,125	2,126	2,125	2,125	2,121	-1.2	0.8	-1.1	0.1	-4.0	9.6	-366	244	-336	31	-1,219	-406	2,943
29	26S/40E-22P04	PW Substation 2	IWV	0.21	705	2,187	2,195	2,192	2,191	2,193	2,206	7.5	-2.5	-0.8	1.2	13.3	0.0	1,110	-370	-118	178	1,970	657	-6
30	26S/40E-19N02		IWV	0.21	448	2,129	2,129	2,129	2,130	2,132	2,129	-0.3	0.2	1.4	1.4	-2.8	0.8	-28	19	132	132	-266	-89	75
31	26S/40E-21K03		IWV	0.21	706	2,164	2,165	2,166	2,164	2,165	2,167	1.1	0.5	-1.9	1.2	2.0	0.6	163	74	-274	174	295	98	94
32	26S/40E-20L01		IWV	0.21	812	2,151	2,150	2,151	2,151	2,151	2,151	-0.1	0.4	-0.1	0.1	-0.2	0.1	-17	68	-14	21	-36	-12	10
33	26S/40E-22H03		IWV	0.21	2,397	2,197	2,196	2,196	2,195	2,195	2,195	-0.6	-0.3	-0.7	-0.4	0.3	0.3	-302	-151	-337	-222	150	50	131
34	26S/39E-20C02		IWV	0.18	1,025	2,157	2,156	2,156	2,154	2,153	2,150	-0.8	-0.5	-1.5	-1.0	-3.2	-0.7	-148	-92	-277	-185	-591	-197	-129
35	26S/39E-13R04		IWV	0.21	1,793	2,129	2,126	2,126	2,128	2,130	2,125	-3.4	0.3	1.8	2.0	-5.1	2.9	-1,280	113	689	738	-1,911	-637	1,085
36	26S/40E-17N01		IWV	0.21	1,039	2,151	2,151	2,152	2,152	2,152	2,152	0.0	0.4	0.1	0.2	0.1	0.0	0	87	31	52	13	4	9
37	26S/40E-15N01		IWV	0.21	2,894	2,187	2,187	2,187	2,187	2,187	2,187	-0.3	0.3	-0.3	0.0	-0.2	-0.2	-182	182	-176	24	-104	-35	-134
38	26S/39E-15J		IWV	0.18	1,688	2,148	2,146	2,147	2,145	2,145	2,144	-1.9	0.5	-1.2	-0.4	-0.8	0.2	-577	152	-365	-137	-231	-77	49
39	26S/39E-14E01		IWV	0.21	864	2,169	2,169	2,168	2,168	2,167	2,165	-0.4	-0.9	-0.2	-0.6	-1.9	-0.6	-73	-163	-38	-103	-346	-115	-102
40	26S/39E-17G02	Kerr McGee	IWV	0.18	1,957	2,154	2,153	2,153	2,151	2,150	2,148	-1.0	-0.5	-1.6	-0.7	-1.9	-0.3	-352	-176	-546	-247	-673	-224	-102
41	26S/39E-11E02	Sandquist Spa	IWV	0.21	987	2,176	2,175	2,174	2,174	2,173	2,171	-0.8	-0.4	-0.8	-0.6	-2.0	-0.7	-166	-83	-158	-122	-413	-138	-147
42	26S/39E-09E		IWV	0.21	1,733	2,146	2,145	2,145	2,143	2,143	2,142	-0.5	-0.4	-1.4	-0.4	-0.6	0.2	-182	-146	-521	-157	-234	-78	73
43	26S/40E-12C		IWV	0.21	8,284	2,162	2,162	2,162	2,161	2,162	2,160	-0.3	0.5	-0.6	0.4	-1.5	0.4	-522	870	-1,096	783	-2,644	-881	659
44	26S/39E-02N01		IWV	0.21	2,103	2,176	2,175	2,175	2,174	2,173	2,173	-0.7	-0.6	-0.6	-0.7	-0.8	-0.5	-309	-265	-269	-292	-333	-111	-234
45	26S/38E-02Q01		IWV	0.21	1,509	2,164	2,164	2,163	2,162	2,160	2,158	-0.6	-1.1</											

Note: This Storage Change Calculation is for Measured Areas of the IWV Basin						Groundwater Level (Feet, msl)							Change (feet)							Storage Change (AF) for Measured Area of IWV Basin														
Polygon	State ID	Common Name	Basin Area	Specific Yield	Surface Area (acres)	2015	2016	2017	2018	2019	2022	2023	2015-2016	2016-2017	2017-2018	2018-2019	2019-2022	2022-2023	WY 2016	WY 2017	WY 2018	WY 2019	2020 to 2022		WY 2023	4-Yr Cumm								
	T/R-S																						3-year Avg	Anl										
56	25S/39E-28P01	Baker 4-NE	IWV	0.21	2,504	2,185	2,187	2,189	2,188	2,190	2,175	2,180	1.9	1.9	-0.2	1.3	-14.3	4.2	1,015	1,015	-89	673	-7,537	-2,512	2,224	-5,313								
57	25S/39E-29M01		IWV	0.21	2,556	2,177	2,177	2,176	2,176	2,175	2,173	2,173	-0.6	-0.5	-0.5	-0.6	-1.8	-0.5	-295	-268	-263	-333	-985	-328	-279	-1,264								
58	25S/38E-25J03	NR 1-D	IWV	0.21	1,475	2,158	2,158	2,157	2,156	2,155	2,143	2,142	-0.5	-0.7	-1.4	-0.8	-11.9	-0.5	-155	-217	-434	-248	-3,687	-1,229	-155	-3,842								
59	25S/38E-14Q01		IWV	0.21	3,621	2,163	2,168	2,167	2,166	2,165	2,163	2,165	4.8	-0.9	-0.9	-0.9	-2.5	2.5	3,650	-684	-684	-684	-1,878	-626	1,878	0								
60	25S/39E-12R01	Charely Tower	IWV	0.21	12,232	2,179	2,179	2,179	2,178	2,178	2,177	2,177	-0.2	-0.2	-0.2	-0.3	-0.7	-0.2	-591	-591	-591	-642	-1,923	-641	-514	-2,436								
61	25S/38E-12L03	USBR 6-D	IWV	0.21	6,289	2,190	2,189	2,189	2,188	2,187	2,187	2,186	-0.9	-0.4	-0.9	-0.6	-0.4	-0.7	-1,189	-528	-1,228	-753	-475	-158	-964	-1,440								
62	25S/39E-03R01	Baker Range	IWV	0.21	6,159	2,177	2,177	2,177	2,176	2,176	2,175	2,175	-0.4	-0.4	-0.3	-0.4	-1.0	-0.4	-474	-474	-414	-492	-1,304	-435	-466	-1,769								
63	24S/38E-21A04	USBR 10-D	IWV	0.21	4,060	2,244	2,244	2,243	2,243	2,241	2,242	2,240	-0.1	-0.9	-0.4	-1.1	0.1	-1.9	-85	-767	-341	-938	85	28	-1,586	-1,500								
64	25S/38E-03B		IWV	0.21	2,291	2,172	2,171	2,170	2,170	2,168	2,166	2,164	-0.9	-0.6	-0.4	-1.4	-2.5	-1.4	-433	-289	-193	-674	-1,202	-401	-664	-1,866								
65	25S/40E-30E01	TTBK MW14	IWV	0.21	6,169	2,177	2,177	2,177	2,177	2,177	2,176	2,176	-0.1	-0.1	-0.3	-0.2	-0.7	-0.2	-71	-71	-337	-259	-868	-289	-233	-1,101								
66	26S/38E-22B	Ostrich Ranch	IWV	0.21	2,465	2,240	2,240	2,236	2,236	2,240	2,237	2,233	-0.2	-4.0	-0.1	4.0	-2.6	-3.8	-104	-2,071	-52	2,071	-1,339	-446	-1,972	-3,311								
67	26S/38E-35B		IWV	0.21	1,714	2,233	2,231	2,232	2,233	2,232	2,232	2,232	-1.6	1.5	0.7	-1.0	-0.3	-0.3	-576	540	252	-360	-101	-34	-115	-216								
68	26S/38E-35D		IWV	0.21	1,869	2,238	2,238	2,238	2,238	2,237	2,239	2,236	0.1	0.1	-0.3	-0.5	1.7	-3.6	39	39	-118	-196	666	222	-1,413	-747								
69	26S/40E-28J01	Hospital	IWV	0.21	569	2,157	2,157	2,156	2,156	2,156	2,157	2,156	0.1	-0.7	-0.1	-0.6	1.0	-0.8	12	-84	-12	-72	120	40	-96	24								
70	26S/40E-29M01		IWV	0.21	2,837	2,124	2,130	2,130	2,127	2,131	2,124	2,125	6.4	0.0	-3.2	4.2	-7.7	1.1	3,813	0	-1,907	2,503	-4,562	-1,521	632	-3,930								
71	27S/38E-01C		IWV	0.08	1,268	2,200	2,199	2,199	2,199	2,199	2,196	2,195	-0.5	-0.3	-0.3	-0.3	-2.9	-0.6	-51	-30	-30	-30	-294	-98	-61	-355								
72	27S/39E-02K	Asphalt Constr	IWV	0.21	2,387	2,151	2,149	2,148	2,147	2,146	2,144	2,142	-1.4	-1.4	-1.4	-0.3	-0.9	-1.5	-711	-711	-711	-150	-451	-150	-750	-1,201								
73	27S/39E-08A01		IWV	0.21	1,190	2,148	2,148	2,147	2,147	2,145	2,139	2,137	0.2	-1.1	-0.5	-1.8	-5.7	-2.7	50	-275	-125	-450	-1,423	-474	-665	-2,088								
74	24S/38E-33J02		IWV	0.21	3,435	2,175	2,174	2,170	2,173	2,172	2,169	2,169	-1.0	-3.4	2.9	-1.1	-3.3	-0.9	-721	-2,453	2,092	-794	-2,381	-794	-632	-3,012								
75	25S/39E-22J01	S. Baker Ranch	IWV	0.21	3,600	2,179	2,178	2,178	2,178	2,177	2,176	2,176	-0.3	-0.3	-0.3	-0.4	-1.1	-0.3	-263	-263	-204	-280	-805	-268	-242	-1,047								
76	26S/40E-34F01	City of Ridgecrest	IWV	0.21	926	2,146	2,147	2,147	2,146	2,145	2,145	2,145	0.5	-0.4	-0.6	-0.5	-1.7	-0.1	97	-78	-107	-107	-321	-107	-17	-338								
77	27S/40E-02J01	DMP Cemetery	IWV	0.21	2,308	2,162	2,162	2,162	2,161	2,161	2,159	2,151	0.2	-0.2	-0.9	-0.7	-1.2	-8.8	97	-97	-436	-339	-584	-195	-4,259	-4,842								
			IWV Main Basin		154,960															IWV Main Basin							-4,791	-12,149	-17,486	-11,107	-47,648	-15,883	-12,370	-60,018
			El Paso Subarea		34,011															El Paso Subarea							412	1,667	1,381	1,770	7,171	2,390	-5,513	1,658
					188,971															Total for measured Area							-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477	-13,492	-17,883	-58,360
																											-4,380	-10,482	-16,105	-9,338	-40,477			

Attachment G

Estimated WY 2023 Groundwater Production

Attachment G: WY 2023 Groundwater Production Estimate

Water Use Sector (DWR)	Water User	No Action Baseline WY 2023		Reported Groundwater Pumping WY 2023		Estimated Groundwater Pumping WY 2023	
		note	(AFY)	note	(AFY)	note	(AFY)
Urban	IWVWD	2	6,628	1	4,266	3	5,443
Urban	City/County	2	425	1	35	3	173
Industrial	Searles Valley Minerals	2	2,907	1	2,514	3	2,575
Other - Federal	U.S. Navy	2	2,041	4	1,377	4	1,377
Agriculture	Meadowbrook Farms	2	12,303	1	3,642	1	3,642
Agriculture	Mojave Pistachio	2	6,891	1	3,523	1	3,523
Agriculture	Simmons Farm	2	931	1	0	1	0
Agriculture	Sierra Shadows	2	765	1	114	3	244
Agriculture	Quist Farms	2	685	1	272	3	489
Agriculture	Other Small Ag	2	957	1	151	3	211
Other - Co- Ops/Mutuals/Community Services District	Other - Co- Ops/Mutuals/Community Services District		544	1	150	3	634
Other - Domestic	Domestic	2	832		0	2	832
			35,909			19,141	

Notes:

- 1 Production reported to IWVGA for volumetric production fees and/or transient pool records. (Not all required pumpers report production.)
- 2 Estimated from GSP 'No Action' Baseline analysis.
- 3 Missing data estimated from best available data sources.
- 4 Data provided by Navy to the IWVGA via letter on November 7, 2023.

Attachment H

WY 2023 Water Quality Data

Table 1 Well Information, Sampling Methods, & Depth to Water Levels

State ID	Other Name	Latitude	Longitude	Well Type	Total Depth (ft, bgs)	Screen Interval (ft, bgs)	Sampling Method	Date	DTW	Sample Time
25S/38E-14A	Bork	35.76809	-117.85244	DOM	unk	unk	Owner purged	10/3/2022	234.91	10/3/2022 9:35
25S/38E-34A01	Means	35.72453	-117.87024	DOM	480	418.5-479.5	Owner purged	10/3/2022	365.83	10/3/2022 12:30
27S/38E-09C01	AB303-04	35.60665	-117.89378	MW	601	501-581	Hydrasleeve	10/3/2022	386.66	10/4/2022 8:22
27S/38E-13A02	AB303-01	35.59369	-117.8307	MW	690	232-272, 372-472, 630-690	Hydrasleeve	10/3/2022	225.81	10/4/2022 9:20
27S/38E-15R01	AB303-06	35.58195	-117.86617	MW	380	280-340	Hydrasleeve	10/3/2022	276.92	10/4/2022 9:45
27S/38E-21L01	AB303-05	35.56985	-117.89592	MW	1045	905-1005	Hydrasleeve	10/3/2022	360.49	10/4/2022 11:11
27S/39E-08A01	08A01	35.60721	-117.79818	MW	955	550-865, 895-935	Hydrasleeve	10/3/2022	397.98	10/4/2022 11:55
27S/40E-01K02	George Air Corridor	35.6147	-117.62469	MW	400	320-380	Hydrasleeve	10/3/2022	165.01	10/4/2022 12:45
27S/38E-32C01	EP-1-S	35.54904179	-117.9107061	MW	0	450-470	Hydrasleeve	10/4/2022	275.28	10/5/2022 17:50
27S/38E-10B02	AB303-03	35.60662	-117.87407	MW	872	452-552	Hydrasleeve	10/4/2022	431.44	10/5/2022 18:22
25S/38E-35B01	35B01	35.72509	-117.85286	MW	unk	200-298	Hydrasleeve	10/4/2022	240.95	10/5/2022 19:00
25S/38E-03B	03B1	35.79546	-117.87382	MW	360	300-360	Hydrasleeve	10/4/2022	294.11	10/5/2022 19:20
26S/39E-25K01	25K1	35.64041	-117.74023	MW	580	440-540	Hydrasleeve	10/4/2022	267.71	10/5/2022 20:00
26S/38E-01M05	Fields	35.70215	-117.84707	DOM	360	299-359	Owner purged	10/5/2022	216.41	10/5/2022 10:40
26S/38E-01L01	Well G	35.702013	-117.841337	DOM	unk	unk	Owner purged			10/5/2022 8:35
25S/39E-03R01	Baker Range	35.78412	-117.76257	MW,C	185	65-165	Hydrasleeve	10/3/2022	51.42	10/5/2022 7:50
25S/39E-12R01	Charley Tower	35.77039	-117.72496	MW	150	60-140	Hydrasleeve	10/3/2022	25.01	10/5/2022 8:25
26S/39E-05L01	05L01(S)	35.69973	-117.80355	MW	600	160-240	Hydrasleeve	10/3/2022	131.38	10/5/2022 9:50
26S/39E-17G02	Kerr McGee	35.67635	-117.80452	MW	881	681-881	Hydrasleeve	10/3/2022	210.1	10/5/2022 10:35
26S/39E-11E02	Sandquist Spa	35.68857	-117.75647	MW,C	191	135-191	Hydrasleeve	10/3/2022	136.51	10/5/2022 11:15
26S/39E-05K01	05K01(D)	35.69973	-117.80339	MW	605	565-585	Hydrasleeve	10/3/2022	129.39	10/5/2022 14:15
26S/40E-19N02	19N02	35.65413	-117.72147	MW	267	245-265	Hydrasleeve	10/3/2022	209	10/5/2022 14:50
26S/40E-22E01	26S/40E-22E01	35.66135	-117.66687	MW	651.5	531-631	Hydrasleeve	10/3/2022	98.87	10/5/2022 15:30
26S/40E-22E02	26S/40E-22E02	35.66132	-117.66633	MW	650	570-630	Hydrasleeve			10/5/2022 16:00

Well Type

MW: Monitoring Well
C: CASGEM Well
DOM: Domestic

Table 2 Water Quality Summary

Sample ID	State ID	Sample Date	Sample Depth (ft bgs)	Specific Conductance (EC) (μmhos/cm)	Total Filterable Residue/TDS (mg/L)	Calculated TDS/EC (multiplier)	Total Hardness (as CaCO ₃) (mg/L)	Total Anions (meq/L)	Total Cations (meq/L)	% difference	Odor Threshold (TON)	Turbidity (NTU)	Total Alkalinity (CaCO ₃) (mg/L)	Bicarbonate HCO ₃ (mg/L)	Carbonate CO ₃ (mg/L)	pH (Lab) (pH Units)
Maximum Contaminant Level (MCL)				1,600	1,000	n/a	n/a	n/a	n/a	n/a	3	5	n/a	n/a	n/a	n/a
14A01	25S/38E-14A	10/3/2022	ubknown	700	430	0.61	250	7.6	7.75	2.0	1	0.57	250	300	ND	7.7
34A01	25S/38E-34A01	10/3/2022	418.5-478.5	870	520	0.60	300	10	10	2.1	1	0.59	420	510	ND	7.2
AB303-04	27S/38E-09C01	10/4/2022	557-560	490	290	0.59	65	4.78	5.20	8.4	1	33	100	120	ND	8.0
AB303-01	27S/38E-13A02	10/4/2022	397-400	460	300	0.65	110	4.53	4.56	0.63	1	0.33	130	160	ND	7.7
AB303-06	27S/38E-15R01	10/4/2022	297-300	390	240	0.62	56	3.64	4.16	13	1	0.2	100	120	ND	8.0
AB303-05	27S/38E-21L01	10/4/2022	952-955	260	160	0.62	ND	2.78	2.7	3.1	1	0.44	120	150	ND	9.0
08A01	27S/39E-08A01	10/4/2022	572-575	410	260	0.63	100	3.95	3.92	0.88	1	0.48	110	140	ND	7.5
George Air Corridor	27S/40E-01K02	10/4/2022	247-250	1900	1000	0.53	150	17.3	16.2	6.3	1	0.24	120	140	ND	8.0
EP-1-S	27S/38E-32C01	10/5/2022	457-460	390	250	0.64	69	4.09	4.19	2.4	1	0.22	160	190	ND	7.5
AB303-03	27S/38E-10B02	10/5/2022	497-500	250	160	0.64	190	2.57	6.41	85	1	41	97	35	41	9.5
35B01	25S/38E-35B01	10/5/2022	247-250	880	510	0.58	160	9.88	9.5	3.9	1	31	370	450	ND	7.7
03B1	25S/38E-03B	10/5/2022	347-350	930	580	0.62	370	10.6	10.2	3.2	1	1.3	370	450	ND	7.0
25K1	26S/39E-25K01	10/5/2022	497-500	420	260	0.62	110	3.93	4.3	9	1	0.18	110	130	ND	7.8
01M05	26S/38E-01M05	10/5/2022	299-359	880	530	0.60	190	8.94	8.81	1.4	1	0.33	160	190	ND	7.6
Well G	26S/38E-01L01	10/5/2022	ubknown	850	520	0.61	170	8.89	8.24	7.6	1	0.2	160	200	ND	7.7
Baker Range	25S/39E-03R01	10/5/2022	97-100	960	610	0.64	260	10.6	10.8	2.1	1	0.17	310	380	ND	7.6
Charley Tower	25S/39E-12R01	10/5/2022	117-120	1100	690	0.63	190	12.30	11.6	5.7	1	1.6	310	380	ND	7.5
05L01(S)	26S/39E-05L01	10/5/2022	197-200	8000	5100	0.64	ND	114	105	8.6	1	0.31	4500	1700	1900	9.8
Kerr McGee	26S/39E-17G02	10/5/2022	697-700	260	170	0.65	18	3.53	2.72	26	1	2.7	160	140	26	8.6
Sandquist Spa	26S/39E-11E02	10/5/2022	157-160	580	340	0.59	190	5.98	5.98	0.056	1	ND	140	170	ND	7.7
05K01(D)	26S/39E-05K01	10/5/2022	572-575	31000	19000	0.61	ND	497	523	5.2	5	0.48	20000	6700	8900	9.9
19N02	26S/40E-19N02	10/5/2022	252-255	250	180	0.72	30	2.68	2.79	3.8	2	1.2	120	150	ND	7.4
22E01	26S/40E-22E01	10/5/2022	557-560	2600	1600	0.62	ND	33	28.6	14	3	1.6	1200	1200	140	8.7
22E02	26S/40E-22E02	10/5/2022	597-600	1800	1300	0.72	400	20.7	20.4	1.2	2	0.26	400	480	ND	7.6

n/a	- Non applicable to dataset
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ND - Analyte not detected at or above the reporting limit

J - Detected below the Reporting Limit; reported concentration is estimated

Table 2 Water Quality Summary

Sample ID	State ID	Sample Date	Sample Depth (ft bgs)	Chloride (mg/L)	Fluoride (mg/L)	Hydroxide (mg/L)	MBAS (LAS Mole. Wt 340.0) (mg/L)	Nitrate as N (mg/L)	Sulfate (mg/L)	Arsenic (µg/L)	Boron (µg/L)	Calcium (mg/L)	Copper (µg/L)	Iron (µg/L)	Magnesium (mg/L)	Manganese (µg/L)	Potassiu m (mg/L)	Sodium (mg/L)	Zinc (µg/L)
Maximum Contaminant Level (MCL)				500	2	n/a	0.5	10	500	10	n/a	n/a	1,000	300	n/a	50	n/a	n/a	5,000
14A01	25S/38E-14A	10/3/2022	ubknown	28	0.80	ND	0.048 ^J	1.9	89	3.3	250	64	12 ^J	200	21	ND	8.4	60	57
34A01	25S/38E-34A01	10/3/2022	418.5-478.5	14	0.61	ND	ND	0.39 ^J	63	6.3	480	77	36 ^J	21 ^J	27	0.83 ^J	6.6	84	59
AB303-04	27S/38E-09C01	10/4/2022	557-560	18	0.29	ND	ND	1.8	110	1.3 ^J	120	21	8.4 ^J	830	3	35	2.8	88	ND
AB303-01	27S/38E-13A02	10/4/2022	397-400	24	0.88	ND	ND	2.3	57	1.9 ^J	270	37	ND	ND	4.9	ND	1.8	52	ND
AB303-06	27S/38E-15R01	10/4/2022	297-300	11	0.27	ND	0.054 ^J	2.7	65	3.7	110	19	ND	ND	1.9	ND	2	69	ND
AB303-05	27S/38E-21L01	10/4/2022	952-955	2.6	0.40	ND	ND	0.13 ^J	11	5.2	100	1.5	ND	ND	ND	2.8 ^J	0.56 ^J	60	ND
08A01	27S/39E-08A01	10/4/2022	572-575	24	0.81	ND	ND	1.7	45	2.4	330	32	ND	120	5.3	21	2.1	42	ND
George Air Corridor	27S/40E-01K02	10/4/2022	247-250	490	1.9	ND	0.053 ^J	0.29 ^J	51	44	2800	50	ND	44 ^J	5.2	5.3	9.5	300	ND
EP-1-S	27S/38E-32C01	10/5/2022	457-460	15	0.64	ND	0.048 ^J	0.74	25	4.8	280	22	ND	ND	3.1	9.8 ^J	2.1	64	ND
AB303-03	27S/38E-10B02	10/5/2022	497-500	4.9	0.36	ND	ND	0.15 ^J	23	13	110	76	9.1 ^J	670	0.72 ^J	300	1	58	ND
35B01	25S/38E-35B01	10/5/2022	247-250	44	0.57	ND	ND	0.14 ^J	59	5.6	1100	44	ND	3600	13	180	5.3	140	ND
03B1	25S/38E-03B	10/5/2022	347-350	23	0.76	ND	ND	1.2	120	5.1	180	87	7.0 ^J	ND	36	ND	7.1	63	ND
25K1	26S/39E-25K01	10/5/2022	497-500	29	0.45	ND	0.051 ^J	3.0	46	4.7	250	34	ND	ND	4.8	ND	2.9	49	ND
01M05	26S/38E-01M05	10/5/2022	299-359	80	0.57	ND	ND	0.59	170	1.4 ^J	700	57	15 ^J	ND	13	1.1 ^J	4.1	110	ND
Well G	26S/38E-01L01	10/5/2022	ubknown	80	0.42	ND	ND	0.30 ^J	160	1.4 ^J	820	49	ND	23 ^J	11	0.99 ^J	3.8	110	ND
Baker Range	25S/39E-03R01	10/5/2022	97-100	50	0.73	ND	0.049 ^J	1.10	140	15	1400	45	7.6 ^J	ND	36	ND	15	120	ND
Charley Tower	25S/39E-12R01	10/5/2022	117-120	110	0.77	ND	0.065 ^J	0.29 ^J	140	15	2900	37	ND	180	24	24	15	170	ND
05L01(S)	26S/39E-05L01	10/5/2022	197-200	760	6.2	ND	0.24	ND	75	5.7	89000	4.1 ^J	ND	ND	ND	ND	15 ^J	2400	ND
Kerr McGee	26S/39E-17G02	10/5/2022	697-700	6	2.60	ND	ND	ND	3	4.7	560	5.7	ND	310	0.94 ^J	24	3.8	52	ND
Sandquist Spa	26S/39E-11E02	10/5/2022	157-160	62	0.55	ND	ND	1.9	68	1.7 ^J	310	61	ND	ND	8.9	ND	2.7	49	ND
05K01(D)	26S/39E-05K01	10/5/2022	572-575	3200	ND	ND	0.85	0.15 ^J	0.74	7.5	500000	ND	ND	ND	ND	ND	42 ^J	12000	ND
19N02	26S/40E-19N02	10/5/2022	252-255	6.0	0.77	ND	0.070 ^J	ND	0.72	1.7 ^J	220	9.5	ND	14 ^J	1.6	6.0 ^J	8.8	45	ND
22E01	26S/40E-22E01	10/5/2022	557-560	280	7.1	ND	0.070 ^J	0.15 ^J	21	3.1	23000	3.0 ^J	ND	ND	ND	9.4 ^J	7.8 ^J	650	ND
22E02	26S/40E-22E02	10/5/2022	597-600	19	3.8	ND	0.083 ^J	ND	580	330	2300	70	8.8 ^J	ND	54	24	29	270	ND

n/a - Non applicable to dataset

ND - Analyte not detected at or above the reporting limit

J - Detected below the Reporting Limit; reported concentration is estimated

Attachment I

IWV Model Configuration Item List

IWV-MODEL CONFIGURATION ITEM (CI) LIST

CI Request Number	CI Request Date	CI Summary	Importance Rank 1 (low) 5 (high)	Priority 1 (low) 5 (high)	Origin of CI (IWVGA, TAC, Navy, etc.)	Date Complete <i>review order</i>
1	10/27/22	Discussing changes to groundwater in storage and compare the model results to a Thiessen Polygon method.			TMG	TMG 12/15/22 Group discussion
2	1/19/23	Dr. Ryan Smith a. Discussion of how to approach AEM data analysis (SkyTEM Survey Data Report) b. Additional data to provide for AEM interpretation			TMG	TMG 2/14/23 Group discussion
3	3/23/23	DRI to present the first proposed GSP Model changes: a. Simulation period: October 1, 1920 through September 30, 2022. b. Stress period: annual stress period from October 1, 1920 to September 30, 1995; monthly stress period from October 1, 1995 to September 30, 2022. c. Six model layers d. Depth and thickness of each model layer based on Monasttero et al. (2002); Shah et al. (2018) and AEM data (2019) e. Hydraulic conductivity f. Pumping g. Recharge	5	5	TMG	TMG 8/17/23 Group discussion
4	5/24/23	Group meeting a. Seismic depth to basement analysis b. Clay plug analysis			TMG	TMG 5/24/23 Group discussion
5	6/14/23	Group meeting a. Depth to basement analysis b. Sedimentary thickness analysis			TMG	TMG 6/14/23 Group discussion
6	6/30/23	Group meeting a. Preliminary model layer delineation			TMG	TMG 6/30/23 Group discussion
7	7/21/23	a. Discussed methodology for discretizing model grid in basalt flow area below Rose Valley, and planned to delineate an aquifer property zone for the White Hills formation. b. DRI will continue work on model grid discretization using SkyTEM and well log data. DRI will complete the preliminary model discretization, define faults to be simulated, and analyze clay fraction in the clay plug to present at the next modeling group meeting.			TMG	TMG 7/21/23 Group discussion
8	9/25/23	Steve Bacon, September 25, 2023. Development of a Tectonic Block Model in Support of the Hydrogeology Conceptual Framework of IWV (2025 GSP Update)	5	5	TMG	TMG 9/25/23 Plan outside AEM review

Attachment J

WY 2023 Precipitation and Stream Gage Data



DRAFT MEMORANDUM

785 Grand Avenue, Suite 202 • Carlsbad, California • 94901
TEL: (760) 730-0701 FAX: (415) 457-1638 e-mail: stever@stetsonengineers.com

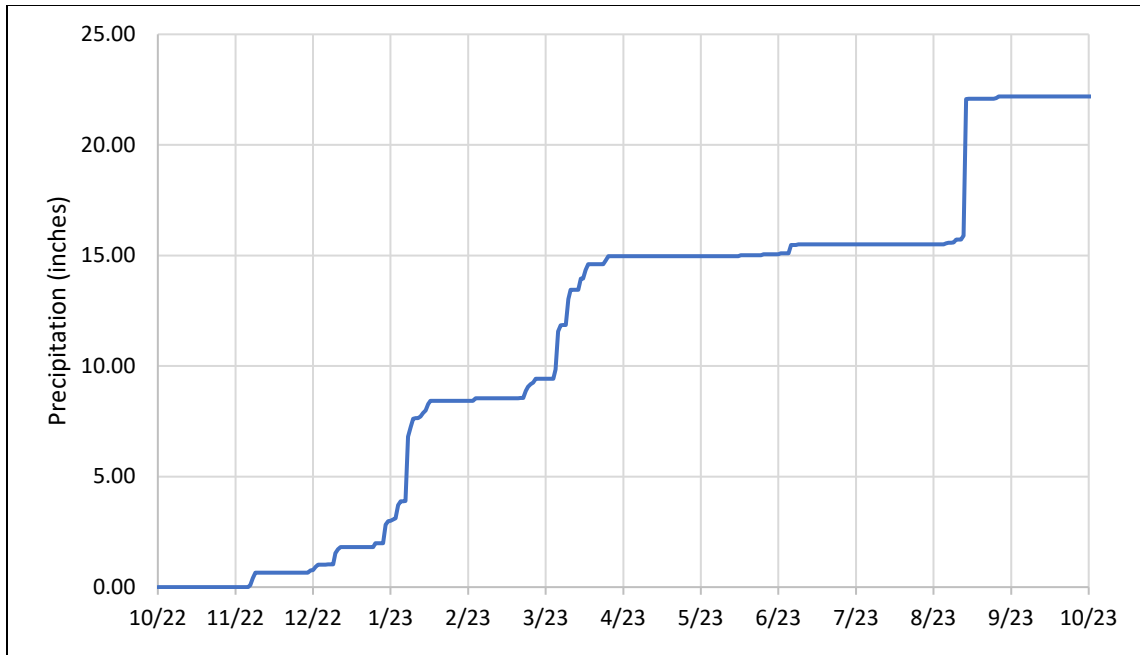
TO: File DATE: November 22, 2023
FROM: Stetson Engineers Inc. JOB NO: 2652
RE: Chimney Peak Weather Station – Annual Report of Precipitation, Water Year 2023

This memorandum serves as an annual summary of station operation and reporting of approved data records associated with the Chimney Peak Weather Station. IWVGA operation of this station is done under legal agreement with the Bureau of Land Management to occupy and operate the station inside of the BLM Chimney Peak Fire Station property boundary.

SUMMARY OF STATION OPERATIONS AND DATA – WY 2023

During WY 2023, three site visits were made to conduct maintenance of the station, October 2022, March 2023, and September 2023. During the March 2023 site visit significant snow accumulation prevented visiting the site, however a visual inspection from outside the fire station was possible to determine that no adverse impacts had occurred as a result of snow accumulation. The September visit further verified that the station had operated without issue throughout the year.

Over the course of the water year 22.19 inches of precipitation was recorded at this station. Total precipitation may have been greater than this as much of the winter time precipitation was as snowfall. Tipping bucket rain gages as are employed at many of the weather station in the area will experience inefficiencies in capturing of precipitation as snowfall due to the design. The following graph shows the accumulated precipitation for Water Year 2023.



**FIGURE 1. CUMULATIVE PRECIPITATION AT CHIMNEY PEAK WEATHER STATION
WATER YEAR 2023**

The following tables summarize the daily recorded precipitation totals, December 2020 through October 2023, by Water Year. Other parameter data is available on the IWVGSP.com website.

Daily Precipitation Data Chimney Peak Fire Station, Water Year 2021

Water year 2021
Station Name Chimney Peak Fire Station
Operating Agency IWVGA Agent - Stetson Engineers Inc.
Latitude 35°52'08.5" N
Longitude 118°00'42.6" W

DAY	Daily Precipitation (inches)											
	2020 OCT	NOV	DEC	2021 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	0	0	0	0	0	0	0	0	0
2	---	---	---	0	0	0	0	0	0	0	0	0
3	---	---	---	0	0	0	0	0	0	0	0	0
4	---	---	---	0	0	0	0	0	0	0	0	0
5	---	---	---	0	0	0	0	0	0	0	0	0
6	---	---	---	0	0	0	0	0	0	0	0	0
7	---	---	---	0	0	0	0	0	0	0	0	0
8	---	---	---	0	0	0	0	0	0	0	0	0
9	---	---	---	0	0	0	0	0	0	0	0	0
10	---	---	---	0	0	0.05	0	0	0	0	0	0.27
11	---	---	---	0	0	0	0	0	0	0.25	0	0
12	---	---	---	0	0.16	0.03	0	0	0	0.13	0	0
13	---	---	---	0	0	0	0	0	0	0.01	0	0
14	---	---	0.03	0	0	0	0	0	0	0	0	0
15	---	---	0	0	0	0.01	0	0	0	0	0	0
16	---	---	0	0	0	0	0	0.01	0	0	0	0
17	---	---	0	0	0	0	0	0	0	0	0	0
18	---	---	0	0	0	0	0	0	0.02	0.01	0	0
19	---	---	0	0	0	0	0	0	0	0.18	0	0
20	---	---	0	0	0	0.01	0	0	0	0	0	0
21	---	---	0	0	0	0	0	0	0	0	0	0
22	---	---	0	0	0	0	0.08	0	0	0	0	0
23	---	---	0	0.12	0	0.01	0.01	0	0	0	0	0
24	---	---	0	0	0	0	0	0	0	0	0	0
25	---	---	0	0	0	0	0	0	0	0	0	0
26	---	---	0	0	0	0	0	0	0	0.19	0	0
27	---	---	0.14	0.01	0	0	0	0	0	0	0	0
28	---	---	0.24	0.22	0	0	0	0	0	0	0	0
29	---	---	0.03	0.26		0	0	0	0	0	0	0
30	---	---	0	0.01		0	0	0	0	0	0	0
31	---		0	0		0		0		0.06	0	
Mean	---	---	0.02	0.02	0.01	0.00	0.00	0.00	0.00	0.03	0.00	0.01
Max	---	---	0.24	0.26	0.16	0.05	0.08	0.01	0.02	0.25	0.00	0.27
Min	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	---	---	0.44	0.62	0.16	0.11	0.09	0.01	0.02	0.83	0.00	0.27

Data Source: IWVGA, Stetson Engineers Inc. Data Management System; via NOAA DCS, DCP - BE100E74

Bold-Italicized data values represent values based on incomplete data sets.

Daily Precipitation Data Chimney Peak Fire Station, Water Year 2022

Water year 2022
Station Name Chimney Peak Fire Station
Operating Agency IWVGA Agent - Stetson Engineers Inc.
Latitude 35°52'08.5" N
Longitude 118°00'42.6" W

DAY	Daily Precipitation (inches)											
	2021 OCT	NOV	DEC	2022 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0	0	0	0.03	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0.05
4	0	0	0	0	0	0	0	0	0	0	0.03	0
5	0	0	0	0	0	0	0	0	0	0	0.38	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0.01	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0.51
11	0	0	0	0	0	0	0	0	0	0	0	0.08
12	0	0	0	0	0	0	0	0	0	0	0	0.55
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0.31	0	0.01	0	0	0	0	0	0	0
16	0	0	0.52	0	0	0	0	0	0	0	0	0
17	0	0	0.03	0	0	0	0	0	0	0.01	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0.15	0	0	0	0	0	0.42	0	0	0
23	0	0	2.11	0	0	0	0	0	0	0	0	0
24	0	0	0.04	0	0.12	0	0	0	0	0	0	0
25	0.35	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0.06	0	0	0	0	0	0	0	0	0
27	0	0	0.01	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0.09	0	0	0	0	0	0
29	0	0	0.06	0		0.01	0	0	0	0.08	0	0
30	0	0	0.58	0		0	0	0	0	0.27	0	0
31	0		0.07	0		0		0		1.09	0	
Mean	0.01	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.01	0.04
Max	0.35	0.00	2.11	0.03	0.12	0.09	0.00	0.00	0.42	1.09	0.38	0.55
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.35	0.00	3.95	0.03	0.13	0.10	0.00	0.00	0.42	1.45	0.41	1.19

Data Source: IWVGA, Stetson Engineers Inc. Data Management System; via NOAA DCS, DCP - BE100E74

Bold-Italicized data values represent values based on incomplete data sets.

Daily Precipitation Data Chimney Peak Fire Station, Water Year 2023

Water year 2023
Station Name Chimney Peak Fire Station
Operating Agency IWVGA Agent - Stetson Engineers Inc.
Latitude 35°52'08.5" N
Longitude 118°00'42.6" W

DAY	Daily Precipitation (inches)											
	2022 OCT	NOV	DEC	2023 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0	0	0.1	0.16	0	0.17	0	0	0	0	0	0.04
2	0	0	0.01	0.01	0	0	0	0	0	0	0	0.07
3	0	0	0.14	0.06	0	0	0	0	0	0	0	0
4	0	0	0.11	0.06	0	0	0	0.01	0	0	0	0
5	0	0	0	0.59	0.11	0	0	0	0	0	0	0
6	0	0	0	0.17	0	0	0	0	0	0	0	0
7	0	0.09	0	0	0	0	0	0	0.03	0	0	0
8	0	0.32	0.01	0.02	0	0	0	0	0	0	0	0
9	0	0.25	0	2.9	0	0.43	0	0	0	0	0	0
10	0	0	0	0.43	0	1.72	0	0	0	0	0	0
11	0	0	0.51	0.39	0	0.27	0	0	0.38	0	0	0
12	0	0	0.17	0.02	0	0.01	0	0	0.01	0	0.04	0
13	0	0	0.1	0	0	0	0	0	0	0	0.03	0
14	0	0	0	0.08	0	1.17	0	0	0.02	0	0	0
15	0	0	0	0.15	0	0.42	0	0	0	0	0.02	0
16	0	0	0	0.12	0	0	0	0	0	0	0.13	0
17	0	0	0	0.29	0	0	0	0	0	0	0	0
18	0	0	0	0.15	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0.51	0	0	0	0	0.17	0
20	0	0	0	0	0	0	0	0	0	0	6.18	0
21	0	0	0	0	0	0.39	0	0	0	0	0.01	0
22	0	0	0	0	0	0.26	0	0.04	0	0	0	0
23	0	0	0	0	0.02	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0.32	0.01	0	0	0	0	0	0
26	0	0	0	0	0.18	0	0	0	0	0	0	0
27	0	0	0.17	0	0.12	0	0	0	0	0	0	0
28	0	0	0	0	0.07	0	0	0	0	0	0	0
29	0	0	0	0		0.17	0	0	0	0	0	0
30	0	0	0.01	0		0.18	0	0	0	0	0	0
31	0		0.84	0		0		0.05		0	0	
Mean	0.00	0.02	0.07	0.18	0.03	0.18	0.00	0.00	0.01	0.00	0.21	0.00
Max	0.00	0.32	0.84	2.90	0.32	1.72	0.00	0.05	0.38	0.00	6.18	0.07
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.66	2.17	5.60	0.82	5.71	0.00	0.10	0.44	0.00	6.58	0.11

Data Source: IWVGA, Stetson Engineers Inc. Data Management System; via NOAA DCS, DCP - BE100E74

Bold-Italicized data values represent values based on incomplete data sets.

CHIMNEY PEAK PRECIPITATION STATION OVERVIEW

Stetson Engineers (Stetson) as acting agent for IWVGA, established this weather station December 2020, with the purpose of collecting regional precipitation data in an area where precipitation data collection has been missing. On December 14th, 2020, Stetson completed the installation of the Chimney Peak Precipitation Station at the Chimney Peak Bureau of Land Management (BLM) Fire Station. The installation was approved and permitted by the BLM with Communications Lease Agreement CACA 058717 and Categorical Exclusion Documentation DOI-BLM-CA-C060-2020-0015-CX. The station was installed inside the Chimney Peak BLM Fire Station facility, in the proposed location, at coordinate position, 35.86902, -118.01185.

The installation is comprised of components to measure and record precipitation, air temperature, and relative humidity measurements, and transmit this data through the NOAA GOES Data Collection System (DCS). The monitoring and telemetry equipment consist of the following listed component parts:

FTS Equipment List:

FTS Serial Number	Manufacture Serial Number	Model Number	Description
NA	NA	GPS-ANTENNA-WP	GPS Antenna
080028	52015405	1032-018	GOES Antenna EON2 Kit2, 401MHz, 6.0dBic
NA	NA	NA	EON2 Amiable Mount
NA	NA	20180	SMA Male to N Female Adapter
NA	NA	20514	Cable, N-Type Bulkhead to SMA M, 10"
118428	NA	LT1-GOES	LT1 Logger/Transceiver 1 GOES
119783	870470.008	21032	Lambrecht Temperature / Humidity Sensor
118802	NA	RG-T-FL	Rain Gage, Pedestal mount, 20 ft armored cable
118884	TS200528030	WS20G6M	20 Watt Solar Panel; SPS-20W-ASC
118884	NA	NA	ASC Battery Charge Regulator, Specialty Concepts, Inc.
NA	NA	12841-3	Charge Regulator to Battery Cable Assembly; MTL 2020-05-06
12220	NA	IT45-12-H	Battery – 12 Volt / 45 Ah
NA	NA	CBL-UC-JB-PWR	Battery to Terminal Cable Assembly; MTL 2020-06-15
1197784	NA	SDI-THPS-LB	Temperature/Humidity Sensor Radiation Shield
NA	NA	WP-ENCL-MINI	Weatherproof Equipment Enclosure, Mini Size
20385	CM106B	Tripod	7-10 ft Tripod with Grounding Kit

Photograph of Installation:



FIGURE 2. CHIMNEY PEAK WEATHER STATION FACING SOUTH-WEST



FIGURE 3. CHIMNEY PEAK WEATHER STATION, FACING SOUTH-WEST

Measurement & Telemetry Programming:

The datalogger / GOES transmitter (LT1) are programmed with the following NOAA DCS settings for data transmission through the NOAA GOES DCS.

Data Collection Platform: BE100E74
Measurement Interval: 15 minutes
Transmission interval: One hour
Transmission Offset: 34 minutes, 10 seconds
Parameter Encoding: SHEF
Measurement Parameters: VB – Battery Voltage; Volts
PC – Accumulated Precipitation; Inches
TA – Instantaneous Air Temperature, Celsius
RH – Instantaneous Relative Humidity; Percent
DP – Instantaneous Dew Point; Celsius
BP – Instantaneous Barometric Pressure; Hectopascal

Stetson has implemented a data retrieval program to collect all environmental monitoring data for the Indian Wells Valley regions, transmitted through NOAA GOES DCS, including this Chimney Peak Precipitation Station. This data is collected and hosted on Indian Wells Valley Groundwater Sustainability Plan website, IWVGSP.com.



DRAFT MEMORANDUM

785 Grand Avenue, Suite 202 • Carlsbad, California • 94901
TEL: (760) 730-0701 FAX: (415) 457-1638 e-mail: stever@stetsonengineers.com

TO: File DATE: November 22, 2023
FROM: Stetson Engineers Inc. JOB NO: 2652
RE: Walker Pass East Weather Station – Annual Report of Precipitation, Water Year 2023

This memorandum serves as an annual summary of station operation and reporting of approved data records associated with the Walker Pass East Weather Station. IWVGA operation of this station is done under legal agreement with the Bureau of Land Management to occupy and operate the precipitation and telemetry equipment installed on the defunct Walker Pass East BLM RAWS weather station structure.

SUMMARY OF STATION OPERATIONS AND DATA – WY 2023

During WY 2023, in November 2022, this station was inadvertently demobilized by the Bureau of Land Management Southwest RAWS Field Group located in Phoenix Arizona. Subsequently the station equipment was stolen from the Arizona BLM equipment yard. As a result of this data for WY 2023 ends on November 9th, 2022. This loss of equipment and station operation was reported to the IWVGA Board once observed. This station has not been restored.

The following tables summarize the daily recorded precipitation totals, August 2020 through November 2022, by Water Year.

Daily Precipitation Data Walker Pass East, Water Year 2020

Water year 2020
 Station Name Walker Pass East
 Operating Agency IWVGA Agent - Stetson Engineers Inc.
 Latitude 35°39'45.4" N
 Longitude 118°01'31.7" W

DAY	Daily Precipitation (inches)											
	2019 OCT	NOV	DEC	2020 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	---	---	---	---	---	---	---	---	0
2	---	---	---	---	---	---	---	---	---	---	---	0
3	---	---	---	---	---	---	---	---	---	---	---	0
4	---	---	---	---	---	---	---	---	---	---	---	0
5	---	---	---	---	---	---	---	---	---	---	---	0
6	---	---	---	---	---	---	---	---	---	---	---	0
7	---	---	---	---	---	---	---	---	---	---	---	0
8	---	---	---	---	---	---	---	---	---	---	---	0
9	---	---	---	---	---	---	---	---	---	---	---	0
10	---	---	---	---	---	---	---	---	---	---	---	0
11	---	---	---	---	---	---	---	---	---	---	---	0
12	---	---	---	---	---	---	---	---	---	---	---	0
13	---	---	---	---	---	---	---	---	---	---	---	0
14	---	---	---	---	---	---	---	---	---	---	---	0
15	---	---	---	---	---	---	---	---	---	---	---	0
16	---	---	---	---	---	---	---	---	---	---	---	0
17	---	---	---	---	---	---	---	---	---	---	---	0
18	---	---	---	---	---	---	---	---	---	---	---	0
19	---	---	---	---	---	---	---	---	---	---	---	0
20	---	---	---	---	---	---	---	---	---	---	---	0
21	---	---	---	---	---	---	---	---	---	---	---	0
22	---	---	---	---	---	---	---	---	---	---	---	0
23	---	---	---	---	---	---	---	---	---	---	---	0
24	---	---	---	---	---	---	---	---	---	---	---	0
25	---	---	---	---	---	---	---	---	---	---	---	0
26	---	---	---	---	---	---	---	---	---	---	0	0
27	---	---	---	---	---	---	---	---	---	---	0	0
28	---	---	---	---	---	---	---	---	---	---	0	0
29	---	---	---	---	---	---	---	---	---	---	0	0
30	---	---	---	---	---	---	---	---	---	---	0	0
31	---	---	---	---	---	---	---	---	---	---	0	
Mean	---	---	---	---	---	---	---	---	---	---	---	0.00
Max	---	---	---	---	---	---	---	---	---	---	---	0.00
Min	---	---	---	---	---	---	---	---	---	---	---	0.00
Total	---	---	---	---	---	---	---	---	---	---	---	0.00

Data Source: IWVGA, Stetson Engineers Inc. Data Management System; via In-Situ HydroVu data platform

Daily Precipitation Data Walker Pass East, Water Year 2021

Water year 2021
 Station Name Walker Pass East
 Operating Agency IWVGA Agent - Stetson Engineers Inc.
 Latitude 35°39'45.4" N
 Longitude 118°01'31.7" W

DAY	Daily Precipitation (inches)											
	2020	2021										
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0.12	0	0	0	0	0	0	0	0	0
8	0	0	0.06	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0.02	0	0	0	0	0
10	0	0	0	0	0	0	0.04	0	0	0	0	0
11	0	0	0	0	0	0	0.03	0	0	0	0	0
12	0	0	0	0	0	0	0.01	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0.16	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0.06	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0.06	0
18	0	0	0	0	0.01	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0.04	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0.12	0	0	0	0	0	0	0
23	0	0	0	0	0.04	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0.02	0
26	0	0	0	0.16	0.05	0	0	0	0	0	0	0
27	0	0	0	0.16	0.02	0	0	0	0	0	0	0
28	0	0	0	0	0.35	0	0	0	0	0	0	0
29	0	0	0	0		0	0	0	0	0	0.06	0
30	0	0	0	0		0	0	0	0	0	0.35	0
31	0		0	0		0		0		0	0	
Mean	0.00	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.02	0.00
Max	0.00	0.00	0.12	0.16	0.35	0.16	0.04	0.00	0.00	0.00	0.35	0.00
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.18	0.38	0.59	0.16	0.14	0.00	0.00	0.00	0.49	0.00

Data Source: IWVGA, Stetson Engineers Inc. Data Management System; via In-Situ HydroVu data platform

Daily Precipitation Data Walker Pass East, Water Year 2022

Water year 2022
Station Name Walker Pass East
Operating Agency IWVGA Agent - Stetson Engineers Inc.
Latitude 35°39'45.4" N
Longitude 118°01'31.7" W

DAY	Daily Precipitation (inches)											
	2021	2022										
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0	0	0	0.01	0	0	0	0	0	0	0.21	0
2	0	0	0	0	0	0	0	0	0	0	1.11	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0.01	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0.7	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0.02	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0.06	0	0	0	0	0	0	0	0	0
11	0	0	0.01	0	0	0	0	0	0	0	0	0.01
12	0	0	0	0	0	0	0	0	0	0	0	0.01
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0.02	0	0	0	0	0	0	0	0	0
15	0	0	0.4	0	0	0	0	0	0	0	0	0
16	0	0	0.03	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0.06	0	0.01	0	0.08	0	0.68	0	0	0
23	0	0	1.63	0	0	0	0	0	0.08	0	0	0
24	0	0	0.38	0	0	0	0	0	0	0	0	0
25	0.35	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0.06	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0.15	0	0	0	0	0	0
29	0	0	0.1	0		0	0	0	0	0	0	0
30	0	0	0.55	0		0	0	0	0	0.38	0	0
31	0		0	0		0		0		1.08	0	
Mean	0.01	0.00	0.11	0.00	0.00	0.01	0.00	0.00	0.03	0.05	0.07	0.00
Max	0.35	0.02	1.63	0.01	0.01	0.15	0.08	0.00	0.68	1.08	1.11	0.01
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.35	0.02	3.30	0.01	0.01	0.16	0.08	0.00	0.76	1.46	2.02	0.02

Data Source: IWVGA, Stetson Engineers Inc. Data Management System; via In-Situ HydroVu data platform

Daily Precipitation Data Walker Pass East, Water Year 2023

Water year 2023
Station Name Walker Pass East
Operating Agency IWVGA Agent - Stetson Engineers Inc.
Latitude 35°39'45.4" N
Longitude 118°01'31.7" W

DAY	Daily Precipitation (inches)											
	2022	2023										
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0	0.024	---	---	---	---	---	---	---	---	---	---
2	0	0.157	---	---	---	---	---	---	---	---	---	---
3	0	0	---	---	---	---	---	---	---	---	---	---
4	0	0	---	---	---	---	---	---	---	---	---	---
5	0	0	---	---	---	---	---	---	---	---	---	---
6	0	0	---	---	---	---	---	---	---	---	---	---
7	0	0.134	---	---	---	---	---	---	---	---	---	---
8	0	0	---	---	---	---	---	---	---	---	---	---
9	0	0.094	---	---	---	---	---	---	---	---	---	---
10	0	---	---	---	---	---	---	---	---	---	---	---
11	0	---	---	---	---	---	---	---	---	---	---	---
12	0	---	---	---	---	---	---	---	---	---	---	---
13	0	---	---	---	---	---	---	---	---	---	---	---
14	0	---	---	---	---	---	---	---	---	---	---	---
15	0	---	---	---	---	---	---	---	---	---	---	---
16	0	---	---	---	---	---	---	---	---	---	---	---
17	0	---	---	---	---	---	---	---	---	---	---	---
18	0	---	---	---	---	---	---	---	---	---	---	---
19	0	---	---	---	---	---	---	---	---	---	---	---
20	0	---	---	---	---	---	---	---	---	---	---	---
21	0	---	---	---	---	---	---	---	---	---	---	---
22	0	---	---	---	---	---	---	---	---	---	---	---
23	0	---	---	---	---	---	---	---	---	---	---	---
24	0	---	---	---	---	---	---	---	---	---	---	---
25	0	---	---	---	---	---	---	---	---	---	---	---
26	0	---	---	---	---	---	---	---	---	---	---	---
27	0	---	---	---	---	---	---	---	---	---	---	---
28	0	---	---	---	---	---	---	---	---	---	---	---
29	0	---	---	---	---	---	---	---	---	---	---	---
30	0	---	---	---	---	---	---	---	---	---	---	---
31	0	---	---	---	---	---	---	---	---	---	---	---
Mean	0.00	---	---	---	---	---	---	---	---	---	---	---
Max	0.00	---	---	---	---	---	---	---	---	---	---	---
Min	0.00	---	---	---	---	---	---	---	---	---	---	---
Total	0.00	0.41	---	---	---	---	---	---	---	---	---	---

Data Source: IWVGA, Stetson Engineers Inc. Data Management System; via In-Situ HydroVu data platform

WALKER PASS EAST PRECIPITATION STATION OVERVIEW

Stetson Engineers (Stetson) as acting agent for IWVGA, re-established precipitation monitoring at the defunct BLM Walker Pass East RAWS station. The existing RAWS weather station had become obsolete and is no longer operable when the NOAA DCP platform expired. The installation was approved and permitted by the BLM with Lease Agreement CACA 058727 and Categorical Exclusion Documentation DOI-BLM-CA-D050-2020-0008-CX. Stetson installed a new tipping bucket rain gage and data telemetry system retrofitted to the existing in place RAWS tripod structure, at coordinate position, 35.66261, -118.02548. The monitoring and telemetry equipment consist of the following listed component parts:

Equipment List:

Part Number	Description
HSA: TB4/0.01/T	Tipping bucket rain gauge, 0.2 mm resolution, dual reed switch outputs, measurement range 0-700mm/hr
In Situ: ISR-0000000-VL	VuLink Cellular Telemetry, 4G LTE, Antenna, GPS, 1.5-3.6V Li-MnO ₂ Battery, built in barometric sensor; HTTPS, FTP, SFTP, SMS, CSV file format

Photograph of Installation:



FIGURE 1. TIPPING BUCKET RAIN GAUGE INSTALLATION AT WALKER PASS EAST RAWS

Measurement & Telemetry Programming:

The datalogger and telemetry device is programmed to record observed rainfall in increments of 0.2 millimeters, with counting interval of 15 minutes. Using the software provided by In-Situ, the telemetry device was programmed to retrieve recorded water level readings from the Level TROLL 400 sensor every 15 minutes. The 15-minute time interval is based on the USGS stream gage standard. Additionally, the telemetry device was programmed to upload the 15-minute readings to In-Situ's FTP server every 24 hours, or 96 readings. The data is then collected from the In-Situ server and hosted on Indian Wells Valley Groundwater Sustainability Plan website, IWVGSP.com.



DRAFT MEMORANDUM

785 Grand Avenue, Suite 202 • Carlsbad, California • 94901
TEL: (760) 730-0701 FAX: (415) 457-1638 e-mail: stever@stetsonengineers.com

TO: File DATE: December 12, 2023
FROM: Stetson Engineers Inc. JOB NO: 2652
RE: Grapevine Canyon Stream Gaging Station – Annual Report of Stream Flows, Water Year 2023

This memorandum serves as an annual summary of station operation and reporting of approved data records associated with this monitoring station for Water Year (WY) 2023, October 2022 through September 2023. Due to issues with flooding, calculation of rated flows was only possible for a portion of the year. However due to the significance and magnitude of the runoff this year, estimates of flow have been made based on the correlation with the Sand Canyon Gage. With these estimates, the estimated total flow for WY2023 was 1,625 acre-feet. Figure 1 shows the annual streamflow measured at Grapevine Canyon over the period of record of operation.

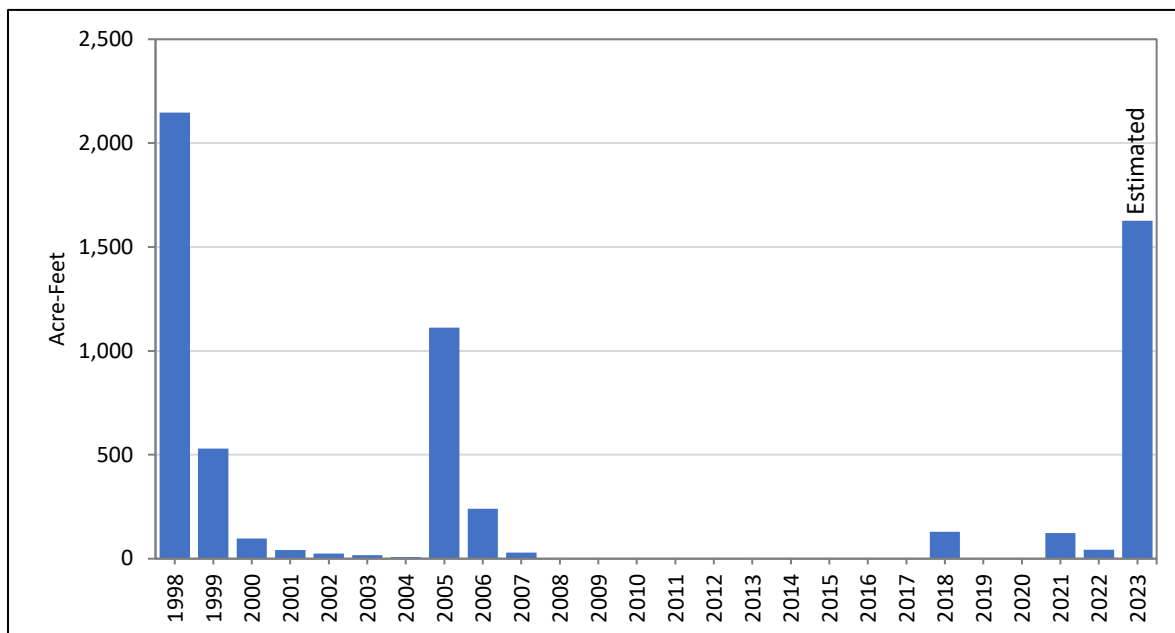


FIGURE 1. GRAPEVINE CANYON ANNUAL FLOW – PERIOD OF RECORD

SUMMARY OF GAGE OPERATIONS AND DATA – WY 2023

During WY 2023, three storm events, in March and August, resulted in significant flows in Grapevine Canyon exceeding the rating of the stream gage and overtopping the channel road crossing on which the station is located. These events resulted in damage to the property of the landowner on which the gage is located. During the flow events the gage weir plates were removed by the property owner to prevent obstruction of culvert structures and allow for maximum flow through the culverts. Stetson, in agreement with the property owner, decided to not pursue maintaining the weir plates in the channel out of an abundance of caution of future flood events causing property damage. At this time the creek channel at the gaging site has no gage equipment in place which would lead to channel obstruction. Monitoring of the stream gage height has continued. Figure 2 is a photograph of the gage location taken by the landowner during the event on March 15th.



FIGURE 2. GRAPEVINE CANYON GAGE STATION – MARCH 15, 2023, FLOW EVENT

The result of these weir operations, as well as the exceedance of the gage rating, is that calculating rated flow for this gage is not possible for WY 2023. This will remain the case until a new rating method is established for this gage location. After initial assessment of the gage location without the weir plates, suggest that developing a rating for this location with open channel flows will be challenging. 1) At the time of inspection, September 2023, significant sediment load was present actively traveling through the culvert creating a dynamic partial obstruction to the channel. 2) The intake pipe of for the stilling well in the channel is located at an elevation partially above the invert elevation of the culverts. During low flows there is potential that water stage height will not be translated from the channel to the stilling well.

In WY 2023 total annual streamflow could not be fully calculated due to the limitations on operations stated above. However, because of the significance of the events of the year, estimated flows have been calculated based on a flow correlation between Grapevine and Sad Canyon gage stations. Figure 3 shows the total monthly flows for WY 2023 with estimated values indicated.

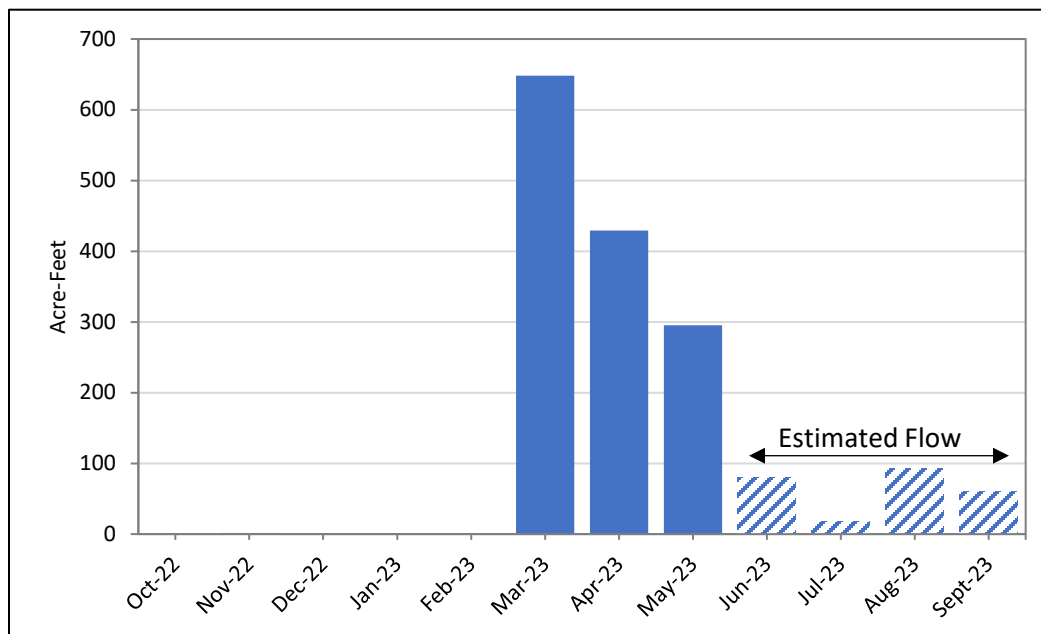


FIGURE 3. GRAPEVINE CANYON MONTHLY FLOW – WATER YEAR 2023

The following tables are provided to serve as reporting of approved daily values of data collected at the Grapevine Canyon gaging station. The tables reflect daily average stream flow rate in cubic feet per second, and total daily flows in acre-feet, by water year. Flows estimated based on Sand Canyon data are not included.

Daily Streamflow Data, Flow Rate Grapevine Canyon, Water Year 2023

Water year 2023
Station Name Grapevine Canyon
Operating Agency IWVGA Agent - Stetson Engineers Inc.
Latitude 35°43'59.4"N
Longitude 117°55'00.4"N

Daily streamflow (cfs)												
DAY	2022 OCT	NOV	DEC	2023 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.02	0.01	0.03	0.01	0.00	0.02	5.72	8.05	---	---	---	---
2	0.02	0.02	0.03	0.01	0.00	0.01	5.65	8.05	---	---	---	---
3	0.01	0.02	0.02	0.01	0.00	0.01	5.69	7.68	---	---	---	---
4	0.02	0.03	0.02	0.01	0.00	0.01	5.47	7.24	---	---	---	---
5	0.01	0.03	0.03	0.01	0.00	0.01	5.29	6.98	---	---	---	---
6	0.01	0.02	0.02	0.01	0.00	0.01	5.19	6.70	---	---	---	---
7	0.01	0.02	0.01	0.01	0.00	0.01	4.97	6.32	---	---	---	---
8	0.01	0.03	0.01	0.01	0.00	0.01	4.95	6.01	---	---	---	---
9	0.01	0.02	0.01	0.02	0.00	0.01	5.15	5.82	---	---	---	---
10	0.01	0.02	0.01	0.02	0.00	0.05	5.47	5.57	---	---	---	---
11	0.01	0.02	0.02	0.01	0.00	<u>44.99</u>	6.06	5.38	---	---	---	---
12	0.01	0.02	0.02	0.01	0.00	<u>27.78</u>	8.06	5.10	---	---	---	---
13	0.01	0.02	0.02	0.01	0.00	9.42	9.13	4.89	---	---	---	---
14	0.01	0.02	0.02	0.01	0.00	<u>11.49</u>	7.81	4.77	---	---	---	---
15	0.01	0.02	0.02	0.02	0.00	<u>49.54</u>	7.10	4.61	---	---	---	---
16	0.02	0.02	0.02	0.01	0.00	<u>38.28</u>	7.11	4.52	---	---	---	---
17	0.01	0.02	0.02	0.01	0.00	<u>20.93</u>	7.93	4.38	---	---	---	---
18	0.01	0.03	0.02	0.01	0.00	15.18	8.53	4.26	---	---	---	---
19	0.01	0.03	0.02	0.01	0.00	14.58	8.17	4.07	---	---	---	---
20	0.01	0.03	0.01	0.01	0.00	11.07	7.92	3.87	---	---	---	---
21	0.01	0.03	0.01	0.01	0.00	10.78	8.24	3.87	---	---	---	---
22	0.01	0.03	0.01	0.01	0.00	9.66	8.32	3.78	---	---	---	---
23	0.01	0.03	0.01	0.01	0.00	8.73	8.48	3.77	---	---	---	---
24	0.02	0.04	0.01	0.01	0.02	8.02	9.50	3.65	---	---	---	---
25	0.01	0.04	0.01	0.01	0.03	7.55	9.48	3.64	---	---	---	---
26	0.01	0.04	0.01	0.01	0.02	7.09	8.95	3.53	---	---	---	---
27	0.01	0.04	0.01	0.01	0.02	6.61	8.22	3.40	---	---	---	---
28	0.02	0.03	0.01	0.01	0.02	6.44	7.96	<i>3.24</i>	---	---	---	---
29	0.01	0.03	0.01	0.01		6.44	8.01	---	---	---	---	---
30	0.01	0.03	0.01	0.00		6.16	7.87	---	---	---	---	---
31	0.01		0.01	0.00		5.84		---		---	---	---
Mean (cfs)	0.01	0.03	0.02	0.01	0.00	10.54	7.21	<i>5.11</i>	---	---	---	---
Max (cfs)	0.02	0.04	0.03	0.02	0.03	49.54	9.50	<i>8.05</i>	---	---	---	---
Min (cfs)	0.01	0.01	0.01	0.00	0.00	0.01	4.95	<i>3.24</i>	---	---	---	---
Total (ac-ft)	1	2	1	1	0	648	429	<i>284</i>	---	---	---	---

Data Source: IWVGA, Stetson Engineers Inc. Data Management System; via NOAA DCS, DCP - BE1000A6

Bold underlined - Values are estimates due to flow exceedance of the stream gage rating table

Italicized - Values are based on incomplete data records

Daily Streamflow Data, Total Flow Volume Grapevine Canyon, Water Year 2023

Water year 2023
 Station Name Grapevine Canyon
 Operating Agency IWVGA Agent - Stetson Engineers Inc.
 Latitude 35°43'59.4"N
 Longitude 117°55'00.4"N

Daily streamflow (AF)												
DAY	2022			2023								
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.03	0.03	0.06	0.02	0.01	0.03	11.35	15.97	---	---	---	---
2	0.03	0.04	0.05	0.02	0.01	0.02	11.21	15.97	---	---	---	---
3	0.02	0.05	0.05	0.02	0.01	0.01	11.28	15.24	---	---	---	---
4	0.03	0.05	0.04	0.02	0.00	0.02	10.86	14.36	---	---	---	---
5	0.03	0.06	0.05	0.02	0.00	0.02	10.49	13.84	---	---	---	---
6	0.02	0.04	0.04	0.02	0.00	0.02	10.30	13.29	---	---	---	---
7	0.02	0.04	0.02	0.02	0.00	0.02	9.85	12.53	---	---	---	---
8	0.03	0.06	0.02	0.02	0.00	0.02	9.82	11.93	---	---	---	---
9	0.03	0.04	0.02	0.03	0.00	0.02	10.22	11.54	---	---	---	---
10	0.02	0.04	0.02	0.03	0.00	0.09	10.85	11.04	---	---	---	---
11	0.02	0.04	0.04	0.02	0.00	<u>89.24</u>	12.02	10.67	---	---	---	---
12	0.02	0.04	0.03	0.01	0.00	<u>55.10</u>	15.98	10.11	---	---	---	---
13	0.02	0.04	0.03	0.01	0.00	18.69	18.10	9.70	---	---	---	---
14	0.02	0.04	0.03	0.02	0.00	<u>22.79</u>	15.49	9.46	---	---	---	---
15	0.03	0.04	0.03	0.03	0.00	<u>98.26</u>	14.08	9.15	---	---	---	---
16	0.04	0.05	0.03	0.03	0.00	<u>75.92</u>	14.11	8.97	---	---	---	---
17	0.03	0.05	0.03	0.01	0.00	<u>41.51</u>	15.74	8.69	---	---	---	---
18	0.02	0.05	0.03	0.01	0.00	30.10	16.93	8.45	---	---	---	---
19	0.02	0.05	0.03	0.01	0.00	28.92	16.20	8.06	---	---	---	---
20	0.02	0.05	0.03	0.01	0.00	21.95	15.71	7.68	---	---	---	---
21	0.02	0.05	0.03	0.01	0.00	21.38	16.34	7.68	---	---	---	---
22	0.02	0.06	0.03	0.01	0.00	19.16	16.50	7.49	---	---	---	---
23	0.03	0.07	0.03	0.01	0.00	17.32	16.82	7.47	---	---	---	---
24	0.03	0.07	0.03	0.01	0.04	15.90	18.83	7.24	---	---	---	---
25	0.03	0.07	0.03	0.01	0.07	14.98	18.80	7.21	---	---	---	---
26	0.02	0.07	0.03	0.01	0.03	14.06	17.75	7.00	---	---	---	---
27	0.02	0.07	0.02	0.01	0.04	13.11	16.30	6.75	---	---	---	---
28	0.03	0.06	0.02	0.01	0.04	12.78	15.80	<i>6.42</i>	---	---	---	---
29	0.02	0.06	0.02	0.01		12.76	15.90	---	---	---	---	---
30	0.02	0.06	0.02	0.01		12.21	15.60	---	---	---	---	---
31	0.02		0.03	0.01		11.59		---		---	---	
Mean (ac-ft)	0.02	0.05	0.03	0.02	0.01	20.90	14.31	<i>10.14</i>	---	---	---	---
Max (ac-ft)	0.04	0.07	0.06	0.03	0.07	98.26	18.83	<i>15.97</i>	---	---	---	---
Min (ac-ft)	0.02	0.03	0.02	0.01	0.00	0.01	9.82	<i>6.42</i>	---	---	---	---
Total (ac-ft)	1	2	1	1	0	648	429	<i>284</i>	---	---	---	---

Data Source: IWVGA, Stetson Engineers Inc. Data Management System; via NOAA DCS, DCP - BE1000A6

Bold underlined - Values are estimates due to flow exceedance of the stream gage rating table

Italicized - Values are based on incomplete data records

GRAPEVINE CANYON STREAM GAGING STATION OVERVIEW

Stetson Engineers (Stetson) as acting agent for IWVGA, re-established monitoring activities at the Grapevine Canyon Stream Gaging Station, on August 26, 2020. Prior to this the Station had been in a defunct state following the cessation of Kern County Water Agency monitoring activities in 2019. Kern County Water Agency (KCWA) previously operated this gaging station with permission of the private property owner where the gage is located. Stetson established an operational agreement with the property owner on behalf of the IWVGA, in order to install and operate the stream gaging and telemetry equipment. To re-establish the monitoring station Stetson, rehabilitated the weir structure and installed new monitoring and satellite telemetry components inside the stilling well. This work planning and installation work is summarized as a Memorandum submitted to the State Department of Water Resources, dated August 28, 2020.

The gaging facility consists of a channel spanning split flow weir. The weir is composed of a V-notched weir and a sharp crested rectangular weir. There was no automatic datalogging or telemetry equipment previously installed at this site. Measurement of upstream pool height is accomplished utilizing an existing staff gage and through a stilling well with a mounted steel box for housing gaging instrumentation. The monitoring and telemetry equipment consist of the following listed component parts:

Equipment List:

Part Number	Description
Stevens Water Part No. 93876	SatComm GOES Transmitter
Stevens Water Part No. 51108	GPS Antenna
Stevens Water Part No. 70018	V2TH Satellite Antenna
Stevens Water Part No. 93750-100	DLight Datalogger
Stevens Water Part No. 70217-100	SOLO Solar Charge Regulator
Stevens Water Part No. 93720-135	SDX Pressure Sensor
Stevens Water Part No. 93030-001	Desiccant Cartridge
Third Party Vendor	25 Watt / 12 Volt Solar Panel
Third Party Vendor	12 Volt / 20 Amp-hour Rechargeable Battery

Photographs of Installation:



FIGURE 4. STILLING WELL AND ENCLOSURE WITH MOUNTED SOLAR PANEL AND SATELLITE ANTENNA



FIGURE 5. REHABILITATED SHARP CRESTED WEIR ON THE LEFT CULVERT OPENING.

Data Resolution & Telemetry Programming:

The Stevens datalogger is programmed to measure and record water level readings every 15 minutes. This 15-minute time interval is based on the USGS stream gage standard. From there the Stevens GOES transmitter is programmed with a NOAA assigned satellite transmission assignment (Data Collection Platform: BE1000A6) to transmit data on an hourly basis to the NOAA GOES Data Collection System (DCS). Utilizing DCS data collection scripts Stetson retrieves monitoring data from the DCS daily to integrate into the IWVGSP Data Management System.

Staff Gauge vs. Weir Stage:

During installation it was observed that the existing staff gauge is installed with 1.00 feet equaling the crest of the V-notch Weir. Staff gage readings reported here are reflective of this 1 foot difference, and calculations of weir discharge utilize stage values 1-foot less than the staff readings.

Calculation of Discharge:

Calculation of stream discharge utilizes corrected stage measurements, recorded with the stilling well monitoring equipment, and the following equations (Francis Equation) utilized by Kern County Water Agency. Adjustments have been made reflecting the stage height differences between activation of the two weirs, using elevation measurements obtained after the installation of the rehabilitated weir, Stetson established the stage-discharge relationship which can be seen in Figure 6.

Discharge Equation(s) for Grapevine Canyon Weir Structure

The discharge equation is the sum of the water passing through the v-notch and rectangular weirs as described by the following equations.

90° V-Notch Weir Component Discharge: $Q = 2.49 \times H^{2.48}$

Rectangular Weir Component Discharge: $Q = 3.33 \times (H - 0.35)^{3/2} \times (L - 0.02 \times H)$

Where:

Q = Discharge in cubic feet per second

L = Width of rectangular weir (24 inches)

H = water stage height weir crests (crest height difference of two weirs is 0.47 ft)

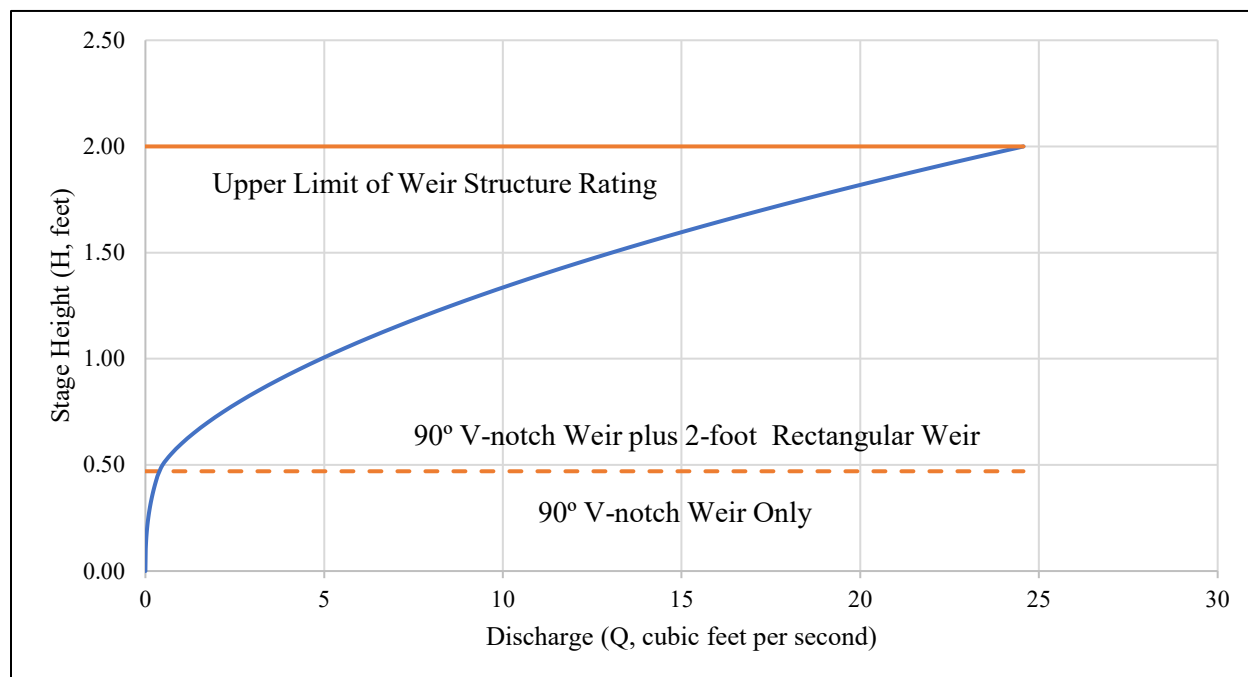


FIGURE 6. RATING CURVE FOR GRAPEVINE CANYON WEIR STRUCTURE



DRAFT MEMORANDUM

785 Grand Avenue, Suite 202 • Carlsbad, California • 94901
TEL: (760) 730-0701 FAX: (415) 457-1638 e-mail: stever@stetsonengineers.com

TO: File DATE: November 22, 2023
FROM: Stetson Engineers Inc. JOB NO: 2652
RE: Sand Canyon Stream Gaging Station – Annual Report of Stream Flows, Water Year 2023

This memorandum serves as an annual summary of station operation and reporting of approved data records associated with the Sand Canyon Stream Gage monitoring station for Water Year (WY) 2023, October 2022 through September 2023. Water measured during WY 2023 was the second highest recorded volume at this location, equaling 2,529 acre-feet. Figure 1 shows the annual streamflow measured at Sand Canyon over the period of record of operation for this location.

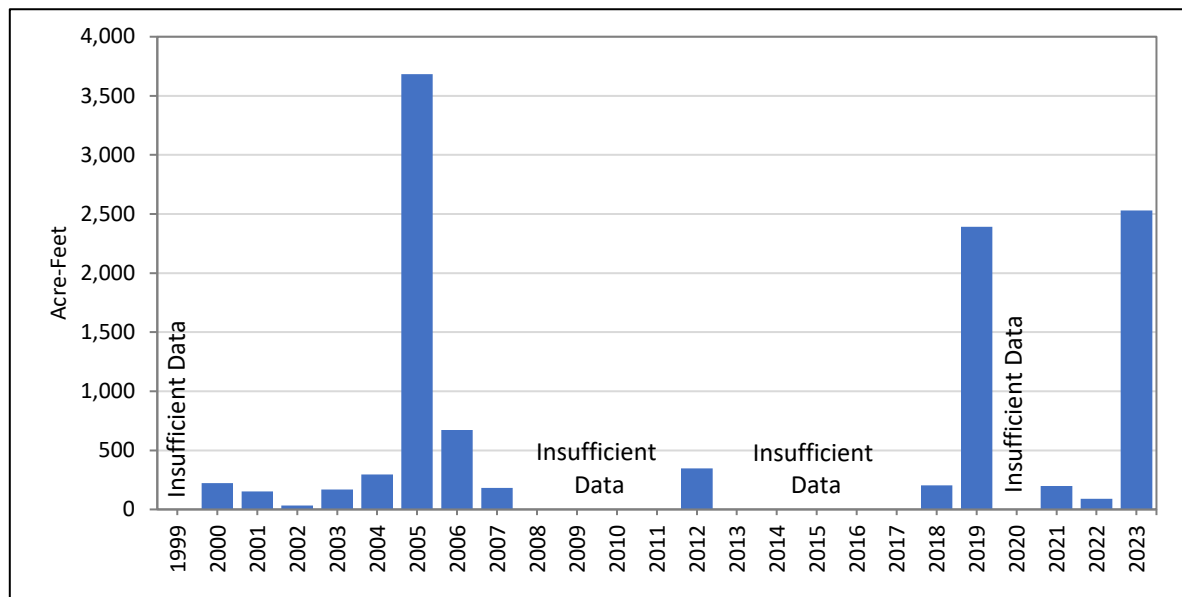


FIGURE 1. SAND CANYON ANNUAL FLOW – PERIOD OF RECORD

SUMMARY OF GAGE OPERATIONS AND DATA – WY 2023

During WY 2023, three site visits were made to conduct manual measurements and maintenance of the gage, October 2022, March 2023, and September 2023. During the October

2022 site visit the stream channel was dry and only maintenance to the monitoring telemetry equipment was conducted. The March 2023 site visit was conducted during low water conditions prior to the major storm runoff events of March. The September 2023 site visit was done at the end of the water year after all runoff events. Standard measurements and maintenance was conducted including the clearing of the weir of vegetation impacting weir operation.

During WY 2023 this gage experienced three storm-runoff events which resulted in stream stage heights exceeding the rated height of the weir. The dates of these occurrences were; March 10th – 12th, March 15th – 16th, and August 20th – 21st. For these periods discharge calculations were based on an extrapolation of the current rating. Measured flow for these dates are recognized as estimates. The following figure shows the total monthly flows for Water Year 2023.

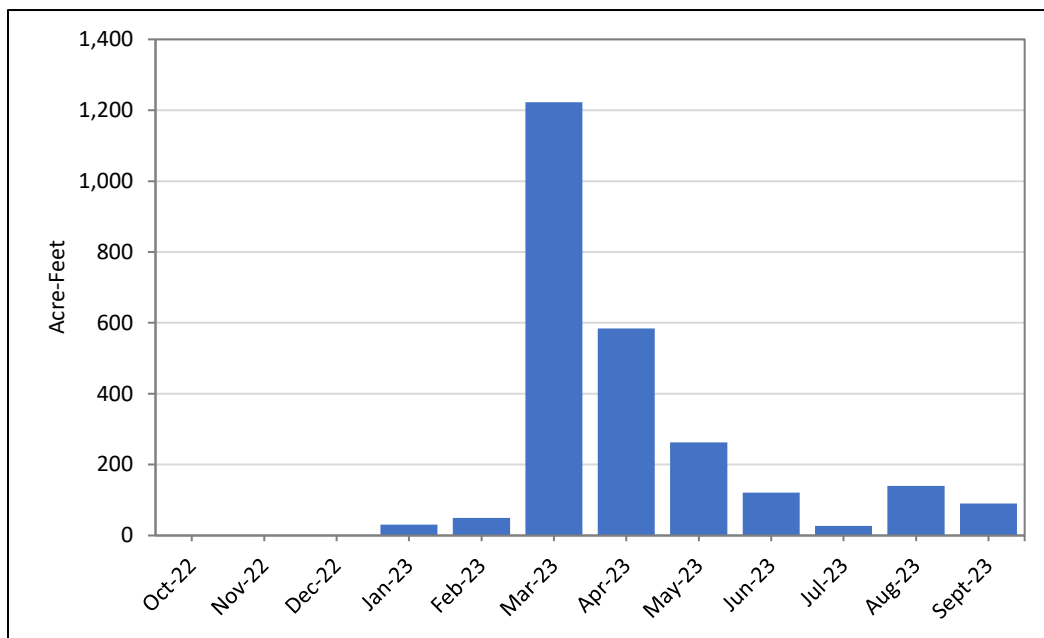


FIGURE 2. SAND CANYON MONTHLY FLOW – WATER YEAR 2023

Since its establishment in August 2020, the Sand Canyon stream gage has experienced seasonal flow, with the channel drying during the summer dry months. During WY2023 the channel remained wetted throughout these normally dry months, which permitted vegetation growth throughout the year, partially impairing the operation of the weir. Minor correction of the stage data was completed to address this influence of the vegetation on the data.

Daily Streamflow Data, Staff Gauge Reading Sand Canyon, Water Year 2023

Water year 2023
Station Name Sand Canyon
Operating Agency IWVGA Agent - Stetson Engineers Inc.
Latitude 35°46'33.6"N
Longitude 117°54'27.4"N

Average Daily Staff Gauge Reading (Feet)												
DAY	2022			2023								
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	0.01	0.19	0.65	1.04	0.93	0.58	0.29	0.10	0.37
2	0.00	0.00	0.00	0.00	0.19	0.56	1.04	0.92	0.56	0.27	0.09	0.41
3	0.00	0.00	0.00	0.00	0.20	0.57	1.03	0.90	0.54	0.25	0.09	0.41
4	0.00	0.00	0.00	0.00	0.21	0.59	1.00	0.90	0.53	0.26	0.09	0.40
5	0.00	0.00	0.00	0.01	0.23	0.59	0.99	0.88	0.53	0.26	0.08	0.39
6	0.00	0.00	0.00	0.00	0.21	0.58	0.98	0.87	0.55	0.26	0.08	0.38
7	0.00	0.00	0.00	0.00	0.21	0.57	0.98	0.85	0.61	0.26	0.09	0.37
8	0.00	0.00	0.00	0.00	0.21	0.58	0.97	0.85	0.58	0.25	0.08	0.36
9	0.00	0.00	0.00	0.02	0.21	0.57	0.97	0.84	0.54	0.25	0.10	0.34
10	0.00	0.00	0.00	0.39	0.22	1.50	0.98	0.83	0.54	0.24	0.10	0.37
11	0.00	0.00	0.00	0.34	0.23	2.02	1.05	0.82	0.58	0.23	0.10	0.42
12	0.00	0.00	0.00	0.02	0.23	1.70	1.15	0.80	0.57	0.21	0.10	0.44
13	0.00	0.00	0.00	0.01	0.23	1.47	1.17	0.79	0.53	0.20	0.11	0.44
14	0.00	0.00	0.00	0.00	0.23	1.53	1.12	0.78	0.52	0.19	0.11	0.43
15	0.00	0.00	0.00	0.58	0.21	2.16	1.08	0.76	0.51	0.17	0.10	0.43
16	0.00	0.00	0.00	0.43	0.20	1.75	1.06	0.75	0.49	0.16	0.10	0.42
17	0.00	0.00	0.00	0.35	0.20	1.56	1.05	0.73	0.47	0.16	0.10	0.42
18	0.00	0.00	0.00	0.26	0.20	1.44	1.05	0.71	0.45	0.15	0.09	0.42
19	0.00	0.00	0.00	0.24	0.21	1.41	1.03	0.69	0.47	0.14	0.16	0.41
20	0.00	0.00	0.00	0.21	0.21	1.32	1.00	0.68	0.46	0.14	0.71	0.43
21	0.00	0.00	0.00	0.19	0.24	1.34	0.99	0.69	0.45	0.13	1.44	0.42
22	0.00	0.00	0.00	0.20	0.23	1.31	0.98	0.69	0.44	0.13	0.90	0.42
23	0.00	0.00	0.00	0.18	0.21	1.23	0.98	0.67	0.43	0.13	0.81	0.43
24	0.00	0.00	0.00	0.17	0.27	1.19	0.98	0.66	0.43	0.13	0.71	0.41
25	0.00	0.00	0.00	0.17	0.78	1.16	0.98	0.65	0.42	0.11	0.62	0.42
26	0.00	0.00	0.00	0.17	0.52	1.13	0.97	0.65	0.41	0.12	0.55	0.39
27	0.00	0.00	0.00	0.19	0.52	1.10	0.96	0.63	0.40	0.10	0.49	0.40
28	0.00	0.00	0.00	0.19	0.61	1.09	0.94	0.62	0.38	0.09	0.45	0.40
29	0.00	0.00	0.00	0.21		1.11	0.93	0.62	0.35	0.09	0.42	0.41
30	0.00	0.00	0.00	0.20		1.09	0.93	0.63	0.33	0.08	0.40	0.43
31	0.00		0.00	0.19		1.05		0.61		0.09	0.39	
Mean (ft)	0.00	0.00	0.00	0.16	0.27	1.16	1.01	0.75	0.49	0.18	0.32	0.41

Data Source: IWVGA, Stetson Engineers Inc. Data Management System; via In-Situ HydroVu data platform

Daily Streamflow Data, Flow Rate Sand Canyon, Water Year 2023

Water year 2023
Station Name Sand Canyon
Operating Agency IWVGA Agent - Stetson Engineers Inc.
Latitude 35°46'33.6"N
Longitude 117°54'27.4"N

Daily streamflow (cfs)												
DAY	2022 OCT	NOV	DEC	2023 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	0.00	0.44	3.08	10.64	7.35	2.61	0.89	0.13	1.32
2	0.00	0.00	0.00	0.00	0.44	2.47	10.51	6.99	2.51	0.83	0.13	1.53
3	0.00	0.00	0.00	0.00	0.48	2.52	10.25	6.55	2.35	0.74	0.12	1.57
4	0.00	0.00	0.00	0.00	0.52	2.70	9.35	6.35	2.28	0.76	0.12	1.51
5	0.00	0.00	0.00	0.00	0.60	2.68	9.00	5.84	2.29	0.78	0.11	1.42
6	0.00	0.00	0.00	0.00	0.54	2.61	8.76	5.64	2.44	0.76	0.10	1.37
7	0.00	0.00	0.00	0.00	0.51	2.55	8.68	5.28	2.82	0.76	0.10	1.30
8	0.00	0.00	0.00	0.00	0.53	2.58	8.39	5.21	2.59	0.72	0.10	1.25
9	0.00	0.00	0.00	0.02	0.54	2.55	8.34	5.12	2.35	0.73	0.14	1.17
10	0.00	0.00	0.00	2.16	0.57	<u>39.20</u>	8.79	4.92	2.37	0.69	0.15	1.32
11	0.00	0.00	0.00	1.31	0.62	<u>60.17</u>	10.87	4.70	2.59	0.64	0.15	1.62
12	0.00	0.00	0.00	0.01	0.59	<u>40.99</u>	14.56	4.49	2.57	0.55	0.15	1.69
13	0.00	0.00	0.00	0.00	0.60	28.98	15.45	4.30	2.29	0.49	0.17	1.69
14	0.00	0.00	0.00	0.00	0.61	32.34	13.50	4.21	2.21	0.46	0.16	1.66
15	0.00	0.00	0.00	2.69	0.51	<u>69.88</u>	12.03	3.99	2.17	0.41	0.15	1.66
16	0.00	0.00	0.00	1.65	0.48	<u>43.92</u>	11.20	3.90	2.03	0.35	0.15	1.62
17	0.00	0.00	0.00	1.20	0.49	33.37	10.98	3.74	1.89	0.35	0.13	1.58
18	0.00	0.00	0.00	0.76	0.48	27.23	11.05	3.53	1.81	0.33	0.12	1.57
19	0.00	0.00	0.00	0.64	0.51	26.11	10.24	3.37	1.92	0.28	0.34	1.53
20	0.00	0.00	0.00	0.51	0.54	21.89	9.43	3.34	1.83	0.28	<u>8.25</u>	1.66
21	0.00	0.00	0.00	0.44	0.64	22.83	8.99	3.37	1.79	0.26	<u>30.75</u>	1.60
22	0.00	0.00	0.00	0.47	0.62	21.42	8.77	3.36	1.75	0.24	6.68	1.59
23	0.00	0.00	0.00	0.41	0.51	17.83	8.72	3.27	1.64	0.24	4.67	1.62
24	0.00	0.00	0.00	0.36	0.81	16.04	8.64	3.17	1.66	0.23	3.66	1.54
25	0.00	0.00	0.00	0.36	4.45	14.90	8.67	3.13	1.61	0.20	2.92	1.60
26	0.00	0.00	0.00	0.37	2.19	13.80	8.49	3.09	1.56	0.20	2.45	1.41
27	0.00	0.00	0.00	0.43	2.18	12.93	8.14	2.94	1.50	0.15	2.05	1.48
28	0.00	0.00	0.00	0.46	2.84	12.41	7.57	2.86	1.41	0.14	1.82	1.49
29	0.00	0.00	0.00	0.52		12.99	7.27	2.86	1.24	0.13	1.63	1.54
30	0.00	0.00	0.00	0.47		12.41	7.26	2.93	1.11	0.11	1.51	1.66
31	0.00		0.00	0.43		11.03		2.83		0.12	1.42	
Mean (cfs)	0.00	0.00	0.00	0.51	0.89	19.88	9.82	4.28	2.04	0.45	2.28	1.52
Max (cfs)	0.00	0.00	0.00	2.69	4.45	69.88	15.45	7.35	2.82	0.89	30.75	1.69
Min (cfs)	0.00	0.00	0.00	0.00	0.44	2.47	7.26	2.83	1.11	0.11	0.10	1.17
Total (ac-ft)	0	0	0	31	49	1,223	584	263	121	27	140	90

Data Source: IWVGA, Stetson Engineers Inc. Data Management System; via In-Situ HydroVu data platform

Bold underlined - Values are estimates due to flow exedance of the stream gage rating table

Daily Streamflow Data, Total Flow Volume Sand Canyon, Water Year 2023

Water year 2023
Station Name Sand Canyon
Operating Agency IWVGA Agent - Stetson Engineers Inc.
Latitude 35°46'33.6"N
Longitude 117°54'27.4"N

DAY	Daily streamflow (AF)											
	2022 OCT	NOV	DEC	2023 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	0.00	0.87	6.11	21.11	14.59	5.19	1.77	0.26	2.62
2	0.00	0.00	0.00	0.00	0.87	4.90	20.85	13.86	4.98	1.64	0.25	3.04
3	0.00	0.00	0.00	0.00	0.95	5.00	20.33	13.00	4.67	1.46	0.24	3.11
4	0.00	0.00	0.00	0.00	1.03	5.36	18.55	12.59	4.52	1.51	0.25	2.99
5	0.00	0.00	0.00	0.00	1.18	5.31	17.85	11.59	4.54	1.55	0.23	2.81
6	0.00	0.00	0.00	0.00	1.06	5.18	17.38	11.18	4.84	1.50	0.20	2.72
7	0.00	0.00	0.00	0.00	1.02	5.05	17.21	10.47	5.58	1.51	0.21	2.58
8	0.00	0.00	0.00	0.00	1.05	5.13	16.64	10.33	5.13	1.43	0.19	2.47
9	0.00	0.00	0.00	0.03	1.07	5.05	16.54	10.15	4.67	1.44	0.27	2.31
10	0.00	0.00	0.00	4.29	1.13	<u>77.75</u>	17.44	9.76	4.71	1.38	0.30	2.62
11	0.00	0.00	0.00	2.61	1.24	<u>119.35</u>	21.57	9.32	5.14	1.27	0.30	3.21
12	0.00	0.00	0.00	0.02	1.17	<u>81.30</u>	28.88	8.90	5.09	1.10	0.29	3.35
13	0.00	0.00	0.00	0.00	1.19	57.48	30.64	8.54	4.55	0.97	0.34	3.35
14	0.00	0.00	0.00	0.00	1.21	64.14	26.78	8.35	4.38	0.91	0.32	3.29
15	0.00	0.00	0.00	5.33	1.02	<u>138.60</u>	23.86	7.92	4.30	0.81	0.29	3.30
16	0.00	0.00	0.00	3.27	0.95	<u>87.12</u>	22.21	7.73	4.03	0.70	0.29	3.21
17	0.00	0.00	0.00	2.38	0.97	66.18	21.78	7.42	3.76	0.70	0.27	3.13
18	0.00	0.00	0.00	1.50	0.95	54.01	21.91	7.00	3.58	0.65	0.25	3.11
19	0.00	0.00	0.00	1.26	1.02	51.78	20.30	6.69	3.81	0.56	0.68	3.04
20	0.00	0.00	0.00	1.01	1.06	43.42	18.70	6.62	3.63	0.55	<u>16.37</u>	3.29
21	0.00	0.00	0.00	0.87	1.26	45.28	17.83	6.69	3.55	0.52	<u>60.98</u>	3.18
22	0.00	0.00	0.00	0.94	1.23	42.49	17.40	6.66	3.47	0.48	13.24	3.15
23	0.00	0.00	0.00	0.81	1.01	35.37	17.30	6.49	3.26	0.48	9.26	3.22
24	0.00	0.00	0.00	0.72	1.61	31.82	17.15	6.28	3.30	0.46	7.27	3.05
25	0.00	0.00	0.00	0.72	8.82	29.56	17.20	6.21	3.19	0.39	5.79	3.18
26	0.00	0.00	0.00	0.74	4.34	27.37	16.84	6.13	3.10	0.41	4.86	2.79
27	0.00	0.00	0.00	0.85	4.33	25.64	16.15	5.84	2.98	0.31	4.06	2.93
28	0.00	0.00	0.00	0.91	5.63	24.61	15.02	5.67	2.79	0.28	3.61	2.97
29	0.00	0.00	0.00	1.02		25.76	14.42	5.67	2.46	0.25	3.23	3.06
30	0.00	0.00	0.00	0.93		24.62	14.40	5.81	2.20	0.22	2.99	3.29
31	0.00		0.00	0.85		21.89		5.61		0.25	2.82	
Mean (ac-ft)	0.00	0.00	0.00	1.00	1.76	39.44	19.47	8.49	4.05	0.89	4.51	3.01
Max (ac-ft)	0.00	0.00	0.00	5.33	8.82	138.60	30.64	14.59	5.58	1.77	60.98	3.35
Min (ac-ft)	0.00	0.00	0.00	0.00	0.87	4.90	14.40	5.61	2.20	0.22	0.19	2.31
Total (ac-ft)	0	0	0	31	49	1,223	584	263	121	27	140	90

Data Source: IWVGA, Stetson Engineers Inc. Data Management System; via In-Situ HydroVu data platform

Bold underlined - Values are estimates due to flow exedance of the stream gage rating table

The following attached tables are provided to serve as reporting of approved daily values of data collected at the Sand Canyon gaging station during WY 2023. The tables reflect; daily average staff gauge readings, daily average stream flow rate in cubic feet per second, and total daily flows in acre-feet; by water year.

SAND CANYON STREAM GAGING STATION OVERVIEW

IWVGA operation of this station is done under legal agreement with the Bureau of Land Management to occupy and operate the stream gage location. Stetson Engineers (Stetson) as acting agent for IWVGA, re-established monitoring activities at the Sand Canyon Stream Gaging Station, on August 25, 2020. Prior to this the Station was in a semi-defunct state following the cessation of Kern County Water Agency monitoring activities in 2019. As of the time of installation the station and associated stage measuring equipment was maintained by the Meadowbrook Dairy. The existing equipment being any antiquated paper chart recorder with float and pulley. To re-establish the monitoring station Stetson installed new monitoring and cellular telemetry components inside the stilling well. This work is summarized as a Memorandum submitted to the State Department of Water Resources, dated August 28, 2020.

The gaging station consists of a channel spanning compound rectangular weir. Upstream of the weirs a metal staff gauge is installed to measure weir stage height. Additionally, a perforated intake pipe is installed leading to an off-channel stilling well where the paper chart recorder and new monitoring equipment is installed. The monitoring and telemetry equipment consist of the following listed component parts:

Equipment List:

Part Number	Description
In-Situ 0099240	Level TROLL 400, Level Sensor Range – 11m, 35ft,(30 Psia)
In-Situ 0052000-05-01-08-00	Rugged Twist Lock Cable, Non-vented
In-Situ ISR-0000000-VL	VuLink Cellular Telemetry, 4G LTE, Antenna, GPS, 1.5-3.6V Li-MnO2 Battery, built in barometric sensor; HTTPS, FTP, SFTP, SMS, CSV file format
Proxicast ANT-121-002	Omni Antenna, 3G/4G/LTE, 3-5dBi

Photographs of Installation:



FIGURE 3. SAND CANYON STREAM GAGE SITE

Data Resolution & Telemetry Programming:

The In-Situ monitoring equipment, Level Troll 400 and Vulink device are programmed to record measured pressure (water and barometric pressure) values every 15-minutes, with barometric compensation made at the Vulink. The 15-minute time interval is based on the USGS stream gage standard. From there the Vulink cellular telemetry is programmed to upload the 15-minute readings to In-Situ's FTP server every 24 hours, or 96 readings. Stetson then retrieves the data from the FTP server for hosting on the IWVGSP.com web server.

Staff Gauge vs. Weir Stage:

During a December 2020 field visit where a level survey, and other verification measurements were completed, a 0.02-foot difference was recognized between the steel staff gauge and the actual weir crest. The staff gauge is installed with 0.02 feet reading equaling the

weir crest. Staff gage readings reported here are reflective of this 0.02-foot difference, and calculations of weir discharge utilize stage values 0.02 feet less than the staff readings.

Calculation of Discharge:

Calculation of stream discharge utilizes corrected stage measurements, recorded with the stilling well monitoring equipment, and the following equations (Francis Equation) to calculate discharge. These equations have been updated to reflect weir verification measurements taken during installation. The associated stage-discharge rating curve is shown below in Figure 4.

Discharge Equation(s) for Sand Canyon Compound Weir Structure

The discharge equation for the Sand Canyon stream gage includes the sum of the flow through the 2-foot and 12-foot weirs as described below.

2-foot Weir Component Discharge: $Q = 3.33 \times (L_1 - 0.02H_1) \times (H_1^{3/2})$

12-foot Weir Component Discharge: $Q = 3.33 \times (L_2 - 0.02(H_2 - 1)) \times ((H_2 - 1)^{3/2})$

Where:

Q = Discharge in cubic feet per second

L₁ = 2 feet; width of 2-foot weir

L₂ = 12 feet; width of 12-foot weir

H₁ = water stage height above 2-foot weir crest, in feet

H₂ = water stage height above 2-foot weir crest, when H is greater than 0.75, in feet

H_{max} = 2.25 feet, height of top of 12-foot high-flow weir

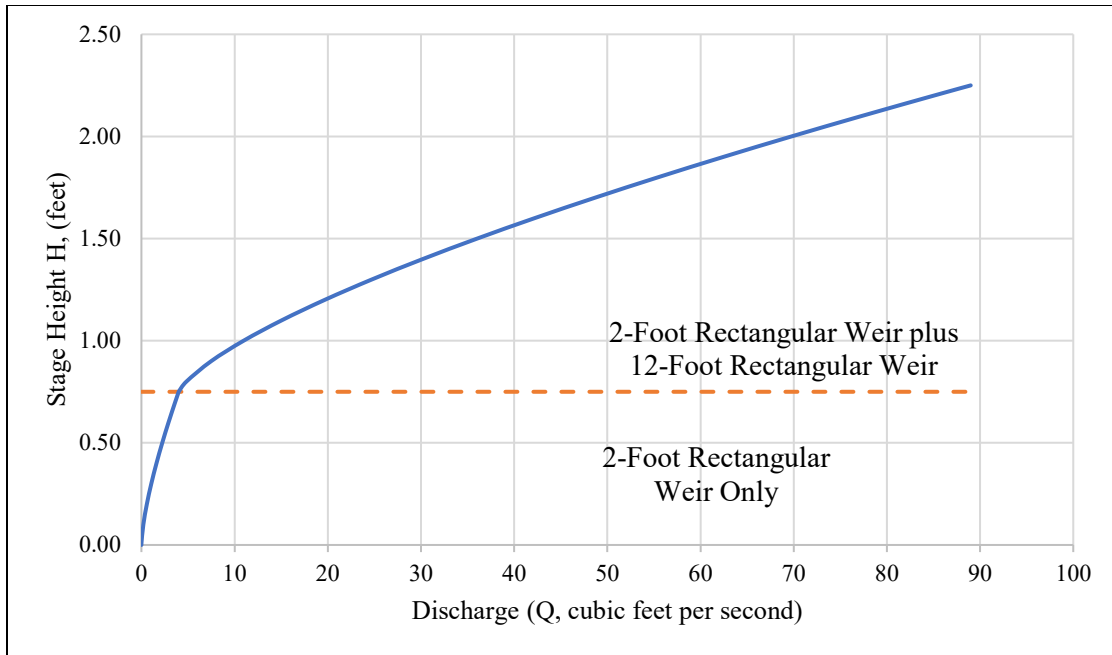


FIGURE 1. STAGE-DISCHARGE RATING CURVE FOR SAND CANYON WEIR STRUCTURE